

INDOOR ENVIRONMENTAL QUALITY INVESTIGATION

**Hamilton County Jr./Sr. High School
1 Fox Lane
McLeansboro, Hamilton County, Illinois
IDPH File No. 502070601**

Illinois Department of Public Health
Division of Environmental Health
Toxicology Program
February 2006

PURPOSE

The Illinois Department of Public Health (IDPH) performed an indoor environmental quality (IEQ) investigation at the Hamilton County Jr./Sr. High School in response to concerns from administration about health problems recently experienced by a group of female students and some staff. There were concerns the health problems may be associated with an environmental problem in the school building. Our investigation included a visual inspection of the school building and its heating, ventilating, and air conditioning (HVAC) system and environmental monitoring.

BACKGROUND AND STATEMENT OF ISSUES

On Tuesday, February 7, 2006, staff from the IDPH Marion Regional Office Toxicology Section conducted an inspection at the Hamilton County Jr./Sr. High School in McLeansboro, IL. The inspection was initiated after receiving a request for assistance from the school Principal.

According to the Principal, seven students have been having episodes that he described as seizures, fainting spells and panic attacks to varying degrees. The students are all female and of various ages. The students have experienced these symptoms at school but also away from the school grounds. He added that there appears to be no pattern to the onset of the symptoms nor is there a common link amongst the students. According to a conversation with the school nurse, some of the students have been diagnosed with medical conditions for the seizures. A few staff also suffer from various health problems including allergies and were concerned something in the school may be affecting their health.

Upon arrival at the school, IDPH staff met with the Assistant Principal who provided a tour throughout the school grounds. IDPH staff also met with the school nurse and maintenance staff. The Hamilton County Jr./Sr. High School building houses grades 7th through 12th with a population of approximately 600 students (200 in 7th-8th; 400 in 9th-12th). The facility was recently constructed with completion in 2001.

Tile covers the floors throughout most of the building (areas such as the office are carpeted). The walls are a block construction with operable windows to the outside. The building has a central, commons/cafeteria/kitchen area separating the high school area from the junior-high area with classrooms and gymnasiums on either side. The building is built on a concrete slab with HVAC ductwork in the ceiling. Ceiling air supply diffusers and return air vents throughout the building were clean. Two science labs with mechanical exhaust units are in each wing. The chemical storage areas are locked and ventilated. A gas powered boiler supplemented with 7 roof-top units with fresh-air intakes and 3 additional roof-top make-up air units (serving the kitchen and two gyms) serve as the HVAC system. This system is computerized and continually monitored. If a unit malfunctions, it is immediately red-flagged on the computer. A review of the HVAC computer revealed air-temperatures throughout the building were being maintained generally at

70-72 °F. The mechanical room housing the boiler is well ventilated. All the HVAC air filters are on a routine maintenance plan and are changed four times a year.

A separate building on the school campus houses the vocational classrooms. Classes such as welding, auto shop, and wood-working are taught in this building. Two overhead doors ventilate the auto shop area.

A visible inspection of the interior and exterior of the school building did not identify any areas of water damage or active water leaks. Walk-off mats are present at all entrances. The school building and grounds are very clean and well maintained.

RESULTS

As IDPH staff toured the building and grounds, ventilation assessment monitoring was conducted using a Q-Trak IAQ Monitor. Components that were monitored included carbon monoxide (CO), carbon dioxide (CO₂), temperature (°F) and relative humidity (%RH). The monitoring was conducted from 10:00am through 11:30am while school was in session.

Carbon Monoxide

Carbon monoxide is an incomplete combustion by-product that can be present in a building for a variety of reasons. Potential sources of CO are furnaces, boilers and other appliances that burn fossil fuels. Tobacco smoke and automobile exhaust also can be a source of CO. CO can elevate to dangerous levels within a building if combustion appliances are not vented properly, the opening to an exhaust flue or chimney is blocked, a flue pipe is cracked or disconnected, or a back draft exists. A back draft can occur when the air pressure inside a building is less than the air pressure outside, causing exhaust to “spill” inward.

