Indoor Air Quality Backgrounder: The Basics

Indoor air quality (IAQ) is an increasingly important issue in schools across the nation. IAQ can directly affect the health and comfort of students and staff. There are many ways that school occupants can help to improve air quality. EPA developed the *Indoor Air Quality Tools for Schools (IAQ TfS)* Program to help schools address many IAQ issues using practical and often low-cost measures (such as unblocking ventilation supply vents to improve airflow).

By simply reviewing this *Indoor Air Quality Backgrounder* and completing the IAQ checklists, occupants can learn how to make a significant impact on IAQ and provide a healthy learning and working environment.

This guidance is based on the following principles:

- Most IAQ problems can be prevented and resolved by school staff through simple, inexpensive measures.
- The cost and effort needed to prevent most IAQ problems is significantly less than the cost and effort required to resolve problems after they develop.

WHY IAQ IS IMPORTANT TO YOUR SCHOOL

Most people are aware that outdoor air pollution can impact their health, but indoor air pollution can also have significant, harmful effects. EPA 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. EPA and its Science Advisory Board consistently rank indoor air pollution among the top five environmental health risks to the public.

This is especially important to schools, as children may be more susceptible to air pollutants.

Failure to prevent or respond promptly to IAQ problems can:

- Increase potential for long- and short-term health problems for students and staff.
- Negatively impact student attendance, comfort, and performance.
- Reduce teacher and staff comfort and performance.
- Accelerate deterioration and reduce efficiency of school facilities and equipment.
- Increase potential for school closings or relocation of occupants.
- Strain relationships among school administration, parents, and staff.
- Create negative publicity.
- Impact community trust.
- Create liability problems.

UNDERSTANDING IAQ PROBLEMS AND SOLUTIONS

To understand IAQ problems and solutions, it is important to know what factors affect IAQ. These include:

- Sources of indoor air pollutants.
- Heating, ventilation, and air conditioning (HVAC) systems.
- Building occupants.
- Pollutant pathways.

SOURCES OF INDOOR AIR POLLUTANTS

Indoor air contaminants can originate within the building or be drawn in from outdoors. Air pollutants consist of numerous particulates, fibers, mists, bioaerosols, and gases. It is important to control air pollutant sources (see the table on the next page), or IAQ problems can arise—even if the HVAC system is properly operating.

Indoor Air Quality



Tools for Schools

Good IAQ helps to provide a healthy and productive environment for students, teachers, and staff in order to assist a school in its core mission—educating children.

Building Occupants

The effects of IAQ problems on school occupants—including staff, students, and others—are often non-specific symptoms rather than clearly-defined illnesses. Symptoms commonly attributed to IAQ problems include:

- Headache, fatigue, and shortness of breath.
- Sinus congestion, cough, and sneezing.
- Eye, nose, throat, and skin irritation.
- Dizziness and nausea.

These symptoms could be caused by air quality deficiencies, but may also be linked to other factors—poor lighting, stress, noise, and more. Due to varying sensitivities among school occupants, IAQ problems may affect a group of people or just one individual. In addition, IAQ problems may affect people in different ways. Individuals that may be particularly susceptible to effects of indoor air contaminants include, but are not limited to, people with:

- Asthma, allergies, or chemical sensitivities.
- Respiratory diseases.
- Suppressed immune systems (due to radiation, chemotherapy, or disease).
- Contact lenses.

Pollutant Pathways and Driving Forces

Airflow patterns in buildings are determined by the combined forces of mechanical ventilation systems, human activity, and natural effects. Air pressure differences created by these forces move airborne pollutants from areas of higher pressure to areas of lower pressure through any available openings in building walls, ceilings, floors, doors, windows, and HVAC systems. For instance, as long as the opening to an inflated balloon is kept shut, no air will flow. When opened, however, air will move from the inside (area of higher pressure) to the outside (area of lower pressure).

Even if the opening is small, air will move until the inside pressure is equal to the outside pressure.

SIX BASIC CONTROL STRATEGIES

There are six basic control methods that can lower concentrations of indoor air pollutants. Specific applications of these basic control strategies may be noted in the attached checklist(s).

1. Source Management - Management of pollutant sources includes:

- **Source removal** - Eliminating pollutant sources or not allowing them to enter the school. Examples include not allowing buses to idle, not placing garbage in rooms with HVAC equipment, and replacing moldy materials.
- **Source substitution** - Replacing pollutant sources. Examples include selecting less- or non-toxic art materials or interior paints.
- **Source encapsulation** - Placing a barrier around the source so that it releases fewer pollutants into the indoor air. Examples include covering pressed wood cabinetry with sealed or laminated surfaces or using plastic sheeting to contain contaminants when renovating.

2. Local Exhaust - Removing point sources of indoor pollutants (through exhausting fume hoods and local exhaust fans to the outside) before they disperse. Examples include exhaust systems for restrooms and kitchens, science labs, storage rooms, printing and duplicating rooms, and vocational/industrial areas (such as welding booths and firing kilns).

