INDOOR AIR QUALITY ASSESSMENT

Marblehead High School
2 Humphrey Street
Marblehead, Massachusetts

Prepared by:
Massachusetts Department of Public Health
Center for Environmental Health
Emergency Response/Indoor Air Quality Program
June 2005

Background/Introduction

At the request of David Dunkley, Director of Facilities, Marblehead School Department (MSD), the Massachusetts Department of Public Health's (MDPH) Center for Environmental Health (CEH) provided assistance and consultation regarding indoor air quality at Marblehead High School (MHS), 2 Humphrey Street, Marblehead, MA. The request was prompted by concerns of mold growth and symptoms (e.g., headaches, exacerbation of allergies, dryness, eye and respiratory irritation, lethargy) that occupants believed to be associated with poor indoor air quality.

On January 5, 2005 the school was visited by Cory Holmes and Sharon Lee, Environmental Analysts in CEH's Emergency Response/Indoor Air Quality (ER/IAQ) Program to conduct an indoor air quality assessment. Mr. Dunkley accompanied CEH staff during the assessment.

The MHS is three-story brick building that was completed in 2002. The building contains general classrooms, science classrooms, gymnasium, locker rooms, media center, art rooms, photo lab, wood shop, auto shop, music rooms, kitchen, cafeteria and administrative offices.

Methods

Air tests for carbon dioxide, carbon monoxide, temperature and relative humidity were conducted with the TSI, Q-TRAK™ IAQ Monitor, Model 8551. CEH staff also performed a visual inspection of building materials for water damage and/or microbial growth. Moisture content of porous building materials was measured with Delmhorst, BD-2000 Model, Moisture Detector with a Delmhorst Standard Probe. Screening for total volatile organic compounds (TVOCs) was conducted using a Thermo Environmental Instruments Inc., Model 580 Series Photo Ionization Detector (PID).

Results

The school houses high school students grades 9-12 with a student population of approximately 970 and a staff of approximately 120. Tests were taken during normal operations at the school and results appear in Table 1. Moisture readings of carpeting in the library are presented in Table 2.

Discussion

Ventilation

It can be seen from Table 1 that carbon dioxide levels were below 800 parts per million parts of air (ppm) in of eighty-three of ninety-seven areas surveyed indicating adequate ventilation in the majority of areas surveyed during the assessment. It is important to note, however that the MSD's heating, ventilation and air conditioning (HVAC) contractor was changing filters the day of the assessment, which required temporary shut-down of ventilation equipment. The shutting down of equipment, even temporarily, can allow carbon dioxide levels to accumulate. Therefore, during normal (continuous) operation, carbon dioxide levels would be expected to be lower than those measured during this assessment.

Mechanical ventilation is provided by rooftop air-handling units (AHUs) equipped with high efficiency pleated air filters (Pictures 1 and 2), which are reportedly changed up to five times a year (as needed). Fresh air is continuously distributed via ceiling-mounted air diffusers and ducted back to AHUs via ceiling or wall-mounted return vents (Pictures 3 and 4). In some cases, the location of exhaust vents can limit exhaust efficiency. In several classrooms, exhaust vents are located above hallway doors (Picture 4). When classroom doors are open, exhaust vents will tend to draw air from both the hallway and the classroom reducing the effectiveness of the exhaust vent to remove common environmental pollutants.

General exhaust ventilation in science rooms is designed to be provided by the continuous operation of laboratory hoods. However, it was reported to MDPH staff that lab hoods were deactivated upon the request of faculty due to excessive noise. This is problematic for two reasons: (1) deactivating the lab hoods eliminates the removal of general classroom heat and pollutants and diminishes air exchange and (2) deactivation can allow the accumulation of chemical odors during science experiments, which can be irritating to certain individuals.

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 to ensure adequate air systems function (SMACNA, 1994). The mechanical ventilation systems at MHS were reportedly last balanced in 2002.

