CASE STUDY

ensuring environmental integrity

Innovative Energy-Saving Measures at Yale University

The issue

Laboratory buildings are notorious energy hogs, and organic chemistry research laboratory buildings are particular offenders. Not only do these buildings commonly employ once-through air systems, but they also require a rigorous

Yale University-CRB

approach to ventilation to protect researchers from breathing the harmful vapors of the volatile organic solvents omnipresent in organic chemistry research.

With 160 eight-foot chemical fume hoods as well as 74 point exhaust systems, 74 vented chemical storage cabinets, and 37 equipment exhaust locations in addition to a once-through air system, Yale University's Chemistry Research Building promised to be a severe energy guzzler unless measures were taken to reduce energy costs. To address this problem, the design team focused on rethinking several aspects of fume hood design and reducing overall ventilation to laboratory spaces.

Throughout the project, the team concentrated on implementing as many energy-saving measures as possible, while ensuring adequate health and safety protections for students and faculty.

The Solution

Phoenix Controls Combination Sash sensors, Zone Presences Sensors® (also known as ZPS®), and lowering ACH

Large fume hoods with wide open sashes were clearly not an option from an energy standpoint. However, it was also true that no individual researcher would need to use the entire eight-foot width of the hood at one time. An effective compromise was struck in the implementation of a combination sash, with a custom-designed aerodynamic airfoil. In addition to sliding up and down like a normal fume hood sash, the combination sash contains glass panels that slide horizontally within it. The combination sash provided openings sufficient to accommodate the full spectrum of research activities conducted at the Chemistry Research Building.

Another significant savings was achieved by employing variable-air-volume (VAV) chemical fume hoods equipped with Zone Presence Sensors. A life cycle cost study of the devices showed that they could reduce energy use by an additional 40 percent by reducing exhaust through the hood when the floor area in front of the hood was unoccupied.

In addition to making fume hoods more efficient, the project team also sought to optimize ventilation airflow into laboratory areas. The first step was finding out when researchers did their work. The Laboratories were equipped with occupancy sensors, lighting switches, and now Zone Presence Sensors to ensure the lab could be monitored thoroughly for occupancy. Given the instrumentation and monitoring capabilities, they were able to determine that an ACH reduction could be justified. Best-practices standards of the day dictated 12 air changes per hour (ACH) for all lab spaces, occupied or not. The team, however, proposed reducing the airflow in unoccupied lab spaces from 12 air changes per hour to six.

After EH&S buy in, the reduction in ACH has resulted in big-time energy savings, with no reduction whatsoever in air quality.

How Phoenix Controls Helped Yale CRB

More than 380 Phoenix Controls valves were installed at Yale's Chemistry Research Building. The 1 second, speed of response, control system (With combination sash sensors)

was key in maintaining lab pressurization and fume hood containment. Fume hood monitors and Zone Presence Sensors were installed on all the eight-foot combination fume hoods to reduce the face velocity from 100 to 60 FPM when the hoods were unoccupied. The reduction in fume hood exhaust was possible because of the turndown (up to 20:1) and accuracy of the Phoenix Controls, flow-metering venturi valve. This reduction combined with lower air change rates during unoccupied periods, provided Yale University significant operational savings seen within the first few years of building occupancy.

Project Notables: The Chemistry Research Building (CRB) is Yale University's third building on Science Hill, joining the Sterling Chemistry Building and the Kline Chemistry Building. The 100,000-sq ft building is dedicated to organic chemistry, with space for 12 PIs and 148 graduate students. It is also the recipient of Labs21 "Go Beyond Award" in 2009 and is LEED certified.