UVC-Ultraviolet Air Treatment

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By now, IUVA readers are well aware of the application of UVC in water disinfection; the same ultraviolet technology has been found to be useful in air and surface disinfection as well. The use of ultraviolet technology to minimize airborne contaminants, reducing infection and providing ultraclean air, has been studied and used since the 1930s. UVC technology used in HVAC applications can be beneficial in various environments ranging from residential to commercial to industrial HVAC systems. There are two major kinds of HVAC applications of UVC: pass-by disinfection, and coil and drain pan treatment. This same technology has also been documented to be beneficial to healthcare settings.

PASS-BY AIR DISINFECTION
Pass-by air disinfection improves the overall air quality by decontaminating air as it is pushed through the HVAC system. For residential HVAC applications, we would typically see a single ultraviolet lamp located in the return duct while a bank of lamps would be used to treat air in commercial or industrial applications. For example, American Ultraviolet’s ICR Rack (Figures 1,1A) works by increasing the density of UVC light in a critical run of duct in a commercial or industrial application or in a large commonplace scenario. Following an easy installation process, reduction rates of bacteria, viruses, fungi and other such contaminants can be over 99 percent, depending on the microbe, with most documenting well over 90 percent.

COIL AND DRAIN PAN TREATMENT
The second option involves the coil and drain pan of the HVAC system. The coil is the heat exchange (heating) or (cooling) coil of the HVAC system, the heating and cooling of the coil creates condensation, which collects in the drain or drip pan. Coil and drain pan treatment works by directly irradiating the surfaces of the coil and drain pan with UVC light. In this type of HVAC application, the origin of the problem is treated as opposed to treating the symptom of infected airborne contaminants, which is targeted by pass by disinfection. Coil and drain pan treatment can either be used in a new installation to preserve the performance of the system or prevent the start of contaminants or used as a retrofit to an existing installation to fix current problems and return the system to the designed performance characteristics. Due to blow off that can occur from dirty coils, it is incredibly important to use a moisture proof fixture in the retrofit application to keep the electrical connections from shorting out. This is less of a concern with new systems, but moisture can still be present for a variety of reasons.

SO WHICH SOLUTION IS BETTER?
Ideally, it would be the most beneficial to combine both methods, by treating the coil directly as well as one or two critical places of ductwork for pass by air disinfection. This approach would not also provide intensive ultraviolet treatment with an additional buffer, but would also maintain the designed performance of the coil and drain pan system for longer periods of time. Ultimately, this approach would preserve the HVAC system thus allowing it to last longer before replacement and effectively saving money down the road. In theory, who doesn’t want the air they are breathing, like anything else important to us, not checked once, but twice! However, there are reasons why someone may choose one system or the other; we typically see more coil and drain pan treatment applications for its system benefits. There are situations where the pass by air disinfection route is an appropriate alternative especially when, planning and space are of concern, the pass by disinfection can be mounted to ductwork pretty quickly and easily. For
example, we have a specific series (Figures 2,2A) with various size offerings that can be mounted essentially anywhere, as opposed to the coil and drain pan treatment which may need additional planning and retrofits that at times may not work reasonably in certain space confinements. Both solutions have similar overall results of reduction in airborne contaminants of over 99 percent, depending on microbe, thus whatever the solution is called for, the end result would be similar.

HEALTHCARE AIR TREATMENT APPLICATIONS

There is a large demand to keep hospital-acquired infections (HAI’s) and contaminants low in rooms frequented by sick individuals, such as waiting rooms and patient examination rooms. In these scenarios, we would recommend in-room upper air treatment systems. These devices disinfect air in the room using upward facing ultraviolet lighting mounted to the wall, thus avoiding exposure by patients directly to the light.

Why would this be necessary? Imagine a scenario of a patient visiting a doctor’s office or clinic. The patient would more than likely spend at least some period of time in a waiting room with other patients, many of who could have an infectious illness. It is unreasonable to believe that an airborne microorganism transmitted from one individual in the waiting room would travel through the entire HVAC system prior to being inhaled by the second individual. The in-room application can acutely treat high traffic rooms to provide disinfection at a quicker rate. To provide an additional level of protection in surgery rooms, upper air treatment can be combined with direct surface treatment using UVC light before, during, and after surgeries. This method, combined with the existing HVAC UVC units, has been documented in various studies to create a reduction in HAI rates. The Journal of Bones & Joint Surgery ran an article discussing such matters in 2008. The authors analyzed the results of a study conducted over a 19-year period. In this specific study, one surgeon conducted 5,980 joint replacement surgeries from 1986 to 2005, at The Center for Hip and Knee Surgery, St. Francis Hospital in Mooresville, Ind. In September 1991, ultraviolet lighting was installed in the operating room while the technology in place, laminar airflow that filters and creates a reduction in microbes in the air, was discontinued. The infection rate prior to the installation of UVC lighting was 1.77 percent, while the infection rate with UVC lighting was 0.57 percent, a three times reduction in the infection rate. The infection rate of total hip replacement went from 1.03 percent with laminar airflow to 0.72 percent with ultraviolet lighting, while the rate for infection during total knee replacement lowered from 2.20 percent to 0.50 percent with the use of ultraviolet technology. According to the article, “when appropriate safety precautions are taken, ultraviolet lighting appears to be an effective way to lower the risk of infection in the operating room during total joint replacement surgery” (Journal of Bone & Joint Surgery, 2008). Why is this important? It demonstrates the benefit of ultraviolet technology by actually killing bacteria/contaminants as opposed to simply reducing the amount of these DNA based airborne contaminants in the operative environment.

In closing, UVC technology has many applications shown to be beneficial. Regardless of using ultraviolet lighting to disinfect water, air, or surfaces, the results are both impressive and needed. There is something to be said about any technology that documents benefits of three to four time reductions in infection, thus proving that UVC light is a technology that more industries should consider implementing!