

TRANS MOUNTAIN PIPELINE EDMONTON TERMINAL

EDMONTON, ALBERTA

2024 ANNUAL AIR QUALITY AND METEOROLOGICAL
MONITORING REPORT

RWDI #2105728

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1 SUMMARY

This report summarizes ambient air measurements made at the Trans Mountain Edmonton Terminal (ET) Air Quality Monitoring (AQM) station from January 1, 2024 to December 31, 2024. This monitoring program addresses the requirements of the Canada Energy Regulator (CER) Condition 79 for the Trans Mountain Expansion Project (Project).

The objective of the ET AQM program during this operational period was to monitor the ambient air quality in the vicinity of the ET and compare it to the applicable Alberta Ambient Air Quality Objectives (AAQOs). The monitoring methods follow the approved Air Emissions Management Plan (AEMP) for the Edmonton Terminal (Trans Mountain 2017, CER Condition 79, Filing ID [A84102](#), Approval [A85838](#)) and the Ambient Air Quality Monitoring Plan (AQMP) for the Edmonton Terminal (Trans Mountain 2020).

The ET AQM station continuously monitors the following air quality parameters: particulate matter less than 2.5 microns (PM_{2.5}), nitrogen oxides (NO_x, NO, NO₂), sulphur dioxide (SO₂), total reduced sulphurs (TRS), ozone (O₃), visibility, and benzene, toluene, ethylbenzene and xylene (BTEX). The 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 over 90% which is well within the data validity acceptable range of greater than 75% (CCME 2019) for the monitoring period.

Throughout the monitoring period from January 1, 2024 to December 31, 2024, there were 16 exceedances of the 24-hour PM_{2.5} Alberta AAQO. Forest fire smoke experienced across the region was determined to be the main cause of the PM_{2.5} exceedances. There were 3 exceedances of the 1-hour TRS AAQO in April 2024. In each case, measured wind directions indicated that the ET station was upwind of the TM facility, indicating that the source of the TRS emissions was likely from surrounding industrial sources. In July 2024, there were 3 ozone concentration exceedances of the daily 1-hour maximum. The ozone exceedances were attributed to hot, stagnant summer conditions and regional emission sources. Values outside of these events were otherwise low when compared to the AAQOs. The annual PM_{2.5} concentration was 10.0 µg/m³ which exceeded the Metro Vancouver annual AAQO of 8 µg/m³. Trans Mountain compares annual PM_{2.5} to Metro Vancouver AAQO, as there is no Alberta annual AAQO for PM_{2.5}. No other exceedances were measured during monitoring period for all other parameters. Overall, monitoring indicates ET operations are not likely having an adverse impact on local ambient air quality.



2 BACKGROUND

2.1 Geographical Area

The location of the ET AQM station is shown in **Figure 1**. The ET AQM station is located in the northeast corner of the intersection of Baseline Road/101 Avenue NW and 17 Street NW. The surrounding land use around ET is heavy industrial and the geographical area features flat terrain with the North Saskatchewan River valley located approximately 1 km northwest of the facility.

2.2 Air Emission Sources

The ET is the starting point of the Trans Mountain Pipeline System. The facility is made up of 39 tanks holding heavy crude, light sweet or light sour crude, and refined products.

The ET is surrounded by industrial emitters such as the Imperial Oil refinery, Enbridge storage and distribution terminal, Suncor Energy refinery and terminal, Celanese Polymers, Keyera Envirofuels and Pipeline Alley. Many of these facilities emit VOCs that contain benzene, xylenes and hydrogen sulphide which are continuously measured at the ET ambient station.



Air Quality Monitoring Station Location Edmonton Terminal

Map Projection: NAD 1983 UTM Zone 12N
Trans Mountain Pipeline - Edmonton, AB



Drawn by: PIP | Figure: 1

Approx. Scale: 1:26,000

Date Revised: Feb 26, 2025



Project #: 2105728



3 MONITORING INSTRUMENTS

The ET 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 42iQ	Nitrous Oxide/Nitrogen Dioxide/Total Nitrogen Oxides (NO/NO ₂ /NO _x)	ppb
Thermo 43iQ	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
Vaisala HC2-S3-L	Relative humidity and air temperature	% and °C
CS 106	Barometric pressure	mb
Ott Pluvio	Precipitation	mm
Nikira OEA	Visibility	km
Campbell CFCC Field Camera	Visibility	N/A

The gas analyzers (Thermo 42iQ, 43iQ, 43iQTL with CDN101 oxidizer, and 49iQ) 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. Automatic IZS checks are performed daily, and the checks consist of a 10-minute zero check, a 10-minute span check and a 10-minute purge. 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 is calibrated once a month to ensure accuracy and validity of its data. 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.

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

Sampling for Ozone (O₃) 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 sampling 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-xylene 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 METEOROLOGY

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).

