



Subway Air Quality – Final Report

Date: July 10, 2019
To: TTC Board
From: Chief Safety Officer

Summary

The TTC completed the subway air quality study over 2017 and 2018 to provide current information on the air quality in the underground portions of the subway and to determine employee exposures to airborne contaminants. Work group specific reports were sent to management, Joint Health and Safety Committees and union safety representatives in February 2019. The summary report was then presented to the Safety, Security and Environment (SX) Committee in June 2019.

Based on the air sampling results, the subway air quality continues to meet all Occupational Health & Safety Act (OHSA) occupational exposure standards for employees and is not expected to affect the health of employees in the assessed work positions with no pre-existing serious respiratory conditions.

These findings are generally consistent with the results of the 1995 Subway Air Quality Study, where none of the contaminants in the more than 280 samples collected were above the former or the current occupational exposure limits.

As there are no regulations for public exposures, Toronto Public Health (TPH) is currently undertaking a health assessment focused on subway commuter exposure to air pollutants using well established assessment approaches that are commonly used in the environmental health field: Human Health Risk Assessment and Rapid Health Impact Assessment. These assessments will provide new, specific information about the public health risks arising from particulate matter (PM) in the subway. As well, these risks will be considered in the context of the broader potential health impacts (both positive and negative) from commuting on the TTC subway system.

Recommendations

It is recommended that the TTC Board:

1. Receive this report, Subway Air Quality – Final Report for information.
2. Forward this report, Subway Air Quality – Final Report to the Toronto Board of Health

3. Require staff to report back when the Health Assessment Report from Toronto Public Health is completed.

Financial Summary

The cost of the Subway Air Quality study was approximately \$825,000 and the cost of the health assessment by Toronto Public Health is \$100,000 for a total cost of \$925,000. Most of the costs of the Subway Air Quality study were incurred in 2017 and 2018, with the balance of \$77,000 incurred in 2019. The total 2019 costs of \$177,000 were included in the 2019 TTC Operating Budget which was approved by the Board on January 24, 2019 and by City Council on March 7, 2019.

The Chief Financial Officer has reviewed this report and agrees with the financial impact information.

Equity/Accessibility Matters

The results of this work enable a fact based evaluation of the need for any future measures to be taken to address the needs of sensitive populations.

Decision History

Board Motion

At its May 18, 2017 meeting, Councillor Joe Mihevc put forth a Notice of Motion recommending that:

“TTC evaluate occupational exposures to fine particles and develop appropriate strategies to mitigate potential health impacts in consultation with responsible occupational health authorities; and further, that TTC provide support and resources to the Medical Officer of Health to oversee an independent study of the potential health impacts for passengers of air quality issues in the subway system, particularly in relation to mitigation measures that could be implemented.”

[http://www.ttc.ca/About the TTC/Commission reports and information/Commission meetings/2017/May 18/Reports/19 Notice of Motion Air Quality.pdf](http://www.ttc.ca/About%20the%20TTC/Commission%20reports%20and%20information/Commission%20meetings/2017/May%2018/Reports/19%20Notice%20of%20Motion%20Air%20Quality.pdf)

At its May 18, 2017 meeting, the Board referred the above Notice of Motion for a report that will address ways and means to study the potential impacts of air quality issues in the subway system and for information on whether any other major subway systems have undertaken similar work.

Board Receives Report on Proposed Approach

At its September 5, 2017 meeting, the proposed approach to studying subway air quality issues was presented and received by the Board.

Issue Background

On April 25, 2017, a Health Canada study entitled “The Urban Transportation Exposure Study (UTES)” was published in a peer-reviewed scientific journal. The UTES compared particulate matter (PM) exposures between major subway systems in Canada. The purpose of the UTES was to gather information about PM levels and therefore it did not draw conclusions about the impact of the PM levels on health. The UTES confirmed previous internal assessments that found that the PM is primarily iron from steel wheels and rails, and that PM concentrations are higher in an enclosed subway station than outside.

The purpose of the UTES was to better understand commuter exposure to air pollutants in metro systems across three Canadian cities. The UTES found that PM 2.5 exposures were higher in Toronto (95 µg/m³) than in Montreal (35 µg/m³) and Vancouver (19 µg/m³) which was based primarily on the different operating systems.

