PRISM Analytical Technologies
The Consultative Air Testing Company

Prism Analytical Technologies
2625 Denison Drive
Mt. Pleasant, MI 48858
(989) 772-5088
www.pati-air.com

Screening Schools for Mold, VOC, and Metal IAQ Problems: A Practical Approach

Many school districts are beginning to take a proactive approach to air quality monitoring in their schools and are expanding the scope to include parameters other than CO_2, temperature, and humidity. Many states now mandate that schools have Indoor Air Quality (IAQ) plans which will generate a need for more enhanced, low-cost testing methods.

It is well known that high levels of indoor air organic contaminants can lead to lethargy, illness, and inattentiveness, as well as a myriad of other afflictions. Poor indoor air quality has also been linked to the exacerbation of asthma and seizures and may have a role in developmental delay in children. These effects are amplified considerably in chemically sensitive individuals. In recent news articles the media and the US Environmental Protection Agency have expressed concern about children's exposure to industrial emissions in school indoor air. In light of all these factors, establishing a documented school IAQ monitoring program is a prudent decision for a school district. However, schools have a multitude of pressures on their ever-shrinking budgets, so establishing an effective yet economical IAQ monitoring program is very important.

A Cost-Effective Approach

The key to a cost-effective approach to monitoring IAQ in schools is to identify and document those school buildings with IAQ concerns so that improvement efforts and resources can be spent where they are most needed, as well as documenting those buildings where there are no indications of IAQ problems. A tiered screening approach to IAQ sampling and analysis can provide this cost-effective building prioritization. Such an approach requires IAQ testing tools that are:

- **Effective for a very wide range of VOCs and metals** – Since nearly every school is different, the only acceptable test must survey a wide spectrum of chemicals.

  Prism Analytical Technologies provides School Air Check -- a test package that checks the air in a school building for the presence of over 500 specific organic compounds and 10 metals.

- **Cost effective** – The testing protocol should not require that a full battery of expensive tests be run at every sampling point.

  Prism Analytical Technologies has developed a protocol that uses an inexpensive screening test to survey the school building and then, based on the results, selects only those samples with the highest Total VOC levels for a full "chemical profile" analysis.

- **Mold Assessment** – The test should include an estimate of mold levels without having to take separate samples and perform additional testing.

  Prism Analytical Technologies School Air Check is able to detect actively growing mold even if it is hidden under carpet or behind walls where it would be missed by simple spore testing. In addition, School Air Check can monitor 2,000 ft^2 as compared to 200 ft^2 using simple spore testing.

- **Expandable** – If the IAQ is poor, the school administration must be able to get information on the nature of the contamination without the expense of re-sampling.

  Using Prism's School Air Check, a complete VOC breakdown is available on all samples so that if the data are ever needed to fully understand the nature, scope, and location of a problem, it is always available without expensive re-sampling.

- **Understandable** – If all that the testing provides is a list of chemical compounds with no explanation as to what levels are "normal" and which compounds are sources of concern, the school administration has no idea what the data means or how to interpret it.

  The report for Prism's School Air Check provides interpretive guidance for the results. In addition, a Prism IAQ expert is available for consultation with the school administration on results interpretation and action plan formulation.

The Mold Issue

Health issues associated with mold contamination is a topic that gets much attention in the media these days. Parents of young children are keenly aware of the potential problems associated with mold contamination and many worry that their children may be exposed to mold toxins while at school. They are demanding that the schools certify that their buildings are free of mold. An example (worst case, perhaps) of what can happen when there is mold contamination and how the problem was solved are illustrated in the case study below.

