INDOOR AIR QUALITY ASSESSMENT

Commonwealth of Massachusetts
Department of Children and Families
Massachusetts Rehabilitation Commission
110 Mulberry Street
Brockton, MA

Prepared by:
Massachusetts Department of Public Health
Bureau of Environmental Health
Indoor Air Quality Program
May 2014

Background/Introduction

In response to a request from Dave Devine, Project Manager, Division of Capital Asset Management and Maintenance (DCAMM), the Massachusetts Department of Public Health (MDPH), Bureau of Environmental Health (BEH) conducted a post-occupancy indoor air quality (IAQ) assessment at the Department of Children and Families (DCF) and Massachusetts Rehabilitation Commission (MCR) Brockton area offices, located at 110 Mulberry Street, Brockton, Massachusetts. This evaluation was conducted as part of enhanced efforts to ensure acceptable IAQ of office space leased by Massachusetts state agencies. On April 7, 2014, a visit to conduct an IAQ assessment was made by Cory Holmes, Environmental Analyst/Inspector and Ruth Alfasso, Environmental Engineer/Inspector, from BEH's IAQ Program.

The Department of Transitional Assistance (DTA) had previously occupied space on the first floor of the building. In January of 2013, tenants were relocated and the building was significantly remodeled, including updates to the heating, ventilating and air conditioning (HVAC) systems, new office layouts, new carpeting and furnishings. In September 2013, the DCF legal department took occupancy of the second floor and the first floor was occupied, by MRC and DCF staff, in November 2013.

The building has two-stories with a flat rubber roof originally built as offices for a telecom company. The current layout includes offices, open work areas (cubicles), conference and hearing rooms, storage, and kitchen/utility areas. The flooring in most areas of the building is covered with carpet tiles. Windows in the building were originally openable but have been rendered unopenable.

Methods

Air tests for carbon dioxide, carbon monoxide, temperature, and relative humidity were taken with the TSI, Q-Trak, IAQ Monitor 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. Testing for Total Volatile Organic Compounds (TVOCs) was conducted using a MiniRAE 2000 photoionization detector. BEH/IAQ staff also performed a visual inspection of building materials for water damage and/or microbial growth.

Results

The combined employee population of the DTA and MRC offices is approximately 100 and up to 25 visitors may access the space daily. Test results appear in Table 1 and are listed by numerical designation for offices and one of the numerical designations in a group of cubicles.

Discussion

Ventilation

It can be seen from Table 1 that carbon dioxide levels were above 800 parts per million (ppm) in 58 out of 101 areas tested, indicating limited air exchange in more than half the areas surveyed at the time of assessment. Most of the areas on the first floor had levels below 800 ppm, while most areas on the second floor had levels above 800 ppm (Table 1).

Fresh air is provided by rooftop air-handling units (AHUs; Picture 1). Fresh air is drawn into the AHUs through a bank of air filters, heated or cooled and delivered to occupied areas via ducted air diffusers (Picture 2). Return air is drawn into ceiling -mounted vents (Picture 3) or vents around light fixtures (Picture 2) and ducted back to rooftop AHUs.

The HVAC system is controlled by digital thermostats. Thermostats examined had a fan switch with 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 pre-set temperature. Once the pre-set temperature is reached, the HVAC system is deactivated. Therefore, no mechanical ventilation is provided until the thermostat re-activates the system. At the time of assessment, all thermostat fan setting were in the "auto" position. As mentioned, this thermostat setting can limit airflow. The MDPH typically recommends that thermostats be set to the fan *on* setting during occupied hours to provide continuous air circulation.

Occupancy levels on both floors of the building were similar, which suggests that thermostat settings on the second floor or the AHUs serving that floor may need adjustment to supply additional fresh air to those areas with levels of carbon dioxide above 800 ppm.

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 HVAC systems be re-balanced every five years to ensure adequate air systems function (SMACNA, 1994). Reportedly, the HVAC system was balanced following the renovation.

