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Delaware Biotechnology Institute

Improving IAQ with UVC

The benefits of high-output UVC devices can extend beyond simply optimizing a facility's IAQ.

It is a well-known fact that poor indoor air quality (IAQ) is harmful to building occupants, but in a biotech lab it can also compromise sensitive research and laboratory experiments. To provide its people and processes with the best protection, the University of Delaware's Delaware Biotechnology Institute (DBI) decided to equip the air-handling units in its six-year-old 72,000-sq.-ft. facility with high-output ultraviolet-C (UVC) devices. While optimizing the air quality with germicidal UVC, DBI has discovered an unexpected fringe benefit: The condensate from the coils is now so clean that they can collect and pump it into the cooling tower as make-up water,

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achieving substantial savings in water usage.

"HVAC systems are an acknowledged breeding ground for mold and microbial growth," said Robert Pekala, engineering and operations manager for DBI. "The biofilm that builds up on coils can contaminate not only the air that circulates through the building, but also the condensate water that is created as the system cools and dehumidifies. If you were to take that water from an air handler untreated with UVC and add it to the cooling tower, you would have to increase the use of biocides and chemicals substantially to counteract the added microbial contamination in the cooling tower."

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Water Savings Described

“With UVC, however, the condensate coming off the air handlers is essentially distilled 55°F water that we can confidently pump into the cooling tower,” Pekala explained. During cooling season, he noted, the air-handling units (AHUs) produce two to 5,000 gal. per day of condensate. Added to the cooling tower, this water can replace roughly 30 to 50 percent of the seven to 10,000 gal. per day that evaporate from the cooling tower during hot weather conditions.

Pekala notes that most city codes mandate that condensate water should go into the storm drains, so DBI sampled and tested the condensate to prove its cleanliness. Since starting the program in 2005, DBI has experienced a direct savings of \$4,000 to \$6,000 in water costs during the yearly cooling season. The average home in the city of Newark, DE consumes 150 to 200 gal. of water per day, so this conservation effort saves enough water to supply 10 to 25 homes.

“It is important to point out that we have been able to accomplish these savings with no increase in the level of biocides used in the cooling tower,” Pekala added. “This can be attributed solely to the germicidal effects of the UVC devices. Also, there are definite energy savings achieved by mixing the 55°F make-up water with the much warmer (80°F to 90°F) water in the tower, though we have not quantified this.”

IAQ, Energy, and Maintenance Benefits

Pekala emphasizes that the UVC lights are also doing a good job with the originally intended function of IAQ control. “In 16 years of dealing with IAQ issues, I have learned that even the most diligently maintained building develops indoor air contamination problems within a few years,” stated Pekala. “DBI



UVC-treated water produced by the air handlers during cooling season at the Delaware Biotechnology Institute on the campus of the University of Delaware is clean enough to be pumped into the cooling tower.

opened its new facility in 2001, and though the level of biofilm we measured in the two 45,000 cfm AHUs was much lower than what you see in most buildings, I knew from experience that it

Energy savings of 15 to 20 percent and higher have been routinely documented in buildings using the technology.

would worsen over time — even though we were pressure-washing the coils three or four times a year to maintain cleanliness,” he said.

Pekala first became aware of UVC technology while attending a facilities

management conference in 2005. He then consulted with General Aire Systems, Inc. of Darby, PA, a manufacturer’s representative, distributor, and service company specializing in HVAC air cleaning technologies, to develop a pre-emptive IAQ control strategy.

Pekala believed that germicidal UVC devices, used in combination with high-efficiency air filters, would provide the added protection they needed. General Aire developed a life-cycle cost and energy-saving analysis that projected a six-month payback on the initial UVC investment, followed by an \$18,000 savings in the remainder of the first year of installation and \$36,000 annual savings in subsequent years.

The estimated savings come from reductions in the electrical energy needed to run the air handlers. By keeping coils clean and free of organic buildup, UVC reduces pressure drop across the coils and increases net cooling capacity. Energy savings of 15 to 20 percent and higher have been routinely documented in buildings using the technology. Pekala notes that DBI is also reaping labor savings from the

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elimination of coil cleaning, which was previously performed at three to four month intervals — reducing system downtime and freeing up in-house crews for other tasks.

General Aire installed the UVC lamps in September 2005. Prior to startup, Dr. Rebekah Helton, a microbiologist and researcher at DBI, sampled the biofilm and condensate in the AHUs (shown on pg. 60). Within a few weeks after the UVC installation, all visual biofilm was gone from both AHUs. Since then, the coils have remained pristine and samples taken one year later detected no biofilm. Viral abundance within AHU condensate was below detectable limits and no bacteria were detected. DBI is planning an expanded study that will provide further insights into the efficacy of UVC and its ability to control microbial proliferation.

The UVC devices require no special maintenance except for annual change out of the bulbs or lamps by a DBI in-house HVAC technician. Pekala says they also are in the process of equipping two new smaller AHUs with UVC lamps: one that serves a lab area, and a second that serves a space requiring supplemental year-round cooling.

Wouldn't Live or Work Without It

Pekala concluded: "We have never had any problems or complaints about the air quality in the building. UVC has been a resounding success for us, and after experiencing the benefits, I personally wouldn't live in a house or work in a building that didn't have it."

Located at the Delaware Technology Park campus in Newark, DE, the University of Delaware's Delaware Biotechnology Institute is a partnership among government, academia, and industry to help establish the First State as a center of excellence in biotechnology and the life sciences. The 72,000-sq.-ft. facility houses 25 dedicated research laboratories and 10 common research laboratories. 

Robert Scheir, Ph.D., is president and chairman of Steril-Aire, Inc. (www.steril-aire.com), a leading manufacturer of UVC devices used in educational and other facilities. For more information, contact 800/2STERIL or 818/565-1128; e-mail sales@steril-aire.com.



UVC lights shine on one of the air conditioning coils at the Delaware Biotechnology Institute.



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