1.0 Purpose:

1.1 To define the procedures for controlling operations and maintaining BEP personnel exposure to ionizing radiation as low as reasonably achievable (ALARA).

1.2 To define the procedures for ensuring no laser radiation in excess of the maximum permissible exposure (MPE) limit reaches the human eyes or skin.

2.0 Scope:

This policy applies to employees who work with ionizing radiation- producing equipment and Class 3B and Class 4 lasers.

3.0 Definitions:

3.1 ALARA - making every reasonable effort to maintain exposures to radiation as far below the dose limits as is practical.

3.2 Ionizing Radiation – radiation consisting of particles, X-rays, or gamma rays with sufficient energy to cause ionization in the medium through which it passes.

3.3 Dose - means the quantity of ionizing radiation absorbed, per unit of mass, by the body or by any portion of the body.

3.4 Laser Classification - based on the laser's potential for causing immediate injury to the eye or skin during use. A qualitative description of laser classes can be found in ANSI Z136.1.

3.5 Laser Operator – A person who has received specific training and qualifications to make unescorted access into the restricted area and perform work with lasers.

3.6 Non-Ionizing Radiation –ranges from extremely low frequency radiation, through the audible, microwave, and visible portions of the spectrum into the ultraviolet range.

3.7 Radiation Worker - A person who has received specific training and qualifications to make unescorted accesses into the restricted area and perform work of a radiological nature.

3.8 Restricted Area – Any area access to which is controlled by the employer for purposes of protection of individuals from exposure to radiation.

3.9 Unrestricted Area - Any area access to which is not controlled by the employer for purposes of protection of individuals from exposure to radiation.

4.0 Roles and Responsibilities:

4.1. OEHS shall:

a. Implement and maintain a program and procedures.

b. Evaluate the overall effectiveness of the radiation and laser safety program on a periodic basis.

c. Provide or coordinate training.

d. Provide guidance on laboratory design, shielding and other radiation exposure control methods.

e. Maintain an inventory of ionizing radiation producing equipment and Class 3B and Class 4 lasers.

f. Notify the BEP Health Unit of any new employees to the program and coordinate all necessary medical exams.

4.2. Offices using radiation producing equipment and/or lasers shall:

a. Perform personnel radiation monitoring on a quarterly basis for radiation workers who will enter a restricted area to work with ionizing radiation producing equipment.

b. Notify OEHS when a new individual begins work in their laboratory.

c. Provide records of radiation monitoring to OEHS and the BEP Health Unit.

d. Ensure standard operating procedures are written.

e. Notify OEHS prior to ordering or acquiring any new radiation producing equipment, lasers and laser systems. Request an EHS review from the OEHS. Once the equipment and proposed location are approved, the equipment may then be installed (see EHS review procedure 75-3-W-08-001 and Large Equipment Boilerplate 75-3-W-08-002.

4.3. BEP Health Unit Shall:

a. Maintain medical files for those covered by this procedure.

b. Provide a medical wellness exam initially and following any suspected injury.

c. Provide or coordinate a baseline eye exam for laser operators prior to employee participation in laser work and following any suspected laser injury per the requirements of ANSI Z136.1.

4.4. Radiation Workers Shall:

a. Follow the policy procedures described in this document.

b. Complete all training required relative to this program.

c. Submit any records from past employment, other than at BEP, regarding radiation monitoring to the BEP Health Unit.

d. Wear a personal radiation dosimeter while working in a restricted area and make sure to wear the dosimeter assigned to them.

e. Wear the appropriate radiation dosimeter as applicable. Ensure that the body badge is worn on the trunk of the body at chest level and ring dosimeters are worn on the hand closest to the radiation source.

f. Store the employee dosimeters in a low radiation area when not in use.

g. Store the control dosimeter in a radiation free area.

h. Immediately report any damage that may have occurred to a dosimeter to the personnel dosimetry vendor.

i. Immediately report any over exposure incident or other concerns related to radiation safety to a supervisor and OEHS.

j. Laser Operators Shall:

k. Follow the policy procedures described in this document.

l. Complete all training required relative to this program.

m. Immediately report any laser related incident/injury or other concerns related to laser safety to a supervisor and OEHS.

