

TRANS MOUNTAIN PIPELINE BURNABY TERMINAL

BURNABY, BRITISH COLUMBIA

2024 ANNUAL AIR QUALITY AND METEOROLOGICAL
MONITORING REPORT

RWDI #2105728

March 25, 2025

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1 SUMMARY

This report summarizes ambient air quality measurements made at the Trans Mountain Burnaby Terminal (BT) Air Quality Monitoring (AQM) station during the operational period from March 15, 2024 through December 31, 2024. This follows an extended baseline survey that occurred from April 4, 2023 to March 14, 2024. This monitoring program addresses the requirements of the Canada Energy Regulator (CER) Condition 79 for the Trans Mountain Expansion Project.

The objective of the BT AQM program during this operational period, after commissioning of the new storage tanks, was to monitor the ambient air quality in the vicinity of the BT and compare it to the applicable Ambient Air Quality Objectives (AAQOs). The BT AQM station is located in Burnaby, so the ambient measurements were compared to the Metro Vancouver (MV) AAQOs and supplemented with values from Alberta where none exist in BC. The monitoring methods follow the Air Emissions Management Plan for Sumas and Burnaby Terminals (Trans Mountain 2017, CER Condition 79, Filing ID A84102, Approval A85838) and the Ambient Air Quality Monitoring Plan (AQMP) for the Westridge Marine Terminal, Burnaby Terminal, and Sumas Terminal (Trans Mountain 2020).

The BT AQM station continuously monitors the following air quality parameters: particulate matter less than 2.5 microns ($PM_{2.5}$), nitrogen oxides (NO_x , NO, NO_2), sulphur dioxide (SO_2), total reduced sulphurs (TRS), ozone (O_3), black carbon (BC), visibility, and benzene, toluene, ethyl benzene and xylene (BTEX). The BT AQM station also continuously monitors the following meteorological parameters: wind speed, wind direction, temperature, relative humidity, barometric pressure, and precipitation. Data validity for all parameters was in the acceptable range of greater than 75% (CCME 2019) for the monitoring period.

Throughout the monitoring period from March 15 to December 31, 2024, there was one (1) exceedance of the 1-hour benzene Alberta AAQO. The benzene value of 14.4 ppb was higher than the 9 ppb Alberta AAQO for one hour on August 9, 2024. The exceedance was attributed to oil-based painting being done at the Burnaby Terminal.

The operational period values were very comparable to the baseline period values with differences generally being less than the accuracy and precision of the instruments. Overall, monitoring indicates BT operations are not likely having an adverse impact on local ambient air quality.

No comparison to the annual AAQOs can be made as the operational reporting period covers less than 75% of the 2024 year. Monitored data will be compared against the annual AAQOs in 2025 and onwards.



2 BACKGROUND

2.1 Geographical Area

The location of the BT AQM station is shown in **Figure 1**. The BT AQM station is located in the northwest corner of the storage terminal at 8099 Shellmont St, Burnaby, BC. The land use around the site is a mixture of parks, residential and light industrial areas. Specifically, there are neighborhoods to the west, residential and light industry to the south, park space to the east and rising to the north is the Simon Fraser University Burnaby Mountain campus.



2.2 Air Emission Sources

At the end of the Trans Mountain Pipeline System, Burnaby Terminal serves as a local distribution point to nearby terminals, including Parkland refinery and Trans Mountain's Westridge Marine Terminal. The existing emission sources, prior to the expansion project, included 13 tanks holding heavy crude, light sweet or light sour crude, and refined products. For the expansion project, one tank was removed and 14 more were built resulting in a total of 26 storage tanks. All new storage tanks include odour abatement equipment (i.e., TVALU or Tank Vapor Adsorption Unit).

There are two tanker truck loading facilities due south of the BT site, not operated by Trans Mountain. Sources of industrial emissions in the area are along the Burrard inlet including the Westridge Marine Terminal, Suncor's Terminal, and the Parkland refinery.



Legend

-  AAQM Station and Rain Gauge
-  Wind Monitoring Station

**Air Quality Monitoring Station Location
Burnaby Terminal**

Map Projection: NAD 1983 UTM Zone 10N
Trans Mountain Pipeline - Burnaby, B.C.



Drawn by: PIP | Figure: 1

Approx. Scale: 1:6,000

Date Revised: Feb 26, 2025

Project #: 2105728





3 MONITORING INSTRUMENTS

The BT AQM station is equipped with air quality and meteorological monitoring instruments shown in Table 1. The ambient air quality and meteorological parameters being monitored are recorded at 1-minute and 60-minute intervals, on a Campbell Scientific CR1000x datalogger. The raw data is stored on the datalogger and is also pushed to a central database for processing and backup. Data is automatically checked using an automated diagnostic observation tool called HORNET and by a technician daily to ensure maximum uptime and data quality of the monitoring parameters. As required by Condition 79, the raw data is also publicly available on the Envision data platform and accessible through the Trans Mountain website.

