INDOOR AIR QUALITY ASSESSMENT

Massachusetts Department of Children and Families
185 Church Street
Village of Whitinsville
Northbridge Massachusetts

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

May 2011

Background/Introduction

At the request of Mr. Douglas Shatkin, Human Resources Director for the Massachusetts Executive Office of Health and Human Services' (EOHHS) Department of Children, Youth and Families (DCYF), the Massachusetts Department of Public Health (MDPH), Bureau of Environmental Health (BEH) provided assistance and consultation regarding indoor air quality concerns at the offices for the Massachusetts Department of Children and Families (DCF) located at 185 Church Street, in the Whitinsville section of Northbridge, Massachusetts.

On March 14, 2011 a visit to conduct an indoor air quality (IAQ) assessment was made to the DCF offices by Cory Holmes, an Environmental Analyst/Regional Inspector in BEH's IAQ Program. The assessment was prompted by mold concerns due to ice dams along the roof's edge at the front of the building and water infiltration at ground level at the rear of the building. During the assessment occupants also raised concerns about the possible presence of lingering residue/pollutants from a fire that reportedly occurred prior to occupancy by the DCF.

The DCF occupies space in a 50 year old, one-story building that formerly served as a supermarket. The DCF has occupied the space for approximately 30 years. The building has a red-brick exterior and an asphalt-shingled peaked roof. The DCF space reportedly underwent interior renovations approximately two years ago. Windows are openable in limited areas of the building.

Methods

General IAQ tests for carbon dioxide, temperature and relative humidity were conducted with the TSI, Q-Trak, IAQ Monitor, Model 7565. In order to determine whether fire residue/pollutants in the building were present, BEH staff conducted air sampling for carbon monoxide and particulate matter with a diameter of 2.5 micrometers (μm) or less (PM2.5). Tests for carbon monoxide were conducted with the TSI, Q-Trak, IAQ Monitor, Model 7565. Air tests for airborne particle matter with a diameter less than 2.5 micrometers were taken with the TSI, DUSTTRAK™ Aerosol Monitor Model 8520. BEH staff also performed visual inspection of building materials for smoke/water damage and/or microbial growth. Moisture content of porous building materials (gypsum wallboard, ceiling tiles and carpeting) was measured with a Delmhorst, BD-2000 Model, Moisture Detector equipped with a Delmhorst Standard Probe.

Results

The DCF office has employee population of approximately 95 and is visited by approximately 10 to 40 individuals daily. Tests were taken during normal operations, and results appear in Table 1.

Discussion

Ventilation

It can be seen from Table 1 that carbon dioxide levels were above 800 parts per million (ppm) in 24 of 31 areas surveyed, indicating a lack of air exchange at the time of the assessment (Table 1). The heating, ventilation and air conditioning (HVAC) system consists of rooftop air-handling units (AHUs) (Picture 1) ducted to ceiling-mounted diffusers (Pictures 2 and 3). Air from the space is ducted back to the AHUs via ceiling-mounted return vents.

The HVAC system is controlled by digital thermostats. Thermostats examined had a fan switch that has two settings, *on* and *auto* (Picture 4). When the fan is set to *on,* the system provides a continuous source of air circulation and filtration. The *automatic* setting on the thermostat activates the HVAC system at a preset temperature. With this setting, once the preset temperature is reached, the HVAC system is deactivated. Therefore, no mechanical ventilation is provided until the thermostat re-activates the system. All thermostats in the DCF were set to the "auto" setting at the time of the assessment. The MDPH recommends that thermostats be set to the fan "on" setting during occupied hours to provide continuous air circulation.

To maximize air exchange, the MDPH recommends that both supply and exhaust ventilation operate continuously during periods of occupancy. In order to have proper ventilation with a mechanical supply and exhaust system, the systems must be balanced to provide an adequate amount of fresh air to the interior of a room while removing stale air from the room. It is recommended that existing ventilation systems be re-balanced every five years to ensure adequate air systems function (SMACNA, 1994). The date of the last balancing of the HVAC system was not available at the time of the assessment.

The Massachusetts Building Code requires that each room have a minimum ventilation rate of 20 cubic feet per minute (cfm) per occupant of fresh outside air or openable windows (SBBRS, 1997; BOCA, 1993). The ventilation must be on at all times that the room is occupied. Providing adequate fresh air ventilation with open windows and maintaining the temperature in the comfort range during the cold weather season is impractical. Mechanical ventilation is usually required to provide adequate fresh air ventilation.

Carbon dioxide is not a problem in and of itself. It 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. A guideline of 600 ppm or less is preferred in schools due to the fact that the majority of occupants are young and considered to be a more sensitive population in the evaluation of environmental health status. Inadequate ventilation and/or elevated temperatures are major causes of complaints such as respiratory, eye, nose and throat irritation, lethargy and headaches. For more information concerning carbon dioxide, please see Appendix A.

