

## UNIVERSITY OF CALIFORNIA, BERKELEY RADIATION- PRODUCING MACHINE SAFETY GUIDELINES

These guidelines are to be posted in all rooms where radiation-producing machines are used or stored. These procedures pertain to electron microscopes, x-ray irradiators, analytical x-ray machines, accelerators, and any other machines producing ionizing radiation. Specific regulations are found in the campus Radiation Safety Manual.

### **EMERGENCIES:**

Notify Office of Environment, Health & Safety - Radiation Safety (RS) immediately in the event of any suspected abnormal personnel radiation exposure. Call 642-3073 during normal working hours or 911 at all other times. In case of injury, call 911 to obtain first aid, ambulance, etc., then notify RS immediately. Some situations requiring RS notification:

1. Suspected exposure of fingers, eyes, or any other part of the body to the primary beam.
2. Failure or misuse of a shutter or enclosure interlock allowing possible exposure to the primary beam.

### **PROCUREMENT AND DISPOSAL:**

State regulations require notification within thirty days of the receipt, transfer, or disposal of any radiation-producing machine. To assure compliance with this requirement, campus regulations require that RS be notified in advance of the following:

1. Acquisition, sale, transfer, or disposal of a radiation-producing machine.
2. Major repair, modification, or component replacement.
3. The transfer of any machine to a new location or a new Authorized User.

### **OPERATION:**

1. Each machine shall have a valid, posted, Radiation Use Authorization (RUA).
2. RS shall be notified of any new operating personnel or in any change in the use of the machine.
3. No machine shall be operated unless an operator, adequately trained and approved by the Authorized User, is in direct charge of the machine.
4. A log shall be maintained for each machine. It must show operator, date, duration of use, number of uses, beam current, voltage, and any comments regarding mode of operation, abnormalities, or malfunctions.
5. Required, individually assigned, dosimetry shall be worn while operating the machine.
6. If required by the RUA, an adequate portable radiation survey meter shall be available for use.
7. Operation in any mode not specified by the RUA shall have prior RS approval. Examples of situations requiring RS approval are: modifications that increase scatter or beam access; operation without required shielding or required safety devices such as beam enclosures, interlocks, safety shutters, beam stops, collimators, or warning lights.
8. RS must be notified immediately if any required safety system fails or becomes non-operational.
9. Operating Safety Procedures:
  - a. Complete operating and safety instructions for each machine shall be posted or be readily available.
  - b. Whenever the machine is operated by new personnel or in a new mode, radiation levels shall be checked with a survey meter.
  - c. Interlocks or operational safety requirements shall not be bypassed.
  - d. When operating a unit that has an accessible radiation beam, adjustments, whenever possible, shall be made with the beam off or shutters closed.
  - e. No part of the body shall come within 3 inches of a primary beam or high-level scatter. Interlocked barriers are highly recommended.
  - f. Personnel not involved in the operation should not be in close proximity to the machine.
  - g. Machine rooms shall be kept locked if machines are unattended.
  - h. Key interlocks shall be removed when machines are not being operated.
10. Call RS for any information regarding radiation safety, survey meters, or safety devices.

### **ANALYTICAL X-RAY HAZARDS:**

1. In-beam radiation dose rate for a typical diffraction tube can be on the order of  $10^5$  rem/min near the port. The scattered beam can have dose rates up to 80 rem/hr. Radiation from defective high-voltage power supplies can give dose rates up to 1 rem/hr.
2. An acute dose in excess of 500 rem can produce skin erythema. Eye damage can occur below this level. Lower exposures may produce long-term somatic and genetic effects.