Table 1. Air Quality and Meteorological Monitoring Instrumentation

Instrument	Parameters measured	Units
Thermo Sharp 5030i	Particulate Matter _{2.5} (PM _{2.5})	µg/m ³
Thermo 42iQTL	Nitrous Oxide/Nitrogen Dioxide/Total Nitrogen Oxides (NO/NO ₂ /NO _x)	ppb
Thermo 43iQTL	Sulphur Dioxide (SO ₂)	ppb
Thermo 49iQ	Ozone (O ₃)	ppb
Thermo 43iQTL with CDN101	Total Reduced Sulphur (TRS)	ppb
AMA GC 5000	Benzene, Toluene, Ethylbenzene, Xylene (BTEX)	ppb
Magee AE-33 Aethalometer	Black Carbon (BC)	ng/m ³
Nikira OEA	Visibility	km
CSCC Field Camera	Visibility	N/A
RM Young 5305-10-L	Wind Speed and Direction	m/s and Degrees
Vaisala HC2-S3-L	Relative humidity and air temperature	% and °C
CSCC CS 106	Barometric pressure	mb
Ott Pluvio	Precipitation	mm

The gas analyzers (Thermo 42iQ, 43iQ, 49iQ, and 43iQTL with CDN101) are zero and span checked daily using the internal zero (charcoal and/or purafil cartridge) and span (permeation wafer in an internal permeation oven) system, referred to as the IZS system. The AMA GC 5000 is zero and span checked daily, but with certified standard span gas and a dilution system. Automatic IZS checks are performed daily, and the checks consist of a zero and span check followed by a purge over a 30-minute period for the Thermo analyzers and 75-minute time-period for the AMA GC 5000. These checks provide a way to monitor daily performance of the analyzer. The IZS checks are not for calibration purposes but are merely a diagnostic tool to identify instrument drift. Monthly calibration visits are undertaken to perform full range linear calibrations and maintenance for all the analyzers.

3.1 PM_{2.5}

The SHARP 5030i is a hybrid nephelometric/radiometric particulate mass monitor capable of providing precise, real-time measurements with a superior detection limit. The SHARP incorporates a high sensitivity light scattering photometer whose output signal is continuously referenced to the time-averaged measurement of an integral beta attenuating mass sensor. The SHARP also incorporates a dynamic inlet heating system designed to maintain the relative humidity of the air passing through the filter tape constant.

The SHARP 5030i monitor is calibrated once a month to ensure accuracy and validity of its data. The PM_{2.5} inlet head and sharp cut cyclone are located on the roof of the AQM building. The inlet and cyclone are cleaned routinely to ensure performance. The monthly calibration process consists of the following: zeroing the nephelometer if necessary, calibration of ambient temperature, calibration of barometric pressure, and flow calibration. Instrument mass foil checks are performed quarterly or if diagnostics indicate a requirement to do so in accordance with the BC FSM (Section 10 of SOP-05b).

3.2 NITROGEN OXIDES

The Thermo 42iQTL trace level Nitrogen Oxide (NO_x) analyzers use chemiluminescence detection, coupled with microprocessor technology to provide sensitivity and stability for ambient air quality applications. The instrument determines real-time concentration of nitric oxide (NO), total nitrogen oxides (NO_x) (the sum of NO and NO₂), and nitrogen dioxide (NO₂). The amount of NO is measured by detecting the chemiluminescence reaction that occurs in the reaction cell when NO molecules are exposed to ozone (O₃). The NO and O₃ molecules collide in the reaction cell and enter a higher energy state.

When these excited molecules return to a stable energy state, they emit a photon of light which is proportional to the amount of NO in the sample stream of gas entering the analyzer.

To determine the total NO_x (NO+NO₂) measurement, sample gas is periodically bypassed through a heated molybdenum converter cartridge that converts any NO₂ molecules in the sample stream into NO (any existing NO molecules in the stream remain as is). The instrument will switch the sample stream through the converter periodically and then through the reaction cell where the same chemiluminescence reaction occurs with ozone.

The resultant response produced is now the sum of NO and converted NO₂, producing a NO_x measurement. The resultant NO₂ determination is the NO_x measurement subtracted from the NO measurement.

3.3 SULPHUR DIOXIDE

The Thermo 43iQTL trace level Sulphur Dioxide (SO₂) Analyzer is a microprocessor-controlled analyzer that determines the concentration of SO₂ in a sample gas drawn through the instrument. In the sample chamber, sample gas is excited by ultraviolet light causing the SO₂ to absorb energy from the light and move to an active state (SO₂*). These active SO₂* molecules must decay into a stable state back to SO₂, and when this happens a photon of light is released which is recognized by the instrument as fluorescence. The instrument measures the amount of fluorescence to determine the amount of SO₂ present in the sample gas.

3.4 TOTAL REDUCED SULPHUR

Total Reduced Sulphur (TRS) monitoring is conducted using a Thermo 43iQTL trace level SO₂ continuous analyzer in conjunction with an CDN-101 thermal oxidizer convertor (oxidizer). This instrument is a two-fold device. Sample air first passes through sulphur dioxide (SO₂) scrubber beads to eliminate any SO₂ molecules that might be in the sample air stream. Sample air is then passed through a glass tube surrounded by an oven inside of the oxidizer which is continuously heated to 800°C and any reduced sulphur compounds are converted into SO₂ molecules. The sample air is then directed to the SO₂ analyzer.

The 43iQTL is a microprocessor-controlled analyzer that determines the concentration of SO₂ in a sample gas drawn through the instrument. In the sample chamber, sample gas is exposed to pulsating ultraviolet light which causes the SO₂ molecules to become excited and enter into a higher energy state.

