

**Report For  
Indoor Air Quality Testing  
At The  
Mont Vernon Village School  
1 Kittredge Road  
Amherst, NH**

**Study Date:**  
February 1, 2021

**Project# 221 045.00**

**STUDY CONDUCTED BY:**

***UNIVERSAL ENVIRONMENTAL CONSULTANTS***  
12 Brewster Road  
Framingham, Massachusetts

February 2, 2021

Mr. Roger Preston  
Director of Facilities  
SAU-39  
1 School Street, P.O. Box 849  
Amherst, NH 03057

Reference: Indoor Air Quality Testing  
Mont Vernon Village School, Amherst, NH

Dear Mr. Preston:

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 Mont Vernon Village School conducted on Monday, February 1, 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

UEC:\221 045.00\IAQReport-MVS.DOC

Enclosure

## 1.0 Scope:

UEC was contracted to perform an Indoor Air Quality Testing at the Mont Vernon Village School, Amherst, NH. Testing was performed at select areas within the school.

Testing was performed on Monday, February 1, 2021.

## 2.0 Methodology:

Air testing was conducted for the following. The sample length at each test location was 2 minutes.

- Total Volatile Organic Compounds (**TVOCs**).
- Carbon Dioxide (**CO<sub>2</sub>**), Carbon monoxide (**CO**), Temperature (**°F**) and Relative Humidity (**RH %**).
- Airborne particulate matter (**PM**) levels for (**PM<sub>10</sub>**) and (**PM<sub>2.5</sub>**).

Testing for **TVOCs** referenced to isobutylene was performed using a Rae Systems ppbRae3000 Photo-Ionization Detector (PID) model PGM7340 equipped with a 10.6 eV lamp (S/N 594-903008). This is a state of the art instrument capable of detecting total **TVOCs** in the parts per billion (ppb) 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 calibrated prior to testing and is serviced annually by the manufacturer or an independent vendor.

**TVOCs** 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 **TVOCs** include paints, paint strippers, other solvents, wood preservatives, aerosol sprays, cleansers, disinfectants, moth repellents, air fresheners, stored chemicals and fuels, automotive products, hobby supplies, and dry-cleaned clothing. Elevated levels of **TVOCs** are a common IAQ problem, especially in newly constructed buildings.

Carbon Dioxide (**CO<sub>2</sub>**), Carbon monoxide (**CO**), Temperature (**°F**) and Relative Humidity (**RH %**) were measured using a TSI Corporation Q-Trak 7575 (S/N 7575X1337003) with a 982 probe (S/N P13350004). The instrument is a direct reading monitor that utilizes infrared technology to measure **CO<sub>2</sub>** and an electro-chemical cell to measure **CO** and provided sampling readings at 1 second intervals over the duration of each test. The instrument was calibrated prior to testing and is serviced annually by the manufacturer or an independent vendor.

**CO<sub>2</sub>** is a useful measure of ventilation effectiveness in spaces occupied by people (i.e., verification that sufficient fresh air is being introduced into the occupied space being tested). Indoor **CO** levels were measured comparatively with outside levels to verify whether sources such as boiler and vehicle exhausts were causing elevated indoor **CO** levels. **CO<sub>2</sub>** and **CO** were measured in parts per million (ppm). Temperature and relative humidity readings were taken to verify indoor levels were within ASHRAE<sup>1</sup> comfort ranges.

Airborne particulate matter (**PM**) levels for **PM<sub>10</sub>** and **PM<sub>2.5</sub>** 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<sub>10</sub>** and **PM<sub>2.5</sub>** in the microgram per cubic meter ( $\mu\text{g}/\text{m}^3$ ) 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**.

Limited moisture testing on interior gypsum walls was performed, and all levels were low.

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<sup>1</sup> ASHRAE = American Society of Heating, Refrigeration and Air-conditioning Engineers.

### 3.0 Results:

The ppbRAE 3000 monitor was used to measure *TVOCs* in ug/m<sup>3</sup>.

