

Ventia – EastLink Tunnel

Ventilation Stack Air Quality Monitoring Validated Data Report

01 July 2024 to 30 September 2024

Ref: DR.2024Q3.ETL

Issue Date: 28 October 2024

Report prepared by: Tim Allfrey

NATA Accredited Laboratory
Number 19660

Accredited for compliance with
ISO/IEC17025 – Testing

The results of the tests, calibrations
and/or measurements included in this
document are traceable to Australian /
national standards.



Norditech Pty Ltd
Unit 2/87 Station Road
Seven Hills NSW 2147

1300 572 822

info@norditech.com.au
norditech.com.au

Document Control

Revision	Date	Details	Prepared By	Approved By
0	28/10/2024		TA	BN

Prepared by



Tim Allfrey
 28 October 2024

Approved by



Bruno Nourdine
 28 October 2024

Distribution

Format	Recipient	Details
PDF	George Vasiliadis	Gvasiliadis@connecteast.com.au
PDF	Nick Huntington	NHuntington@connecteast.com.au

Table of Contents

1	Executive Summary.....	5
1.1	Compliance to limits	5
1.2	Summary of Results	7
2	Compliance Limits	9
2.1	Standards Compliance	9
3	Introduction.....	10
4	Explanation of Monitoring	11
4.1	Methodology.....	11
4.2	Ventilation Stacks.....	12
4.3	Data Collection.....	13
4.4	Data Validation.....	13
4.5	Reporting and Calculations.....	14
4.5.1	Data Availability.....	15
4.5.2	Unit Conversions.....	15
5	Calibrations and Maintenance	16
5.1	Units and Uncertainties	16
5.2	Last Calibrations and Maintenance records.....	17
5.3	Automatic Instrument Calibration Checks.....	19
6	Results	20
6.1	July 2024.....	20
6.1.1	Data Availability.....	20
6.1.2	Exceedances.....	21
6.1.3	Tabulated Results	22
6.1.3.1	<i>Statistical Summary of 1-hour Mass Rate Data Western and Eastern Ventilation Stacks</i>	22
6.1.4	Graphical Representations	23
6.1.4.1	<i>July 2024 - Monthly 1-hour mass rate NO₂</i>	23
6.1.4.2	<i>July 2024 - Monthly 1-hour mass rate NO</i>	24
6.1.4.3	<i>July 2024 - Monthly 1-hour mass rate CO</i>	25
6.1.4.4	<i>July 2024 - Monthly 1-hour mass rate PM_{2.5}</i>	26
6.1.4.5	<i>July 2024 - Monthly 1-hour mass rate PM₁₀</i>	27
6.1.4.6	<i>July 2024 - Monthly 1-hour average stack velocity</i>	28
6.1.4.7	<i>July 2024 - Monthly 1-hour average stack temperature</i>	29
6.1.5	Data Validation Table	30
6.1.5.1	<i>July 2024 - Western Ventilation Stack</i>	30
6.1.5.2	<i>July 2024 - Eastern Ventilation Stack</i>	30
6.2	August 2024.....	31
6.2.1	Data Availability.....	31
6.2.2	Exceedances.....	32
6.2.3	Tabulated Results	33
6.2.3.1	<i>Statistical Summary of 1-hour Mass Rate Data Western and Eastern Ventilation Stacks</i>	33
6.2.4	Graphical Representations	34
6.2.4.1	<i>August 2024 - Monthly 1-hour mass rate NO₂</i>	34
6.2.4.2	<i>August 2024 - Monthly 1-hour mass rate NO</i>	35
6.2.4.3	<i>August 2024 - Monthly 1-hour mass rate CO</i>	36
6.2.4.4	<i>August 2024 - Monthly 1-hour mass rate PM_{2.5}</i>	37
6.2.4.5	<i>August 2024 - Monthly 1-hour mass rate PM₁₀</i>	38
6.2.4.6	<i>August 2024 - Monthly 1-hour average stack velocity</i>	39
6.2.4.7	<i>August 2024 - Monthly 1-hour average stack temperature</i>	40
6.2.5	Data Validation Table	41
6.2.5.1	<i>August 2024 - Western Ventilation Stack</i>	41
6.2.5.2	<i>August 2024 - Eastern Ventilation Stack</i>	41
6.3	September 2024.....	42