Minimum design ventilation rates are mandated by the Massachusetts State Building Code (MSBC). Until 2011, the minimum ventilation rate in Massachusetts was higher for both occupied office spaces and general classrooms, with similar requirements for other occupied spaces (BOCA, 1993). The current version of the MSBC, promulgated in 2011 by the State

Board of Building Regulations and Standards (SBBRS), adopted the 2009 International Mechanical Code (IMC) to set minimum ventilation rates. **Please note that the MSBC is a minimum standard that is not health-based**. At lower rates of cubic feet per minute (cfm) per occupant of fresh air, carbon dioxide levels would be expected to rise significantly. A ventilation rate of 20 cfm per occupant of fresh air provides optimal air exchange resulting in carbon dioxide levels at or below 800 ppm in the indoor environment in each area measured. MDPH recommends that carbon dioxide levels be maintained at 800 ppm or below. This is because most environmental and occupational health scientists involved with research on IAQ and health effects have documented significant increases in indoor air quality complaints and/or health effects when carbon dioxide levels rise above the MDPH guidelines of 800 ppm for schools, office buildings and other occupied spaces (Sundell et al., 2011). 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 temperature measurements at the time of assessment ranged from 71° F to 77° F (Table 1), which were within the MDPH recommended comfort range. 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. In a few areas, direct sunlight was streaming through windows (solar gain, Table 1), which can contribute to fluctuations in temperature and feelings of thermal discomfort. Shades should be used in these areas to moderate the impact of direct sunlight.

Indoor relative humidity measurements at the time of assessment ranged from 19 to 29 percent (Table 1), which were below the MDPH recommended comfort range. 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. Water-damaged ceiling tiles were observed in a few areas (Table 1; Picture 5). According to building occupants in one area of the second floor, there had been a significant leak reportedly from the HVAC system above and that the ceiling tiles had been recently changed.

Water-damaged ceiling tiles can provide a source of mold and should be replaced after a water leak is discovered and repaired. If leaks from the HVAC system continue to occur, an HVAC technician should be consulted about repairs to the system or condensate drainage.

The US Environmental Protection Agency (US EPA) and the American Conference of Governmental Industrial Hygienists (ACGIH) recommend that porous materials (e.g., carpeting, gypsum wallboard) 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 some areas (Table 1). 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.

Water dispensing equipment and small refrigerators were observed in carpeted areas (Table 1; Picture 6). Spills or leaks from this equipment can moisten carpet and lead to microbial growth and carpet degradation. In addition, gaskets in one of the kitchen refrigerators was found to be colonized with mold (Picture 7), which can result in odors and exposure to mold spores. All refrigerators should be cleaned regularly and if gaskets and other components cannot be adequately cleaned with an anti-microbial agent, they should be replaced.

A ductless air conditioning unit was observed in one conference room (Picture 8). These units typically have a condensation drain to remove accumulated moisture. The drain should be inspected regularly to ensure that it is not leaking into the wall cavity or becoming stagnant where it can create odors.

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 and particulate matter with a diameter of 2.5 micrometers (μm) or less (PM2.5) can produce immediate, acute health effects upon exposure. To determine whether combustion products were present in the indoor environment, BEH/IAQ staff obtained measurements for carbon monoxide and PM2.5.

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, 2011). 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. Outdoor carbon monoxide concentrations were 1.6 ppm the day of assessment (Table 1). No measureable levels of carbon monoxide were detected in the building during the assessment (Table 1).