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 from January 1, 2024 to December 31, 2024, the hourly PM_{2.5} data validity was 99.1%. Summary statistics are presented in Appendix Tables A1, A2 and A6. There were 16 events that were over the 24-hour AAAQO, between January and September. These elevated events were attributed to forest fire activity in central and northern Alberta and British Columbia in the middle part of the year and roadway emissions during the winter. Appendix Table A9 provides a summary of the elevated events. The highest maximum 1-hour mean PM_{2.5} concentration during the monitoring period was in July 2024 with a value of 219.6 µg/m³. The annual average for 2024 was 10.0 µg/m³, above the 8 µg/m³ annual AAQO. The annual AAQO is based on the Metro Vancouver annual AAQO of 8 µg/m³, in the absence of an Alberta AAQO.



4.2 NITROGEN OXIDES

During the monitoring period from January 1, 2024 to December 31, 2024, the hourly NO_x data validity was 99.1%. Summary statistics are presented in Appendix Tables A1, A2 and A6. There were no events over the NO₂ 1-hour AAQO during the monitoring period. The highest maximum 1-hour mean NO_x concentration during the monitoring period was in March 2024 with a value of 203.9 ppb, with NO₂ contributing to 26% of the total NO_x measured. The highest maximum 1-hour mean NO₂ concentration occurred in March 2024 with a value of 53.7 ppb. Higher NO_x values were seen to be more prevalent during winter months likely due to higher emissions from home heating and vehicular traffic, exacerbated by thermal inversions. The annual NO₂ level for 2024 was 10.1 ppb, below the annual AAQO of 24 ppb.

4.3 SULPHUR DIOXIDE

During the monitoring period from January 1, 2024 to December 31, 2024, the hourly SO₂ data validity was 99.0%. Summary statistics are presented in Appendix Tables A1, A2 and A6. There were no events that were over the 1-hour, 24-hour, or 30-day SO₂ AAQO during the monitoring period. The highest maximum 1-hour mean during the monitoring period was on May 28, 2024, with a value of 65.2 ppb, which is 62% of the AAQO (172 ppb). The annual SO₂ level for 2024 was 1.4 ppb, below the annual AAQO of 8 ppb.

4.4 TOTAL REDUCED SULPHUR

During the monitoring period from January 1, 2024 to December 31, 2024, the hourly TRS data validity was 98.9%. Summary statistics are presented in Appendix Tables A1, A2 and A6. There were 3 events in April that were over the TRS 1-hour AAQO in the monitoring period. During the 3 events the ET AQM was upwind of the TM facility. This indicated that the TRS was from surrounding sources and not a result of TM operations. Appendix Table A10 provides a summary of the elevated events. The highest maximum 1-hour mean during the monitoring period was in April with a value of 19.8 ppb. The TRS AAQO being referenced was adopted from Metro Vancouver's guidelines as there is no Alberta AAQO for TRS. There is no annual AAQO for TRS.

4.5 OZONE

During the monitoring period from January 1, 2024 to December 31, 2024, the hourly O₃ data validity was 98.8%. Summary statistics are presented in Appendix Tables A1, A2 and A6. There were three O₃ events that were over the 1-hour daily maximum. There was also three 8-hour maximum AAQO exceedances during the monitoring period. This 8-hour AAQO was adopted from Metro Vancouver as Alberta only has a 1-hour AAQO. All of the exceedances happened in July. Ozone is not emitted from operations at the Trans Mountain ET; rather, it forms in the atmosphere as a secondary pollutant typically under hot stagnant summertime conditions. The Ozone exceedances were happening around PM_{2.5} exceedances and are likely the result of downwind production resulting from contributions from chemical emissions in wild-fire smoke. Appendix Table A11 provides a summary of the elevated events. The highest maximum 1-hour mean during the monitoring period was in July 2024 with a value of 106.6 ppb. There is no annual AAQO for O₃ in Alberta.



4.6 VISIBILITY

During the monitoring period from January 1, 2024 to December 31, 2024, the hourly visibility data validity was 93.3%. Summary statistics are presented in Appendix Table A5. By the end of August, the Nikira Optical Extinction Analyzer laser was fouled and needed to be sent for cleaning. This resulted in a lower data validity for September, while the unit was out for repair. The minimum 1-hour mean value was measured in May and July of (2.9 km). These were the months with elevated PM_{2.5} readings, indicating that wide-spread fire smoke was the likely cause of the poor visibility.

Images are captured by a camera every hour onsite and can be made available for future reference. There are no AAQO or criteria in Alberta for reduced 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 monitoring period from January 1, 2024 to December 31, 2024, the hourly BTEX data validity was 91.5%. Summary statistics are presented in Appendix Tables A3, A4 and A6. There were no BTEX events that were over the 1-hour or daily AAQOs during the monitoring period. The maximum 1-hour mean benzene concentration during the monitoring period was measured in August 2024 with a value of 4.4 ppb, which is 51% of the AAQO (9 ppb). The maximum 1-hour mean toluene, ethylbenzene and xylene concentrations were between 0.8% and 5% of their respective AAQOs. The annual benzene level for 2024 was 0.23 ppb, below the annual AAQO of 0.9 ppb. There are no annual AAQOs for toluene, ethylbenzene, or xylenes.