6.3.1	Data Availability	42
6.3.2	Exceedances.....	43
6.3.3	Tabulated Results	44
6.3.3.1	<i>Statistical Summary of 1-hour mass rate data Western and Eastern Ventilation Stacks</i>	44
6.3.4	Graphical Representations	45
6.3.4.1	<i>September 2024 - Monthly 1-hour mass rate NO₂</i>	45
6.3.4.2	<i>September 2024 - Monthly 1-hour mass rate NO</i>	46
6.3.4.3	<i>September 2024 - Monthly 1-hour mass rate CO</i>	47
6.3.4.4	<i>September 2024 - Monthly 1-hour mass rate PM_{2.5}</i>	48
6.3.4.5	<i>September 2024 - Monthly 1-hour mass rate PM₁₀</i>	49
6.3.4.6	<i>September 2024 - Monthly 1-hour average stack velocity</i>	50
6.3.4.7	<i>September 2024 - Monthly 1-hour average stack temperature</i>	51
6.3.5	Data Validation Table	52
6.3.5.1	<i>September 2024 - Western Ventilation Stack</i>	52
6.3.5.2	<i>September 2024 - Eastern Ventilation Stack</i>	53
6.4	Data Availability Year to Date	54
6.5	Annual Performance Statement Bubble Limits.....	55
7	Report Summary	56
Appendix 1	57
Glossary	57
Data Validation Explanations	57

Figures

Figure 1: EastLink Tunnel ventilation stack locations.....	12
Figure 2: July 2024 Monthly 1-hour mass rate NO ₂	23
Figure 3: July 2024 Monthly 1-hour mass rate NO.....	24
Figure 4: July 2024 Monthly 1-hour mass rate CO.....	25
Figure 5: July 2024 Monthly 1-hour mass rate PM _{2.5}	26
Figure 6: July 2024 Monthly 1-hour mass rate PM ₁₀	27
Figure 7: July 2024 Monthly 1-hour average stack velocity.....	28
Figure 8: July 2024 Monthly 1-hour average stack temperature.....	29
Figure 9: August 2024 Monthly 1-hour mass rate NO ₂	34
Figure 10: August 2024 Monthly 1-hour mass rate NO	35
Figure 11: August 2024 Monthly 1-hour mass rate CO	36
Figure 12: August 2024 Monthly 1-hour mass rate PM _{2.5}	37
Figure 13: August 2024 Monthly 1-hour mass rate PM ₁₀	38
Figure 14: August 2024 Monthly 1-hour average stack velocity	39
Figure 15: August 2024 Monthly 1-hour average stack temperature	40
Figure 16: September 2024 Monthly 1-hour mass rate NO ₂	45
Figure 17: September 2024 Monthly 1-hour mass rate NO.....	46
Figure 18: September 2024 Monthly 1-hour mass rate CO.....	47
Figure 19: September 2024 Monthly 1-hour mass rate PM _{2.5}	48
Figure 20: September 2024 Monthly 1-hour mass rate PM ₁₀	49
Figure 21: September 2024 Monthly 1-hour average stack velocity	50
Figure 22: September 2024 Monthly 1-hour average stack temperature.....	51
Figure 23: Annual Performance Statement stack emission rates	55

Tables

Table 1: April 2024 Exceedances of EPA Limits	5
Table 2: May 2024 Exceedances of EPA Limits	6
Table 3: June 2024 Exceedances of EPA Limits.....	6
Table 4: April 2024 Summary of results	7
Table 5: May 2024 Summary of results	8
Table 6: June 2024 Summary of results	8
Table 7: EPA Compliance Limits	9
Table 8: Measurement methods and instrumentation	11
Table 9: EastLink Tunnel ventilation stack GPS Coordinates.....	12
Table 10: Measurement units and uncertainties	16
Table 11: April 2024 Instrument calibration dates	17
Table 12: May 2024 Instrument calibration dates.....	17
Table 13: June 2024 Instrument calibration dates.....	18
Table 14: Nightly span, zero and CO reference times.....	19
Table 15: April 2024 ventilation stack data availability	20
Table 16: April 2024 Exceedances of EPA Goals	21
Table 17: April 2024 Summary of 1-hour mass rate pollutant data.....	22
Table 18: April 2024 Western Ventilation Stack data validation	30
Table 19: April 2024 Eastern Ventilation Stack data validation	30
Table 20: May 2024 ventilation stack data availability.....	31
Table 21: May 2024 Exceedances of EPA Goals.....	32
Table 22: May 2024 Summary of 1-hour mass rate pollutant data	33
Table 23: May 2024 Western Ventilation Stack data validation.....	41
Table 24: May 2024 Eastern Ventilation Stack data validation.....	41
Table 25: June 2024 ventilation stack data availability.....	42
Table 26: June 2024 Exceedances of EPA Goals.....	43
Table 27: June 2024 Summary of 1-hour mass rate pollutant data	44
Table 28: June 2024 Western Ventilation Stack data validation.....	52
Table 29: June 2024 Eastern Ventilation Stack data validation.....	53
Table 30: EastLink Ventilation Stack year to date data availability.....	54
Table 31: Annual Performance Statement stack emission rates	55

