

# the NEWS

JULY 24, 2006

WWW.ACHRNEWS.COM

A BNP MEDIA PUBLICATION \$3.00

## School IAQ Solutions Can Save Energy

BY B. CHECKET-HANKS  
Of The News Staff

**S**chool administrators' concerns about indoor air quality (IAQ) problems are sometimes tempered by their fear of the solutions breaking the budget. However, as you will read here, many of today's IAQ products and systems are also de-signed to lower school energy costs.

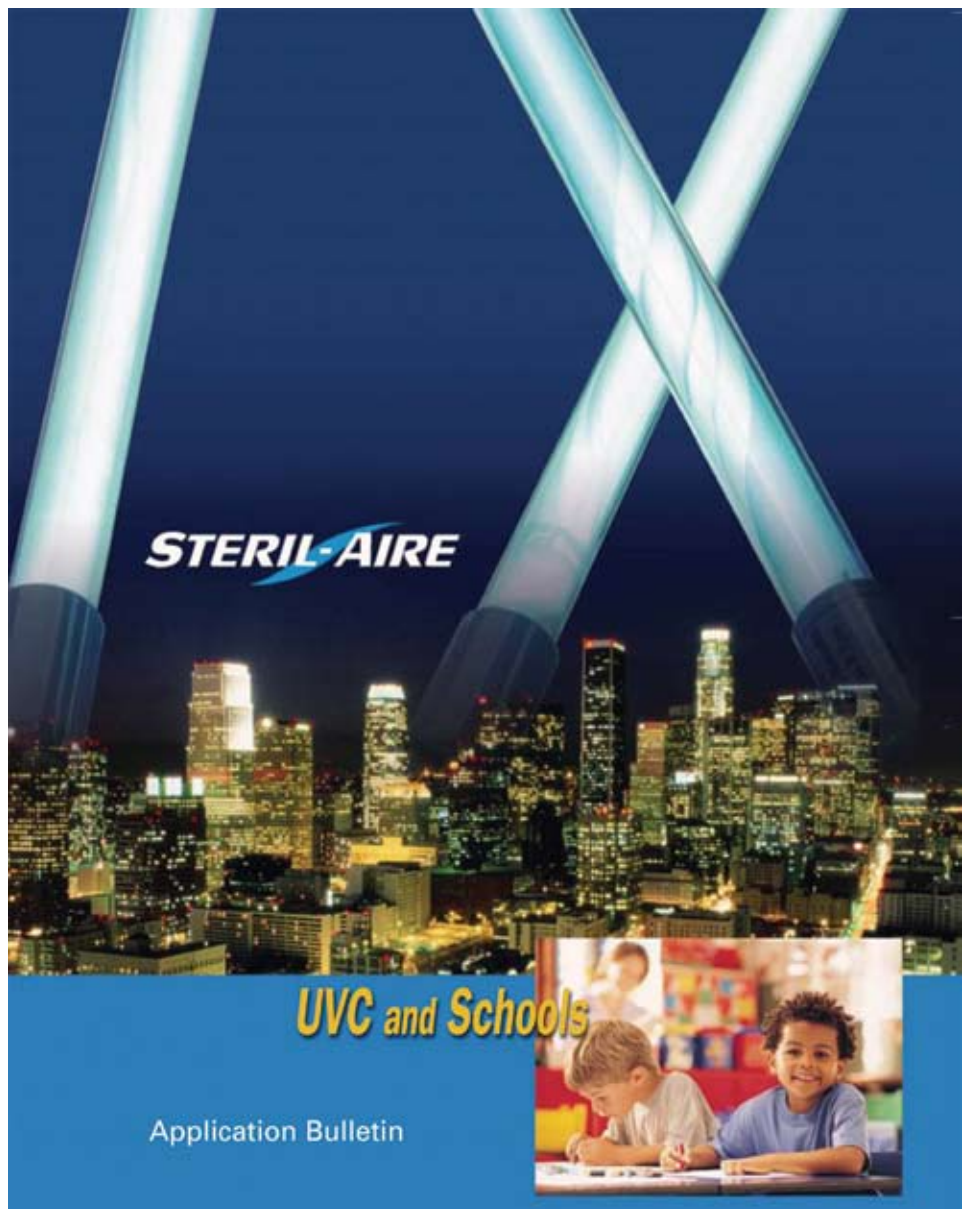
Everyone involved in these situations stands to benefit — the HVACR professionals, school administrators, and parents, but especially the teachers and students. Strategies can range from major system overhauls and new controls equipment to ultraviolet (UV) lighting systems and energy recovery products.

