



Paul G. Bakalis, AIA, NCARB
Executive Director

Indoor Air Quality Information

Updated July 1, 2019

According to the United States Environmental Protection Agency, indoor air quality (or IAQ) in schools is important because indoor air pollution can have significant and harmful health effects. It has been demonstrated that a positive link exists between airborne bacteria and mold and asthma in children, which in turn increased absentee rates. According to the EPA's IAQ reference guide "Studies of human exposure to air pollutants indicate that indoor levels of pollutants may be two to five times – and occasionally more than 100 times – higher than outdoor levels. These levels of indoor air pollutants are of particular concern because most people spend about 90 percent of their time indoors." The American Lung Association found that U.S. students miss more than ten million school days each year because of asthma exacerbated by poor indoor air quality.

Susan Gerard, Director of the Arizona Department of Health Services, wrote in the Agency's 1998 Arizona Comprehensive Asthma Control Plan:

"Asthma is a major public health issue of growing concern in Arizona. Within the past decade statewide prevalence rates have continued to increase and are much higher than the national average. Asthma is one of our states most common and costly diseases. More than 600,000 Arizonans suffer from asthma, of which 100,000 are children. Nationally, direct and indirect costs exceed \$14 billion annually.

The direct impact of asthma includes hospitalizations, emergency department visits, and deaths. The indirect effects of asthma reach well beyond asthmatics themselves and include missed school and workdays, and quality of life issues."

Some of the undesirable effects of poor indoor air quality cited by the EPA:

- Impacts student attendance, comfort, and performance.
- Reduces teacher and staff performance.
- Accelerates the deterioration and reduces the efficiency of a school's physical plant and equipment.
- Strains school administration, parent and staff relationships and impacts community trust.
- Creates negative publicity.
- May create liability problems for a school district.

Why is IAQ Suddenly So Important?

School buildings construction practices were changed after the energy crisis of the 1970s in order to conserve energy. Buildings were more tightly sealed, ventilation rates were reduced to save energy. Also, the use of synthetic building materials and furnishings became prevalent, as did the greater use of chemically formulated school supplies such as dry erase marker pens, white board cleaners, copy machine toners, art supplies, laboratory chemicals, pesticides, and janitorial products. In addition, school district decisions such as delaying maintenance procedures or conducting insufficient maintenance in order to "save" money or reduce budgets sometimes lead to air quality problems. For example, moisture problems from roof and plumbing leaks, condensation, and excess humidity become more critical in newer buildings because tightly sealed buildings may not allow moisture to escape easily.

Studies of indoor air contaminants demonstrate that children are more likely than adults to be adversely affected by poor indoor air quality. They breathe greater volumes of air relative to their body weights, which may lead to a greater effect of pollutants on their bodies. Children also are less likely than adults to recognize and communicate the symptoms they may be suffering. Similarly, some individuals may be susceptible to "multiple chemical sensitivity", which is thought to occur when they are exposed and become sensitized to environmental contaminants.

Schools present some unique problems for managing indoor air quality, because students and teachers generally work more closely together in classrooms than people in office buildings. Also, schools have diverse activities through the day that may expose children to air pollutant sources from cafeterias, art and science classrooms, vocational education areas, restrooms and locker rooms.

Some Common Sources of Indoor Air Pollutants in Schools

• Outdoor Air

Poor indoor air quality can occur from natural materials such as pollen, dust and mold spores as well as from generated sources such as nearby industrial emissions, cars, buses, trucks and lawn and garden equipment. On-site sources can come from loading docks, dumpsters, and grease traps, particularly when they are located near building air intakes.

• Moisture

Moisture can be introduced into a building through structural leaks, plumbing leaks, flooding and heating ventilating and air conditioning (HVAC) related humidity problems. Moisture, in turn, may cause growth of mold, mildew and bacteria.

• HVAC Systems

The purpose of the HVAC system is to filter air, heat and cool as required, and control humidity in the building. Many such systems introduce outside air into the process to dilute building contaminants, such as high carbon dioxide levels (CO₂), which occupants contribute to a space such as a classroom. Poorly maintained HVAC equipment can allow water and mold growth to build up in drip pans, ductwork, coils and humidifiers, which can cause such conditions as Legionnaires' disease. Other sources come from improper venting of combustion products or dust and debris in ductwork.

Other School Equipment

Emissions of poor quality air can come from office equipment such as copier toner and from shop, lab, cleaning equipment and air fresheners. Science lab supplies, vocational art supplies, dry-erase markers and similar wet pens can contribute to poor indoor air quality.

• Plumbing

Sink and floor drains have U-shaped traps that can cause IAQ problems in school buildings. If water in the trap evaporates due to infrequent use, any odor in the sewer, or even what someone in a nearby space has poured in the drain, can be dispersed in the building. Conversely, when liquids or solids are trapped in bends in traps forming a seal, sewer gases cannot escape out of the drain as intended.

