Cleaning & Maintenance Management

Maintaining Healthy Classrooms With Air Quality Monitors

Good indoor air quality makes for better, healthier learning environments.

By: *Tom Aiken*

There's a good reason that the U.S. Environmental Protection Agency (EPA) urges school facility managers to seek products that protect indoor air quality (IAQ).

Poor air quality in classrooms negatively affects students' academic performance and the health of other occupants.

This is especially true when classrooms used for reading and writing are also used as science labs, art centers and even for physical education programs.

The American Lung Association notes that the typical school houses four times as many people as an office building with the same amount of floor space.

This makes classrooms especially prone to high concentrations of volatile organic compounds (VOCs), which are harmful gases emitted from humans, cleaning supplies, furniture, building materials, etc.

Unhealthy indoor air can cause occupants to suffer from sick building syndrome (SBS) and other facility-related illnesses.

Symptoms arising from poor IAQ include difficulty concentrating, headaches, dizziness, nausea, coughs and chills, etc.— all of which can lead to increased absences by both students and faculty.

Impacts Of Poor IAQ

The Indoor Air Quality Scientific Findings Resources Bank notes that available scientific literature from 1993 to 2009 indicates that, in classrooms where ventilation rates are at or below minimum standards, student performance increased between five percent and 10 percent when the ventilation rate was doubled.

Another study revealed that students in classrooms with more fresh air scored 14 percent to 15 percent higher on standardized tests compared to students in classrooms with less ventilation.

From a teacher's perspective, approximately 80 percent surveyed in Chicago and the District of Columbia in 2002 noted that school facility conditions were connected to the quality of instruction and job satisfaction.

In this same survey, the most frequently cited facility-related problem was poor IAQ.

Poor IAQ also has financial consequences.

Student absences in many school districts result in decreased government funding, while teacher absences lead to higher expenses.

In addition to increased costs, even the best substitute teachers are likely to disrupt the learning process.

Ignoring an IAQ problem can drain thousands of dollars from educational programs, result in lost administrative time and have an adverse impact on relations between school district officials, teachers, staff, parents and students.

Source Control

Source control is critical to maintain healthy classroom air.

For example, facility maintenance issues such as leaky roofs, heating, ventilation and air conditioning (HVAC) system malfunctions, ineffective cleaning or excessive use of

Good IAQ reduces distractions from malodors and other airborne contaminants so students can better learn and instructors can more effectively teach.

cleaning products all affect the quality of classroom air.

In addition, typical classrooms can harbor many sources of VOCs, including old carpet and furniture, flaking paint, glue used for art projects and formaldehyde used to preserve science specimens.

These materials can all be the source of harmful gases and should be replaced, contained or eliminated.

The EPA recommends facilities managers and maintenance personnel use IAQ-safe products for the classroom that are minimally toxic, water-based, odorless and easy to clean and maintain.

The EPA also encourages building architects and interior designers to use products that are not prone to moisture damage or mold growth.

Fortunately, low-VOC paints, flooring, wall and ceiling systems and wood products are becoming increasingly common and affordable.

VOC Detection In addition to paying attention to source control, facilities personnel can integrate IAQ monitors with HVAC systems to reduce energy costs and to improve air quality.

One way HVAC systems are activated is through the use of motion, light and heat detectors to signal fans to turn on and off.

However, these systems simply respond to changes in the environment and not to changes in air quality.

A second method is to install indoor air monitors that measure the amount of carbon dioxide (CO_2) in the room and signal the HVAC system to circulate fresh air when CO_2 threshold levels are exceeded.

Unfortunately, these systems cannot detect odors like those from a lunchbox left in a desk over the weekend or harmful VOCs emitted from old furnishings or other sources.

The third alternative is to use IAQ monitors equipped with metal oxide semiconductor-based VOC sensors that reliably detect a broader range of VOCs.

These IAQ monitors use a maintenancefree sensing element that automatically corrects baseline readings at certain intervals so that no recalibration or compensation for humidity is necessary.

Some advanced IAQ monitors also feature low power consumption and provide long-term stability even in harsh environmental conditions.

A study on air quality in a typical 700-square-foot classroom with 20 to 30 occupants ventilated by a standard HVAC system was recently conducted.

In that study, the amount of VOCs in the classroom exceeded healthy thresholds within a matter of minutes after students arrived in the classroom.

Measured values of VOCs in the classroom — correlated to parts per million of CO_2 — continued to increase during the first hour of instruction.

While slight improvements over the next few hours resulted from doors being opened for breaks or recess, pollution increased and air quality continued to decline as the day went on.

The unhealthiest levels were recorded just before students were dismissed for lunch.

Energy-efficient IAQ

IAQ monitors can also reduce energy costs when integrated with a demand-controlled ventilation (DCV) system.

The monitors alert the DCV system to increase airflow by initiating a ventilating action only when the threshold air quality levels for target VOCs are exceeded and fans are signaled to shut off when air quality returns to normal.

This can significantly reduce utility costs compared to DCV systems that are set to go on and off at predetermined times, regardless of the air quality.

For example, a study was conducted of a health club's air handling system to monitor the quality of the air and to control the speed of the system's fan.

Before the installation of an IAQ module, the time-controlled system ventilated the club even when it was unoccupied.

By switching to an IAQ monitor-controlled ventilation system, the fan's operating time was reduced by 24 percent, which in turn reduced energy consumption by 60 percent.

While studies have shown that an increase in ventilation of just one cubic foot per minute decreases absentee rates by up to two percent, IAQ monitors are still not widely used in U.S. classrooms.

In some cases, school district officials are not aware of the impact poor air quality has on student attendance and performance.

In others, financial challenges have reduced facilities' budgets.

While they may not be able to eliminate all VOCs from the classroom, selected building materials and maintenance products that reduce the amount of VOCs can significantly improve IAQ.

The EPA offers a comprehensive online resource called Tools for Schools — available at www.epa.gov/iaq/schools — that can help facility personnel work with the school's administration to improve IAQ.

Installing VOC-sensitive IAQ monitors in as many classrooms as possible will reduce energy costs and ensure clean, healthy classroom air. *CM*

Thomas Aiken is the chief executive officer (CEO) of AppliedSensor Inc. Relying on 25 years of research and development, AppliedSensor designs and manufactures chemical sensor systems for a broad range of applications, including highly sensitivity and fast-responding intelligent IAQ monitors and hydrogen leak sensors. The company operates three facilities worldwide: AppliedSensor Inc. in New Jersey; AppliedSensor Sweden AB in Sweden; and AppliedSensor GmbH in Germany.

More information is available at www.appliedsensor.com, by calling 908-222-1477 or e-mailing Tom.Aiken@appliedsensor.com.