EMORY UNIVERSITY | Environmental Health and Safety

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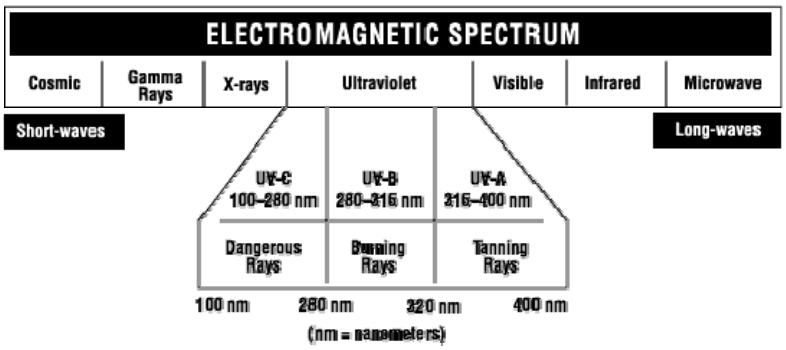
SAFETY TOOLBOX TRAINING – ULTRAVIOLET (UV) RADIATION FACTS

SUPERVISOR INSTRUCTIONS:

- *Use toolbox trainings to spark safety discussions during monthly meetings with employees.*
- *Fax a copy of the employee sign-in sheet to Tiffany Dothard with EHSO at 404-727-5904 as a record of employee attendance.*



Background

Ultraviolet (UV) radiation is invisible to the eye and is defined as that portion of the electromagnetic spectrum between x-rays and visible light, i.e., between 100 nm and 400 nm. The UV spectrum is divided into three main regions: UV-A (315 nm to 400 nm), UV-B (280 nm to 315 nm), and UV-C (100 nm to 280 nm). The sun is our primary natural source of UV radiation. However, artificial sources include tanning booths, black lights, curing lamps, germicidal lamps, mercury vapor lamps, halogen lights, high-intensity discharge lamps, fluorescent and incandescent sources, and some types of lasers. Unique hazards apply to the different sources depending on the wavelength range of the emitted UV radiation. The ability of UV radiation to penetrate human tissue also depends on wavelength. 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. Some equipment can generate UV-C radiation that, if used without the appropriate controls, can result in injury with only a few seconds of exposure. UV-C radiation is very effective at killing bacteria and it is used in germicidal lamps located in air handling units as well as in some devices found in laboratories, such as Crosslinkers, Transilluminators, and Biological Safety Cabinets.

Crosslinker

Transilluminator

Biological Safety Cabinet

Hazards Associated with UV Radiation

The primary organs of the body affected by UV light hazards are the skin and the eyes. An unfortunate property of UV radiation is that there are no immediate warning symptoms to indicate overexposure until well after the exposure has occurred. Symptoms of overexposure include varying degrees of erythema (sunburn) or photokeratitis (cornea inflammation) typically do not appear until hours after the exposure.

UV Radiation Eye Hazards

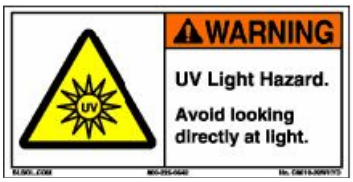
The cornea and lens are the main areas of the eyes affected by UV radiation. Various components of the human eye are susceptible to damage arising from photochemical effects as a result of extended exposure to direct/reflected UV radiation. UV radiation exposure can injure the cornea, the outer protective 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. This condition usually does not present until 6 to 12 hours following the UV exposure. Although very painful (often described as having sand in the eyes), this condition is usually temporary (a few days) because in most cases the corneal cells will grow back. Chronic exposures to acute high-energy UV radiation can lead to the formation of cataracts.