When the light is shut off during one of the pulse cycles, these excited SO₂ molecules decay into a lower energy state where fluoresced light is emitted proportionally to the SO₂ concentration in the gas stream. This fluorescence is read by a photo-multiplier tube, and the instrument reports the concentration of SO₂ in a ratio of 1:1 for TRS.

3.5 OZONE

Ozone (O₃) monitoring is conducted using a Thermo 49iQ to provide sensitivity and stability for ambient air quality applications. The instrument determines real-time concentration of O₃ in a sample gas drawn through the instrument. The sample is split into two gas streams using solenoids, one stream is stripped of O₃ by a scrubber to become a reference gas. Each stream is then intermittently stored in two different cells within which the UV light intensities are measured, and the instrument calculates the O₃ concentrations.

3.6 VISIBILITY

Visibility monitoring is conducted using a Nikira Optical Extinction Analyzer (Model NIK-OEA-52001-C01OP). The instrument combines open-path cavity ringdown measurements with a patented self-referencing system to rapidly measure the optical extinction coefficient of ambient aerosols. Ambient air is drawn into the cavity at ~1 m/s where direct optical extinction coefficient measurement is made. The cavity is closed off to ambient air and purged with filtered air to provide a background measurement to use in a comparison calculation for aerosol optical extinction. A Campbell Scientific CFCC field camera takes photographs of the horizon each hour of the day so the OEA visibility readings can be confirmed by visual records.

3.7 BTEX

Sampling of benzene, toluene, ethylbenzene, m, p-xylenes and o-xylene (BTEX) is being completed using an AMA Gas Chromatograph (GC) 5000 BTX monitor fitted with a flame ionization detector (FID). An ambient air sample is drawn into the instrument every 15 min and the gaseous eluent is ignited to produce gas-phase ions of the analytes of interest. These ions are detected by an electrode and the integration of the electrical signal produced is calibrated and used to quantify the concentration of each analyte in the sample. An AMA HG 500 ultra-high



purity generator uses deionized water and compressor to generate ultra-high purity Hydrogen (H₂) as a supply gas for the FID flame and act as a carrier gas for the GC.

3.8 BLACK CARBON

Black carbon (BC) is measured continuously using a Magee Model AE33 Aethalometer. This unit collects aerosol particles continuously by drawing the aerosol laden air stream through a spot on a filter tape. The aerosols are analyzed by the transmission of light through one portion of the filter tape containing the sample compared to an unloaded portion of the filter tape. This analysis is done on 7 wavelengths spanning near infra-red to near ultraviolet. The aethalometer calculates the concentrations of optically absorbing aerosols from the rate of attenuation of light transmitted through the filter. The results of the two sample spots are combined to determine the BC mass concentration. Each month, the validity of the readings are checked via verification of flow rates through the unit and the use of neutral density optical filters measuring the attenuation of each of the wavelengths.

3.9 METEOROLOGY

The Burnaby AQM station continuously monitors the wind speed (WS) and wind direction (WD) using a tower mounted R.M. Young 5305-10-L Wind Speed/Wind Direction sensor. Relative humidity and temperature are measured using a Vaisala HC2-S3-L. Air Pressure is measured using Campbell Scientific CS 106. Precipitation is measured using an Ott Pluvio, a highly sensitive weight-based measurement system that maximizes capture and quantification of snow and rain, with the attachment of a wind shield and antifreeze inside the collection bucket. Meteorological equipment is physically inspected every 3-months to annually, or if data QA/QC indicates the need more frequently. Calibrations are recertified following manufacturer recommendations (1 to 2 years).

3.10 Performance Audits

A third-party performance audit, conducted by WSP Engineering Consultants, took place on December 9 through 13, 2024. This audit involved comparing instrument operations against the BC Ministry of Environment and Parks specifications as outlined in the BC Field Sampling Manual (Table 6.4.1 Gas Analyzer Tolerance Levels and Acceptance Criteria, Page 20 of Part B1). RWDI is in the process of addressing corrective actions identified in the performance audit and will apply the learnings to the other stations in the TM air monitoring network. There was no major impact to data coverage as a result of the audit.

The Burnaby AQM station was inspected internally by TM on October 22, 2024.



4 SUMMARY OF AMBIENT MEASUREMENTS

Data validity is the percentage of hourly values available over the given period of time that remain after final data quality assurance and control checks (QA/QC). For measured values to be compared to hourly, 8-hour, 24-hour and annual average values there needs to be >75% of the data available for each relevant time period in accordance with the Alberta (AB), Metro Vancouver (MV) and BC AAQO as informed by the Canadian Council of Ministers of the Environment (CCME 2019). Similar requirements exist in Alberta and BC in their respective ambient air monitoring guideline documents.

4.1 PM_{2.5}

During the operational monitoring period March 15, 2024 through December 31, 2024, the hourly PM_{2.5} validity was 99.5%. Summary statistics are presented in Appendix Tables A1, A2 and A6. There were no events that were over the PM_{2.5} 24-hour Metro Vancouver AAQO in 2024. During the baseline period the mean was 6.2 µg/m³. The mean during operations in 2024 was 5.0 µg/m³.

4.2 NITROGEN OXIDES

During the operational monitoring period March 15, 2024 through December 31, 2024, the hourly NO_x data validity was 97.1%. Summary statistics are presented in Appendix Tables A1, A2 and A6. There were no events exceeding the NO₂ 1-hour AAQO during the 2024 operational monitoring period. NO_x concentrations were greatest in December likely due to higher emissions from home heating and vehicular traffic, exacerbated by thermal inversions. During the baseline period the mean NO_x concentration was 10.7 ppb. The mean NO_x concentration during operations in 2024 was 7.9 ppb.