Carbon monoxide is a colorless, odorless gas that reduces the oxygen-carrying capacity of the blood. At low levels this can cause headaches, nausea, disorientation, weakness and muscle aches. Higher levels can impair judgment, cause paralysis or coma, and death. Because CO is odorless and exposure may result in symptoms similar to those of other common illnesses, the effects may not be recognized until the onset of severe illness.

The background concentration of CO in most buildings would not be expected to exceed 5 ppm. IDPH recommends that CO levels inside buildings not exceed 9 ppm. According to the American Medical Association, health effects can occur after 2-hour exposures to CO concentrations of 100 ppm.

No levels of CO were detected inside the school building or vocational building at the time of the inspection. All combustion appliances appeared to be well ventilated and exhausted to the outside. No fresh air intakes are located near areas where idling vehicle fumes could be drawn into the building. Roof top exhaust stacks are extended greater than 6 feet above fresh-air intakes.

Carbon Dioxide

Carbon dioxide is a normal constituent of exhaled breath and is commonly used as a screening tool to evaluate whether adequate volumes of fresh outdoor air are being introduced into a building. The outdoor level of CO₂ is usually 300 - 400 parts per million (ppm). If indoor levels are more than 1,000 ppm, there is probably inadequate ventilation; and complaints such as headaches, fatigue, and eye and throat irritation may be prevalent. The CO₂ itself is not responsible for the complaints; however, high CO₂ levels may indicate that other contaminants in the building may also be present at elevated levels and could be responsible for occupant complaints.

Carbon dioxide levels recorded throughout the building generally were 1000 ppm or less. In the Jr. High wing, vocational building, commons and gymnasium areas, CO₂ levels ranged from 650–800 ppm while CO₂ levels were around 1000 ppm in the Sr. High wing. This would be expected since the population in this area is greater.

The American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) have developed standards for indoor air quality which can be found in the document *Ventilation for Acceptable Indoor Air Quality*. These guidelines recommend that school classroom areas be supplied with 15 cubic feet per minute (CFM) of outside air per person.

Temperature

Temperature is frequently identified in indoor air complaints because it is directly linked to occupant comfort. Excessively high or low temperatures can lead to general thermal discomfort and occupant dissatisfaction. ASHRAE recommends that temperatures be maintained between 68 and 75 EF (71EF is optimal) during the winter months and between 73 and 79 EF (76 EF is optimal) during the summer months. These ranges are generally acceptable for sedentary or slightly active persons. The temperatures recorded in the school ranged from 70 to 72 EF.

Relative Humidity

Relative humidity (%RH) is an important factor in indoor air quality because moisture levels are linked to occupant comfort and other considerations. High moisture levels impair the body's ability to lose heat, and can lead to microbial growth. This growth may lead to irritating odors, cause permanent damage to building components, and result in a variety of infectious or allergic illnesses for building occupants. Excessively low moisture levels result in dry air that can irritate the lungs, eyes, nose and throat. ASHRAE recommends that %RH be maintained between 30% and 60%. The %RH recorded inside the school was around 20%.

CONCLUSIONS

The described symptoms of the affected students and staff can be caused by many conditions, diseases, injuries, and other factors. The purpose of the IEQ investigation was to identify if potential environmental factors at the school facility may be contributing to these symptoms. Based on the information gathered during a visual inspection of the school building and its HVAC systems, environmental monitoring for CO, CO₂, temperature and %RH, and discussions with building staff, no areas of concern were noted at the facility.

Addressing indoor air concerns in the school environment can be an on-going task for building administrators. The U.S. Environmental Protection Agency has developed the *Indoor Air Quality (IAQ) Tools for Schools* kit. The kit includes checklists for school employees, a guide for coordinating the checklists, fact sheets on indoor air pollution issues, and sample policies and memos. Information in this kit may be helpful in the continuing effort to address indoor air concerns from parents, staff and students and may prove to be a valuable resource. The *IAQ Tools for Schools* kit and its components are available free of charge and can be obtained from the IAQ INFO Clearinghouse at 1-800-438-4318. Ask for EPA document number 402-K-05-001.

Preparer of Report

Lynn M. Stone
Environmental Health Specialist

cc: Div. of Env. Health-Env. Tox.
MRO-Env. Tox.