Report
For
Indoor Air Quality Testing
At The
Middle School
Ashland, MA

Study Date:
January 6, 2021

Project# 221 014.00

STUDY CONDUCTED BY:

UNIVERSAL ENVIRONMENTAL CONSULTANTS
12 Brewster Road
Framingham, Massachusetts

UEC universal environmental consultants

January 7, 2021

Mr. Jonathan Murray
Ashland Public Schools
87 West Union Street
Ashland, MA 01720

Reference: **Indoor Air Quality Testing**
Middle School, Ashland, MA

Dear Mr. Murray:

Thank you for the opportunity for Universal Environmental Consultants (UEC) to provide professional services.

Enclosed please find the report for Indoor Air Quality testing at the Middle School, Ashland, MA conducted on Wednesday, January 6, 2021.

Please do not hesitate to call should you have any questions.

Very truly yours,

Universal Environmental Consultants

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Ammar M. Dieb
President

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Enclosure

Scope:
UEC was contracted to perform an Indoor Air Quality testing at the Middle School, Ashland, MA. Testing was performed on Wednesday, January 6, 2021.

Methodology:
Testing for Total Volatile Organic Compounds (***TVOC***) was performed using a Rae Systems "ppbRae 3000" Photo-ionization Detector (PID) with a 10.6 eV lamp. This is a state-of-the-art instrument capable of detecting ***TVOC*** in the ppb (parts per billion) and µg/m^3 (micrograms per cubic meter) ranges. The instrument is a direct reading instrument and provides continuous results over an extended time. The unit is calibrated prior to use and serviced by an independent vendor annually.

Volatile organic compounds are a broad class of chemicals with diverse applications which are frequently emitted by new carpets, furniture, pressboards, varnishes, adhesives, and high gloss finishes. Other common products which may emit VOCs include construction materials, paints, paint strippers, other solvents, wood preservatives, aerosol sprays, cleansers, disinfectants, hand sanitizer, moth repellents, air fresheners, stored fuels, automotive products, hobby supplies, and dry-cleaned clothing. High levels of VOCs are a common Indoor Air Quality problem, especially in newly constructed, recently renovated, or currently being renovated buildings.

Carbon monoxide (***CO***), Carbon Dioxide (***CO_2***), Temperature (***˚F***) and Relative Humidity (***%RH***) were measured using a Q-Trak plus monitor manufactured by TSI Incorporated. The unit is calibrated prior to use and serviced by an independent vendor annually.

Hydrogen Sulfide (***H_2S***), Oxygen (***O_2***) and Lower Explosive Limit (***LEL***) were measured using a QRAE2 manufactured by Rae Systems Incorporated. The unit is calibrated prior to use and serviced by an independent vendor annually. Testing for ***LEL*** will check for any flammable gas. It does not call out natural gas specifically, but it checks for the presence of it along with other flammable gasses

Samples were collected for approximately 5 minutes at each test location. No TWA (8-hour time weighted average) or other types or methods of sampling were included in the scope of work.

Airborne particulate matter (***PM***) levels for ***PM_{10}*** and ***$PM_{2.5}$*** were tested using a TSI Corporation DustTrak DRX 8534 handheld aerosol monitor (S/N 8534124302). This is a state-of-the-art instrument capable of simultaneously detecting ***PM_{10}*** and ***$PM_{2.5}$*** in the microgram per cubic meter (µg/m^3) range. The instrument is a direct reading monitor and provided sampling readings at 1 second intervals over the duration of each test. The instrument was zeroed prior to testing and is serviced annually by the manufacturer or an independent vendor.

Real time ***PM*** Measurement is a useful comparative measure of indoor and outdoor dust levels as well as identifying indoor sources of ***PM***.