5.0 Training:

5.1 Employees must be trained and familiar in:

a. The safety-related work practices that pertain to their respective job assignments. Online training will be provided when the employee is initially assigned to the job and refresher training will be provided annually or when conditions change.

b. The standard operating procedures for all equipment that the employee is authorized to use.

6.0 Equipment:

6.1 All ionizing radiation equipment must have the following:

a. Safety device(s) to prevent entry of any portion of an individual's body into the primary X-ray beam path or safety device(s) that causes the beam to shut off if an individual's body crosses the primary X-ray beam path.

b. Warning devices for X-ray tube "on –off" status and shutter "open-closed" status.

c. Labeling of all X-ray equipment with a sign or signs bearing the radiation symbol.

d. Shutters on open-beam configurations.

e. Radiation source housing.

f. Generator cabinet.

6.2 All Lasers must have the following:

a. Warning labels affixed on both the housing and the control panel. Removal of protective housing or system modification can increase a laser's classification. Contact OEHS for review prior to servicing or system modification.

b. The engineering control measures required for Class 3B and Class 4 lasers are described in ANSI Z136.1 Safe Use of Lasers. Where specific engineering controls are infeasible they may be replaced with specific administrative and procedural controls and personal protective equipment (PPE) with prior review by OEHS.

7.0 Area Requirements

7.1 Ionizing Radiation Restricted Areas:

a. Offices using radiation producing equipment shall ensure each area or room shall post a sign bearing the radiation caution symbol and the words “Caution Radiation Area” or words having a similar intent.

b. Radiation levels must be controlled by sufficient shielding or access control so as to prevent any radiation levels from existing in any surrounding area.

c. Radiation surveys shall be conducted monthly, after any change or whenever personnel monitoring devices show a significant increase.

d. Always have a dosimetry badge freely monitoring the environmental radiation exposure in the room of the X-ray equipment. This badge is never to be stored in a radiation free environment.

e. Any Non-Radiation Worker who requires access to a radiation area for reasons to include, but not limited to, building maintenance and housekeeping must obtain prior approval from the Radiation Safety Officer responsible for the area.

f. Ionizing radiation equipment will be turned off to allow safe access to Non-Radiation Workers on a schedule that is pre-determined by the Radiation Safety Officer for the area.

7.2 Laser Restricted Areas:

a. Offices using laser equipment shall ensure that Laser restricted areas must be posted with the appropriate warning signs at the entryway(s) and if necessary, within the laser controlled area.

b. Ensure the laser lab area is controlled when the laser is in use by means of engineering or administrative controls.

8.0 Personnel Monitoring:

8.1 Individuals working with ionizing radiation producing equipment must limit the amount of working time in a restricted area so as to not exceed the OSHA dose limits of Table G-18 of 29 CFR 1910.1096(b)(1) during any period of a calendar quarter.

8.2 Any person who enters a restricted area or who is likely to receive >10% of a permissible limit shall wear appropriate devices for monitoring exposure.

9.0 Dose Limits:

29 CFR 1910.1096(b)(1) Table G-18 (Ionizing Radiation)

	Rems per calendar quarter
Whole body: Head and trunk; active blood-forming organs; lens of eyes; or gonads	1 ¼
Hands and forearms; feet and ankles	18 ¾
Skin of whole body	7 ½

9.1 The dose to an embryo/fetus during the entire pregnancy of a declared pregnant woman, due to occupational exposure of a declared pregnant woman, shall not exceed 0.5 rem (5 mSv).

10.0 Related Documents

1.1 Requirements for Large Equipment Purchases 75D-07.0-06
1.2 EHS Review 75D-07.0-01
1.3 ANSI 136.1 Safe Use of Lasers

11.0 Document Revision History

Rev. #	Purpose of Revision	Approver	Eff. Date
1	Update OEHS and OMT responsibilities, area requirements; remove duplicate definition and punctuation changes. Remove Office of Materials Technology.	N. Mohlmann	10/9/13
2	Changed document number to align with new scheme	N. Mohlmann	04/01/2014
3	Periodic review of procedures, one addition to area requirements for ionizing radiation restricted areas, and one revision to laser restricted area requirements.	V. Antoine-Pompey	03/16/17
4	Change document format to align with new scheme. Remove requirement to register radiation producing equipment, does not apply to BEP equipment.	V. Antoine-Pompey	08/10/20