1 Executive Summary

EastLink is a 39 km motorway running between Nunawading and Frankston, linking the Eastern, Monash Frankston and Peninsula Link freeways. Two 1.6 km tunnels pass under the Mullum Mullum Valley, with a ventilation stack at the end of each tunnel as an exit point for tunnel ventilation.

Two ventilation stacks provide ventilation for the tunnel, one at the western end of the tunnel at Discharge Point 1 (DP1), and one at the eastern end of the tunnel at Discharge Point 2 (DP2).

This report presents the monthly validated stack data for July 2024 to September 2024 to Ventia Pty Ltd for the EastLink Tunnel.

1.1 Compliance to limits

The Environment Protection Authority (Victoria) designates limits to which pollutant mass rates being discharged from the ventilation stacks must meet. (Environmental Licence No. 2043).

Instances of the ventilation stack pollutants exceeding the EPA Limits goals during the reporting period are presented in Table 1, Table 2 and Table 3 and below. Maximum mass rates are provided for comparison to the limits.

There were two exceedances of the prescribed limits during the reporting period.

EastLink Ventilation Stack Air Quality Limit Exceedances July 2024								
Location	Parameter	Time Period	Licence Limit	Units	Maximum Mass Rate	Number of exceedances	Value of exceedance	Date and Time of exceedance
Western Ventilation Stack (Discharge Point 1)	NO ₂	1-hour	3.98	kg/h	0.34	-	-	-
	CO	1-hour	112	kg/h	5.51	-	-	-
	PM _{2.5}	1-hour	2.4	kg/h	0.14	-	-	-
	PM ₁₀	1-hour	2.6	kg/h	0.54	-	-	-
Eastern Ventilation Stack (Discharge Point 2)	NO ₂	1-hour	3.98	kg/h	0.51	-	-	-
	CO	1-hour	112	kg/h	6.21	-	-	-
	PM _{2.5}	1-hour	2.4	kg/h	0.11	-	-	-
	PM ₁₀	1-hour	2.6	kg/h	0.32	-	-	-

Table 1: July 2024 Exceedances of EPA Limits

EastLink Ventilation Stack Air Quality Limit Exceedances August 2024								
Location	Parameter	Time Period	Licence Limit	Units	Maximum Mass Rate	Number of exceedances	Value of exceedance	Date and Time of exceedance
Western Ventilation Stack (Discharge Point 1)	NO ₂	1-hour	3.98	kg/h	0.37	-	-	-
	CO	1-hour	112	kg/h	4.35	-	-	-
	PM _{2.5}	1-hour	2.4	kg/h	0.14	-	-	-
	PM ₁₀	1-hour	2.6	kg/h	0.34	-	-	-
Eastern Ventilation Stack (Discharge Point 2)	NO ₂	1-hour	3.98	kg/h	0.54	-	-	-
	CO	1-hour	112	kg/h	4.95	-	-	-
	PM _{2.5}	1-hour	2.4	kg/h	0.36	-	-	-
	PM ₁₀	1-hour	2.6	kg/h	3.94	2	3.9 3.7	16/08/2024 08:00 16/08/2024 09:00

Table 2: August 2024 Exceedances of EPA Limits

EastLink Ventilation Stack Air Quality Limit Exceedances September 2024								
Location	Parameter	Time Period	Licence Limit	Units	Maximum Mass Rate	Number of exceedances	Value of exceedance	Date and Time of exceedance
Western Ventilation Stack (Discharge Point 1)	NO ₂	1-hour	3.98	kg/h	0.40	-	-	-
	CO	1-hour	112	kg/h	5.27	-	-	-
	PM _{2.5}	1-hour	2.4	kg/h	0.11	-	-	-
	PM ₁₀	1-hour	2.6	kg/h	0.38	-	-	-
Eastern Ventilation Stack (Discharge Point 2)	NO ₂	1-hour	3.98	kg/h	0.60	-	-	-
	CO	1-hour	112	kg/h	4.76	-	-	-
	PM _{2.5}	1-hour	2.4	kg/h	0.14	-	-	-
	PM ₁₀	1-hour	2.6	kg/h	0.41	-	-	-

