



SNS COLLEGE OF TECHNOLOGY

(Autonomous Institution)

COIMBATORE-35

DEPARTMENT OF BIOMEDICAL ENGINEERING



19BME308 - Medical Radiation Safety

UNIT III - LASER AND ULTRAVIOLET RADIATION SAFETY

3.3 Hazards associated with UV Radiation

Ultraviolet light is invisible electromagnetic radiation of wavelengths between 100 nm and 400 nm. It is further divided into three bands - UVA, UVB, and UVC (a sub-part of UVC is called VUV). Each of these bands has a different potential for health effects:

Band	Wavelengths (nm)	Eye Hazard	Skin Hazard	Notes
UVA	320-400	Less harmful. Prolonged exposure may lead to cataracts	Less harmful. Prolonged exposure may lead to sunburn or skin cancer.	95% of the UV radiation received from the sun on the earth's surface. Harder to shield.
UVB	280-320	Can lead to eye injury (photokeratitis/conjunctivitis). Prolonged exposure may lead to cataracts	Deposited more deeply into the skin and can lead to sunburn, peeling, and blistering that is more severe and longer lasting. Considered major cause of skin cancer.	Relatively easy to shield.
UVC	180-280	Very damaging. Can lead to eye injury (photokeratitis/conjunctivitis)	Deposited in outer layer of skin. Can lead to sunburn, peeling, and blistering. May contribute to risk of skin cancer.	Very easy to shield. UVC received from the sun is entirely blocked by the atmosphere.
VUV	100-180	These UVC wavelengths are not transmitted through air and are referred to as vacuum UV. Because they are absorbed by air, they do not pose biological health and safety concerns.		



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Exposure to UV causes photochemical reactions in tissue. For the skin, this can lead to darkening of the skin and eventually sunburn, peeling or blistering. For the eyes, the cornea can become damaged, called keratitis, or the membrane lining the eyelid and white of the eyes can become injured, known as conjunctivitis. When these conditions are caused by exposure to UV light, we call them photo conjunctivitis or photo keratitis.

The injury to the eyes can be extremely painful but is usually temporary because of the recuperative powers of the epithelial layer of the eye. The latent period is usually 4–12 h from the time of UVB/C exposure, and the damage is dependent on both the UVB/C dose and the UVB/C spectrum. It takes at least 8 h for visual incapacitation to become evident and the individual may be visually incapacitated for 48 h. The latent period varies inversely with the intensity of exposure. Symptoms can include blurred vision, photophobia or sensitization to light, lacrimation or tears, blepharospasm (painful uncontrolled blinking), and a sensation of sand in the eyes. Symptoms, including severe pain, may last from 6 to 24 h and recovery may take up to 48 h. Conjunctivitis develops more slowly than photokeratitis and may be accompanied by erythema of the facial skin around the eyelids. Cataract formation and photo degradation of the eye lens by UVA/B exposure has not been demonstrated in humans and has only been observed in animal studies at extremely high doses. So, prolonged UVA/B exposure should be considered a potential risk for cataract development.

Ultraviolet radiation exposure can produce various effects on skin including erythema, photosensitivity, skin aging, immune system damage, and skin cancer. Erythema is the reddening of the skin, like sunburn, after exposure to UVB/C. UVA can also cause erythema, but only at very high doses. Skin color affects how bad the reddening can be, with darker pigmentation offering more protection against UV damage. The melanin that is present in the skin acts like a UV-blocking filter. Prolonged UVA/B/C exposure to skin or tissue can increase the risk of skin cancer.



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The earth's atmosphere shields all of the UVC and most of the UVB that comes from the sun. Therefore, exposure to UVC and UVB bands comes from manmade sources, such as those listed here. Fortunately, UV is easy to shield with tightly woven clothing for your skin and polycarbonate eyewear or face shields for our eyes.

Exposure Limits

There is no Occupational Safety and Health Administration (OSHA) standard for exposure to ultraviolet light, but the American Conference of Governmental Industrial Hygienists (ACGIH) has issued recommended Threshold Limit Values (TLVs) for occupational exposure to UV. These TLVs refer to incoherent ultraviolet radiation with wavelengths between 180 and 400 nm and represent conditions under which nearly all healthy workers may be repeatedly exposed without acute adverse health effects such as erythema and photokeratitis. When UV hazard assessments are performed at Georgia Tech, the ACGIH TLVs are typically used for reference. UV lasers are not included in the sources of UV covered by these TLVs. Please refer to the Georgia Tech Laser Safety Program for laser hazards.