UV Radiation Skin Hazards

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 product found in anti-dandruff shampoos, certain foods (e.g., celery root), certain medications (i.e., birth control pills, tetracycline, sulphathizole, cyclamates, antidepressants). Chronic skin exposure to UV radiation has been linked to premature skin aging, wrinkles, and skin cancer

Equipment and Area Labeling

Any equipment that emits UV radiation and the area where the equipment is located must have appropriate UV warning labels posted. There is no standard UV warning label; therefore, you may see any of the following signage:



UV Control Measures

UV control measures discussed here may not be suitable for all UV exposure circumstances. Each situation should be evaluated so that appropriate control measures can be implemented to prevent overexposure. Contact EHSO at 404-727-5922 for help in evaluating UV control measures to ensure they are not creating other safety hazards.

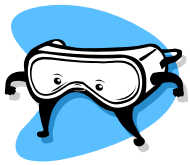
Engineering Controls

The preferred control method is the use of engineering control(s) to contain UV light. UV enclosures and interlocks supplied by the manufacturer must be used at all times. UV is easily shielded by opaque materials such as metal, wood, and cardboard; polycarbonate material is also a good UV shield. Some types of clear glass may transmit significant amounts of UV-A radiation and should not be relied on for UV protection unless UV shielding is verified.

Administrative Controls

Procedures should be developed to control and minimize UV exposure to personnel where engineering controls cannot adequately protect personnel from UV exposure. It is important to remember to turn off the UV lights before working in areas where these lights are being used (i.e., inside air handling units). Also, unauthorized personnel should be prevented from entering UV radiation areas.

Personal Protective Equipment (PPE)



If engineering and administrative controls cannot protect personnel from UV exposure, PPE should be used. Commonly used PPE against UV are UV safety goggles, UV face shields, long-sleeved, tightly-woven clothing that covers much of the body, and gloves. Application of sun-screen with high sun-protection factor (>15) against UV-A and UV-B may provide some protection. However, the use of UV sun-block is considered inadequate for protection against the high irradiance of man-made UV radiation sources.

To protect the human eye from exposure to UV radiation, all that is usually needed is a pair of polycarbonate safety glasses or a polycarbonate face shield. This protective eyewear should be worn whenever there is a potential for ongoing UV radiation exposure. Contact EHSO for information and advice on appropriate UV protective eyewear, if needed. Skin protection is not difficult, as most clothing tends to absorb UV radiation. Protection of the skin from UV radiation is best achieved through the use of clothing, gloves, and face shields.

UV Radiation Protection from the Sun

Outdoor workers can minimize solar UV exposure by:

- Use of shade where practical
- Avoiding the outdoors when the sun is most intense, 11 a.m. to 4 p.m.
- Use of wide-brimmed hats and long and tightly woven clothing to cover skin
- Use of sunscreen, minimum SPF 15 (sun-protection-factor)

- Use of UV blocking sunglasses

Emergency Situations

As careful as we try to be we all know accidents can still occur. If you are ever exposed to a UV-C radiation source, you need to seek medical attention immediately. If the exposure occurs between the hours of 8:00 AM and 4:30 PM, staff should report to Employee Health Services (EHS). During evenings and weekends, staff should report to the Emergency Room. As always, report all incidents to your supervisor and remember to complete an Incident Report.

Many serious eye injuries have taken place because workers or visitors to an area believed there was no danger as long as they weren't looking *directly* at the UV light. However, ultraviolet rays into the side of the eye can cause painful burns as well. Therefore, make sure you always protect against this hazard by wearing safety glasses with wraparound protection.

UV radiation has numerous useful applications but increased awareness and control of UV hazards are needed to prevent accidental overexposures. Working around UV radiation is safe - if you follow the rules. However, if you try to take short cuts, or you don't take the proper precautions, it could become a hazardous job. Just remember to take time for safety and health. You will certainly be glad you did!

REMEMBER: HINDSIGHT EXPLAINS THE INJURY THAT FORESIGHT WOULD HAVE PREVENTED

SUGGESTIONS FOR DISCUSSION:

1. Do you know the location of UV sources in your work area?
2. Does everyone know that UV sources should be turned off before any work near the sources begins?
3. Does everyone have a pair of wrap-around safety glasses?
4. Does anyone have any suggestions that could improve safety in your area?
5. Review a Material Safety Data Sheet (MSDS) for a chemical that is used by employees.