School Case Study

In a school, which was the home of the district's birth-to-6 programs for impaired children, the School Air Check Total Mold Volatile Organic Compound (TMVOC) values in some of the classrooms approached 1,200 ng/L. Based on Prism Analytical Technologies' TMVOC interpretation table, greater than 300 ng/L indicates "severe" mold contamination. In this particular school, symptoms ranged from headaches and nasal, eye, and throat irritation to increased frequency of seizures. Some teachers refused to work in the building and several parents pulled their children out of the school. The school district was considering abandoning the building or making major renovations in an attempt to alleviate the problem. Through a simple sampling protocol followed up with some investigative work, the problem was shown to be wood chips in the landscaping placed up against the individual room air intakes. Also, the roof runoff was allowed to flow back against the building and into the wood chips. Removal of the wood chips, installation of downspout extensions, and making a swale along the school totally eliminated the problem. In addition to vastly improving the learning environment of the building occupants, this represented a tremendous financial savings to the school district. The total IH/analytical cost of solving the problem was less than $3,000.

Total Volatile Organic Compounds (TVOCs)

School Case Studies

Most school IAQ investigations are initiated because an IAQ problem is known to exist. However, by selecting data from schools where proactive evaluations were conducted (no known IAQ problems) a better evaluation of "typical" schools can be made. Forty-one such schools were identified to provide data for this summary. Based on the data from these schools, TVOC values averaged 3,500 ng/L and ranged from < 200 ng/L to 26,000 ng/L. Twenty-nine percent of the schools had levels ≤ 500 ng/L, which is the maximum allowable level based on LEED USGBC (United States Green Building Council) guidelines. The following table breaks down the schools into the various subcategories of TVOC air quality:

TVOC Level	% of Schools	TVOC Assessment
Less than 200	12	Ideal
200-500	17	Acceptable
500-1,000	12	Poor
1,000-3,000	29	Exposure effects possible*
3,000-25,000	29	Exposure effects ***probable****
More than 25,000	2	Toxic Range, neurological effects possible

* Exposure effects – eye and respiratory irritation, headaches, nausea, drowsiness, general malaise, etc.

From the data above, it is clear that many schools have significant problems with TVOCs. There is no set of organic chemicals that is common to all, or even most, schools that is responsible for the high TVOC levels. A few chemicals are found more often in certain situations. For example, ethanol from antiseptic wipes is often present in grade schools, and marker chemicals for latex- and oil-based paints are often found in schools that have been recently painted. However, nearly every school will have its own, singular chemical profile.

The sample chemicals listed in the next table, the frequency of identification, and the ranges listed indicate the wide diversity of IAQ situations. Many states have established compound-specific limits for IAQ. The limits presented in the table below are from the State of Michigan (Michigan Department of Environmental Quality Remediation and Redevelopment Division Industrial and Commercial II, III, and IV Acceptable Indoor Air Concentrations).

Compound	% of Schools with Compound Present	Average Level (ng/L) (Based only on schools with the compound present)	Range (ng/L)	Michigan Industrial & Commercial Limit (ng/L)
Toluene	90	47	0.8-460	600
Benzene	86	2	0.4-6.2	12
Acetone	76	67	3-250	8,800
Hexane	69	17	1-100	300
Ethanol	59	160	5-1300	-
Methylene chloride	48	56*	1-330*	210
1,4-Dichlorobenzene	38	3	0.3-5.9	14
Formaldehyde	37	62	15-200	7.6
Acetaldehyde	34	16	3-97	13

* One school had a level of 6,100 ng/L of methylene chloride; this value was not included in the average or the range.

Metal Scan

General scan for 10 different metals using a high flow sampling pump and 37mm 3 pc Cassette w/0.45um MCE. Analysis will be for antimony, arsenic, beryllium, cadmium,chromium, cobalt, lead, manganese, nickel, and selenium.

Sampling Kit Contents

4 - Low flow sampling pumps for the VOC/MVOC and Formaldehyde analyses
10 - A2 Thermal Desorption Tubes (TDTs) for VOC/MVOC detection
10 - A14 TDTs for Formaldehyde detection
1 - High flow sampling pump
1 - Metal sampling cassette
Instructions for sampling
Chain of Custody forms