

# **INDOOR AIR QUALITY ASSESSMENT**

**Department of Revenue  
100 Trade Center Drive  
Suite 760  
Woburn, MA**



Prepared by:  
Massachusetts Department of Public Health  
Bureau of Environmental Health  
Indoor Air Quality Program  
September 2016

## Background

<b>Building:</b>	Department of Revenue (DOR)
<b>Address:</b>	100 Trade Center Drive (Suite 760), Woburn, MA
<b>Assessment Requested by:</b>	Joshua Martin, Deputy Director, Office of Facilities Management, Massachusetts DOR
<b>Reason for Request:</b>	Lease renewal IAQ status report
<b>Date of Assessment:</b>	September 9, 2016
<b>Massachusetts Department of Public Health/Bureau of Environmental Health (MDPH/BEH) Staff Conducting Assessment:</b>	Ruth Alfasso, Environmental Engineer/Inspector, IAQ Program
<b>Building Description:</b>	Single-story, flat-roofed building with basement, located in an office park. The building has several other tenants including offices, medical offices and a fitness center.
<b>Building Population:</b>	Approximately 130 employees and regular visitors
<b>Windows:</b>	Openable

## Methods

Please refer to the IAQ Manual for methods, sampling procedures, and interpretation of results (MDPH, 2015).

## IAQ Testing Results

The following is a summary of indoor air testing results (Table 1).

- **Carbon dioxide levels** were below 800 parts per million (ppm) in all areas assessed, indicating adequate fresh air in the space.
- **Temperature** was within the recommended range of 70°F to 78°F in all areas assessed.
- **Relative humidity** was within the recommended range of 40% to 60% in most areas assessed, with some readings above.
- **Carbon monoxide** levels were non-detectable in all indoor areas assessed.

- *Fine particulate matter (PM2.5)* concentrations measured were below the National Ambient Air Quality Standard (NAAQS) level of 35 µg/m<sup>3</sup> in all areas assessed.

The assessment results indicate that the ventilation system is providing adequate fresh air for the occupancy in the building. Note that some areas had low occupancy which can reduce the creation of carbon dioxide. To maximize air exchange, the BEH recommends that mechanical ventilation systems operate continuously during periods of occupancy. Without the system operating as designed, normally occurring pollutants cannot be diluted or removed, allowing them to build up and can lead to IAQ/comfort complaints.

### **Ventilation**

A heating, ventilating, and air conditioning (HVAC) system has several functions. First it provides heating and, if equipped, cooling. Second, it is a source of fresh air. Finally, an HVAC system will dilute and remove normally occurring indoor environmental pollutants by not only introducing fresh air, but by filtering the airstream and ejecting stale air to the outdoors via exhaust ventilation. Even if an HVAC system is operating as designed, point sources of respiratory irritation may exist and cause symptoms in sensitive individuals. The following analysis examines and identifies components of the HVAC system and likely sources of respiratory irritant/allergen exposure due to water damage, aerosolized dust, and/or chemicals found in the indoor environment.

Fresh air is provided by air handling units (AHUs) located on the roof. Air from the AHUs is filtered, heated/cooled, and delivered to rooms via ducted supply vents (Picture 1). Air is returned/exhausted through vents in the ceiling (Picture 1).

It is recommended that HVAC systems be re-balanced every five years to ensure adequate air systems function (SMACNA, 1994). It was reported that this system was balanced recently as a part of the lease renewal.

Restrooms are provided with dedicated exhaust ventilation to remove odors and moisture generated in these areas. Other areas, such as the janitorial storage closet (Picture 2) and the breakroom, might benefit from the installation of direct-vented exhaust ventilation to remove odors such as cleaning chemicals and cooking which were noticeable during the visit.

### **Microbial/Moisture Concerns**

Plants were observed in office areas (Table 1; Picture 3). 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 to prevent water damage to porous materials. Plants should also be located away from air diffusers to prevent the aerosolization of dirt, pollen, and mold.

Small refrigerators and water dispensers were observed in several carpeted areas. These appliances may spill or leak and lead to carpet damage and microbial growth. In some locations, the carpet was visibly stained (Picture 4). It is recommended that these appliances be located in areas without carpeting or on waterproof mats. Carpet squares could also be replaced with tile in areas where water dispensers and refrigerators are located.

In the file storage room, boxes were located on the floor where they could become moistened by condensation if humidity is high for extended periods of time.