Table 3: September 2024 Exceedances of EPA Limits

1.2 Summary of Results

Summaries of the ventilation stack pollutants for the reporting period are presented in Table 4, Table 5 and Table 6 below. Maximum mass rates are provided for comparison to the limits.

EastLink Ventilation Stack Summary July 2024							
Location	Parameter	1hr Average Maximum	1 hr Average Minimum	Monthly Average	Monthly Total	Number of Exceedances	Data Availability (%)
Western Ventilation Stack	NO (kg/h)	2.31	0.00	0.54	383.54	N/A	94.8%
	NO ₂ (kg/h)	0.34	0.00	0.09	62.10	0	94.8%
	CO (kg/h)	5.51	0.00	1.56	1100.71	0	94.8%
	PM _{2.5} (kg/h)	0.1	0.0	0.0	15.3	0	96.4%
	PM ₁₀ (kg/h)	0.5	0.0	0.0	36.0	0	99.5%
Eastern Ventilation Stack	NO (kg/h)	2.35	0.00	0.66	467.69	N/A	95.0%
	NO ₂ (kg/h)	0.51	0.00	0.14	98.82	0	95.0%
	CO (kg/h)	6.21	0.00	1.43	1011.56	0	95.0%
	PM _{2.5} (kg/h)	0.1	0.0	0.0	19.3	0	99.2%
	PM ₁₀ (kg/h)	0.3	0.0	0.1	46.0	0	99.3%

Table 4: July 2024 Summary of results

EastLink Ventilation Stack Summary August 2024							
Location	Parameter	1hr Average Maximum	1 hr Average Minimum	Monthly Average	Monthly Total	Number of Exceedances	Data Availability (%)
Western Ventilation Stack	NO (kg/h)	2.33	0.00	0.54	385.47	N/A	95.6%
	NO ₂ (kg/h)	0.37	0.00	0.09	67.54	0	95.6%
	CO (kg/h)	4.35	0.00	1.61	1146.72	0	95.6%
	PM _{2.5} (kg/h)	0.1	0.0	0.0	20.3	0	96.6%
	PM ₁₀ (kg/h)	0.3	0.0	0.1	39.6	0	99.6%
Eastern Ventilation Stack	NO (kg/h)	2.37	0.00	0.67	475.87	N/A	95.4%
	NO ₂ (kg/h)	0.54	0.00	0.15	104.87	0	95.4%
	CO (kg/h)	4.95	0.00	1.44	1020.68	0	95.6%
	PM _{2.5} (kg/h)	0.4	0.0	0.0	24.9	0	96.6%
	PM ₁₀ (kg/h)	3.9	0.0	0.1	74.3	2	99.6%

Table 5: August 2024 Summary of results

EastLink Ventilation Stack Summary September 2024							
Location	Parameter	1hr Average Maximum	1 hr Average Minimum	Monthly Average	Monthly Total	Number of Exceedances	Data Availability (%)
Western Ventilation Stack	NO (kg/h)	2.79	0.00	0.54	371.67	N/A	95.4%
	NO ₂ (kg/h)	0.40	0.00	0.10	67.28	0	95.4%
	CO (kg/h)	5.27	0.00	1.60	1096.12	0	95.4%
	PM _{2.5} (kg/h)	0.1	0.0	0.0	17.3	0	95.4%
	PM ₁₀ (kg/h)	0.4	0.0	0.1	37.1	0	98.2%
Eastern Ventilation Stack	NO (kg/h)	2.71	0.00	0.69	450.87	N/A	90.6%
	NO ₂ (kg/h)	0.60	0.00	0.15	97.73	0	90.6%
	CO (kg/h)	4.76	0.00	1.31	891.73	0	94.6%
	PM _{2.5} (kg/h)	0.1	0.0	0.0	20.9	0	96.7%
	PM ₁₀ (kg/h)	0.4	0.0	0.1	49.8	0	98.2%

Table 6: September 2024 Summary of results

2 Compliance Limits

Air quality limits are provided in Condition LI_DA1.13 of the Environment Protection Authority (Victoria) Licence No 2043 for the EastLink Tunnel. The air quality limits for 1-hour mass rates are shown in Table 7 below.

