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

Study Date:
December 29, 2022

Project# 222 724.00

STUDY CONDUCTED BY:

UNIVERSAL ENVIRONMENTAL CONSULTANTS
12 Brewster Road
Framingham, Massachusetts

UEC universal environmental consultants

January 1, 2023

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

Reference: **Indoor Air Quality Testing**
Mindess 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 Mindess School, Ashland, MA conducted on Thursday, December 29, 2022.

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

Very truly yours,

Universal Environmental Consultants

_____

Ammar M. Dieb
President

UEC:\222 724.00\Mindess School Report.DOC

Enclosure

Scope:
UEC was contracted to perform an Indoor Air Quality testing at the Mindess School, Ashland, MA. Testing was performed on Thursday, December 29, 2022.

Methodology:
Testing for Total Volatile Organic Compounds (***TVOCs***) was performed using Q-Trak XP monitor manufactured by TSI Incorporated. This is a state-of-the-art instrument capable of detecting ***TVOCs*** 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 XP monitor manufactured by TSI Incorporated. The unit is calibrated prior to use and serviced by an independent vendor annually.

Airborne particulate matter (***PM***) levels for ***PM_{10}*** and ***$PM_{2.5}$*** were tested using a Q-Trak XP monitor manufactured by TSI Incorporated. 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***.

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.

Results:

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

Location	W	D	#	T	RH	CO	CO_2	TVOC µg/m³
Outside	-	-	0	46.6	50.3	0.0	284	0.0
Main Office	C	O	0	64.9	38.5	0.0	459	80
Room 36	C	O	0	64.0	37.9	0.0	442	80
Room 38	C	O	0	63.3	33.7	0.0	499	80
Room 31	C	O	0	63.3	32.8	0.0	735	80
Library	C	O	0	64.2	39.4	0.0	493	80
Cafeteria	C	O	0	58.6	38.3	0.0	438	110
Gymnasium	C	O	0	63.0	37.6	0.0	489	100
Room 6	C	O	0	62.4	32.7	0.0	567	100
Room 13	C	O	0	61.9	36.7	0.0	587	100
Auditorium	C	O	0	63.4	31.6	0.0	456	120
Room 16	C	O	0	63.0	31.4	0.0	468	90
Room 20	C	O	0	62.2	32.0	0.0	549	90
Room 24	C	C	0	63.3	34.1	0.0	687	110

***PM_{10}*, *$PM_{2.5}$* and PM1**

Location	PM 10 (mg/m³)	PM 2.5 (mg/m³)	PM1 (mg/m³)
Main Office	0.004	0.004	0.004
Room 36	0.007	0.006	0.005
Room 38	0.009	0.008	0.006
Room 31	0.007	0.006	0.005
Library	0.003	0.002	0.002
Cafeteria	0.009	0.009	0.007
Gymnasium	0.007	0.007	0.006
Room 6	0.012	0.011	0.009
Room 13	0.010	0.008	0.006
Auditorium	0.018	0.012	0.009
Room 16	0.008	0.006	0.005
Room 20	0.010	0.008	0.007
Room 24	0.006	0.006	0.005

Legend:
µg/m³ - micrograms per cubic meter, ppm - parts per million, ppb - parts per billion
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/m³
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 46.6ºF and 50.3%. Massachusetts Department of Public Health (MDPH) recommends that indoor ***T*** be maintained in a range of 70 - 78 ºF and 40 to 60 % for indoor ***RH*** to provide for the comfort of building occupants.

Interior ***T*** and ***RH*** were 58.6ºF – 64.9ºF and 31.5% – 39.4% during the test period. Interior ***T*** tests were lower than the MDPH recommended ***T*** range of 70-78 ºF. Interior ***RH*** tests were also lower than the MDPH recommended ***RH*** range of 40 to 60 %.

TVOCs
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 ***TVOCs*** 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). ***TVOCs*** test levels were between 80 ug/m^3 and 120 ug/m^3, lower than the Seifert target guideline of 300 ug/m^3 and much lower than the 1-week and 6-week post-construction/renovation acceptable limits of 15,000 ug/m^3 and 3,000 ug/m^3.

