

Reducing HVAC Coil Cleaning Costs and Improving IAQ with Ultraviolet Lamps

The potential of using UVGI cannot be overstated.

By: Chris Willette

Installing ultraviolet germicidal irradiation (UVGI) on air conditioning coils can save a maintenance department budget up to tens of thousands of dollars annually.

Depending on the number of heating, ventilating and air conditioning (HVAC) systems, UVGI can free cash-strapped maintenance and cleaning budgets by drastically reducing coil cleaning costs at hospitals, schools, office facilities and all other commercial and industrial facilities.

A Proven Process

UVGI is a proven process. For example, Geary Community Hospital (GCH), Junction City, Kansas, is saving more than \$1,500 on coil cleaning costs on four air handlers in its recently-built \$34 million addition, according to Steve Rippert, CHFM, GCH's director of maintenance.

Rippert bases the savings on the periodic cleaning costs of older air handlers in GCH's original building.

The only significant difference between the two building sections is the use of UVGI systems.

While GCH's original air handlers require periodic cleaning, the new air handlers are now five years old, but have not yet needed cleaning, according to Rippert.

About half of all commercial building maintenance departments hire outside HVAC contractors for coil cleaning with costs ranging from \$300 to \$500 per coil.

Facilities with dozens of HVAC systems can spend tens of thousands of dollars annually on coil cleaning.

Since half of today's commercial building maintenance departments clean HVAC coils in-house, using UVGI systems

can save significant labor and cleaning solvent/rinse costs while freeing up the staff for other building maintenance projects.

Reducing toxic coil cleaning chemicals and biocides lessens the health risks to maintenance workers and improves the facility's indoor air quality (IAQ).

Furthermore, some applications, such as a hospital's surgery suite, can't withstand any extended amounts of HVAC system downtime for cleanings.

The condensate-rich, dark environment of HVAC system interiors are an

ideal breeding ground for biological contaminants.

Eliminating mold on coils improves heat transfer capabilities and can potentially return a payback in efficiency gains in as little as six to 12 months.

Besides heat transfer considerations, studies also show that just a .002-inch thick biofilm on coils can reduce the free area and increase air velocity up to nine percent.

The result is a system with higher static pressure across the coil for which it was designed.

Eliminating biological growths can result



Image courtesy of Fresh-Aire UV

Reducing toxic coil cleaning chemicals and biocides can decrease the health risks to maintenance workers and improve the facility's IAQ.

in a 30 percent cooling capacity increase compared to a dirty coil.

Finally, clean coils extend the lifecycle of HVAC systems.

Maintaining The Facility's IAQ

UVGI has been used for decades to sterilize and inactivate airborne biological contaminants, such as fungi, mold, viruses, bacteria and other biological contaminants in HVAC systems.

Until recently, however, minimal data was available to support its effectiveness claims.

A 2012 study by one of the top five international air cleaner equipment test labs, Air-mid Healthgroup (AHG), Dublin, Ireland, has proven UVGI's effectiveness against mold, bacteria and viruses in a simulated HVAC unit environment.

The study simulated airstream microbe inactivation in an ASTM/AHAM style environmental test chamber.

AHG custom-built the chamber to simulate a typical building's indoor environment with an HVAC air handler providing 73°F (23°C) temperatures, 55 percent relative humidities and airflow velocities of 492-fpm (0.93m3/sec.).

A single pass test was also performed on an ASHRAE Standard 52.2 test duct system.

The test's UVGI light single-pass inactivation results were:

- Bacteria (*S. epidermidis*): 98-85 percent
- Virus (MS2 coliphage): 99.03 percent
- Mold (*A.niger*): 78.80 percent.

As impressive as these results are, they only represent a single-pass test.

Multiple passes, as simulated in a typical HVAC system producing several room air changes hourly, would have produced even greater microbial inactivation, according to Dean T. Tompkins, Ph.D, P.E., a Milwaukee, Wisconsin-based independent IAQ consultant who reviewed the AHG test results.

Installing And Maintaining UVGI Systems

Most commercial facility maintenance departments are capable of in-house UVGI retrofits of existing air handlers.

Commercial UVGI systems typically cost approximately \$1,000 to \$4,000 in equipment costs per air handling or rooftop unit, depending on the coil size and number of lamps needed for proper coverage.

Installation labor typically requires two to six hours per unit.

UVGI system configuration, including sizing and proper placement of the UV lamps, are an installation's most critical factors.

Some manufacturers provide online sizing programs. A user simply fills out an online form that prompts parameters, such as enclosure dimensions, air velocity and air handler/coil model.

Output data includes selected lamp model and parameters, number of lamps, lamp locations, UV power, electrical power requirements, each lamp's peak irradiance, in-duct irradiance ($\mu\text{W}/\text{cm}^2$) and microbe inactivation calculations.

Some web services provide calculations of both airborne and cooling coil surface microbe disinfection efficiencies from UV light exposure, a free review by factory engineers and detailed color chart and graph image printouts for building owner presentations.

Some manufacturers will also send a factory technician to train a maintenance department and supervise UVGI installations, especially if the retrofit project involves multiple units.

The type of UVGI system chosen for an HVAC unit will affect how much of an additional maintenance workload it puts on a facility's staff.

Like most products, UVGI comes in good, better and best classifications.

Generally, high quality UVGI systems are maintenance-free, with the exception of routine lamp replacement.

The quality of the equipment will affect longevity and the amount of routine maintenance required.

UV lamps are available in one-year or two-year models.

While two-year models are more expensive, the extended lifecycle will cut replacement labor by half or more compared to one-year lamps.

Replacement generally amounts to a 10 minute or less process and simply involves unplugging the old lamp, removing it from the lamp clips and installing the new lamp(s).

Replacement lamps generally come in 15-, 32-, 46- and 60-inch long models, ranging in cost from \$60 to \$150.

The most reliable lamps have sturdy filaments with a cathode guard and a hard quartz glass lens and a secondary hard

quartz shield for added stability.

Not A One Size Fits All

UV lamps are not all the same.

They come in single-end and bi-pin varieties and the latter typically has electrical connector pins on both ends of the lamp and sometimes tend to be more failure-prone due the fragility of the exposed electrical connection points.

Single-ended lamps, especially those using a remote ballast, are the quickest to replace. They snap quickly out of their suspension rack holder and the rubber electrical connection easily pulls off the lamp's single pin end.

Instead of a lamp fixture mounted ballast, which can be as problematic and as unreliable as conventional fluorescent lamp ballasts, more reliable UVGI systems use remote power supplies that provide power to the lamp(s) via a marine-grade, water-resistant cable connection.

When mounted outside the air handler, remote power supplies will have longer lifecycles than power supplies and/or ballasts designed for mounting inside the humid, corrosive environment of the unit.

Thus, some manufacturers offer lifetime warranties on remote power supplies, which demonstrates confidence in the equipment's longevity.

UVGI for HVAC systems offers many advantages for any commercial facility.

It reduces a maintenance department's workload, increases the HVAC system's efficiency and lifecycle, while enhancing IAQ for the benefit of building occupants. *CM*

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