# UVC SHEDS NEW LIGHT ON SCHOOL MOLD PROBLEMS

## UVC devices can be beneficial in unexpected ways

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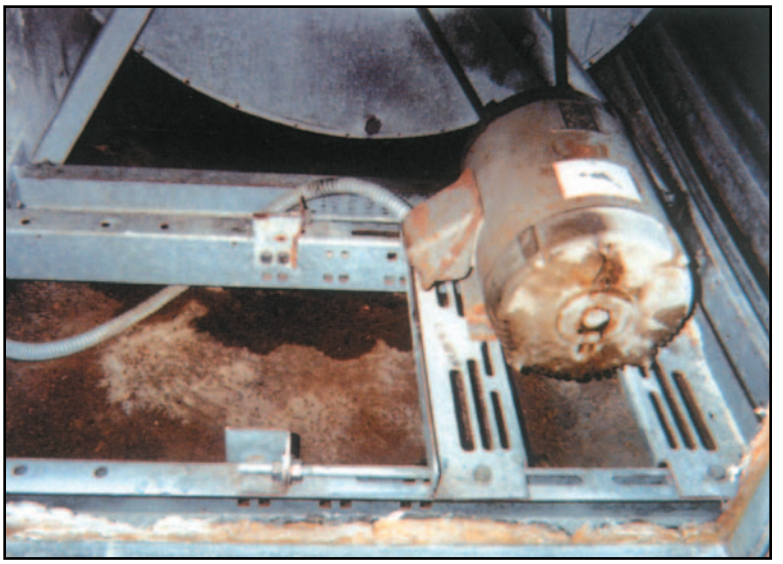
In the warm, humid southern Texas environment, mold and mildew can be persistent problems in educational and other buildings. Outbreaks of fungus and mold have been reported in many schools here and even have resulted in closures. At Rizzuto Elementary School, part of the LaPorte Independent School District (LPISD), a very aggressive operation-and-maintenance (O&M) program was helping to keep mold in check. But remedial measures showed no promise of eradicating mold and mildew problems—until the air handlers were outfitted with high-output, HVAC-style, ultraviolet light in the "C" band (UVC) lights. The devices have helped to solve a costly maintenance problem, and have delivered unanticipated energy and operational savings.



***This air handler at Jennie Reid Elementary School shows a condition of mold and organic buildup similar to that at Rizzuto Elementary before UVC lights were installed.***

### A PERSISTENT PROBLEM

In the spring of 1997, the maintenance department received notice that one of the classroom wings in 16-year-old Rizzuto Elementary School had a moldy smell. Crews surveyed the wing, but could not pinpoint the source of the problem. The consensus was that the carpet had not been dried thoroughly after a shampooing. Reports of odors continued, with the majority of complaints coming from the area of two classrooms. Fungus was found in a set of cloth-bound books stored in an adjacent book room. Immediately after this discovery, in August 1997, crews cleaned the area and treated it with a general-purpose disinfectant and odor neutralizer.

Maintenance crews monitored the area for months. Fungal growth returned approximately every 10 days and was temporarily kept in check by cleaning and disinfectant procedures. There was concern that the problem would continue until the books were discarded, and that, sooner or later, a major outbreak would occur. In the meantime, we continued the current O&M program.

During Christmas break, fungus spread throughout the book room. Crews cleaned the entire room and treated it with bleach and a disinfectant, a process they repeated every 10 to 14 days. Though this O&M program seemed to be preventing mold proliferation, it was an expensive, constant maintenance situation with no permanent "fix" in sight. This continued for about six months, when fungus and mold broke out again. This time, the entire wing of the building was affected. Ceilings, walls, furniture, carpets—everything had a coating of green or black growth. It was evident that the contamination from the book room had spread via the two variable-air-volume (VAV) air-handling units (AHUs) to the rest of the wing. Though these contaminants were not specifically identified, the most common molds found in HVAC equipment and conditioned spaces are *Aspergillus*, *Penicillium*, *Stachybotrys,* and *Cladosporium*.

