Indoor Air Quality Assessment

Our Lady of the Cape School, K - 8

Cape St. George, Western Region

Prepared for

Transportation & Works

Prepared By:

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1.0 Introduction

On March 21, 2019, the undersigned conducted an indoor air quality assessment at our Lady of the Cape. The school is currently a kindergarten to Grade 8 school operated by NLESD. The assessment measured; carbon dioxide levels, Total volatile organic compound (TVOCs) levels, and included a visual assessment for mould.

2.0 Building Description

The school has a footprint of 36,000 square feet and was originally constructed in 1979 with renovations occurring in 1992. The school is primarily concrete wall construction with brick veneer and metal siding. Ceiling and ceiling finishes consist mainly of 2' x 4' acoustic lay-in tile. Floor finishes consist of 1' x 1' vinyl tile, vinyl sheet flooring, poured concrete, ceramic tile and rubber stair treads.

Interior lighting consists of fluorescent, incandescent and emergency backup lights. The school building is primarily heated by electric wall mounted units.

Prior to conducting the assessment, a HAZMAT report carried out by All-Tech in 2008 was reviewed and no specific concerns were noted from that document.

A review of TW records indicate that the roof (2 ply modified roof system) was replaced in 2008.

Other than building washrooms and custodial rooms, there was no visual evidence of mechanical ventilation in classrooms throughout the school. As such, natural ventilation is provided via opening windows.

From an indoor air quality perspective, the lower wing to be occupied by the CSFP, has little to no wall materials susceptible to water damage. Furthermore, the windows (vertical aluminum sliders), appear to be in good condition, and are operable to ensure adequate natural ventilation is provided. Given the combined school occupancy load, and the size of the occupied areas, it is unlikely that carbon dioxide levels will accumulate to levels of concern.

3. Methodology

Carbon dioxide readings were taken using a YESAIR IAQ Monitor (Serial # YA1011K00360) that was previously serviced and calibrated by Enviromed Solutions on February 8, 2019.

VOC readings were taken using Enviromed Detection Services calibrated (March 20, 2019) MiniRae 3000 (Serial # 592-903887).

Sampling began at approximately 11:30 am in the lower level of the building and was later carried out upstairs around 12:15. School ended for the students at 12:00 due to parent teacher meetings scheduled in the afternoon for 12:30.

The lower level classrooms, with the exception of the Industrial Arts Room, are used for storage and as such were not occupied. However, there were approximately 8 to 10 people in the immediate area involved in moving materials out of the rooms and hallway. “Touch up” painting had been carried out in the basement in the days prior to this assessment. The paint containers on site were low VOC type paints.

The sampling for VOCs and carbon dioxide carried out on the upper level was after students were finished for the morning (approximately 15 minutes after).

4.0 Standards Related to Carbon Dioxide (CO_2) Levels and Volatile Organic Compounds (VOCS)

4.1 Carbon dioxide (CO_2)

The American Conference of governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs), are the airborne permissible limits for NL workplaces, as regulated by the Occupational Health and Safety Branch, Service NL. The ACGIH have set an airborne limit of 5000 ppm for carbon dioxide. However it is not considered for air quality purposes to be an appropriate standard for assessing the adequacy of fresh air in classrooms. The Environmental Health Inspectorate, a branch of Service NL, has not established a specific limit for carbon dioxide in schools.

In the absence of relevant NL regulatory standards for schools, there are a number of guidelines used elsewhere that will be briefly discussed here.

Health Canada has established a CO_2 residential level of 3500 ppm based on biochemical changes that are detectable at the cellular level in the human body. This standard is not particularly relevant to schools given the higher occupancy rates as compared to homes.

ASHRAE Standard 62, a guideline established by the American Society of Heating, Refrigerating, and air-conditioning Engineers, used by building designers, recommends maintaining carbon dioxide levels within 700 ppm above outdoor levels. If the ventilation rate is held at about 15 cfm per person, it is believed that the resulting steady-state CO_2 concentration mentioned above (approximately 1100 ppm) will be deemed acceptable to the majority of visitors entering that space from a body odour perspective and overall occupant comfort.

However, ASHRAE, section 1.3, states it has not written the standard for the regulation of existing buildings although the principles are the same. Section 1.2 and 2.4 acknowledges some of the new standard requirements may be unreasonable for existing buildings.

In the United Kingdom, schools are held to an 8 hour time weighted level of 1500 ppm for carbon dioxide. The UK’s Building Bulletin 101, DfES (2006), uses carbon dioxide as an IAQ indicator for schools and goes on to prescribe a maximum concentration of 5000 ppm and a

mean occupied concentration of 1500 ppm.

4.2 Volatile Organic Compounds (VOCs)

VOCs are a large group of carbon-based chemicals with similar chemical properties that have high vapor pressures at room temperature. Examples include acetone, toluene, hexane, xylene, etc. Neither NL nor the Federal Government has set standards specifically for total VOCs (TVOC) levels in non-industrial settings.

One practical approach for providing indoor air quality guidelines for VOCs has been to use Total VOC (TVOC) as a general indication of the quality of air. This approach is generalized from published toxicological studies performed to determine the health effects elicited by humans exposed to mixtures of VOCs under controlled conditions.

