



ENHANCED HVAC INFECTION CONTROL:

ULTRAVIOLET DISINFECTION

This is the third in a series of white papers covering the topic of infection control in buildings through enhanced HVAC strategies.

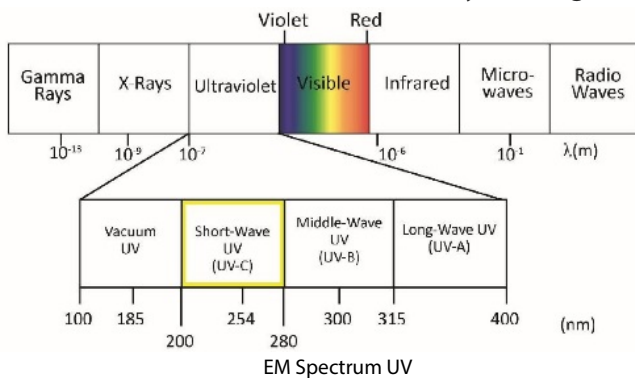
Introduction

In this white paper we discuss the different Germicidal UV (GUV) systems currently available for commercial, industrial and residential HVAC applications. GUV is a time-tested technology that has been used in hospital, pharmaceutical and clean room applications for decades. It is proven to be effective at killing viruses, bacteria and fungal organisms, as long as those agents can be directly exposed to UV rays of sufficient power and/or duration.

Ultraviolet Light

Ultraviolet is the region of the electromagnetic spectrum between 100 nm and 400 nm wavelengths, just below the visible light spectrum. The ultraviolet region is further divided into Vacuum UV (100 nm - 200 nm), Short-Wave UV known as UV-C (200 nm - 280 nm), Middle-Wave UV known as UV-B (280 nm - 315 nm), and Long-Wave UV known as UV-A (315 nm - 400 nm). The UV spectrum associated with disinfection is UV-C. Studies have shown that the peak germicidal wavelengths fall between 265 nm and 270 nm. Typical UV generating lamps produce 254 nm UV-C, which is very close to the peak. UV-C is very effective at inactivating viral, bacterial, and fungal organisms by destroying the molecular bonds that hold their DNA together.

Any UV spectrum can be detrimental to human skin and eyes, with UV-A and UV-B being most notorious for causing skin cancer. Even UV-C can cause skin and eye damage.

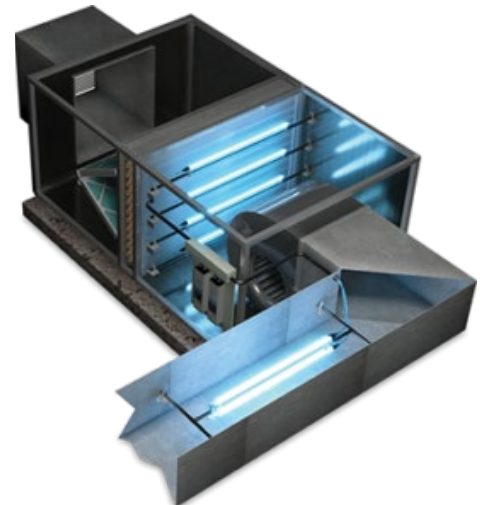


UV-C Use within HVAC Systems

The most common use of UV-C for air sterilization is within new and existing HVAC system equipment. There are two main applications of this technology in commercial HVAC systems:

Coil Surface and Drain Pan Irradiation: UV-C lamps are sometimes installed within the HVAC unit to inhibit the growth of bacteria and mold on the cooling coil and drain pan surfaces. Given the continuous exposure of the surfaces to the UV lamps, a low power level is enough to be effective in preventing growth. As a complement to system maintenance, this application has also been shown to benefit the overall system performance by reducing air pressure drop through the coil and increasing heat transfer efficiency.

In-Duct Air Disinfection: To achieve airstream disinfection, UV-C lamps are installed within the main supply air duct for the purpose of disinfecting the air as it passes through. In-duct air disinfection can be achieved by the same lamps used for the coil and drain pan irradiation, however the power intensity required is greater than for the coil and pan irradiation process. A typical target is an 85% inactivation rate, however, a greater rate is possible by increased lamp power level. Portable, self-contained recirculating units operate on this same technology.



UV-C Sterilization in an HVAC System

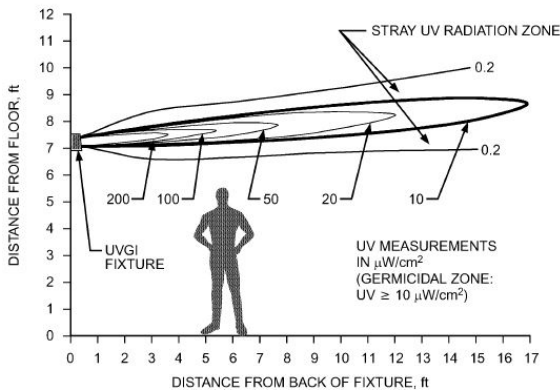


In Room UV-C

Upper-Room GUV: A UV-C light device is installed on the wall a minimum of 7'-0" A.F.F. The fixture is designed to only irradiate the air above 7 feet, thus making the room safe for human occupation during irradiation. This approach relies on the normal mixing of the room air to bring infectious particles into the UV-C irradiated zone for deactivation. Upper-Room GUV can be used in areas without mechanical ventilation, however the presence of an HVAC system or even ceiling fans greatly improves the effectiveness of Upper-Room GUV. These fixtures have integral louvers to ensure the UV-C light energy is directed away from the room occupants at all times.



Upper-Room UV Fixture



Upper Room GUV Coverage Graph

UV-C Portable Room Decontamination: These types of devices are fully automatic and intended to be used for surface decontamination. These devices are to be used only when the room is not occupied. The "robot" moves around the room blasting it with UV-C radiation in all directions. Due to the high level of UV energy delivered by these devices, they are fully automated to include

automatic shutoff in the event anyone accidentally enters the room while it is being irradiated.



Portable Automatic Device

Summary

The use of ultraviolet energy for disinfection has been around for over one hundred years. The technology has been evolving to meet the demands of an ever changing world. Well established methods (HVAC GUV and Upper-Room GUV) have been joined by fully automated room decontaminators, as well as portable, self-contained air cleaners that incorporate GUV in their operation. These are all safe and proven anti-infectious agent technologies.

One very important safety reminder is that UV light, even UV-C light, is not safe for exposure to the skin or eyes for even a short period of time. Manufacturers of hand held and wand type systems may report that their far-UVC light (222 nm) is "safe" for human exposure, however if it is truly "safe" for humans, then it is likely doing very little to kill infectious particles.

About Pedro:



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