Indoor temperatures ranged from 69° F to 77° F, which were within or very close to the lower end of the MDPH recommended comfort guidelines. The MDPH recommends that indoor air temperatures be maintained in a range of 70° F to 78° F in order to provide for the comfort of building occupants. In many cases concerning indoor air quality, fluctuations of temperature in occupied spaces are typically experienced, even in a building with an adequate fresh air supply.

The indoor relative humidity ranged from 23 to 32 percent, which was below the MDPH recommended comfort range in all areas surveyed. The MDPH recommends a comfort range of 40 to 60 percent for indoor air relative humidity. The sensation of dryness and irritation is common in a low relative humidity environment. Low relative humidity is a very common problem during the heating season in the northeast part of the United States.

Microbial/Moisture Concerns

In order for building materials to support mold growth, a source of water exposure is necessary. The building has chronic water infiltration issues from two sources: ice dams along the front of the building and water infiltration due to flooding/drainage issues at the rear of the building. At the time of the assessment the building was in the final stages of flood remediation, which consisted of drying out carpeting, removing vinyl coving at the base of walls and drying out gypsum wallboard (GW) by drilling holes to facilitate airflow into the wall cavity (Picture 5). BEH staff conducted moisture testing of carpeting, and GW in the rear areas of the building affected by flooding and found that all materials were dry with the exception of a small area of carpeting directly inside the rear exterior door (Picture 6). In addition, no visible mold was observed nor were any musty/mold-like odors detected at the time of the assessment.

The terrain at the rear of the building consists of rock ledge, which causes water to run down and collect into a series of drains behind the building (Pictures 7 and 8). It appears that at times of sustained rainfall or melting snow conditions, the capacity of the drainage system is exceeded, which leads to flooding inside the building.

Water-damaged ceiling tiles and paint were reported in offices and conference rooms along the front of the building, where ice dams are said to occur along an awning-type roof (Picture 9). At the time of the assessment, the ceiling tiles had been replaced. BEH staff removed ceiling tiles in these areas to observe conditions above the ceiling plenum, which appeared dry with no visible mold growth.

BEH staff also examined the exterior of the building to identify breaches in the building envelope and/or other issues that could provide a source of water penetration. A number of potential moisture sources and exterior building envelope breaches were identified:

- Rainwater accumulating against exterior walls/foundation due to missing/damaged gutters and downspouts (Pictures 10 through 12);
- Missing/damaged mortar around exterior brick and foundation (Pictures 13 and 14);
- Light penetration/spaces beneath exterior doors;

- Missing/damaged brickwork and open utility holes (Pictures 15 through 19)
- Rotted decomposing wood at roof line; and
- Missing/damaged window caulking, joint sealant and damage/breaches in wooden window frames (Pictures 20 through 23). Window and expansion joint sealant may be composed of regulated materials [e.g., asbestos, polychlorinated biphenyls (PCBs)]. For information regarding PCBs, please consult MDPH guidance (Appendix B).

These conditions can undermine the integrity of the building envelope and provide a means of water entry by capillary action into the building through exterior walls, foundation concrete and masonry (Lstiburek & Brennan, 2001). In addition, these breaches in exterior areas can provide a means of drafts and pest entry into the building.

The US Environmental Protection Agency (US EPA) and the American Conference of Governmental Industrial Hygienists (ACGIH) recommend that porous materials (e.g., ceiling tiles, carpeting) be dried with fans and heating within 24 to 48 hours of becoming wet (US EPA, 2001; ACGIH, 1989). If not dried within this time frame, mold growth may occur. Once mold has colonized porous materials, they are difficult to clean and should be removed/discarded.

Plants were noted in several areas. Plants can be a source of pollen and mold which can be respiratory irritants to some individuals. Plants should be properly maintained and equipped with drip pans. They should also be located away from mechanical ventilation components to prevent the aerosolization of dirt, pollen and mold.

Other IAQ Evaluations

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 can produce immediate, acute health effects upon exposure. As stated previously, to determine whether combustion products were present in the building environment, BEH staff obtained measurements for carbon monoxide and airborne particulates.

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 the 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 was measured at 5 $\mu g/m^3$ (Table 1). Indoor PM2.5 levels ranged from 4 to 11 $\mu g/m^3$ (Table 1). Both indoor and outdoor PM 2.5 levels were below the NAAQS PM2.5 level of 35 $\mu g/m^3$. 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 indoors 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.

Other Conditions

Other conditions that can affect indoor air quality were observed during the assessment. As stated previously, occupants were concerned about the presence of lingering residues/pollutants from a fire that occurred approximately 30 years ago, prior to occupancy by the DCF. BEH staff was specifically asked to evaluate conditions above the ceiling tile system toward the rear portion of the building. BEH staff removed a number of ceiling tiles in this area; no lingering odors or visible smoke/fire damage was noted in the ceiling plenum. The absence of lingering odors combined with a lack of elevated respirable particulates (i.e., PM2.5 below 35 ug/m^3) within the DCF offices indicates that fire damage residue would not likely contribute to health issues in the building.

