

SMARTschools

The newsletter for sustainable education facilities.

Smart Schools, Healthy Classrooms: The Case for Indoor Air Monitors

By Thomas Aiken - August 25, 2011

Did you know that indoor air can be more polluted than outdoor air in a big city? This is especially true for schools. In fact, the American Lung Association notes that a typical school packs in four times as many occupants per square foot than an office building. Because occupied classrooms are especially prone to high concentrations of potentially harmful volatile organic compounds (VOCs), proper ventilation is critical when maintaining healthy classroom air. Figure 1 shows the sources of the most common chemical groups of VOCs. In fact, unhealthy indoor air quality (IAQ) can cause students and teachers to suffer from a variety of building-related illnesses – sometimes called Sick Building Syndrome – characterized by headache, dizziness, nausea, cough, chills, difficulty concentrating, etc. Poor IAQ also has financial implications, as student absences can result in decreased government funding and teacher absences can result in higher expenses. Fortunately, an increase in ventilation of just one-cubic-foot per minute can decrease absentee rates by up to two percent.

Just as poor air quality has many negative effects, good air quality improves students' ability to learn. A study by the Indoor Air Quality Scientific Findings Resources Bank reported that student performance increased between five and ten percent when the room's ventilation rate was doubled. A separate report revealed that students in classrooms with more fresh air scored 14 to 15 percent higher on standardized test scores compared to students in classrooms with less ventilation.

Figure 1 – Examples of VOCs and Sources

Substance Group	Example	Sources
Alkanes	heptane, methane	human breath, bio-effluents
Alcohols	alcohol, mineral spirits	cleaning supplies
Aldehydes	formaldehyde	building materials
Ketones	butanone	paints
Esters	methyl acetate	glues
Terpenes	pinene	perfumes and glues
Aromatics	xylol	paints and glues

Source: AppliedSensor

Choosing the Right IAQ Monitor

Considering that a typical 700-square-foot classroom can exceed healthy thresholds for VOCs within minutes after students arrive (See Figure 2), it is important to monitor air quality. Traditional IAQ sensors use motion, light or heat to signal fans to activate. However, if an HVAC system responds to changes in environment rather than air quality by signaling fans to run more often than needed, it can increase energy costs. Another type of IAQ monitor measures the amount of carbon dioxide (CO₂) in the room and signals the HVAC system to circulate fresh air when levels are exceeded. Unfortunately, CO₂ sensors cannot detect odors or VOCs, like those from a lunchbox left in a desk over the weekend or gases emitted from old furnishings. A more effective alternative is IAQ monitors equipped with metal oxide semiconductor (MOS)-based sensors that detect a broad range of VOCs. These intelligent air quality (iAQ) sensors increase air flow by triggering the HVAC system to ventilate only when threshold air quality levels for VOCs are exceeded.

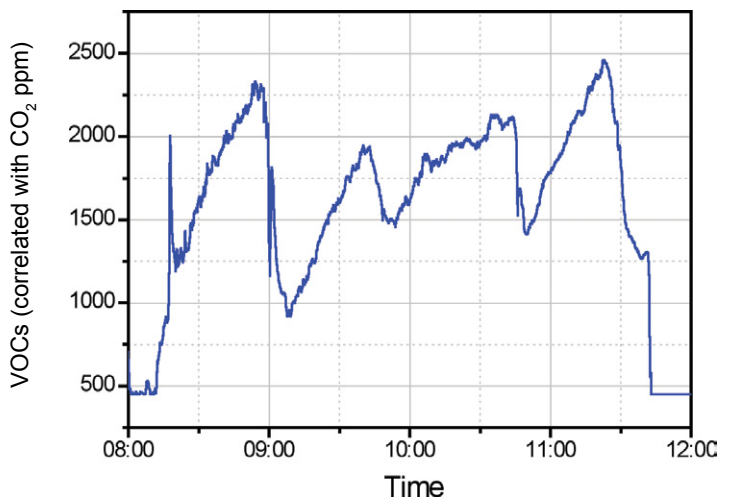


Figure 2 – Fluctuation in air quality in a typical 700-square-foot classroom (60-70m²) with 20 to 30 occupants

Source: AppliedSensor

If school-wide IAQ monitoring isn't in the district budget, facility managers can equip teachers with personal USB monitors, like AppliedSensor's Indoor Air Monitor (Figure 3). Teachers simply plug the device into the USB port of their laptop or PC. Within minutes, the LED display will light up in one of three colors (green/yellow/red) to indicate whether classroom air is polluted. If polluted, the teacher can open a window or turn on a fan to ventilate the room.

Manufactured for use in industrial, commercial and residential facilities, the Indoor Air Monitor detects VOCs, carbon monoxide, hydrocarbons and aromatic/non-aromatic compounds. The flash drive-sized device comes with downloadable software to display real-time changes to indoor air on a computer monitor or laptop – a useful tool for classroom science projects.

Action Items for Smart Schools

In addition to IAQ monitors, schools can help maintain healthy classrooms by eliminating the sources of VOCs – including carpet, paint, chalk, adhesives, art supplies, science laboratory equipment and more. The U.S. Environmental Protection Agency (EPA) advises school facility managers and designers to use cost-effective, durable products that protect both IAQ and aesthetic qualities. For example, classroom furnishings should be IAQ-safe products that are non-toxic, odorless, easy to clean/maintain and resistant to moisture damage or mold growth.

The EPA's Tools for Schools program (available online at www.epa.gov/iaq/schools) includes a wealth of information written specifically for school facility managers, administrators, teachers and parents who want to improve the quality of air in their schools. A small investment of time and resources combined with an efficient indoor air monitor can ensure students and school personnel are breathing clean air in a healthy, productive environment.



Figure 3 – The Indoor Air Monitor plugs into the USB port of a laptop or PC to indicate whether classroom air is polluted.

Thomas Aiken is CEO of AppliedSensor Inc. and an industry veteran with extensive experience in the microelectronic chemical sensors, energy and chemical industries. Aiken is responsible for the U.S. operations of AppliedSensor, a global designer and manufacturer of chemical sensor systems for a broad range of applications, including indoor air quality monitors and hydrogen leak sensors. He may be reached at Tom.Aiken@appliedsensor.com.