INDOOR AIR QUALITY ASSESSMENT
INCIDENT RESPONSE

MassHealth Enrollment Center
45-47 Spruce Street
Chelsea, Massachusetts

Prepared by:
Massachusetts Department of Public Health
Bureau of Environmental Health
Indoor Air Quality Program
October 2012

Background/Introduction

At the request of Deborah Coleman, Director of the Office of Leasing and State Owned Property, Executive Office of Health and Human Services, the Massachusetts Department of Public Health (MDPH), Bureau of Environmental Health (BEH), Indoor Air Quality (IAQ) Program conducted an assessment of the MassHealth Enrollment Center (MHEC), located at 45-47 Spruce Street, Chelsea Massachusetts. This visit was prompted by concerns following a building evacuation due to odors attributed to the mechanical ventilation system.

According to Ms. Coleman, on the morning of September 12, 2012, MHEC staff reported burning odors in one area of the second floor office space, near one specific supply vent. Staff were evacuated shortly after the start of the normal work day (approximately 9:00 AM), and the Chelsea Fire Department (CFD) was contacted regarding a potential fire issue. According to Ms. Coleman, the building management's mechanical ventilation service provider determined that the odor was caused by a frayed fan belt in one mechanical unit. Although the CFD reportedly conducted some testing for oxygen levels, carbon monoxide and other gases, they also recommended that the MDPH be contacted to provide further assessment/recommendations. At 11:30 AM, Ms. Coleman contacted the MDPH/BEH on September 12, 2012 with a request for assessing the occupied space. Sharon Lee and Cory Holmes, Environmental Analysts/Inspectors for BEH's IAQ Program, arrived at the MHEC to conduct an assessment in the early afternoon of September 12, 2012.

The MHEC is the sole occupant of a two-story building that was recently renovated. It was reported that staff moved into this building several months ago. Four new rooftop ventilation units provide tempered air to MHEC offices. Windows in this office are not openable.

Methods

To determine whether airborne pollutants were present, BEH/IAQ staff conducted air sampling for particulate matter with a diameter of 2.5 micrometers (μm) or less (PM2.5), carbon monoxide, and volatile organic compounds (VOCs). To determine if adequate air exchange was occurring BEH/IAQ staff conducted air monitoring for carbon dioxide. Air tests for carbon dioxide and carbon monoxide were conducted with the TSI, Q-Trak, IAQ Monitor, Model 7565. Tests for airborne particle matter with a diameter less than 2.5 micrometers were taken with the TSI, DUSTTRAK™ Aerosol Monitor Model 8520. Air testing for total volatile organic compounds (TVOCs) was conducted using a MiniRAE 2000 photo ionization detector (PID).

Results

The building was not occupied at the time of the assessment. Results appear in Table 1.

Discussion

IAQ Evaluations

At the time of assessment, the building management's mechanical ventilation service provider had examined all ventilation equipment and was in the process of replacing any frayed/worn fan belts. Indoor air quality can be negatively influenced by the presence of respiratory irritants, such as products of combustion. The process of combustion produces a number of pollutants. Common combustion emissions include carbon monoxide, carbon dioxide, water vapor, and smoke (fine airborne particle material). Of these materials, exposure to carbon monoxide and PM2.5 can produce immediate, acute health effects upon exposure.

BEH/IAQ staff also measured for TVOCs, which are sources of eye and respiratory irritation. No odors were detected at the time of assessment.

Carbon Monoxide

Carbon monoxide is a by-product of incomplete combustion of organic matter (e.g., gasoline, wood and tobacco). Exposure to carbon monoxide can produce immediate and acute health effects. Several air quality standards have been established to address carbon monoxide and prevent symptoms from exposure to these substances. The MDPH established a corrective action level concerning carbon monoxide in ice skating rinks that use fossil-fueled ice resurfacing equipment. If an operator of an indoor ice rink measures a carbon monoxide level over 30 ppm, taken 20 minutes after resurfacing within a rink, that operator must take actions to reduce carbon monoxide levels (MDPH, 1997).

The American Society of Heating Refrigeration and Air-Conditioning Engineers (ASHRAE) has adopted the National Ambient Air Quality Standards (NAAQS) as one set of criteria for assessing indoor air quality and monitoring of fresh air introduced by HVAC systems (ASHRAE, 1989). The NAAQS are standards established by the US EPA to protect the public health from six criteria pollutants, including carbon monoxide and particulate matter (US EPA, 2006). As recommended by ASHRAE, pollutant levels of fresh air introduced to a building should not exceed the NAAQS levels (ASHRAE, 1989). The NAAQS were adopted by reference in the Building Officials & Code Administrators (BOCA) National Mechanical Code of 1993 (BOCA, 1993), which is now an HVAC standard included in the Massachusetts State Building Code (SBBRS, 1997). According to the NAAQS, carbon monoxide levels in outdoor air should not exceed 9 ppm in an eight-hour average (US EPA, 2006).

Carbon monoxide should not be present in a typical, indoor environment. If it *is* present, indoor carbon monoxide levels should be less than or equal to outdoor levels. On the day of assessment, outdoor carbon monoxide concentrations were non-detect (ND) (Table 1). No measureable levels of carbon monoxide were detected inside the building during the assessment (Table 1).