4.8 METEOROLOGY

A wind rose, which visually plots the joint frequencies of wind speed and wind direction, is shown in **Figure 2** for the 12-month operational monitoring period.

During the monitoring period from January 1, 2024 to December 31, 2024, the hourly meteorological data validity was above 99.7%. Summary statistics are presented in Appendix Tables A7 and A8.

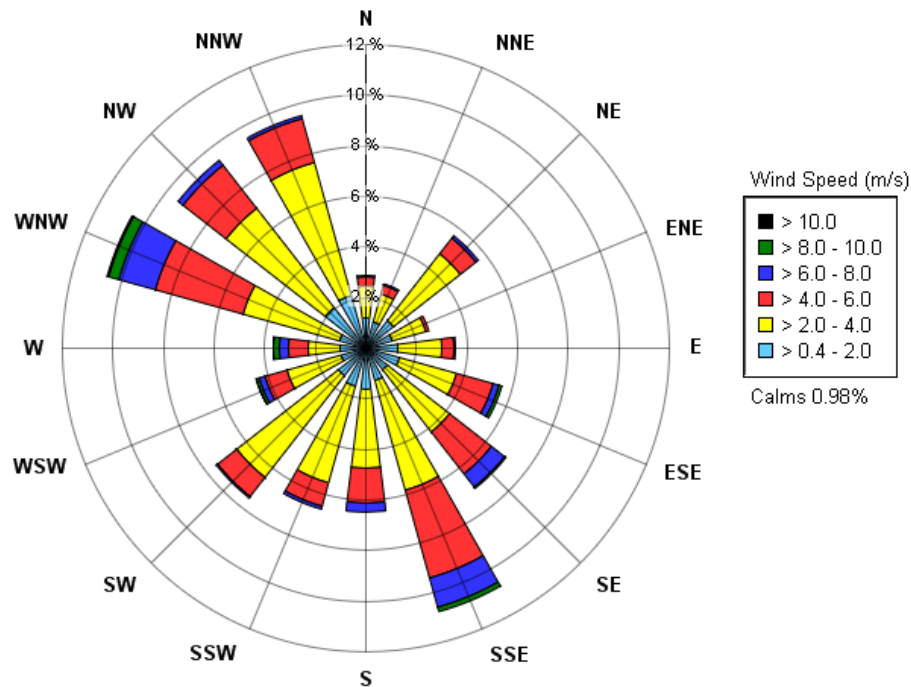


Figure 2 Edmonton Terminal Wind Rose – January 1, 2024 to December 31, 2024

5 DISCUSSION

Data validity for all parameters meets the minimum data completeness criteria acceptable range of >75% for the monitoring period. Wherever possible, ET AQM station data comparisons were made with the nearby Edmonton East AEPA station and Scotford South in the data QA/QC. All comparable data over this monitoring period showed a close agreement in measurement.

In January 2024, the PM_{2.5} exceedance event was the result of low wind speeds (stagnant air mass) and regional accumulation of PM_{2.5} likely from roadway emissions. Forest fire smoke experienced across the region was determined to be the main cause of the remaining 15 events over the AAQOs for PM_{2.5} and was not related to ET operations. These elevated conditions throughout the summer resulted in the annual mean (10.0 µg/m³) being above the 8 µg/m³ annual AAQO. The annual AAQO is based on the Metro Vancouver annual AAQO of 8 µg/m³, in the absence of one for Alberta. Three (3) events in April 2024 that were over the TRS 1-hour AAQO were



determined to be from surrounding emission sources and not a result of TM operations. Three (3) ozone daily 1-hour daily maximum and three (3) 8-hour maximum AAQO exceedances were happening around PM_{2.5} exceedances and are likely the result of downwind production resulting from contributions from chemical emissions in wild-fire smoke. The 8-hour AAQO is adopted from Metro Vancouver as Alberta only has a 1-hour AAQO.

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 the Edmonton Terminal. Trans Mountain Expansion Project. CER Condition 79.

Trans Mountain Pipeline, 2020. Ambient Air Quality Monitoring Plan for the Edmonton Terminal. Trans Mountain Expansion Project.

7 GENERAL STATEMENT OF LIMITATIONS

This report entitled Edmonton 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 and the Canada Energy Regulator. 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.