### Mold Control With UVC

**S**ome parents get extremely upset whenever there is a risk to their children. When there is potential exposure to mold or infectious diseases, parents of children with asthma can be especially concerned. School administrators need to balance their own concerns over student and teacher well-being with tight budgets.

Steril-Aire Inc. (Cerritos, Calif.) has plenty of information on how to apply IAQ and energy-saving products in schools. According to the company's literature, school A/C systems can provide an environment that encourages the growth of mold and other microorganisms.

"These organisms multiply 24/7 to huge concentrations, creating a hidden biofilm of mold deep inside the HVAC



Steril-Aire's recent brochure states that school A/C systems "provide cool, moist gardens for the growth of mold and other microorganisms."



Students were losing consciousness in a lab in this West Virginia school.

system,” the company stated. “This bio-film, and the mold spores that travel from the coil through the airstreams, account for much of the illness and discomfort in schools today, and for many of the maintenance and operational problems.”

Infectious disease particles may circulate through the air-handling system and travel through the school.

Steril-Aire said its UVC Emitters™ apply UVC energy “to eradicate both surface and airborne mold, as well as viruses and bacteria.” Knowledgeable contractors install the units on the downstream side of the cooling coil, where the units irradiate high-output UVC energy to eliminate surface contaminants and reduce the number of airborne microbes. “The products thus enhance school IAQ by preventing the spread of colds, flu, and other viral and bacterial infections, while eliminating mold and associated odors,” the company said.

The devices can also help schools reduce energy consumption and operational costs. The UVC light cleans the coils of mold and organic buildup, increasing their rate of heat exchange.

Benefits cited by the company include improved airflow, temperature, and humidity control. Other benefits include the elimination of coil cleaning programs and potential energy savings, the company indicated.

In public schools, “funding is related directly to attendance,” Steril-Aire point-

ed out. “High absenteeism ultimately means less money for the school. Many studies have found that poor IAQ leads to greater absenteeism and lower productivity.” The financial rationale alone “should be sufficient reason to take school IAQ very seriously,” the company said.

“At Rizzuto Elementary School, remedial measures showed no promise of eradicating mold and mildew problems,” said James Freeman, HVAC foreman, La Porte Independent School District, La Porte, Texas, until the air handlers were outfitted with UVC lights.

“The devices have helped solve a costly maintenance problem, while proving to deliver unanticipated energy and operational savings,” Freeman said.

“Everyone from teachers to the principal is happy with the results. The maintenance work controller has commented on the lack of complaints from this campus.”

“UVC lights reduced the need for several other remedial measures in a building where mold was discovered,” added Susan Radabaugh, executive director of Stepping Stones Center, Cincinnati.

“When we found that the actual costs would be considerably lower, we were able to use the funds instead to expand and up-grade the building. We’re delighted that the UVC lights took care of our problem and enabled us to perform this expansion.”

### Fainting Spells Ring Some Bells

If some physical IAQ symptoms are like warning bells, you could say this one was like a siren. In 1998, students working in a lab in Raleigh County Schools, Beckley, W. Va., started passing out.

Someone in the facility decided that the school should check out IAQ problems immediately. The entire school’s operation was at stake. “If the school is inoperable, we have no choice but to send the students back home,” said Charles Jones, maintenance supervisor for Raleigh County Schools.

Jones and the school system called in their equipment manufacturer’s local commercial service office. Together the team surveyed the school building’s HVAC system to diagnose the problem.

To say that it was a sensitive state of affairs is putting it mildly. “We went into this situation without any preformed opinions,” said Brian Layton, senior account executive for Carrier Commercial Service (Scott Depot, W. Va.). “By listening carefully to the customer and analyzing their system, we were able to provide the best solution within their budget.”

Several problems had to be addressed. The area in question was being served by a four-pipe central air handler and zoned by an older, energy-intensive reheat variable air volume (VAV) system with pneumatic controls. Insufficient outside air contributed to an odor in the building.

Starting at the air handler and working back, the team found that the outside air damper, which was supposed to be controlled by pneumatic temperature controllers, was not functioning properly. In addition, the VAV units were not functioning and were in fact beyond repair.