The Massachusetts Building Code requires a minimum ventilation rate of 15 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 Department of Public Health uses a guideline of 800 ppm for publicly occupied buildings. A guideline of 600 ppm or less is preferred in schools due to the fact that the majority of occupants are young and considered to be a more sensitive population in the evaluation of environmental health status. Inadequate ventilation and/or elevated temperatures are major causes of complaints such as respiratory, eye, nose and throat irritation, lethargy and headaches. For more information concerning carbon dioxide, consult Appendix A.

Temperature measurements ranged from 68^{o} F to 75^{o} F, which were within or very close the MDPH recommended comfort range. 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. Temperature control complaints from occupants were expressed to MDPH staff prior to the assessment. School maintenance officials reported that they are continuing to work to resolve these issues with the school's HVAC contractor. 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 measured in the building ranged from 20 to 39 percent, which was below the MDPH recommended comfort range. The majority of readings were in the 20 to 30 percent 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

As discussed, occupants expressed concerns about possible mold growth, primarily in carpeting in the library. In order for building materials to support mold growth, a source of moisture is necessary. Identification and elimination of water moistening building materials is necessary to control mold growth. Building materials with increased moisture content over normal concentrations may indicate the possible presence of mold growth. Identification of the location of materials with increased moisture levels can also provide clues concerning the source of water supporting mold growth.

In an effort to ascertain moisture content of carpeting in the library, moisture readings were taken throughout the library. As indicated, moisture content was measured with a Delmhorst Moisture Detector equipped with a Delmhorst Standard Probe. The Delmhorst probe is equipped with three lights that function as visual aids that indicate moisture level. Readings that activate the green light indicate a sufficiently dry or low moisture level, those that activate the yellow light indicate borderline conditions and those that activate the red light indicate elevated moisture content. No elevated moisture readings were measured during the assessment (Table 1). In addition, a thorough visual examination of the library was conducted. No visible water damage, mold growth or associated odors were observed and/or detected during the assessment.

A number of areas throughout the building had water-damaged ceiling tiles, which can indicate leaks from the roof or plumbing system (Pictures 5 and 6). Water-damaged ceiling tiles can provide a source of mold and should be replaced after a water leak is discovered and repaired. No active leaks were reported by MHS staff or observed by MDPH staff during the assessment.

Several classrooms contained a number of plants (Picture 7). 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 ventilation sources to prevent aerosolization of dirt, pollen or mold.

Several rooms contained humidifiers. Humidifiers contain reservoirs that hold standing water. These reservoirs should be cleaned and maintained as per manufacturer's instructions to prevent microbial growth.

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; however, the pollutant produced is dependent on the material combusted. Common combustion products include carbon monoxide, carbon dioxide, water vapor and smoke (fine airborne particle material). Of these materials, exposure to carbon monoxide can produce immediate, acute health effects upon exposure. Due to occupant complaints of headaches and lethargy, MDPH staff conducted testing for 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 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 to 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 6 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 throughout the building were also ND.

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. Indoor TVOC measurements throughout the building were also ND (Table 1).

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 of TVOC-containing products. While no measurable TVOC levels were detected in the indoor environment, VOC-containing materials were noted. Several science classrooms contained operating chemical hoods. The purpose of chemical hoods is to draw aerosolized chemical vapors and odors from the work area out of the building. Chemical hoods should not be used for storage of unattended materials because this equipment can be deactivated during off-hours (Rose, 1984). If the chemical hoods are deactivated, off-gassing material can penetrate into adjacent areas. Chemical hoods should be on at all times that chemicals are within the equipment. It is also good chemical hygiene practice to return stock bottles back to the storage cabinet after use.

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

Chemical odors were detected in room B-305. The source of the odor was a plug-in air freshener (Picture 8). Air fresheners contain chemicals that can be irritating to the eyes, nose and throat of sensitive individuals. In addition, air fresheners do not remove materials causing odors, but rather mask odors, which may be present in the area.

