INDOOR AIR QUALITY ASSESSMENT

Marshall Simonds Middle School
114 Winn Street
Burlington, MA 01803

Prepared by:
Massachusetts Department of Public Health
Center for Environmental Health
Emergency Response/Indoor Air Quality Program

May 2005

Background/Introduction

At the request of parents and Mr. Craig Robinson, Director of Facilities for the Burlington School Department (BSD), the Massachusetts Department of Public Health's (MDPH) Center for Environmental Health (CEH) provided assistance and consultation regarding indoor air quality concerns at the Marshall Simonds Middle School (MSMS), 114 Winn Street, Burlington, Massachusetts. On February 2, 2005, Cory Holmes an Environmental Analyst for CEH's Emergency Response/Indoor Air Quality (ER/IAQ) Program conducted an assessment of the MSMS. Concerns about indoor air quality related to elevated carbon dioxide levels prompted the request.

The MSMS is a red brick building that was originally constructed in 1956 as the Burlington High School. In 1922, the building was converted to a middle school. The MSMS consists of a two-story classroom wing (A and B wings), a single-story classroom wing (C-wing), a gymnasium and administrative offices. A number of building improvements were reportedly made over the years, including replacement of window systems in 2000 and replacement of the boiler plant and heating, ventilation and air conditioning (HVAC) equipment over the summer of 2004. Mr. Robinson also reported that the town of Burlington has commissioned a comprehensive facilities and educational study to determine the current physical state and future needs of all existing buildings within the Burlington public school system. The study is tentatively scheduled to be completed by August of 2005.

In August of 2004, the BSD contracted with Hub Testing Laboratory, Inc. (HUB), an environmental consultant, to conduct mold and dust testing. The HUB report recommended that "any moisture issues should be addressed immediately and the school building should be maintained and its condition monitored for conditions that would promote microbial growth" (HUB, 2004).

Methods

MDPH staff conducted air tests for carbon monoxide, carbon dioxide, temperature and relative humidity were taken with the TSI, Q-Trak, IAQ Monitor, Model 8551. 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 (TVOCs) was conducted using a Thermo Environmental Instruments Inc., Model 580 Series Photo Ionization Detector (PID). Air tests for ultrafine particulates were taken with the TSI, P-Trak ™ Ultrafine Particle Counter Model 8525. MDPH staff also performed a visual inspection of building materials for water damage and/or microbial growth.

Results

The school houses approximately 860 students in sixth through eighth grade and approximately 90 staff members. Tests were taken during normal operations at the school 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 twenty-four of forty areas surveyed, indicating inadequate air exchange in more than half of the areas surveyed. Fresh air in classrooms is mechanically supplied by a computer-programmed unit ventilator (univent) systems (Picture 1). A univent draws air from outdoors through a fresh air intake located on the exterior wall of the building (Picture 2) and returns air through an air intake located at the base of the unit. Fresh and return air are mixed, filtered, heated and provided to classrooms through an air diffuser located in the top of the unit (Figure 1). Univents were activated in all but one classroom surveyed. At the time of the assessment, Mr. Robinson reported that the BSD's HVAC technician was working on balancing all univent systems to adjust the units for proper air exchange.

Exhaust ventilation in classrooms is provided by ducted, grated wall vents (Picture 3) powered by rooftop motors (Picture 4). At the time of the assessment, several exhaust vents were off and/or obstructed (Picture 5). As with the univents, in order to function properly, exhaust vents must be activated and remain free of obstructions. In addition, the location of some exhaust vents can limit exhaust efficiency. In several rooms, exhaust vents are located near hallway doors. When classroom doors are open, these exhaust vents become blocked (Picture 3). Exhaust vents in these rooms will also tend to draw air from both the hallway and the classroom reducing the effectiveness of the exhaust vent to remove common environmental pollutants.

Mechanical ventilation in the main office and common areas such as the gymnasium and auditorium is provided by rooftop air-handling units (AHUs) connected to ceiling or wall-mounted air diffusers via ductwork (Picture 6). Return air is drawn into wall or ceiling exhaust vents, which are ducted back to the AHUs. The majority of these systems were functioning during the assessment. Because of the location of supply and exhaust vents near the ceiling, CEH staff could not determine whether the units in the gymnasium were operating at the time of the assessment. However, considering the elevated carbon dioxide levels in the gym relative to the large volume of air in the gym space, it likely that the mechanical ventilation systems were not operating at the time of the assessment.