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APPENDIX A

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

Edmonton Station 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				159	172	10^[1]	76	29						
January	50.4	167.9	123.0	45.4	16.1	3.2	41.5	30.8	102.7	65.3	37.4	2.6	0.8	28.2
February	37.0	166.0	117.3	48.8	21.8	1.8	42.4	18.9	62.8	44.2	32.4	5.6	0.7	37.3
March	24.9	203.9	150.1	53.7	28.3	1.5	55.3	12.5	56.3	31.7	24.6	5.6	0.5	39.0
April	20.7	46.1	18.9	32.7	28.3	19.8	57.4	9.1	15.1	4.2	13.6	6.9	2.4	46.7
May	167.5	55.5	22.7	32.8	65.2	0.9	59.0	105.6	14.0	3.6	10.8	11.2	0.2	45.3
June	20.3	45.2	24.1	26.1	31.4	2.6	65.3	10.4	15.2	4.3	11.0	7.7	0.5	47.7
July	219.6	58.3	35.1	36.0	35.8	4.1	106.6	130.9	19.3	5.8	14.9	8.4	0.7	55.4
August	214.6	100.3	74.2	30.5	28.5	2.4	69.2	121.8	21.9	11.8	10.3	4.5	0.9	44.0
September	83.3	87.9	55.5	42.4	27.7	5.8	71.8	32.1	25.2	9.7	20.0	4.6	1.1	38.6
October	55.2	82.1	59.5	37.3	18.2	3.1	39.7	19.2	29.7	17.0	16.8	5.0	1.1	29.0
November	70.9	129.6	98.2	35.7	59.6	2.6	36.2	20.8	53.0	29.9	23.1	6.5	0.8	29.5
December	46.7	171.9	131.5	46.8	17.8	3.8	38.7	21.5	70.7	44.7	27.4	2.8	0.9	28.9
January to December	219.6	203.9	150.1	53.7	65.2	19.8	106.6	130.9	102.7	65.3	37.4	11.2	2.4	55.4

Notes:

Alberta AAQOs referenced unless noted otherwise.

Bold text indicates an exceedance of the AAQO.

[1] TRS AAQO adopted from Metro Vancouver 1-hour acceptable AAQO.

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)

Operational period data collected from January 1, 2024 to December 31, 2024.



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

Edmonton Station 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						% (hourly)						
January	10.2	29.6	12.7	16.9	0.7	0.3	15.2	96.1	95.8	95.8	95.8	96.0	95.8	94.1
February	7.4	22.4	7.9	14.5	1.3	0.2	20.9	99.7	99.6	99.6	99.6	99.6	99.6	99.3
March	5.4	13.6	4.0	9.7	1.5	0.2	31.6	99.6	99.6	99.6	99.6	98.8	99.6	99.3
April	4.3	8.2	1.2	7.0	1.6	0.3	34.8	99.7	99.6	99.6	99.6	99.6	99.7	99.4
May	11.1	7.3	1.2	6.2	2.2	0.1	31.9	99.2	99.2	99.2	99.2	99.2	99.2	99.2
June	5.5	6.6	1.2	5.5	1.9	0.3	32.0	98.5	99.0	99.0	99.0	99.0	99.0	98.9
July	22.6	9.3	1.9	7.5	2.2	0.3	30.6	99.3	99.3	99.3	99.3	99.3	98.7	99.2
August	19.8	7.8	1.8	6.1	1.3	0.5	28.9	99.2	99.1	99.1	99.1	99.2	98.8	98.9
September	8.8	13.7	4.2	9.5	1.0	0.4	24.2	98.9	98.8	98.8	98.8	98.8	98.8	98.5
October	5.9	15.7	5.1	10.5	1.2	0.4	18.1	99.6	99.3	99.3	99.3	99.3	98.7	99.6
November	8.5	18.0	6.4	11.6	0.7	0.4	15.1	99.4	99.6	99.6	99.6	99.6	99.3	99.2
December	10.3	26.4	10.3	16.1	0.9	0.5	16.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
January to December	10.0	14.9	4.8	10.1	1.4	0.3	25.0	99.1	99.1	99.1	99.1	99.0	98.9	98.8

Notes:

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)

Operational period data collected from January 1, 2024 to December 31, 2024.

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

Edmonton Station 2024 Statistics	Maximum 1-Hour Mean				Maximum 24-Hour Mean			
Compound	Benzene	Toluene	Ethylbenzene	Xylenes	Benzene	Toluene	Ethylbenzene	Xylenes
Units	ppb				ppb			
AAQO	9	499	460	530		106		161
January	3.8	7.9	3.5	6.8	0.5	2.5	0.5	1.8
February	1.9	7.8	1.3	3.5	0.4	3.2	0.7	2.0
March	0.8	4.5	0.8	2.8	0.3	1.2	0.3	0.9
April	1.0	4.3	0.6	1.5	0.2	1.0	0.2	0.5
May	1.1	3.1	1.0	2.1	0.6	0.9	0.2	0.5
June	2.7	3.9	1.5	2.3	0.4	1.1	0.3	0.7
July	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
August	4.4	7.0	1.8	6.8	2.1	2.1	0.6	1.7
September	3.5	8.2	2.9	6.0	0.6	1.9	0.5	1.4
October	1.4	25.4	1.9	4.7	0.5	3.1	0.5	1.4
November	0.9	4.4	0.6	7.1	0.5	1.8	0.3	1.7
December	0.8	4.1	1.8	4.6	0.4	1.5	0.7	1.5
January to December	4.4	25.4	3.5	7.1	0.7	1.8	0.4	1.3

Notes:

No AAQO available

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

Operational period data collected from January 1, 2024 to December 31, 2024.

