TECHNICAL PAPER

Indoor Air Quality Monitoring Aerosol Particle Counter used in Mold Investigation at Local Shool

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Aerosol Particle Counter used in Mold Investigation at Local School

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Poor indoor air quality in our educational facilities is an ongoing concern in many communities. Mold in particular, has teachers, students, parents, and administrators across the country looking very closely at possible causes of contamination, and the associated costs of dealing with these problems. A growing number of professionals conducting IAQ investigations are utilizing a wide variety of testing instrumentation, including aerosol particle counters, to aid in better defining these contamination sources. I recently spent time assisting with an IAQ investigation at a middle school (Grades 6-8) in Southern Oregon, and will share the testing methodology and results in this article.

The U.S. Environmental Protection Agency states that 20% of the United States population, nearly 55 million people, spend their days in our elementary and secondary schools. The EPA goes on to say that one-half of our nation's 115,000 schools have problems linked to indoor air quality. As we know, students are at a greater health risk because of the time spent each day at these facilities, and because children are more susceptible to pollutants due to their maturing immune systems.

Most airborne particulates cannot be seen with the human eye. In fact, approximately 98% of all airborne particles are less than 1 micron in diameter. Visible particles start at around 30 microns (the average human hair is 60 microns in diameter). Airborne mold spores are generally between 1 and 10 microns. Due to the lack of mass, these "invisible" particles tend to remain airborne for an extended period of time, drifting with the air currents, or attaching themselves to our clothing, animals, etc. Determining the levels of these airborne pollutants requires an instrument capable of properly sizing and counting particles in an accurate and reliable manner. One such instrument is a handheld aerosol particle counter.

Aerosol particle counters have been used in a variety of applications for the last quarter century. Originally designed for monitoring cleanrooms in the electronics and biotechnology industries, the particle counter is still a common instrument found in laboratories around the world. Over the past few years, more and more indoor air quality professionals are utilizing this technology in their day-to-day investigations – with good reason! Particle counters can offer instant feedback to indicate relative levels of cleanliness or contamination. This feedback, when used in conjunction with other assessment processes, is especially helpful in the location of contamination sources, assuring containment during remediation work, and verifying the lack of airborne contaminants prior to clearance.

Particle counters employ advanced technology to measure the reflected light of airborne particulates as they are drawn through a focused beam of visible (laser) light. These reflections are measured electronically to determine size and quantity of the particulates. The larger the particle, the more light reflected. Sample data is stored in memory for downloading to a personal computer, and is commonly used for creating baselines, trending, analysis and report generation.

Case Study

In October of this year, I was asked to participate in an IAQ Investigation at a local school here in Southern Oregon. A number of the staff members had been concerned over possible fungal growth in a few of the classrooms due to previous water intrusions, and asked the district to investigate. The focus of this article will be on two of the classrooms. As there is litigation pending between the district administration and the teacher's union, I am unable to disclose the name of the school and participants, but will share with you the testing methodology and results.

The school was built in the 1950's, and has under gone widespread changes throughout the life of the buildings. Extensive remodeling has occurred twice to accommodate the ever-increasing student population, and smaller additions were done when needed. The classrooms in question have both had water intrusion problems in the past. Six years ago, a plumbing failure above one of these classrooms occurred which did result in mold growth at least on/in the carpeting and some file folders in a cabinet. Additional small water leaks have occurred when the fire suppression sprinkler system was installed; at some outside doors from water seepage under doors; condensate lines not completed by a contractor, and in a locker room where a disconnected exhaust duct had not been tightly covered. There have been ongoing water leaks in some of the classrooms when it rains and there are strong winds. It is suspected that the water enters the ceiling cavity through the outside air intake vents, flashing, or metal roofing.

It should be noted here that before this time, the school district had no set periodic inspections for indoor air quality issues. Routine maintenance was performed when needed, but no IAQ plan was in place. I left the school superintendent a copy of the EPA's "Tools for Schools", which has been implemented.