Particulate Matter

The US EPA has established NAAQS limits for exposure to particulate matter. Particulate matter includes airborne solids, which can result in eye and respiratory irritation if exposure occurs. 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 9 μg/m^3 (Table 1). PM2.5 levels measured indoors ranged from 6 to 11 μg/m^3 (Table 1), which were below the NAAQS PM2.5 level of 35 μg/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 in buildings can generate particulate matter 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

Indoor air concentrations can be greatly impacted by the use of products containing volatile organic compounds (VOCs). VOCs are carbon-containing substances that have the ability to evaporate at room temperature. Total volatile organic compounds (TVOCs) can result in eye and respiratory irritation if exposure occurs. For example, chemicals evaporating from a paint can stored at room temperature would most likely contain VOCs. In an effort to determine whether VOCs were present in the building, air monitoring for TVOCs was conducted.

Outdoor air samples were taken for comparison. Outdoor TVOC concentrations were measured at 1.0 ppm (Table 1). Indoor measurements of TVOCs ranged from non-detect (ND) to 1.3 ppm (Table 1). These low levels of TVOCs are likely associated with outdoor/background concentrations combined with the relatively new office furnishings and use of products containing VOCs in the office (see below).

Hand sanitizer was found in many offices and common areas (Table 1). Hand sanitizer products may contain ethyl alcohol and/or isopropyl alcohol, which are highly volatile and may

be irritating to the eyes and nose and may contain fragrances to which some people may be sensitive.

Photocopiers were located in several areas. VOCs and ozone can be produced by photocopiers, particularly if the equipment is older and in frequent use. Ozone is a respiratory irritant (Schmidt Etkin, 1992). It was noted that most copiers were located in areas not directly adjacent to occupied areas, which is recommended. However, no dedicated exhaust ventilation was observed near copiers. One copier was observed to have a *supply* vent directly above it (Picture 9), which may push/distribute odors and particulates from the use of the photocopier to other areas of the office.

Cleaning products were found in a number of areas throughout the building (Table 1). Cleaning products contain chemicals that can be irritating to the eyes, nose and throat of sensitive individuals. These products should be properly labeled. Consideration should be given to working with building management to provide staff with cleaning products and supplies consistent with lease agreements to prevent any potential for adverse chemical interactions.

Other Conditions

Other conditions that can affect indoor air quality were observed during the assessment. Filters in AHUs located on the roof were examined and some were found to be the wrong size for the units (Picture 10). Filter should be correctly sized to fit into AHU filter racks without gaps that can allow unfiltered air to bypass.

Heaters, personal fans and air purifying units were observed in some offices. These items should be kept clean and free of debris. Personal air purifying units should be maintained in accordance with manufacturer's instructions to prevent them becoming a source of particulates and odors.

In some offices, a large number of items were on flat surfaces (e.g., floors, windowsills, tabletops), which provide a source for dusts to accumulate (Picture 11). These items (e.g., papers, folders, boxes) make it difficult for areas to be cleaned. Items should be relocated and/or be cleaned periodically to avoid excessive dust build up. In addition, dust and debris can accumulate on flat surfaces (e.g., desktops, shelving and carpets) in occupied areas and subsequently be re-aerosolized causing further irritation. Storage areas, including those for clothing and car seats, were examined and appeared well-designed for the items stored, although some items were found on floors in storerooms and many of the plastic totes were open with items spilling out of them (Picture 12). Keeping items off the floor and totes sealed will protect the stored items from dust and moisture.

Food and food preparation equipment was observed in many offices and common areas. Food should be kept in tightly-sealed containers to prevent attracting pests and food preparation equipment should be kept clean and free of debris that can cause odors, smoke when heated or attract pests.

Most areas in the offices are carpeted; 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).

Conclusions/Recommendations

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

1. Set thermostats to the fan “on” position to provide continuous air circulation/filtration during business hours. Consult with an HVAC technician to increase fresh air intake/delivery, particularly on the second floor.