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

Edmonton Station 2024 Statistics	Monthly Mean				Valid Data			
	Benzene	Toluene	Ethylbenzene	Xylenes	Benzene	Toluene	Ethylbenzene	Xylenes
Units	ppb				% (hourly)			
January	0.3	0.9	0.2	0.9	89.5	89.5	89.5	89.5
February	0.2	0.7	0.2	0.6	95.3	95.3	95.3	95.3
March	0.2	0.5	0.2	0.4	94.4	94.4	94.4	94.4
April	0.2	0.5	0.1	0.3	94.7	94.7	94.7	94.7
May	0.2	0.5	0.1	0.3	93.0	93.0	93.0	93.0
June	0.2	0.6	0.2	0.4	95.1	95.1	95.1	95.1
July	N/A	N/A	N/A	N/A	65.2	65.2	65.2	65.2
August	0.4	0.8	0.2	0.7	92.7	92.7	92.7	92.7
September	0.2	0.9	0.2	0.7	95.3	95.3	95.3	95.3
October	0.2	0.9	0.3	0.8	92.6	92.6	92.6	92.6
November	0.2	0.9	0.3	0.9	95.3	95.3	95.3	95.3
December	0.3	0.9	0.3	0.8	94.6	94.6	94.6	94.6
January to December	0.2	0.8	0.2	0.6	91.5	91.5	91.5	91.5

Notes:

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

Operational period data collected from January 1, 2024 to December 31, 2024.

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

Edmonton Station 2024 Statistics	Minimum 1-Hour Mean	Monthly Mean	Valid Data
Compound	Visibility	Visibility	Visibility
Units	km	km	%
January	10.4	62.2	96.4
February	17.4	86.6	100.0
March	20.3	192.4	100.0
April	38.6	344.4	100.0
May	2.9	326.6	99.5
June	40.3	404.4	99.7
July	2.9	325.5	99.6
August	3.2	364.1	86.3
September	N/A	N/A	37.5
October	21.4	261.4	100.0
November	15.0	166.0	100.0
December	21.1	168.6	100.0
January to December	2.9	245.7	93.3

Notes:

N/A: Not available-indicates <75% data availability.

Operational period data collected from January 1, 2024 to December 31, 2024.

Table A6. Trans Mountain Edmonton 1-hour, 24-hour and Annual Average AAQO exceedances

2024 Event Statistics	1-Hour average > AAQO								24-Hour average > AAQO			Annual average > AAQO			
	NO ₂	SO ₂	TRS	O ₃	B	T	E	X	PM _{2.5}	T	X	NO ₂	SO ₂	B	PM _{2.5}
Compound	NO ₂	SO ₂	TRS	O ₃	B	T	E	X	PM _{2.5}	T	X	NO ₂	SO ₂	B	PM _{2.5}
AAQO	159	172	10 ^[1]	76 ^[2]	9	499	460	530	29	106	161	24	8	0.9	8 ^[3]
Units	ppb								µg/m ³	ppb		ppb			µg/m ³
Units	No. > AAQO								No. > AAQO			No. > AAQO			
January	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
April	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
May	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
June	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
July	0	0	0	3	0	0	0	0	6	0	0	0	0	0	0
August	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0
September	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
October	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
November	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
January to December	0	0	3	3	0	0	0	0	16	0	0	0	0	0	0

Notes:

^[1] TRS AAQO adopted from Metro Vancouver 1-hour acceptable AAQO.

^[2] Averaging period: 1-hour daily maximum

^[3] PM_{2.5} annual AAQO adopted from Metro Vancouver.

Bold text indicates events that exceed the AAQO.

Operational period data collected from January 1, 2024 to December 31, 2024.

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

E (ethylbenzene); X (xylenes)

