INDOOR AIR QUALITY
POST-OCCUPANCY ASSESSMENT

Department of Industrial Accidents
1 Congress Street
Boston, Massachusetts

Prepared by:
Massachusetts Department of Public Health
Bureau of Environmental Health
Indoor Air Quality Program
October 2010

Background/Introduction

In response to a request from Martha Goldsmith, Director of Leasing, Division of Capital Asset Management (DCAM), the Massachusetts Department of Public Health (MDPH), Bureau of Environmental Health (BEH), conducted post-occupancy indoor air quality (IAQ) testing at the Department of Industrial Accidents (DIA), 1 Congress Street, Boston, Massachusetts. This IAQ evaluation was done as part of a new effort to assess indoor air quality of office space leased by Massachusetts state agencies shortly after taking occupancy. On August 17, 2010, a visit to conduct an indoor air quality assessment was made by Michael Feeney, Director, of BEH's IAQ Program. Mr. Feeney was accompanied by Cory Holmes and Sharon Lee, Environmental Analysts within BEH's IAQ Program.

The building is a multi-story structure consisting of office space located above a parking garage. The DIA occupies the western portion of the tenth floor, which consists of office space, open work areas and conference/meeting rooms. The building has no openable windows.

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. Screening for total volatile organic compounds was conducted using a Thermo Environmental Instruments Inc., Model 580 Series Photo Ionization Detector (PID). BEH staff also performed visual inspection of building materials for water damage and/or microbial growth.

Results

The tests were taken during normal operations. Test results appear in Table 1.

Discussion

Ventilation

It can be seen from Table 1 that carbon dioxide levels were below 800 parts per million (ppm) in all but one of 127 areas assessed, indicating optimal air exchange at the time of the assessment (Table 1). Fresh air is provided by rooftop air-handling units (AHUs). Fresh air is drawn into the AHUs through a bank of pleated air filters, heated or cooled and delivered to occupied areas via ducted air diffusers. Return air is drawn into an above ceiling plenum and ducted back to the rooftop AHUs.

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 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 ranged from 65°F to 77°F (Table 1), which were below the MDPH recommended comfort range in some areas. The MDPH recommends that indoor air temperatures be maintained in a range of 70 ^{o} F to 78 ^{o} F in order to provide for the comfort of building occupants. A number of temperature/comfort complaints were expressed by DIA staff. Since this is newly occupied space, DIA management and staff should work with building management to determine appropriate heating/cooling settings. 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.

Relative humidity measurements ranged from 45 to 59 percent, which were within the MDPH recommended comfort range the day of the assessment (Table 1). The MDPH recommends a comfort range of 40 to 60 percent for indoor air relative humidity. Relative humidity levels in the building would be expected to drop during the winter months due to heating. 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

Occupants in perimeter offices indicated that some windows were experiencing leaks. The window design at the DIA office is prone to leakage over time (Pictures 1 and 2). It was reported that during the building's renovation for the DIA, these windows were examined and attempts were made to reseal them to prevent leaks. These windows should be monitored and occupants should report leaks to the building's maintenance liaison/department for further evaluation/repair as necessary.

Other Indoor Air 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 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 affects. 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 in 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 18 $\mu g/m^3$ (Table 1). PM2.5 levels measured indoors ranged from 1 to 12 $\mu g/m^3$ (Table 1), which 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 in buildings can generate particulate during normal operations. Sources of indoor airborne particulates may include but are not limited to particles generated during the operation of fan belts in the HVAC system, use of stoves and/or microwave ovens in kitchen areas; use of photocopiers, fax machines and computer printing devices; operation of an ordinary vacuum cleaner and heavy foot traffic indoors.

Volatile Organic Compounds

Indoor air concentrations can be greatly impacted by the use of products containing volatile organic compounds (VOCs) within the building. VOCs are carbon-containing substances that have the ability to evaporate at room temperature. Frequently, exposure to low levels of total volatile organic compounds (TVOCs) may produce eye, nose, throat and/or respiratory irritation in some sensitive individuals. 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 the day of the assessment were ND (Table 1). Indoor TVOCs measured from ND to a slight detection of 0.2 ppm in a few areas (Table 1), likely attributed to new building furnishings (carpeting, desks/furniture, work space dividers, etc.).