Although a preventative maintenance plan is in place, which reportedly changes filters up to twice a year, the type of filters installed in AHUs (25% efficiency) provide limited filtration of respirable dusts. In order to decrease aerosolized particulates, disposable filters with an increased dust spot efficiency can be installed. The dust spot efficiency is the ability of a filter to remove particulates of a certain diameter from air passing through the filter. Filters that have been determined by ASHRAE to meet its standard for a dust spot efficiency of a minimum of 40 percent would be sufficient to reduce many airborne particulates (Thornburg, D., 2000; MEHRC, 1997; ASHRAE, 1992). Pleated filters with a Minimum Efficiency Reporting Value dust-spot efficiency of 9 or higher are recommended. Note that increasing filtration can reduce airflow (called pressure drop), which can subsequently reduce the efficiency of the unit due to increased resistance. Prior to any increase of filtration, each AHU component should be evaluated by a ventilation engineer to ascertain whether it can maintain function with more efficient filters.

Dust/debris was observed accumulated on supply/return vents, as well as on the fan blades of personal fans. Vents and fans should be cleaned periodically to prevent dust/debris from being aerosolized and redistributed throughout occupied areas.

In a number of areas, items were observed on the floor, windowsills, tabletops, counters, bookcases and desks. The large number of items stored provides a source for dusts to accumulate. These items (e.g., papers, folders, boxes) make it difficult for custodial staff to clean. Items should be relocated and/or be cleaned periodically to avoid excessive dust build up. In addition, these materials can accumulate on flat surfaces (e.g., desktops, windowsills and carpets) in occupied areas and subsequently be re-aerosolized causing further irritation.

Many areas of the building contain wall to wall carpeting. It was unclear if a regular carpet cleaning program was in place. The Institute of Inspection, Cleaning and Restoration Certification (IICRC), recommends that carpeting be cleaned annually (or semi-annually in soiled high traffic areas) (IICRC, 2005).

Finally a large number of hornet/wasp nests were observed along the exterior of the building (Picture 24). These nests should be removed in a manner that does not introduce pesticides and/or insects into the building.

Conclusions/Recommendations

The conditions related to indoor air quality at the DCF raise a number of issues. Some of these conditions can be remedied by actions of building occupants. Other remediation efforts will require alteration to the building structure and equipment. For these reasons, a two-phase approach is required for remediation. The first consists of **short-term** measures to improve air quality and the second consists of **long-term** measures that will require planning and resources to adequately address the overall indoor air quality concerns.

Short-Term Recommendations

1. Operate the HVAC system continuously in the fan "on" mode during periods of occupancy to maximize air circulation and filtration.
2. Work with HVAC vendor to adjust/increase percentage of fresh air supply and/or exhaust capabilities to improve air exchange.
3. For buildings in New England, periods of low relative humidity during the winter are often unavoidable. Therefore, scrupulous cleaning practices should be adopted to minimize common indoor air contaminants whose irritant effects can be enhanced when the relative humidity is low. To control for dusts, a high efficiency particulate arrestance (HEPA) filter equipped vacuum cleaner in conjunction with wet wiping of all surfaces is recommended. Avoid the use of feather dusters. Drinking water during the day can help ease some symptoms associated with a dry environment (throat and sinus irritations).
4. Contact a roofing contractor to investigate causes of ice dam formation along front of building and make repairs to roof/exterior brick and flashing/drainage as needed. Repair

or replace areas of rotted wood at roof line. Once repairs are completed, water-damaged walls should be prepped and refinished and water-damaged ceiling tiles replaced.

5. Encourage staff to monitor their respective areas for active leaks/water damage and report to building maintenance via DCF management for prompt remediation.
6. Contact a masonry firm or general contractor to repair holes/breaches in exterior walls to prevent water penetration, drafts and pest entry.
7. Address deteriorated window/joint sealant in accordance with EPA regulations/MDPH guidance.
8. Repair/replace missing/damaged gutters, downspouts and elbow extensions. Extend downspouts to empty at least 5 feet away from the foundation (if possible).
9. Inspect drains behind building on a regular basis to ensure proper drainage, clear debris as needed.
10. Consider removing carpeting from along exterior walls and around exterior doors prone to flooding. Consider replacing carpeting in these areas with tile to prevent chronic moistening of porous materials and potential mold growth conditions.
11. Ensure proper installation of weather-stripping/door sweeps on exterior doors. Consider installing on both sides of doors to provide a dual barrier. Ensure tightness of doors by monitoring for light penetration and drafts around doorframes.
12. Ensure plants are equipped with drip pans. Examine drip pans periodically for mold growth and disinfect with an appropriate antimicrobial, as needed. Move plants away from fresh air supply sources.
13. Continue to change filters for air handling equipment as per the manufacturers' instructions or more frequently if needed. Consider upgrading to pleated MERV 9 (or

higher) dust-spot efficiency. Prior to any increase of filtration, HVAC system components should be evaluated by a ventilation engineer as to whether it can maintain function with more efficient filters.

14. Relocate or consider reducing the amount of stored materials to allow for more thorough cleaning. Clean items regularly with a wet cloth or sponge to prevent excessive dust build-up.