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

2024 Meteorological Statistics	Maximum 1-Hour Mean					Minimum 1-Hour Mean				
	Parameter	Wind Speed	Temp	Relative Humidity	Pressure	Precip	Wind Speed	Temp	Relative Humidity	Pressure
Units	m/s	°C	%	mb	mm	m/s	°C	%	mb	mm
January	8.5	12.1	98.9	1035.8	0.6	0.1	-36.5	35.2	993.7	0.0
February	7.9	11.5	100.0	1027.5	0.9	0.1	-21.9	21.9	990.0	0.0
March	8.4	16.3	100.0	1026.8	0.6	0.2	-25.2	16.7	994.0	0.0
April	9.8	19.5	100.0	1034.0	1.3	0.3	-6.2	13.0	1001.0	0.0
May	10.5	25.4	100.0	1026.9	3.2	0.5	0.4	15.1	998.0	0.0
June	9.3	25.9	100.0	1023.0	5.5	0.2	3.3	19.6	993.5	0.0
July	10.6	35.2	100.0	1023.0	16.9	0.2	10.6	21.5	1003.0	0.0
August	9.5	28.2	100.0	1027.0	8.5	0.4	9.0	25.2	999.0	0.0
September	8.7	31.7	100.0	1027.0	4.3	0.3	4.1	22.2	995.0	0.0
October	8.9	22.7	100.0	1025.0	1.6	0.0	-2.8	26.8	994.5	0.0
November	8.2	15.3	100.0	1027.2	0.8	0.0	-19.1	34.3	987.0	0.0
December	9.5	7.1	100.0	1032.0	1.6	0.0	-22.8	42.5	994.0	0.0
January to December	10.6	35.2	100.0	1035.8	16.9	0.0	-36.5	13.0	990.0	0.0

Notes:

Operational period data collected from January 1, 2024 to December 31, 2024.



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

2024 Meteorological Statistics	Monthly Mean				Total	Valid Data					
Parameter	Wind Speed	Temp	Relative Humidity	Pressure	Precip	Wind Speed	Wind Direction	Temp	Relative Humidity	Pressure	Precip
Units	m/s	°C	%	mb	mm	(%)					
January	2.7	-11.7	75.5	1014.6	7.2	100.0	100.0	96.4	96.4	96.4	96.2
February	2.9	-4.9	70.4	1010.7	12.2	100.0	100.0	100.0	100.0	100.0	100.0
March	3.6	-3.9	66.3	1013.4	6.2	100.0	100.0	100.0	100.0	100.0	100.0
April	3.8	6.7	49.1	1012.6	19.8	100.0	100.0	100.0	100.0	100.0	99.9
May	3.7	11.2	60.0	1010.7	53.7	100.0	100.0	99.9	99.9	99.9	99.7
June	4.0	14.6	59.6	1011.2	63.2	100.0	100.0	100.0	100.0	100.0	100.0
July	3.5	21.8	60.8	1013.4	70.6	100.0	100.0	99.9	99.9	99.9	99.9
August	3.4	18.6	65.8	1016.2	53.8	100.0	100.0	100.0	100.0	100.0	100.0
September	3.2	15.6	60.5	1011.5	25.3	100.0	100.0	100.0	100.0	99.7	100.0
October	3.2	6.7	66.5	1012.4	5.3	100.0	100.0	100.0	100.0	100.0	100.0
November	2.8	-4.2	88.8	1012.5	18.1	99.9	99.9	100.0	100.0	100.0	100.0
December	3.0	-6.3	89.9	1012.9	18.7	100.0	100.0	100.0	100.0	100.0	100.0
January to December	3.3	5.4	67.8	1012.7	354.1	100.0	100.0	99.7	99.7	99.7	99.7

Notes:

Operational period data collected from January 1, 2024 to December 31, 2024.

Table A9. Trans Mountain Edmonton 24-Hour PM_{2.5} Exceedance Summary

Date	24-hour Average (µg/m ³)	Wind Speed (m/s)	Wind Direction (deg)	Discussion
January 30, 2024	30.8	1.4	237	Air quality in the City of Edmonton was poor on January 25 th . The Alberta Government reported Air Quality Health Index (AQHI) readings that ranged from 4 to 7 (moderate to high risk). The AQHI ranges between 1-10 and is a tool to help the general public understand local air quality health risks and appropriate precautions. It is very likely that the source of the elevated AQHI values was low wind speeds (stagnant air mass) and regional accumulation of PM _{2.5} from road salt and grit applied to public roads.
May 11, 2024	105.6	2.7	281	Air quality in the City of Edmonton was poor for May 11 th . At 5:00 May 11 th the PM _{2.5} concentration started to rise reaching a maximum of 167.5 µg/m ³ by 10:00. Concentrations remained above 108 µg/m ³ through 23:00. Environment and Climate Change Canada (ECCC) issued air quality advisories based on Air Quality Health Index (AQHI) readings that reached values of 10+ very high risk. As stated in the advisory, the source of the elevated AQHI values was the forest fire smoke from active fires in Northeastern BC.
May 12, 2024	88.7	3.6	108	Air quality in the City of Edmonton was poor throughout May 11 th and 12 th . At 5:00 May 11 th the PM _{2.5} concentration started to rise reaching a maximum of 167.5 µg/m ³ by 10:00 on that day. During May 12 th decreased from 163.5 µg/m ³ at 01:00 to 25.7 µg/m ³ at 23:00 on that day. Environment and Climate Change Canada (ECCC) issued air quality advisories based on Air Quality Health Index (AQHI) readings that reached values of 10+ very high risk. As stated in the advisory, the source of the elevated AQHI values is the forest fire smoke from active fires in Northeastern BC.
July 19, 2024	59.6	2.2	121.9	The PM _{2.5} levels started to rise above the 29 µg/m ³ limit at 6:00 on July 19 th , 2024, and continued to build throughout the day. A wildfire smoke advisory was issued by Environment Canada. The dominant wind direction with highest concentrations was from the NE suggesting this smoke is coming from fires burning in NE AB and W SK.

