

**HUMAN
RESOURCES**

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Memorandum

To: Kevin Tasa, Associate Dean, Academic, Schulich School of Business

From: Jessica Hau, Health & Safety Advisor, Health, Safety & Employee Well-Being

Date: October 20, 2022

Subject: Indoor Air Quality (IAQ) Testing – Schulich School of Business, McEwen Building G101

Background:

On September 29, 2022, concerns regarding Carbon Dioxide (CO₂) levels in room G101 in the McEwen Building were brought to the attention of Health, Safety and Employee Well-Being (HSEWB). HSEWB conducted an IAQ assessment, which involved continuous air monitoring (data logging) on October 6, 2022 and spot measurements on October 13, 2022 during the scheduled lectures.

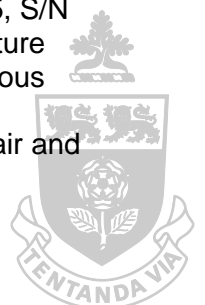
Observations:

G101 is located on the east side of the first floor of the McEwen Building. This room is only used for scheduled classes. There are supply vents at the front of the classroom, under the chalkboard. The classroom has an occupancy capacity of 73 students. No odour was noticed or reported while in the area.

The continuous monitoring was conducted during the regularly scheduled class on October 6, 2022. During the monitoring, 1 instructor presented the lecture to 36 students. Upon entry into the classroom, several individuals indicated that the “air is stuffy”, and students had indicated that the temperatures were above their comfort levels. A student attempted to open the windows within the classroom to cool the space down, however, the windows could not be opened in this space.

Following additional adjustments to the ventilation system, spot measurements were taken during the regularly scheduled class on October 13, 2022. Measurements were taken at the beginning of the scheduled class (approximately 11:45 AM), at the end of the lecture (approximately 1:30 PM), and at the end of the scheduled class (at 2:30 PM) during a lecture with 45 students in attendance.

IAQ testing was completed using the Q-Trak meter (Model VelociCalc/Q-Trak 7575, S/N 7575X1418004) to measure air quality parameters: carbon dioxide (CO₂), temperature (T), relative humidity (RH), and barometric pressure (BP). Testing included continuous data logging and spot measurements during a scheduled lecture. As per routine procedure, spot measurements were taken (for the same parameters) for outdoor air and the hallway near the lecture room on each day of sampling.



For continuous data logging, the meter was set up at 10 second sampling intervals with measurements recorded. There was a class scheduled prior to the class to be monitored. Sampling was initiated 10 minutes prior to the start of the lecture and continued for 20 minutes after the lecture concluded. The instructor indicated that they change locations during the delivery of the class. The instrument was placed in the vicinity of the various locations that the instructor would be located for most of the class. The instructor required access to the computer (where they controlled their presentation), the blackboard, and the aisleway where they presented the lecture. The instructor maintained a 1.5 to 2 metre distance from the instrument. During the monitoring, a door remained ajar (approximately an inch wide opening). The instrument was also placed away from any source of air vents or doorways.



Figure 1 - Locations. (1) Location where the instructor delivers the lecture from; (2) Location where the closest student is seated.



Figure 2 - Locations (Continued). (3) Blackboard used by the instructor; (4) Location where the instructor accessed and controlled the course materials (e.g. presentation slides).

The spot measurements within the classroom were taken at 4 different locations: (1) the front of the classroom (at the same location that the instrumentation was placed for the continuous monitoring), (2) the south side of the classroom (where the television is mounted), (3) the back of the classroom (where the windows to the outside are located), and (4) the north side of the classroom.

This report summarizes the results of the testing conducted. Table 1 shows the Occupational Exposure Limits and recommended guidelines on indoor air quality parameters, Table 2 show the continuous air monitoring results from October 6th, 2022, and Table 3 shows the spot measurement results from the beginning of the scheduled class on October 13, 2022 at approximately 11:45 AM. Table 4 shows the spot measurement results from the end of the scheduled class on October 13, 2022 at approximately 1:30 PM (at the end of the lecture) and at 2:30 PM (the schedule end of the class).

Table 1 - Recommended Levels based on MLTSD, CSA Standard Z412 and ASHRAE 55 Standards:

Carbon Dioxide (CO ₂) PPM	Temperature (°C)	Relative Humidity (RH%)
See explanatory note* below.	<u>Winter:</u> 20.0°C - 23.6°C <u>Summer:</u> 22.8°C - 26.1°C (ASHRAE 55)	<u>Winter:</u> 20 - 60% <u>Summer:</u> 30 - 50% preferred
ppm = parts per million		

