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## **Chapter 50**

### **ENVIRONMENTAL RADIOLOGICAL PROTECTION PROGRAM**

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#### **50.1 Policy**

Berkeley Lab has an established and implemented program to protect the public and the environment against undue risk from radiation associated with radiological activities. This

program is tailored to Berkeley Lab activities and uses a graded approach. The program ensures compliance with regulatory dose limits and ensures that potential radiation exposure to the public and environment from Berkeley Lab activities is as low as reasonably achievable (ALARA).

## 50.2 Scope

This policy applies to:

- o Emissions of radionuclides into the air
- o Discharges of radioactive liquids to the sanitary sewer and storm-water systems
- o Protection from external penetrating radiation at the site boundary
- o Protection from radiological contamination of groundwater, drinking water, soils, and sediment
- o Protection from radiological doses from property released for reuse
- o Protection of the public and the environment (including aquatic animals, terrestrial plants, and terrestrial animals (biota) from radiological activities at Berkeley Lab

## 50.3 Applicability

Berkeley Lab managers, supervisors, employees, and affiliates or contractors on behalf of Berkeley Lab who plan to work with or support work with radiation-generating equipment or radioactive materials

## 50.4 Exceptions

None

## 50.5 Roles and Responsibilities

Role	Responsibilities
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Principal Investigators and Supervisors	<ul style="list-style-type: none"> <li>• Ensure that environmental laws, regulations, and policies are followed</li> <li>• Request technical advice from the Environmental Services Group on what environmental requirements apply to their operations and what compliance strategies are appropriate</li> <li>• Ensure that activities are performed within acceptable operating standards and that any required records are current</li> <li>• Notify the Environment, Health, and Safety (EHS) Division immediately of any unplanned releases</li> </ul>
Employees, Affiliates and Contractors	<ul style="list-style-type: none"> <li>• Follow applicable environmental laws, regulations, and policies</li> <li>• Must be fully aware of the environmental impact of their activities, and comply with all requirements that govern those activities</li> <li>• Perform activities within acceptable operating standards, and maintain current records whenever required</li> <li>• Ensure that exposures of the public and the environment to radioactive emissions and discharges are kept ALARA</li> <li>• Take immediate action to stop unplanned releases to the environment, and report all instances of unplanned environmental releases to the EHS Division</li> <li>• Complete all required training provided by supervisors and the EHS Division</li> </ul>
Environmental Services Group	<ul style="list-style-type: none"> <li>• Develops Laboratory policies and procedures to assure that operations are conducted in an environmentally safe manner and in full compliance with all applicable environmental laws and regulations and Department of Energy (DOE) orders and standards</li> <li>• Prepares environmental compliance plans and reports as mandated by DOE orders and Environmental Protection Agency (EPA) requirements</li> </ul>

	<ul style="list-style-type: none"> <li>• Assesses current and planned Berkeley Lab programs, and assists in defining environmental-protection compliance upgrades and corrective actions</li> <li>• Identifies significant institutional environmental-compliance issues, and develops cost-effective mechanisms for resolving them</li> <li>• Performs environmental dose assessments to document that radiation doses to the public and environment are maintained well below the applicable standards and regulations</li> <li>• Prepares budget requests for and manages environmental-protection upgrades and corrective actions for institutional projects</li> <li>• Curtails or suspends any operations that pose an immediate danger to members of the public or the environment</li> <li>• Monitors radioactive emissions and discharges to the environment to verify compliance with applicable regulations</li> <li>• Investigates reports of unplanned environmental releases, and notifies appropriate authorities in a timely manner, as required</li> <li>• Coordinates and represents Berkeley Lab activities during environmental audits and inspections by regulatory agencies and DOE</li> <li>• Responds to information requests from the public</li> </ul>
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**50.6 Definitions**

