Report For
Indoor Air Quality Testing
At The
Wilkins School
80 Boston Post Road
Amherst, NH

Study Date:
December 16, 2022

Project#222 743.00

STUDY CONDUCTED BY:

UNIVERSAL ENVIRONMENTAL CONSULTANTS
12 Brewster Road
Framingham, New Hampshire

UEC universal environmental consultants

December 17, 2022

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

Reference: Indoor Air Quality Testing
Wilkins 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 Wilkins School conducted on Friday, December 16, 2022.

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 Wilkins School, Amherst, NH. Testing was performed at select areas within the school.

Testing was performed on Friday, December 16, 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 $\mu g/m^3$ (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***) 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 ($\mu g/m^3$) 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***.

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	#	Temperature (°F)	Humidity %RH	CO (ppm)	CO_2 (ppm)	TVOCs (µg/m³)
Outside	-	-	0	34.2	63.7	0.0	446	0.0
Gymnasium	C	O	>50	67.6	48.6	0.0	1,204	300
Office	C	C	2	61.7	53.0	0.0	853	230
Library	C	O	3	67.8	36.5	0.0	716	110
Room 1	C	O	0	68.7	33.2	0.0	667	110
Room 4	C	O	0	68.9	32.7	0.0	750	110
Room 33	C	O	0	69.8	31.7	0.0	660	160
Nurse	C	O	2	69.6	36.5	0.0	845	180
Room 13	C	O	0	69.8	35.3	0.0	690	190
Room 10	C	C	0	70.0	35.3	0.0	700	180
Room 17	C	O	12	69.8	36.9	0.0	980	170
Room 21	C	O	15	70.0	36.3	0.0	1,010	160
Room 24	C	O	1	69.1	35.2	0.0	740	200
Room 27	C	O	19	68.7	38.1	0.0	1,030	210
Room 35	C	C	21	66.9	52.8	0.0	1,070	140
Room 37	C	C	20	69.6	52.5	0.0	1,095	2,500

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

Location	PM 10 (mg/m³)	PM 2.5 (mg/m³)	PM1 (mg/m³)
Gymnasium	0.0	0.0	0.0
Office	0.0	0.0	0.0
Library	0.0	0.0	0.001
Room 1	0.0	0.0	0.0
Room 4	0.0	0.0	0.0
Room 33	0.0	0.0	0.0
Nurse	0.0	0.0	0.0
Room 13	0.0	0.0	0.0
Room 10	0.0	0.001	0.001
Room 17	0.0	0.0	0.0
Room 21	0.0	0.0	0.0
Room 24	0.0	0.0	0.0
Room 27	0.0	0.0	0.0
Room 35	0.0	0.0	0.001
Room 37	0.0	0.0	0.0

Legend:

W: Windows; D; Doors; # Number of Occupants (e.g., 25 Occupants = 25); O = Open; C = Closed.

mg/m³ - milligrams per cubic meter; µg/m³ - 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_2 - OSHA PEL is 5000 ppm, Mass DOH Guideline is 800 ppm.
TVOC – Seifert “Target Guideline Value” of 300 ug/m^3

Observations and Interpretation of Results:

Temperature and Relative Humidity (T & RH)
The outside ***T*** and ***RH*** were approximately 34.2ºF and 63.7%. It is recommended 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.

Indoor ***T*** and ***RH*** were 61.7ºF – 70.0ºF and 31.7% – 53.0% during the test period. Indoor ***T*** tests were lower than the recommended ***T*** range of 70 - 78 ºF. Indoor ***RH*** tests were mostly lower than the recommended ***RH*** range of 40 to 60 %.

TVOCs
TVOC levels on this day were mostly 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 110 ug/m^3 and 2,500 ug/m^3, mostly 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 150 ug/m^3 and 2,500 ug/m^3. Level at Room 37 was most likely due to the presence of hand sanitizers or cleaning products.

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

Carbon Dioxide
CO_2 levels were mostly lower than 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 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_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.

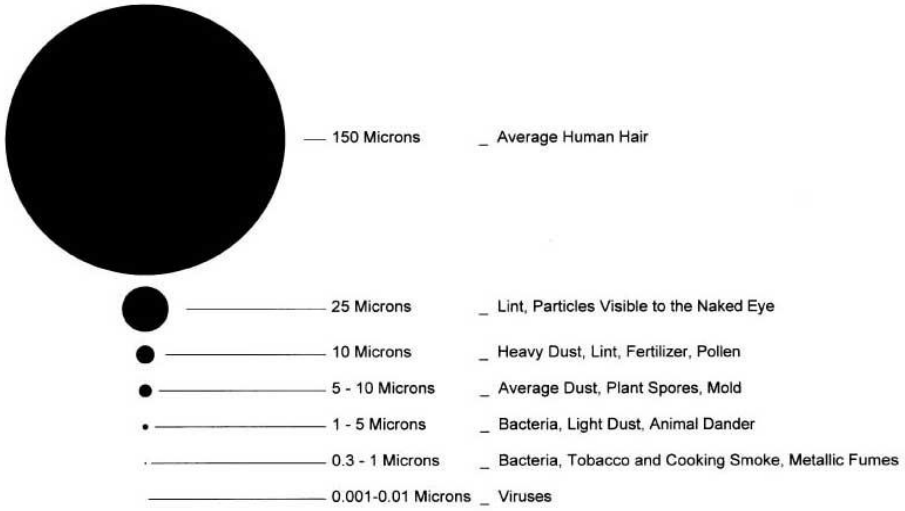
Airborne Particulate Matter (Dust):
Dust monitoring is one aspect of air quality that an industrial hygienist can use to determine the amount of dust particles present in the workplace, cities or communities over a given period.

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 were **0.0 ug/m^3 or 0.0 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 **0.0 to 1.0 ug/m^3 or 0.0 to 0.001 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:
Indoor ***T*** tests were lower than the recommended ***T*** range of 70 - 78 ºF. Indoor ***RH*** tests were lower than the recommended ***RH*** range of 40 to 60 %.

TVOCs test levels were between 150 ug/m^3 and 2,500 ug/m^3. Level at Room 37 was most likely due to the presence of hand sanitizers or cleaning products. ***TVOCs*** levels will dissipate with time.

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.

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