

FM ARTICLES

ODOR-Free: Ultraviolet Germicidal Irradiation



Most school air conditioning systems achieve the proper ventilation rate required per student. However, not all school A/C systems provide good indoor air quality, which can lead to a rise in communicable diseases, and in some cases, may impact student and teacher performance. In other words, the air in some schools is making students sick.

Commercial air handling equipment is designed to condition (cool or heat) a space, as well as to provide adequate ventilation rates to achieve the proper CFM (cubic-foot-per-minute) per person for the space they serve. For classrooms, ASHRAE recommends a rate of 15 CFM per person, 67 percent of which (10 CFM) should be comprised of outdoor air.

Proper space ventilation is designed to use outdoor air to dilute interior airborne contaminants, such as odors from occupants, volatile organic compounds (VOC's) emitted from interior furnishings, chemicals used for cleaning, etc.

This constant recirculation of air by a heating, ventilating, and air-conditioning (HVAC) system has a direct correlation to a school's Indoor Environmental Quality (IEQ).

Disinfecting the Air

In fact, the transmission of infectious airborne diseases such as tuberculosis, influenza and the common cold can be accelerated or controlled by a school or college's HVAC equipment. Again, a school's air handling equipment can increase or reduce disease transmission.

HVAC equipment is so important that these systems are ground zero for infection control engineers at hospitals, who work to ensure that air handling equipment operates in concert with dedicated infection-control systems to prevent disease transmission and/or cross contamination.

While ventilation in classrooms does not get the same scrutiny as hospitals, educational institutions can and should employ one affordable healthcare strategy to prevent the spread of infections, called ultraviolet germicidal irradiation (UVGI).

UV-C for Infection Control

UVGI or ultraviolet light in the 254-nm germicidal C-band wavelength (UV-C) kills all known microorganisms, including bacteria, viruses, molds and other pathogens – even those immune to antibiotics, known as superbugs.

UV-C technology can be applied to continuously reduce, or in some cases prevent, infectious pathogens from growing on or circulating in school air and surfaces.

Indeed, the UV-C wavelength is a supplemental and extremely effective approach to fighting infectious diseases.

Besides improving air quality, the hidden value of UV-C's use in HVAC systems is its ability to improve airflow, boost heat exchange efficiency and reduce maintenance needs. It accomplishes this veritable HVAC hat trick for an average equipment cost of less than \$0.15 per cfm. Moreover, the cost of the efficiency-enhancing UV-C equipment is a mere fraction of the 10-35 percent potential reduction in energy and maintenance costs it offers.

Applying Ultraviolet Germicidal Irradiation

UV-C can be installed inexpensively throughout a building by using 1) upper-room units for interior spaces, 2) lamps in HVAC ducts for airstream disinfection, and 3) in air handlers to disinfect airstreams, coils, air filters, drain pans and other potential reservoirs for microbial growth and proliferation.

Airstream disinfection techniques are typically reserved for high-risk areas such as surgical suites, neonatal care centers and isolation rooms/wards. Therefore, we will just review UV-C upper room and HVAC coil irradiation methods.

Upper-Air Units

The first means of applying UVC in schools is through upper-air units.

Upper-air (upper-room) UV-C units have been in use since the 1930s and can be installed in classrooms, cafeterias, gymnasiums, locker rooms, childcare centers – anywhere infectious agents may exist. Studies have shown that upper air UV-C units can translate to the equivalent of 10 to 16 ACH (air changes per hour).

These systems work by creating an irradiation zone within the upper region of most any space. As convection or mechanical air currents lift airborne infectious agents into the upper air (above 7-8 feet), they are exposed to the UV irradiation where they are killed.

Upper-air UV-C units kill pathogens circulated into its irradiation zone by drafts, pressure differentials or the movement of people, such as entering, exiting or cleaning a room. They are also effective against droplet nuclei from coughing or sneezing.

Because people generate many of the infectious airborne pathogens (which fall out or plate out onto equipment surfaces and floors) in a space, these upper-air systems are very effective at killing in-room, airborne microorganisms.

Upper-air installation guidelines are available from the National Institute for Occupational Safety and Health or from device manufacturers.

HVAC Coil Irradiation

The second means of applying UVC in schools is through HVAC coil irradiation. HVAC systems provide an excellent growth area for mold and some bacteria in and around cooling coils, drain pans, plenum walls and filters. Growth of these microbial deposits also leads to coil fouling, which will increase coil pressure drop and reduce airflow and heat exchange efficiency.

UVC systems applied in this manner can also provide first pass kill ratios of airborne pathogens of up to 30 percent. Another benefit of installing UV-C within HVAC units or duct runs is its ability to prevent the recirculation and re-transmission of harmful microorganisms within a space.

It is exactly this 24/7 pathogen-killing operation that makes UV-C technology such an ideal supplement to an educational institution's overall IEQ strategy.

Safe & Effective

UV-C installations are a simple, effective and relatively inexpensive means for schools to improve IEQ. Infectious diseases such as tuberculosis, influenza and the common cold are transmitted via airborne and surface pathogens. There is a long history of investigations concluding that UVGI can be safe and highly effective in disinfecting the air while producing no bi-products, thereby preventing transmission of a variety of airborne infections.

Because ultraviolet germicidal irradiation kills all known microorganisms, the technology can be applied to continuously reduce, or in some cases prevent, infectious pathogens from growing on or circulating in school air and surfaces.