Previous TTC Subway Air Quality Studies

The TTC has conducted comprehensive subway air quality studies in 1977, 1980, and 1995. These were performed to provide information on the air quality in the underground portions of the subway and determined both employee and customer exposures to airborne contaminants. The 1995 study found that none of the 280 samples taken were above the occupational exposure limits for employees. It was determined that the subway air quality would not affect the health of employees or customers who do not have pre-existing serious respiratory conditions. In those past studies, PM 2.5 was never measured because no occupational exposure standards exist to compare to. Respirable dust which includes PM 2.5 was measured because it has an occupational exposure limit.

Since that time, numerous job-specific workplace investigations have been completed and recommendations were implemented as required.

Comments

The Ontario Ministry of Labour and Health Canada are responsible for establishing safe exposure limits for employees and the public, respectively. The TTC is responsible for complying with all applicable legislation and appropriate industry best practices and standards.

Occupational Exposures

The Ministry of Labour sets out occupational exposure limits in Ontario Regulation 833 - Control of Exposure to Biological or Chemical Agents and other related Regulations such as Ontario Regulation 490/09 Designated Substances. An occupational exposure limit is an upper limit on the acceptable concentration of a hazardous substance in workplace air for a particular material or class of materials.

Public Exposures

Public exposures are distinct from employee exposures as they have to take into account vulnerable populations including those in various states of health (e.g., with respiratory illnesses such as COPD), infants, young children and the elderly.

Health Canada has indicated that in regards to public health, there are no directly comparable standards for PM_{2.5} levels in the subway. Public exposure standards are normally for outdoor air, and are often averaged over 24 hours or even a year, which makes them difficult to apply to typical commuter exposure patterns.

TTC Subway Air Quality Study Results

The updated 2018 Subway Air Quality Study characterized employee exposures to airborne contaminants and verified compliance with applicable regulations made under the Occupational Health and Safety Act.

PM 2.5 dust samples were collected for future reference to occupational standards when and if they are developed. Total and respirable (less than 10 microns) dust samples were collected and compared to existing occupational exposure limits.

Based on the results of 5,697 air samples, the use of respiratory protection is not required for non-maintenance positions. Only one maintenance group, who are already part of the respiratory protection program, require respirators due to an exceedance of silica and inhalable particulates during structure maintenance activities.

None of the remaining levels of the sampled contaminants in this study exceeded the applicable occupational exposure limits specified in Ontario Regulation 833 Control of Exposure to Biological or Chemical Agents and Ontario Regulation 490/09 Designated Substances.

These findings are generally consistent with the results of the 1995 Subway Air Quality Study, where none of the contaminants in the 280 plus samples collected were above the former or the current occupational exposure limits.

Contact

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Signature

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Attachments

Attachment 1 – Subway Air Quality – Executive Summary



OHE CONSULTANTS
Occupational Hygiene & Environment

May 21, 2019

VIA EMAIL (Virgil.Umali@ttc.ca)

Toronto Transit Commission (TTC)
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Attention: Virgil Umali, M.H.Sc., CIH, Occupational Hygienist, Safety and Environment Department

**Subject: TTC Subway Air Quality Study – Executive Summary Report
TTC Subway System, Toronto, Ontario
OHE Project No: 22152**

OHE Consultants (OHE) and Pinchin Ltd. (Pinchin) were retained by Toronto Transit Commission (TTC) to conduct a study to assess the air quality in the underground portions of the subway system (herein referred to as the “Subway Air Quality Study”) by conducting personal and area air sampling for various airborne contaminants. The purpose of the study is to provide current information on the air quality; determine employee exposures; verify compliance with the Ontario Regulation 833 for Control of Exposure to Biological and Chemical Agents (Reg. 833) and the Ontario Regulation 490/09 for Designated Substances (O. Reg. 490/09), made under the Occupational Health and Safety Act; and assess the effectiveness of current controls.

OHE was retained to review and provide a master summary of the results of the Subway Air Quality Study. The scope of work performed as part of the Subway Air Quality Study included personal and area air sampling for various airborne contaminants to determine employee exposures during regular work shifts.

