

Chapter 9: [Radiological Safety](#)

Radioactive and Nuclear Material and Waste Requirements

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URL: <https://www-group.slac.stanford.edu/esh/eshmanual/references/radReqMaterials.pdf>

1 Purpose

The purpose of these requirements is to ensure radioactive and nuclear materials (special nuclear materials and other accountable nuclear materials) and devices are handled safely. They cover use, storage, handling, and disposal of radioactive and nuclear materials and waste, including sealed sources and radiation generating devices. They apply to workers, and their line management, supervisors, and points of contact, who work with radioactive and nuclear materials or waste, and Radiation Protection.

2 Requirements

2.1 SLAC's Radiological Facility Classification

SLAC is a *radiological facility* as defined in the Department of Energy Standard 1027-2018, Change Notice 1, "Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports" ([DOE-STD-1027-2018, Chg Notice 1](#)). This classification restricts the quantity of radioactive material that may be stored on site.

Because the radiological facility classification is based on the quantity of radioactive material and how it is stored, RPD controls on-site quantities of radionuclides. RPD must be contacted before any radioactive material (including radioactive sources) is brought to SLAC to ensure quantities will not cause SLAC to exceed the allowance for a radiological facility.

2.1.1 Areas under Classification

The four SLAC areas under this classification are: the 2-mile accelerator and the complex that houses the beam line experimental facilities; the Stanford Synchrotron Radiation Lightsource (SSRL), including the linac, booster, SPEAR, and experimental halls; the Radioactive Waste Management Storage Yard (RAMSY); and the campus area outside the accelerator area fence.

2.1.2 Radioactive Materials Quantity Restrictions

It is SLAC policy that radionuclides in non-certified containers be restricted to the lowest quantity that is consistent with operational or experimental requirements. The total amount of any radionuclide in a non-certified container at each of these facilities must not exceed the fraction with a numerical value of one

half¹ of the Category 3 threshold quantity for that radionuclide.² When more than one radionuclide is at a facility, the quantities must be limited so that the sum of the fractions of the materials will not exceed one half.

2.1.3 Special Nuclear Materials and Other Accountable Nuclear Materials

Nuclear material, including *special nuclear material* and *other accountable nuclear material* (such as deuterium and enriched lithium), is subject to the requirements in the [Nuclear Material Control and Accountability Plan](#). (For lists of such materials, see Tables I, II, IV, and X of the plan.)

Before such material is acquired or shipped to SLAC, the nuclear material representative must evaluate the amount before shipment to ensure that SLAC will not exceed the SLAC administrative limit for nuclear material inventory. SLAC also makes the appropriate requests for authorization from facilities to which material is being shipped.

2.2 Radioactive Sealed Source and Radiation Generating Device (RGD) Management

2.2.1 Radioactive Sealed Sources

Radioactive sealed sources typically are used at SLAC to calibrate instruments and for experimental work. A *sealed source* consists of radioactive material that is either fixed between layers of non-radioactive material or fixed to a non-radioactive surface and contained in a closed capsule. Sealed sources are categorized as either *accountable* or *exempt* (exempt sources are also known as *non-accountable sources*).

Pre-authorization is required from the RP Department before any sealed source can be brought on site.

To obtain a sealed source at SLAC, individuals can borrow one from the Radiation Protection Field Operations Group (RPFO) or from a source custodian. If a source must be acquired from a vendor, a [Radiological Safety: Sealed Radioactive Source Acquisition Authorization Form](#) must be completed, approved by RP, and included with the requisition.

Personnel using a sealed source are identified as either a custodian or a user. In many cases, the custodian and user is the same individual. A custodian is an individual directly responsible for the safe and positive controls of one or more sealed sources. A custodian may temporarily issue a sealed source to another user as long as all requirements stipulated in the RP Department [Radioactive Sealed Source Procedure](#) are met. Custodians will be trained in these policies prior to receiving custody of sealed sources and must be retrained on these policies every two years.

Users typically have sealed sources in their possession for no more than a few days. Users are prohibited from transferring sealed sources to other personnel. Only custodians can issue sealed sources. Users will be briefed on the sealed source policies by custodians prior to taking possession of any sealed source.

1 The fraction is defined as the mass of each radionuclide divided by its Category 3 threshold quantity.

2 For the Category 3 threshold value, see [DOE-STD-1027-2018, Chg Notice 1](#), Attachment 1

See the RP Department [Radioactive Sealed Source Procedure](#) and the [Radiological Control Manual](#) for further discussion on control requirements for sealed sources and the [Sealed Source Acquisition Process](#) for instructions on obtaining a sealed source.

