Ultraviolet Radiation-Fact Sheet

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Background of UV

Ultraviolet light (UV) has two levels of radiation, ionizing and non-ionizing, which are separated by the length of waves they emit. Non-ionizing radiation ranges from 40-400 nanometers and is the most common form of UV radiation being used in biomedical and microbiological research laboratories. The ranges of non-ionizing UV can be charted into three regions:

Region	Wavelength (nm)	Hazard Rating
UVA	315-400 (Black Light)	Lowest
UVB	280-314 (Erythemal)	Mid to High
UVC	180-280 (Germicidal)	Highest

Sunlight falls into the UVA region, which is known to be the most common form of UV. The Earth's Ozone layer intercepts all of the UVC and between 97-99% of the UVB, varying by geographical regions. Most of the natural UV should be avoided by use of personal protection such as a hat, sunblock, and sunglasses. However, UV radiation from laboratory equipment is in a more concentrated form which poses a greater threat to personnel. If no personal protection equipment is used, tissue damage may occur in only a few seconds.

Laboratory equipment emitting non-ionizing ultraviolet wavelengths

Typical laboratory equipment with the capacity to emit non-ionizing UV wavelengths includes: biological safety cabinets (BSCs), transilluminator boxes and UV crosslinkers. The BSCs usually contain a UV lamp used to help maintain a sterile environment. Transilluminator boxes are used to observe gels susceptible to electrophoresis and contain nucleic acids. UV crosslinkers are mainly used to crosslink DNA or RNA to membranes.

Exposure and Hazards of UV

Exposure to UV light poses a serious threat to both the eye and skin. Diagnosis of exposure may vary but are commonly set into two categories, photokeratitis (eye injury) and erythema (sunburn). Photokeratitis is an inflammation of the cornea (outer protective coating of the eye) that is caused by exposure to ultraviolet radiation. Eye injury can occur due to very brief exposure or with just a flash of intense UV. Erythema is sunburn of the skin and can occur within a few seconds of exposure to a concentrated form of UV. Prolonged exposure to ultraviolet light also causes premature aging and cancer of the skin.

UV affects both the epidermis and dermis skin layers

Ultraviolet Radiation is absorbed by the epidermal skin layer and usually proceeds via photochemical and thermal reactions into the dermal skin layers. Exposure usually results in erythema, which is commonly called sunburn. Symptoms are comparable of normal sunburn and include redness, swelling, pain, blisters and peeling on the burned area. Severe sunburn can lead to headache and nausea like conditions. Variables for this intensity are mostly genetic factors but can be exaggerated by photosensitization from certain foods (e.g., celery root), drugs (e.g., tetracycline) and other chemical agents. Being at the cutaneous level, the cornea of the eye is also very susceptible to UV radiation and is extremely vulnerable because of its lack of thickness. UV exposure can cause lesions of the cornea and ultimately cause photokeratitis. Symptoms are described as a sensation of sand in the eye that may last for several days. Other symptoms of an overexposed eye may occur within a few hours and include sensitivity to light, unexplained tearing, and a burning or painful sensation in the eye.

Laboratory Safety Precautions

As a common rule, never allow your eyes or skin to be exposed to UV light in the laboratory. This "laboratory UV light" is heavily concentrated and can cause severe damage with very short exposure periods. Always wear personal protective equipment (PPE) such as gloves, face shields, and lab coats (long sleeves) when using UV light. Thick nitrile gloves are recommended, but latex gloves can be doubled for use. Biological Safety Cabinets (BSCs) are never to be occupied while the UV lamp is activated. Always lower sash and keep away from escaping rays. Mechanical safety devices should be standard on most new cabinets. If there is no safety shield or safety switch, these must be retro-installed in such a way as to prevent exposure and not interfere with the operation of the apparatus. Transilluminators are never to be used without the protective shield in place. A face shield, thick nitrile or double latex gloves along with a lab coat are the recommended PPE. Crosslinkers are not to be used if the door safety interlocking mechanism is not working properly.

Label Equipment Properly

Overexposure of UV radiation almost always occurs because of inadequate education with regard to hazards when using UV emitting equipment. All equipment should be obviously and specifically labeled pertaining to UV emission. Properly labeled equipment will decrease the likeliness of an accident involving exposure to the eyes and/or skin. If you need proper UV Hazard labeling, contact the UK Department of Biological Safety at (859) 257-1049 or ehsbiosafety@uky.edu.

National Institutes of Health (NIH) & Use of Ultraviolet (UV) Radiation in Laboratories

> **"***The NIH does **not** recommend or support the use of ultraviolet (UV) radiation in laboratories. Although UV is effective against most microbes, it requires an understanding of its abilities and limitations. The 253.7-nm wavelength emitted by the germicidal lamp has limited penetrating power and is primarily effective against unprotected microbes on exposed surfaces or in the air. It does not penetrate soil or dust. The intensity or destructive power decreases by the square of the distance from the lamp. Thus, exposure time is always related to the distance. The intensity of the lamp diminishes over time. This requires periodic monitoring with a UV meter. The intensity of the lamp is drastically affected by the accumulation of dust and dirt on it. The bulbs require frequent maintenance. In addition, there are safety hazards associated with the use of UV that require personal protective equipment or other safety devices to protect users. UV lights in biosafety cabinets require the cabinet be decontaminated prior to performing maintenance on the system.*
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> *Past experience has proven that good techniques in conducting experiments are highly effective in preventing contamination. The use of UV radiation does not eliminate the necessity for using good practices and procedures.***"**

Source https://www.ors.od.nih.gov/sr/dohs/safety/laboratory/BioSafety/Pages/decontamination.aspx

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