4.3 SULPHUR DIOXIDE

During the operational monitoring period March 15, 2024 through December 31, 2024, the hourly SO₂ data validity was 99.1%. Summary statistics are presented in Appendix Tables A1, A2 and A6. There were no events that were over the 1-hour SO₂ AAQO during the 2024 operational monitoring period. The highest 1-hour (10.2 ppb), 24-hour (1.9 ppb) occurred in September. The operational period mean was 0.4 ppb.

4.4 TOTAL REDUCED SULPHUR

During the operational monitoring period March 15, 2024 through December 31, 2024, the hourly TRS data validity was 99.1%. Summary statistics are presented in Appendix Tables A1, A2 and A6. During the WSP audit, the TRS failed the SO_x scrubber test. As a result, the scrubber media was changed and further testing with pure SO₂ calibration gas will be conducted. It was also found that the slope was non-linear so a photo-multiplier tube adjustment and system calibration were performed. There were no events exceeding the Metro Vancouver's AAQO 1-hour average of 10 ppb. During the baseline period, the mean was 0.5 ppb. The mean during operations in 2024 was 0.4 ppb.



4.5 OZONE

During the operational monitoring period March 15, 2024 through December 31, 2024, the hourly O₃ data validity was 98.3%. Summary statistics are presented in Appendix Tables A1, A2 and A6. There were no events over Metro Vancouver's 1-hour AAQO of 82 ppb or 8-hour AAQO of 62 ppb. During the baseline period the mean was 22.1 ppb. The mean during the operations in 2024 was 26.2 ppb.

4.6 VISIBILITY

During the operational monitoring period March 15, 2024 through December 31, 2024, the hourly visibility data validity was 75.7%. Summary statistics are presented in Appendix Table A5. The unit was down from September to October due to extended maintenance (replacement of measurement laser was required). The minimum 1-hour mean monthly values were measured in June 2024 (23.3 km). During the baseline period, the mean distance was 1014.9 km. The mean distance during operations was 1611.3 km.

Images are captured by a camera every hour onsite and can be made available for future reference. There are no AAQO or criteria in BC for visibility. Based on a theoretical distance provided by the manufacturer, RWDI invalidates data over 15 000 km to eliminate extreme values.

4.7 BTEX

During the operational monitoring period March 15, 2024 through December 31, 2024, the hourly BTEX data validity was 78.9%. Summary statistics are presented in Appendix Tables A3, A4 and A6. The GC unit from Sumas Terminal AQM station required ongoing repairs. The GC uptime was maximized across the Trans Mountain network by rotating GC instrumentation between stations to maintain annual uptime >75% at all stations. A similar GC5000 system was provided on loan from CDNOVA and was installed December 31, 2024. During the WSP audit, the GC failed to perform, and the calibration process is being reviewed. Overnight zero and span checks from the automated calibration checks were used to validate data prior to this audit.

Trans Mountain compares measured benzene, toluene, ethylbenzene and xylenes values to the Alberta AAQOs, as BC does not have objectives for these pollutants.

There was one (1) exceedance of the benzene 1-hour Alberta AAQO and no exceedances of the 1-hour toluene, ethylbenzene, or xylene Alberta AAQO. On August 9, 2024, 1-hour averaged benzene reached 14.4 ppb which is above the Alberta AAQO of 9 ppb. Benzene is a common ingredient in commercial oil-based paints. It was determined that there was painting occurring near the AQM station at the Burnaby Terminal at the time of the exceedance. Appendix Table A9 provides a summary of the elevated event.

During the baseline period the mean values of benzene, toluene, ethylbenzene and xylenes were 0.2 ppb, 0.6 ppb, 0.1 ppb, and 0.7 ppb, respectively. The mean values of benzene, toluene ethylbenzene and xylenes during operations were 0.2 ppb, 0.6 ppb, 0.1 ppb, and 0.4 ppb, respectively.



4.8 BLACK CARBON

During the operational monitoring period March 15, 2024 through December 31, 2024, the hourly black carbon data validity was 99.2%. Summary statistics are presented in Appendix Table A5. During the baseline period (April 4, 2023, to March 14, 2024), the mean concentration was 625.7 ng/m³. The operational mean concentration was 321.2 ng/m³. There are no AAQO or criteria in BC or Alberta for Black Carbon.

4.9 METEOROLOGY

During the operational monitoring period March 15, 2024 through December 31, 2024, the hourly meteorological data validity was between 99.9 and 98.3%. Summary statistics are presented in Appendix Tables A7 and A8. In December 2024, due to a string of overcast conditions the solar panel failed to maintain the charge on the battery for the meteorological tower. A replacement battery was swapped in on December 17, 2024 to fix this.

A wind rose, which visually plots the joint frequencies of wind speed and wind direction, is shown in **Figure 2** for the operational monitoring period in 2024.

