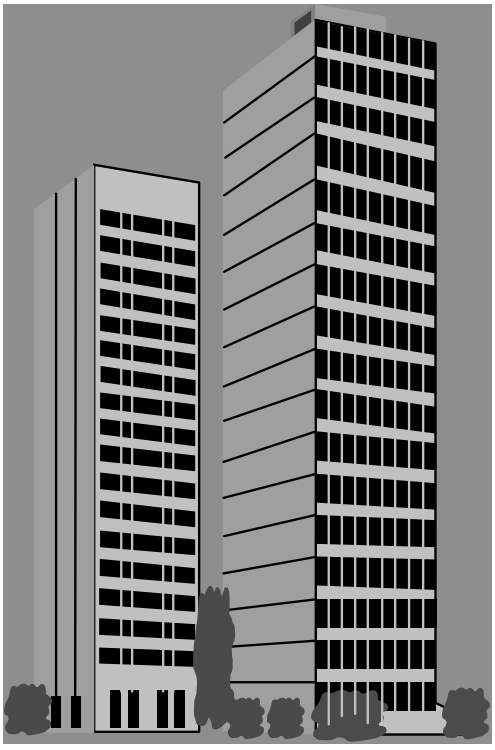
INDOOR AIR QUALITY ASSESSMENT

Department of Revenue
Child Support Enforcement Division
2 South Street
Pittsfield, Massachusetts



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Background/Introduction

In response to a request from Rosemary Day, Deputy Commissioner of the Department of Revenue (DOR), an indoor air quality assessment was done at the Child Support Enforcement Division (CSE) facility at 2 South Street, Pittsfield, Massachusetts. This assessment was conducted by the Massachusetts Department of Public Health (MDPH), Bureau of Environmental Health Assessment (BEHA).

On September 14, 2000 a visit was made to this building by Michael Feeney, Chief of Emergency Response/Indoor Air Quality (ER/IAQ). The CSE office exists in a two-story cement and steel girder building (see Picture 1). The CSE has occupied this building since 1995. Their offices are located in the south section of the second floor of this building, which contains a number of businesses and offices in downtown Pittsfield. A penthouse on the roof contains the building's heating, ventilation and air conditioning (HVAC) equipment that services the CSE office. Windows in the building do not open.

Methods

Air tests for carbon dioxide, temperature and relative humidity were taken with the TSI, Q-Trak, IAQ Monitor.

Results

The CSE has a staff of 14 employees and is visited by over 3 to 5 members of the public daily. The tests were taken under normal operating conditions. Test results appear in Tables 1-2. Air samples are listed in the tables by the location in which the air sample was taken.

Discussion

Ventilation

It can be seen from the tables that carbon dioxide levels were below comfort guidelines [800 parts per million (ppm) of carbon dioxide] in all areas surveyed. These levels are indicative of adequate ventilation in the building at the time of this assessment.

Ventilation in the building is provided by a ducted HVAC system. As previously mentioned, fresh air for the CSE is provided by an air handling unit (AHU) located in a penthouse on the roof. The AHU is connected to ducts that supply fresh air to rooms through ceiling- mounted air diffusers. Heating and cooling in occupied areas is supplemented by the use of unit ventilators (univents), which are installed along exterior walls. While fresh air supply vents were operating, most univents examined in the building were deactivated. Airflow in the building is enhanced by the operation of univents, particularly in private offices.

Exhaust ventilation is provided by infiltration of air into an open plenum above the ceiling, which returns air to the AHUs. This system has no ductwork, but uses the entire ceiling space to draw air back to the AHU. Air is drawn into the ceiling plenums through plastic grates.

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. The date of the last servicing and balancing of these systems was not available at the time of the visit.

The Massachusetts Building Code requires a minimum ventilation rate of 20 cubic feet per minute (cfm) per occupant of fresh outside air or have openable windows in each room (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 occurs 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 Department of Public Health 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.

Temperatures were measured in a range of 70^{o} F to 75^{o} F, which are within BEHA comfort guidelines. The BEHA recommends that indoor air temperatures be maintained in a range of 70^{o} F to 78^{o} F in order to provide 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 relative humidity in this building was also within the BEHA recommended comfort range in all areas sampled. Relative humidity measurements ranged from 41 percent to 48 percent. The BEHA recommends that indoor air relative humidity is comfortable in a range of 40-60%. 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

A single water-stained ceiling tile was observed in the center of the office. Water-damaged ceiling tiles can provide a source of mold and mildew and should be replaced after a water leak is discovered. CSE staff report that the leak that wetted the ceiling tile was repaired.