<b>Term</b>	<b>Definition</b>
As low as reasonably achievable (ALARA)	"An approach to radiation protection to manage and control releases of radioactive material to the environment, and exposure to the work force and to members of the public so that the levels are as low as is reasonably achievable, taking

	into account societal, environmental, technical, economic, and public policy considerations. As used in this Order, ALARA is not a specific release or dose limit but a process which has the goal of optimizing control and management of releases of radioactive material to the environment and doses so that they are as far below the applicable limits of the Order as reasonably achievable." (from DOE O 458.1)
Collective dose	"The sum of the total effective dose to all persons in a specified population received in a specified period of time. For clearance of property the collective dose refers to the population potentially exposed to the cleared property. Collective dose is expressed in units of person-rem (or person-sievert)." (from DOE O 458.1)
Effluent	Any treated or untreated liquid discharge from Berkeley Lab or from a Laboratory facility
Emission	Any filtered or unfiltered substance released to the air from Berkeley Lab or from a Laboratory facility
Environmental surveillance	"The collection and analysis of samples of air, water, soil, foodstuffs, biota, and other media at the DOE site and surrounding environs and the measurement of external radiation to demonstrate compliance with applicable standards, assess radiation exposure of members of the public, and assess effects, if any, on the environment."" (from DOE O 458.1)
Equivalent dose	"The product of average absorbed dose (DT,R) in rad (or gray) in a tissue or organ (T) and a radiation (R) weighting factor (wR). For external dose, the equivalent dose to the whole body is assessed at a depth of 1 cm in tissue; the equivalent dose to the lens of the eye is assessed at a depth of 0.3 cm in tissue, and the equivalent dose to the extremity and skin is assessed at a depth of 0.007 cm in tissue. Equivalent dose is expressed in units of rems (or sieverts)." (from DOE O 458.1)

Radionuclide	A natural or man-made atom that spontaneously undergoes radioactive decay
Technologically enhanced naturally occurring radioactive material (TENORM)	"Any naturally occurring radioactive materials whose radionuclide concentrations or potential for human exposure have been increased above levels encountered in the natural state by human activities." (from DOE O 458.1)
Total effective dose	Sum of doses from external and internal sources of radiation; total effective dose is expressed in units of rem (or sievert)
United States Environmental Protection Agency (EPA)	A federal agency responsible for enforcing environmental laws, including Clear Air Act regulations for radionuclide air emissions
Unplanned release	A release of radionuclides to the environment that was not anticipated

## 50.7 Required Work Processes

### Work Process A. Environmental Radiological Protection Program

- Before the start-up of a new site, facility, or process that has potential to expose the public or environment to radiation or radioactive material, Berkeley Lab ensures that adequate knowledge exists to understand: (1) radiological background, (2) pertinent environmental and ecological parameters, and (3) potential pathways for human exposure or ecological/natural-resource impact. This knowledge comes either from existing data or documents (for example, National Environmental Policy Act [NEPA] evaluations or existing monitoring and surveillance programs) or from a preoperational study initiated at least one year prior to the new operation's start-up. If the start-up of a new site or facility involves the emissions of dispersible radiological material or the change in process at an existing site or facility involves constructing a new stack for new emissions, the preoperational/preparation lead time should be considered 12-18 months due to permit requirements with the EPA. Berkeley Lab controls and manages the release of liquids containing

radionuclides that have resulted from DOE activities, in accordance with DOE Order 458.1 and the Laboratory's East Bay Municipal Utility District discharge permit.