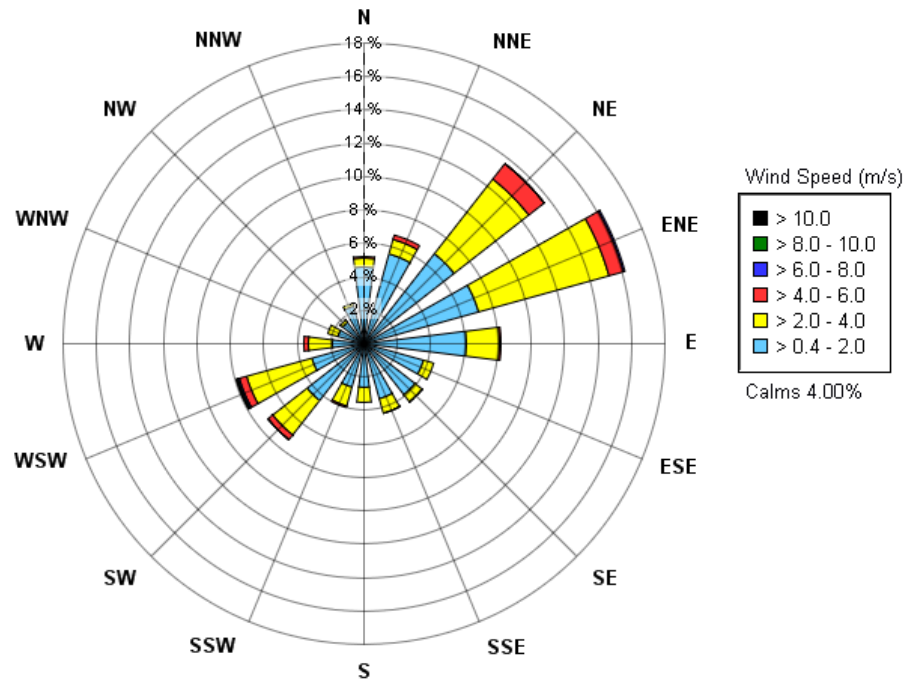


Figure 2 Burnaby Terminal Wind Rose - March 15, 2024 to December 31, 2024



5 DISCUSSION

Data validity for all parameters, meets the minimum data completeness criteria acceptable range of >75%. Excluding BTEX and visibility. Months with reduced validity for specific instruments were caused by unscheduled maintenance on units within the TM network. Strategies have been implemented to prevent data loss and will continue to be improved upon into the future. Wherever possible, BT AQM station data comparisons were made with the nearby Burnaby Mountain, Burnaby Kensington Park WT AQM and ST AQM stations. All comparable data over this operational monitoring period showed a close agreement in measurement, suggesting that a reliable data set was achieved.

Throughout the monitoring period from March 15 to December 31, 2024, there was one (1) exceedance of the 1-hour AAQO. The benzene value of 14.4 ppb was higher than the 9 ppb AAQO for one hour on August 9, 2024. The exceedance was attributed to fumes from commercial oil-based paints being used at the facility at the time of the exceedance. Values outside of that event were determined to be low when compared to the available AAQOs. The baseline values were very comparable to the operational values with differences generally being less than the accuracy and precision of the instruments.

No comparison to the annual AAQOs can be made as the operational reporting period covers less than 75% of the 2024 year. Monitored data will be compared against the annual AAQOs in 2025 and onwards.

6 REFERENCES

- Canadian Council of Ministers of the Environment, 2019. Ambient Air Monitoring And Quality Assurance/Quality Control Guidelines. Downloaded from: https://ccme.ca/en/res/ambientairmonitoringandqa-qcguidelines_ensecure.pdf
- Trans Mountain Pipeline, 2017. Air Emissions Management Plan for Sumas and Burnaby Terminals. Trans Mountain Expansion Project. CER Condition 79.
- Trans Mountain Pipeline, 2020. Ambient Air Quality Monitoring Plan for the Westridge Marine Terminal, Burnaby Terminal and Sumas Terminal. Trans Mountain Expansion Project.



7 GENERAL STATEMENT OF LIMITATIONS

This report entitled Burnaby Terminal 2024 Annual Air Quality and Meteorological Monitoring Report was prepared by RWDI AIR Inc. ("RWDI") for Trans Mountain ("Client"). The findings and conclusions presented in this report have been prepared for Trans Mountain and are specific to the project described herein ("Project"). This report was prepared using scientific principles, published methodologies and professional judgment in assessing available information and data. The findings presented within this document are based on available data within the limits of the existing information, budgeted scope of work, and schedule. The conclusions contained in this report are based on the information available to RWDI when this report was prepared; subsequent changes made by the Client after the date of this report have not been reflected in the conclusions.

This report was prepared for the exclusive use of Trans Mountain. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibility of such third parties. RWDI accepts no responsibility for damages, if any, suffered by any third party as result of decisions made or actions based on this report.

A large decorative graphic on the left side of the page. It features a blue triangular shape at the top left, which is partially overlapped by a white curved line. Below this line is a large, light gray semi-circular area that dominates the lower half of the page.