Particulate Matter

The US EPA has established NAAQS limits for exposure to particulate matter. Particulate matter is airborne solids that can be irritating to the eyes, nose and throat. The NAAQS originally established exposure limits to particulate matter with a diameter of 10 μm or less (PM10). According to the NAAQS, PM10 levels should not exceed 150 micrograms per cubic meter ($\mu g/m^3$) in a 24-hour average (US EPA, 2006). These standards were adopted by both ASHRAE and BOCA. Since the issuance of the ASHRAE standard and BOCA Code, US EPA established a more protective standard for fine airborne particles. This more stringent PM2.5 standard requires outdoor air particle levels be maintained below 35 $\mu g/m^3$ over a 24-hour average (US EPA, 2006). Although both the ASHRAE standard and BOCA Code adopted the PM10 standard for evaluating air quality, MDPH uses the more protective PM2.5 standard for evaluating airborne particulate matter concentrations in the indoor environment.

Outdoor PM2.5 concentrations the day of assessment were measured at 9 $\mu g/m^3$ (Table 1). PM2.5 levels measured inside the building ranged from 7 to 9 $\mu g/m^3$, which were below the NAAQS PM2.5 level of 35 $\mu g/m^3$ (Table 1). Frequently, indoor air levels of particulates (including PM2.5) can be at higher levels than those measured outdoors. A number of mechanical devices and/or activities that occur in buildings can generate particulate during normal operations. Sources of indoor airborne particulates may include but are not limited to

particles generated during the operation of fan belts in the HVAC system, use of stoves and/or microwave ovens in kitchen areas; use of photocopiers, fax machines and computer printing devices; operation of an ordinary vacuum cleaner and heavy foot traffic indoors.

Volatile Organic Compounds (VOCs)

In an effort to determine whether detectable VOCs were present in the building, BEH staff conducted VOC screening. Outdoor air samples were also taken for comparison. On the day of assessment, outdoor TVOC concentrations were ND (Table 1). No measureable levels of TVOCs were detected inside the building during the assessment (Table 1).

Carbon Dioxide

Carbon dioxide is used as an indicator of the adequacy of the fresh air ventilation. As carbon dioxide levels rise, it indicates that the ventilating system is malfunctioning or the design occupancy of the room is being exceeded. When this happens, a buildup of common indoor air pollutants can occur, leading to discomfort or health complaints. The Occupational Safety and Health Administration (OSHA) standard for carbon dioxide is 5,000 parts per million parts of air (ppm). Workers may be exposed to this level for 40 hours/week, based on a time-weighted average (OSHA, 1997). The MDPH uses a guideline of 800 ppm for publicly occupied buildings. At the time of the assessment carbon dioxide measurements ranged from 352 to 551, which were well below the MDPH guideline of 800 ppm, indicating ventilation equipment was operating.

Conclusions/Recommendations

At the time of the assessment, no lingering odors were detected in the building, and air testing results showed that no elevated levels of PM2.5, carbon monoxide, carbon dioxide or TVOCs were present, indicating that the building was safe for reoccupancy. However, short-term exposures may have resulted in some irritant effects particularly in individuals with pre-existing conditions (e.g., asthma, allergies). Such effects would be expected to be short-term and be alleviated upon removal from the area; long-term effects are unlikely. In view of the findings at the time of the visit, the following recommendations are made:

1. Ensure ventilation equipment/parts are examined/serviced on a regularly scheduled basis. Consider requesting a service calendar from building management.
2. Continue to operate ventilation equipment continuously while the building is occupied.

References

ASHRAE. 1989. Ventilation for Acceptable Indoor Air Quality. American Society of Heating, Refrigeration and Air Conditioning Engineers. ANSI/ASHRAE 62-1989.

BOCA. 1993. The BOCA National Mechanical Code/1993. 8th ed. Building Officials and Code Administrators International, Inc., Country Club Hill, IL.

MDPH. 1997. Requirements to Maintain Air Quality in Indoor Skating Rinks (State Sanitary Code, Chapter XI). 105 CMR 675.000. Massachusetts Department of Public Health, Boston, MA.

OSHA. 1997. Limits for Air Contaminants. Occupational Safety and Health Administration. Code of Federal Regulations. 29 C.F.R 1910.1000 Table Z-1-A.

SBBRS. 1997. Mechanical Ventilation. State Board of Building Regulations and Standards. Code of Massachusetts Regulations. 780 CMR 1209.0

US EPA. 2006. National Ambient Air Quality Standards (NAAQS). US Environmental Protection Agency, Office of Air Quality Planning and Standards, Washington, DC. http://www.epa.gov/air/criteria.html

Location: MassHealth Enrollment Center **Indoor Air Results**

Address: 45-47 Spruce St, Chelsea, MA **Date: 9/12/2012**

Table 1

Location	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	PM2.5 ($\mu g/m^3$)	TVOCs (ppm)	Ventilation	
					Intake	Exhaust
Background	333	ND	9	ND		
116	333	ND	8	ND	Y	Y
127	341	ND	8	ND	Y	Y
130/Cubicle area	352	ND	8	ND	Y	Y
134/137	352	ND	7	ND	Y	Y
150/157	344	ND	8	ND	Y	Y
202	403	ND	9	ND	Y	
208	363	ND	7	ND	Y	
209	374	ND	8	ND	Y	
211/212	356	ND	9	ND	Y	Y
223/226/228	376	ND	7	ND	Y	Y
232/233	357	ND	7	ND	Y	Y
Reception	358	ND	8	ND	Y	
Waiting room	551	ND	8	ND	Y	Y

ppm = parts per million

$\mu g/m^3$ = micrograms per cubic meter

ND = non detect

TVOCs = total volatile organic compounds