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UVC Helps Cut Heating Costs In Jails

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TACOMA, Wash. — If you think it's hard to get HVAC money for schools and similar public buildings, there is a harder nut to crack: correctional facilities. It can be even more difficult to get additional funds appropriated to improve conditions in buildings where people are incarcerated.

Compounding the problem, many correctional facility employees are in close proximity with the inmate community daily. Moreover, the dense inmate population raises the risks of disease outbreaks, including TB, HIV, hepatitis, asthma, and antibiotic-resistant staph, states the U.S. Federal Bureau of Prisons (BOP), which has been working to prevent/contain the spread of these and other diseases.

Because of TB's airborne transmission, the BOP points out, "The identification of a potentially infectious TB case in a correctional facility should always provoke a rapid response because of the potential for widespread TB transmission. Numerous outbreaks of TB have been reported in prisons and jails, especially among HIV-infected inmates."

According to the BOP, characteristics of TB exposure include:

- **Air volume** — "The volume of air shared between an infectious TB patient and susceptible contacts is an important determinant in the risk of TB transmission," states the BOP. "The larger the air space, the more infectious particles are distributed and the less likely they are of being inhaled." However, the more ventilation air is used, the higher the cost of system operation, particularly when the outdoor air needs to be heated or cooled."

- **Ventilation** — "Ventilation is an important factor in the risk of airborne transmission of disease," the bureau continues. "Exposures in confined air systems with little or no ventilation have been associated with increased TB transmission. The space where airborne infection spreads includes all space sharing the same air. Thus, if air circulates from the room occupied by an infectious patient into other rooms, their occupants will also be exposed."

- **Duration of exposure** — TB transmission can occur after even a brief exposure, but the longer or more often a person is exposed to an infectious person, the greater the likelihood that person will also become infected.

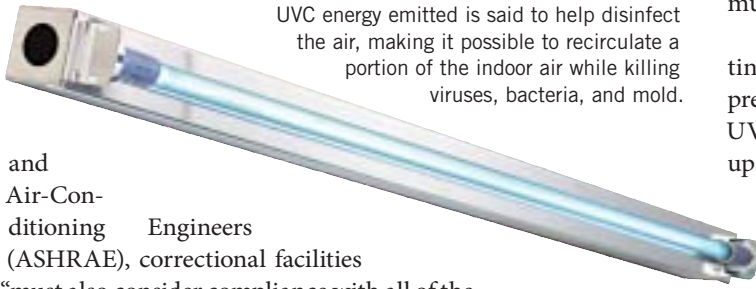


TOP: Maintenance worker Ike Franco shows some of the Steril-Aire UVC lamps installed opposite the cooling coils in the Tacoma Jail's air-handling units. **ABOVE:** Correctional facilities' dense inmate population raises risks of outbreaks, such as TB, HIV, hepatitis, asthma, and antibiotic-resistant staph.

According to the BOP, "certain risks and conditions, such as HIV infection, diabetes, chronic renal failure, injection drug use history, and close contact with someone who is sick with infectious TB, all pose a greater risk for getting TB disease."

There are additional ventilation design considerations, not the least of which is security.

According to the American Society of Heating, Refrigerating,



UVC energy emitted is said to help disinfect the air, making it possible to recirculate a portion of the indoor air while killing viruses, bacteria, and mold.

and
Air-Conditioning Engineers
(ASHRAE), correctional facilities

“must also consider compliance with all of the regulations that may affect their mission to protect the general population by securely housing the criminal offenders of the state. Security issues or the original structure of earlier facilities may prevent certain ventilation practices from being incorporated into existing facility designs. The building owner/operator should prioritize projects based on the criteria above and complete those projects based on hazard concerns and financial ability.”

Again, it comes back to being a question of money and population safety.

A SPECIFIC CASE

Facilities management officials in Pierce County, Wash., wanted to find a way to reduce natural gas heating costs at the existing Tacoma jail as well as in a new addition, without compromising the indoor air quality, or perhaps even improving it.

In this case, the addition of ultraviolet-C (UVC) lamps in the air-handling systems helped meet these dual challenges.

The UVC energy emitted by the lamps helps disinfect the air, making it possible to recirculate a portion of the indoor air while simultaneously killing viruses, bacteria, and mold for enhanced air quality, states manufacturer Steril-Aire Inc. (Burbank, Calif.). Plus, the use of the technology is said to be saving the county an estimated \$55,000 net annually.

“With the jail occupied to full capacity on a 24/7 basis, we previously had to bring in 100 percent outside air, which was very costly to heat,” explained Jim Loewen, project manager for the Department of Facilities Management at Pierce County.

“Back in 2001, we did extensive research on UVC disinfection, and we predicted that we could safely recirculate up to 30 percent of the jails’ ventilation air by installing UVC lamps in the air-handling systems,” he continued. By recirculating 30 percent of ventilation air, the county stood to save 34,102 therms of natural gas a year at the older jail, and another 39,491 therms at the neighboring addition that was under construction at the time.