2. Consider adopting a balancing schedule of every 5 years for all mechanical ventilation systems, as recommended by ventilation industrial standards (SMACNA, 1994).
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. Replace water-damaged ceiling tiles when a leak is discovered and repaired. If chronic HVAC leaks occur, consult with an HVAC engineer to repair systems. Staff should be encouraged to report building leaks to management for prompt remediation.
5. Avoid overwatering of plants. Ensure flat surfaces around plants are free of potting soil and other plant debris. Examine drip pans periodically for mold growth and disinfect with an appropriate antimicrobial where necessary.
6. Place refrigerators and water dispensing equipment in non-carpeted areas or consider using a waterproof mat to contain spills or leaks.
7. Ensure refrigerators are cleaned out regularly. Clean moldy gaskets with a mild detergent or antimicrobial agent, if cannot be adequately cleaned consider replacing. Consider reducing the number of refrigerators in use in the office.
8. Monitor the condensation drain from ductless air conditioners for leaks and stagnant water.

9. When possible, move photocopiers to areas with exhaust ventilation; consider removing the supply vent over the photocopier shown in Picture 9.

10. Use properly sized filters in rooftop AHUs and change in accordance with manufacturer's recommendations.

11. Clean/maintain heaters, personal fans and air purifiers regularly to prevent aerosolization of dust and debris.

12. Relocate or consider reducing the amount of stored materials in offices to allow for more thorough cleaning. Move items from floors when possible. Clean items regularly with a wet cloth or sponge to prevent excessive dust build-up.

13. Continue to use shelving and totes/bins in storerooms and keep bins closed when not in use.

14. Ensure that food is kept tightly sealed and food preparation equipment is cleaned regularly to prevent smoke, odors and attracting of pests.

15. 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://1.cleancareseminars.net/?page_id=185 (IICRC, 2005).

