UV Radiation Safety Guide

77 Massachusetts Avenue,
Cambridge , Ma. 02139

(617)-452-3477 | environment@mit.edu | ehs.mit.edu

MIT EHS
ENVIRONMENT · HEALTH · SAFETY

Delegation of Authority

MIT has a standing institute committee on Radiation Protection to oversee all uses of radiation at the Institute and its associated off campus locations. They give the RPP authority to stop any experiment or process involving radiation that is deemed unsafe.

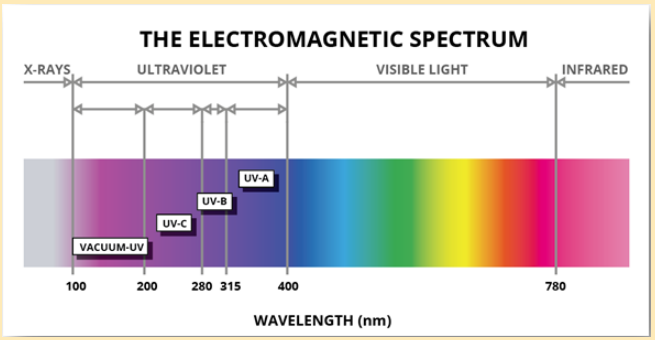
Scope

This guidance is for incoherent (i.e., LEDs, lamps, ..) sources of UV found in the laboratory. For coherent sources of UV, please refer to the laser safety program. The MIT Radiation Protection program does not register sources of UV (with the exception of Lasers) but provides guidance and implements policy for the safe use of UV sources. Although the single largest exposure to UV is from the sun, this guidance only address common UV light sources in the laboratory and does not include sources of UV arising from welding

Basic Description of UV Radiation

Ultraviolet light (UV) is non-ionizing radiation in the 180 to 400-nanometer wavelength region of the electromagnetic spectrum. The ultraviolet spectrum is commonly divided into the following three regions:

Region	Region Name	Wavelength (nm)
VUV	Vacuum UV	100-180
UVC	Germicidal	180-280
UVB	Erythemal	280-314
UVA	Black Light	315-400

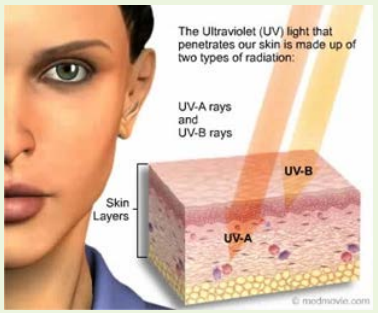


Exposure to ultraviolet radiation is typically limited to the UVA region resulting from exposure to direct sunlight. The Earth's atmosphere shields us from the more harmful UVC and greater than 99% of UVB radiation. However, some equipment can generate concentrated UV radiation in all the spectral regions that, if used without the appropriate shielding and personal protective equipment, can cause injury with only a few seconds of exposure.

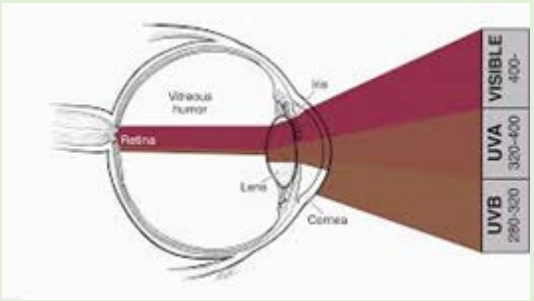
Hazards Associated with Exposure to Ultraviolet Light

An unfortunate property of UV radiation is that there are no immediate warning symptoms to indicate overexposure. Symptoms of overexposure including varying degrees of erythema (sunburn) or photokeratitis (welder's flash) typically appear hours after exposure has occurred.

Skin Injury - UV radiation can initiate a photochemical reaction called erythema within exposed skin. This "sunburn" can be quite severe and can occur as a result of only a few seconds exposure. Effects are exaggerated for skin photosensitized by agents such as coal tar products, certain foods (e.g., celery root), certain medications and photoallergens. Chronic skin exposure to UV radiation has been linked to premature skin aging, wrinkles and skin cancer.

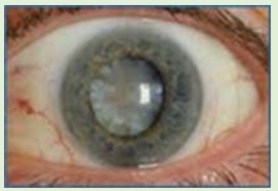


Eye Injury – UV radiation exposure can injure the cornea, the lens, or the retina depending on the type of UV radiation.



Photokeratitis is a painful inflammation of the eye caused by UV radiation-induced lesions on the cornea. Symptoms include a sensation of sand in the eye that may last up to two days.

Cataracts may result from chronic exposures to acute high-energy UV radiation.