To maximize air exchange, the MDPH recommends that both supply and exhaust ventilation operate continuously during periods of school 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 (SMACNA, 1994). As discussed, Mr. Robinson reported that balancing of the system was on going and that at the time of this assessment, the BSD had not accepted ownership of the recently installed HVAC system.

The Massachusetts Building Code requires that each room have a minimum ventilation rate of 15 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 consult Appendix A.

Temperature measurements ranged from 70^{o} F to 82^{o} F, which were within the MDPH comfort guidelines, with the exception of the art room. 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. 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 measurements in the building ranged from 15 to 25 percent, which were below the MDPH recommended comfort range. 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

Several areas had water-damaged ceiling tiles, which can indicate leaks from the roof or plumbing system (Pictures 7 and 8/Table 1). Occupants in the Tutor's room reported periodic leaks, which are the result of faulty flashing according to BSD staff. Repeated water damage to porous building materials (e.g., wallboard, ceiling tiles, carpet) can result in microbial growth. Water-damaged ceiling tiles can provide a source of mold and should be replaced after a water leak is discovered and repaired. The US Environmental Protection Agency (US EPA) and the American Conference of Governmental Industrial Hygienists (ACGIH) recommend that porous materials be dried with fans and heating within 24 to 48 hours of becoming wet (US EPA, 2001; ACGIH, 1989). If porous materials are not dried within this time frame, mold growth may occur.

In several classrooms, plants were found on top of univents. Plants, soil and drip pans can serve as sources of mold growth, and thus should be properly maintained. Plants should have drip pans to prevent wetting and subsequent mold colonization of window frames. Plants should also be located away from univents and ventilation sources to prevent aerosolization of dirt, pollen or mold.

Other Concerns

Indoor air quality can be adversely impacted by the presence of respiratory irritants, such as products of combustion. The process of combustion produces a number of pollutants. Common combustion products 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 school environment, MDPH staff obtained measurements for carbon monoxide and PM2.5.

Carbon monoxide is a by-product of incomplete combustion of organic matter (e.g., gasoline, wood and tobacco). As discussed, exposure to carbon monoxide can produce immediate and acute health affects. Several air quality standards have been established to address carbon monoxide pollution 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 of reduce carbon monoxide levels (MDPH, 1997).

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, 2000a). As recommended by ASHRAE, pollutant levels of fresh air introduced to a building should not exceed the NAAQS (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 established by the US EPA, carbon monoxide levels in outdoor air should not exceed 9 ppm in an eight-hour average (US EPA, 2000a).

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 non-detect or ND (Table 1). Carbon monoxide levels measured in the school were also ND.

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 for 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, 2000a). This standard was adopted by both ASHRAE and BOCA. Since the issuance of the ASHRAE standard and BOCA Code, US EPA proposed a more protective standard for fine airborne particles. This more stringent, PM2.5 standard requires outdoor air particulate levels be maintained below 65 $\mu g/m^3$ over a 24-hour average (US EPA, 2000a). Although both the ASHRAE standard and BOCA Code adopted the PM10 standard for evaluating air quality, MDPH uses the more protective proposed PM2.5 standard for evaluating airborne particulate matter concentrations in the indoor environment.

Outdoor PM2.5 concentrations were measured at 44 $\mu g/m^3$ (Table 1). PM2.5 levels measured indoors ranged from 16 to 42 $\mu g/m^3$, which were below background and the NAAQS of 65 $\mu g/m^3$. 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 schools can generate particulates 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, cooking in the cafeteria stoves and microwave ovens; use of photocopiers, fax machines and computer printing devices; operation of an ordinary vacuum cleaner and heavy foot traffic indoors.

Indoor air quality can also be impacted by the presence of materials containing volatile organic compounds (VOCs). VOCs are substances that have the ability to evaporate at room temperature. Frequently, exposure to low levels of total VOCs (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 were ND (Table 1). Indoor TVOC measurements throughout the building were also ND.

Please note, TVOC air measurements are only reflective of the indoor air concentrations present at the time of sampling. Indoor air concentrations can be greatly impacted by the use TVOC containing products (i.e., the concentration of TVOCs within a classroom when the products are actually in use). While no TVOC levels measured exceeded background levels, materials containing VOCs were present in the school. At the time of the assessment, a gas-powered snow blower was being stored inside the hallway outside the gymnasium (Picture 9). Odors and off-gassing of VOCs from gasoline can have an adverse effect on indoor air quality.