Date	24-hour Average ($\mu\text{g}/\text{m}^3$)	Wind Speed (m/s)	Wind Direction (deg)	Discussion
July 20, 2024	113.3	2.0	115.7	The $\text{PM}_{2.5}$ levels started to rise above the $29 \mu\text{g}/\text{m}^3$ limit at 6:00 on July 19 th , 2024, and maintained higher readings through July 20 th . The AQHI was +10 during that time. A wildfire smoke advisory was issued by Environment Canada. The dominant wind direction with highest concentrations was from the N and NE suggesting this smoke is coming from fires burning in N-NE AB and W SK.
July 21, 2024	37.9	3.4	100.8	The $\text{PM}_{2.5}$ levels started to rise above the $29 \mu\text{g}/\text{m}^3$ limit at 6:00 on July 19 th , 2024, and maintained higher readings through July 21 st for all hours excluding 14:00 when it was $28.6 \mu\text{g}/\text{m}^3$. A wildfire smoke advisory was issued by Environment Canada. The dominant wind direction with highest concentrations was from the N and ESE suggesting this smoke is coming from fires burning in NE AB and W SK.
July 22, 2024	120.4	6.7	120.4	The $\text{PM}_{2.5}$ levels started to rise above the $29 \mu\text{g}/\text{m}^3$ limit at 6:00 on July 19 th , 2024, and maintained higher readings through July 22 nd , excluding four hours between 07:00 and 11:00. A wildfire smoke advisory was issued by Environment Canada. The dominant wind direction with highest concentrations was from the ESE suggesting this smoke is recirculating from fires burning in NE AB and W SK.
July 23, 2024	109.3	4.2	109.3	The $\text{PM}_{2.5}$ levels started to rise above the $29 \mu\text{g}/\text{m}^3$ limit at 6:00 on July 19 th , 2024, and maintained high readings through July 23 rd . A wildfire smoke advisory was issued by Environment Canada. The dominant wind direction with highest concentrations was from the NE and SE suggesting this smoke is recirculating from fires burning in NE AB and W SK.
July 24, 2024	56.4	3.2	23.4	The $\text{PM}_{2.5}$ levels started to rise above the $29 \mu\text{g}/\text{m}^3$ limit at 6:00 on July 19 th , 2024, and maintained high readings through July 24 th . A wildfire smoke advisory was issued by Environment Canada. The dominant wind direction with highest concentrations was from the N-NE suggesting this smoke is from fires burning in NE AB and W SK.
August 7, 2024	38.0	2.9	18.1	The $\text{PM}_{2.5}$ levels started to rise above the $29 \mu\text{g}/\text{m}^3$ limit at 2:00 on Aug 6, 2024. Briefly dropping below the limit at 8:00, the $\text{PM}_{2.5}$ concentrations peaked at 15:00 before settled below the limit at 20:00. Environment Canada issued a special air quality statement



Date	24-hour Average (µg/m³)	Wind Speed (m/s)	Wind Direction (deg)	Discussion
				suggesting wildfire smoke as the cause. The dominant wind direction with highest concentrations was from the North-northeast.
August 14, 2024	126.0	3.2	247.8	The PM _{2.5} levels started to rise above the 29 µg/m³ limit at 1:00 on Aug 14 th , 2024. Environment Canada issued a special air quality statement indicating wildfire smoke as the cause. The dominant wind direction with highest concentrations were from the North and Northwest.
August 15, 2024	62.6	2.6	134.7	The PM _{2.5} levels started to rise above the 29 µg/m³ limit at 1:00 on Aug 14 th , 2024. Environment Canada issued a special air quality statement suggesting wildfire smoke as the cause. The PM _{2.5} levels dropped below the AAQO limit around 15:00 on August 15 th , 2024. On August 15 th , the AQHI was 10+ until 14:00 then dropped to 4 by 19:00. The dominant wind directions with highest concentrations were from East through Southwest.
August 17, 2023	33.2	1.4	129.3	After dropping below the AAQO limit at 15:00 on Aug 15 th , 2024, the PM _{2.5} levels rose again at 1:00 on Aug 17 th , 2024. The PM _{2.5} levels dropped below the AAQO limit briefly at 2:00, then again from 15:00 to 19:00 on August 17 th , 2024. On August 17 th , the AQHI had a max of 7 from 7:00 to 8:00 with an average of 5 for the 24-hr period. The dominant wind directions with highest concentrations were from Northeast through East Northeast.
August 18, 2024	33.1	1.8	156.9	After dropping below the AAQO limit at 15:00 on Aug 15 th , 2024, the PM _{2.5} levels rose again at 1:00 on Aug 17 th , 2024. The PM _{2.5} level remained just above the 29 µg/m³ limit. On August 18 th , the AQHI had a high of 6 and an average of 4.76 for the 24-hr period. While likely fire smoke, no statements were issued by Environment Canada. The dominant wind directions with highest concentrations were from Northeast.