16. Refer to resource manual and other related indoor air quality 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.

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Picture 1

Air handling unit (AHU) on the roof

Picture 2

Typical supply diffuser

Picture 3

Typical exhaust grate

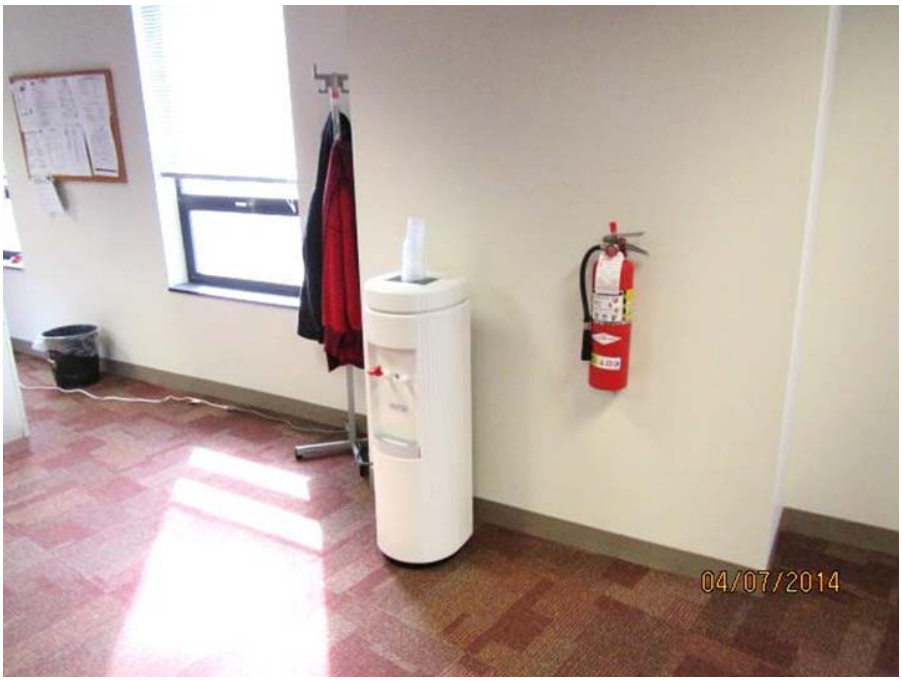
Picture 4

Thermostat in the office

Picture 5

Water-damaged ceiling tile

Picture 6



Water dispenser on carpet

Picture 7

Mold-colonization (dark staining) on refrigerator gasket

Picture 8

Ductless air conditioning unit

Picture 9

Photocopier directly below supply vent

Picture 10

Opened rooftop AHU showing wrong-sized filter

Picture 11

Items in an office

Picture 12

Stored items in open totes

Location: EOHHS center **Indoor Air Results**

Address: 110 Mulberry Street **Date: 4/7/2014**

Table 1

Location	Carbon Dioxide (ppm)	Temp (°F)	Relative Humidity (%)	Carbon Monoxide (ppm)	PM2.5 ($\mu g/m^3$)	TVOC (ppm)	Occupants in Room	Windows Openable	Ventilation Supply	Ventilation Exhaust	Comments
Background	387	60	17	1.6	9	1.0					Sunny, hazy, parking lot
1017 mail	720	74	21	ND	6	1	0	N	Y	Y	
1020	839	75	21	ND	8		0	N	Y	N	HS, AP, DO
1021	810	75	23	ND	7	1	0	N	Y	N	DO, WD CT, food, HS, CP
1022 office	815	75	21	ND	7	1	0	N	Y	N	DO, water dispenser on carpet in hall
1025 cube	807	75	22	ND	7	1	1	N	Y	Y	
1030 cube	802	75	22	ND	7	1	1	N	Y	Y	Food, plants
1032 cube	859	75	23	ND	7	1	2	N	Y	Y	Door to outside (tight)
1037 cube	811	75	22	ND	7	1	2	N	Y	Y	Items, food
1040 half-wall	798	75	21	ND	7	1	0	N	Y	Y	Items, HS, CP

ppm = parts per million
ND = non detect
$\mu g/m^3$ = micrograms per cubic meter
AC = air conditioner
CP = cleaning products
CT = ceiling tile
DO = door open
HS = hand sanitizer
NC = non-carpeted
PF = personal fan
WD = water-damaged
DEM = dry erase materials

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: EOHHS center **Indoor Air Results**

Address: 110 Mulberry Street **Table 1** **Date: 4/7/2014**

Location	Carbon Dioxide (ppm)	Temp (°F)	Relative Humidity (%)	Carbon Monoxide (ppm)	PM2.5 ($\mu g/m^3$)	TVOC (ppm)	Occupants in Room	Windows Openable	Ventilation Supply	Ventilation Exhaust	Comments
1041	790	75	21	ND	6	1	0	N	Y	Y	HS, plant
1051 office	747	74	21	ND	7	1	0	N	Y	N	DO, food
1052 office	713	74	21	ND	7	1	0	N	Y	N	DO, CP
1053 cubes	722	74	21	ND	8	1	2	N	Y	Y	Printer/copier nearby
1055 cubes	690	74	21	ND	7	0.9	0	N	Y	Y	NC
1056	724	74	21	ND	7	1	2	N	Y	N	DO, food
1057 cubes	782	74	21	ND	7	1	1	N	Y	Y	Food
1060 cubes	810	74	21	ND	7	1	1	N	Y	Y	
1070 office	683	76	19	ND	6	1	0	N	Y	Y	DO
1071 office	708	75	20	ND	7	0.9	0	N	Y	Y	DO, plush chair

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1072 office	730	75	21	ND	6	0.9	0	N	Y	Y	DO
1075 office	678	75	20	ND	7	0.9	1	N	Y	Y	Plant, items on floor, CP
1076 office	725	75	20	ND	7	1	1	N	Y	Y	Plant
1077 office	730	75	20	ND	7	1	1	N	Y	Y	DO, papers on floor
1078 office	735	76	20	ND	7	1	0	N	Y	Y	DO
1080 conference	781	75	20	ND	7	1	3	N	Y	N	Electric wall-mounted AC
1081 office	761	77	19	ND	7	1	0	N	Y	N	DO
1082 office	869	77	21	ND	7	1	1	N	Y	N	Plants on carpet, solar gain, DO
1083 office	741	77	20	ND	7	1	1	N	Y	N	DO, potpourri, plants
1089	733	77	20	ND	6	0.9	1	N	Y	Y	Items

