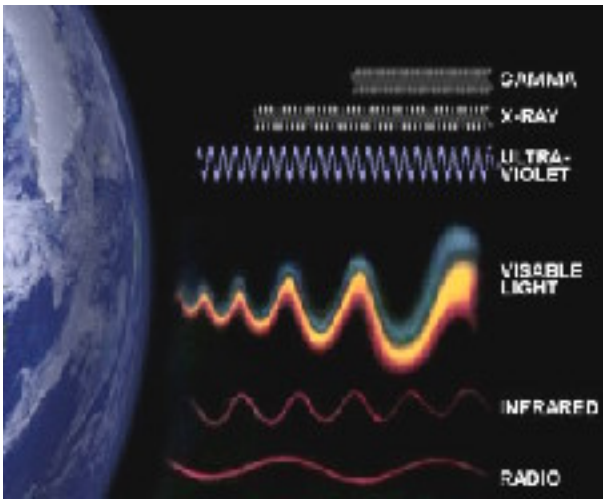
Understanding UV-C

The Spectrum of Light



The Sun is a source of electromagnetic energy including radio waves, infrared, visible light, ultraviolet, x-rays, gamma rays, and cosmic rays. Each band has its own characteristic wavelengths and properties as a result of wavelength.

Visible light is "visible" because its wavelengths can be detected as various colors by the human eye. Ultraviolet, although invisible, also has various wavelengths and properties.

Learn more about the UV Spectrum.
UV-A, UV-B, and UV-C are part of the ultraviolet spectrum and we are usually exposed to some of each every day. UV exposure can be harmful or harmless depending on the type of UV, the type of exposure, the exposure duration, and individual differences in response to UV.

Is ultraviolet light harmful?

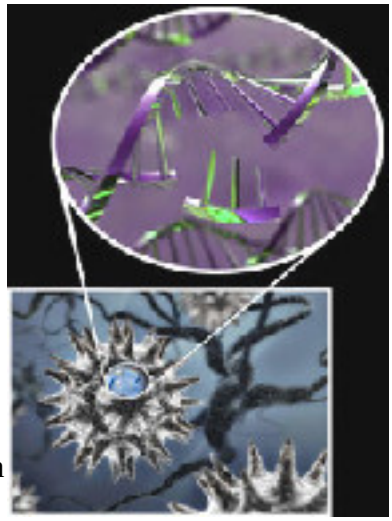
The difference has to do with the ability of UV rays to penetrate body surfaces.

UV-A is also known as "black light" and is generally harmless. It results in skin tanning and is used in medicine to treat certain skin disorders.

UV-B has a very high penetrating ability and prolonged exposure is responsible for some types of skin cancer, skin aging, and cataracts (clouding of the lens of the eye).

UV-C has extremely low penetrating ability and is nearly completely absorbed by the outer, dead layer of skin where it does little harm. It does reach the most superficial layer of the eye where overexposure can cause reddening and painful but temporary irritation, but it cannot penetrate to the lens of the eye and cannot cause cataracts. UV-C is also known as "germicidal UV."

Germicidal UV

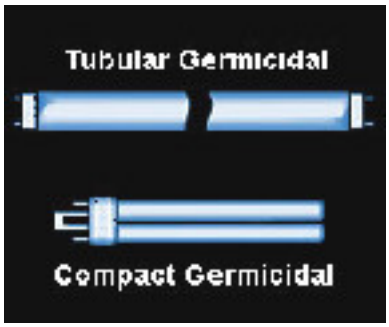


Germicidal UV has a specific wavelength of 253.7 nanometers (253.7 billionths of a meter) and is known to deactivate (break the DNA of) germs contained in tiny airborne droplets (droplet nuclei) that transmit diseases such as measles, tuberculosis, and influenza from person to person.

Once the DNA of a microbe is broken it loses its ability to reproduce. Bacteria and viruses that can not reproduce are rendered harmless.

Germicidal UV has been used safely and effectively in hospitals, clinics, laboratories, and industry for more than 50 years.

Improvements in the technology



Electric lamps, resembling ordinary fluorescent lamps, are especially designed to emit germicidal UV and include a glass envelope to filter out harmful, ozone forming radiation. The lamps are available in a variety of sizes and shapes and must be mounted in special housings and located so that people are not exposed to direct irradiation.

The newer, compact tubes are technologically more advanced and provide higher UV-C output and increased reliability. The shorter tubes also permit a variety of special application fixture designs to maximize UV-C in a room by mounting the units from the ceiling, from walls, and in corners and corridors. Lumalier features a complete line of application specific fixtures using the newer, more effective, compact lamps.

Installation

Fixtures for upper room air irradiation provide a high intensity beam of germicidal UV while shielding the lower part of the room. Highly reflective parabolic reflectors and louvers focus the rays into a wide but narrow zone while minimizing energy loss and stray irradiation. The shape and placement of the louvers is critical.

Underneath the zone, where the people are, the National Institute for Occupational Safety and Health (NIOSH) recommends that the UV-C dose should not exceed 6mJ/cm² below the six foot level for the 24 hour exposure. The recommendation is based on eight hours working shift with continuous exposure of the eye, the body's most sensitive tissue, and includes a margin of safety. Properly designed upper air equipment produces minimal UV intensity in the lower room, and the natural movement of people within the space allows for safe application of upper air UV systems not exceeding the NIOSH threshold limit of 6mJ/cm².

Air mixing is the key

Air mixing is vitally important to provide disinfection of total room air. Normal convection between upper and lower room air may be adequate to move total room air and its airborne microorganisms through the zone. However, if normal convection is not sufficient, it should be supplemented with some method of forced air.

People spread germs

Anywhere people congregate there is a risk that an infected person will exhale droplet nuclei carrying disease. Since the droplets are very small (about 2,000,000 would fit on the head of a pin) they can hang suspended or be carried on air currents. The infection can then be dispersed throughout confined environments such as buildings as the infected person moves about. Other people then inhale the airborne droplets and contract the disease. Germicidal UV should be installed throughout buildings where a significant hazard of airborne infection has been identified. Hospitals, clinics, prisons, treatment centers, and similar institutions are especially susceptible.