### **Other IAQ Evaluations**

Exposure to low levels of total volatile organic compounds (TVOCs) may produce eye, nose, throat, and/or respiratory irritation in some sensitive individuals. To determine if VOCs were present, BEH/IAQ staff examined rooms for products containing VOCs. BEH/IAQ staff noted hand sanitizers, cleaners, and dry erase materials in use within the building (Table 1). All of these products have the potential to be irritants to the eyes, nose, throat, and respiratory system of sensitive individuals.

The offices were mostly carpeted. Carpets should be cleaned annually (or semi-annually in soiled/high traffic areas) in accordance with Institute of Inspection, Cleaning and Restoration Certification (IICRC) recommendations, (IICRC, 2012). Carpeting had reportedly been recently replaced in most areas of the office.

A feather duster was observed in the janitorial closet (Picture 5); feather dusters can aerosolize particulates and are not recommended for dust control. The use of wet wiping and high-efficiency particulate arrestance (HEPA) filter-equipped vacuum cleaners is recommended. In some offices, items such as paper, boxes and decorative items make it harder for custodial staff to clean. Personal fans and heaters were observed in many offices. Both can be a source of particulates if they are not kept clean; note heaters are not allowed per the terms of the lease.

## Conclusions/Recommendations

Based on observations at the time of assessment, the following is recommended:

1. Operate supply and exhaust ventilation in all areas during occupied periods.
2. Have the HVAC system balanced every 5 years in accordance with SMACNA recommendations (SMACNA, 1994).
3. Consider adding dedicated exhaust ventilation to areas such as janitorial closets and the breakroom to remove associated odors.
4. Keep indoor plants in good condition, avoid overwatering, and avoid placing them on porous items such as carpets or paper. Also, keep plants out of the air stream of supply vents.
5. Consider locating refrigerators and water dispensers in non-carpeted areas or place on a waterproof mat.
6. Avoid storing porous items such as boxes on the floor.
7. 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).
8. If windows are opened for fresh air, ensure they have intact screens and are tightly closed at the end of each day to prevent pest entry. Do not open windows during hot, humid weather to avoid creating conditions where condensation may occur indoors.
9. Reduce the use of cleaning products, sanitizers, and scented products.
10. Change filters on AHUs on a regular schedule at least twice a year.
11. Clean carpeting in accordance with IICRC recommendations (IICRC, 2012).
12. Reduce accumulated materials on flat surfaces and store in an organized manner to allow for thorough cleaning.
13. Clean the blades of personal fans periodically to avoid aerosolizing dusts.

14. Refer to resource manual and other related IAQ documents located on the MDPH's website for further building-wide evaluations and advice on maintaining public buildings. These documents are available at: <http://mass.gov/dph/iaq>.

## References

IICRC. 2012. Institute of Inspection, Cleaning and Restoration Certification. Carpet Cleaning: FAQ. Retrieved from <http://www.iicrc.org/consumers/care/carpet-cleaning/#faq>.

MDPH. 2015. Massachusetts Department of Public Health. Indoor Air Quality Manual: Chapters I-III. Available at: <http://www.mass.gov/eohhs/gov/departments/dph/programs/environmental-health/exposure-topics/iaq/iaq-manual/>.

SMACNA. 1994. HVAC Systems Commissioning Manual. 1<sup>st</sup> ed. Sheet Metal and Air Conditioning Contractors' National Association, Inc., Chantilly, VA.

**Picture 1**



**Typical supply (dark arrows) and exhaust (light arrow) vents**

**Picture 2**



**Cleaning chemicals, leading to odors in the janitorial storeroom without exhaust ventilation**

**Picture 3**



**Plants in an office**

**Picture 4**



**Refrigerator and water dispenser; note stained carpeting**

**Picture 5**



**Feather duster in janitorial closet**

Location: Department of Revenue Office

Indoor Air Results

Address: 100 Trade Center Drive, Suite 760, Woburn, MA

Table 1

Date: 9/9/2016

Location	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	Temp (°F)	Relative Humidity (%)	PM2.5 (µg/m <sup>3</sup> )	Occupants in Room	Windows Openable	Ventilation		Remarks
								Supply	Exhaust	
Background	389	0.6	77	89	28					Cloudy, hazy, hot and humid
Office 131	626	ND	75	61	13	0	N	Y	N	
Breakroom	511	ND	75	67	16	0	Y	Y	Y	NC, food/toast odor
Conference 2	491	ND	75	67	15	0	N	Y	N	DO
Mailroom	553	ND	75	60	13	0	N	Y	N	NC, mail equipment
Ladies room									Y	
Training	531	ND	75	67	16	0	N	Y	Y	Computers
Training/ videoconference	517	ND	75	67	17	0	N	Y	Y	
Files	676	ND	75	58	17	0	N	Y	Y	NC
Conference	574	ND	73	54	11	0	Y	Y	Y	