• Volatile Organic Compounds (VOCs)

VOCs are byproducts emitted as gases from certain solids or liquids. Some common examples are paints, solvents, building materials (especially those manufactured with formaldehyde), aerosol sprays, adhesives, and emissions from new furnishings and floorings.

The EPA offers the following examples of formaldehyde products in everyday use: it is used to add permanent-press qualities to clothing and draperies, as a component of glues and adhesives, and as a preservative in some paints and coating products. Significant sources of formaldehyde are found in pressed wood products made using adhesives that contain urea-formaldehyde resins. Pressed wood products made for indoor use include a) particleboard, which is used as sub-flooring and shelving and in cabinetry and furniture; hardwood plywood paneling used in cabinets and furniture, and b) medium density fiberboard used for drawer fronts, cabinets, and furniture tops. Because medium density fiberboard contains a higher resin-to-wood ratio than any other UF pressed wood product, it is generally recognized as being the highest formaldehyde-emitting pressed wood product. Some VOCs cause eye, nose and throat irritation, headaches and nausea, and are suspected or known to cause cancer in humans.

• Radon Gas

Radon gas is a naturally occurring radioactive gas. It is harmlessly dispersed in outdoor air, but can be harmful when trapped in buildings. Radon generally enters buildings from soil and rock beneath and around building foundations and floor slabs. According to the EPA, long-term exposure to radon is estimated to cause about 21,000 lung cancer deaths per year.

• Pesticides

Chemical pesticides used to kill or control pests in and around schools can cause both indoor air quality problems and problems outside buildings when occupants either breathe in the chemicals or come into physical contact with them. The EPA states that one of its top priorities is to concentrate on reducing children's exposure to pesticides.

• Dust

Dust is difficult to control in schools because of the amount of children and adults moving in and out of the building, windows and doors that are opened frequently, and simply from moving air generated by school activities. Dust pollutants introduced into schools may include molds, bacteria, pollen, dust mites, and animal dander. Dust mite allergens are known to cause an allergic reaction or trigger an asthma episode in sensitive individuals, and may cause new cases of asthma in susceptible children.

Preventative Maintenance Strategies for Managing Indoor Air Quality

1. Implement a comprehensive, district-wide indoor air quality maintenance program consistent with the EPA Tools for Schools Program.
2. Conduct regular building walkthrough inspections, and measure temperature, relative humidity, carbon monoxide and carbon dioxide. Following the walkthrough, identify and prioritize IAQ problems in the school.
3. Ensure that all HVAC system air supply diffusers, return registers, and outside air intakes are clean and unobstructed. Regularly change filters and ensure condensate (or drip) pans are draining properly.
4. Bring adequate outdoor air into the building through the school ventilation system in order to flush polluted air out of the school. Maintain minimum outdoor air ventilation rates consistent with the most current standards of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE). Make sure ventilation systems are operating when custodial cleaning is being performed.
5. Maintain indoor humidity levels at manufacturer's recommended standards to ensure comfort and reduce problems with mold and bacteria.
6. Regularly clean and remove dust from hard surfaces with a damp cloth, and vacuum using high-efficiency filters.
7. Follow EPA's guidelines for prevention and remediation of mold.
8. Promptly fix moisture problems, including those from roof, window, and plumbing leaks. Thoroughly dry wet areas within 24-48 hours to prevent mold growth.
9. Employ integrated pest management methods instead of traditional pesticide-based methods.
10. Use low volatile organic compound (VOC) paints, adhesives, and cleaning products that emit lower levels of gases into the air.

Arizona Resources:

Arizona Department of Environmental Quality (ADEQ):

Information on IAQ within its High Performance School grant from EPA. Stated goals are to:

- a. Provide high performance school design and operations information to school districts, architects, and school building officials through a variety of means.
- b. Work with schools to develop case studies on individual school's project implementation.
- c. Assist in developing statewide recommendations or guidelines for High Performance Schools.

<http://www.azdeq.gov/function/about/download/green.pdf>

Arizona Department of Education:

Under Academic Achievement Division: "Steps to a Healthier Arizona Initiative"

Links to EPA website for "Indoor Air Quality – Tools for Schools" program

<http://www.azed.gov/hns/>

Arizona Administrative Code, R3-3-304

Requires buffer zones around schools for applications of pesticides. Pesticides are not to be sprayed within ¼ mile of a school or day care facility, whether ground or aerial application. This section also states that highly toxic pesticides cannot be applied within ¼ mile of a school or day care facility.

https://apps.azsos.gov/public_services/Title_03/3-03.pdf

Environmental Protection Agency

Indoor Air Quality – Tools for Schools Program

<http://www.epa.gov/iaq/schools/toolkit.html>