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

Study Date:
August 24, 2020

Project# 220 423.00

STUDY CONDUCTED BY:

UNIVERSAL ENVIRONMENTAL CONSULTANTS
12 Brewster Road
Framingham, Massachusetts

August 25, 2020

Mr. Joseph Richardson
Director of Facilities
Ashland Public Schools
87 West Union Street
Ashland, MA 01720

Reference: **Indoor Air Quality Testing**
David Mindess Elementary School, Ashland, MA

Dear Mr. Richardson:

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 David Mindess Elementary School, Ashland, MA conducted on Monday, August 24, 2020.

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 David Mindess Elementary School, Ashland, MA. Testing was performed on Monday, August 24, 2020.

Methodology:
Testing for Total Volatile Organic Compounds (***TVOCs***) 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 ***TVOCs*** in the ppb (parts per billion) and $\mu g/m^3$ (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***), Hydrogen Sulfide (H2S), Oxygen (***O_2***) and Lower Explosive Limit (LEL) 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 ($\mu g/m^3$) 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
Outside	-	-	-	81.4	75.8	0.0	414	0.0
Main Office	O	O	2	79.0	53.0	0.0		0.0
Room 36	O	O	0	79.3	75.8	0.0		0.0
Room 38	O	O	0	79.6	74.3	0.0		0.0
Room 31	O	O	0	80.9	75.1	0.0		0.0
Library	O	O	2	79.6	73.8	0.0		0.0
Cafeteria	C	O	0	79.9	73.6	0.0		286
Gymnasium	C	O	0	78.7	64.3	0.0		0.0
Room 6	0	O	0	78.9	80.3	0.0		0.0
Room 13	0	O	0	78.5	79.3	0.0		0.0
Auditorium	-	O	0	78.3	78.7	0.0		0.0
Room 16	O	O	0	81.3	81.3	0.0		0.0
Room 20	C	O	0	79.9	72.9	0.0		0.0
Room 24	O	O	0	78.2	76.3	0.0		0.0

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

Location	*H_2S*	*O_2*	*LEL*
Main Office	0.0	20.9	0.0
Room 36	0.0	20.9	0.0
Room 38	0.0	20.9	0.0
Room 31	0.0	20.9	0.0
Library	0.0	20.9	0.0
Cafeteria	0.0	20.9	0.0
Gymnasium	0.0	20.9	0.0
Room 6	0.0	20.9	0.0
Room 13	0.0	20.9	0.0
Auditorium	0.0	20.9	0.0
Room 16	0.0	20.9	0.0
Room 20	0.0	20.9	0.0
Room 24	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)
Main Office	0.010	0.002	0.0	0.0	0.004
Room 36	0.006	0.003	0.002	0.001	0.001
Room 38	0.005	0.002	0.001	0.001	0.001

Room 31	0.006	0.003	0.001	0.001	0.001
Library	0.008	0.003	0.002	0.001	0.001
Cafeteria	0.005	0.002	0.002	0.001	0.001
Gymnasium	0.001	0.0	0.0	0.0	0.0
Room 6	0.006	0.003	0.002	0.002	0.002
Room 13	0.005	0.004	0.003	0.003	0.002
Auditorium	0.003	0.002	0.002	0.001	0.001
Room 16	0.009	0.005	0.003	0.002	0.002
Room 20	0.006	0.002	0.001	0.001	0.001
Room 24	0.004	0.004	0.002	0.002	0.002

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 81.4ºF and 75.8%. 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*** humidity were 78.3ºF – 80.9ºF and 53.0% – 80.3% during the test period. Interior temperature tests were slightly higher than the MDPH recommended temperature range of 70 - 78 ºF. Interior relative humidity tests were mostly higher than the MDPH recommended relative humidity range of 40 to 60 %.

TVOCs
TVOC levels on this day were all 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 0 ug/m^3 and 286 ug/m^3, lower than the Seifert target guideline of 300 ug/m^3 and also 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 (mg/m^3)	Irritation and discomfort	Exposure
< 0.20	No irritation or discomfort	The comfort range
0.20 - 3.0	Irritation and discomfort possible if other exposures interact	The multifactorial exposure range
3.0 – 25	Exposure effect and probable headache possible if other exposures interact	The discomfort range
> 25	Additional neurotoxic effects other than headache may occur	The toxic range

TVOCs test levels were between 0 ug/m^3 and 286 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 are 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.

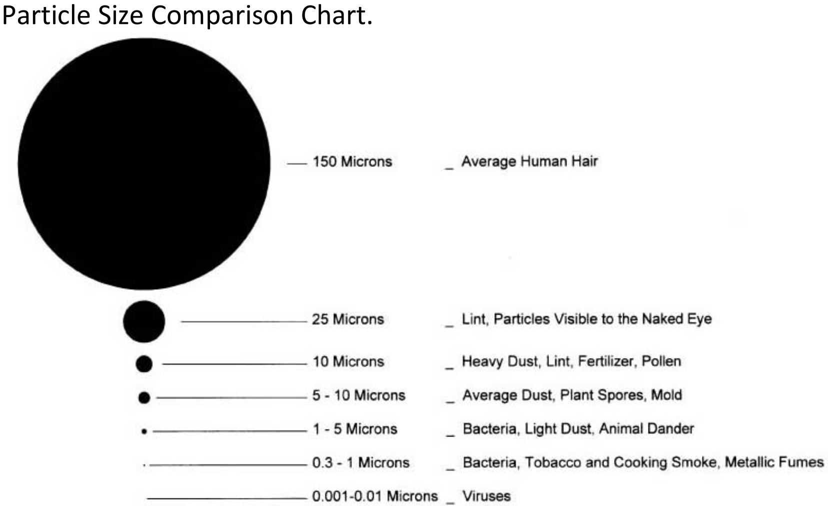
Airborne Particulate Matter (Dust):
Dust monitoring is one aspect of air quality that an industrial hygienist can use to determine the amount of dust particles present in the workplace, cities or communities over a given period.

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-$\mu g/m^3$ and for PM2.5 is 35-$\mu g/m^3$ (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-$\mu g/m^3$) 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 5-$\mu g/m^3$ or 0.0 to 0.005-mg/m^3**. EPA's health-based National Ambient Air Quality Standard (NAAQS) recommended level for PM10 is **150-$\mu g/m^3$** 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-$\mu g/m^3$ or 0.0 to 0.003-mg/m^3**. OSHA PEL limit for PMresp is **5,000-$\mu g/m^3$** 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:

All IAQ parameters tested were within the acceptable ranges except for ***Relative Humidity levels*** which are due to the high ***Relative Humidity*** level outside.

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.

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