

ES&H DIVISION  
RADIATION CONTROL DEPARTMENT

## Shielding Policy for Ionizing Radiation

June 2020

RCD-POL-14 #001  
rev2

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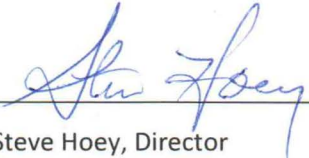
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 **Jefferson Lab**  
Thomas Jefferson National Accelerator Facility

# Shielding Policy for Ionizing Radiation

rev2

RCD-POL-14 #001

**Approval**  \_\_\_\_\_ 6/23/2020  
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**Revision History**

<b>rev #</b>	<b>Statement of revision</b>	<b>Effective date</b>
2	<ul style="list-style-type: none"><li>- reviewed with revision of Radiological Control Manual</li><li>- removed from Radiological Control Manual to become stand-alone document</li><li>- assigned new document number (RCD-POL-14 #001)</li><li>- assigned new author/owner</li><li>- re-formatted to standard RCD document style per Maintenance of Radiation Control Documents (RCD-PRG-16 #001)</li></ul>	June 2020
1	standard review with Radiological Control Manual	March 2017
0	initial release	2014

## 1 SUMMARY

Shielding design shall limit exposure to ionizing radiation to values consistent with Jefferson Lab's low hazard, non-nuclear facility designation. Shielding must follow Shielding Design Criteria (listed below) and implement the ALARA principle to minimize worker and public exposure to ionizing radiation. Permanent or temporary shielding shall be implemented as necessary to mitigate radiation exposure from:

- sources of prompt radiation generated by accelerator operation, around accelerator component test stands and any other radiation-generating devices
- activated accelerator components and activated utilities such as air or cooling water
- radiation sources and any other radioactive material on site

Ionizing radiation shielding design shall:

- incorporate permanent shielding to the maximum extent practicable
- comply with requirements in the design criteria for normal operation and credible accident scenarios
- specify required amounts and configuration of shielding materials such as earth, concrete or steel, alone or in combination (When required, labyrinths, mazes and penetrations through the shielding shall be designed to provide an equivalent level of radiation protection.)
- be validated by initial radiation surveys and subsequently checked for proper configuration at regular intervals
- be documented in as-built drawings
- be improved, or the operating power shall be reduced, whenever the Radiation Control Department (RCD) determines that the shielding configuration does not provide the required attenuation value
- be reviewed for the specific planned activity and approved by the RCD before the radiation source is present in the area being shielded

## 2 CONFIGURATION MANAGEMENT

All shielding affecting personnel radiation safety shall be subject to configuration controls. If identified in the Accelerator Safety Envelope (which has specific requirements regarding periodic evaluation of shielding integrity), shielding shall meet configuration management requirements specified for a Level 1 Configuration Management (CM) system in the *Conduct of Engineering Manual* (ENG-AD-01-001, Revision C).

Earth shielding shall be evaluated periodically to ensure its integrity. Excavation around accelerator areas that incorporate earth shielding shall be controlled through written authorizations such as dig permits. Shielding that can be altered by non-destructive means (e.g., moveable shielding) shall be:

- approved by the RCD (design and installation);
- appropriately identified by labels and/or signs; and
- inspected periodically.

For moveable shielding, preparation of the design package, configuration control and periodic inspections shall be described in a specific Health Physics Procedure.

## 2.1 Temporary Shielding

The use of temporary shielding should be limited to situations in which the radiation source is of a temporary nature. Installation and removal should be controlled through written requirements. Appropriate administrative configuration controls should be used to ensure that the temporary shielding is adequate and remains in place as long as needed. This may include the use of physical barriers and lockout devices.

## 2.2 Shielding Design Criteria

Shielding against ionizing radiation must be designed to specifications that will ensure compliance with radiation exposure limits listed in Chapter 2 of the *Radiological Control Manual* (RCD-PMAN-94 #001). Accelerator shielding design considerations must include both normal accelerator operations and accident conditions. Radiation shielding shall be designed to satisfy the following conditions.

**Normal operation** with continuous beam within the allowed beam-power limits in specific areas

- a) integrated equivalent dose in occupied RCAs will not exceed 2.5 mSv (250 mrem)/y
- b) integrated equivalent dose in occupied areas other than RCAs (including at or beyond the site boundary) will not exceed 0.1 mSv (10 mrem/y)
- c) levels of radionuclides in groundwater will not exceed limits in the current VPDES permit

*Note 1:* Use of appropriate occupancy factors is applicable in a) and b) above.

*Note 2:* Shielding calculations for normal operation are based on beam losses that are expected and predictable. The variable magnitude and duration of beam loss in different experiments are regulated by limits imposed on the "radiation budget". These limits are specified by the RCD in the Radiological Safety Analysis Document (RSAD) for each experiment.

The **maximum credible accident scenario** is defined as mis-steering or loss of control of the electron beam under conditions corresponding to the upper limit of the beam power possible in a specific area. Under such conditions the integrated equivalent dose per occurrence will not exceed 150 mSv (15 rem).