15. Clean personal fans, supply, exhaust/return vents periodically of accumulated dust.

16. Remove wasps/hornet's nests along exterior of building in a manner as to not introduce insects or chemical agents into the building via windows and/or the ventilation system. If necessary contact a licensed professional exterminator.

17. Clean carpeting annually or semi-annually in soiled high traffic areas as per the recommendations of the Institute of Inspection, Cleaning and Restoration Certification (IICRC). Copies of the IICRC fact sheet can be downloaded at: http://www.cleancareseminars.com/carpet_cleaning_faq4.htm (IICRC, 2005)

18. For more information on mold consult as "Mold Remediation in Schools and Commercial Buildings" published by the US Environmental Protection Agency (US EPA, 2001). Copies of this document can be downloaded from the US EPA website at: http://www.epa.gov/iaq/molds/mold_remediation.html

19. Refer to resource manuals and other related indoor air quality documents for further building-wide evaluations and advice on maintaining public buildings. Copies of these materials are located on the MDPH's website: http://mass.gov/dph/iaq.

Long-Term Recommendations

1. Consider having exterior walls re-pointed and waterproofed to prevent water intrusion. This measure should include a full building envelope evaluation.
2. Contact a landscaping specialist, town DPW and/or a hydro-geological firm to inspect/redesign drainage system behind building to mitigate flooding.
3. Consider replacing window systems building-wide.