An outside contractor cleaned the AHUs and applied Foster 40/20 to prevent the spread of mold spores. The affected books were removed, and suspicious ceiling tiles in both the classroom wing and the café were replaced. These remedial actions, completed in approximately one week, cost more than $20,000 to perform. There were no more major outbreaks, but crews had to conduct daily inspections and spray with

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disinfectant everytime they found a suspicious area.

A few months later, we learned of high-output UVC devices that eliminate mold and bacteria in air-handling systems and remove coil and drain-pan debris. By providing a continuous form of source control, UVC showed promise as a practical and effective solution to this daily maintenance problem.

After cleaning the coil and installing the UVC lights, five months went by without a problem; and an inspection at that time uncovered no mildew, fungus, mold, or odor. Due to the drastic drop in maintenance problems, the HVAC department received the green light to install UVC throughout Rizzuto. Everyone from teachers to the principal has been pleased with the results. The maintenance-work controller has commented on the lack of complaints from this campus.

**ENERGY USAGE DROPS**

Though the UVC lights were installed specifically to combat mold, mildew, and fungus, an unanticipated benefit has been a drop in energy usage. As each AHU was outfitted with UVC, the energy-management system (EMS) began to throttle back on chilled-water usage. This system works by measuring individual room temperatures. The more sensors it has calling for cooling, the greater the volumes of air it delivers. The further from the setpoint the AHU discharge is, the greater the amount of chilled water it pumps. More air and more water at a lower temperature means much more energy consumed.

In March 2000, the chilled-water plant at Rizzuto was supplying 54-F water. Believing a sensor was out of calibration, a senior technician was dispatched to verify the actual temperature. The plant indeed, was supplying only 54-F water, yet the building was "happy." An inspection of discharge temperatures for the other AHUs showed that some were as high as 60 F.

We then compared this campus to its twin sister, Jennie Reid Elementary. Jennie Reid's chilled-water supply was 46 F, and the AHU-discharge temperatures ranged from 48 to 55 F. In light of these discrepancies, the energy manager conducted an audit to compare energy costs per square foot at Rizzuto and Jennie Reid using utility-management software. Table 1 shows the comparison.

Total energy costs for Rizzuto during the above 12-month period were $84,197, compared to $80,321 for Jennie Reid. Though its annual energy cost was nearly 5 percent higher, the Rizzuto campus is more than 14-percent larger than the Jennie Reid complex is. This amounts to an apparent 8 cents per square foot, or 9.17-percent reduction in energy usage. Stated another way, if Rizzuto had not been equipped with UVC and energy cost per square foot were at the same level as that of Jennie Reid, the annual utility bill for Rizzuto would have jumped to $91,762. Thus, Rizzuto realized an apparent energy saving of $7,565.

*A close-up view of the air handler at Jennie Reid Elementary School.*

*The interior of the classroom wing of Rizzuto Elementary School, where the problems arose.*

Rizzuto and Jennie Reid were at one time twin campuses and still have many similarities. Both locations use the same EMS equipment—AHUs and VAVs, the same ventilation and outdoor-air make-ups, and the same setpoints (68 F heating, 74 F cooling). However, in addition to a 12,000-sq-ft size difference, Rizzuto has 40-percent more after-hour events and still has its original 15-year-old chiller plant, while two of the three chillers at Jennie Reid were replaced recently.

In spite of the advantages in favor of Jennie Reid, Rizzuto now costs considerably less per sq ft to cool, and chilled-water temperatures are 2-to-7-F higher at Rizzuto on any given day. Thus, if all things were equal at the two campuses, the UVC devices would actually be saving much more