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 operate the ventilation system continuously during business hours. This will aid in removing any lingering odors and/or TVOCs from new building furnishings that may be present.
2. DIA management/staff should work with building management to identify areas of uneven heating/cooling to determine appropriate heating/cooling settings.
3. Change filters for air handling equipment as per the manufacturer's instructions or more frequently if needed.
4. Consider adopting a balancing schedule of every 5 years for all mechanical ventilation systems, as recommended by ventilation industrial standards (SMACNA, 1994).
5. Monitor windows for signs of water infiltration or leakage and report to building management for prompt remediation.
6. Do not store porous items (cardboard, paper, etc.) in areas of known leaks to prevent water damage/mold growth.

7. 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.

References

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

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

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

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

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

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

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

Picture 1

Window system at the DIA

Picture 2

Window system at the DIA

Location: Department of Industrial Accidents **Indoor Air Results**

Address: 1 Congress St, Boston, MA **Table 1** **Date: 8/17/2010**

Location/ Room	Occupants in Room	Temp (°F)	Relative Humidity (%)	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	TVOCs (ppm)	PM2.5 ($\mu g/m^3$)	Windows Openable	Ventilation		Remarks
									Supply	Exhaust	
Background (Outdoors)		82	62	364	ND	ND	18				
10-002 (PI Desk)	1	74	52	551	ND	ND	8	N	Y	Y	
10-003 Copy Room	1	72	49	700	ND	ND	2	N	Y	Y	DO
10-004	1	73	51	610	ND	ND	2	N	Y	Y	
10-005	0	72	47	711	ND	ND	2	N	Y	Y	DO
10-006	0	71	46	681	ND	ND	2	N	Y	Y	DO
10-007	0	72	45	622	ND	ND	1	N	Y	Y	DO
10-008	1	73	45	666	ND	ND	1	N	Y	Y	DO
10-009	0	73	46	870	ND	ND	1	N	Y	Y	DO
10-009 E	5	74	56	540	ND	ND	10	N	Y	Y	

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DO = door open

PF = personal fan

PC = photo copier

Comfort Guidelines

Carbon Dioxide:	< 600 ppm = preferred	Temperature:	70 - 78 °F
	600 - 800 ppm = acceptable	Relative Humidity:	40 - 60%
	> 800 ppm = indicative of ventilation problems	Particle matter 2.5	< 35 ug/m^3

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Table 1 (continued)

Location/ Room	Occupants in Room	Temp (°F)	Relative Humidity (%)	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	TVOCs (ppm)	PM2.5 (µg/m^3)	Windows Openable	Ventilation		Remarks
									Supply	Exhaust	
10-009 W	5	74	55	535	ND	ND	10	N	Y	Y	
10-010	0	73	46	685	ND	ND	1	N	Y	Y	DO
10-011	1	73	46	763	ND	ND	3	N	Y	Y	
10-013	1	74	46	657	ND	ND	2	N	Y	Y	DO
10-0133A	5	72	51	580	ND	ND	2	N	Y	Y	PC
10-0133B	2	72	51	577	ND	ND	3	N	Y	Y	
10-0133C	3	73	51	587	ND	ND	1	N	Y	Y	
10-0133D	2	73	51	581	ND	ND	2	N	Y	Y	
10-016	0	74	45	645	ND	ND	2	N	Y	Y	DO
10-017A	4	72	47	761	ND	ND	1	N	Y	Y	

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									Supply	Exhaust	
10-017B	0	72	47	672	ND	ND	1	N	Y	Y	
10-017C	0	72	48	705	ND	ND	1	N	Y	Y	
10-017D	1	72	50	656	ND	ND	1	N	Y	Y	
10-018	3	75	49	762	ND	ND	2	N	Y	Y	
10-018	1	72	51	785	ND	ND	1	N	Y	Y	
10-020	0	75	50	632	ND	ND	2	N	Y	Y	
10-024	1	75	52	693	ND	ND	3	N	Y	Y	PF
10-025	3	75	53	703	ND	ND	2	N	Y	Y	DO
10-026	0	75	53	696	ND	ND	2	N	Y	Y	DO
10-027	0	74	55	679	ND	ND	2	N	Y	Y	DO

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									Supply	Exhaust	
10-028	5	74	52	570	ND	ND	3	N	Y	Y	
10-040	0	72	53	484	ND	ND	10	N	Y	Y	
10-041	0	73	53	485	ND	ND	10	N	Y	Y	
10-042	1	74	54	540	ND	ND	10	N	Y	Y	
10-043	1	73	54	694	ND	ND	2	N	Y	Y	PF
10-050	0	75	53	560	ND	ND	10	N	Y	Y	
10-051	1	75	54	564	ND	ND	10	N	Y	Y	
10-052	1	75	55	589	ND	ND	10	N	Y	Y	
10-054	1	75	55	566	ND	ND	10	N	Y	Y	
10-056	1	74	55	538	ND	ND	10	N	Y	Y	

