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The quality of not being harmful to the environment or depleting natural resources, thereby supporting long-term ecological balance

THE SUSTAINABILITY ISSUE

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about 2 to 3 million megawatts hit our global coastlines daily

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Fighting infections, costs with ultraviolet light

While it goes relatively unnoticed in the sunshine that blankets the Earth's atmosphere, ultraviolet light (UV) is being harnessed by the commercial building industry to reduce maintenance costs, increase facility energy efficiency and fight health risks.

BY AARON ENGEL

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Myriad UV light systems developed in the last decade are helping commercial buildings reduce biological growths in heating, ventilation and air conditioning (HVAC) system coils and interiors, while also improving their energy efficiency. More recently, short-wavelength ultraviolet (UV-C) light use has played a significant role in the worldwide effort to offset the alarming rise in hospital-acquired infection (HAI) cases by disinfecting health care facility air and surfaces of infectious, resilient pathogens.

The process of using UV light to disinfect viruses, bacteria, mold and other biological contaminants is called ultraviolet germicidal irradiation (UVGI). UVGI technology disinfects pathogens in the air and on surfaces by scrambling their DNA and preventing reproduction. The non-ozone-producing UV-C is the most effective wavelength for deactivating biological contaminants.

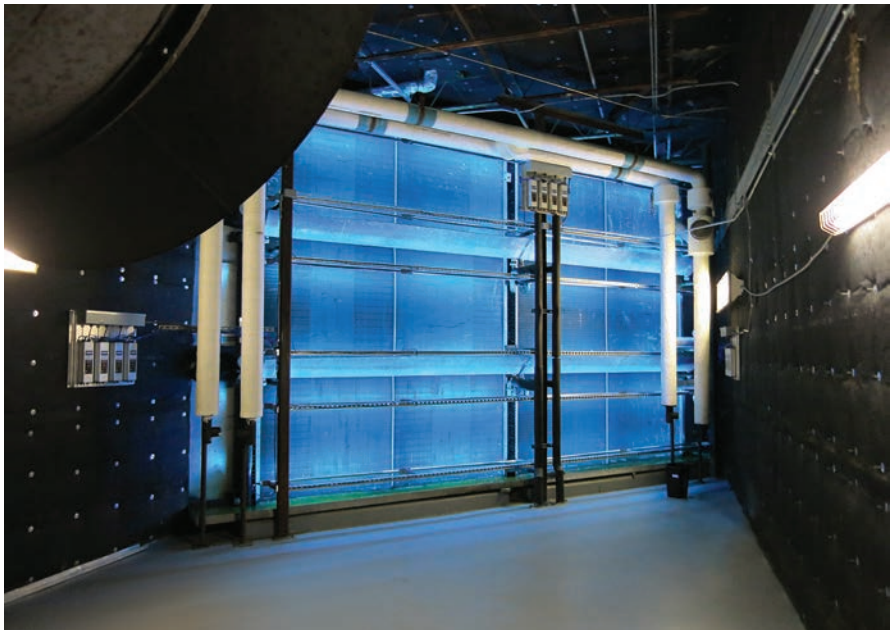
While some microorganisms may require longer exposure times, nearly all can be sterilized by UV-C. As opposed to other longer and less lethal UV wavelengths appearing in unfiltered sunlight, such as UV-A (used in black lights) or UV-B (causes sunburn), biological contaminants have no prior experience with or defense against UV-C because it is filtered out by the atmosphere before reaching the Earth's surface.

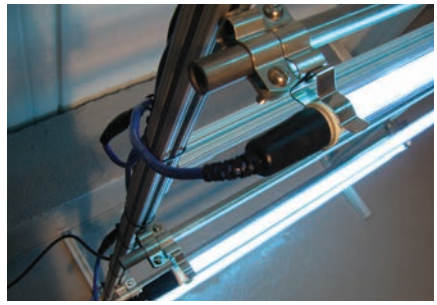
Reducing maintenance costs

UV-C light systems can be instrumental in reducing maintenance costs by eliminating mold procreation on an HVAC system's coils, interiors and ductwork. The cool, dark and damp interiors of HVAC systems, particularly during air conditioning season, attract mold and other biological contaminants that spread throughout a building via the air distribution system.

Cleaning biological contaminants from HVAC systems is costly. Installing UV-C light systems on an air conditioning coil not only disinfects biological contaminants, but also prevents new growth and reduces conventional cleaning frequency. UV-C systems are relatively inexpensive in terms of equipment and installation/labor costs. When compared to in-house staff or outsourced continual cleaning service costs, their payback is typically within one year.

UV-C light systems don't require maintenance other than replacing the UV lamps (bulbs) every two years.





Photos courtesy of Fresh-Aire UV, Jupiter, Florida, USA

Many manufacturers offer lifetime warranties on their power supplies. Manufacturer warranties vary greatly and often cover ballasts (power supplies), electronics and hardware, while also guaranteeing the UV-C lamp itself.

Increasing energy efficiency

Energy efficiency is also a benefit of UV-C light systems. A thin film of mold or other biological growths act as insulation on HVAC system coils and reduces heat transfer energy efficiency.

Studies have also proven that just a .002-inch-thick bio-film on coils can reduce the free area and increase air velocity up to 9 percent. The result is a system with higher static pressure across the coil and higher fan energy use. Eliminating biological growths can result in up to a 30 percent cooling capacity increase when compared to a dirty coil. Furthermore, biological growth can also attract dirt that ordinarily wouldn't accumulate on a clean coil.

