

Limited Indoor Air Quality Assessment Report

February 24, 2020
Toquam Elementary School – Room 34
123 Ridgewood Avenue
Stamford, Connecticut

Stamford Public Schools
Stamford, Connecticut

February 27, 2020



FUSS & O'NEILL

Fuss & O'Neill, Inc.
56 Quarry Road
Trumbull, CT 06611



FUSS & O'NEILL

February 27, 2020

Mr. Kevin McCarthy
Facilities Manager
Stamford Public Schools
888 Washington Blvd
Stamford, CT 06901

**RE: Limited Indoor Air Quality Assessment
Toquam Elementary School – Room 34
123 Ridgewood Ave, Stamford, CT**
Fuss & O'Neill Project No. 20140748.A10

Dear Mr. McCarthy:

Enclosed please find the report for the limited indoor air quality assessment conducted within Room 34 (Area of Concern) and surrounding non-affected areas at the Toquam Elementary School located at 123 Ridgewood Avenue, Stamford, Connecticut (the "Site"). The work was conducted for Stamford Public Schools (the "Client").

The services were performed on February 24, 2020 by a Fuss & O'Neill, Inc. in accordance with our email task authorization dated February 24, 2020.

If you have any questions regarding the enclosed report, please do not hesitate to contact me at (203) 374-3748, extension 5574. Thank you for this opportunity to have served your environmental needs.

Sincerely,

Eduardo Miguel Marques
Senior Environmental Analyst

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1 Introduction and Background

Fuss & O'Neill, Inc. (Fuss & O'Neill) was retained to conduct a limited indoor air quality assessment (IAQ) within Room 34 (Area of Concern) and surrounding non-affected areas at the Toquam Elementary School located at 123 Ridgewood Avenue, Stamford, Connecticut (the "Site"). The purpose of this assessment was to provide data regarding a potential indoor air quality (IAQ) issue at the Site related to occupant concern of an odor in Classroom 34. The work was conducted for Stamford Public Schools (the "Client") in accordance with the City of Stamford State Contract #548/549 and email task authorization dated February 24, 2020 and is subject to the limitations included in *Appendix A*.

Fuss & O'Neill's Senior Environmental Technician, Mr. James B. Blum, conducted the assessment and sampling on February 24, 2020.

2 Building Description

Based on information provided by the City of Stamford Assessor's database and the Client, the Site building was originally constructed in 1970. The building is a public school with three floors. Various renovations have occurred at the Site, including a recent window and roof replacement in limited areas of the Site. We also understand an evaluation is underway of the buildings (exhaust) ventilation system. The building is heated by perimeter radiant heat and cooled by rooftop units serving individual classroom cooling units. Interior finishes are a mix of plaster and gypsum wallboard. The exterior is a mix of brick and masonry block. The roof consists of rubber membrane on a flat roof deck.

3 Scope of Testing and Methodology

The scope of work included visual and olfactory assessment within Classroom 34, the Area of Concern (AOC), as well as adjacent areas where no concern were reported select areas of the Site building where IAQ concerns were reported (as identified by the Client). Refer to *Appendix B* for the site diagram.

The assessment also included real-time measurements for typical IAQ indicators and comparison to recognized guidelines. Test parameters included measurement of temperature, relative humidity (RH), carbon monoxide (CO), carbon dioxide (CO₂), and Volatile Organic Compounds (VOCs).

Measurements were obtained using a calibrated portable TSI Q-Trak IAQ meter, Model 7545X, and a calibrated portable Ion Science Tiger photoionization detector (PID). Refer to *Appendix C* for a complete instrumentation list and corresponding calibration information used in conducting this assessment.

3.1 Temperature and Relative Humidity

Temperature and relative humidity levels are indicators of thermal comfort. The American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) recommends that wintertime indoor temperature be maintained between 68°F and 74°F and summertime indoor temperature be maintained

between 73°F and 79°F. ASHRAE also recommends that humidity be maintained in the range of 30% to 60%. Humidity below this range may cause stress through the drying of mucous membranes and skin. Humidity above this range may promote the growth of fungi spores with resultant contamination of the building and/or ventilation system.

According to its Standard 55-2017, Thermal Environmental Conditions for Human Occupancy, ASHRAE has defined the operative temperature (68°F to 79°F) as that temperature range at which at least 80% of the sedentary or near sedentary occupants will find the environment thermally acceptable.