Plants were observed in various areas within the office space. Plants can be a source of pollen and mold, which can be a respiratory irritant to some individuals. Plants should be properly maintained and equipped with drip pans. Plants should also be located away from the air stream of mechanical ventilation to prevent aerosolization of dirt, pollen or mold. A water cooler was placed on carpeting (see Picture 2). This condition can result in the repeated moistening of carpeting, which can lead to mold growth.

Other Concerns

The AHU was equipped with a metal rack, into which the filter medium is cut to fit the filter rack (see Picture 3). This type of filter installation can result in the creation of spaces between the filter media and rack edge, which can allow for particulates to by-

pass the filters. The interiors of two univents were examined. One univent had a metal filter, which provides minimal filtration of respirable dusts (see Picture 4). The second univent did not have a filter (see Picture 5). The filters provide 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 (Minimum Efficiency Reporting Value equal to 9) would be sufficient to reduce many airborne particulates (Thornburg, D., 2000; MEHRC, 1997; ASHRAE, 1992).

Conclusions/Recommendations

In view of the findings at the time of this visit, the following recommendations are made:

1. Install replaced filters in univents.
2. In order to decrease aerosolized particulates, consider installing disposable filters with an increased dust spot efficiency in the AHU and univents. Note that increased filtration can reduce airflow by increased resistance (called "pressure drop"). Prior to any increase of filtration, each unit should be evaluated by a ventilation engineer to determine whether it can maintain function with more efficient filters.
3. Replace the water damaged ceiling tile.
4. For buildings in New England, periods of low relative humidity during the winter are often unavoidable. 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 HEPA filter equipped vacuum cleaner in conjunction with wet wiping of all surfaces is recommended. Drinking water during the day can help ease some symptoms associated with a dry environment (throat and sinus irritations).

5. Ensure all plants are equipped with drip pans. Examine drip pans periodically for mold growth and disinfect with an appropriate antimicrobial where necessary.

References

ASHRAE. 1992. Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter. American Society of Heating, Refrigeration and Air Conditioning Engineers. ANSI/ASHRAE 52.1-1992.

BOCA. 1993. The BOCA National Mechanical Code-1993. 8th ed. Building Officials & Code Administrators International, Inc., Country Club Hills, IL. M-308.1

MEHRC. 1997. Indoor Air Quality for HVAC Operators & Contractors Workbook. MidAtlanatic Environmental Hygiene Resource Center, Philadelphia, PA.

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

Thornburg, D. Filter Selection: a Standard Solution. *Engineering Systems* 17:6 pp. 74-80.

Picture 1

DOR CSE Office Located on Second Floor of Building

Picture 2

Water Cooler on Carpet

Picture 3

Metal Rack Filter in AHU

Picture 4

Univent with Metal Filter Installed in Univent

Picture 5

Univent without Filter

TABLE 1

Indoor Air Test Results – Department of Revenue, Child Support Enforcement Division, Pittsfield, MA
September 14, 2000

Remarks	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
NE - Conference Room	650	75	45	0	No	Yes	Yes	Fan coil on, door open
E – Main Cubicles	635	74	44	3	No	Yes	Yes	Fan coil off, 2 CT, plants
Office Manager's Office	584	73	41	0	No	Yes	No	Fan coil on, door open
Team Leader's Office	690	73	42	2	No	Yes	Yes	Fan coil on, , door open
Central Files	562	73	45	0	No	Yes	Yes	Fan coil off
Kitchen	567	73	47	0	No	Yes	Yes	
W – Main Cubicles	627	73	47	0	No	Yes	Yes	Fan coil-off, photocopier
W – Attorney's Office	565	73	47	0	No	Yes	Yes	Fan coil off, door open
E – Attorney's Office	565	73	46	0	Yes	Yes	Yes	Fan coil off, door open
W – Supervisor's Office	600	73	46	0	No	Yes	Yes	Fan coil off, door open

*** ppm = parts per million parts of air**
CT = water-damaged ceiling tiles

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%

TABLE 2

Indoor Air Test Results – Department of Revenue, Child Support Enforcement Division, Pittsfield, MA
September 14, 2000

Remarks	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
W – Store Room	619	72	47	0	No	Yes	Yes	Door open
File Room	581	71	47	0	No	Yes	Yes	Door open
N – Conference Room (new Receptionist)	587	71	47	0	No	Yes	Yes	Door open
Reception Desk	675	71	48	1	No	Yes	Yes	
S - Conference Room	575	70	48	0	No	Yes	Yes	
Reception Area	583	70	48	0	No	No	Yes	No fresh air supply

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