

# INDOOR AIR QUALITY ASSESSMENT REPORT

## Ottawa Light Rail Train (LRT) – Rideau Station

**Prepared for:**

Glen Hanlan  
Rideau Transit Maintenance

**Performed by:**



Derek Stashick, B.Ed, CMI, C-NRPP  
Project Manager

**Reviewed by:**

Buller Crichton Environmental Inc.



Mike Buller, ROHT, CRSP, CMI  
Partner

Date of Report: February 7<sup>th</sup>, 2020

BCE Project Number: 20-109

## **EXECUTIVE SUMMARY**

An Indoor Air Quality (IAQ) assessment was conducted on February 6<sup>th</sup>, 2020 by Buller Crichton Environmental Inc. (BCE) within the Ottawa Light Rail Train (LRT) Rideau Station (the “Site”) for the Rideau Transit Maintenance (Client).

The IAQ assessment was conducted following concerns regarding an odour which is reportedly associated with water infiltrating the tunnel system adjacent to the West platform of the Rideau Station. Locations were specified by the Client based on odour complaints within the Rideau Station. Each location was assessed, and measurements were recorded. IAQ data was assessed against ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Standard 62.1, 2016 “Ventilation for Acceptable Indoor Air Quality”, Health Canada guidelines and the Ministry of Labour’s Ontario Regulation 632/05- *Confined Space* and Ontario Regulation 833- *Control of Exposure to Biological and Chemical Agents* made under *Ontario Occupation Health and Safety Act* and Part II of the Canada Labour Code (CLC)- *Occupation Health and Safety*.

The following IAQ parameters were recorded at each location:

- Oxygen Content (O<sub>2</sub>);
- Hydrogen Sulphide (H<sub>2</sub>S);
- Lower Explosive Limits (LEL) of Combustible Gases;
- Total Volatile Organic Compounds (TVOCs);
- Carbon Monoxide (CO);
- Carbon Dioxide (CO<sub>2</sub>); and
- Percent Relative Humidity (%RH).

No concerns were identified regarding atmospheric hazards of H<sub>2</sub>S, O<sub>2</sub> and the lower explosive limits of combustible gases. The air quality observed within the selected locations of the Rideau Station is within the acceptable ranges to satisfy 80% of the occupants as required by current ASHRAE and Health Canada guidelines for RH, CO, CO<sub>2</sub> and TVOCs.

For complete information and findings, as well as the limitations, the reader should read the complete report.

## **INTRODUCTION & BACKGROUND**

An Indoor Air Quality (IAQ) assessment was conducted on February 6<sup>th</sup>, 2020 by Buller Crichton Environmental Inc. (BCE) within the Ottawa Light Rail Train (LRT) Rideau Station (the “Site”) for the Rideau Transit Maintenance (Client).

The IAQ assessment was conducted following concerns regarding an odour which is reportedly associated with water infiltrating the tunnel system adjacent to the West platform of the Rideau Station. Locations were specified by the Client based on odour complaints within the Rideau Station. Each location was assessed, and measurements were recorded. IAQ data was assessed against ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Standard 62.1, 2016 “Ventilation for Acceptable Indoor Air Quality”, Health Canada guidelines and the Ministry of Labour’s Ontario Regulation 632/05- *Confined Space* and Ontario Regulation 833- *Control of Exposure to Biological and Chemical Agents* made under *Ontario Occupation Health and Safety Act* and Part II of the Canada Labour Code (CLC)- *Occupation Health and Safety*.

The following report includes a description of the assessment methodologies, discussion and conclusions of the investigation findings as well as sampling results.

## **SCOPE OF WORK & METHODOLOGY**

### Scope of Work

The scope of this assessment was completed on February 6<sup>th</sup>, 2020. IAQ measurements were recorded at a total of five (5) locations as specified by the Client.