References

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Picture 1

Rooftop Air Handling Unit

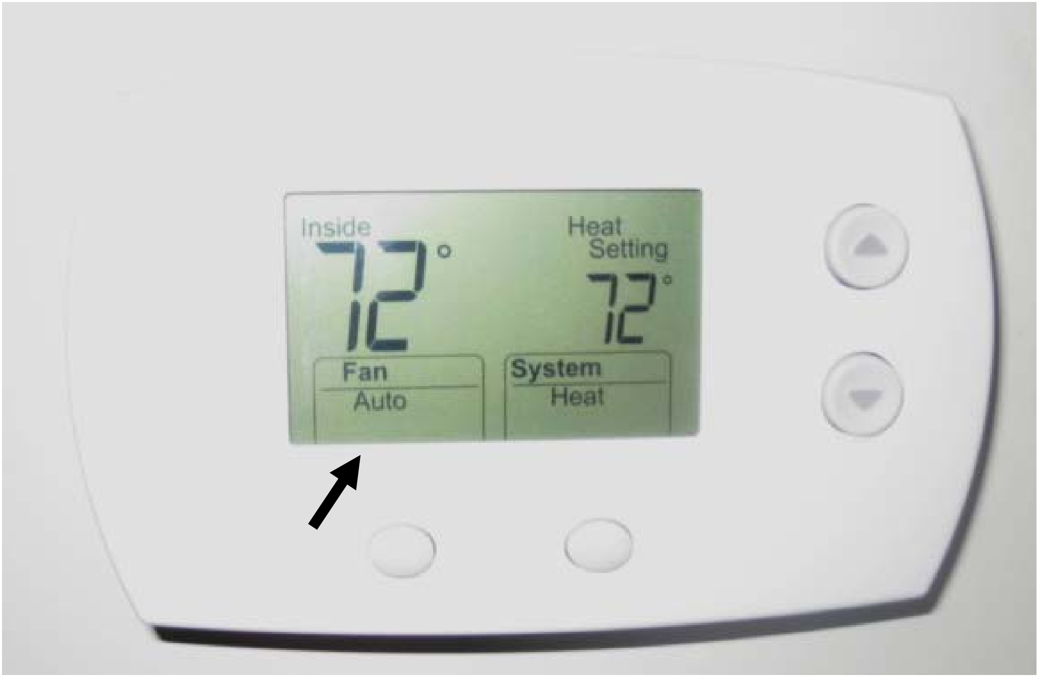
Picture 2

Ceiling-Mounted Supply Diffuser

Picture 3

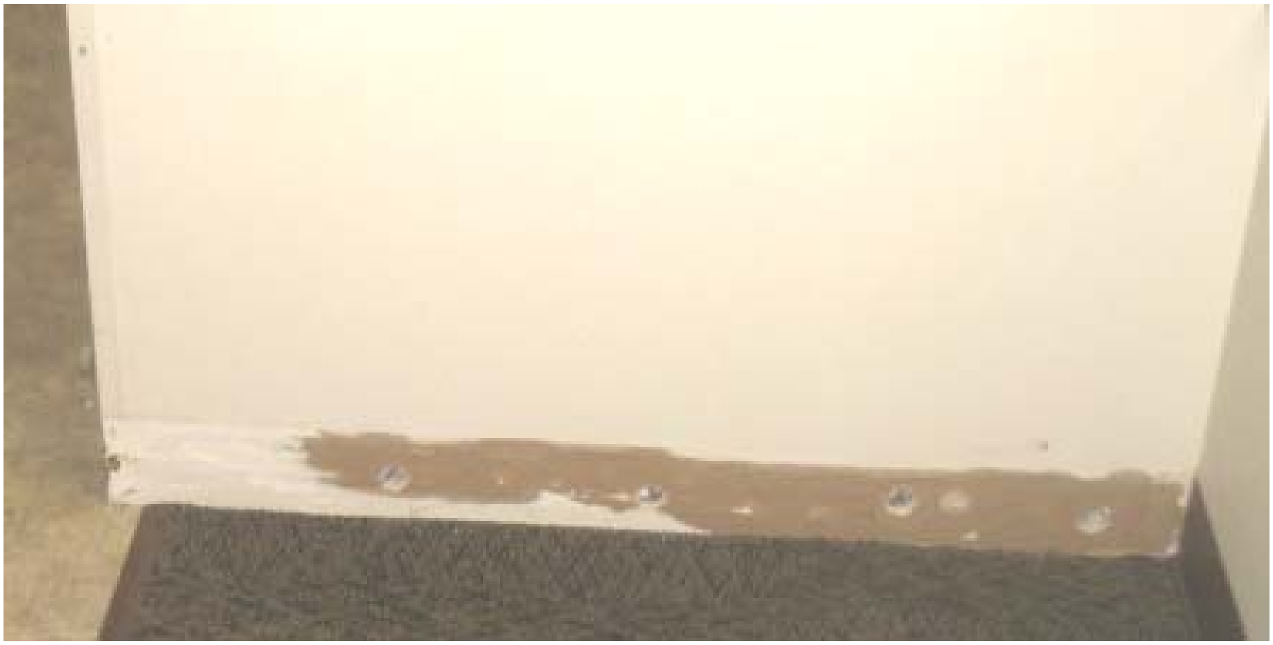
Ceiling-Mounted Supply Diffuser

Picture 4



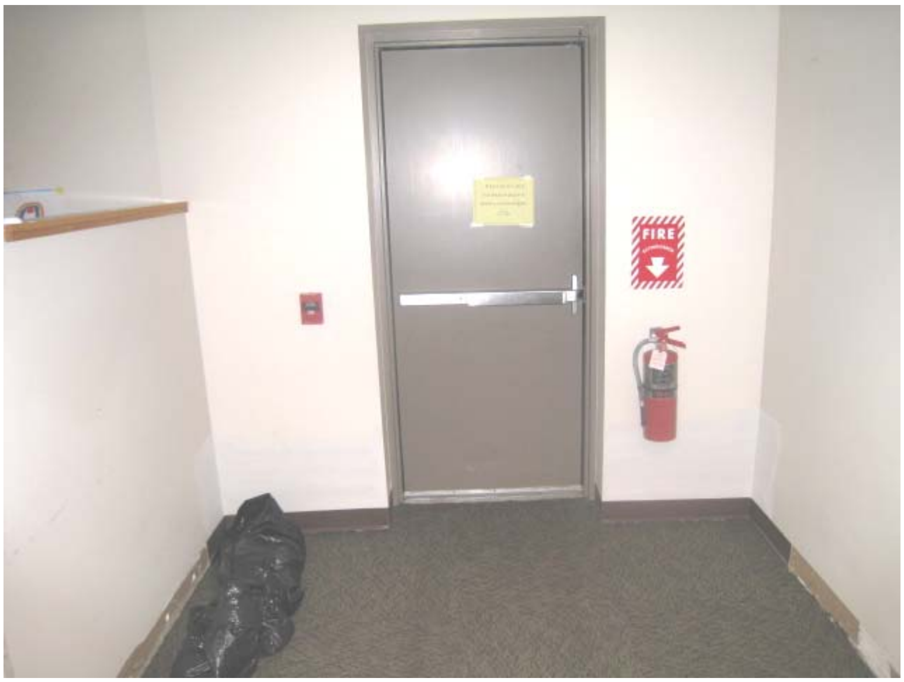
Digital Thermostat for HVAC System, Note Fan in "Auto" Position

Picture 5



Vinyl Base Coving Removed and Holes Drilled into Gypsum Wallboard to Facilitate Drying

Picture 6



Moistened Carpeting Directly inside Rear Exterior Door Prone to Flooding

Picture 7

Rock Ledge/Terrain behind Building

Picture 8

Rock Ledge/Terrain behind Building

Picture 9

Awning-Type Roof along Front Façade of Building

Picture 10

Downspout Emptying against Exterior Walls, Note Moss Growth (Dark Staining)

Picture 11

Downspout Emptying against Exterior Walls, Note Missing Elbow Extension and Moss Growth (Dark Staining)

