

ACCELERATOR DIVISION PROCEDURE

ADSP-02-0110

Outline for Performing Shielding Assessments

RESPONSIBLE DEPARTMENT ES&H

PREPARED BY: Wayne Schmidt DATE: 4/29/13
Accelerator Division Radiation Safety Officer

REVIEWED BY: [Signature] DATE: 4/29/13
Fermilab ES&H Shielding Review Committee Chairperson

REVIEWED BY: [Signature] DATE: 4/30/13
Accelerator Division ES&H Department Head

APPROVED BY: [Signature] DATE: 5-1-13
Accelerator Division Head

REVISION NO. 1 REVISION ISSUE DATE: 04/23/13

CONTROLLED DOCUMENT

Users are responsible for ensuring they work to the latest approved revision. Printed or electronically transmitted copies are uncontrolled.

TABLE OF CONTENTS

1 PURPOSE OF THIS PROCEDURE.....1

2 RESPONSIBILITIES2

3 OVERVIEW3

4 SPECIFIC GUIDANCE AND CURRENT CRITERIA3

1 PURPOSE OF THIS PROCEDURE

This document provides an outline and describes the methodology used to perform a consistent, complete, and compliant Shielding Assessment in the Accelerator Division (AD). The description covers not only those shielding aspects that relate directly to accident conditions, but also covers such issues as surface, ground, and RAW water activation concentrations, off-site and on-site prompt radiation rates, air activation issues both in enclosures and those associated with site releases, residual activation rates, shielding for experiment halls, and other controls necessary to monitor dose rates from normal operations.

At a minimum, the following components must be considered during the Shielding Assessment process:

- clear description of the assessment boundaries
- clear statement of the intended assessment beam parameters
- a spreadsheet that categorically defines the “Shielding Requirements” for the stated beam parameters
- Longitudinal Shielding Summary (passive shielding directly above the beam line)
- Transverse Shielding Summary (radial distribution of passive shielding along the beam line)
- Monte Carlo (e.g., MARS) simulations (to define the shielding requirements at target stations, decay regions, fixed aperture collimators, pinhole collimators, as well as primary, secondary, and tertiary beam absorbers)
- Labyrinth and Penetration Summary and calculations
- air activation calculations along with an estimate of annual release
- list of activated air release points and recommended air monitoring locations
- air-scattered radiation (“skyshine”) calculations
- ground and surface water activation calculations derived from MARS simulations
- list of surface water discharge points and recommended monitoring locations
- muon production and associated dose rates for both on-site and off-site
- residual dose rate estimates associated with known loss locations
- residual dose rate estimates associated with cooling water (e.g., LCW, RAW) systems
- intended active shielding controls and monitoring
- mechanisms for monitoring dose rates in experimental areas during normal operations as required
- clear summary of conclusions and, if required, action items
- comprehensive list of references

- available package of supporting drawings, sketches, and documents

2 RESPONSIBILITIES

- Accelerator Division Head

The Accelerator Division Head is responsible for requesting a Shielding Assessment, approving an assessment, and forwarding it to the ESH&Q Section for approval, if required. The AD Head may request recommendations from the Fermilab FESHCom Shielding Review Subcommittee prior to approving an assessment.

- Accelerator Division Department Heads

The applicable Department Head is charged by the Accelerator Division Head to conduct an assessment, and is responsible for ensuring that the Shielding Assessment is documented in accordance with this procedure and AD/RSO direction before submitting the completed assessment for further review and approval.

- Accelerator Division Radiation Safety Officer (AD/RSO)

The AD/RSO is responsible for providing the Accelerator Division Head with a recommendation as to whether or not the Fermilab FESHCom Shielding Review Subcommittee should be convened, for ensuring that the Shielding Assessment contains all required components, satisfies requirements stated in the Fermilab Radiological Control Manual, and that the format is appropriate. Each assessment is unique and at times the format may need to be modified to provide the appropriate level of detail for review. When this occurs the AD/RSO will provide specific format guidance. The AD/RSO will ensure that the necessary Radiation Safety Drawings are produced or modified at the appropriate time and obtain the required signatures.

- Fermilab FESHCom Shielding Review Subcommittee Chairperson

The Fermilab FESHCom Shielding Review Subcommittee Chairperson is responsible for:

- 1) coordinating a review of the assessment by the committee for methodology, completeness, and compliance with the Fermilab Radiological Control Manual,
- 2) recommending acceptance or rejection of the assessment to the ESH&Q Director based on consensus of the committee, and
- 3) advising the Accelerator Division Head and the ESH&Q Director of effects the assessment may have on overall operations or other assessments.

- Fermilab FESHCom Shielding Review Subcommittee

The Fermilab FESHCom Shielding Review Subcommittee is responsible for reviewing the Shielding Assessment for methodology, completeness, compliance with the current Fermilab Radiological Control Manual and/or specific approved methodologies, and compliance with this procedure.

3 OVERVIEW

Passive shielding is preferred. Active shielding should only be considered following discussions with the AD/ES&H Department, AD/Operations Department and ESH&Q Director concerning operational impacts and cost. If it is decided that active systems are necessary, then they should be designed to be fail-safe according to current guidance and avoid administrative controls.

The time needed to complete a Shielding Assessment varies based on the complexity and detail necessary. Since the criteria associated with any component of an assessment can change and the standard format described in this document may not be appropriate for all types of assessments, defining the appropriate format of the documentation in coordination with the AD/RSO is paramount in optimizing the time and level of effort required to complete the assessment.

In addition to passive and active shielding associated with accidental beam loss, Shielding Assessments include a number of equally important normal operating issues in order to ensure compliance with laboratory, state, and federal requirements. When the AD/RSO has determined that the assessment contains all the required components, meets the requirements stated in the Fermilab Radiological Control Manual or specific approved methodologies, and that the format is appropriate, the AD/RSO will recommend to the Accelerator Division Head that the documentation is suitable for further review. The Accelerator Division Head has two options: 1) ask the Fermilab FESHCom Shielding Review Subcommittee for recommendations, or 2) approve the assessment without further advice.

If the assessment affects the existing approved Safety Envelope as stated in the current Fermilab Safety Assessment Document, then the Fermilab ESH&Q Director must also approve the Shielding Assessment. If the assessment affects the existing approved Safety Envelope, then the Fermilab Safety Assessment Document must be modified to reflect the new Safety Envelope and also be reviewed by the Accelerator Division ES&H Department, the ESH&Q Section, and be approved by the Directorate. In addition, DOE approval is required for the revised Safety Envelope before beam may be delivered to the affected area.

4 SPECIFIC GUIDANCE AND CURRENT CRITERIA

The AD/RSO can provide specific guidance documents as well as the current criteria to be followed in compiling Shielding Assessments. Because DOE regulations evolve and changes may occur in the Fermilab Radiological Control Manual, questions regarding the details or format of Shielding Assessments should be directed to the AD/RSO.