3.2 Carbon Dioxide (CO₂)

Carbon dioxide (CO₂) is a product of human respiration. CO₂ concentrations in a building are used as a primary indicator of outside air exchange. CO₂ at very high concentrations (e.g., greater than 5,000 parts per million [ppm]) can pose a health risk. However, in most buildings, concentrations rarely rise to these levels and CO₂ at the concentrations commonly identified in buildings is not a direct health risk. At the activity levels in typical office buildings, steady CO₂ concentrations of about 700 ppm above outdoor air measurements indicate an outdoor air ventilation rate of about 15 cubic feet per minute (cfm) per person. CO₂ concentrations in outdoor air typically range from 300 to 500 ppm.

ASHRAE Standard 62.1-2016, Ventilation for Acceptable Indoor Air Quality, suggests an indoor CO₂ concentration of up to 1,000 to 1,200 ppm in spaces housing sedentary people is acceptable and an indicator of adequate outside air exchange.

3.3 Carbon Monoxide (CO)

Carbon monoxide (CO) is a colorless and odorless toxic gas that most often occurs as a by-product of incomplete hydrocarbon fuel combustion. The most likely sources of CO are from incomplete hydrocarbon fuel combustion inside a building, and from air intakes placed in, at, or near parking garages or street level that may entrain automotive exhaust gases into the air handling system. Back drafts from boiler flues may also provide a pathway for CO infiltration. In absence of any formal IAQ standard, Fuss & O'Neill uses the more conservative National Ambient Air Quality Standard (NAAQS) of 9 ppm for CO. The Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL) for carbon monoxide is 50 ppm, as an eight-hour time-weighted-average (8-hr. TWA).

3.4 Volatile Organic Compound (VOC) Screening

Volatile organic compounds (VOCs) are emitted as gases from certain solids or liquids. VOCs include a variety of chemicals, some that may have short and/or long-term adverse health effects. Concentrations of many VOCs are consistently higher indoors when compared to outdoor measurements. VOCs are emitted by a wide array of products, numbering in the thousands. Some examples include:

- paints and lacquers;
- paint strippers;
- cleaning supplies;

- pesticides;
- building materials and furnishings;
- office equipment such as copiers and printers;
- correction fluids and carbonless copy paper;
- graphics and craft materials including glues and adhesives;
- permanent markers; and
- Photographic solutions.

The ability of organic chemicals to cause health effects varies greatly from those that are highly toxic, to those with no known health effects. As with other pollutants, the extent and nature of the health effect depends on many factors, including but not limited to the exposure duration and concentration (“time/dose”). Eye and respiratory tract irritation, headaches, dizziness, visual disorders, and memory impairment are among the most common symptoms that some people have experienced.

To date, no standards have been established for VOCs exposure in non-industrial settings. However, exposures to specific VOCs, such as formaldehyde, have been regulated by governmental agencies. For example, OSHA regulates formaldehyde as a carcinogen.

For the purpose of this limited assessment, Fuss & O’Neill performed direct reading measurements using a PID. The PID measures Total Volatile Organic Compounds (TVOCs) and is used as a screening tool to identify areas of concern and potential sources of VOCs in the built environment.

4 Observations

On the day of the assessment, February 24, 2020, the weather was unseasonably warm and partly cloudy, with a light breeze. No precipitation occurred during the assessment.

Mr. Blum performed a visual and olfactory assessment of the areas noted below:

- Room 34 – Area of Concern
 - Odor similar to a cleaning solvent observed in area
 - Staff had floor blowers/dryers operating nearby door facing toward open windows
 - Odor was noted to have dissipated after windows were closed and floor blowers/dryers were removed
 - Room was not occupied
 - A tower-style air purifier equipment was observed, but not operating at time of this assessment
 - Filter within unit was found to be wrapped in original plastic wrapping
 - Equipment was found to be connected to an outlet and could be turned on.
 - Ceiling mounted cooling unit is operated during summer season; equipment was not operating at time of the assessment.
 - Accumulation of dust and particulate was observed on the return air register of ceiling mounted cooling unit.
 - Perimeter radiant heating was active at the time of the assessment.