Classroom B-213 contained a blueprint machine/printer (Picture 9). Blueprint machines use ammonia and can give off VOCs and irritating odors during use. This area is not equipped with a local mechanical exhaust system that would remove off-gassing vapors generated during the operation of this machine.

Several other conditions that can affect indoor air quality were noted during the assessment. 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. A number of supply and exhaust/return vents in classrooms and restrooms had accumulated dust. If exhaust vents are not functioning, backdrafting can occur, which can re-aerosolize dust particles. In addition, these materials can accumulate on flat surfaces (e.g., desktops, shelving and carpets) in occupied areas and subsequently be re-aerosolized causing further irritation. Dust can be irritating to eyes, nose and respiratory tract.

The consumer science room (D-203) contained an unvented clothes dryer. Clothing dryers are a source of lint and dusts, which can be irritating to certain individuals. Unvented dryers can also result in moisture and waste heat being vented into the classroom. The MDPH recommends that dryers be vented to the outside of the building to remove lint, dusts, excess moisture and waste heat from occupied areas.

A number of rooms had portable air purifiers (Picture 10). This equipment has air filters that should be cleaned or changed as per the manufactures' instructions to avoid the reaerosolization of dusts and particulates. Items were also observed hanging from ceiling tiles. The movement or damage to ceiling tiles can release accumulated dirt, dust and particulates that accumulate in the ceiling plenum into occupied areas.

Conclusions/Recommendations

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

1. Reactivate lab hood exhaust vents to provide exhaust ventilation to science classrooms. Contact an HVAC engineering firm and/or the manufacturer to examine methods to reduce noise. In not feasible, consider providing alternate means of exhaust ventilation (e.g. local exhaust fans, rooftop ducted exhaust motors).
2. Continue working with HVAC contractor to resolve temperature/ventilation issues. Faculty and staff are encouraged to report any complaints concerning temperature control/preventive maintenance issues to the facilities department via the main office or alternate reporting procedure.
3. Consider having the ventilation system balanced by an HVAC engineer every five years (SMACNA, 1994).
4. Close classroom doors to maximize air exchange.
5. 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).
6. Ensure roof leaks are repaired and 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.

7. Clean/maintain dehumidifiers/humidifiers as per the manufactures' instructions.
8. Ensure all plants are equipped with drip pans. Examine drip pans periodically for mold growth and disinfect with an appropriate antimicrobial where necessary.
9. Ensure chemical hoods operating at all times that chemicals are within the equipment. It is also good chemical hygiene practice to return stock bottles back to the storage cabinet after use.
10. Consider discontinuing use of the blueprint machine, installing local exhaust ventilation or relocating to an area equipped with local exhaust ventilation.
11. Relocate or consider reducing the amount of materials stored in classrooms to allow for more thorough cleaning of classrooms. Clean items regularly with a wet cloth or sponge to prevent excessive dust build-up.
12. Clean supply, return and exhaust vents periodically of accumulated dust. Attempts should also be made to clean dust accumulation on ceiling tiles adjacent to vents.
13. Vent clothes dryer to the outside.
14. Refrain from using strongly scented materials (e.g., air fresheners) in classrooms.
15. Clean/change filters for portable air purifiers as per the manufactures' instructions.
16. Consider adopting the US EPA (2000b) document, "Tools for Schools", as an instrument for maintaining a good indoor air quality environment in the building. This document is available at: http://www.epa.gov/iaq/schools/index.html.
17. 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://www.state.ma.us/dph/MDPH/iaq/iaqhome.htm.