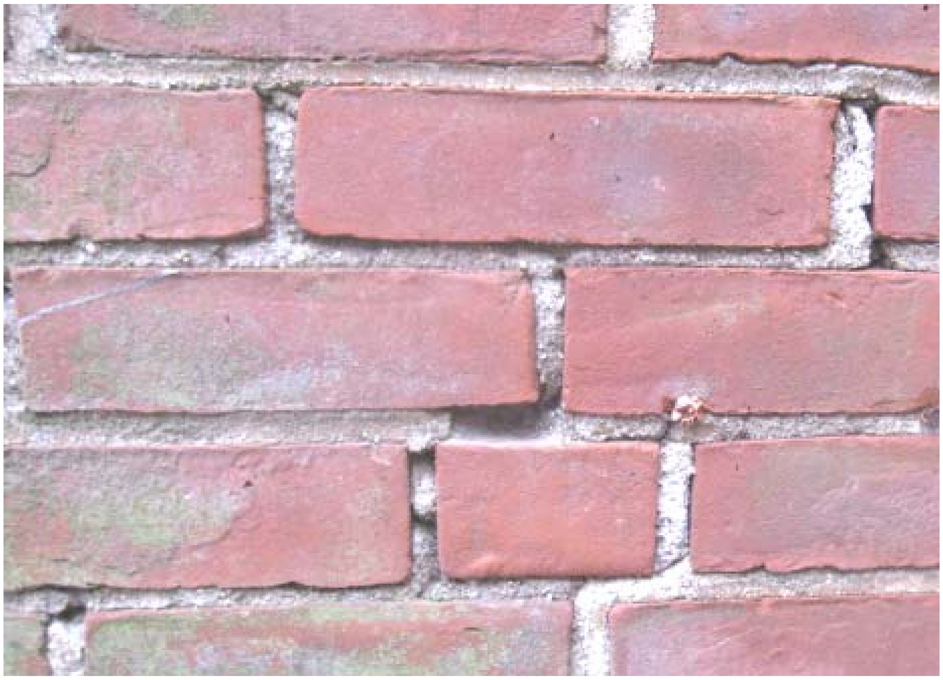
Picture 12

Disconnected Downspout

Picture 13

Missing/Damaged Mortar, Pen Inserted to Show Depth

Picture 14



Missing/Damaged Mortar

Picture 15

Damaged Exterior Brick

Picture 16

Damaged Exterior Brick

Picture 17

Damaged Exterior Brick/Utility Hole

Picture 18

Open Utility Hole

Picture 19

**Damaged Brickwork and Hole Stuffed with Insulation Material
Note Rotted, Decomposing Wood at Roof Line**

Picture 20

Missing/Damaged Caulking around Window Frame

Picture 21

**Missing/Damaged Caulking around Window Frame,
Also Note Peeling Paint and Exposed Wood**

Picture 22

Missing/Damaged Caulking around Window Frame

Picture 23

Missing/Damaged Sealant/Joint Compound

Picture 24

Numerous Hornets/Wasps Nests Were Observed along the Exterior of the Building

Location: Department of Children and Families **Indoor Air Results**

Address: 185 Church St, Whitinsville, MA **Table 1** **Date: 3/14/2011**

Location	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	Temp (°F)	Relative Humidity (%)	PM2.5 (µg/m3)	Occupants in Room	Windows Openable	Ventilation		Remarks
								Supply	Exhaust	
Outside (Background)	374	ND	46	33	5					Cold, mostly cloudy
Burgess Office	954	ND	69	29	10	2	N	Y	Y	
G Unit	863	ND	71	32	5	3	N	Y	Y	Refrigerator on carpet, microwave
Consoletti Office	1042	ND	74	29	6	2	N	Y	Y	
Gemski	1025	ND	74	28	5	1	N	Y	Y	Louvers shut on supply vent, missing adjustment key
Family Resource Unit	894	ND	74	26	4	2	N	Y	Y	
Conference Room A/B	744	ND	74	26	4	0	N	Y	Y	
Interview Room 1	735	ND	72	23	4	0	N	Y	Y	
Interview Room 2	762	ND	72	24	4	0	N	Y	Y	
Interview Room 5	707	ND	72	23	4	0	N	Y	Y	
Reception	956	ND	72	27	5	2	N	Y	Y	

ppm = parts per million µg/m3 = micrograms per cubic meter ND = non-detect

WD = water damaged GW = gypsum wallboard PF = personal fan

Comfort Guidelines

Carbon Dioxide: < 600 ppm = preferred
600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems

Temperature: 70 - 78 °F
Relative Humidity: 40 - 60%

Location: **Department of Children and Families** **Indoor Air Results**

Address: **185 Church St, Whitinsville, MA** **Date:** **3/14/2011**

Table 1 (continued)

Location	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	Temp (°F)	Relative Humidity (%)	PM2.5 (µg/m3)	Occupants in Room	Windows Openable	Ventilation		Remarks
								Supply	Exhaust	
Conference Room C	852	ND	73	27	6	0	N	Y	Y	
Employees Lounge	780	ND	74	27	4	0	N	Y	Y	
Records Room	775	ND	74	26	6	0	N	Y	Y	
Teaming Unit	861	ND	74	28	5	2	N	Y	Y	
Kimberley's Office	892	ND	74	27	7	0	N	Y	Y	
Intake Investigation Unit	986	ND	76	27	5	3	Y	Y	Y	
Investigation Unit	1001	ND	76	26	6	7	N	Y	Y	
Carlo Office	894	ND	76	25	6	0	Y	Y	N	Plants
Gardner Office	853	ND	76	25	5	0	Y	Y	N	Plants
Cushner Office	862	ND	76	25	6	0	N	Y	N	

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Address: **185 Church St, Whitinsville, MA** **Date:** **3/14/2011**

