

Radionuclide Analysis Facility

Section V - Chapter 4

Revision 0

June 10, 2015

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Revision History

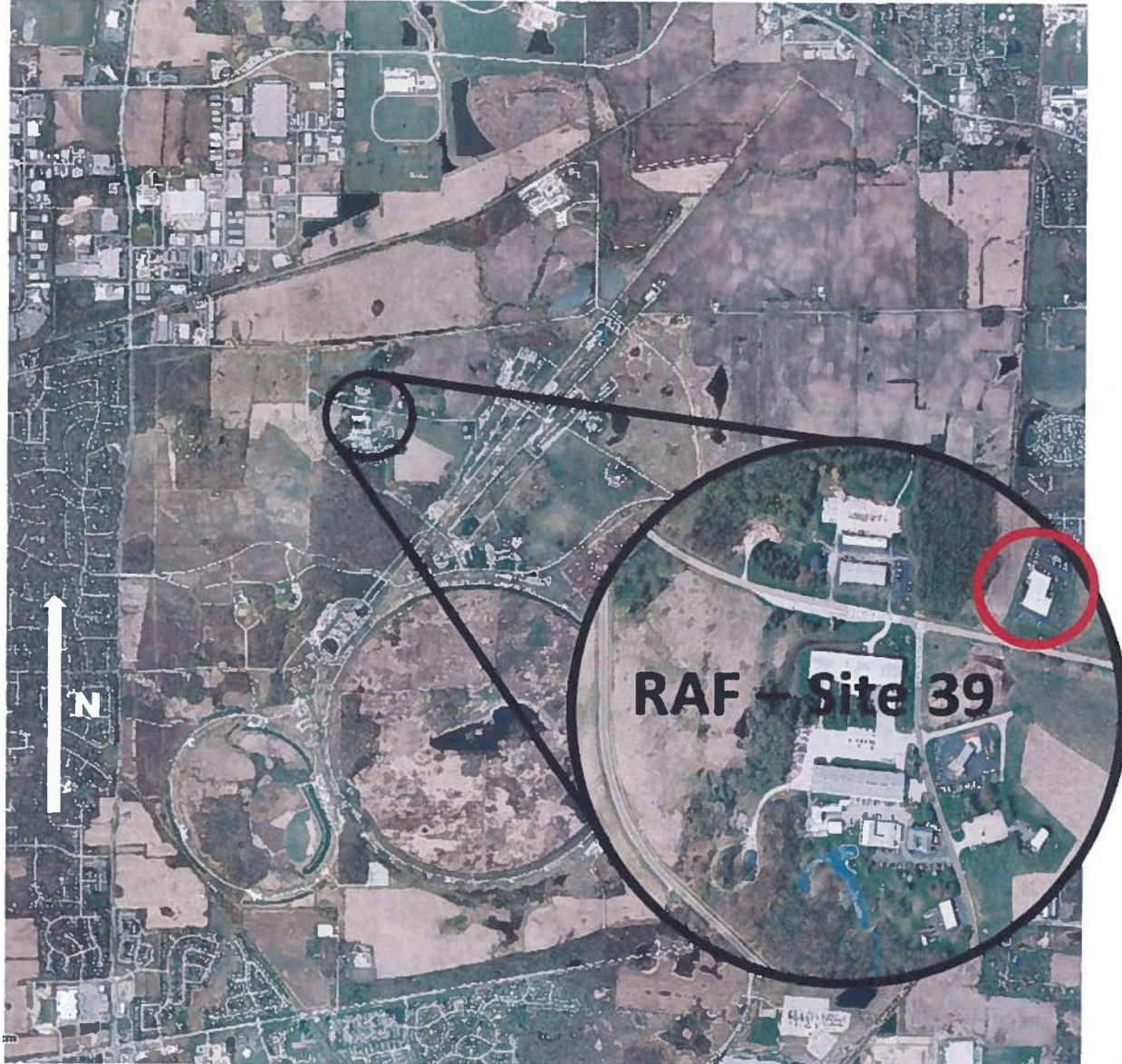
Author	Description of Change	Revision No. & Date
Matt Quinn	Initial release of the Radionuclide Analysis Facility chapter of the Fermilab Safety Assessment Document.	Revision 0 June 10, 2015