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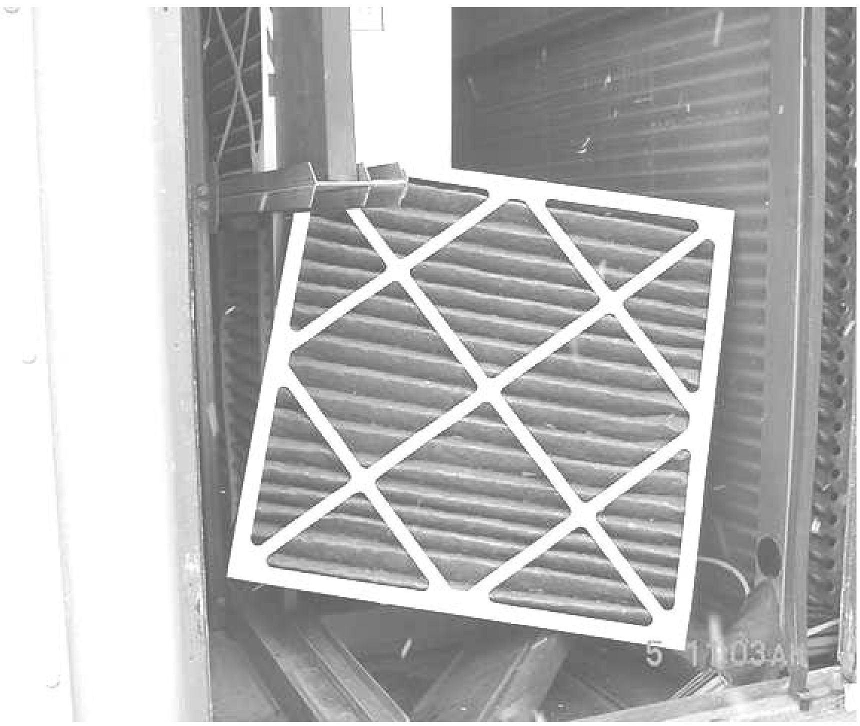
Picture 1



Rooftop Air Handling Unit Equipped With High Efficiency Pleated Air Filters

Picture 2

Rooftop Air Handling Unit Equipped With Secondary Bag Filters

Picture 3

Ceiling-Mounted Air Diffuser, Note Characteristic Dust Accumulation on Surrounding Tiles