- Room 33 – Adjacent Area
 - Room located across from Room 34
 - Slight odor observed that quickly dissipated
 - Room was not occupied
 - A tower-style air purifier equipment was observed, but not operating at time of this assessment
 - Filter was observed to have an excess of particulate accumulation
 - Air handler within room is operated during summer season; equipment was not operating at time of the assessment
 - Observed large amount of dust/particulate within return vent of the unit
- Hallway – Adjacent Area
 - No odor observed
 - Hallway contains newly installed air supply vents which provides fresh air for nearby classrooms
 - At the time of this assessment, it could not be determine if air supplies were operating or not.
- Roof – Rooftop air handling cooling unit
 - Observed sealed five-gallon containers of heat transfer and anti-freeze fluid (inhibited propylene glycol) within two HVAC housing units
 - Filters within HVAC housing units did not display excessive loading indicating they were recently changed
 - The unit appears clean and well maintained

5 Results

5.1 Temperature and Relative Humidity

At the time of the assessment, interior temperature measurements ranged from 71.5°F to 74.6°F. These measurements were primarily within the ASHRAE recommended wintertime range of between 68°F and 74°F.

At the time of the assessment, interior relative humidity measurements ranged from 21.1% to 27.0%. These measurements were below the ASHRAE recommended range of 30 to 60%.

Outdoor ambient temperatures ranged from 60.3°F to 55.8°F and outdoor relative humidity measurements ranged from 16.1% to 18.6%.

Refer to *Appendix D* for the data sheet for temperature, relative humidity, carbon dioxide, carbon monoxide, and volatile organic compounds.

5.2 Carbon Dioxide

Interior concentrations of carbon dioxide ranged from 944 ppm to 1120 ppm during the assessment period. These measurements were found to be at upper range of the ASHRAE recommended range. However, it should be noted that these concentrations were documented when the areas assessed were not occupied; and concentrations may be higher during normal occupancy.

5.3 Carbon Monoxide

Within the limitation of instrumental accuracy, there was no carbon monoxide detected in the building during this assessment.

5.4 Volatile Organic Compound (VOC) Screening

Measurements of VOCs were collected using a PID and measured as total VOCs (TVOCs). A PID identifies concentrations of TVOCs, but the instrument does not identify the type of compound.

At the time of the assessment, an odor similar to that of a cleaning solvent was briefly identified in Classroom 34 however, at the time of the assessment; no interior measurements of TVOCs were recorded within this space. Within the hallway adjacent to Classroom 34, interior measurements of TVOCs were recorded at various concentrations with the highest measurement of 0.7 parts per million (ppm) documented at the HVAC supply vent in the hallway adjacent to classroom 34.

6 Conclusions and Recommendations

Based on the measurements, physical walk-through, and information available at the time of this assessment, Fuss & O'Neill concludes and recommends the following:

6.1 Conclusions

- Interior temperature measurements were primarily within the ASHRAE recommended comfort range.
- Interior relative humidity measurements were below the ASHRAE recommended comfort range.
 - This can likely be attributed to seasonably low ambient humidity.
- Interior concentrations of carbon dioxide were observed to be at the high end of the ASHRAE recommended range.
 - It is important to note that measurements were documented when the areas assessed were not occupied; and concentrations may be higher during normal occupancy.
- Interior concentrations of carbon monoxide were below levels specified by the NAAQS.

- Within the limitation of instrumental accuracy, concentrations of TVOCs were not detected in Classroom 34.
 - Within the hallway adjacent to Classroom 34, interior measurements of TVOCs were recorded at various concentrations with the highest measurement of 0.7 parts per million (ppm) documented at the HVAC supply vent in the hallway adjacent to classroom 34.
- An accumulation of dust and particulate was observed on the return air register of ceiling mounted cooling unit within classroom 34. This condition may be present in other locations.
- The air purification units within classroom 34 and classroom 33 were observed to be improperly used and/or maintained
 - The filter located within the unit in Classroom 34 was observed to be sealed in the original plastic wrapping
 - The filter located within the unit in Classroom 33 was found with an excess of particulate accumulation that may restrict proper air flow
- At the time of this assessment, it could not be determined if (exhaust) ventilation systems or were operational.

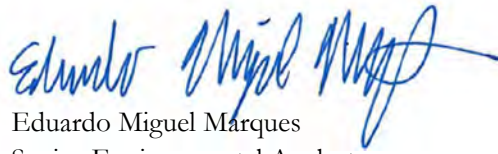
6.2 Recommendations

- Review documents (if available) of work performed on air handling system and, if applicable, review Safety Data Sheets to review products used during the work.
- A supplemental assessment may be necessary during normal school hours (when building is normally occupied) to review ventilation and verify appropriate air exchange within the assessed areas.
 - This is to document if there is a change in concentrations of carbon dioxide and/or TVOCs
- Review schedule and scope for general cleaning tasks with custodial staff and/or occupants
 - This may include periodic cleaning of HVAC supply and return vents as well as air purifying equipment and review of proper use in accordance with the manufacturer's recommendations.
- Continue regular maintenance of the HVAC system(s), including regular filter change/cleaning and maintenance.
 - This may include alternative storage locations of maintenance products such as anti-freeze.
- Conduct a review of the HVAC system to ensure the ventilation system is operating as designed.