The team's designed solution involved putting the air handler under direct digital control and getting outside air into the building. Carrier replaced four VAV boxes with new ones and installed DDC, including CO<sub>2</sub> monitors, in the student space. CO<sub>2</sub>-based demand-controlled ventilation (DCV) modulates outside air ventilation based on real-time occupancy to decrease CO<sub>2</sub> levels in the space cost effectively.

"The DCV system rectified the building's fresh air problem," stated Carrier, "and the school could now focus on who was passing science, instead of worrying about who was passing out."

Since then, Raleigh County Schools has upgraded eight buildings; factory-mounted communicating controls are the basis of design for four new school buildings. Five more systems are being planned for the near future.

### Moisture Control With Desiccants

In many cases, controlling moisture in the school is the key to preventing mold growth in the first place. It can be a lot less expensive than mold litigation and remediation.

According to the Commercial DH Division of Munters Corp. (Selma, Texas), in 2002 an Austin, Texas, school district passed a \$49.3 million bond issue to pay for mold removal and preventive maintenance in 91 schools. That same year, the Texas Department of Health said at least 10 school districts had reported mold problems in the last year.

In addition to climate, changes in how schools are built contribute to the problem. Gypsum wallboard, now widely used instead of plaster, allows a fertile environment in which mold can grow. HVAC engineer Joe Lstiburek refers to materials like this as "mold candy."

Carpeting also can create a breeding ground for mold; so do flat roofs, which make it harder to detect leaks, said Quade Stahl, chief of the indoor air quality branch of the Texas Department of Health.

Wide temperature and humidity vari-

ations in southern Texas and other areas make it difficult to maintain internal atmospheric conditions to minimize the formation of mold or mildew, explained Munters.

Pharr-San Juan-Alamo (PSJA) School District's Memorial High School, a \$23 million project, had been open less than three years when mold issues reached crisis stage. Mold was growing on ceilings, walls, equipment, and books. Students and staff complained

of allergic reactions, respiratory infections, and, in some cases, neurological responses.

"On two separate occasions, students staged a walkout to protest the conditions," the manufacturer reported.

The poor IAQ, said Munters, was due to high ventilation and people loads in classrooms; high intermittent ventilation loads; moisture carryover from showers in gyms and locker rooms; and long periods where the building was unoccupied. Ventilation and infiltration brought in so much moisture from the unconditioned air, the building had reached a saturation point.

Small roof and window leaks also contributed to the problem. Mold proliferated. According to the manufacturer, "Desks and floors were wet; humidity inside the building was as high as 90 percent."

"We had a lot of complaints from teachers, staff, and from students — some staff and students were becoming ill," said Arturo Guajardo, superintendent of PSJA School District. Two air quality studies recommended replacing ceiling tiles and cleaning up the mold, but did not address the source.

The district contracted Assured Indoor Air Quality Inc. (AIAQ, Dallas) to identify the problem, cut off the sources of moisture, and clean up the mold.

Large volumes of fresh outside air are drawn into the building to meet health and ventilation codes; this outside air also was the main source of building humidity. AIAQ brought in Munters equipment to begin supplying dry air to the building via temporary desiccant dryers. While the mold was removed and materials were replaced, the company designed a permanent system using desiccant dehumidifiers.

The permanent drying equipment conditions outside air efficiently and pressurizes the building to keep humid

air from being drawn inside.

Prior to incorporating the desiccant dehumidification system, the schools used refrigeration-based ventilating systems, which operated to meet setpoint conditions 12 hours a day, five days a week. During nights and weekends, the humidity rose and the building absorbed moisture. When the equipment turned back on, the energy required to dry the building was significant.

"Two previous studies offered solutions that didn't address the source of the problem," said Bill Holder, senior vice president of AIAQ. "The most effective way to control a high-humidity environment is to employ desiccant dehumidifiers. Today Memorial High School's hourly operating costs have decreased 50 percent."

By incorporating the desiccant dehumidifiers and controlling humidity at all times, the building remained dry and significantly reduced the total building energy cost.

Over a three-month period, the desiccant dehumidification system dried the building. Today the school is kept at 45 percent rh and 75°F.

### Energy Recovery And IAQ

Energy recovery ventilators (ERVs) offer another good IAQ solution for schools. According to Lennox, "Good indoor air quality requires a delicate balance between comfort and efficiency."

That was the case for the Middle School Seventh/Eighth Grade Center in the Missouri Raymore Peculiar School System, which began to remodel and expand in 1999.