Picture 4

Ceiling-Mounted Return Vent, Note Proximity to Open Classroom Door

Picture 5

Water Damaged Ceiling Tiles

Picture 6

Water Damaged Ceiling Tiles, Note Dark Staining That May Indicate Mold Growth

Picture 7

Classroom Plant on Paper Towel

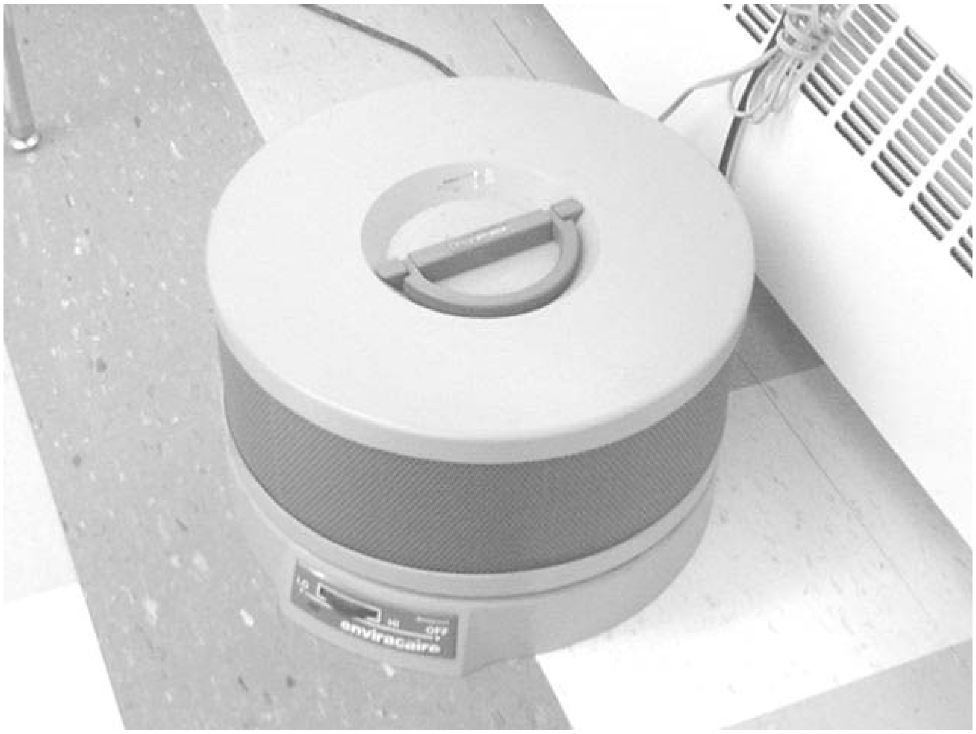
Picture 8

Plug-In Air Freshener in Classroom

Picture 9

Ammonia-Based Blueprint Machine

Picture 10



Portable Air Purifier on Floor

Marblehead High School **Indoor Air Results**

2 Humphrey St, Marblehead, MA **January 5, 2005**

Table 1

Location/ Room	Carbon Dioxide (*ppm)	Temp (°F)	Relative Humidity (%)	Carbon Monoxide (*ppm)	TVOCs (*ppm)	Occupants in Room	Windows Openable	Ventilation		Remarks
								Supply	Exhaust	
Background (outdoors)	372	40	45	ND	ND		-			Snow flurries, north winds ~5-10 mph
A302	1450	72	39	ND	ND	26	Y	Y	Y	DEM
A304	1018	72	31	ND	ND	6	Y	Y	Y	Plants, DEM, PF, DO, heat complaints, APs
A303	553	73	25	ND	ND	0	Y	Y	Y	Plants, DEM, clutter, WD CT, items hanging from CTs
A305	692	72	25	ND	ND	4	Y	Y	Y	DEM, plants, ~20 students gone ~5 min
A307	881	73	26	ND	ND	24	Y	Y	Y	Plants, DEM
A309	720	72	25	ND	ND	18	Y	Y	Y	DEM, PF

ppm = parts per million parts of air

µg/m3 = microgram per cubic meter

AD = air deodorizer
AHU = air-handling unit
AP = air purifier
AC = air conditioning
AT = ajar tile
CD = chalk dust

CT= ceiling tile
DEM = dry erase marker
DO = door open
MT= missing ceiling tile
PC = photocopier

PF = personal fan
TB = tennis balls
UF = upholstered furniture
WD = water damage
ND = non-detect

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%

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								Supply	Exhaust	
A311 computer rm	485	71	22	ND	ND	0	Y	Y	Y	25 PCs, DEM
A313	477	72	22	ND	ND	2	Y	Y	Y	DEM, WD CT
A313-A	853	73	25	ND	ND	4	Y	Y	Y	DEM, cleaners
B212	619	73	24	ND	ND	7	Y	Y	Y	DEM, plants, DO
B310	547	73	22	ND	ND	7	Y	Y	Y	DEM, DO
B306	655	74	22	ND	ND	12	Y	Y	Y	DEM
B304	837	74	24	ND	ND	27	Y	Y	Y	DEM

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B202	514	75	22	ND	ND	13	Y	Y	Y	DEM, acrylic paints-odors, fume hood, DO
B206	502	74	20	ND	ND	9	Y	Y	Y	DEM, photo lab-slight odors, fume hood, DO, MT, dry sink
B210	669	73	22	ND	ND	18	Y	Y	Y	Fume hood, DEM, rubber cement, oil pastels
A213	823	73	22	ND	ND	22	Y	Y	Y	DEM, DO
A211	537	72	23	ND	ND	3	Y	Y	Y	Plants, DEM, DO
A209	772	72	24	ND	ND	20	Y	Y	Y	DO
A207	527	72	23	ND	ND	9	Y	Y	Y	DO, DEM