Loewen learned that Puget Sound Energy’s (PSE’s) energy-efficiency program would cover half the cost of the initial UVC installation.

INSTALLATION AND CONTROL

In late 2002, more than 100 Steril-Aire UVC lamps were installed in the two facilities, opposite the cooling coils in the air-handling units (AHUs).

The AHUs consist of dedicated systems for each inmate cell area — mostly single-fan systems built up with heating and cooling, Loewen said. On one air handler, where there is no cooling coil on the fan, the lamps are installed in the variable air volume (VAV) boxes instead.

The systems are tied into Honeywell controls; CO₂ sensors increase or decrease air recirculation as needed, to a maxi-

mum of 30 percent recirculated air.

Installed in these locations, the high-output UVC energy continuously kills bacteria, viruses, and other microbes, and helps to prevent them from spreading through the occupied space. The UVC is also said to kill mold and organic debris that may build up on the surfaces of the cooling coils. According to the manufacturer, the mold control has a dual advantage:

1. It helps the coils stay clean, which allows them to perform more efficiently.
2. It prevents mold-related allergens from recirculating through the building.

TUBE MAINTENANCE

According to the manufacturer, UVC output or intensity diminishes over time. The light tubes are replaced annually according to manufacturer’s recommendations, so that sufficient output will be maintained, delivering the desired germicidal effect.

The maintenance crew at the jail also performs quarterly visual inspections, at the time of air filter change-out, to make sure all lamps are functioning with no sign of damage.

To use UVC successfully, Pierce County officials noted that certain precautions should be observed. “Always follow the manufacturer’s guidelines for proper lamp sizing, location, and spacing within the system,” advised Loewen. “If the lamps are not applied correctly, they may not perform as expected.”

Safety signage should be posted on the air handlers so that service technicians know to turn the UVC lamps off when they are working inside the units. An additional solution is to use lockout switches that automatically turn the lights off when a unit door is opened.

In addition, prolonged direct exposure to UVC (like other parts of the UV spectrum) can be harmful, so protective eye-wear is necessary during maintenance and inspection. Safety signage should be posted on the air handlers so that service technicians know to turn the UVC lamps off when they are working inside the units. An additional solution is to use lockout switches that automatically turn the lights off when a unit door is opened.

As another precaution, Pierce County wrapped exposed wiring and pneumatic lines in tin foil to protect them from potential UV degradation over time.

BENEFITS AND SAVINGS

Bob Hamilton, maintenance supervisor for the corrections facilities at Pierce County, said he was the biggest skeptic in the room when UVC was first discussed. "I was concerned that the big reduction in outdoor air would result in odor problems," he noted. "We were considering the use of carbon filtration to offset any potential problems.

"We have found, however, that the UVC lamps do a good job of controlling odors, so we haven't needed the additional filtration."

Hamilton also stated, "The condensate pans are cleaner, and the algae growth we sometimes used to see on the coils is no longer evident. Coils have a cleaner, shinier appearance." He noted that, prior to installing UVC, they would brush the coils every three months and perform pressure washing annually. Now that the coils stay cleaner, Hamilton said he has cut back on the frequency of these coil-cleaning procedures, although these savings have not yet been quantified.

"A review of our utility bills confirms that we have saved more

than \$70,000 a year in natural gas by reducing our outdoor air requirement through the use of UVC technology," reported Loewen.

"Even after we subtract the parts and labor costs for servicing and changing the UVC lamps, annual savings still exceed \$55,000."

Loewen added that the lamps have created a healthier and more comfortable environment. "People used to call all the time, saying it was either too hot and stuffy, or too cold in the jail. We are not getting those phone calls anymore.

"Overall, we believe UVC technology is meeting our expectations for energy savings and enhanced IAQ," he said. "Another stakeholder in the process, the Corrections Officers' Union, has been monitoring the program, and I believe they are pleased with the results as well.

"Energy savings and good IAQ are often regarded as conflicting goals, but with the use of UVC we have found it possible to achieve both objectives at the same time." ■



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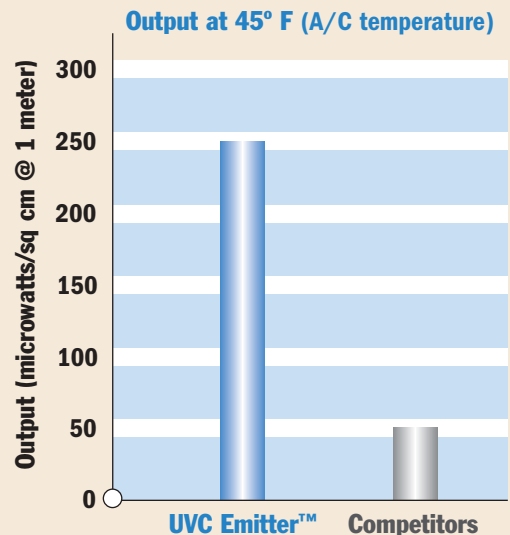
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