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

Location	W	D	#	Temperature (°F)	Humidity %RH	CO (ppm)	CO <sub>2</sub> (ppm)	TVOCs (ug/m <sup>3</sup> )
Outside	-	-	-	24.9	32.9	0.0	386	0.0
Office	-	C	3	67.3	13.7	0.0	751	257
Gymnasium	C	C	14	63.0	18.3	0.0	699	98
Library	C	O	0	69.7	11.6	0.0	767	255
Room E5	C	O	11	70.5	12.7	0.0	919	384
Room E4	C	O	16	70.0	15.1	0.0	1,140	616
Room W4	C	C	12	70.3	12.6	0.0	984	406
Room W7	C	O	0	70.5	13.9	0.0	1,135	317

#### Total PM - PM<sub>10</sub>, Respirable, PM<sub>2.5</sub> and PM1

Location	Total PM	PM 10 (mg/m <sup>3</sup> )	Respirable (mg/m <sup>3</sup> )	PM 2.5 (mg/m <sup>3</sup> )	PM1 (mg/m <sup>3</sup> )
Office	0.014	0.005	0.002	0.001	0.001
Gymnasium	0.148	0.029	0.007	0.005	0.005
Library	0.011	0.004	0.002	0.001	0.001
Room E5	0.024	0.005	0.002	0.002	0.002
Room E4	0.049	0.009	0.003	0.002	0.002
Room W4	0.012	0.003	0.001	0.001	0.001
Room W7	0.019	0.004	0.002	0.001	0.001

#### Legend:

W: Windows; D; Doors; # Number of Occupants (e.g. 25 Occupants = 25); O = Open; C = Closed;  
 mg/m<sup>3</sup> - milligrams per cubic meter; µg/m<sup>3</sup> - micrograms per cubic meter;  
 ppm - parts per million;  
 ppb - parts per billion;  
 CO OSHA PEL is 30 ppm and ACGIH TLV is 25 ppm;  
 CO<sub>2</sub> - OSHA PEL is 5000 ppm, Mass DOH Guideline is 800 ppm;  
 TVOC – Seifert “Target Guideline Value” of 300 ug/m<sup>3</sup>

#### 4.0 Observations and Interpretation of Results:

##### **Temperature and Relative Humidity (T & RH):**

The outside temperature and relative humidity were approximately 24.9°F and 32.9%. It is recommended that indoor air temperatures be maintained in a range of 70 - 78 °F and 35 to 55 % for indoor air relative humidity in order to provide for the comfort of building occupants.

The interior temperature and relative humidity were 63.0 – 70.5 °F and 11.6 – 18.3 % during the test period. Interior temperature tests were mostly within the recommended comfort temperature range of 70 - 78 °F. Interior relative humidity tests were lower than the recommended comfort relative humidity range of 35 to 55 %.

##### **TVOCs:**

**TVOC** tests on this day were lower than the Seifert “Target Guideline Value” of 300-µg/m<sup>3</sup>. 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 ug/m<sup>3</sup>) and after 6 weeks, 10 times higher be acceptable (i.e., 3,000 ug/m<sup>3</sup>). **TVOCs** test levels were between 0.0 and 616 ug/m<sup>3</sup>, higher than the Seifert target guideline of 300 ug/m<sup>3</sup> but much lower than the 1-week and 6-week post-construction/renovation acceptable limits of 15,000 mg/m<sup>3</sup> and 3,000 ug/m<sup>3</sup>.

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.

The 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.

Møhlhave of Denmark reported at INDOOR AIR '90 (reference #8 below) on low levels of indoor air VOCs and human health. Bearg summarized Møhlhave's findings as follows.

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

Total concentration (ug/m <sup>3</sup> )	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 0.0 and 616 ug/m<sup>3</sup>.

Bearg points out that the overlap between Seifert's and Møhlhave's recommendations could be interpreted as a consensus on recommendations for guideline values.

##### **Carbon Monoxide:**

No **CO** levels were detected during testing.