Several classrooms contained dry erase boards and dry erase markers. Materials such as dry erase markers and dry erase board cleaners may contain volatile organic compounds (VOCs), (e.g., methyl isobutyl ketone, n-butyl acetate and butyl-cellusolve) (Sanford, 1999), which can be irritating to the eyes, nose and throat.

Cleaning products were found in unlocked cabinets below sinks and on countertops in a number of classrooms. Cleaning products also contain chemicals that can be irritating to the eyes, nose and throat and should be kept out of reach of students. Unlabeled/poorly labeled spray bottles were also noted. For identification purposes especially in the event of an emergency, products should be kept in their original containers or should be clearly labeled as to their contents.

Items hanging from ceiling tiles were seen in several classrooms (Picture 10). Classrooms in a number of areas also had missing, damaged or dislodged ceiling tiles. The absence or movement of ceiling tiles can allow for accumulated dirt and dust from the ceiling plenum into occupied areas. A number of exhaust/return vents were noted with accumulated dust. If exhaust vents are not functioning, backdrafting can occur, which can re-aerosolize accumulated dust particles.

Also of note was the amount of materials stored in some classrooms. Items were observed on windowsills, tabletops, counters, bookcases and desks. The large number of items stored in classrooms 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. Dust can be irritating to eyes, nose and respiratory tract.

Conclusions/Recommendations

The on-going facilities study is expected to provide a comprehensive evaluation of the building's needs, as well as recommendations for improvement. However, in view of the findings at the time of the MDPH visit, the following recommendations are made:

1. Continue working with HVAC engineering firm for options to increase the introduction of outside air to occupied areas.
2. Operate all ventilation systems that are operable throughout the building (e.g., gym, auditorium, classrooms) continuously during periods of school occupancy and independent of thermostat control. To increase airflow in classrooms, set univent controls to "high".
3. Inspect exhaust motors and belts for proper function. Repair and replace as necessary.
4. Close classroom doors to maximize exhaust function.
5. Use openable windows to facilitate air exchange.
6. Remove all blockages from univents and exhaust vents to ensure adequate airflow.
7. Develop a notification system for building occupants to report ventilation/comfort complaints.
8. Balance mechanical ventilation equipment every five years, as recommended by ventilation industrial standards (SMACNA, 1994).
9. 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. Drinking water during the day can help ease some symptoms associated with a dry environment (throat and sinus irritations).

10. Continue with plans to make roof/flashing repairs. Once leaks are repaired, replace water damaged ceiling tiles. Examine the area above and around these areas for mold growth. Disinfect areas of water leaks with an appropriate antimicrobial.

11. Consult "Mold Remediation in Schools and Commercial Buildings" published by the US EPA (2001) for further information on mold and/or mold clean up. Copies of this document are available from the US EPA at: http://www.epa.gov/iaq/molds/mold_remediation.html.

12. Ensure plants have drip pans. Examine drip pans periodically for mold growth and disinfect with an appropriate antimicrobial where necessary. Keep plants away from the air stream of univents.

13. Replace missing/damaged ceiling tiles (in areas without active roof leaks). Consider discontinuing hanging items from ceiling tile system.

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

15. Clean exhaust/return vents periodically to prevent excessive dust build-up.

16. Store gas-powered equipment outside the building.

17. Store cleaning products properly and out of reach of students. Ensure spray bottles are properly labeled in case of emergency.

18. Consider adopting the US EPA (2000b) document, *Tools for Schools*, in order to provide self-assessment and maintain a good indoor air quality environment. The document can be downloaded at http://www.epa.gov/iaq/schools/index.html.

19. Refer to resource manuals and other related indoor air quality documents for further building-wide evaluations and advice on maintaining public buildings. These materials are located on the MDPH's website at http://www.state.ma.us/dph/beha/iaq/iaqhome.htm.