Results:

TEMPERATURE, RELATIVE HUMIDITY, CARBON MONOXIDE, CARBON DIOXIDE & TOTAL VOLATILE ORGANIC COMPOUNDS by PID

Location	W	D	#	T	RH	CO	CO_2	TVOC (ug/m^3)
Outside	-	-	-	37.6	44.9	0.0	387	0
Activity Room	C	O	0	34.2	28.1	0.0	400	0
Room 103	C	O	1	75.8	17.8	0.0	430	0
Room 106	C	C	0	74.8	21.8	0.0	468	0
Facilities	-	C	0	70.1	24.3	0.0	541	13
Library	C	O	0	71.8	18.6	0.0	403	0
Room 123	C	O	0	71.5	18.9	0.0	399	0
Room 114	C	C	0	70.7	18.1	0.0	405	0
Little Gymnasium	C	O	0	70.0	20.0	0.0	418	0
Theater	-	O	0	70.2	20.0	0.0	408	0
Large Gymnasium	C	O	0	68.0	22.9	0.0	404	0
Room 130	C	O	0	67.9	20.2	0.0	402	0
Room 223	C	O	0	70.1	20.9	0.0	424	0
Room 226	C	O	0	71.0	18.3	0.0	401	0
Room 220	C	O	0	72.5	18.8	0.0	398	0
Room 235	C	O	0	73.5	17.7	0.0	401	0
Room 205	C	O	0	73.0	18.8	0.0	409	0
Room 212	C	O	0	72.1	16.7	0.0	406	0

HYDROGEN SULFIDE (*H_2S*), OXYGEN (*O_2*) AND LOWER EXPLOSIVE LIMIT (*LEL*)

Location	*H_2S*	*O_2*	*LEL*
Activity Room	0.0	20.9	0.0
Room 103	0.0	20.9	0.0
Room 106	0.0	20.9	0.0
Facilities	0.0	20.9	0.0
Library	0.0	20.9	0.0
Room 123	0.0	20.9	0.0
Room 114	0.0	20.9	0.0
Little Gymnasium	0.0	20.9	0.0
Theater	0.0	20.9	0.0
Large Gymnasium	0.0	20.9	0.0
Room 130	0.0	20.9	0.0
Room 223	0.0	20.9	0.0
Room 226	0.0	20.9	0.0
Room 220	0.0	20.9	0.0
Room 235	0.0	20.9	0.0

Room 205	0.0	20.9	0.0
Room 212	0.0	20.9	0.0

***Total PM* - PM_{10}, Respirable, $PM_{2.5}$ and PM1**

Location	Total PM	PM 10 (mg/m^3)	Respirable (mg/m^3)	PM 2.5 (mg/m^3)	PM1 (mg/m^3)
Activity Room	0.007	0.002	0.001	0.001	0.001
Room 103	0.003	0.001	0.001	0.0.01	0.001
Room 106	0.005	0.002	0.001	0.001	0.001
Facilities	0.010	0.004	0.001	0.001	0.001
Library	0.001	0.001	0.001	0.001	0.001
Room 123	0.001	0.001	0.001	0.001	0.001
Room 114	0.001	0.001	0.001	0.001	0.001
Little Gymnasium	0.000	0.000	0.000	0.000	0.000
Theater	0.008	0.002	0.001	0.001	0.001
Large Gymnasium	0.058	0.014	0.003	0.003	0.002
Room 130	0.002	0.002	0.001	0.001	0.001
Room 223	0.005	0.001	0.001	0.001	0.001
Room 226	0.001	0.001	0.001	0.001	0.001
Room 220	0.007	0.001	0.001	0.001	0.001
Room 235	0.011	0.002	0.001	0.001	0.001
Room 205	0.001	0.001	0.001	0.001	0.001
Room 212	0.001	0.001	0.001	0.001	0.001

Legend:

$\mu g/m^3$ - micrograms per cubic meter, ppm - parts per million, ppb - parts per billion

ND - Not Detected, CO OSHA PEL is 30 ppm, ACGIH TLV is 25 ppm.

CO_2 - OSHA PEL is 5000 ppm, Mass DOH Guideline is 800 ppm

TVOC – UEC suggested guideline of 100 ppb: Seifert “Target Guideline Value” of 0.3 mg/m^3

ND - Not Detected

W/D: Windows and Doors (Open/Closed)

#: Number of Occupants

Observations and Interpretation of Results:

Temperature and Relative Humidity (T & RH)
The outside ***T*** and ***RH*** were approximately 37.6ºF and 44.9%. Massachusetts Department of Public Health (MDPH) recommends that indoor air temperatures be maintained in a range of 70 - 78 ºF and 40 to 60 % for indoor air relative humidity to provide for the comfort of building occupants.

Interior ***T*** and ***RH*** were 64.2ºF – 75.8ºF and 16.7% – 28.1% during the test period. Interior ***T*** tests were mostly within the MDPH recommended ***T*** range of 70 - 78 ºF. Interior ***RH*** tests were lower than the MDPH recommended ***RH*** range of 40 to 60 %.