Date	24-hour Average ($\mu\text{g}/\text{m}^3$)	Wind Speed (m/s)	Wind Direction (deg)	Discussion
August 21, 2024	48.2	3.3	239.4	At 23:00 on Aug 21 st , 2024, the PM _{2.5} levels rose above the AAQO limit. Between 10:00 to 15:00 August 22 nd , an RWDI tech was conducting monthly calibrations and confirmed the validity of the measurements before and after. The AQHI had a high of 9 and an average of 5.6 for the 24-hr period. While likely fire smoke, no statements were issued by Environment Canada. The dominant wind directions with highest concentrations were from North Northwest and Southeast
September 7, 2024	33.1	1.3	179.4	At 5:00 on Sep 7 th , 2024, the PM _{2.5} levels rose above the AAQO limit. The AQHI had a high of 10+ and an average of 6.5 for the 24-hr period. The PM _{2.5} levels dropped below the AAQO limit at 16:00 only to rise above again between 02:00 and 11:00 on Sep 8 th , 2024. An advisory statement was issued by Environment Canada, identifying wildfire smoke in BC as the cause. The dominant wind directions with highest concentrations were from the Southwest and Southeast

Table A10. Trans Mountain Edmonton 1-Hour TRS Exceedance Summary

Date	1-hour Average (ppb)	Wind Speed (m/s)	Wind Direction (deg)	Discussion
April 11, 2024, 22:00-23:00	13.7	5.5	113	The Edmonton TMEP station hourly TRS concentrations started elevating at 20:00 on April 11 th and concentrations declined around April 12 th 00:00. During the exceedance event, the wind was blowing from the ESE, which puts the station upwind of the Transmountain site. It is likely that in this case, that the origin of the exceedance was from a surrounding source. The Edmonton East station also recorded an H ₂ S spike of the same magnitude during this time period.
April 14, 2024, 5:00-6:00	17.0	1.0	187	The Edmonton TMEP station hourly TRS concentrations started elevating around 03:00 on April 14 th and concentrations declined around 08:00. During the exceedance event, the wind was blowing from the SSE-SW, which puts the station upwind of the Transmountain site. It is likely that in this case, that the origin of the exceedance was from a surrounding source. The Edmonton East station also recorded an H ₂ S spike of the same magnitude during this time period.
April 14, 2024, 6:00-7:00	19.8	1.6	172	The Edmonton TMEP station hourly TRS concentrations started elevating around 03:00 on April 14 th and concentrations declined around 08:00. During the exceedance event, the wind was blowing from the SSE-S, which puts the station upwind of the Transmountain site. It is likely that in this case, that the origin of the exceedance was from a surrounding source. The Edmonton East station also recorded an H ₂ S spike of the same

Table A11. Trans Mountain Edmonton 1-Hour daily max O₃ Exceedance Summary

Date	1-hour daily max (ppb)	Wind Speed (m/s)	Wind Direction (deg)	Discussion
July 10, 2024, 15:00-16:00	106.6	1.7	324	Environment Canada (EC) issued a special air quality statement for the city of Edmonton on July 10 th , 2024. The Air Quality Health Index (AQHI) for Edmonton reached a 7. Ozone is not emitted from operations at the Trans Mountain ET; rather, it forms in the atmosphere as a secondary pollutant typically under hot stagnant summertime conditions. Hot stagnant summertime conditions and forest fires in NE Alberta and central Saskatchewan are the likely cause of the poor air quality.
July 18, 2024, 14:00-16:00	82.3	1.9	15	Between 14:00 and 15:00 the Ozone levels were above the Alberta Environment limit of 76 ppb. The AQHI index at the time was 4, Moderate Risk. No air quality alerts for Edmonton at the time. Ozone is not emitted from operations at the Trans Mountain ET; rather, it forms in the atmosphere as a secondary pollutant typically under hot stagnant summertime conditions.
July 20, 2024, 14:00-15:00	104.1	1.9	33.7	On July 20 th , 2024, at 10:00 to 16:00 the Ozone exceeded the 1-hr average of 76 ppb, except for the 11 o'clock hr. (69.0 ppb). The AQHI was +10 during that time. There were also exceedances of the PM _{2.5} limit at the same time and an advisory of wildfire smoke. Ozone is not emitted from operations at the Trans Mountain ET; rather, it forms in the atmosphere as a secondary pollutant typically under hot stagnant summertime conditions.