References

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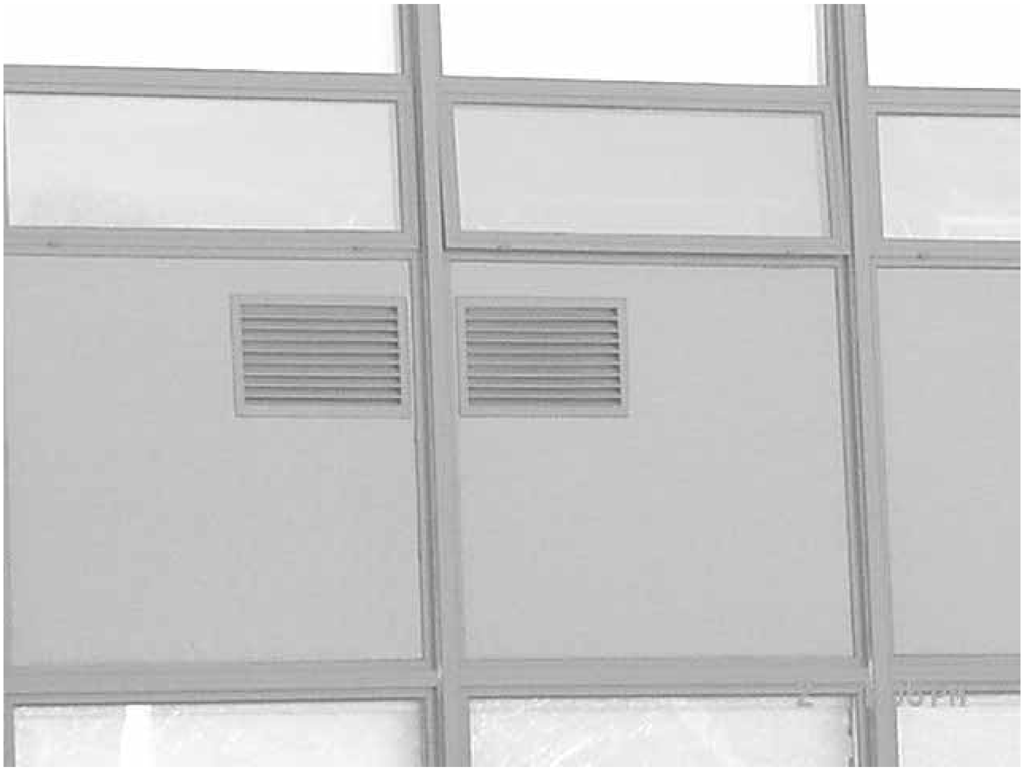
Picture 1