TVOC
TVOC levels on this day were lower than the Seifert "Target Guideline Value" of 300-µg/m^3. The Seifert Target Guideline Value (reference #3 and #8 below) is a widely recognized ***TVOC*** guideline for pollutant levels based on Seifert's personal judgment, rather than on toxicological data, for long term exposure. Seifert proposed that 1 week after completion of construction or renovation ***TVOC*** concentration of 50 times higher be acceptable (i.e., 15,000 µg/m^3.) and after 6 weeks, 10 times higher be acceptable (i.e., 3,000 µg/m^3). ***TVOC*** test levels were between 0 ug/m^3 and 13 ug/m^3, lower than the Seifert target guideline of 300 ug/m^3, lower than the 1-week post-construction/renovation acceptable limit of 15,000 ug/m^3 and the 6-week post-construction/renovation acceptable limit of 3,000 ug/m^3.

Neither OSHA (Occupational Safety and Health Administration) nor ACGIH (American Conference of Governmental Industrial Hygienists) promulgates exposure standards for ***TVOC*** that relate to protection of the general population as opposed to industrial occupational standards. Both have limits on individual VOCs, but they relate to industrial occupational standard.

Testing conducted was of short duration and did not assess representative full-day occupancy levels. Measurements were made using a real-time, portable ***TVOC*** monitor referenced to isobutylene and not by sample collection for individual VOC analysis by gas chromatography technique and evaluation based on Seifert's chemical classes. Mølhave of Denmark reported at INDOOR AIR '90 (reference #8 below) on low levels of indoor air VOCs and human health. Bearg summarized Mølhave's findings as follows.

Table 4.5 Tentative Dose-Response Relationship for Discomfort Resulting from Exposure to Solvent-Like VOCs

Total concentration (ug/m^3)	Irritation and discomfort	Exposure
200	No irritation or discomfort	The comfort range
200 – 3,000	Irritation and discomfort possible if other exposures interact	The multifactorial exposure range
3,000 – 25,000	Exposure effect and probable headache possible if other exposures interact	The discomfort range
> 25,000	Additional neurotoxic effects other than headache may occur	The toxic range

TVOC test levels were between 0 ug/m^3 and 13 ug/m^3.

Carbon Monoxide
No ***CO*** was detected during testing.

Carbon Dioxide
All ***CO_2*** levels were within the acceptable range. For comparative purposes, fresh outdoor air has approximately 400 ppm of ***CO_2***. All areas were well below the OSHA/NIOSH limit of 5000 ppm, and below the MDPH guideline of 800 ppm for publicly occupied buildings. MDPH recommends an optimal level of below 600 ppm. Exposure to high levels of ***CO_2*** for prolonged periods could cause building occupants to become lethargic and generally uncomfortable. ***CO_2*** levels will rise over the course of the

day especially in those areas which have a high occupancy. ***CO_2*** *at these levels is a comfort as opposed to a health issue*.

Hydrogen Sulfide (*H_2S*), Oxygen (*O_2*) and Lower Explosive Limit (*LEL*)
No ***H_2S*** was detected. ***O_2*** Levels were within recommended level of 20.9% and no ***LEL*** was detected.

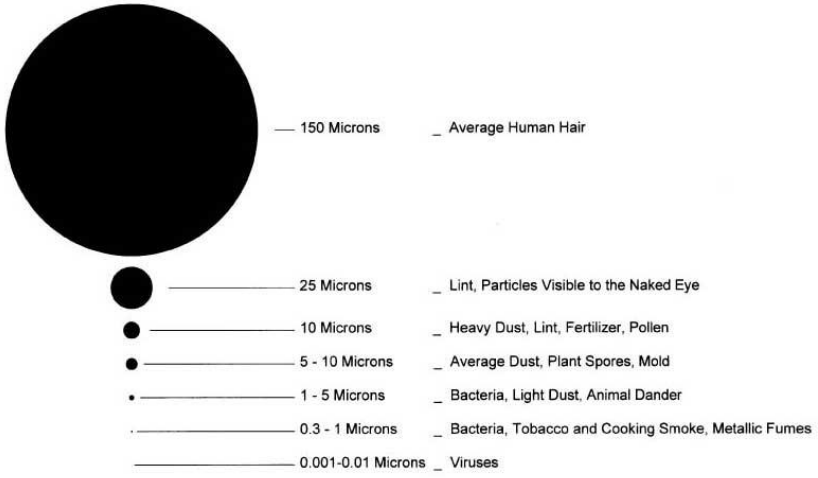
Airborne Particulate Matter (Dust):
Dust monitoring is one aspect of air quality that an industrial hygienist can use to determine the amount of dust particles present in the workplace, cities or communities over a given period.