2.2.2 Radiation Generating Devices (RGDs)

Radiation generating devices (RGDs) are “devices which produce ionizing radiation, including, certain sealed radioactive sources, small particle accelerators used for single purpose applications which produce ionizing radiation (e.g., radiography), and electron generating devices that produce x-rays incidentally.” ([DOE G 441.1-1C, Chg 1 \[Admin Chg\]](#))

Pre-authorization is required from the RP Department before any RGD can be brought on site.

See the [Radiation Generating Devices Program Manual](#) for more information about RGDs at SLAC.

2.3 Transporting Radioactive Material within SLAC

Use of personal vehicles to transport radioactive material is prohibited. When needed, transport of radioactive materials must be conducted using SLAC vehicles and appropriate containers and equipment. Prior to transport, the individual who has ownership or responsibility for the radioactive material is responsible for contacting the RPD to ensure the radioactive materials are properly identified, packaged, and labeled.

Containers must be secured to prevent sliding or shifting of contents or the packages themselves during transport. Transporters of radioactive materials must ensure the recipient of the radioactive material is properly notified to receive the radioactive material.

For more detailed information on transporting radioactive material at SLAC or off-site, see the [Radiological Control Manual](#) and the [Radioactive Waste Manual](#).

2.4 Storage of Radioactive Material

The storage of radioactive materials within SLAC is subject to controls and will be coordinated with RPD.

Material determined to be radioactive must be stored within a *radiologically controlled area (RCA)* and a *radioactive material area (RMA)*. In most cases, all radioactive material is identified with a radioactive label except if located in accelerator housings or a RMA, where all material is considered radioactive and must be surveyed upon removal.

2.5 Managing Radioactive Waste

The Radioactive Waste Management Group provides radioactive waste processing services for radioactive waste generators. RPD accepts, stores, processes, and prepares radioactive waste and/or mixed waste for shipment off-site to licensed/permitted treatment and disposal facilities.

Radioactive waste and mixed waste generators are responsible for the following tasks:

- Waste minimization

- Waste segregation, according to waste type (mixed versus radioactive only), and by material composition (concrete, metal, wire/cable). Segregation in this manner reduces both disposal and handling costs.
- Waste characterization, including chemical composition and physical state and composition.
- Packaging, marking, and labeling the waste in accordance with the requirements of Chapter 5 of the [Radioactive Waste Manual](#).
- Completing a [Radioactive Material Declaration Form](#), which certifies the waste meets the waste acceptance criteria of Chapter 5 of the [Radioactive Waste Manual](#)

For more detailed information on managing radioactive waste, consult the [Radioactive Waste Manual](#).

2.6 Decommissioning Activities

Decommissioning activities that may involve potentially radioactive materials are subject to case-by-case evaluation by RPD.

3 Forms

The following forms and systems are required by these requirements:

- [Radiological Safety: Sealed Radioactive Source Acquisition Authorization Form](#) (SLAC-I-760-0A30J-005). Form for authorizing the acquisition of sealed radioactive sources
- [Radioactive Material Declaration Form](#) (contained in [Radioactive Waste Manual](#), [SLAC-I-760-2A08Z-001])
- See the program manuals and procedures referenced under each topic above for other forms.

4 Recordkeeping

The following recordkeeping requirements apply for these requirements:

- See the program manuals and procedures referenced under each topic above.

5 References

[SLAC Environment, Safety, and Health Manual](#) (SLAC-I-720-0A29Z-001)

- [Chapter 9, “Radiological Safety”](#)
 - [Radiological Control Manual](#) (SLAC-I-720-0A05Z-001)
 - [Radioactive Sealed Source Procedure](#) (SLAC-I-760-2A30C-005, FO 008)
 - [Sealed Source Acquisition Process](#) (SLAC-I-760-2A30S-001)
 - [Radiation Generating Devices Program Manual](#) (SLAC-I-760-2A30C-015, FO 035)
 - [Shipping and Receiving of Radioactive Materials](#) (SLAC-I-760-0A30C-002, FO 010)

- [Nuclear Material Control and Accountability Plan](#) (SLAC-I-760-2A30C-008, FO 021)
- [Radioactive Waste Manual](#) (SLAC-I-760-2A08Z-001)
- [Radiation Protection Program Site](#) (SharePoint)

Other SLAC Documents

- [Radiation Protection Department](#)

Other Documents

- Department of Energy Standard 1027-2018, Change Notice 1, “Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports” ([DOE-STD-1027-2018, Chg Notice 1](#))
- Department of Energy Guide 441.1-1C, Change 1, “Radiation Protection Programs Guide for Use with Title 10, Code of Federal Regulations, Part 835, Occupational Radiation Protection” ([DOE G 441.1-1C, Chg 1 \[Admin Chg\]](#))
- Department of Energy Order 474.2A, “Nuclear Material Control and Accountability” ([DOE O 474.2A](#))