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									Supply	Exhaust	
10-059	1	74	55	587	ND	ND	10	N	Y	Y	
10-060	0	74	53	499	ND	ND	10	N	Y	Y	
10-061	0	74	52	510	ND	ND	11	N	Y	Y	
10-062	3	74	52	533	ND	ND	11	N	Y	Y	
10-063	0	74	52	507	ND	ND	10	N	Y	Y	
10-064	0	74	59	477	ND	ND-0.1	10	N	Y	Y	PF
10-070 (Waiting)	1	74	53	504	ND	ND	8	N	Y	Y	
10-072	0	75	53	500	ND	ND	8	N	Y	Y	DO
10-073 (Office)	1	75	53	451	ND	ND	8	N	Y	Y	DO, PF
10-074	0	74	52	611	ND	ND	2	N	Y	Y	DO

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									Supply	Exhaust	
10-075	1	75	52	647	ND	ND	2	N	Y	Y	PF DO
10-076A	2	75	54	487	ND	ND	8	N	Y	Y	
10-076B	0	74	54	456	ND	ND	8	N	Y	Y	
10-077	1	75	57	668	ND	ND	3	N	Y	Y	PF DO
10-082A	2	74	53	437	ND	ND	8	N	Y	Y	
10-082B	2	74	54	504	ND	ND	9	N	Y	Y	
10-083	1	71	54	640	ND	ND	2	N	Y	Y	PF DO
10-090 ATT-Copy	0	72	51	728	ND	ND	1	N	Y	Y	
10-091	0	71	50	714	ND	ND	2	N	Y	Y	DO
10-092	0	71	50	635	ND	ND	1	N	Y	Y	DO

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									Supply	Exhaust	
10-093	0	70	51	641	ND	ND	1	N	Y	Y	Do
10-094	1	69	51	702	ND	ND	2	N	Y	Y	DO
10-095	0	68	51	664	ND	ND	1	N	Y	Y	DO
10-096	0	65	52	593	ND	ND	1	N	Y	Y	DO
10-097	0	68	51	642	ND	ND	1	N	Y	Y	DO
10-098	0	67	51	593	ND	ND	1	N	Y	Y	DO
10-099	0	68	51	650	ND	ND	1	N	Y	Y	
10-100	2	72	50	468	ND	ND	6	N	Y	Y	Record's Room
10-101	0	71	49	453	ND	ND-0.2	7	N	Y	N	
10-102	0	71	49	445	ND	ND	5	N	Y	Y	

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									Supply	Exhaust	
10-110	0	72	56	521	ND	ND	10	N	Y	Y	
10-111	0	73	56	564	ND	ND	10	N	Y	Y	
10-112	0	77	57	576	ND	ND	10	N	Y	Y	
10-114	2	73	56	678	ND	ND	11	N	Y	Y	
10-115	0	73	55	547	ND	ND	11	N	Y	Y	
10-117	1	73	55	557	ND	ND	11	N	Y	Y	
10-118	0	73	55	578	ND	ND	11	N	Y	Y	
10-120	2	73	55	563	ND	ND	2	N	Y	Y	DO
10-121 Copy Room	4	72	57	588	ND	ND	2	N	Y	Y	
10-122	2	72	55	630	ND	ND	2	N	Y	Y	

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									Supply	Exhaust	
10-123 Copy Room	0	71	53	560	ND	ND	2	N	Y	Y	
10-125	1	72	53	599	ND	ND	3	N	Y	Y	DO
10-127	2	71	52	577	ND	ND	2	N	Y	Y	PF DO
10-128	0	73	53	561	ND	ND	2	N	Y	Y	DO
10-129	0	73	53	570	ND	ND	2	N	Y	Y	PF DO
10-133E	4	73	53	485	ND	ND	7	N	Y	Y	
10-133F	1	72	52	430	ND	ND	7	N	Y	Y	
10-133G	1	73	53	440	ND	ND	7	N	Y	Y	
10-133H	1	73	53	423	ND	ND	7	N	Y	Y	
10-133I	2	73	53	434	ND	ND	7	N	Y	Y	

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									Supply	Exhaust	
10-133J	1	73	54	446	ND	ND	8	N	Y	Y	
10-133K	0	73	54	450	ND	ND	8	N	Y	Y	
10-141		73	57	517	ND	ND		N			
10-145	0	72	57	562	ND	ND	10	N	Y	Y	
10-146	1	73	58	584	ND	ND	10	N	Y	Y	
10-148	1	71	57	450	ND	ND-0.2	9	N	Y		DO
10-153	0	73	55	491	ND	ND	11	N	Y	Y	
10-156	2	73	56	500	ND	ND	11	N	Y	Y	
10-162	0	73	57	574	ND	ND	12	N	Y	Y	
10-163	0	73	57	546	ND	ND	12	N	Y	Y	