Neither OSHA (Occupational Safety and Health Administration) nor ACGIH (American Conference of Governmental Industrial Hygienists) promulgates exposure standards for ***TVOCs*** 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

TVOCs test levels were between 80 ug/m^3 and 120 ug/m^3.

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

Carbon Dioxide
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***.

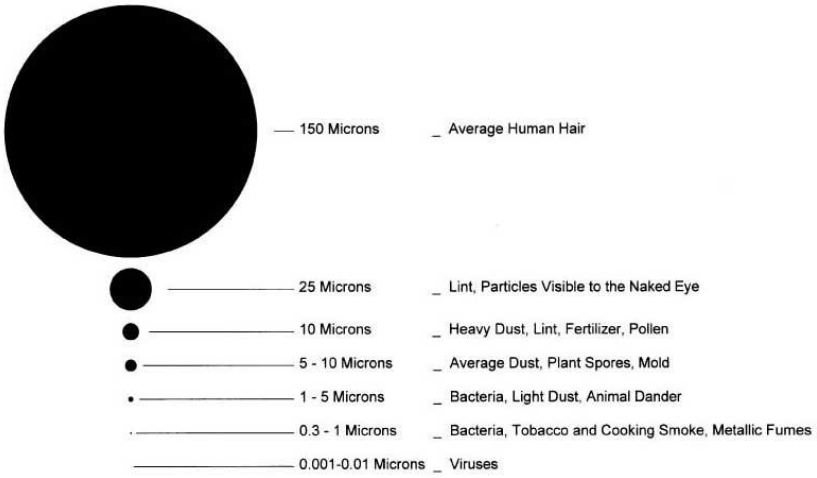
Airborne Particulate Matter (Dust):
Dust monitoring is one aspect of air quality that an industrial hygienist can use to determine the amount of dust particles present in the workplace, cities or communities over a given period.

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 Q-Trak XP monitor used in this survey can measure PM simultaneously as PM10, PM2.5, and PM1, i.e., particles in the size range categories of 10, 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 **3 to 18-µg/m^3 or 0.003 to 0.018-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 PM2.5 recorded in areas tested during the survey ranged from **2 to 12-µg/m^3 or 0.002 to 0.012-mg/m^3**. EPA's health-based National Ambient Air Quality Standard (NAAQS) recommended level for PM2.5 is **35-µg/m^3** or **0.035-mg/m^3**. 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 5 minutes at each test location and results/levels are not based on TWA (8-hour time weighted average).

Conclusions and Recommendations:
Most IAQ parameters tested were within the acceptable ranges.

Interior ***T*** tests were lower than the MDPH recommended ***T*** range of 70-78 ºF. Interior ***RH*** tests were also lower than the MDPH recommended ***RH*** range of 40 to 60 %.

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:

1. ACGIH, Threshold Limit values and Biological Exposure Indices, 2007.
2. AIHA, 2700 Prospect Ave., Fairfax, VA. IAQ Paper #130 June 23, 1999.
3. Seifert, B. Regulation Indoor Air. In: Indoor Air '90, Proceedings of the 5th International Conference on Indoor Air Quality and Climate, Volume V, p. 35. Toronto1990.
4. American Society of Heating, Refrigeration and Air-conditioning Engineers' ANSI/ASHRAE 55-1992 **"Thermal Environmental Conditions for Human Occupancy.**"
5. BOCA, 1993. The BOCA National Mechanical Code 1993 8th edition Building Officials and Code Administrators International., Inc., Country Club Hills, Ill
6. SBBRS, 1997. Mechanical Ventilation, State Board of Building Regulations and Standards Code of Massachusetts Regulations 780 CMR 1209.0
7. Field Guide for the Determination of Biological Contaminants in Environmental Samples. (2005)
8. Bearg, David W. Indoor Air Quality and HVAC Systems (1993) Pages 76, 77 and others