

Ultraviolet Light Safety Guidelines

Ultraviolet radiation is divided into three regions: UV-A: 315-400 nanometers (nm), UV-B: 280-315 nm, and UV-C: 100-280 nm. UV can be associated with adverse health effects depending on duration of exposure and the wavelength. The adverse health effects that may occur are erythema (sunburn), photokeratitis (a feeling of sand in the eyes), skin cancer, melanoma, cataracts, and retinal burns.

Band	Wavelength	Primary Visual Hazard	Other Visual Hazards	Other Hazards
UV-A	315-400nm	cataracts of lens		skin cancer, retinal burns
UV-B	280-315nm	corneal injuries	cataracts of lens, photokeratitis	erythema, skin cancer
UV-C	100-280nm	corneal injuries	photokeratitis	erythema, skin cancer

There is no Occupational Safety and Health Administration (OSHA) standard for exposure to ultraviolet light, but the National Institute for Occupational Safety and Health (NIOSH) recommends that the time of exposure to an intensity of 100 microwatts per square centimeter at wavelength 254 nanometers not exceed 1 minute. When averaged over an eight-hour work day, this value is 0.2 microwatts per square centimeter.

The American Conference of Governmental Industrial Hygienists (ACGIH) has issued Threshold Limit Values (TLVs) for occupational exposure to UV. These TLVs refer to ultraviolet radiation in the spectral region between 180 and 400 nm and represent conditions that nearly all workers may be repeatedly exposed without adverse health effects. The TLVs for occupational exposure to UV incident upon skin or eye are based on the irradiance and time of exposure. Broad band sources are weighted to determine the effective irradiance compared with the spectral effectiveness curve at 270 nm. Refer to current "Threshold Limit Values for Chemical Substances and Physical Agents" published by ACGIH for values .

Personnel that may be exposed to harmful amounts and wavelengths of UV must take adequate steps to shield themselves and in some cases limit the duration of exposure. Environmental Safety can provide assistance in measuring UV emissions and evaluating personal protective equipment for its UV protection.

It is also important to note that ozone is produced in air by sources emitting UV at wavelengths below 250 nm. Some UV devices may produce ozone in appreciable levels and consideration should be given to ozone levels.

Below are several ultraviolet light generating devices, what they are used for, and where they are generally found within the University. Included in this list are recommendations for personal protective equipment and maintenance/monitoring.

Transilluminator

Uses: Transilluminators are frequently used in research laboratories for visualizing nucleic acids following gel electrophoresis and ethidium bromide staining.

General locations: Transilluminators can be found in research labs throughout the River Campus and Medical Center. Access to rooms containing transilluminators must be controlled by closing the door and posting a warning sign on the door stating the instrument is in use. The warning sign should include Caution: High Intensity Ultraviolet Energy. Protect Skin and Eyes.

Personal Protective Equipment: Personal protective equipment must be worn by all individuals in the room while the transilluminator is operating. The personal protective equipment must protect the eyes and skin. Appropriate PPE would include gloves, lab coat with no gap between the cuff and the glove, and a UV resistant face shield.

Maintenance/ Monitoring: In general there is no reason to perform periodic monitoring of the transilluminator emissions. Maintenance should be performed according to the manufacturer's instructions.

Hand-held UV Units

Uses: Hand-held UV units are frequently used in research laboratories for visualizing nucleic acids following gel electrophoresis and ethidium bromide staining.

General Locations: Hand-held UV units can be found in research labs throughout the River Campus and Medical Center. Access to rooms must be controlled by closing the door and posting a warning sign on the door stating the instrument is in use. The warning sign should include Caution: High Intensity Ultraviolet Energy. Protect Skin and Eyes.

Personal Protective Equipment: Personal protective equipment must be worn by all individuals in the room while the hand-held UV unit is operating. The personal protective equipment must protect the eyes and skin. Appropriate PPE would include gloves, lab coat with no gap between the cuff and the glove, and a UV resistant face shield.

Maintenance/ Monitoring: In general there is no reason to perform periodic monitoring of the hand-held UV unit emissions. Maintenance should be performed according to the manufacturer's instructions.

Germicidal Lamps in Biosafety Cabinets

Uses: Germicidal lamps are used for disinfecting the interior surfaces of a biosafety cabinet prior to and after use. The germicidal properties of ultraviolet light are used in addition to routine chemical disinfection and must not be relied on as the sole method of disinfection.