Testing Methods

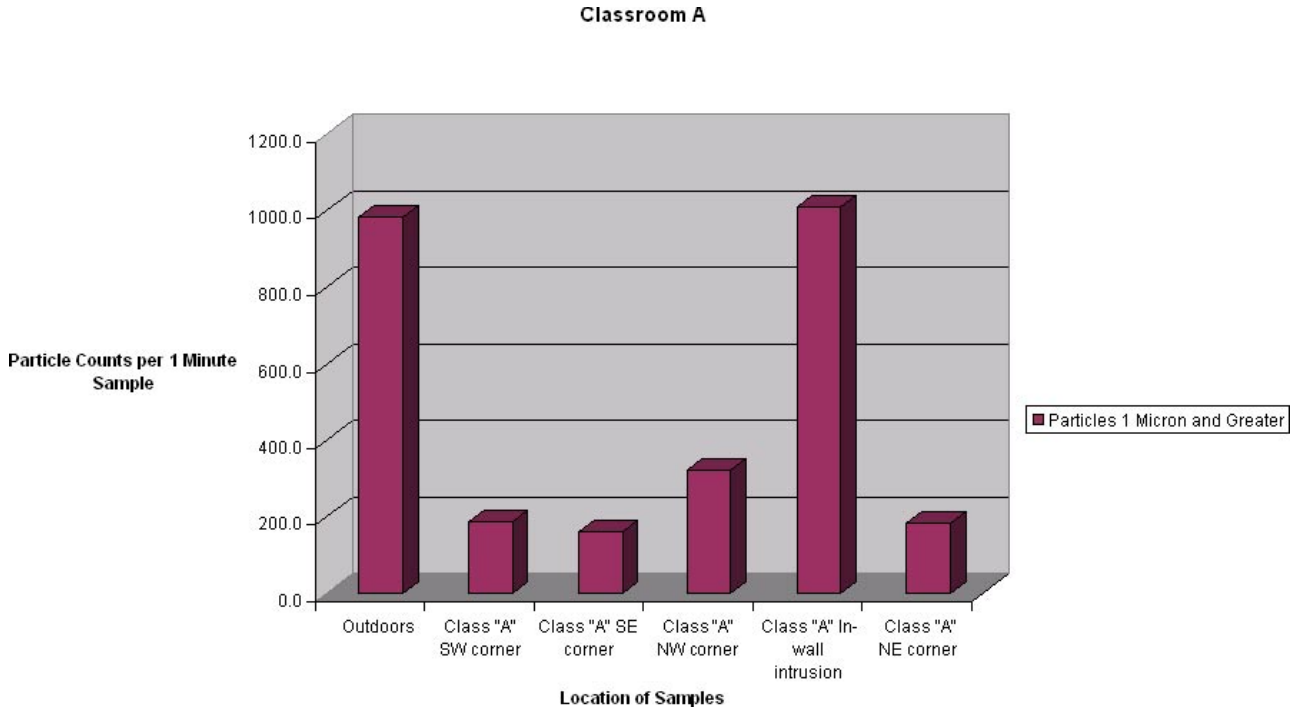
During this investigation, the following testing methods were used:

- Visual inspection
  - Walkthrough
  - Particle Counts
- Viable and Non-Viable biological samples
  - Air-O-Cell Cassettes
  - Tape Lift Samples
  - Bulk Samples

We also tested a classroom that was recently constructed, and an older classroom that had no history of water intrusion, to be used as comparison test locations.