APPENDIX A

Table A1. Trans Mountain Burnaby Maximum 1-hour and Maximum 24-hour Summary Statistics

Burnaby Terminal 2024 Statistics	Maximum 1-Hour Mean							Maximum 24-Hour Mean						
Compound	PM _{2.5}	NO _x	NO	NO ₂	SO ₂	TRS	O ₃	PM _{2.5}	NO _x	NO	NO ₂	SO ₂	TRS	O ₃
Units	µg/m ³	ppb						µg/m ³	ppb					
AAQO				60^[1]	70^[1]	10^[1]	82^[1]	25^[2]						
March 15 to March 31	23.6	45.6	22.9	23.4	2.2	1.0	45.6	8.0	15.6	4.1	11.4	0.6	0.4	39.7
April	12.1	41.7	16.3	39.6	2.6	1.0	52.9	8.5	10.9	2.2	9.3	0.8	0.6	45.4
May	15.7	39.8	20.4	21.9	2.1	1.4	56.9	8.4	9.4	2.4	8.2	0.8	0.7	41.2
June	18.5	27.1	9.2	18.3	5.1	1.7	59.9	9.6	10.4	1.7	8.7	1.3	0.8	41.4
July	26.8	37.0	17.8	27.0	6.3	1.8	71.9	16.3	12.7	2.1	10.8	1.1	0.9	47.8
August	21.5	38.1	16.0	24.9	6.1	1.4	59.1	16.6	15.4	3.5	11.9	1.3	0.8	38.9
September	25.4	53.9	34.3	31.6	10.2	1.6	45.0	17.9	15.4	5.5	11.9	1.9	0.5	34.0
October	19.1	55.5	31.5	25.1	3.9	1.0	43.1	7.1	16.4	6.1	11.1	1.2	0.5	32.8
November	21.5	92.9	68.5	26.3	0.9	0.8	37.8	13.2	24.6	11.3	15.2	0.3	0.4	33.8
December	25.2	126.5	110.7	29.9	2.9	0.9	39.8	10.0	61.8	48.2	18.0	0.9	0.5	37.7
March 15 to December 31	26.8	126.5	110.7	39.6	10.2	1.8	71.9	17.9	61.8	48.2	18.0	1.9	0.9	47.8

Notes:

^[1] Metro Vancouver 1-hour acceptable AAQO.

^[2] Metro Vancouver 24-hour acceptable AAQO. Note that this is a 24-hour rolling average and tabulated values here are results from the 24-hour daily average.

Bold text indicates an exceedance of the AAQO.

N/A – Not available: Data validity is below 75%.

Operational period data collected between March 15 and December 31, 2024.

PM_{2.5} (particulate matter less than 2.5 microns); NO_x, NO, NO₂ (nitrogen oxides); SO₂ (sulphur dioxide); TRS (total reduced sulphurs); O₃ (ozone)

Table A2. Trans Mountain Burnaby Monthly Mean and Valid Data Summary Statistics

Burnaby Terminal 2024 Statistics	Monthly Mean							Valid Data							
Compound	PM _{2.5}	NO _x	NO	NO ₂	SO ₂	TRS	O ₃	PM _{2.5}	NO _x	NO	NO ₂	SO ₂	TRS	O ₃	
Units	µg/m ³	ppb							Percentage of time (hourly)						
AAQO				17^[1]	5^[1]										
March 15 to March 31	4.4	8.3	1.4	7.0	0.4	0.3	27.7	99.5	97.3	97.3	97.3	99.3	98.8	98.5	
April	3.7	6.1	0.8	5.3	0.5	0.3	35.0	99.7	94.7	94.7	94.7	99.4	99.3	97.6	
May	4.6	5.8	0.9	5.0	0.5	0.4	32.5	98.9	94.5	94.5	94.5	97.6	98.9	98.8	
June	4.7	5.5	0.8	4.7	0.6	0.6	30.4	99.7	94.6	94.6	94.6	99.3	99.4	98.1	
July	7.8	7.6	1.3	6.3	0.4	0.4	28.0	99.7	95.3	95.3	95.3	99.6	99.5	98.0	
August	7.1	6.9	1.4	5.6	0.6	0.5	24.8	99.7	98.8	98.8	98.8	98.8	99.5	98.8	
September	6.5	8.9	1.8	7.0	0.6	0.3	19.9	99.2	99.2	99.2	99.2	99.2	98.6	98.3	
October	4.2	8.0	1.6	6.4	0.4	0.3	21.6	99.7	98.8	98.8	98.8	99.6	99.2	97.4	
November	3.7	9.0	1.9	7.1	0.1	0.3	20.5	99.6	98.6	98.6	98.6	99.0	99.0	97.8	
December	3.4	12.8	5.5	7.3	0.3	0.3	21.3	99.6	99.5	99.5	99.5	99.3	99.2	99.3	
March 15 to December 31	5.0	7.9	1.7	6.2	0.4	0.4	26.2	99.5	97.1	97.1	97.1	99.1	99.1	98.3	

Notes:

NA- Not available: Data validity is below 75%.

^[1] Metro Vancouver AAQO Annual 1-hour average.

Operational period data collected between March 15 and December 31, 2024.

PM_{2.5} (particulate matter less than 2.5 microns); NO_x, NO, NO₂ (nitrogen oxides); SO₂ (sulphur dioxide); TRS (total reduced sulphurs); O₃ (ozone)

Table A3. Trans Mountain Burnaby Maximum 1-hour and Maximum 24-hour BTEX Summary Statistics