General Locations: These lamps are found within the biosafety cabinet, above the work surface. Biosafety cabinets are primarily found in the Medical Center with some located on the River Campus. Access to the interior of the biosafety cabinet while the lamp is operating is controlled by closing the sash. Some cabinets are equipped with an interlocking switch which deactivates the UV lamp when the fluorescent lamp is activated, however, personnel must ensure that the UV light is off prior to working at the cabinet. Placing labels that fluoresce when exposed to UV inside the biosafety cabinet should be considered if the UV lamp is not interlocked with the fluorescent lamp

Personal Protective Equipment: Personal protective equipment must be worn by individuals reaching into the biosafety cabinet while UV lamp is operating. The personal protective equipment must protect the eyes and skin. Appropriate PPE would include gloves, lab coat with no gap between the cuff and the glove, and a UV resistant face shield.

Maintenance/ Monitoring: Since ultraviolet light is not used as a sole method of disinfection for the interior of biosafety cabinets, routine monitoring of the lamp's output is unnecessary. Bulbs should be wiped off on a monthly basis with a soft cloth dampened with ethanol. The bulb must not be operating and must be cool to the touch prior to wiping. Bulb replacement should proceed according to manufacturer's instructions based on the amount of use.

Germicidal Lamps in Clinical Units

Uses: Germicidal lamps installed at ceiling level in some Clinical Units are used for air disinfection purposes to control exposure to Mycobacterium tuberculosis. These lamps are used secondarily to ventilation controls such as directional airflow, dedicated exhaust, and increased air exchanges.

General Locations: Germicidal lamps have been installed for air disinfection in Pulmonary (3-4400) and in the Infectious Disease Clinic (3-5000).

Access to room: Access to the room does not need to be controlled while the lamps are operating. Room occupants are protected from exposure by the baffling portion of the light fixture.

Signage: Warning labels must be placed on the fixture stating Caution: High Intensity Ultraviolet Energy. Protect Skin and Eyes.

Personal Protective Equipment: Personal protective equipment is required only in situations when the baffle is removed and the lamp is operating. In those situations personal protective equipment would include skin and eye protection such as gloves, long sleeves with no gap between the cuff and the gloves, and a UV resistant face shield.

Maintenance/Monitoring: Since there are no guidelines indicating the how much ultraviolet light output is required for air disinfection, routine monitoring to determine the lamp's efficacy is unnecessary. Bulbs should be wiped off on a monthly basis with a soft cloth and dampened with ethanol. The bulb must not be operating and must be cool to the touch prior to wiping. Bulb replacement occurs annually. Baffled bulbs are monitored at that time for potential exposure.

Germicidal Lamps in Laboratories

Uses: Germicidal lamps installed at ceiling level in some laboratories are used for air and surface disinfection. These lamps are used secondarily to ventilation controls such as directional airflow, dedicated exhaust, and increased air exchanges.

General Locations: Germicidal lamps have been installed for air and surface disinfection in some laboratories in the Medical Center.

Access to room: Access to the room must be strictly controlled while the lamps are operating to prevent employee exposure. Many laboratories have a switch that is interlocked with the door. The UV lamp is only operational when the door is closed.

Signage: Laboratories having germicidal lamps without an interlocking switch must strictly control access to that area. Access can be controlled by installing an interlock switch such that the lamp is deactivated when the door is opened or by posting a warning sign on the door when the lamp is operating. The warning sign should include Caution: High Intensity Ultraviolet Energy. Protect Skin and Eyes.

Personal Protective Equipment: Personnel must not enter area while the germicidal lamp is operating.

Maintenance/Monitoring: Since there are no guidelines indicating the how much ultraviolet light output is required for air disinfection, routine monitoring to

determine the lamp's efficacy is unnecessary. The efficacy of surface disinfection via a ceiling mounted UV lamp is unreliable. Surface disinfection must be conducted with a chemical disinfectant specific for the organism in question. Bulbs should be wiped off on a monthly basis with a soft cloth and dampened with ethanol. The bulb must not be operating and must be cool to the touch prior to wiping. Bulb replacement occurs annually.

Blacklight

Blacklight (320-400 nm) does not represent a hazard.

UV Lamps in SMH Operating Rooms

See separate SMH Surgical Operating Room Suite Policy 3.5 "Ultraviolet Light in the Operating Room"

UV Treatment Booths in ACF Dermatology

See separate Dermatology departmental policy.

UV Lasers

See University Laser Safety Program.