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1089 cubes	758	76	21	ND	7	1	0	N	Y	Y	Printer
1092 cubes	731	76	21	ND	7	0.9	0	N	Y	Y	Plant
1095 cubes	785	72	21	ND	7	0.9	2	N	Y	Y	
1097 cubes	766	76	21	ND	7	0.9	0	N	Y	Y	Water dispenser on carpet, solar gain
1111	703	76	22	ND	6	0.9	1	N	Y	Y	Vacant area
1113 storage	773	76	21	ND	7	0.9	0	N	Y	Y	NC, boxes on floor
1114 office	766	76	22	ND	7	0.9	1	N	Y	N	DO
1115 office	729	75	21	ND	7	0.9	0	N	Y	N	DO, boxes on floor
1118 office	713	75	20	ND	7	0.9	0	N	Y	N	DO, heater, items on floor, food
1119 office	707	76	21	ND	7	0.9	0	N	Y	N	DO, fridge on carpet, items

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Location	Carbon Dioxide (ppm)	Temp (°F)	Relative Humidity (%)	Carbon Monoxide (ppm)	PM2.5 ($\mu g/m^3$)	TVOC (ppm)	Occupants in Room	Windows Openable	Ventilation Supply	Ventilation Exhaust	Comments
1122 cube	706	75	20	ND	7	0.9	0	N	Y	Y	
1124 office	704	76	21	ND	7	0.9	0	N	Y	N	DO
1125 office	749	76	21	ND	7	0.9	0	N	Y	N	DO, slight fruit/cleaner odor
1127 cube	718	76	21	ND	7	0.9	1	N	Y	Y	
1129 office	776	76	22	ND	7	0.9	1	N	Y	N	DO, fridge on carpet, box on floor
1131 office	793	76	20	ND	7	0.9	1	N	Y	N	DO
1132 cubes	799	76	21	ND	6	0.9	2	N	Y	Y	Items
1133	815	76	21	ND	7	0.9	0	N	Y	N	DO, PF, solar gain
1st floor kitchen	661	74	23	ND	7	0.9	1	N	Y	Y	2 refrigerators, microwave, toasters, sink, NC
1st floor law library	726	74	21	ND	7	1	0	N	Y	N	DO, books

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Carbon Dioxide: < 600 ppm = preferred
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Temperature: 70 - 78 °F
Relative Humidity: 40 - 60%

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1st floor staff ladies room								N	Y	Y	New wallboard near sink
1st floor waiting area	700	72	23	ND	7	0.9	0	N	Y	Y	
1st main floor reception	759	75	21	ND	6	1	2	N	Y	Y	Printer, mailing equipment, perfume odor
2001 office	831	72	23	ND	11	1.0	0	N	Y	Y	
2003 office	886	72	25	ND	8	1.1	0	N	Y	Y	DO, 1 WD CT
2006 cube	1160	74	27	ND	10	1.2	0	N	Y	Y	DO
2007 cubes	1200	75	26	ND	9	1.2	1	N	y	Y	
2012 cube	1063	74	25	ND	8	1.1	1	N	Y	Y	
2013	1035	74	25	ND	9	1.1	0	N	Y	Y	DO
2014	1030	74	25	ND	9	1.1	0	N	Y	Y	DO