Saving lives in health care

The exponential growth of HAIs threatens the mission of the health care industry to improve patient health. According to an HAI Prevalence Survey conducted by the U.S. Centers for Disease Control and Prevention, on any given day, one in 25 hospital patients has at least one type of HAI. More than 722,000 HAIs in U.S. acute care hospitals occurred in 2011. About 75,000 of those U.S. hospital patients contracting HAIs died during their hospitalizations.

Health care administrators are increasingly looking toward UV-C disinfection to help reduce HAIs. Two popular UV-C applications are airborne disinfection and environmental surface disinfection systems (ESDS).

Airborne disinfection through HVAC air distribution

Airborne disinfection is typically facilitated by the same UV-C light systems that prevent biological contaminant buildup in HVAC units. In this process, microbes are disinfected within the airstream as it passes through the HVAC system's UV light field. There are UV light systems large enough for huge building-wide air handlers or slight enough to fit smaller HVAC systems such as room unit ventilator coils or mini-split ductless air conditioning evaporator coils.

Airborne disinfection has been proven effective in studies. Airmid Healthgroup in Dublin, Ireland, an indoor air cleaning device test facility, has proved that UV-C lights sterilize microorganisms when installed in HVAC systems commonly used in health care facilities. The 2013 study used UV-C light systems to demonstrate airstream microbe inactivation in an ASTM-style environmental test chamber that simulated a typical building's indoor environment and HVAC air handler arrangement.

A single-pass test was also performed on an ASHRAE Standard 52.2 test duct system. While the single-pass test demonstrated impressive inactivation results for bacteria, virus and mold, indoor air quality experts claim even higher inactivity rates among the three tested microbes could occur in a multiple-pass environment, such as the continual recirculation of air from a typical building HVAC system.

Environmental surface disinfection systems in health care

ESDS disinfection is applied either via stationery ceiling mounted UV light systems or mobile robots. In contrast to airborne disinfection, ESDSs disinfect surfaces as well as air within the UV-C field of a given space.

ESDSs complement manual disinfection practices. Studies show that as much as 50 percent of high-touch surfaces are not adequately addressed through manual cleaning. ESDSs are particularly strategic in surgery suites and areas where patients have compromised immune systems that are susceptible to the many microbes in health care settings.

UV-C robots are also popular ESDS systems. They carry a higher cost and require trained staff to transport, calibrate and operate them for each room they surface disinfect. In contrast, a stationery ESDS system can be automatically programmed to operate for a minimum disinfection time during unoccupied periods.

Like airborne disinfection, ESDS has also been proven in studies. As reported by www.sciencedaily.com and presented at the 2012 IDWeek, an annual scientific meeting where infectious diseases professionals meet, ESDS effectiveness was presented in a study by researchers at Duke University Medical Center and the University of North Carolina Hospital System. The study confirmed that UV-C killed drug-resistant bacteria on door handles, bedside tables and other hospital room surfaces.

Looking into the future of UV

As more equipment in buildings becomes susceptible to biological contaminants, UV manufacturers are responding. Recent innovations include miniaturization to reach confined areas of smaller systems, plus advancements in technology that promise improved monitoring, controlling and interfacing UV equipment with building management systems (BMSs).

Commercial ice machines, for example, are being outfitted with UV systems to maintain ice sanitation, clarity and taste. An ice and cold water dispenser or ice machine's exposure to exterior bacteria through condensate drains and ice chutes can generate mold, slime and other biological contaminants inside the machine that eventually transcend to the ice and can impact the health of its consumers.

Miniaturization of UV lamps now make UV light systems available for nursing station ice machines (also known as "flakers"). Cleaning these machines can cost an estimated US$200 to US$400 per unit depending on the severity of the mold growth. Multiplying a US$400 cleaning cost by four annual cleanings means that maintenance costs can surpass US$1,000 for just one machine. Many hospitals have dozens of nursing station ice dispensers. Worse yet, an ice machine with mold can cause a facility to fail a health inspection, even if everything else around it is spotless.

The next frontier for UV disinfection is the application of microprocessor controllers that can monitor multiple lamp systems throughout a building's air handler systems. The controllers can monitor for lamp efficacy or failures and relay the information to the BMS or send alarms and updates to maintenance personnel.

From an operational standpoint, UV equipment capital costs are typically paid back in less than a year in terms of reduced or eliminated maintenance costs. Maintenance requires a one-minute UV lamp replacement every one to two years. In contrast, coil cleaning can be expensive for health care facilities, depending on the number of units and their sizes. Also, residual toxic biocide chemicals on poorly rinsed coils contribute to poor indoor air quality, affect occupant respiratory systems and prematurely shorten HVAC system life cycles.

While maintenance costs and energy efficiency equate to a dollar value, no amount of money can equate to saving lives or increasing quality of life by minimizing HAIs. No person should go into a hospital or a workplace and become sicker than when he or she entered. While viruses and infections are an accepted risk of entering some facilities, UV disinfection can help minimize their occurrence. **FMJ**

UV-C light systems can be instrumental in reducing maintenance costs.

Aaron Engel is vice president of business development at Fresh-Aire UV (www.freshaireuv.com), North America's largest manufacturer of UV disinfection and carbon/photocatalytic oxidation-based indoor air quality products. Fresh-Aire UV offers UV-C light systems for most HVAC systems, ice machines and surface disinfection, as well as free trial demonstrations of UV-C lights on HVAC coils of selected commercial buildings. Engel can be reached at aaron@freshaireuv.com or +1-800-741-1195.