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V - 4 Radionuclide Analysis Facility (RAF)**V - 4.1 RAF Location on Fermi National Accelerator (Fermilab) Site**

The RAF is located in the Site 39 Annex. The RAF is operated by the Environment, Safety, Health, & Quality (ESH&Q) Section Radiation Protection Group as a building tenant of the Facilities Engineering Services Section (FESS). FESS supplies the Building Management functions for this building. The map below shows the location on the Fermilab site.



V - 4.2 Inventory of Hazards

The following table lists the identified hazards found in the RAF. All hazards with an * have been discussed in Section I Chapters 1-10 of this document.

Radiation Residual component activation Radioactive sources	Kinetic Energy Power tools* Pumps and motors*
Toxic Materials Lead shielding * Acids *	Potential Energy Compressed gases* Vacuum / pressure vessels* Vacuum pumps*
Flammable & Combustible Materials Cables* Flammable Liquids *	Electrical Energy High voltage exposure *

V - 4.3 Introduction

This Section V, Chapter 4 of the Fermi National Accelerator Laboratory (Fermilab) Safety Assessment Document (SAD) covers the Radionuclide Analysis Facility located in the Site 39 Annex.

V - 4.3.1 Purpose of RAF

Fermilab has had a Radionuclide Analysis Facility (RAF), formerly known as the Activation Analysis Laboratory and the Nuclear Counting Laboratory, since 1971. The work activity was moved to the present Annex at Site 39 in 2000. The RAF has played a vital role in environmental sample analysis, waste stream characterizations, calibrations of beam intensity

monitoring devices, beam absorber monitoring, cross calibrations of other types of instrumentation, and material activation studies¹.

Environmental samples are analyzed as part of a continuing on-site surveillance and National Pollutant Discharge Elimination Systems (NPDES) monitoring programs. Waste samples are analyzed primarily for the purpose of characterizing their radionuclide content to meet disposal facility requirements. Results of RAF analyses are also used for screening purposes in cases where a waste generator is unsure of the origin of radioactivity in a waste stream². Activated materials are analyzed to evaluate hadron intensities, specific radionuclide activities, activation cross sections, Monte Carlo computer model predictions, and to assist in establishing correlations between specific radionuclide activities and detectors operating in single channel modes.

V - 4.3.2 Description of RAF

The RAF uses several commercial high-purity germanium detectors, liquid scintillation counters, and gas proportional counters to measure the activity of samples. Lead shields are in or around most of these devices. Additionally, a chemistry lab at RAF is used to prepare samples for analysis. A liquid nitrogen tank is situated outside the southwest entrance to the RAF.

V - 4.4 Safety Assessment

Unique hazards at the RAF are listed in this section.

V - 4.4.1 Radiological Hazards

A number of different types of radioactive materials and radioactive sources are located at RAF that present radiological hazards. This section identifies the types of radiological materials, radioactivated material, sealed radioactive sources, and radioactive waste, and their respective safety controls. Radiological hazards are not directly associated with accelerator operations and are managed in accordance with the requirements of the FRCM that implement 10 CFR 835.

Safety controls at Fermilab are in the form of prescribed procedures and protective measures detailed in the following guidance documents: Fermilab Environment, Safety, and Health Manual³ (FESHM), Fermilab Radiological Control Manual⁴ (FRCM), Fermilab Sealed Source Control and Accountability Program⁵, Fermilab Nuclear Materials Control and Accountability (MC&A) Plan⁶, Fermilab Site Security Plan⁷, and Low-Level Waste Certification Program².

V - 4.4.1.1 Residual Activation

The RAF produces no residual activation. Activated materials are brought to RAF for isotopic analysis. As indicated in the FRCM Article 555, *Collection and Analysis of Analytical Samples*, no radioactive material above Fermilab radioactive material Class 1 may be brought into RAF without ESH&Q Section approval. Work at the RAF is performed according to approved procedures including requisite safety precautions that include consideration of radiation protection or an approved Radiological Work Permit (RWP) if the need for an RWP arises.