The Particulate Matter (PM) monitoring focused on measuring a range of particulate sizes in the air that are equal to or less than 10 micrometers (PM10) and equal to or less than 2.5 micrometers (PM2.5) in diameter (course dust and fine dust respectively), i.e., PM capable of penetrating the outer defenses of the respiratory tract, such as the mouth and nose, and can pass into the lungs based on PM size. PM air pollutants include but are not limited to soot, smoke, salts, metals, acids and soil and road dust. These pollutants are typically monitored along work site fence lines, industrial complexes, during wildfires, and high traffic areas (vehicle exhaust).

EPA's health-based National Ambient Air Quality Standard (NAAQS) for PM10 is 150-µg/m^3 and for PM2.5 is 35-µg/m^3 (measured as a 24-hours period concentration) for outdoor (ambient) air. The OSHA Permissible Exposure Limit (PEL) for occupational exposure for respirable dust is 5-mg/m^3 (5,000-µg/m^3) for a time-weighted average (8 hour) exposure. While the EPA NAAQS is an outdoor, ambient air standard, it is a useful reference guide for acceptable air quality in general with limits far below OSHA worker compliance requirement levels.

The TSI DustTrak DRX 8534 real-time PM monitor used in this survey can measure PM simultaneously as PM10, PMresp, PM2.5 and PM1, i.e., particles in the size range categories of 10, Respirable (4), 2.5 and 1 micrometer diameter.

Figure 1.1-Visual Particle Size Comparison Chart.



Levels of PM10 recorded in areas tested during the survey ranged from **0 to 14-µg/m^3 or 0.0 to 0.014-mg/m^3**. EPA's health-based National Ambient Air Quality Standard (NAAQS) recommended level for PM10 is **150-µg/m^3** or **0.150-mg/m^3**. All areas tested during the survey were below the EPA recommended level.

Levels of PMresp (respirable dust) recorded in areas tested during the survey ranged from **0 to 3-µg/m^3 or 0.0 to 0.003-mg/m^3**. OSHA PEL limit for PMresp is **5,000-µg/m^3** or **5-mg/m^3**. All areas tested during the survey were below the OSHA PEL limit.

Levels of PM2.5 recorded in areas tested during the survey ranged from **0 to 3-µg/m³ or 0.0 to 0.003-mg/m³**. EPA's health-based National Ambient Air Quality Standard (NAAQS) recommended level for PM2.5 is **35-µg/m³** or **0.035-mg/m³**. All areas tested during the survey were below the EPA recommended level.

Direct reading PM monitors are not a reference method for OSHA compliance Respirable Dust testing. However, the direct reading instrument is useful in providing accurate order of magnitude evaluation of Respirable Dust levels.

Samples were collected for approximately 10 minutes at each test location and results/levels are not based on TWA (8-hour time weighted average).

Conclusions and Recommendations:

Interior Relative Humidity tests were lower than the MDPH recommended Relative Humidity range of 40 to 60 %.

All other IAQ parameters tested were within the acceptable ranges.

Limitations and Conditions:
This report has been completed based on visual and physical observations made and information available at the time of the site visits. This report is intended to be used as a summary of available information on existing conditions with conclusions based on a reasonable and knowledgeable review of evidence found in accordance with normally accepted industry standards, state, and federal protocols, and within the scope and budget established by the client. Any additional data obtained by further review must be reviewed by UEC and the conclusions presented herein may be modified accordingly.

This report and attachments, prepared for the exclusive use of Owner for use in an environmental evaluation of the subject site, are an integral part of the inspections and opinions should not be formulated without reading the report in its entirety. No part of this report may be altered, used, copied, or relied upon without prior written permission from UEC, except that this report may be conveyed in its entirety to parties associated with Owner for this subject study.

REFERENCES:

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