- Berkeley Lab's radiological activities that have the potential to impact the environment are conducted such that populations of aquatic animals, terrestrial plants, and terrestrial animals in local ecosystems are protected from the adverse effects of radiation and radioactive material released during DOE operations.
- Where long-term stewardship and institutional controls are necessary to protect the public and the environment, Berkeley Lab ensures that the need for the controls is documented and maintained and the controls are implemented. Where transfer of real property to other use would impact long-term radiological protection of adjacent DOE properties, Berkeley Lab demonstrates that the property clearance would not result in noncompliance with requirements of applicable statutes, regulations, or DOE directives for the adjacent property.
- Berkeley Lab documents actions it takes to comply with the dose limits contained in DOE Order 458.1 and EPA regulations pertaining to radionuclide air emissions.
- Berkeley Lab conducts DOE radiological activities, including remedial actions and activities using technologically enhanced naturally occurring radioactive material (TENORM), such that exposure of members of the public to ionizing radiation will not cause a total effective dose exceeding 100 mrem (1 mSv) in a year, an equivalent dose to the lens of the eye exceeding 1,500 mrem (15 mSv) in a year, or an equivalent dose to the skin or extremities exceeding 5,000 mrem (50 mSv) in a year, from all sources of ionizing radiation and exposure pathways that could contribute significantly to the total dose. This does not include doses from radon, medical sources, background radiation, and occupational exposures under Nuclear Regulatory Commission or Agreement State license or to general employees regulated under 10 CFR Part 835, *Occupational Radiation Protection Program*.
- Berkeley Lab applies the public dose limit in DOE Order 458.1 to members of the public located off DOE sites and on DOE sites outside of controlled areas, and to those exposed to residual radioactive material after any remedial action or clearance of property.
- In determining the representative person or the maximally exposed individual, Berkeley Lab includes members of the public both on DOE sites outside of controlled areas and off DOE sites.
- If special circumstances could affect a DOE radiological activity such that the potential dose to a member of the public could exceed a total effective dose of 100 mrem (1 mSv) in a year, Berkeley Lab submits a request to the DOE Berkeley Site

Office (BSO) for specific authorization for a temporary public dose limit higher than 100 mrem (1 mSv) in a year. The request documents and justifies the need for the increase, the alternatives considered, and the application of the process for keeping doses ALARA. Temporary dose limits do not include doses from radon, medical sources, background radiation, and occupational exposures.

- If it is suspected that any of the dose limits specified in DOE Order 458.1 may be exceeded or the estimated total effective dose for members of the public exceeds 25 mrem (0.25 mSv) in a year, Berkeley Lab evaluates doses to the lens of the eye, skin, and extremities.
- To demonstrate compliance with the DOE Order 458.1 public dose limit and to assess collective dose, Berkeley Lab uses analytical models that consider likely exposure pathways, including external or internal radiation from cleared real property and any other pathway unique to the DOE site or activity.
- Berkeley Lab conducts radiological activities such that radiation exposure to members of the public from management and storage of radioactive waste complies with ALARA process requirements and does not result in a total effective dose greater than 25 mrem (0.25 mSv) in a year from all exposure pathways and radiation sources associated with the waste. This does not include transportation and radon and its decay products.
- Berkeley Lab manages, stores, and disposes of low-level radioactive waste in such a manner that public exposure to radiation from radioactive waste complies with ALARA process requirements, and does not exceed a total effective dose of 25 mrem (0.25 mSv) in a year from all exposure pathways and radiation sources associated with the waste. This does not include transportation and radon and its decay products.
- Berkeley Lab's annual Site Environmental Report summarizes information on approved authorized limits, approved revised authorized limits, use of pre approved authorized limits, results of radiological monitoring and surveys of cleared property (with type and quantity of property cleared), and independent verification results.
- Berkeley Lab's annual Radionuclide Air Emissions report summarizes information on the emissions of dispersible radiological material used throughout the year and demonstrates compliance with both EPA and DOE public dose limits.
- Berkeley Lab notifies the DOE BSO within 30 calendar days of identifying that any specific requirement of DOE Order 458.1 that is not otherwise required to be reported under paragraph 2.1.(5)(a) of DOE Order 458.1 has not been met.

- Unless otherwise specified, Berkeley Lab clearly indicates the quantities used in the reports and records required by DOE Order 458.1 in special units of curie, rad, roentgen, or rem, including multiples and subdivisions of these units; or other conventional units, such as dpm, dpm/100 cm<sup>2</sup>, or mass units. International System (SI) units and the units of becquerel (Bq), gray (Gy), and sievert (Sv) may be provided parenthetically.

## 50.8 Source Requirements

- Department of Energy Order 458.1 Chg 4 — *Radiation Protection of the Public and the Environment*, September 15, 2020
- 40 CFR 61, Subpart H (1989, as amended) Environmental Protection Agency, *National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities*

## 50.9 Reference Documents

Title	Type
Environmental Protection	Program