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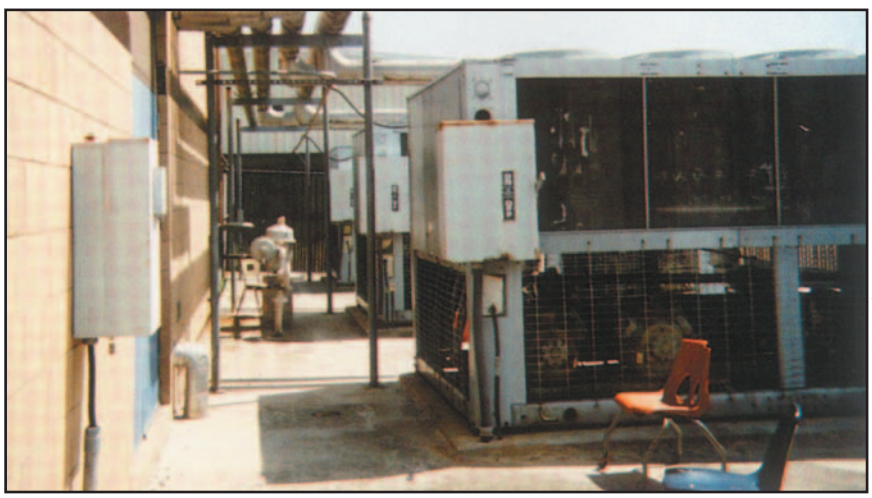
***The interior of the classroom wing of Rizzuto Elementary School, where the problems arose.***

**Table 1: Energy Use Comparison**

| | | |
|---|---|---|
| Size of building | 94,600 sq ft | 82,680 sg ft |
| Annual energy use | 1,031,808 KWH | 958,752 KWH |
| Use per square foot | 10.91 KWH | 11.80 KWH |
| Annual cost per square foot | $0.89 | $0.97 |
| **Building name:** | Rizzuto | Jennie Reid |

*The chiller plant on the Jennie Reid Elementary school campus.*

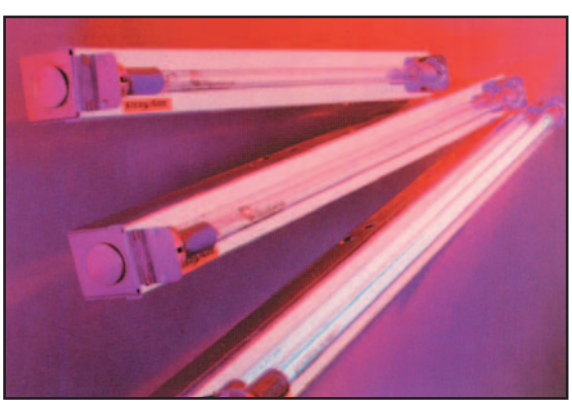


*The chiller plant on the Rizzuto Elementary School campus.*

than 9 percent in energy costs and, possibly, even twice that amount. For this reason alone, the LPISD executive director of operations approved the installation of UVC in all areas deemed feasible, subject to budget constraints.

## ADDITIONAL BENEFITS CITED

Since their initial installation, the UVC devices have kept coil and drain-pan areas clean and free of mold. And the coils look like new—two years after the UVC installation. As an experiment, we ran the original equipment bulbs beyond the recommended 12 months without replacing them. Organic matter started to build up in the drain pans after 14 months, which was probably attributable to some loss in UVC output. Since we adopted a 12-month bulb-changeout schedule, this problem has not recurred.



*The high-output UVC device used for the project. Photo courtesy of Steril-Aire.*

## CONCLUSION

In summary, UVC has proven to work quickly and reduce the labor, expenses, and safety worries associated with other remedial tasks. It is important to stress, however, that UVC is an important component in an overall O&M program, not a maintenance panacea. For example, though it very effectively stops mold and microbial growth inside the air-handling system and prevents its spread to occupied areas, it will not eradicate mold on carpets, walls, ceiling tiles, etc. Also, mold proliferation within a building can be a "chicken-and-egg" dilemma—did the problem originate in the air handlers and spread to localized trouble spots, or vice versa? It often is difficult, if not impossible, to know for certain. That is why other tasks, such as those performed at Rizzuto (e.g., removal or cleaning and disinfecting of contaminated items), may be needed in concert with UVC.

On a closing note, there is another, perhaps more important, benefit to the use of high-output UVC devices in schools. Absenteeism has dropped in areas where UVC is used at LPISD schools, and the teachers do not complain of environmental quality. In the future, the school district hopes to compile enough statistical evidence to quantify this claim.



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