ppm = parts per million

µg/m<sup>3</sup> = micrograms per cubic meter

AI = accumulated items

CP = cleaning products

DO = door open

HS = hand sanitizer

NC = not carpeted

PF = personal fan

**Comfort Guidelines**

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

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

Location	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	Temp (°F)	Relative Humidity (%)	PM2.5 (µg/m <sup>3</sup> )	Occupants in Room	Windows Openable	Ventilation		Remarks
								Supply	Exhaust	
Office	601	ND	72	56	10	0	Y	Y	N	
Menton (cubes)	617	ND	72	57	11	1	Y	Y	Y	Plants, food, CP
Kneeland (cubes)	607	ND	72	58	10	2	Y	Y	Y	Plants, food
Hakaj (cubes)	613	ND	72	58	11	1	Y	Y	Y	Plants
Santos (cubes)	658	ND	72	58	11	0	Y	Y	Y	AI
Brown (cubes)	608	ND	72	59	11	1	Y	Y	Y	Plants, HS
Malone (office)	615	ND	72	59	11	2	Y	Y	Y	
McNamara (office)	602	ND	73	59	12	0	Y	Y	N	Thermostat on auto
Dinneen (office)	543	ND	72	60	15	0	Y	Y	N	HS, DO
Barresi (cubes)	550	ND	72	61	14	0	Y	Y	Y	Plants

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								Supply	Exhaust	
Musto (cubes)	537	ND	72	61	15	0	Y	Y	Y	PF, plants
Magee (cubes)	710	ND	74	55	11	4	Y	Y	Y	HS
Sanchez (cubes)	684	ND	74	55	11	1	Y	Y	Y	PF, heater
Magno (cubes)	670	ND	74	56	11	1	Y	Y	Y	
DeVitto (cubes)	671	ND	74	56	11	1	Y	Y	Y	WC and fridge on carpet
Duarte (cubes)	666	ND	75	55	10	2	Y	Y	Y	Plant
Jean (cubes)	646	ND	73	55	11	2	Y	Y	Y	Plants, AI, heater
Aretusi (cubes)	663	ND	73	56	10	1	Y	Y	Y	PF, HS
Vacca (cubes)	650	ND	73	56	11	4	Y	Y	Y	HS, PF
Candage (cubes)	693	ND	73	57	11	2	Y	Y	Y	Plant

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								Supply	Exhaust	
Mari (cubes)	679	ND	73	57	11	2	Y	Y	Y	
Interview	701	ND	73	63	12	0	N	Y	N	
Storage										
# 126 office	623	ND	74	61	13	0	N	Y	N	Food
Prusic (cubes)	570	ND	73	61	15	5	Y	Y	Y	Noisy air supply
Livingston (cubes)	586	ND	74	60	14	1	Y	Y	Y	PF
Luongo (cubes)	579	ND	75	59	14	1	Y	Y	Y	Warm air
Coscia (cubes)	572	ND	75	59	14	0	Y	Y	Y	
Cravotta (cubes)	580	ND	75	59	15	2	Y	Y	Y	
Palumbo (cubes)	561	ND	74	57	14	1	Y	Y	Y	PF

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Temperature: 70 - 78 °F  
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Location: Department of Revenue Office

Indoor Air Results

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Table 1 (continued)

Date: 9/9/2016

Location	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	Temp (°F)	Relative Humidity (%)	PM2.5 (µg/m <sup>3</sup> )	Occupants in Room	Windows Openable	Ventilation		Remarks
								Supply	Exhaust	
Baltodano (cubes)	592	ND	74	57	13	1	Y	Y	Y	
Nangle (cubes)	576	ND	74	58	14	1	Y	Y	Y	Plants, heater
Office 118	585	ND	74	58	13	0	N	Y	N	DO
Holdsworth (cubes)	632	ND	75	56	13	3	Y	Y	Y	
Zampella (cubes)	665	ND	75	55	11	2	Y	Y	Y	Skylight, food

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