*** Recommended Indoor CO₂ concentration/level:**

- Health Canada (CO₂ exposure limit for **Canadian homes** is 1000 ppm based on a 24-hour average: <https://www.canada.ca/en/health-canada/services/publications/healthy-living/carbon-dioxide-home.html>)
- Health Canada also refers to ASHRAE's recommendation (below):
- The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) recommends maintaining indoor CO₂ levels no greater than 700 ppm above ambient levels (assumed to range between 300 and 500 ppm): https://www.ashrae.org/File%20Library/Technical%20Resources/Standards%20and%20Guidelines/Standards%20Addenda/62.1-2016/62_1_2016_d_20180302.pdf

Occupational Exposure Limits for Workplaces:

- Occupational Exposure Limit = 5000 ppm TWA (time awaited average over an 8-hour working shift/day during a 40-hour working week), Short Time Exposure Limit (15 minutes) STEL = 30000 ppm. Health effects can occur at 5000 ppm and over) - Ontario, OSHA, NIOSH <https://www.ontario.ca/page/current-occupational-exposure-limits-ontario-workplaces-under-regulation-833>

Table 2 – IAQ Test Summary Results - Continuous air monitoring (data-logging):

Date/Time: October 6, 2022; 11:31 PM – 2:08 PM				
	CO ₂ (ppm)	T (0°C)	RH (%)	BP (kPa)
Outdoor				
Before Class	464	21.2	54.4	101.0
After Class	428	22.0	40.3	100.9
Hallway				
Before Class	623	21.5	44.0	101.0
After Class	655	23.0	39.6	100.9
Classroom				
Min	554	24.0	38.3	100.9
Max	1879	25.0	49.7	101.0
Average	1642	24.8	47.6	101.0
Interpretation	Does not meet recommendations	Meets recommendations	Meets recommendations	Not Applicable

Air Monitoring Results - Graph

The graph below summarizes the details of the air samples taken in the classroom before, during and after class on October 6, 2022. Air quality parameters are indicated on the Y-axis and the time is indicated on the X-axis.

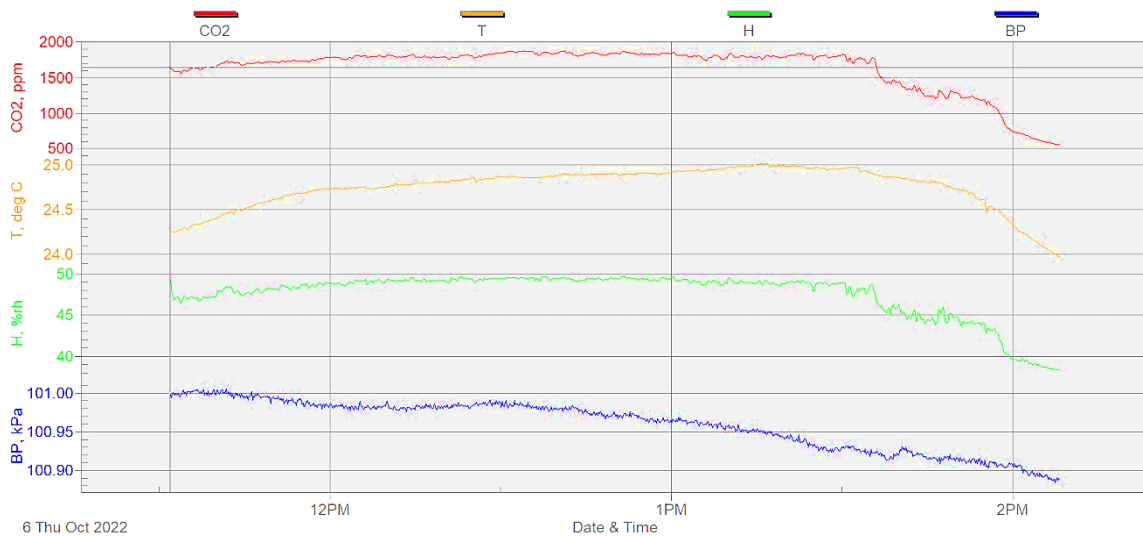


Figure 3 – Air monitoring results. Carbon Dioxide (CO₂); Temperature (T); Relative Humidity (H); Barometric Pressure (BP).

Table 3 – IAQ Test Summary Results – Spot Measurements at the Beginning of the Class:

Date/Time: October 13, 2022 (At the Beginning of the Class, approximately 11:45 AM)				
	CO₂ (ppm)	T (0°C)	RH (%)	BP (kPa)
Outdoor				
Min	421	12.8	59.0	99.8
Max	440	13.8	60.5	99.8
Average	428	13.3	59.7	99.8
Hallway				
Min	660	18.8	66.7	99.8
Max	708	19.2	68.0	99.8
Average	688	19.0	67.3	99.8
Front of the Classroom				
Min	665	21.3	54.6	99.9
Max	696	21.3	54.8	99.9
Average	683	21.3	54.7	99.9
South Side of the Classroom				
Min	680	21.4	55.6	99.9
Max	695	21.4	56.7	99.9
Average	689	21.4	56.3	99.9
Back of the Classroom				
Min	714	21.5	55.4	99.9
Max	737	21.5	56.1	99.9
Average	730	21.5	55.8	99.9
North Side of the Classroom				
Min	706	21.6	54.5	99.9
Max	731	21.6	55.7	99.9
Average	717	21.6	55.2	99.9
Interpretation	Meets recommendations	Meets recommendations	Meets recommendations	Not Applicable