Table 1 (continued)

Location	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	Temp (°F)	Relative Humidity (%)	PM2.5 (µg/m3)	Occupants in Room	Windows Openable	Ventilation		Remarks
								Supply	Exhaust	
Clerical Area	897	ND	75	26	6	1	Y	Y	Y	
Area Director's Conference Room	904	ND	73	25	10	0	N	Y	Y	Ice dams reported in this area, Carpet-dry/low moisture, no visible water damage
Geselius Office	908	ND	72	25	11	0	N	Y	Y	Ice dams reported in this area, Carpet-dry/low moisture, GW – water-damaged paint-dry/low moisture
On-Going Unit	873	ND	74	27	9	3	N	Y	Y	
Whalen Office	827	ND	74	27	6	0	N	Y	N	PF
Burns Unit	817	ND	74	27	5	2	N	Y	Y	Carpet-dry in unit, moderate moisture reading near exterior door
Burns Office	782	ND	75	26	6	0	N	Y	N	
Sullivan Office	1005	ND	76	28	5	1	N	Y	Y	Plants-musty/earthy odors
Weils Unit	834	ND	77	25	5	3	N	Y	Y	

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Address: 185 Church St, Whitinsville, MA

Table 1 (continued)

Date: 3/14/2011

Location	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	Temp (°F)	Relative Humidity (%)	PM2.5 (µg/m3)	Occupants in Room	Windows Openable	Ventilation		Remarks
								Supply	Exhaust	
Wayside Family Networks	947	ND	77	25	5	3	N	Y	Y	
Adolescent Unit	970	ND	77	27	5	3	N	Y	Y	

ppm = parts per million
µg/m3 = micrograms per cubic meter
ND = non-detect
WD = water damaged
GW = gypsum wallboard
PF = personal fan

Comfort Guidelines

Carbon Dioxide: < 600 ppm = preferred
600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems

Temperature: 70 - 78 °F
Relative Humidity: 40 - 60%

Appendix B

An Information Booklet Addressing PCB-Containing Materials in the Indoor Environment of Schools and Other Public Buildings

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Appendix B

INTRODUCTION

The purpose of this information booklet is to provide assistance to school and public building officials and the general public in assessing potential health concerns associated with polychlorinated biphenyl (PCB) compounds in building materials used in Massachusetts and elsewhere. Recently, the U.S. Environmental Protection Agency (EPA) provided broad guidance relative to the presence of PCBs in building materials, notably PCBs in caulking materials. The most common building materials that may contain PCBs in facilities constructed or significantly renovated during the 1950s through the 1970s are fluorescent light ballasts, caulking, and mastic used in tile/carpet as well as other adhesives and paints.

This information booklet, developed by the Massachusetts Department of Public Health's Bureau of Environmental Health (MDPH/BEH), is designed to supplement guidance offered by EPA relative to potential health impacts and environmental testing. It also addresses managing building materials, such as light ballasts and caulking, containing PCBs that are likely to be present in many schools and public buildings across the Commonwealth. This is because the Northeastern part of the country, and notably Massachusetts, has a higher proportion of schools and public buildings built during the 1950s through 1970s than many other parts of the U.S. according to a 2002 U.S. General Accounting Office report. The Massachusetts School Building Authority noted in a 2006 report that 53 percent of over 1,800 Massachusetts school buildings surveyed were built during the 1950s through 1970s. This information booklet contains important questions and answers relative to PCBs in the indoor environment and is based on the available scientific literature and MDPH/BEH's experience evaluating the indoor environment of schools and public buildings for a range of variables, including for PCBs as well as environmental data reviewed from a variety of sources.

<u>1. What are PCBs?</u>

Polychlorinated biphenyl (PCB) compounds are stable organic chemicals used in products from the 1930s through the late 1970s. Their popularity and wide-spread use were related to several factors, including desirable features such as non-flammability and electrical insulating properties. Although the original use of PCBs was exclusive to closed system electrical applications for transformers and capacitors (e.g., fluorescent light ballasts), their use in other applications, such as using PCB oils to control road dust or caulking in buildings, began in the 1950s.

2. When were PCBs banned from production?

Pursuant to the Toxic Substance Control Act (TSCA) of 1976 (effective in 1979), manufacturing, processing, and distribution of PCBs was banned. While the ban prevented production of PCB-containing products, it did not prohibit the use of products already manufactured that contained PCBs, such as building materials or electrical transformers.

3. Are PCBs still found in building materials today?

Yes. Products made with PCBs prior to the ban may still be present today in older buildings. In buildings constructed during the 1950s through 1970s, PCBs may be present in caulking, floor mastic, and in fluorescent light ballasts. Available data reviewed by MDPH suggests that caulking manufactured in the 1950s through 1970s will likely contain some levels of PCBs. Without testing it is unclear whether caulking in a given building may exceed EPA's definition of PCB bulk product waste of 50 parts per million (ppm) or greater. If it does, removal and disposal of the caulk is required in accordance with EPA's TSCA regulations (40 CFR § 761).