**Carbon Dioxide:**

CO<sub>2</sub> levels were mostly lower than acceptable range. For comparative purposes, fresh outdoor air has approximately 400 ppm of CO<sub>2</sub>. All areas were well below the OSHA/NIOSH limit of 5000 ppm and mostly lower than the State of New Hampshire recommended guideline of 1,000 ppm for publicly occupied office buildings. We use this value as a reference for schools. Exposure to high levels of CO<sub>2</sub> for prolonged periods could cause building occupants to become lethargic and generally uncomfortable. CO<sub>2</sub> levels will rise over the course of the day especially in those areas which have a high occupancy. CO<sub>2</sub> at these levels is a comfort as opposed to a health issue.

**Airborne Particulate Matter (Dust):**

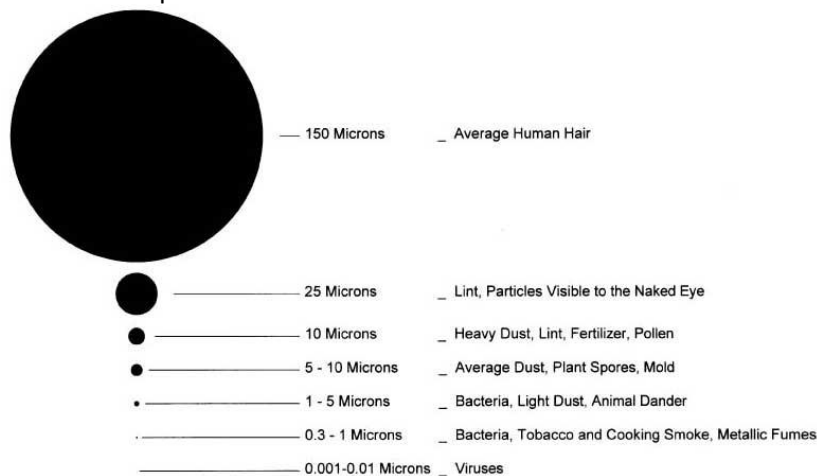
Dust monitoring is one aspect of air quality that an industrial hygienist can use to determine the amount of dust particles present in the workplace, cities or communities over a given period.

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<sup>3</sup> and for PM2.5 is 35-µg/m<sup>3</sup> (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<sup>3</sup> (5,000-µg/m<sup>3</sup>) 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 **3 to 29-µg/m<sup>3</sup> or 0.003 to 0.029-mg/m<sup>3</sup>**. EPA's health-based National Ambient Air Quality Standard (NAAQS) recommended level for PM10 is **150-µg/m<sup>3</sup> or 0.150-mg/m<sup>3</sup>**. 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 **1 to 7-µg/m<sup>3</sup> or 0.001 to 0.007-mg/m<sup>3</sup>**. OSHA PEL limit for PMresp is **5,000-µg/m<sup>3</sup> or 5-mg/m<sup>3</sup>**. All areas tested during the survey were below the OSHA PEL limit.

Levels of PM<sub>2.5</sub> recorded in areas tested during the survey ranged from **1 to 5- $\mu\text{g}/\text{m}^3$  or 0.001 to 0.005- $\text{mg}/\text{m}^3$** . EPA's health-based National Ambient Air Quality Standard (NAAQS) recommended level for PM<sub>2.5</sub> is **35- $\mu\text{g}/\text{m}^3$  or 0.035- $\text{mg}/\text{m}^3$** . 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 10 minutes at each test location and results/levels are not based on TWA (8-hour time weighted average).

**Conclusions and Recommendations:**

Hand sanitizer and cleaning products in use causing **TVOCs** levels higher than the Seifert target guideline of 300  $\text{ug}/\text{m}^3$ . Interior relative humidity tests were lower than the recommended comfort relative humidity range of 35 to 55 %.

All other IAQ parameters tested were within the acceptable ranges.

## 5.0 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. Toronto 1990.
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. Berg, David W. Indoor Air Quality and HVAC Systems. (1993). Pages 76, 77 and others.