Burnaby Terminal 2024 Statistics	Maximum 1-Hour Mean				Maximum 24-Hour Mean			
Compound	Benzene	Toluene	Ethylbenzene	Xylenes	Benzene	Toluene	Ethylbenzene	Xylenes
Units	ppb				ppb			
AAQO^[1]	9^[1]	499^[1]	460^[1]	530^[1]		106^[2]		161^[2]
March 15 to March 31	0.3	1.2	0.3	0.7	0.1	0.4	0.1	0.3
April	0.9	2.8	0.4	4.7	0.4	1.6	0.2	0.5
May	2.8	6.0	1.2	4.7	0.7	2.7	0.3	1.0
June	1.8	5.6	1.7	2.6	0.6	1.8	0.3	0.7
July	2.9	7.1	4.6	2.6	0.7	2.9	1.4	1.2
August	14.4	10.3	6.2	37.1	1.8	3.6	1.9	5.3
September	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
October	1.9	5.3	2.4	6.2	0.6	1.7	0.4	1.1
November	1.2	3.7	0.9	2.3	0.4	1.3	0.3	0.8
December	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
March 15 to December 31	14.4	10.3	6.2	37.1	1.8	3.6	1.9	5.3

Notes:

^[1] Alberta AAQO. Metro Vancouver do not include air quality objectives for this.

^[2] Alberta AAQO 24-hour average. Metro Vancouver do not include air quality objectives for this.

NA- Not available: Data validity is below 75%.

Bold text indicates an exceedance of AAQO

Operational period data collected between March 15 and December 31, 2024.

Table A4. Trans Mountain Burnaby Monthly Mean and Valid Data BTEX Summary Statistics

Burnaby Terminal 2024 Statistics	Monthly Mean				Valid Data			
Compound	Benzene	Toluene	Ethylbenzene	Xylenes	Benzene	Toluene	Ethylbenzene	Xylenes
Units	ppb				Percentage of Time (hourly)			
AAQO	0.9^[1]							
March 15 to March 31	0.1	0.2	0.0	0.2	94.5	94.5	94.5	94.5
April	0.1	0.3	0.1	0.3	85.3	85.3	85.3	85.3
May	0.2	0.6	0.1	0.3	94.8	94.8	94.8	94.8
June	0.2	0.6	0.1	0.4	96.1	96.1	96.1	96.1
July	0.2	0.7	0.3	0.3	90.3	90.3	90.3	90.3
August	0.4	1.1	0.6	0.9	78.5	78.5	78.5	78.5
September	N/A	N/A	N/A	N/A	11.5	11.5	11.5	11.5
October	0.2	0.7	0.2	0.6	90.1	90.1	90.1	90.1
November	0.2	0.6	0.2	0.5	94.7	94.7	94.7	94.7
December	N/A	N/A	N/A	N/A	53.4	53.4	53.4	53.4
March 15 to December 31	0.2	0.6	0.2	0.4	78.9	78.9	78.9	78.9

Notes:

N/A- Not available: Data validity is below 75%.

^[1] Alberta AAQO Annual 1-hour average. Metro Vancouver do not list AAQO for this.

Operational period data collected between March 15 and December 31, 2024.

Table A5. Trans Mountain Burnaby Maximum 1 hour, Maximum 24-hour, Monthly Mean and Valid Data Visibility and Black Carbon Summary Statistics

Burnaby Terminal 2024 Statistics	Maximum 1-Hour Mean		Maximum 24-Hour Mean		Minimum 1-Hour Mean	Monthly Mean		Valid Data	
	BC	Visibility*	BC	Visibility	Visibility	BC	Visibility	BC	Visibility
Units	ng/m ³	km	ng/m ³	km	km	ng/m ³	km	Percentage of time (hourly)	
March 15 to March 31	1690.7	13565.4	699.2	5923.1	65.4	328.3	2244.0	99.2	95.8
April	1498.2	14897.4	356.7	4953.7	146.0	209.9	2564.1	99.6	96.5
May	1216.1	13337.4	412.5	4275.1	128.2	211.9	1723.2	98.7	95.2
June	2218.1	14782.0	556.0	5645.6	23.3	218.0	1919.1	99.6	96.5
July	1700.3	13538.3	730.3	1670.8	49.9	327.1	482.7	99.7	99.9
August	1975.9	14061.2	1054.3	1876.4	45.5	367.0	370.5	99.5	93.4
September	2482.6	N/A	1128.9	N/A	N/A	432.8	N/A	99.2	16.9
October	1786.1	N/A	648.7	N/A	N/A	336.0	N/A	94.1	0.0
November	3223.2	N/A	802.7	N/A	N/A	324.9	N/A	99.7	73.8
December	3666.1	14699.6	1779.2	4398.9	35.1	456.2	1975.5	99.3	89.4
March 15 to December 31	3666.1	14897.4	1779.2	5923.1	23.3	321.2	1611.3	98.9	75.7

Notes:

N/A- Not available: Data validity is below 75%.

*RWDI Uses 15,000 km as a maximum theoretical distance for visibility.

Operational period data collected between March 15 and December 31, 2024.

Table A6. Trans Mountain Burnaby 1-hour and 24-hour Average AAQO exceedances

Burnaby Terminal 2024 Event Statistics	1-Hour average > AAQO								24-Hour average > AAQO		
	NO ₂	SO ₂	TRS	O ₃	B ^[1]	T ^[1]	E ^[1]	X ^[1]	PM _{2.5}	T ^[1]	X ^[1]
AAQO	60	70	10	82	9	499	460	530	25^[2]	106	161
Units	ppb								µg/m ³	ppb	
	Number > AAQO								Number > AAQO		
March 15 to March 31	0	0	0	0	0	0	0	0	0	0	0
April	0	0	0	0	0	0	0	0	0	0	0
May	0	0	0	0	0	0	0	0	0	0	0
June	0	0	0	0	0	0	0	0	0	0	0
July	0	0	0	0	0	0	0	0	0	0	0
August	0	0	0	0	1	0	0	0	0	0	0
September	0	0	0	0	0	0	0	0	0	0	0
October	0	0	0	0	0	0	0	0	0	0	0
November	0	0	0	0	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0	0	0	0	0
March 15 to December 31	0	0	0	0	1	0	0	0	0	0	0

Notes:

^[1] B-Benzene, T-Toluene, E-Ethylbenzene, X-Xylenes, AAQO adopted from Alberta

^[2] 24-hour rolling average.