Classroom Univent

Picture 2



Univent Air Intakes

Picture 3

Classroom Exhaust Vent, Note Proximity to Open Hallway Door

Picture 4

Rooftop Exhaust Motor

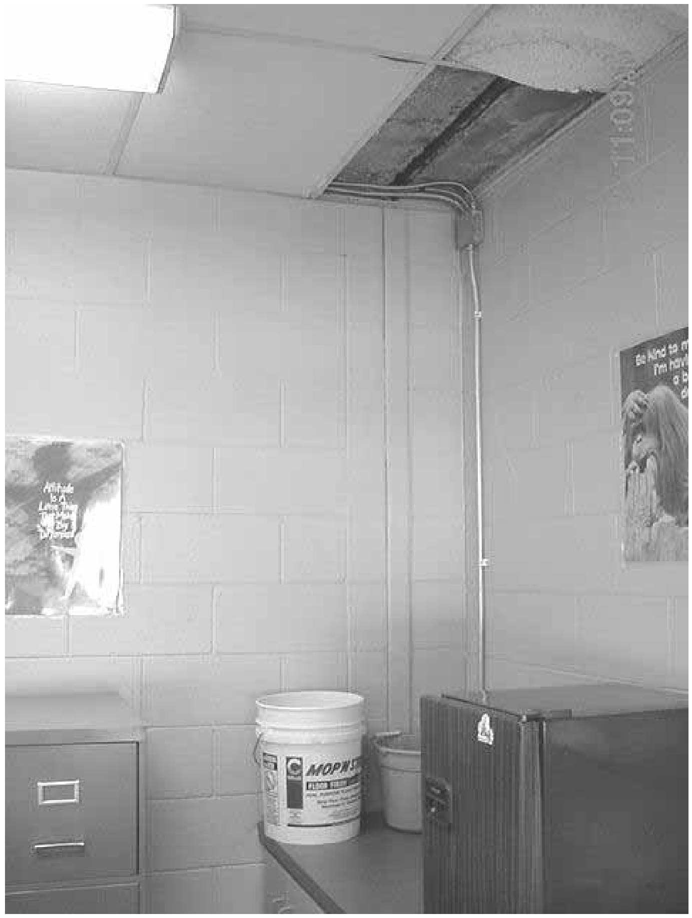
Picture 5

Classroom Exhaust Vent Obstructed by Trash Barrel

Picture 6

Ceiling-Mounted Return Vent

Picture 7



Active Roof Leak in Tutor’s Room, Note Missing Tile and Bucket

Picture 8

Water Damaged Ceiling Tile in Classroom

Picture 9

Snow-Blower Stored in Hallway Outside Gymnasium

Picture 10

Items Hanging Form Ceiling Tiles in Classroom

Marshall Simonds Midde School

114 Winn Street, Burlington, MA 01803

Table 1

Indoor Air Results

February 2, 2005

Location/ Room	Occupants in Room	Temp (°F)	Relative Humidity (%)	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	TVOCs (ppm)	PM2.5 (µg/m3)	Windows Openable	Ventilation		Remarks
									Supply	Exhaust	
Background	0	40	19	403	ND	ND	44	N # open: 0 # total: 0			Comments: sunny, cold, winds light and variable.
B-18	24	70	24	835	ND	ND	29	Y # open: 0 # total: 5	Y univent wall	Y wall	Hallway DO, WD-ceiling, #MT/AT: 1, DEM, items hanging from CT, Comments: ceiling fans.
C-5	13	71	17	589	ND	ND	19	Y # open: 0 # total: 14	Y univent wall	Y wall	#MT/AT : 7.

ppm = parts per million
µg/m3 = micrograms per cubic meter

AD = air deodorizer
AP = air purifier
aqua. = aquarium

AT = ajar ceiling tile
BD = backdraft
CD = chalk dust
CP = ceiling plaster
CT = ceiling tile
DEM = dry erase materials

design = proximity to door
DO = door open
FC = food container
G = gravity
GW = gypsum wallboard
M = mechanical

MT = missing ceiling tile
NC = non-carpeted
ND = non detect
PC = photocopier
PF = personal fan
plug-in = plug-in air freshener

PS = pencil shavings
sci. chem. = science chemicals
TB = tennis balls
terra. = terrarium
UF = upholstered furniture
WP = wall plaster

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%

Marshall Simonds Midde School | **Indoor Air Results**

114 Winn Street, Burlington, MA 01803 | **February 2, 2005**

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Location/ Room	Occupants in Room	Temp (°F)	Relative Humidity (%)	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	TVOCs (ppm)	PM2.5 (µg/m3)	Windows Openable	Ventilation		Remarks
									Supply	Exhaust	
C-4	1	73	18	511	ND	ND	16	Y # open: 0 # total: 4	Y univent wall	Y wall	Hallway DO, DEM.
Auditorium	3	70	19	474	ND	ND	22	N # open: 0 # total: 0	Y ceiling	Y ceiling	Hallway DO
Music	20	73	25	778	ND	ND	22	Y # open: 0 # total: 10	Y ceiling	Y wall	Hallway DO, DEM, plants.
Main Office	3	73	21	780	ND	ND	27	Y # open: 0 # total: 6			Hallway DO, PC.

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									Supply	Exhaust	
B-3	21	73	22	820	ND	ND	21	Y # open: 0 # total: 6	Y wall	Y wall	DEM, plants.
B-2	24	72	22	962	ND	ND	29	Y # open: 0 # total: 6	Y univent wall	Y wall	#MT/AT: 1, DEM.
B-5	23	73	23	1801	ND	ND	19	Y # open: 0 # total: 6	Y univent wall	Y wall	DEM, cleaners.
B-4	22	72	21	1000	ND	ND	21	Y # open: 0 # total: 6	Y univent wall	Y wall	DEM.

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									Supply	Exhaust	
B-7	24	78	17	839	ND	ND	19	Y # open: 0 # total: 6	Y wall	Y wall	Hallway DO, items hanging from CT.
Media Center	3	73	15	514	ND	ND	22	Y # open: 0 # total: 12	Y univent wall	Y wall	Hallway DO
B-13	22	71	22	1170	ND	ND	23	Y # open: 0 # total: 0	Y univent wall	Y wall	WD-ceiling, DEM, cleaners.
B-12	20	71	21	940	ND	ND	23	N # open: 0 # total: 0	Y univent wall	Y wall	WD-ceiling, #WD-CT : 4, #MT/A : 1.

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									Supply	Exhaust	
B-10	23	72	20	827	ND	ND	21	Y # open: 0 # total: 5	Y univent wall	Y wall	Hallway DO, WD-ceiling, #WD-CT: 3, DEM.
Art	23	82	20	759	ND	ND	24	Y # open: 0 # total: 11	Y univent wall	Y wall	Hallway DO, DEM.
B-17	23	71	22	935	ND	ND	26	Y # open: 0 # total: 5	Y univent wall	Y wall clutter	Hallway DO, DEM, Comments: 25 occupants gone 2 min.