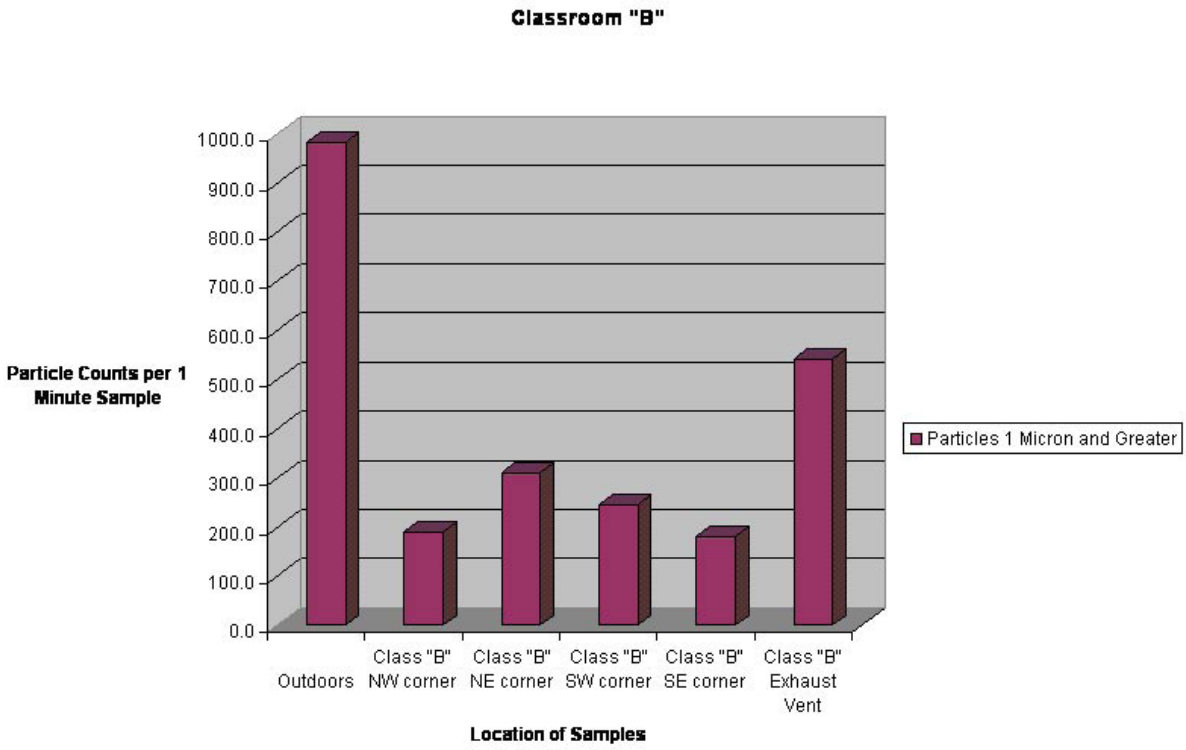
Visual Inspection

The visual inspections included a walk-through of all classrooms and areas staff members were concerned with, a review of the ceiling cavities and insulation, inspection of the walls and cabinets behind vinyl coving, review of classroom books, posters and file cabinets for signs of water damage or mold growth. A handheld particle counter was used in each area to establish a baseline of airborne particulate levels, and in one instance to assist in the location of the contamination source. The results of some of this testing can be seen in Tables 1 and 2 below. The testing method for the particle counts was three samples per location (only the average of the 3 counts are shown); one-minute sample duration at each location, and the particle counter was set for cumulative mode (particle counts at the listed micron size and larger).



Notice that outside particulate levels were also included. This is a vital step to remember when sampling. Obviously, if the particulate counts seen inside are higher than, or are similar to those recorded outside, further investigation should occur. You will also see that in classroom “A”, counts were quite a bit higher in the northwest corner of the room. No visible water damage or mold growth was evident. Upon further investigation and an in-wall intrusion, a small area (3” x 4”) of fungal growth was found on a 2x4 truss.

There was quite a bit of black “dust” on the ceiling tiles of classroom “B” in close proximity to the exhaust area of the ventilation system. At the time of sampling, the ventilation system was not on. Particulate counts in this area were slightly higher as well, as shown in table 2. Tape lift samples would later confirm that there were only a small amount of common outdoor mold spores present, indicating fairly good filtering of the air through the HVAC system. The spores were found to be dormant, but the school subsequently had the entire HVAC system cleaned as a precaution.



Conclusion

In classroom A, full remediation of the wall cavity has been completed. Industry standards were followed during remediation (containment, respirators and proper clothing worn, etc), and follow up inspections and airborne particulate sampling have proved normal. Damp carpet and ceiling tiles have been replaced as an added precaution.

Other than to two particle counts shown in Table's 1 & 2, the level of airborne particulates were consistent throughout the school. To date, there are no regulations for "acceptable" particulate levels. The use of air monitoring data was used to help determine potential levels of spore and fungal materials that individuals may be exposed too, and in the case of Classroom A, to help locate the pollutant source. The immediate feedback provided by the aerosol particle counter was indeed helpful in establishing a baseline, and highlighting areas of concern to be investigated further.

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