# Breath of FRESH AIR

## Combining air purification methods enhances IAQ in healthcare facilities

By Chris Willette

Indoor air quality is an area of growing concern for healthcare facilities managers. Although ultraviolet germicidal irradiation light and gas-phase air purification are proven technologies, the combination of these technologies with photo catalytic oxidation offers a new and powerful tool for healthcare facility indoor air quality.

The combination of these three technologies offers healthcare administrators a complete IAQ solution that disinfects airborne microbes, adsorbs gaseous contaminants and regenerates the adsorption media itself using new PCO methodology. Combining the technologies has the potential of advancing a healthcare facility's IAQ well past the airborne particulate capturing capabilities of high-efficiency particulate arrestor and ultra-low particulate arrestor filters.

### Germicidal UV light: Established chemical-free disinfection

UVGI is a proven technology in reducing airborne infectious contaminants. There are many recent studies pointing to the effectiveness of a UVGI in reducing airborne pathogens. For example, a 2009 Michigan State University study at Ingham Regional Medical Center, Lansing, Mich., and its Greenlawn campus, demonstrated significant reductions in airborne bacteria. The study, which was prepared by Marc P. Verhougstraete, Tomoyuki Shibata and Joan B. Rose from the Center for Advancing Microbial Risk Assessment, recorded indoor air levels of viable bacteria and fungi before and after UVGI lamps were installed in an HVAC system.

The study concluded that "average levels (organisms/m3 air) of total bacteria found in the air prior to the UVGI installation were 45.5 and 25.5" on the Greenlawn and the main campus, respectively. "Average levels of total bacteria found in the air after the UVGI installation were 8.67 and .418," respectively.

Not every hospital has the funding to periodically test IAQ for infectious diseases, however experience has shown that UVGI lights minimize mold growths on air conditioning coils and air handler interior surfaces which, in turn, minimize biological growths and their distribution via the ventilation system.

For example, Geary Community Hospital, Junction City, Kan., has been using UVGI in new HVAC air handlers supplying common areas, a patient tower and operating rooms as part of a recent multi-million dollar expansion. While it's difficult to compare new technology in the new air handlers to the hospital's older HVAC units that were installed before UVGI was available, the new units have required no cleaning based on periodic visual inspections. "We pressure clean the original units' coils annually, but the new units with UVGI have not required any maintenance cleaning in more than three years," said Steve Rippert, CHPM, director of maintenance, Geary Community Hospital.

Based on the success of the recent UV-C lights, Rippert will likely include UVGI technology when replacing the facility's older air handlers.

### Gas-phase air purification: Absorb VOCs

Like UVGI, there are studies proving the effectiveness of gas-phase air purification, such as "Predicting Gaseous Air Cleaner Performance in the Field" by C. Howard-Reed, S.J. Nabinger, and S.J. Emmerich of the Building and Fire Research Laboratory, National Institute of Standards and Technology, Gaithersburg, Md. The filtration tests, performed in a house using decane as the gaseous pollutant, demonstrated gas-phase air purification reduced the contaminant by 30-44 percent in a single pass.

Many hospitals are already using gas-phase air purification, according to Dean Tompkins, Ph.D., P.E., a Milwaukee, Wis.-based air purification and IAQ consultant, and a past chairman of the ASHRAE Technical Committee 2.3, "Gas Phase Control and Removal Equipment."

Outdoor air intakes and re-circulated indoor air are the two most common sources of gaseous airborne contaminants in healthcare facilities. Outdoor air typically contains acid gases such as nitrous oxides and sulfur oxides. Ground level ozone is a common pollutant as well.

Indoor re-circulated air typically distributes a variety of VOCs throughout the facility. The VOCs include cleaning chemicals such as chlorine and d-limonene, and interior furnishings off-gassing of formaldehydes, acetones and other toxic chemicals.

Consequently, healthcare facility managers have looked to gas-phase air purification, which is an activated carbon-based material derived from coconut shells, charcoal or wood chips. The carbon adsorbs and holds VOCs through a chemi-sorption process.

Unfortunately, the carbon media eventually reaches 100 percent adsorption capacity and loses its effectiveness. Replacing the media can be costly and time consuming, and failing to replace it in a timely manner can result in compromised IAQ.

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### PCO: Complete the cycle

PCO is a method in which light, such as UVGI, stimulates a chemical reaction when shined on PCO media of titanium dioxide-infused activated carbon. PCO by itself is somewhat effective at reducing airborne VOCs, however using activated carbon as the PCO media achieves the best results. Titanium dioxide-infused carbon media holds onto VOC contaminants and gives the PCO process time to convert them into harmless CO2 and water vapor.

An additional benefit of PCO in this type of system is the "regeneration" of the gas-phase media. Because the PCO process is continuous, contaminants don't have time to accumulate and the carbon media never reaches adsorption capacity. In most cases, the activated carbon PCO media will never need to be replaced.

Unlike many conventional air-purification and adsorption methods, the addition of PCO destroys contaminants versus just transferring them to an adsorption substrate. This process is easily performed at ambient temperatures and pressures, thus additional energy to cool or heat the airstream isn't required.

Many IAQ experts, such as Tompkins, feel the combination of UVGI light, gas-phase air purification and PCO to optimize performance in controlling both biological, as well as gaseous contaminants will provide a positive step toward healthier environments in healthcare facilities.

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