The following IAQ parameters were recorded in each location:

- Oxygen Content (O<sub>2</sub>);
- Hydrogen Sulphide (H<sub>2</sub>S);
- Lower Explosive Limits (LEL) of Combustible Gases;
- Total Volatile Organic Compounds (TVOCs);
- Carbon Monoxide (CO);
- Carbon Dioxide (CO<sub>2</sub>); and
- Percent Relative Humidity (%RH).

Outdoor air sampling was completed for all measured parameters to provide benchmark data.

## **METHODOLOGY**

### Comfort Parameters

Carbon monoxide, carbon dioxide and percent relative humidity were tested using a TSI Q-track instrument designed to measure the noted comfort parameters.

RH was collected as they affect occupants' actual as well as perceived thermal comfort within the office environment.

Temperature was excluded from the assessment as this is not an applicable parameter to the conditions at the site (i.e., outdoor scenario).

CO<sub>2</sub> levels were collected as they provide an indication of the ventilation performance, the quality of air within the indoor environment, and an indication of whether enough outside air is being delivered.

Carbon monoxide was collected to ensure that no outside sources of combustion released carbon monoxide gas into the investigated areas.

### Total volatile organic compounds (TVOCs)

Instantaneous measurements for TVOCs were collected using an RKI GX-6000 monitor. This instrument is used as a screening tool for VOCs in general, for short or long periods of time. The limit of detection for VOCs is 1 ppb. VOCs include a variety of chemicals, some of which may cause adverse health effects.

Concentrations of many VOCs are generally higher indoors than outdoors. VOCs are emitted by many common products including paints and lacquers, paint strippers, cleaning supplies, pesticides, building materials and furnishings, fuels, office equipment and supplies, glues and adhesives, and permanent markers, as well as cosmetics, perfumes, hand sanitizers, and other personal hygiene products. All these products can release organic compounds while being used or stored.

### Atmospheric Hazards

Samples for oxygen content (O<sub>2</sub>), hydrogen sulphide (H<sub>2</sub>S) and lower explosive limits (LEL) of combustible gases were collected during the assessment using an RKI GX-2010 Multi-gas detector. Built around high-quality micro-sensor technology, the GX-2012 is RKI's smallest personal 1-5 sensor gas monitor with a built-in sample pump. Controlled by a microprocessor, the GX-2012 continuously checks itself for sensor connections, low battery, circuit trouble, low flow, and calibration errors.

## REGULATIONS AND GUIDELINES

There are no regulations regarding indoor air quality in office buildings in Canada, however standards are outlined in the 1995 Health Canada publication “*Indoor Air Quality in Office Buildings - A Technical Guide*” and the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE).

ASHRAE Standard 55-2017 “*Thermal Environmental Conditions for Human Occupancy*” and ASHRAE Standard 62.1 – 2016 “*Ventilation for Acceptable Indoor Air Quality*” as well as Health Canada guidelines are some of the most recognized guidelines when interpreting mould and IAQ data and were used to interpret the results of this assessment. The ASHRAE guidelines specify conditions in which 80% or more of the occupants are expected to find the indoor environments acceptable.

Health Canada recommends that RH be maintained above 25 percent to prevent uncomfortable working conditions and drying of mucous membranes and below 65% to inhibit mould growth. ASHRAE recommends keeping buildings below 70% RH. With an average measured RH and an understanding of the time of year (i.e. summer or winter) the operative temperatures recommended by American Society of Heating and Refrigeration Engineers (ASHRAE) Standard 55-2017 *Thermal Conditions for Human Occupancy* range are outlined in Table 1 below. The difference between summer and winter is a result of expected clothing worn in office buildings during these months.