ND- No Data.

Bold text indicates events that exceed the AAQO.

Operational period data collected between March 15 and December 31, 2024.

PM_{2.5} (particulate matter less than 2.5 microns); NO₂ (nitrogen oxides); SO₂ (sulphur dioxide); TRS (total reduced sulphurs); O₃ (ozone)

Table A7. Trans Mountain Burnaby Maximum 1-hour and Maximum 24-hour Meteorological Summary Statistics

2024 Meteorological Statistics	Maximum 1-Hour Mean					Minimum 1-Hour Mean				
Parameter	WS	Temp	RH	Pres	Rain	WS	Temp	RH	Pres	Rain
Units	m/s	°C	%	mb	mm	m/s	°C	%	mb	mm
March 15 to March 31	4.8	21.4	100.0	1026.0	3.4	0.2	3.2	27.6	1000.0	0.0
April	5.1	19.3	100.0	1030.0	5.0	0.1	2.3	16.5	1004.0	0.0
May	7.7	27.4	100.0	1028.7	5.8	0.1	5.2	23.3	998.0	0.0
June	5.3	28.5	100.0	1022.0	6.9	0.2	8.5	18.6	994.3	0.0
July	4.9	32.5	100.0	1024.0	2.7	0.2	11.3	27.6	1008.0	0.0
August	6.2	30.2	100.0	1025.0	5.1	0.1	10.3	38.0	1004.0	0.0
September	6.1	32.6	100.0	1029.0	5.7	0.1	7.0	30.0	1001.0	0.0
October	5.9	22.4	100.0	1026.0	15.7	0.2	4.4	36.6	1000.9	0.0
November	10.3	14.0	100.0	1028.0	10.5	0.2	0.9	42.8	993.9	0.0
December	6.1	13.8	100.0	1031.0	9.8	0.2	1.1	38.6	986.9	0.0
March 15 to December 31	10.3	32.6	100.0	1031.0	15.7	0.1	0.9	16.5	989.9	0.0

Notes:

N/A- Data validity is below 75%.

Operational period data collected between March 15 and December 31, 2024.



Table A8. Trans Mountain Burnaby Monthly Mean and Valid Data Meteorological Summary Statistics

2024 Meteorological Statistics	Monthly Mean					Total	Valid Data					
Parameter	WS	Temp	RH	Pres	Rain	Rain	WS	WD	Temp	RH	Pres	Rain
Units	m/s	°C	%	mb	mm	mm	Percentage of time					
March 15 to March 31	1.6	9.3	79.7	1011.8	0.1	46.7	100.0	100.0	100.0	100.0	99.8	100.0
April	2.0	9.1	72.0	1016.1	0.2	123.6	100.0	100.0	100.0	100.0	100.0	100.0
May	2.0	12.5	74.1	1015.4	0.2	131.9	100.0	100.0	98.9	98.9	98.9	98.9
June	2.0	15.2	72.7	1013.7	0.1	92.8	100.0	100.0	100.0	100.0	99.9	100.0
July	1.7	20.3	67.8	1015.6	0.0	35.3	100.0	100.0	100.0	100.0	99.9	100.0
August	1.7	18.8	78.2	1015.0	0.1	80.6	100.0	100.0	100.0	100.0	100.0	100.0
September	1.4	16.2	83.6	1013.8	0.1	72.1	100.0	100.0	100.0	100.0	100.0	100.0
October	1.6	11.0	87.6	1015.1	0.5	354.8	100.0	100.0	100.0	100.0	100.0	100.0
November	2.0	6.9	90.9	1011.6	0.4	274.6	100.0	100.0	100.0	100.0	99.9	100.0
December	1.8	6.3	92.3	1013.8	0.4	293.3	83.2	83.2	100.0	100.0	100.0	100.0
March 15 to December 31	1.8	12.6	79.9	1014.2	0.2	1505.8	98.3	98.3	99.9	99.9	99.8	99.9

Notes:

N/A- Data validity is below 75%.

Operational period data collected between March 15 and December 31, 2024.

Table A9. Trans Mountain Burnaby 1-Hour Benzene Exceedance Summary

Date	1-hour Average (ppb)	Wind Speed (m/s)	Wind Direction (deg)	Discussion
August 9, 2024, 13:00-14:00	14.4	2.4	216.6	On August 9 th , 2024, at 12:31 the Benzene levels increased to 30.91 ppb before returning to regular levels at 13:16. Ethylbenzene and Xylenes were also elevated during this time. Benzene and Xylenes are common ingredient in commercial paints. At the time of the exceedance the Campbell Scientific CFCC field camera captured an image of an employee painting some piping in the south-westerly direction (the source wind direction) which could have contributed to this exceedance. Painting was known to be carried out at the fire pump buildings onsite during that time.