Some UV sources may extend beyond 400 nm as part of a spectral continuum and it is this "blue light" that may also affect the Retina. **Blue light hazards** are unique since the damage may not be manifested until 24 to 48 hours post exposure. Blue light hazards are part of the reason we should not stare at the sun or arc flashes.

Radiation Protection Program Services

- **Hazard Assessment:** The Radiation protection program can perform hazard assessments such as confirming the performance of safety equipment, shielding and personal protective equipment.
- **Personal Protective Equipment Recommendations:** Radiation Protection is available to recommend appropriate personal protective equipment suited for the particular source of UV radiation.

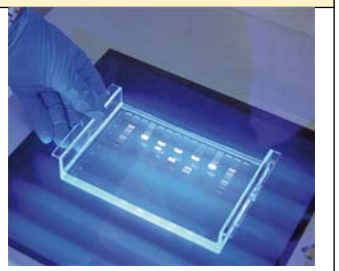
Commonly UV Sources in Laboratories

Biological Safety Cabinets

Although Centers for Disease Control (CDC) and the National Institute of Health (NIH) no longer recommend the use of UV for sterilization, a number of them exists at MIT. Never work in a biological safety cabinet while the germicidal lamp is on. If possible, close the sash while lamp is on.

Transilluminators

UV transilluminators should be guarded (enclosed in an absorbent polymer) with an interlock that will make the device safe (i.e. turn it off) if the guard is opened. Eye and skin exposure should be avoided, alternatives to manipulating gels with hands whilst under UV should be found. The manufacturer's specification should be consulted for information as to the potential exposure level and frequency of radiation and their suggested operating protocols. Never use a transilluminator without the protective shield in place. Shields must be kept clean and replaced when damaged.



Crosslinkers

UV-Crosslinker is used to "cross-link" or covalently attach nucleic acid to a surface or membrane following Southern blotting, Northern blotting, dot blotting, and Colony/Plaque lifts. 254 nm wavelength is used. Crosslinkers must not be used if the door safety interlock is not working properly.

UV Curing Systems

UV curing is a speed curing process in which high -intensity ultraviolet (UV) light is used to create a photochemical reaction that instantly cures inks, adhesives, and coatings. The spectra available for UV curing are quite varied and may extend into the blue light spectrum.

Traits of a Positive Safety Culture

1. Leadership Safety Values and Actions
2. Problem Identification
3. Personal Accountability
4. Work Processes
5. Continuous Learning
6. Environment for Raising Concerns
7. Effective Safety Communication
8. Respectful Work Environment
9. Questioning Attitude

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Personal Protective Equipment

Protective Clothing: Wear standard laboratory apparel including a fully buttoned lab coat, long pants and closed toe shoes. While working with UV radiation sources, lab workers must be particularly vigilant to prevent gaps in protective clothing that commonly occur around the neck and wrist areas.

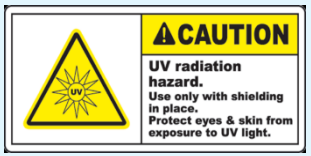
Eye/Face Protection: If there is any potential for the eyes and face to be exposed to UV radiation, a polycarbonate face shield stamped with the ANSI Z87.1 UV certification must be worn to protect the eyes and face. Ordinary prescription eyeglasses may not block UV radiation. UV certified goggles and safety glasses will protect the eyes, but it is common for lab workers to suffer facial burns in the areas not covered by the goggles or glasses.

Note that if spectrum extends beyond 400 nm, then the protective eyewear may need to be considered separately for these wavelengths as well. Under these conditions googles rated for this **blue light hazard** to protect the eye needs to be worn in conjunction with a face shield (used to protect the skin of the face).

Gloves: Wear disposable nitrile gloves to protect exposed skin on the hands. Ensure wrists and forearms are covered between the tops of gloves and the bottom of the lab coat sleeves.

Equipment Labeling

Many overexposures to UV radiation have occurred as a result of individuals not knowing the hazards associated with UV-emitting equipment. To help prevent eye and skin injuries, any equipment that emits UV radiation must be conspicuously labeled with a caution label. The label should contain language similar to:



Do's and Don'ts

Do

- read the manufacturer's instructions.
- follow the controls in the procedure
- wear protective clothing if there is a risk of harmful exposure.
- avoid unnecessary exposure to eyes or skin.

Don't

- expose other people to UV radiation due to your activities.
- modify the equipment.
- remove covers.
- defeat interlocks

Emergency Procedures

Emergency: Dial 100 from Campus Phone or 617-253-1212
General Medical Attention: If you suspect a UV exposure, seek medical attention by contacting MIT Medical; note that symptoms may not appear till 12 – 48 hr after exposure.
Follow-up: • Notify Supervisor so that an injury report can be filed if necessary • Notify EHS Radiation Protection to review the incident to assess and help identify corrective actions.