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2015 office	1142	75	26	ND	8	1.1	0	N	Y	Y	DO, heater
2016 office	1532	75	28	ND	10	1	1	N	Y	Y	Perfume odor
2017 office	1168	75	25	ND	10	1	1	N	Y	Y	Fridge
2018	1143	75	26	ND	9	1.2	0	N	Y	Y	DO
2019	1142	75	26	ND	9	1.1	1	N	Y	Y	
2021	1182	75	25	ND	9	1.2	2	N	Y	Y	DO
2022 office	1132	75	26	ND	9	1.1	2	N	Y	Y	PF
2028 cubes	1084	75	24	ND	10	1.2	2	N	Y	Y	
2029 office	1057	75	23	ND	10	1.1	0	N	Y	Y	Fridge on carpet
2030 office	1144	75	25	ND	10	1.2	0	N	Y	Y	Fridge, area rug, DO

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2031 office	1064	75	23	ND	10	1.2	0	N	Y	Y	Food, CP, HS
2032 cubes	1070	75	24	ND	10	1.2	2	N	Y	Y	PF
2041 cubes	1040	75	23	ND	10	1.2	2	N	Y	Y	
2046 records								N			NC
2047 office	1043	76	23	ND	11	1.2	0	N	Y	Y	DEM, fridge, DO
2048 kitchen	1060	76	23	ND	8	1.2	0	N	Y	Y	NC, fridge, toasters, microwave
2053 cubes	1025	75	22	ND	10	1.2	4	N	Y	Y	Items, food
2055 office	1048	75	23	ND	8	1.2	2	N	Y	Y	Heater, 2 refrigerators, DO
2058 cube	1087	75	25	ND	9	1.2	0	N	Y	Y	Items
2064 conference	1066	76	22	ND	9	1.2	0	N	Y	Y	DO, DEM

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2065 office	1076	76	23	ND	9	1.2	0	N	Y	Y	DO
2066 office	1140	76	23	ND	9	1.2	1	N	Y	Y	Plant, fridge, fabric chair, DO
2067 office	1333	76		ND	10	1.2	2	N	Y	Y	Items, bike, fridge
2068 office	1138	75	24	ND	10	1.2	1	N	Y	Y	DO, fridge on carpet
2074 cube	1091	75	24	ND	9	1.2	4	N	Y	Y	Items on floor
2074 office	698	75	21	ND	8	0.9	1	N	Y	N	DO, thermostat
2075 office	1117	75	24	ND	9	1.1	0	N	Y	Y	Heater, fridge
2076 cubes	1110	74	24	ND	9	1.3	1	N	Y	Y	Printer
2079 office	1104	74	25	ND	9	1.3	1	N	Y	Y	Fridge
2080 office	1117	74	24	ND	9	1	1	N	Y	Y	DO, fridge

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2086 cubes	1107	74	24	ND	9	1	1	N	Y	Y	WD CT, items
2092 cubes	1114	74	24	ND	9	1	2	N	Y	Y	
2098 cubes	1095	74	24	ND	9	1	1	N	Y	Y	Plants, boxes on floor
2099 cubes	1101	74	24	ND	9	1	1	N	Y	Y	
2109 cubes	1100	74	24	ND	8	1	3	N	Y	Y	Plants, items, recycling
2111 office	1133	74	25	ND	10	1	2	N	Y	Y	Fridge, food, DEM, DO
2112 office	1096	74	25	ND	8	1	1	N	Y	N	DO, fridge on carpet
2113 office	1330	73	26	ND	8	1	2	N	Y	N	DO, fridge on carpet, cut flowers
2114 office	1390	72		ND	9	1	2	N	Y		Plants, cut flowers, fridge on carpet
2120 cubes	1104	74	25	ND	9	1	4	N	Y	Y	CT reportedly recently changed, reported AC leak, one WD CT

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2121 storage	782	71	22	ND	10	1	0	N	Y	N	Stored items in bins, some items not enclosed
2123 cube	1022	73	26	ND	9	1	4	N	Y	Y	Food, HS
2128 cube	1030	72	25	ND	9	1	2	N	Y	N	plants
2135 cube	1161	75	29	ND	9	1.2	3	N	Y	Y	Items, hanging items from ceiling
2nd floor car seat storage								N			Boxes on floor, NC
2nd floor storage								N			

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