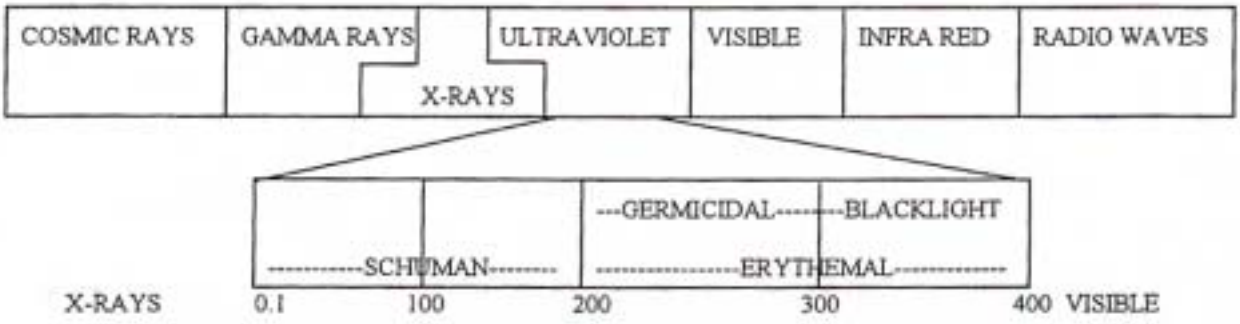
ULTRAVIOLET RADIATION

The band of radiation just below the violet end of the visible spectrum is called ultraviolet. This invisible band is divided in several regions.



Five (5) well-known bands exist with the lower band overlapping into the X-Ray band. Most concern lies in the usage of three (3) of these bands:

(1) The "near" ultraviolet, which lies between 320nm and 400nm, is also known as blacklight or longwave ultraviolet. (UVA)

(2) The "middle" ultraviolet, which lies between 280nm and 320nm, is known as erythemal or suntan ultraviolet. (UVB)

(3) The band which lies between 200nm and 300nm, is known as germicidal or shortwave ultraviolet. (UVC)

Ultraviolet radiation is artificially produced by various sources: blacklight lamps, suntan lamps, germicidal lamps, carbon arcs, welding and cutting torches, furnaces, and laboratory test analysis equipment. Nature, in the form of sun, is a major source.

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Longwave/Blacklight

The lamps that produce blacklight or longwave ultraviolet radiate the major portion of their energy at 365nm. The envelope is clear glass with a phosphor coating permitting some visible blue radiation, primarily the 435.8nm from the mercury vapor arc. External filters to block visible blue radiation are usually needed because this radiation distracts or dominates the fluorescent effects being observed.

Germicidal/Shortwave

Germicidal ultraviolet destroys only microorganisms that are not visible to the naked eye. It will not affect insects. All types of microorganisms known to man, including bacteria, viruses and mold spores can be killed by germicidal ultraviolet rays.

Low Penetration

Ultraviolet rays will not penetrate most substances. Meat, cloth and food will not be sterilized, other than the outer surfaces, as the rays do not go below the surface. Ordinary glass is opaque to shortwave germicidal ultraviolet. Clear water, however, will permit penetration sufficient to sterilize the water when germicidal ultraviolet is applied in properly-designed liquid sterilizers. Certain plastic films also permit some transmission of germicidal shortwave ultraviolet.

In personal protection applications (the use of lamps for room irradiation in home, schools, offices, etc.) indirect fixtures such as "TB-Series or Corner Mounted", are installed above eye level. Only upper air is irradiated, and persons or animals occupying the area receive no direct radiation.

Direct ultraviolet irradiation is often used in product protection. Here the fixtures, such as American Ultraviolet "Utility" or "Deluxe Surface Mounted," irradiate the entire air in the room. In such installations, personnel are protected either by wearing goggles or face shields, such as American Ultraviolet Ultra- Spec 100 Safety Goggles and Ultra-shield 200 Face Shields.

Safety Requirements

The rays from germicidal ultraviolet lamps, like those from the sun, may irritate the eyes and redden the skin, if of sufficiently high intensity, or if exposure is prolonged for a period of time.

There are no known harmful physiological effects from the ultraviolet rays except reddening of the skin and irritation of the eyes, both which are transitory conditions.

Transient dyes and colors may be faded from prolonged exposures to ultraviolet rays.

Bactericidal radiation will reproduce an erythema. Nearly twice the amount of 253.7nm radiation is necessary to evoke an erythema on normal skin as is required for 296.7nm, the radiation most active in the "suntan" region. However, the results are not the same. Even large doses of 253.7nm radiation will not produce blistering nor tanning of the skin. Nearly all of this short radiation is absorbed by the corneum with only a small amount of radiation penetrating to the malpighian layer.

The protective clothing for the operating team or pharmaceutical personnel consist of a long-sleeved gown to protect the arms and a small flap sewn to the cap to protect the back of the neck and the sides of the face. Ordinary gowns absorb about 90% of the radiation. Rays reflected from metal tables, as used in food processing, may cause eye irritation, and for this reason, if an individual is working in the room for any length of time he or she must use goggles or a face shield. American Ultraviolet Company's Ultra-Spec 100 and Ultra-Shield 200 face shields are capable of completely absorbing 253.7nm radiation. The amount of 253.7nm energy necessary to produce a threshold keratitis is only about one-tenth of that necessary to produce a minimal perceptible erythema. All the radiation is absorbed by the cornea and conjunctiva and does not penetrate to the lens.

In the application of indirect bactericidal radiation for disinfection of air, such as in school rooms, offices, hospital wards, or laboratories, it has been accepted practice to consider 0.2 microwatts per square centimeter for an 8 hour exposure

and 0.1 microwatts per square centimeter for a 24 hour exposure as the acceptable maximum intensity of 235.7nm ultraviolet radiation incident on people. This amount of energy would be far below the limit necessary to produce a perceptible erythema on an untanned normal skin.

Longwave ultraviolet is a natural component of our environment. Filtered natural light or artificial longwave ultraviolet sources causes the eye media to fluoresce which produces an unusual and sometime uncomfortable sensation. This fluoresce effect is temporary however, no permanent histological effects of the eye tissues have been reported from longwave ultraviolet exposure. Hyper-sensitivity can be effected by certain drugs and chemicals resulting in adverse reactions by some people exposed to these agents.

Reflection

Many substances that are good reflectors for visible light are poor reflectors for shortwave ultraviolet rays.

When personnel are involved and germicidal ultraviolet is used, it is more important that the walls and ceilings have a surface that has low ultraviolet reflection factor.

White plaster, some water paints, and lacquers have high reflection factor, and for this reason it may be necessary to repaint with a low reflection paint. Most oil paints have a low ultraviolet reflection factor at less than 5%. This is especially important in low ceiling areas of schools, offices and hospitals where personnel may be exposed to ultraviolet radiation for a long period of time. Where ceilings are very low, louvered "TB-Series", or Corner Mount fixtures should be utilized.