GuideSheet

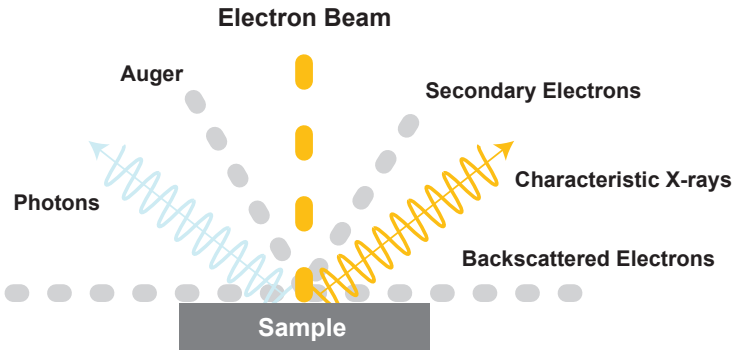
Electron Microscope Safety

Electron microscopes (EM) produce low levels of ionizing radiation as a result of the electron beam interacting with the sample material. Radiation is considered ionizing when the energy is high enough to produce ions by breaking molecular bonds and displacing (or removing) electrons from atoms or molecules.

Ionizing radiation has a number of beneficial uses that include cancer treatment, medical equipment sterilization, and scientific research. However, unsafe use of ionizing radiation is potentially harmful and can result in permanent effects on DNA, severe skin or tissue damage, and cancer.

Both characteristic and bremsstrahlung X-rays are produced when electrons strike the sample and components of the EM with a high enough energy. Some electrons from the primary beam are also backscattered from the sample.

Modern EMs are well-shielded and eliminate or greatly minimize exposure to personnel. However, the safety of the device is dependent on the design and integrity of the shielding. All EM users must be aware of the radiation safety concerns and take precautions to avoid exposure.



To ensure exposures are As Low As Reasonably Achievable (ALARA), EM users will conduct the following:

- Ensure that shielding, safety interlocks, and warning lights are maintained and operable prior to each use. The device shall not be used if the integrity of the device is suspect.
- Turn off EMs when not in use.
- Reduce time around energized EMs.
- Maximize distance away from energized EMs. Keep hands/arms off the energized EM unless working with it.

Additionally, EM users **must**:

- Know safe operating and emergency procedures.
- Complete device-specific training with the supervisor of the EM.
- Never alter the original design or shielding of the EM without written approval from the Radiation Safety Officer (RSO).
- Log user name and date of EM usage.
- Notify the EM Owner/Supervisor and RSO of any radiation incidents or unsafe practices.

EM Owners/Supervisors **must**:

- Apply to purchase an EM by submitting a Radiation Use Authorization (RUA) application to the Radiation Safety Committee (see RUA information).
- Email radsafety@usc.edu to begin registration of the EM. NOTE: All EMs (e.g., transmission, scanning, reflection, scanning transmission, low voltage) must be registered (see form) with the California Department of Public Health (CDPH) within thirty (30) days of acquisition.
- Provide device-specific training to all EM users and document compliance. Documentation must remain on file in the lab for review by Radiation Safety.
- Notify the RSO of a relocation, disposal, or transfer of the EM prior to change.
- Provide written operating and emergency procedures to EM Users.
- Secure the EM from unauthorized users.

NOTE: Personal dosimetry is not required when working with an EM.

Fill in the sections below and email completed document to radsafety@usc.edu. Keep this document on file in the lab.

ELECTRON MICROSCOPE IDENTIFICATION
SERIAL NO.:
MODEL:
MANUFACTURER:
LOCATION (BLDG/RM):

Device Owner(s)/Supervisor(s):
I have thoroughly read and understand the risks of radiation when using an electron microscope (EM) and my responsibilities as the Owner and/or Supervisor of the EM. I certify that I will conduct my research safely and be responsible for the safety policies stated in this document.

Name Signature Date

Name Signature Date

Device User(s):
I have thoroughly read and understand the risks of radiation when using electron microscopes. I certify that I will conduct my research safely and be responsible for the safety policies stated in this document.

Name	USC ID	Signature	Date

FOR EH&S USE ONLY		
Date reviewed	Rad Safety Staff	Signature