4. Are health concerns associated with PCB exposure opportunities?

Although the epidemiological evidence is sometimes conflicting, most health agencies have concluded that PCBs may reasonably be anticipated to be a carcinogen, i.e., to cause cancer.

PCBs can have a number of non-cancer effects, including those on the immune, reproductive, neurological and endocrine systems. Exposure to high levels of PCB can have effects on the liver, which may result in damage to the liver. Acne and rashes are symptoms typical in those that are exposed to high PCB levels for a short period of time (e.g., in industry / occupational settings).

5. If PCBs are present in caulking material, does that mean exposure and health impacts are likely?

No. MDPH/BEH's review of available data suggests that if caulking is intact, no appreciable exposures to PCBs are likely and hence health effects would not be expected. MDPH has conducted indoor tests and reviewed available data generated through the efforts of many others in forming this opinion.

6. How can I tell if caulking or light ballasts in my building may contain PCBs?

If the building was built sometime during the 1950s through 1970s, then it is likely that the caulking in the building and/or light ballasts may contain some level of PCBs. Light ballasts manufactured after 1980 have the words "No PCBs" printed on them. If the light ballast does not have this wording or was manufactured before 1980, it should be assumed that it contains PCBs.

7. What are light ballasts?

A light ballast is a piece of equipment that controls the starting and operating voltages of fluorescent lights. A small capacitor within older ballasts contains about one ounce of PCB oil. If light bulbs are not changed soon after they go out, the ballast will continue to heat up and eventually result in the release of low levels of PCBs into the indoor air.

8. Does the presence of properly functioning fluorescent light ballasts in a building present an environmental exposure concern?

No appreciable exposure to PCBs is expected if fluorescent light ballasts that contain PCBs are intact and not leaking or damaged (i.e., no visible staining of the light lenses), and do not have burned-out bulbs in them.

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9. Should I be concerned about health effects associated with exposure to PCBs as a result of PCB-containing light ballasts?

While MDPH has found higher PCB levels in indoor air where light bulbs have burned-out, the levels are still relatively low and don't present imminent health threats. A risk assessment conducted recently at one school did not suggest unusual cancer risks when considering a worst case exposure period of 35 years for teachers in that school. Having said this, MDPH believes that facility operators and building occupants should take prompt action to replace bulbs and/or ballasts as indicated to reduce/eliminate any opportunities for exposure to PCBs associated with PCB-containing light ballasts.

10. When should PCB-containing light ballasts be replaced?

If ballasts appear to be in disrepair, they should be replaced immediately and disposed of in accordance with environmental regulatory guidelines and requirements. However, if light bulbs burn out, the best remedy is to change them as soon as possible. If light bulbs are not changed soon after they go out, the ballast will continue to heat up and eventually result in the release of low levels of PCBs into the indoor air. Thus, burned-out bulbs should be replaced promptly to reduce overheating and stress on the ballast. As mentioned, ballasts that are leaking or in any state of disrepair should be replaced as soon as possible.

It should be noted that although older light ballasts may still be in use today, the manufacturers' intended lifespan of these ballasts was 12 years. Thus, to the extent feasible or in connection with repair/renovation projects, the older light ballasts should be replaced consistent with the intended lifespan specified by the manufacturers.

11. Does MDPH recommend testing of caulking in buildings built during the 1950s - 1980?

Caulking that is intact should not be disturbed. If caulking is deteriorating or damaged, conducting air and surface wipe testing in close proximity to the deteriorating caulking will help to determine if indoor air levels of PCBs are a concern as well as determining the need for more aggressive cleaning. Results should be compared with similar testing done in an area without deteriorating caulking. In this way, a determination can be made regarding the relative contribution of caulking materials to PCBs in the general indoor environment.

12. What if we determine that caulking in our building is intact and not deteriorating?

Based on a review of available data collected by MDPH and others, the MDPH does not believe that intact caulking presents appreciable exposure opportunities and hence should not be disturbed for testing. As with any building, regular operations and maintenance should include a routine evaluation of the integrity of caulking material. If its condition deteriorates then the steps noted above should be followed. Consistent with EPA advice, if buildings may have materials that contain PCBs, facility operators should ensure thorough cleaning is routinely conducted.

13. Should building facilities managers include information about PCB-containing building materials in their Operations and Maintenance (O&M) plans?

Yes. All buildings should have an O&M plan that includes regular inspection and maintenance of PCB building materials, as well as thorough cleaning of surfaces not routinely used. Other measures to prevent potential exposure to PCBs include increasing ventilation, use of HEPA filter vacuums, and wet wiping. These O&M plans should be available to interested parties.

14. Are there other sources of PCBs in the environment?

Yes. The most common exposure source of PCBs is through consumption of foods, particularly contaminated fish. Because PCBs are persistent in the environment, most residents of the U.S. have some level of PCBs in their bodies.

15. Where can I obtain more information?

For guidance on replacing and disposing of PCB building materials, visit the US EPA website: http://www.epa.gov/pcbsincaulk/. For information on health concerns related to PCBs in building materials, please contact MDPH/BEH at 617-624-5757.