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								Supply	Exhaust	
A205	854	72	26	ND	ND	15	Y	Y	Y	DEM, dusty counters
A203	613	72	23	ND	ND	19	Y	Y	Y	DEM, DO, PS
A202	678	74	24	ND	ND	17	Y	Y	Y	DEM, DO, PF
A103	610	71	25	ND	ND	0	Y	Y	Y	DEM, DO, AD
A104	617	71	25	ND	ND	1	Y	Y	Y	DEM, DO, complaints of "stuffiness"
A108	541	69	24	ND	ND	0	Y	Y	Y	DEM
A106	647	71	26	ND	ND	0	Y	Y	Y	Cleaners, FC, plants

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A110	478	72	23	ND	ND	0	Y	Y	N	DEM
A112	605	72	25	ND	ND	6	Y	Y	N	MT, PF
A114	647	75	27	ND	ND	1	Y	Y	Y	25 computers, ~25 students gone ~5 min
Cafeteria	794	74	25	ND	ND	~300	N	Y	Y	DO
E202	778	71	26	ND	ND	22	Y	Y	Y	DEM, DO
E206	854	72	27	ND	ND	21	Y	Y	N	1 WD CT, 2 AT, plants, DO, hood
E210	879	72	26	ND	ND	23	Y	Y	Y	DEM, hood, 1 WD CT, DO

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E213	631	73	23	ND	ND		N	Y	Y	PC
D215	540	73	22	ND	ND	0	N	Y	Y	DEM, interior DO
Studio	520	73	23	ND	ND	0	N	Y	Y	Interior DO
Soundboard/ Monitors	559	74	26	ND	ND	0	N	Y	Y	1 WD CT
D213	540	74	22	ND	ND	1	N	Y	Y	DEM, PF, clutter, spray paint
Library Main	457	74	22	ND	ND	14	N	Y	Y	Carpet moisture content-low

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Marblehead High School

2 Humphrey St, Marblehead, MA

Indoor Air Results

January 5, 2005

Table 1

Location/ Room	Carbon Dioxide (*ppm)	Temp (°F)	Relative Humidity (%)	Carbon Monoxide (*ppm)	TVOCs (*ppm)	Occupants in Room	Windows Openable	Ventilation		Remarks
								Supply	Exhaust	
C202	507	74	22	ND	ND	1	N	Y	Y	AP, humidifier, Carpet moisture content-low
C203	536	73	23	ND	ND	0	N	Y	Y	FC, DO, Carpet moisture content-low
Library (near C205)	467	73	21	ND	ND	21	N	Y	Y	Carpet moisture content-low
Library (end corner)	483	73	22	ND	ND	21	N	Y	Y	Carpet moisture content-low
Library (near lunchroom)	477	73	22	ND	ND	22	N	Y	Y	Carpet moisture content-low
Library Computer Lab	402	73	20	ND	ND	0	N	Y	Y	Carpet moisture content-low, 25 computers

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C109 Auto	421	70	29	ND	ND	0	N	Y	Y	General repairs, DEM, dust, spray paints, gen chemicals
Wood Shop	490	68	29	ND	ND	6	N	Y	Y	Dusty, DEM
C108	538	70	25	ND	ND	1	N	Y	N	DO
C105	602	71	25	ND	ND	1	N	Y	Y	6 WD CT, paint, DO
C103A	521	71	24	ND	ND	0	N	Y	N	DO
C103	470	71	23	ND	ND	5	Y	Y	Y	DEM, DO
C106	455	71	23	ND	ND	1	Y	Y	Y	DO, DEM