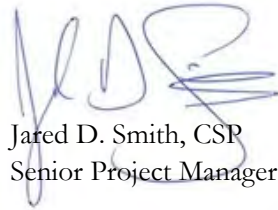
Refer to *Appendix E* for photographs taken during the assessment.

Report prepared by Senior Environmental Technician, James B. Blum, CMC.

Report reviewed by:



Eduardo Miguel Marques
Senior Environmental Analyst



Jared D. Smith, CSP
Senior Project Manager

Appendix A

Limitations

APPENDIX A

**Site: Toquam Elementary School
123 Ridgewood Ave, Stamford, CT**

1. This environmental report has been prepared for the exclusive use of Stamford Public Schools (the "Client"), and is subject to, and is issued in connection with our email task authorization dated February 24, 2020. Any use or reliance upon information provided in this report, without the specific written authorization of the Client and Fuss & O'Neill, Inc. (Fuss & O'Neill) shall be at the User's individual risk.
2. Fuss & O'Neill has obtained and relied upon information from multiple sources to form certain conclusions regarding the Site when conducting this assessment. Except as otherwise noted, no attempt has been made to verify the accuracy or completeness of such information or verify compliance by any party with federal, state or local laws or regulations.
3. The findings, observations, and conclusions presented in this report are limited by the scope of services outlined in our task email authorization dated February 24, 2020. Furthermore, the assessment has been conducted in accordance with generally accepted environmental practices. No other warranty, expressed or implied, is made.
4. The conclusions presented in this report are based solely upon information gathered by Fuss & O'Neill to date. Should further environmental or other relevant information be discovered at a later date, the Client should immediately bring the information to Fuss & O'Neill's attention. Based upon an evaluation and assessment of relevant information, Fuss & O'Neill may modify this report and its conclusions.

Appendix B

Site Diagram



**Toquam
Magnet School**

Appendix C

List of Instrumentation

Instrumentation

Measurement Parameter	Description	Calibration
Temperature, Relative Humidity, Carbon Dioxide & Carbon Monoxide	TSI IAQ-Calc IAQ Meter (7545X)	Annually – 2019
Volatile Organic Compounds	Ion Science Tiger photoionization detector	Annually – 2020 & Field Calibrated

Appendix D

Data Sheet for Temperature, Relative Humidity, Carbon Dioxide, Carbon Monoxide, and Volatile Organic Compounds

Air Quality Parameters

CLIENT: Stamford Public Schools

SITE ADDRESS: 123 Ridgewood Avenue

CITY & STATE: Stamford, CT

FUSS & O'NEILL PROJECT NO. 20140748.A10

Date: February 24, 2020

Location: Toquam Elementary School – Room 34

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Location	Time (0000)	# of Occupants	CO ₂ (PPM)	CO (PPM)	Temp. (°F)	RH (%)	VOCs (PPM)
Recommended Guidelines			< 1,200	< 9.0	68-79	30-60	Not Applicable
Pre-Assessment – Exterior	1400	NA	441	0.0	60.3	16.1	0.0
Room 34	1416	0	944	0.0	74.6	21.1	0.0 Throughout Space
Hallway	--	-	-	-	-	-	0.7 at Air Supply Vent
Room 33	1533	0	1008	0.0	72.5	23.4	0.4 Throughout
Room 34	1620	0	1120	0.0	71.5	27.0	0.0 Throughout Space
Post-Assessment – Exterior	1640	NA	438	0.0	55.8	18.6	0.0

Appendix E

Site Photographs



Classroom 34



HVAC unit – Not operating; runs during summer season



Classroom 34 – Return vent of HVAC unit



Classroom 34 – Tower-style Air Purifying equipment and pre-filter



Classroom 34 – Filter in original manufacturer's plastic wrapping



Classroom 33 – Filter of Tower-style Air Purifying equipment showing significant particulate loading



Hallway – Air Supply vent adjacent to Classroom 33 and 34



Roof-mounted HVAC systems



Roof – Anti-freeze container within HVAC housing



Roof – Additional view of anti-freeze container in 2nd HVAC housing



Roof – View of air intake filters