ENVIRONMENTAL
HEALTH & SAFETY

Safety Guidelinse
Ultraviolet (UV) Radiation Hazards

UV Hazards

Many people are not aware that UV lights can pose hazards. Like the sun, UV lights emit UV radiation that can cause skin burns, eye damage, including permanent blindness and skin cancer. Ultraviolet light is non-ionizing radiation in the 180 to 400-nanometer wavelength range of the electromagnetic spectrum. The ultraviolet spectrum is commonly divided into the following three ranges by their wavelengths:

UV Spectrum	Spectrum Name	Wavelength (nm)
UVA	Black Light	315-400
UVB	Erythemal	280-314
UVC	Germicidal	180-280

Exposure to sunlight causes UV exposure in the UVA spectrum. However, the Earth's atmosphere shields us from the more harmful UVC and greater than 99% UVB spectrum radiation.

Some laboratory equipment can generate concentrated UV radiation in all the spectral regions. High intensities of UV light are hazardous to the eyes and can injure the cornea, the outer protective coating of the eye, in as little as a few seconds of exposure. However, it may be a few hours or the next day before the extent of the injury is felt. UV light can also cause skin burns and lead to skin cancer on unprotected skin. In addition, UV light can reflect off shiny surfaces such as stainless steel, so use caution when working around equipment when the UV light is on.

UV Light Sources in the Laboratory

Laboratory sources of UV light may include germicidal lamps in biological safety cabinets (BSCs), nucleic acid trans-illumination boxes, nucleic acid cross-linkers, curing lamps, and UV lasers. The best method of protection is to avoid exposure. Do not use trans-illuminators without the protective UV shield in place. Keep shields clean and replace them when damaged. Never operate equipment with missing, broken, or improperly functioning shields or interlocks. **Never override safety interlocks.**

The Principal Investigator, or PI, is responsible for ensuring all individuals are properly trained in using UV equipment safely.

Personal Protective Equipment

Protect your skin and eyes from exposure to UV radiation sources. The UV radiation generated by laboratory equipment can exceed recommended exposure limits and cause severe and potentially permanent injury with exposures as brief as three seconds in duration.

Eye/Face Protection: When working with UV emitting equipment, wear the appropriate eye and face protection. Always wear a full-face shield. Use a polycarbonate face shield stamped with the ANSI Z87.1-1989 UV certification to protect the eyes and face. The face shield should be marked with the term Z87 to indicate that the shield meets the ANSI standard to provide at least basic UV protection. Users should read the manufacturer's instructions provided with the face shield to verify that the shield offers adequate UV protection. UV face shields must wrap around the side of the head and cover the face and neck. UV face shields are available for purchase in eShop.

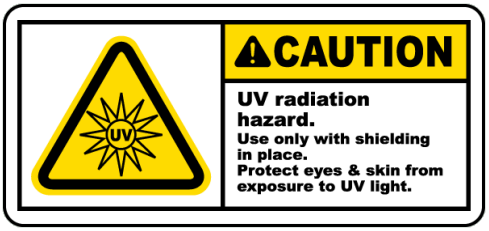
Ordinary prescription eyeglasses may not block UV radiation. UV-certified goggles and safety glasses will protect the eyes, but it is common for lab workers to suffer facial burns in the areas not covered by the goggles or glasses.

Skin: Protect all exposed skin. Wear a lab coat or a shirt with long sleeves. Use gloves that are long enough to cover the hand, wrist, and forearms. Wear disposable latex or nitrile gloves to protect exposed skin on the hands. Do not use vinyl gloves, which can transmit significant amounts of actinic UV.

You can find more information on UV Radiation here: PREVENT EYE DAMAGE Protect Yourself from UV Radiation, Office of Air and Radiation (6205J) EPA-430-F-10-038, August 2010

UV Warning Labels

Post equipment that emits UV radiation with a warning label that contains wording similar to the one shown here.



UV hazard labels are available from EHS.