3. Ventilation - Lowering pollutant concentrations by using cleaner (outdoor) air to dilute polluted (indoor) air. Local building codes likely specify the quantity (and sometimes quality) of outdoor air that should be continuously supplied in your school, as do voluntary standards set by the American Society of Heating, Regrigerating, and Air-Conditioning Engineers (ASHRAE). Temporarily increasing ventilation coupled with proper use of the exhaust system while painting or applying pesticides, for example, can be useful in diluting the concentration of noxious fumes in the air.

A complicating factor is that indoor air pollutant concentration levels can vary by:

- Time (for example, weekly, during floor stripping); and
- Location (within a school or even within a single classroom).

HVAC System Design and Operation

Properly designed HVAC equipment in a school helps to:

- Control temperature and humidity to provide thermal comfort.
- Distribute adequate amounts of outdoor air to meet ventilation needs of school occupants.
- Isolate and remove odors and pollutants through pressure control, filtration, and exhaust fans.

Not all HVAC systems accomplish all of these functions. Some buildings rely only on natural ventilation. Others lack mechanical cooling equipment, and many function with little or no humidity control.

The two most common HVAC designs in schools are unit ventilators and central air-handling systems. Both can perform the same HVAC functions, but a unit ventilator serves a single room while a central air-handling unit serves multiple rooms.

TYPICAL SOURCES OF INDOOR AIR POLLUTANTS

Outdoor Sources

Polluted Outdoor Air

- Pollen, dust, fungal spores
- Industrial emissions
- Vehicle emissions

Nearby Sources

- Loading docks
- Odors from dumpsters
- Unsanitary debris or building exhausts near outdoor air intakes

Underground Sources

- Radon
- Pesticides
- Leakage from underground storage tanks

Building Equipment

HVAC Equipment

- Microbiological growth in drip pans, ductwork, coils, and humidifiers
- Improper venting of combustion products
- Dust or debris in ductwork

Other Equipment

- Emissions from office equipment (volatile organic compounds, ozone)
- Emissions from shop, lab, and cleaning equipment

Components and Furnishings

Components

- Microbiological growth on or in soiled or water-damaged materials
- Dry traps that allow the passage of sewer gas
- Materials containing volatile organic compounds, inorganic compounds, or damaged asbestos
- Materials that produce particles (dust)

Furnishings

- Emissions from new furnishings and floorings
- Microbiological growth on or in soiled or water-damaged furnishings

Other Indoor Sources

- Science laboratory supplies
- Vocational art supplies
- Copy/print areas
- Food prep areas
- Smoking lounges
- Cleaning materials
- Emissions from trash
- Pesticides
- Odors and volatile organic compounds from paint, chalk, adhesives
- Occupants with communicable diseases
- Dry-erase markers and similar pens
- Insects and other pests
- Personal care products

4. Exposure Control - Adjusting the time and location of pollutant exposure. An example of time control is scheduling floor stripping and waxing (with the ventilation system functioning) for Friday after school. This allows products to off-gas over the weekend while the school is unoccupied. Location control involves moving the pollutant source away from occupants or even relocating susceptible occupants.

5. Air Cleaning - Filtering particles and gaseous contaminants as air passes through ventilation equipment. In most cases this type of system should be engineered on a case-by-case basis.

6. Education - Teaching and training school occupants about IAQ issues. People in the school can reduce their exposure to many pollutants by understanding basic information about their environment and knowing how to prevent, remove, or control pollutants.

Some solutions, such as major ventilation changes, may not be practical to implement due to lack of resources or the need for long periods of non-occupancy to ensure the safety of the occupants. Use temporary measures to ensure good IAQ in the meantime. Other solutions, such as anti-idling programs, offer low-cost options that can be easily and quickly implemented.

YOUR ROLE IN THE IAQ TEAM

As a school occupant, your activities and decisions have an impact on the quality of the school's indoor air. You can participate by completing the appropriate checklist and by continuing to apply these principles on a daily basis. Your school's IAQ Coordinator serves as a focal point for collecting IAQ information and handling IAQ concerns.

HOW TO KNOW IF YOU HAVE AN IAQ PROBLEM

Diagnosing IAQ-related symptoms can be tricky, especially because acute (short-term) symptoms are similar to those from colds, allergies, fatigue, or the flu. There are clues, however, that can help link symptoms to IAQ problems.

- Symptoms are widespread within a class or school.
- Symptoms disappear when the students or staff leave the school building for a day or for extended periods of time.
- Onset is sudden after some change at school (such as painting or pesticide application).
- Reactions occur indoors but not outdoors.
- Symptoms have been identified by a doctor as being IAQ-related.

It is not safe to assume that a lack of symptoms means that the IAQ in your school is acceptable. Symptoms of long-term health effects (such as lung cancer due to radon) often do not become evident for many years.

IF YOU THINK YOU HAVE AN IAQ PROBLEM

If you have a potential IAQ problem in your school or area that requires a simple solution or action, correct the problem. If the problem cannot be easily corrected or if the complaint seems to indicate a potentially severe IAQ problem, contact the IAQ Coordinator immediately. The IAQ Coordinator will investigate the problem further, either using in-house resources or by calling in help from outside the school.

PLEASE CONTACT A COORDINATOR AT YOUR BUILDING:

John Barlow, Director of Facilities