Table 4 – IAQ Test Summary Results – Spot Measurements at the End of the Class:

Date/Time: October 13, 2022				
	CO₂ (ppm)	T (0°C)	RH (%)	BP (kPa)
At the End of the Lecture (Approximately 1:30 PM)				
Outdoor				
Min	419	14.2	54.8	99.8
Max	431	15.7	58.4	99.8
Average	423	15.0	56.5	99.8
Hallway				
Min	705	18.5	66.8	99.8
Max	742	18.9	67.8	99.8
Average	722	18.6	67.2	99.8
Front of the Classroom				
Min	803	22.2	51.7	99.8
Max	828	22.2	51.9	99.8
Average	817	22.2	51.8	99.8
South Side of the Classroom				
Min	776	22.1	52.5	99.8
Max	792	22.1	52.8	99.8
Average	788	22.1	52.7	99.8
Back of the Classroom				
Min	808	22.2	52.6	99.8
Max	820	22.2	53.4	99.8
Average	817	22.2	52.9	99.8
North Side of the Classroom				
Min	822	22.2	52.4	99.8
Max	845	22.2	52.7	99.8
Average	836	22.2	52.5	99.8
Interpretation	Meets recommendations	Meets recommendations	Meets recommendations	Not Applicable
At the End of the Lecture (Approximately 1:30 PM)				
Outdoor (same as information for 1:30 PM)				
Min	419	14.2	54.8	99.8
Max	431	15.7	58.4	99.8
Average	423	15.0	56.5	99.8
Hallway (same as information for 1:30 PM)				
Min	705	18.5	66.8	99.8
Max	742	18.9	67.8	99.8
Average	722	18.6	67.2	99.8

Front of the Classroom				
Min	468	20.6	47.2	99.8
Max	507	20.8	48.0	99.8
Average	490	20.7	47.7	99.8
South Side of the Classroom				
Min	457	20.7	47.3	99.8
Max	459	20.8	47.4	99.8
Average	458	20.8	47.4	99.8
Back of the Classroom				
Min	457	20.7	47.4	99.8
Max	463	20.8	47.6	99.8
Average	469	20.8	47.4	99.8
North Side of the Classroom				
Min	468	20.8	47.3	99.8
Max	471	20.8	47.4	99.8
Average	469	20.8	47.4	99.8
Interpretation	Meets recommendations	Meets recommendations	Meets recommendations	Not Applicable

Conclusions:

- CO₂ level is an indicator of the adequacy of fresh air. The majority of the measurements taken for carbon dioxide (CO₂) during the initial air monitoring session on October 6, 2022 do not meet the recommendations. Subsequent measurements taken during a follow-up assessment meet the recommendations outlined above.
- The temperature readings were within the recommended guidelines.
- The relative humidity (RH%) levels measured were lower than the outdoor levels.

The testing/sampling was done in accordance with the applicable reference guidelines and with the information available at that time.

When the COVID-19 and ventilation concerns were raised HSEWB contacted Facilities Services who made improvements to the ventilation. Following the improvements, HSEWB conducted air quality monitoring and identified elevated carbon dioxide levels. Upon discovery, HSEWB notified Facilities Services, who investigated and made additional adjustments to the ventilation system.

Following the adjustments, Facilities Services continued to monitor the levels within the area over the course of the week. As a best practice, HSEWB performed confirmatory monitoring on the next scheduled class. It was confirmed that the controls in place are functioning as intended as the levels meet the recommendations.

Facilities Services indicated that the changes are temperature-dependent, so the supply air intake will likely need to get reassessed and adjusted as the temperatures cool down over the Fall season.

Please contact HSEWB if there are any questions on this report or further assistance is needed

Regards,

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References:

- https://www.ccohs.ca/oshanswers/phys_agents/thermal_comfort.html
- Occupational Health and Safety Act (OHS Act). R.R.O. 1990
- Ontario Industrial Establishments Regulation. O.Reg. 851/90
- Health <https://www.canada.ca/en/health-canada/services/publications/healthy-living/carbon-dioxide-home.html>
- The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
https://www.ashrae.org/File%20Library/Technical%20Resources/Standards%20and%20Guidelines/Standards%20Addenda/62.1-2016/62_1_2016_d_20180302.pdf

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