

DESCRIPTION

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)
UVA	Black Light	315-400
UVB	Erythema	280-314
UVC	Germicidal	180-280

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 and tasks can generate concentrated UV radiation in all the spectral regions that, if used or completed without the appropriate shielding and personal protective equipment, can cause injury with only a few seconds of exposure.

COMMON SOURCES OF UV RADIATION IN THE LABORATORY

There are several sources of UV radiation in the laboratory including germicidal lamps in biological safety cabinets, nucleic acid transilluminators and crosslinkers, and UV lasers. For laser safety information, please refer to the Laser Safety Manual at <https://ehrs.upenn.edu/health-safety/laser-safety>



Transilluminator



Crosslinker

HAZARDS ASSOCIATED WITH EXPOSURE TO ULTRAVIOLET LIGHT

An unfortunate property of UV radiation is that there are few immediate warning symptoms to indicate overexposure. Symptoms of overexposure, including varying degrees of erythema (sunburn) of the skin or photokeratitis (welder's flash) of the eyes, 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 outer protective coating of the eye. 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. Chronic exposures to acute high-energy UV radiation can lead to the formation of cataracts.

SPECIAL WORK PRACTICES

Minimize skin and eye exposure to UV radiation sources as much as possible. The UV radiation generated by laboratory equipment and electrical welding can exceed recommended exposure limits and cause injury with exposures as brief as three seconds.

- **Biological Safety Cabinets** - Never work in a biological safety cabinet while the germicidal lamp is on. If possible, close the sash or stay away from the cabinet while lamp is on. Penn does not require UV lights in biosafety cabinets.
- **Transilluminators** - Never use a transilluminator without the protective cover shield in place. Shields must be kept clean and replaced when cracked or otherwise damaged.
- **Crosslinkers** - Crosslinkers must not be used if the door safety interlock is not functional.

- **Electric Welding** – Use a welding screen/curtain to protect bystanders and wear personal protective equipment including a welding coat, gloves, and a welding helmet with the appropriate lens shade to protect the eyes.

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 UV caution label. The label should contain language similar to:

CAUTION
UV RADIATION HAZARD
USE ONLY WITH SHIELDING IN PLACE
PROTECT EYES AND SKIN FROM
EXPOSURE TO UV LIGHT

Caution labels are available from EHRS or may be available from the manufacturer of the UV light producing equipment.

LABORATORY WORKER 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.
- **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.

EMERGENCY PROCEDURES

Notify supervisor of all incidents and injuries. If medical treatment is required, seek treatment at the appropriate Penn provider. Campus-specific Penn medical provider information for employees and students can be found on the EHRS Emergency Information section of our web site. <https://ehrs.upenn.edu/emergency-info/where-seek-treatment-emergencies-involving-injuries>

EHRS UV LIGHT/RADIATION SERVICES

- **Measurements:** EHRS has instrumentation to accurately measure UV radiation. Based upon the strength of the UV radiation source and the duration of exposure, we can provide information on recommended occupational exposure limits. EHRS can also confirm the performance of safety equipment including equipment shielding and personal protective equipment.
- **Personal Protective Equipment Recommendations:** EHRS is available to recommend appropriate personal protective equipment suited for the particular source of UV radiation.
- **Training:** EHRS is available to provide training to lab workers on safe work practices and procedures for working with specific UV radiation sources.

Please contact EHRS at (215) 898-4453 to arrange for any of the above services or for any questions pertaining to UV radiation safety.

RESOURCES

- **Penn EHRS – UV Lights in Biosafety Cabinets** - <https://ehrs.upenn.edu/health-safety/biosafety/biosafety-cabinets>
- **OSHA Welding Safety Information** - <https://www.osha.gov/welding-cutting-brazing>
- **OSHA General UV Safety Information** - <https://www.osha.gov/laws-regs/standardinterpretations/2003-02-26>