Areas that contained a high volume of active students flowing in and out each hour, such as the gym and multipurpose room, needed more fresh air to meet American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) standards.

"We needed to decrease the extreme temperatures outside the building to maintain an even climate control and bring more fresh air in for the students," said Joe Coon, Raymore Peculiar School System HVAC service engineer and technician. "The oxygen levels had to increase, but we needed to minimize energy use at the same time."

Coon decided to solve the problem with an ERV, whose energy recovery

wheel transfers heat and humidity from incoming outside air to the exhaust air in summertime conditions; it can do the opposite to preheat the outside air and add moisture in wintertime conditions.

Coon and director of building grounds Jack Woodbury applied the ERV offered on Lennox L Series packaged rooftop units. The stand-alone makeup air unit is said to



The L Series with ERV is said to reduce the design load on an air conditioning system and minimize the tonnage of a rooftop unit by 10 percent to 40 percent.

use an energy recovery wheel to reduce energy costs while maintaining adequate ventilation and increased airflow.

The L Series with ERV can reduce the design load on an air conditioning system and minimize the tonnage of a rooftop unit by 10 percent to 40 percent, the manufacturer said. "Not only does this decrease the installed cost of the equipment, it also diminishes the amount of energy necessary to maintain required air quality. It further cuts installed costs by reducing the size of ductwork that is required."

"We have three L Series with ERVs in the Middle School Seventh/Eighth Grade Center and one in Eagle Glenn Fifth Grade Center, and we have been nothing but impressed since installation," said Woodbury. Coon reported similar results.

### Controls Improve Maintenance

In other school districts, adding controls has provided an indirect effect on IAQ by freeing up more money for maintenance. Osceola County School

District in Florida operates 30 schools in a 1,500-square-mile area in the central part of the state.

Since 1988, it has expanded 150 percent. Maintaining buildings is demanding, complex, and costly. Jack Joyner Heating and Air Conditioning (Clearwater, Fla.) uses the LonWorks platform to simplify control and put more money in the classrooms.

The contractor has sparked something of a maintenance revolution.

Like any institution, the district has proprietary control systems from multiple vendors: HVAC, security, fire, lighting, etc. For each system, they had to use its control hardware and software, learn its controls, rely on the original

installation company for service and future phases, upgrade as the vendor eliminated support and spare parts, and replace and upgrade it with school growth.

"For every proprietary system, you have a totally separate monitoring system," said Mike Sullivan, director of maintenance. "As the district continues to grow, if we don't standardize, we'll end up with a room with 40 computers with different systems on them. It was becoming a nightmare."

The district uses LonWorks control networks in two schools: Celebration High School, located in the Disney Celebration community, and Gateway High School in Kissimmee. Each school provides access to data and the Internet for every classroom and administrative office via a 100-mbps Ethernet system built on a district-wide fiber optic backbone. The network is also used for maintenance and building systems.

Celebration is housed in seven buildings and serves about 750 students. Gateway has 24 buildings and about 2,200 students.

Numerous HVAC units and network devices comprise the LonWorks network and use FTT-10A (Free Topology Transceiver) interfaces. Each HVAC unit connects to an i.LON™ 1000 on the school Ethernet.

Several Echelon LonPoint modules gather data for the LonWorks network from physical relays on HVAC chiller plants. Rick Joyner, vice president of controls for Jack Joyner Heating and Air, said his company uses the devices because they eliminate the expense of full-size manufacturer controls.

The maintenance building PC uses an Echelon PCLTA-10 ISA adapter to access an i.LON; this communicates with the LonWorks network over the Ethernet. Software gives personnel control of every unit and provides complete monitoring data.

Jim Damico, maintenance foreman, said, "I'm able to see the ABB drives, the XL10s, the Honeywells, the Circons, all coming in on one front end. That's a big help right there. I'm able to read everything that's in that drive or everything that's in that VAV box. When the XL10s go down and I find a different VAV controller that works better and lasts longer, I can just plug it in and away I go."

The system is also helping address classroom temperature, humidity, and mold problems through its monitoring and control. Teachers have temperature control through the i.LONs; they simply use a classroom intranet PC, go to their room control Web page, and adjust temperature settings.

"We're excited," said Sullivan. "The new trend is using one communications line for security, HVAC controls, and fire alarms. That's potentially going to save the district a lot of money. IN

---

### Reprinted from

Air Conditioning | Heating | Refrigeration

the **NEWS**

Copyright 2006