Maintenance and Disposal

Maintain UV lights per the equipment manufacturer's instructions. Only trained and knowledgeable personnel should replace UV bulbs using proper personal protective equipment. Dispose of UV bulbs as Universal Waste. Refer to the Universal Waste Disposal Fact Sheet.

Exposure Reporting

Report any injuries related to UV exposure immediately. Incident Reporting information is available online.

UV Lamps in BSC

UNMC Environmental Health and Safety (EHS) and the UNMC Institutional Biosafety Committee (IBC) **strongly discourage** the use of Ultraviolet (UV) lamps in Biological Safety Cabinets (BSCs) and UV disinfection of laboratory work surfaces. In addition, the National Institutes of Health (NIH), Center for Disease Control and Prevention (CDC), National Science Foundation/ANSI, and the American Biological Safety Association (ABSA) all agree that UV lamps are not recommended or necessary for decontamination in BSCs. Instead, the **primary** surface decontamination is wiping with an approved disinfectant.

If portable UV lights must be used to disinfect work surfaces in a laboratory, conduct this work when the room is unoccupied by others. If UV lights must be used to decontaminate hoods or biological safety cabinets, be sure the sash is closed, and the lab is unoccupied

The Principal Investigator (PI) is responsible for ensuring personnel under their supervision are trained on the safe and proper use of the BSC and that the correct decontamination procedure is followed.

Requirements for Use of UV Lamps in BSC

Follow this procedure if a UV lamp is used in your BSC.

- Post a UV warning label on the front of the BSC. These are available from EHS.
- Turn off the UV lamp if the room is occupied.
- Turn off the UV lamp after 15 minutes. If UV lamps are used for longer than 15 minutes, post a sign on the outside of the room's closed door.
- Decontaminate the BSC surface and any items removed from the BSC before UV lamp use.
- Fully close the BSC sash before turning on the UV lamp.
- No work is permitted within the BSC while the UV lamp is on.
- Retrofitting any equipment, such as UV lamps, into a biological safety cabinet is prohibited and may alter the airflow characteristics of the cabinet and invalidate any manufacturer warranted.

Factors that Influence IV Lights for Decontamination Purposes

- **Penetration:** UV light is not penetrating and should only be used for surface decontamination
- **Relative humidity:** Above 70% relative humidity, the germicidal effect drops off precipitously.
- **Temperature and Air Movement:** Optimal temperature for output is 77- 80°F. Temperatures below this result in reduced output of the germicidal wavelength. Moving air tends to cool the lamp below its optimum operating temperature and therefore results in reduced output.
- **Cleanliness:** UV lamps must be cleaned to remove dust and dirt that could block the UV light's germicidal effectiveness.
- **Age:** UV lamps lose intensity and should be checked and replaced based upon the manufacturer's guidelines. UV lights are NOT checked by UNMC Facilities personnel during the annual routine inspection process for BSCs.

Maintenance for UV Lamps in BSC

- Clean and replace UV lamps based upon manufacturer's guidelines. A trained individual should perform this task.
- Before replacing UV lamp bulbs, clear the BSC of any equipment or materials and properly disinfect the BSC with an appropriate disinfectant.
- Install the new bulb with gloved hands to prevent oil build-up.

Disposal

- Disinfect UV bulbs before disposal.
- Dispose of UV lamps as Universal Waste in accordance with hazardous waste regulations. Please refer to the Universal Waste Disposal Fact Sheet for information on properly disposing of UV bulbs.
- Should a UV lamp break, follow standard precautions for cleaning up broken glass. Collect broken glass pieces in a closed container or box, and contact EHS for proper disposal. After handling broken lamps, remove PPE and thoroughly wash hands.

References:

American Biological Safety Association (ABSA) Position Paper on the Use of Ultraviolet Lights in Biological Safety Cabinets

CDC/NIH Biosafety in Microbiological and Biomedical Laboratories, page 385.