V - 4.4.1.2 Sealed Radioactive Sources

Radioactive sources used at RAF are issued and used in accordance with FRCM Chapter 4, Part 3 *Radioactive Source Controls*.

V - 4.4.1.3 Radioactive Waste

The majority of samples return to the original requestor, who initiates proper disposal in accordance with FESHM 8021 including FRCM Chapter 4, *Radioactive Material, Part 4, Radioactive Waste Management*. Sample aliquots drawn for tritium analysis have a scintillator cocktail added. In accordance with Department of Energy (DOE) order 458.1⁸ and 40 CFR Part 141⁹, all aliquots are disposed of as mixed waste in accordance with FRCM requirements.

V - 4.5 Assessment of Potential Credited Controls**V - 4.5.1 Passive Controls**

There are no passive credited controls that qualify for inclusion in the Accelerator Safety Envelope (ASE).

V - 4.5.2 Active Controls

There are no active controls that qualify for inclusion in the ASE.

V - 4.5.3 Administrative Controls

Administrative control of RAF begins with keeping the facility locked at all times¹⁰. Only a small number of personnel possess keys to RAF. All work at RAF is performed according to procedures approved by the ESH&Q Section. All samples delivered to RAF must have a signed chain-of-custody form, which ensures that no materials are brought into the facility

without the knowledge of RAF staff. There are no administrative controls that qualify for inclusion in the ASE.

V - 4.6 Summary & Conclusion

Specific hazards associated with RAF operations are identified and assessed in this chapter of the Fermilab SAD. The designs, controls, and procedures to mitigate RAF specific hazards are identified and described. In addition to these specific safety considerations, the RAF is subject to the global and more generic safety requirements, controls and procedures outlined in Section 1 of this Fermilab SAD.

Within the specific and generic considerations of this assessment RAF can be operated with a level of safety that will protect people and property and is equal to or exceeding that currently prescribed by DOE orders and Fermilab regulations as put forth in the FESHM including FRCM.

V - 4.7 Glossary, Acronyms

ESH&Q Environment, Safety, Health and Quality

FESHM Fermilab Environment, Safety, and Health Manual

FRCM Fermilab Radiological Control Manual

SAD Safety Assessment Document

V - 4.8 References

- ¹ Radionuclide Analysis Facility Quality Assurance Plan. The current web link is:
<https://esh-docdb.fnal.gov:440/cgi-bin/ShowDocument?docid=1082>
- ² Fermilab Low Level Waste Certification Program. – The current web link is:
<https://esh-docdb.fnal.gov:440/cgi-bin/ShowDocument?docid=3046>
- ³ Fermilab Environment, Safety, and Health Manual. – The current web link is:
<http://esh.fnal.gov/xms/FESHM>
- ⁴ Fermilab Radiological Control Manual. - The current web link is:
<http://esh.fnal.gov/xms/FRCM>
- ⁵ Fermilab-Sealed Source Control and Accountability. – The current web link is: <https://esh-docdb.fnal.gov:440/cgi-bin/ShowDocument?docid=156>
- ⁶ Fermilab Nuclear Materials Control and Accountability (MC&A) Plan. – The current web link is: <https://esh-docdb.fnal.gov:440/cgi-bin/ShowDocument?docid=2024>
- ⁷ Fermilab Site Security Plan – The current web link is:
<https://esh-docdb.fnal.gov:440/cgi-bin/ShowDocument?docid=2761>
- ⁸ DOE O 458.1, Radiation Protection of the Public and the Environment, Issued January 15, 2013.
- ⁹ Title 40 of the Code of Federal Regulations, Part 141 (40 CFR 141), National Primary Drinking Water Regulations, May 12, 2014.
- ¹⁰ Radionuclide Analysis Facility Quality Assurance Plan. The current web link is:
https://esh-docdb.fnal.gov:440/cgi-bin/RetrieveFile?docid=1082&filename=RAF_QA1_R2.pdf&version=1



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