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								Supply	Exhaust	
C104	574	72	24	ND	ND	0	Y	Y	Y	25 computers, DEM, temp control complaints
C102	698	72	25	ND	ND	21	Y	Y	Y	25 computers, DEM, DO,
Auditorium	518	75	20	ND	ND	0	N	Y	Y	
D104	533	71	24	ND	ND	1	N	Y	N	DO, interior door open
D105	639	72	24	ND	ND	1	N	Y	N	Interior door open
Gym	438	70	23	ND	ND	7	N	Y	Y	
E115	558	71	27	ND	ND	1	N	Y	N	

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								Supply	Exhaust	
A306	916	72	33	ND	ND	15	Y	Y	Y	Plants, DEM, window open
A308	769	72	29	ND	ND	25	Y	Y	Y	DEM, Items hang from CTs
A310	779	72	28	ND	ND	18	Y	Y	Y	
A312	794	72	28	ND	ND	1	Y	Y	Y	Plants, PC
A314	726	73	26	ND	ND	9	Y	Y	Y	DEM
B315	701	74	26	ND	ND	24	Y	Y	Y	2 CT, dusty rtn vent
B313	584	74	25	ND	ND	0	Y	Y	Y	Class at lunch, window open

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Location/ Room	Carbon Dioxide (*ppm)	Temp (°F)	Relative Humidity (%)	Carbon Monoxide (*ppm)	TVOCs (*ppm)	Occupants in Room	Windows Openable	Ventilation Supply	Ventilation Exhaust	Remarks
B300-A, Faculty Men's Room									Y	Local exhaust vent off
B309	475	74	23	ND	ND	1	Y	Y	N	PC
B307	646	74	24	ND	ND	19	Y	Y	Y	1 CT
B305	455	74	23	ND	ND	0	Y	Y	Y	3 CT, plug-in air freshener
B303	797	75	26	ND	ND	28	Y	Y	Y	

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B205	603	73	25	ND	ND	10	Y	Y	Y	
B207	490	73	23	ND	ND	1	Y	Y	Y	Local exhaust
B213	475	71	25	ND	ND	1	N	Y	Y	~12 students gone ~50 minutes, blue print machine (ammonia)
B215	548	73	24	ND	ND	0	N	Y	Y	2 CT
A214	750	74	25	ND	ND	20	Y	Y	Y	Plants, aquarium
A208	685	73	24	ND	ND	23	Y	Y	Y	DO
A206	514	73	24	ND	ND	8	Y	Y	Y	Plants

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								Supply	Exhaust	
A204	856	74	26	ND	ND	23	Y	Y	Y	
D222	892	74	26	ND	ND	20	Y	Y	Y Lab hood	1 CT, lab hood-off
D202	573	75	24	ND	ND	2	N	Y	Y Lab hood	PC
D220	586	74	23	ND	ND	1	Y	Y	Y Lab hood	
D218	484	73	22	ND	ND	1	Y	Y	Y	Plants, chemicals in lab hood-off, windows reported to not stay open
D204	644	73	25	ND	ND	27	Y	Y	Y	2 CT

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								Supply	Exhaust	
D216	775	73	25	ND	ND	17	Y	Y	Y	
D212	934	74	26	ND	ND	24	Y	Y	N	
D205	690	74	24	ND	ND	3	Y	Y	Y	DO
D201 Cooking	825	75	21	ND	ND	18	Y	Y	Y	DO, strong food/oil odors in classroom and hallway
D203	597	75	23	ND	ND	0	Y	Y	Y	Unvented dryer
Main Office	676	72	26	ND	ND	7	N	Y	Y	Heavy dirt/dust deposits CT near PC
B110	821	72	27	ND	ND	12	N	Y	Y	

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Guidance	682	72	26	ND	ND		Y	Y	Y	Humidifier
B120	660	72	26	ND	ND	3	Y	Y	Y	
B122	610	72	27	ND	ND	1	N	Y	Y	AP
B124	659	73	26	ND	ND	1	N	Y	Y	AP, DO
B126	638	73	26	ND	ND	2	N	Y	Y	AP, humidifier
B127	672	73	26	ND	ND	2	N	Y	Y	

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