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Address: 1 Congress St, Boston, MA **Date: 8/17/2010**

Table 1 (continued)

Location/ Room	Occupants in Room	Temp (°F)	Relative Humidity (%)	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	TVOCs (ppm)	PM2.5 (µg/m^3)	Windows Openable	Ventilation		Remarks
									Supply	Exhaust	
10-164	0	73	57	576	ND	ND	12	N	Y	Y	
10-165	0	73	57	564	ND	ND	6	N	Y	Y	
10-167	0	73	57	551	ND	ND	11	N	Y	Y	
10-169	0	73	56	550	ND	ND	11	N	Y	Y	
10-170	0	73	53	519	ND	ND	12	N	Y	Y	
10-170	0	73	56	590	ND	ND	11	N	Y	Y	
10-172	0	73	54	485	ND	ND	12	N	Y	Y	
10-173	0	73	55	490	ND	ND	6	N	Y	Y	
10-174	0	73	56	512	ND	ND	11	N	Y	Y	
10-176CU	2	73	56	534	ND	ND	11	N	Y	Y	

ppm = parts per million

µg/m^3 = micrograms per cubic meter

ND = non detect

DO = door open

PF = personal fan

PC = photo copier

Comfort Guidelines

Carbon Dioxide:	< 600 ppm = preferred	Temperature:	70 - 78 °F
	600 - 800 ppm = acceptable	Relative Humidity:	40 - 60%
	> 800 ppm = indicative of ventilation problems	Particle matter 2.5	< 35 ug/m^3

Location: Department of Industrial Accidents **Indoor Air Results**

Address: 1 Congress St, Boston, MA **Date: 8/17/2010**

Table 1 (continued)

Location/ Room	Occupants in Room	Temp (°F)	Relative Humidity (%)	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	TVOCs (ppm)	PM2.5 (µg/m^3)	Windows Openable	Ventilation		Remarks
									Supply	Exhaust	
10-182	0	74	54	480	ND	ND	12	N	Y	Y	
10-184	1	73	57	551	ND	ND	11	N	Y	Y	
10-185	2	73	57	553	ND	ND	11	N	Y	Y	
10CU/NE	7	74	56	566	ND	ND	11	N	Y	Y	
10-CU/NW	4	74	55	535	ND	ND	11	N	Y	Y	
10-CU/SE	7	74	56	550	ND	ND	11	N	Y	Y	
10-CU/SW	5	73	56	550	ND	ND	11	N	Y	Y	
Hearing Room 1 10-030	0	72	52	701	ND	ND	2	N	Y	Y	
Hearing Room 1 10-031	0	72	52	589	ND	ND	2	N	Y	Y	

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Location: Department of Industrial Accidents **Indoor Air Results**

Address: 1 Congress St, Boston, MA **Date: 8/17/2010**

Table 1 (continued)

Location/ Room	Occupants in Room	Temp (°F)	Relative Humidity (%)	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	TVOCs (ppm)	PM2.5 (µg/m^3)	Windows Openable	Ventilation		Remarks
									Supply	Exhaust	
Hearing Room 10 10-039	0	70	54	650	ND	ND	3	N	Y	Y	
Hearing Room 3 10-032	0	72	48	613	ND	ND	2	N	Y	Y	
Hearing Room 4 10-033	0	69	51	631	ND	ND	1	N	Y	Y	
Hearing Room 5 10-034	0	69	51	701	ND	ND	1	N	Y	Y	
Hearing Room 6 10-035	0	68	54	634	ND	ND	1	N	Y	Y	
Hearing Room 7 10-036	0	68	54	591	ND	ND	2	N	Y	Y	
Hearing Room 8 10-037	0	68	54	633	ND	ND	2	N	Y	Y	
Hearing Room 9 10-038	0	69	55	649	ND	ND	2	N	Y	Y	

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Location: Department of Industrial Accidents **Indoor Air Results**

Address: 1 Congress St, Boston, MA **Date: 8/17/2010**

Table 1 (continued)

Location/ Room	Occupants in Room	Temp (°F)	Relative Humidity (%)	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	TVOCs (ppm)	PM2.5 ($\mu g/m^3$)	Windows Openable	Ventilation		Remarks
									Supply	Exhaust	
Main Waiting Area	3	71	50	615	ND	ND	2	N	Y	Y	DO

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