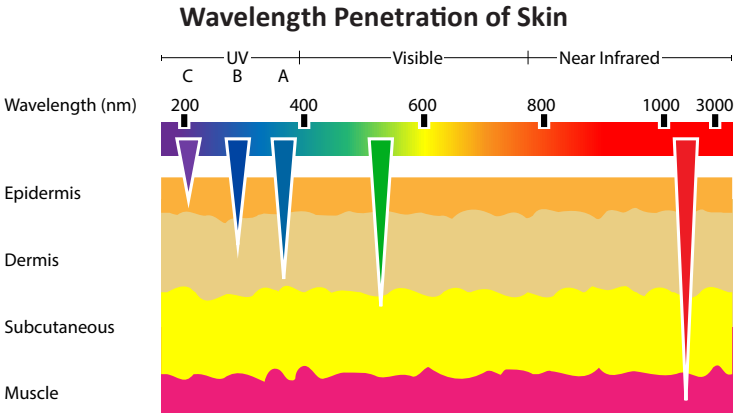
FactSheet Ultraviolet Radiation

Ultraviolet (UV) radiation is a form of electromagnetic radiation with wavelengths from 10 nm to 400 nm, shorter than visible light but longer than X-rays. Unlike visible light, it cannot be observed by the human eye. It can be divided into three sections: UVA (black light) 315 – 400 nm; UVB (erythemal) 280 – 315 nm; and UVC (germicidal) 100 – 280 nm.

What injuries may occur from UV radiation sources?

UV radiation is strongly absorbed by proteins and DNA. It does not penetrate deeply into tissue, but it greatly impacts the skin and the eyes (see figure below).



Acute exposure may cause erythema (redness of the skin) and photokeratitis (a feeling of sand in the eyes). Chronic exposure to UV radiation can cause cataracts, skin aging, skin or eye cancer, and/or immunosuppression (see table below). The International Agency for Research on Cancer (IARC) has classified UV, including the UVA, UVB, and UVC bands, as a Group 1 human carcinogen.

Biological Effects of UV Light

UV Range	Eye Effects	Skin Effects
UVC* (200 nm - 280 nm)	Photokeratitis	Erythema (sunburn) Skin cancer
UVB (280 - 315 nm)	Photokeratitis	Accelerated skin aging Increased pigmentation
UVA (315 - 400 nm)	Photochemical UV cataract	Pigment darkening Skin burn

* UV radiation less than 190 nm is mainly absorbed by air.

What are other potential hazards?

UVC radiation at wavelengths less than 242 nm reacts with oxygen to form ozone. Note that ozone causes chronic health problems at extremely low concentrations. Operate all ozone-producing lamps (e.g., lamps which emit the 185 nm Hg line, as used in UV-ozone cleaning of substrates) in exhausted enclosures or fume hoods. Short-arc UV lamps are potential explosion hazards because their internal gas/plasma is under elevated pressure when operated.

What I need to do

- Enclose or orient UV source to contain or direct UV radiation away from the skin and eyes.
- Select eyewear that protects against UV radiation.
- Keep sashes of BSCs and fume hoods equipped with UV lamps down during operation.

What are common sources of UV radiation at USC?

Common UV sources at USC include: germicidal lamps in biosafety cabinets (BSC), clinics, and laboratories; hand-held UV devices (e.g., Woods Lamp); mercury vapor lights; curing lamps; UV lasers; ultraviolet light-emitting diodes (ULEDs); UV photolithography; welding and plasma arcs; and xenon lights.

Are there any UV radiation standards?

The National Institute for Occupational Safety and Health (NIOSH) recommends that an exposure to 100 microwatts per square centimeter at wavelength 254 nanometers not exceed one minute. When averaged over an eight-hour work day, this value is 0.2 microwatts per square centimeter.

What PPE is needed?

- Protective Clothing: standard lab apparel including long pants, closed-toe shoes, and appropriate lab coats are required. While working with UV radiation sources, ensure that no gaps exist in protective clothing particularly around the neck, wrist, and forearm areas.
- Eye/Face Protection: a polycarbonate face shield stamped with the ANSI z87.1-1989 UV certification must be worn to protect the eyes and face, if there is any UV radiation exposure potential. Note that ordinary prescription glasses may not block UV radiation.
- Gloves: thick nitrile gloves are recommended for protecting exposed skin on the hands.

References

AIHA Non Ionization Radiation Committee

AIHA - *Ultraviolet Radiation Quick Reference Sheet*

National Institute for Occupational Safety and Health (NIOSH)

USC Laser Safety Manual

USC University of Southern California

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