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Marshall Simonds Midde School

114 Winn Street, Burlington, MA 01803

Table 1

Indoor Air Results

February 2, 2005

Location/ Room	Occupants in Room	Temp (°F)	Relative Humidity (%)	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	TVOCs (ppm)	PM2.5 (µg/m3)	Windows Openable	Ventilation		Remarks
									Supply	Exhaust	
B-16	24	70	25	1430	ND	ND	28	Y # open: 0 # total: 5	Y univent wall	Y wall dust/deb ris	DEM.
Tutors	2	70	21	804	ND	ND	23	Y # open: 0 # total: 4	Y univent wall (off)	Y wall	Hallway DO, WD-ceiling, Comments: periodic leaks reported-corner .
B-14	22	72	24	1310	ND	ND	29	Y # open: 0 # total: 6	Y univent wall	Y wall	WD-ceiling, #WD-CT: 1, #MT/AT: 1, DEM, PF, cleaners.

ppm = parts per million
µg/m3 = micrograms per cubic meter

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AP = air purifier
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									Supply	Exhaust	
Gym	40	93	24	1049	ND	ND	42	N # open: 0 # total: 0	Y ceiling	Y	
C-12	23	74	22	969	ND	ND	20	Y # open: 0 # total: 6	Y univent wall	Y wall (off) (BD)	DEM.
C-11	22	74	21	937	ND	ND	19	N # open: 0 # total: 0	Y univent wall	Y wall (off) (BD)	DEM, plants.

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									Supply	Exhaust	
C-10	24	75	19	736	ND	ND	17	N # open: 0 # total: 0	Y univent	Y wall	Hallway DO, WD-ceiling, #WD-CT: 3, DEM, cleaners, plants.
Family & Consumer Science	13	73	20	572	ND	ND	28	Y # open: 0 # total: 6	Y univent wall	Y wall	Hallway DO, WD-ceiling, #WD-CT: 15, DEM.
C-14	4	73	19	600	ND	ND	23	Y # open: 0 # total: 0		Y ceiling	WD-ceiling, #WD-CT : 6, DEM.
C-13	10	74	20	682	ND	ND	18	Y # open: 0 # total: 4	Y univent wall	Y wall	Hallway DO, WD-ceiling, #WD-CT: 1, DEM, PF.

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									Supply	Exhaust	
C-9	23	71	19	859	ND	ND	22	Y # open: 0 # total: 8	Y univent wall	Y wall clutter	DEM, PF, aqua/terra, clutter.
A-8	24	74	21	1006	ND	ND	19	N # open: 0 # total: 0	Y univent wall	Y	Hallway DO, plants.
A-11	13	72	19	767	ND	ND	20	Y # open: 0 # total: 6	Y univent wall	Y wall	DEM.
A-9	23	70	21	881	ND	ND	20	Y # open: 0 # total: 6	Y univent wall	Y wall	WD-ceiling, #WD-CT : 4, ceiling, #CT : 4, DEM.

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									Supply	Exhaust	
Health Room	0	73	19	646	ND	ND	26	N # open: 0 # total: 0	Y	Y wall	
A-16	21	73	22	1031	ND	ND	28	Y # open: 0 # total: 7	Y univent wall	Y wall	DEM, items hanging from CT.
A-5	21	75	22	974	ND	ND	27	Y # open: 0 # total: 6	Y univent wall		DEM, plants.
A-6	25	74	23	1370	ND	ND	29	Y # open: 1 # total: 6	Y univent wall (off)	Y wall	cleaners, items hanging from CT, plants.

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									Supply	Exhaust	
A-13	10	73	19	583	ND	ND	22	Y # open: 0 # total: 6	Y univent wall	Y wall	Hallway DO, DEM, Comments: 25 occupants gone 1hour.
B-1	24	73	23	1084	ND	ND	19	Y # open: 0 # total: 5	Y univent wall	Y wall clutter	#MT/AT : 1.
Teachers Work Room	0	75	18	623	ND	ND	22	Y # open: 0 # total: 1	Y ceiling	Y ceiling wall	PC.
A-19	21	72	19	972	ND	ND	28	Y # open: 0 # total: 8	Y univent wall	Y wall	Hallway DO, DEM, cleaners.

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