The airborne contaminants studied are listed below:

- a. Asbestos
- b. Respirable dust and crystalline silica
- c. Respirable metals (aluminum, cadmium, iron oxide, molybdenum, and zinc oxide)
- d. Inhalable dust and inhalable metals (beryllium, magnesium oxide, molybdenum, nickel, thallium, and vanadium pentoxide)
- e. Total metals (antimony, arsenic, barium, beryllium, cadmium, calcium oxide, chromium, cobalt, copper, lead, manganese, and selenium)
- f. Hexavalent chromium (on some survey dates)
- g. Particulate Matter 2.5 (PM_{2.5})
- h. Total dust

- i. Combustion engine exhaust markers (carbon monoxide (CO) and nitrogen dioxide (NO₂))
- j. Carbon dioxide (CO₂)
- k. Particle sizing (on some survey dates)
- l. Open characterization for semi-volatile organics (air and bulk sampling on one survey date)

Eighteen (18) work groups were assessed as part of the Subway Air Quality Study. These included the following Maintenance and Non-Maintenance Work Groups:

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|--|---|
| - Transit Enforcement – Special Constables | - Transit Enforcement – Transit Fare Inspectors |
| - End Terminal Cleaners | - Janitors |
| - Traffic Checkers | - Collectors & Customer Service Agents |
| - Station Service Maintenance Mechanics | - Escalator Services Crew |
| - Line Mechanics | - Plant Maintenance (Escalator) Welders |
| - Subway Operators / Guards | - Subway Supervisors |
| - Signals Technicians Crew | - Subway Electricians |
| - Radio Shop Technicians | - Sunset Corridor Services Crew |
| - Structure Maintenance Crew | - Track Patrollers |

Additional area air sampling was also performed at the following subway platforms:

- Dupont, Spadina, St. George, Museum, Queen’s Park, Union, Rosedale, and Lawrence Stations (Line 1)
- Dufferin, Yonge, Sherbourne, Castle Frank, and Pape Stations (Line 2)

Two (2) samples exceeded the applicable Occupational Exposure Limits (OELs) specified in Reg. 833 and O. Reg. 490/09. These were personal samples for respirable silica (quartz) and inhalable particulates of the Structure Maintenance Crew performing dry concrete cutting at Lower Bay on June 22, 2018. However, the workers were wearing full-facepiece respirators equipped with P100 filters, which would be expected to provide adequate protection against the silica and inhalable dust levels that were measured. Reportedly, the dry concrete cutting performed on June 22, 2018 (without adequate dust control) is not typically performed by the work crews. The concrete cutting is reportedly typically performed using water or a HEPA vacuum.

None of the remaining levels of the sampled contaminants in this study (5,697 samples) exceeded the applicable OELs specified in Reg. 833 and O. Reg. 490/09.

By work group/area, the number of samples that were below the applicable OELs is as follows:

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|--|---|
| - Special Constables (128 out of 128) | - Transit Fare Inspectors (128 out of 128) |
| - End Terminal Cleaners (399 out of 399) | - Janitors (254 out of 254) |
| - Traffic Checkers (259 out of 259) | - Collectors & Customer Service Agents (531 out of 531) |



- Maintenance Mechanics (243 out of 243)
- Line Mechanics (245 out of 245)
- Subway Operators / Guards (720 out of 720)
- Signals Technicians Crew (313 out of 313)
- Radio Shop Technicians (64 out of 64)
- Structure Maintenance Crew (60 out of 62)
- Subway Platform area samples (1,021 out of 1,021)
- Escalator Services Crew (241 out of 241)
- Plant Maintenance (Escalator) Welders (97 out of 97)
- Subway Supervisors (396 out of 396)
- Subway Electricians (128 out of 128)
- Sunset Corridor Services Crew (153 out of 153)
- Track Patrollers (317 out of 317)

With the exception of the Structure Maintenance Crew, based on the results of the air sampling obtained to date, the use of respiratory protection during the work shifts studied is not required. This applies to the observed tasks performed by the work groups assessed.

This executive summary report provides a brief overview of the findings of the Subway Air Quality Study. It is not intended to substitute for the complete work group and master summary reports, nor does it discuss specific issues documented in the reports. The executive summary report should not be used as a substitute to reading the complete reports.



General Statement of Limitations

The information and opinions rendered in this report are for use exclusively by the **Toronto Transit Commission (TTC)**. OHE reserves the right to review and comment on any interpretation of the data or conclusions derived by **TTC**. No other representation, either expressed or implied, is included in this report.

OHE has exercised a degree of thoroughness and competence that is consistent with the profession during the execution of the TTC Subway Air Quality Study. OHE considers the opinions and information as they are presented in this report to be factual at the time of the study of the subject space.

OHE relied on professional judgment while gathering and analyzing the information obtained. OHE cannot warrant or guarantee that the conclusions reached are absolutely complete or accurate. However, OHE commits itself to care and competence in reaching those conclusions.

Sincerely,

OHE Consultants

Occupational Hygiene & Environment



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