The findings are as follows:

Table 2: Anticipated health effects from various VOC Levels in Non-Industrial Settings

VOC Concentration Range	**Exposure Range**	**Health Effects**
< 0.12 ppm	Comfort Range	No irritation or discomfort expected
0.12 to 1.2 ppm	Multifactorial Exposure Range	Odors, irritation and discomfort may appear in the presence of TVOC together with other thermal comfort factors and stressors
1.2 to 10 ppm	Multifactorial Discomfort Range	Further discomfort, complaints may be expected

Source: Health Canada: “Indoor Air Quality in Office Buildings: A Technical Guide” (2007).

5.0 Findings:

Prior to measuring inside the school, outdoor readings were taken for comparison purposes. The outdoor readings were 450 ppm CO_2 and 0 ppm total volatile organic compounds.

1. A summary of instantaneous carbon dioxide and VOC readings taken on March 21,2019, are as follows:

Table 1: CO2 and VOC Instantaneous Levels taken throughout the School late morning/early afternoon

Room	**CO2 Level (ppm)**	**VOC readings (ppm)**
Lower Level to be occupied		
Industrial Arts	628 ppm	0 (undetectable)
Classroom 205 (adjacent to Industrial Arts)	529 ppm	0 (undetectable)
Classroom 206	650 ppm	0 (undetectable)
Classroom 202 (will be kindergarten class)	680 ppm	0 (undetectable)
Gym	699 ppm	0 (undetectable)
Cafeteria	647 ppm	0 (undetectable)
Upper Level		
Room 103	1132 ppm	0 (undetectable)
Main hall adjacent to room 103	1160 ppm	0 (undetectable)

2. A visual inspection of the lower level and portions of the upper level revealed no visible mildew or mold.

6.0 Discussion:

Teachers, support staff and students spend up to 8 hours of their day at school. Therefore, maintaining adequate indoor air quality (IAQ) in their building is of utmost importance. To maintain adequate indoor air quality it is important to provide outside air to dilute potential indoor air pollutants including odors.

6.1 Carbon dioxide (CO_2)

CO_2 is a natural component of the air outside. The school outdoor air was 450 ppm carbon dioxide. Carbon dioxide is often used as an "indicator" of the adequacy of air delivery to a space.

Since building occupants generate high levels of carbon dioxide in their breath (approximately 100 times higher than outdoor levels), the goal of ventilation is to maintain CO_2 levels in buildings at or below the recommended ASHRAE (American Society of Heating Refrigerating and Air-Conditioning Engineers) levels (700 ppm above outdoor air levels).

CO_2 at the concentrations commonly found in buildings is not believed to be a direct health risk, but CO_2 concentrations can be used as an indicator of occupant odors and occupant acceptance of these odors. At the activity levels found in typical office buildings, steady state CO_2 concentrations of about 700 ppm above outdoor air levels indicate an outdoor ventilation rate of about 15 cfm/person. Lab and field studies have shown that this rate of ventilation will dilute odors from human bio-effluents to levels that will satisfy a substantial majority of visitors in a space. … Thus indoor CO_2 concentrations of 1000 to 1200 ppm in spaces housing sedentary people is an indicator that a substantial majority of visitors entering the space will be satisfied with respect to human bioeffluents (body odor)". (Source: ASHRAE's Technical "Frequently Asked Question" Document ID 35)

The carbon dioxide levels on the main level were higher than those levels found downstairs. This is not surprising since there were more people present during the morning on the main level. That being said, the CO2 levels found were within ASHRAE's recommendations for all classrooms sampled. During my visit I did not observe any windows open in regards to the main level. However, it is possible that they may have been open prior to my arrival. It was approximately 2 C outdoors.

With respect to ventilation and carbon dioxide, numerous windows were checked and they were found to be operable. Large benefits can be gained in terms of carbon dioxide level reductions by opening windows small amounts periodically throughout the day during times of high occupancy loads.

6.2 Total Volatile Organic Compounds

VOC readings indicated that no detectable levels of volatile organics were accumulating within the building. Classrooms and hallways recorded no detectable readings (resolution 0.1 ppm).

6.3 Mold

During the site visit, there was no visible mildew/mould noted. In addition, the presence of interior concrete block along the building perimeter, as opposed to gypsum board, is ideal for minimizing the likelihood for mold to grow if and when water damage occurs in future.

6.4 Dust

With respect to the Industrial Arts Room, which apparently is only used once per week by the Grade 8 class, there was no evidence of a portable dust collector available on site. Such a device should be used for controlling dust emissions, in order to ensure dust is not only controlled within the room, but does not leave the room as well. It is possible that it is available, but was not evident during the inspection.

Conclusions and Recommendations

The indoor environment of Our Lady of the Cape has no apparent health concerns. However, for occupant comfort to be maximized:

1. Continue adhering to the natural ventilation policy (see Appendix A). The contents of this report should be explained to staff as well as the purpose behind the Natural Ventilation Policy. The district/school management in consultation with the occupational health and safety committee should continue to promote the natural ventilation protocol.

2. Confirm the presence and usage of portable dust collection equipment during dust generating activities within the industrial Arts room.

Yours truly,

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Appendix A