**Table 1: Temperature Ranges Based on Average Relative Humidity Readings & Time of Year**

Relative Humidity	Temperature	
	Winter	Summer
10%	21.5°C to 26.0°C	25.0°C to 28.0°C
20%	21.0°C to 25.5°C	24.5°C to 27.5°C
30%	21.0°C to 25.0°C	24.0°C to 27.5°C
40%	20.5°C to 24.5°C	24.0°C to 27.0°C
50%	20.0°C to 24.5°C	24.0°C to 27.0°C

Health Canada recommends that carbon monoxide levels be maintained below 25 parts per million (ppm) as a short term (i.e. one hour) exposure and below 11 ppm as a long term (i.e. 8 hour) average.

ASHRAE recommends that CO<sub>2</sub> concentrations within the indoor environment remain below 700 ppm above outdoor levels.

Health Canada guidelines for TVOCs indicate a target limit of approximately 400 ppb and an action limit of approximately 2,000 ppb is being discussed. BCE would consider an office environment with TVOC concentrations up to 400 ppb units to be at little risk of IAQ complaints.

The Ministry of Labour’s Ontario Regulation 632/05- *Confined Space* (O.Reg 632/05) and Ontario Regulation 833 (O.Reg 833) - *Control of Exposure to Biological and Chemical Agents* made under *Ontario Occupation Health and Safety Act* and Part II of the Canada Labour Code (CLC) - *Occupation Health and Safety* outlines acceptable limits of atmospheric hazards such as oxygen content, hydrogen sulfide and the LEL combustible gases. These guidelines recommend that atmospheric hazards exist where any of the following conditions exist.

- (a) The accumulation of flammable, combustible or explosive agents in excess of 10 percent of the lower explosive limit (LEL);
- (b) An oxygen content in the atmosphere that is less than 19.5% or more than 23.5% by volume;
- (c) An accumulation of atmospheric contaminants including gases, vapours, fumes, dusts, mists or vapours that could result in acute health effects that are immediately dangerous to life and health or impeded egress out of the confined space
- (d) The Time-Weighted Average Limit (TWA) of hydrogen sulfide (H<sub>2</sub>S) is 10 parts per million (ppm) and the Short-Term Exposure Limit (STEL) is 15 parts per million (ppm).

## **RESULTS AND DISCUSSION**

The assessment was completed February 6<sup>th</sup>, 2020. **Table 2** below provides an overview of results obtained during the survey.

**Table 2: IAQ Measurements, February 6<sup>th</sup>, 2020 – LRT Rideau Station**

Location	RH (%)	CO <sub>2</sub> (ppm)	CO (ppm)	TVOCs (ppb)	LEL Combustible Gases (%)	H <sub>2</sub> S (ppm)	O <sub>2</sub> (%)
East Concourse	35.6	521	0	0	0	0	20.9
West Concourse	40.7	487	0	0	0	0	20.9
West Platform (East Portion)	51.6	444	0	0	0	0	20.9
West Platform (West Portion)	46.2	533	0	0	0	0	20.9
Williams Street Entrance	37.5	553	0	6	0	0	20.9
Average	42.3	508	0	1.2	0	0	20.9
<b>Average Outdoor Benchmark</b>	<b>70.1</b>	<b>424</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>20.9</b>

The following parameters were used to assess the air quality at the Site.

### Visual Assessment

No obvious signs of water damage, suspected mould growth or other issues that may negatively impact indoor air quality were obvious nor observed during the assessment. Moreover, there was no significant evidence that any materials likely to generate significant quantities of airborne contaminants or contribute to poor air quality were present.

### Comfort Parameters

IAQ comfort parameters were recorded on February 6<sup>th</sup>, 2020. Outdoor benchmark samples were also collected. The following is a summary of findings.

#### Relative Humidity (RH)

With an average measurement of 42.3%, RH measurements collected were below the Health Canada guideline limits to reduce the likelihood of mould growth. Levels were also below the maximum guideline limit of 70% prescribed by (ASHRAE) Standard 55-2017 *Thermal Conditions for Human Occupancy*.

#### Carbon Dioxide (CO<sub>2</sub>)

Carbon dioxide measurements were well below the guideline limit of 1,124 ppm (700 ppm greater than the average outdoor concentration of 424 ppm measured on February 6, 2020) with an average reading of 508 ppm and a range of 444 to 553 ppm at the time of the assessment.

#### Carbon Monoxide (CO)

Concentrations of CO remained well within the Health Canada's long-term guideline of 11 ppm for the duration of the sampling. The average concentration within the station was 0 ppm. No concerns regarding CO were identified during the assessment.

#### Total Volatile Organic Compounds (TVOCs)

Readings collected for TVOCs ranged from 0 ppb to 6 ppb and averaged 1.2 ppb overall within all sampled areas at the time of the assessment. All readings were below the Health Canada Guideline of 400 ppb and were not considered elevated at the time of the assessment.

### Atmospheric Hazards

#### Oxygen (O<sub>2</sub>)

With an average measurement of 20.9%, oxygen content in the atmosphere remained well within the range of 19.5% and 23.5% as outlined by *Ontario Regulation 632/05*.

### *Lower Explosive Limits – Combustibles Gases*

With an average measurement of zero (0), combustible gases were not detected while on site and not considered a concern at the time of the assessment.

### *Hydrogen Sulphide (H<sub>2</sub>S)*

With an average measurement of zero (0), hydrogen sulphide levels remained well below the limit of 15 ppm as outlined by *Ontario Regulation 833* and was not considered a concern at the time of the assessment.

## **CONCLUSIONS & RECOMMENDATIONS**

The air quality observed within the selected locations of the Rideau Station is within the acceptable ranges to satisfy 80% of the occupants as required by current ASHRAE and Health Canada guidelines for RH, CO, CO<sub>2</sub> and TVOCs. Additionally, no concerns were identified regarding atmospheric hazards of H<sub>2</sub>S, O<sub>2</sub> and the lower explosive limits of combustible gases.

No recommendations are warranted based on the air quality sampling, and BCE understands that the source of the odour within the Rideau Station is currently being mitigated by Rideau Transit Maintenance.

## **REPORT LIMITATIONS**

The Site investigations were completed on February 6<sup>th</sup>, 2020. Observations expressed in this document apply only to conditions inside and outside of the building on the noted date.

In performing the assessment, BCE has relied in good faith on information provided by other individuals noted in this report.

Interpretation of the sample results are based on current industry standards. This includes sample comparison against applicable guidelines and threshold values as well as comparison against standard samples.

Work performed by BCE was conducted in accordance with generally accepted scientific practices current in this geographical area at the time the work was performed. No warranty is either expressed or implied, or intended by the agreement executed with the Client, or by furnishing oral or written reports or findings. The Client acknowledges that subsurface/concealed conditions may vary from those encountered inspected. BCE could only comment on the conditions observed on the dates and times the assessment was performed. The work was limited to those areas of concern identified by the Client. Other areas of concern may exist but were not investigated within the scope of this assignment.



BCE makes no other representations whatsoever, including those concerning the legal significance of its findings or as to other legal matters mentioned in this report, including, but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and these interpretations may change over time. BCE accepts no responsibility for consequential financial effects on transactions or property values, or requirements for follow-up actions and costs.

Information provided by BCE is intended for Client use only. BCE will not provide results or information to any party other than the Client, unless the Client, in writing, requests information to be provided to a third party.

Any use which a third party makes of this report is the responsibility of such third parties. BCE accepts no responsibility for damages, if any, suffered by any third party because of decisions made or actions based on this report. BCE states that to the best of our knowledge, the information presented is accurate.

**CLOSURE**

If you have any questions or require any further information, please feel free to contact the undersigned at (613) 729-5291. Thank you for the opportunity to be of service. We look forward to working with you again.

Best regards,

BULLER CRICHTON ENVIRONMENTAL INC.

Prepared by:



Derek Stashick, B.Ed, CMI, C-NRPP  
Project Manager



Mike Buller, ROHT, CRSP, CMI  
Partner