EastLink Ventilation Stack Air Quality Limits					
Location	Parameter	Time Period	License Limit	Units	Applicable Licence
Western Ventilation Stack (Discharge Point 1)	NO ₂	1-hour	3.98	kg/h	EPA Vic Licence No 2043
	CO	1-hour	112	kg/h	
	PM _{2.5}	1-hour	2.4	kg/h	
	PM ₁₀	1-hour	2.6	kg/h	
Eastern Ventilation Stack (Discharge Point 2)	NO ₂	1-hour	3.98	kg/h	EPA Vic Licence No 2043
	CO	1-hour	112	kg/h	
	PM _{2.5}	1-hour	2.4	kg/h	
	PM ₁₀	1-hour	2.6	kg/h	

Table 7: EPA Compliance Limits

The procedure for reporting particulate matter results from the TEOMs and assessment of licence compliance is detailed in the EastLink Particulate Matter Protocol (PMP) dated 17/06/2013. The PMP requires validated uncorrected TEOM one hour clock average data to be compared to the following TEOM mass rate compliance limits for both DP1 and DP2.

- PM_{2.5}: 2.0 kg/h
- PM₁₀: 2.0 kg/h

2.1 Standards Compliance

Norditech's NATA Accreditation does not cover the following parameters monitored at the EastLink Tunnel ventilation stack air quality monitoring stations.

- Measurement of Stack Flow.
- AS/NZS 3580.9.8 refers specifically to the monitoring of PM₁₀.

3 Introduction

Norditech were contracted by Ventia Pty Ltd in August 2021 to provide continuous stack air quality monitoring and reporting services for the EastLink Tunnel. Ventia Pty Ltd are responsible for the operation and maintenance of the motorway.

Norditech is a NATA accredited organisation (Accreditation Number 19660).

Addresses of relevant parties:

Norditech Pty Ltd
2/87 Station Rd
Seven Hills NSW 2147

Ventia Pty Ltd
2 Hillcrest Avenue
Ringwood VIC 3134

This report presents the validated Western and Eastern ventilation stack data for July 2024 to September 2024.

- Describes air quality measurements.
- Reports any readings above the relevant EPA Limits.
- Compares monitoring results.
- Has been quality assured.

4 Explanation of Monitoring

4.1 Methodology

In the tunnel air is discharged via two ventilation stacks – one located at the Western end of the tunnel (DP1), and one located at the Eastern end (DP2). For each stack, monitoring as per the requirements of EPA Licence 2043 is undertaken.

Gaseous parameters are sampled by an extractive sampling system. Oxides of nitrogen are measured using chemiluminescence. Carbon monoxide is measured using non-dispersive infra-red absorption.

Particulates PM₁₀ and PM_{2.5} are measured using tapered element oscillating microbalances.

Stack gas velocity is measured using an optical flow sensor.

Monthly routine maintenance is undertaken by Norditech. Maintenance is performed as per the relevant Australian Standard or in house method. Maintenance cycles generally involve 1, 3, 6 and 12 monthly scheduled items.

The following instrumentation and methods are used in data collection:

EastLink Ventilation Stack Measurement Methods		
Parameter	Method	Instrument
CO	In house method TP.003	Thermo Scientific 48i
NO, NO ₂ , NO _x	In house method TP.001	Thermo Scientific 42i
PM ₁₀	AS/NZS 3580.9.8	Rupprecht & Patashnick TEOM
	In house method TP.005	
	AS 4323.1	
PM _{2.5}	In house method TP.026	Rupprecht & Patashnick TEOM
	AS 4323.1	
Temperature	In house method TP.012	PT100
Stack Velocity	USEAP (CFR 40) Part 75	OSI OFS2000

Table 8: Measurement methods and instrumentation

4.2 Ventilation Stacks

The locations of the EastLink Tunnel Western and Eastern ventilation stacks are detailed in Table 9 and Figure 1 below.

EastLink Ventilation Stack Locations		
Discharge Point	Site Name	GPS Coordinates
1	Western Ventilation Stack	-37.801229°, 145.196092°
2	Eastern Ventilation Stack	-37.808885°, 145.212012°

Table 9: EastLink Tunnel ventilation stack GPS Coordinates

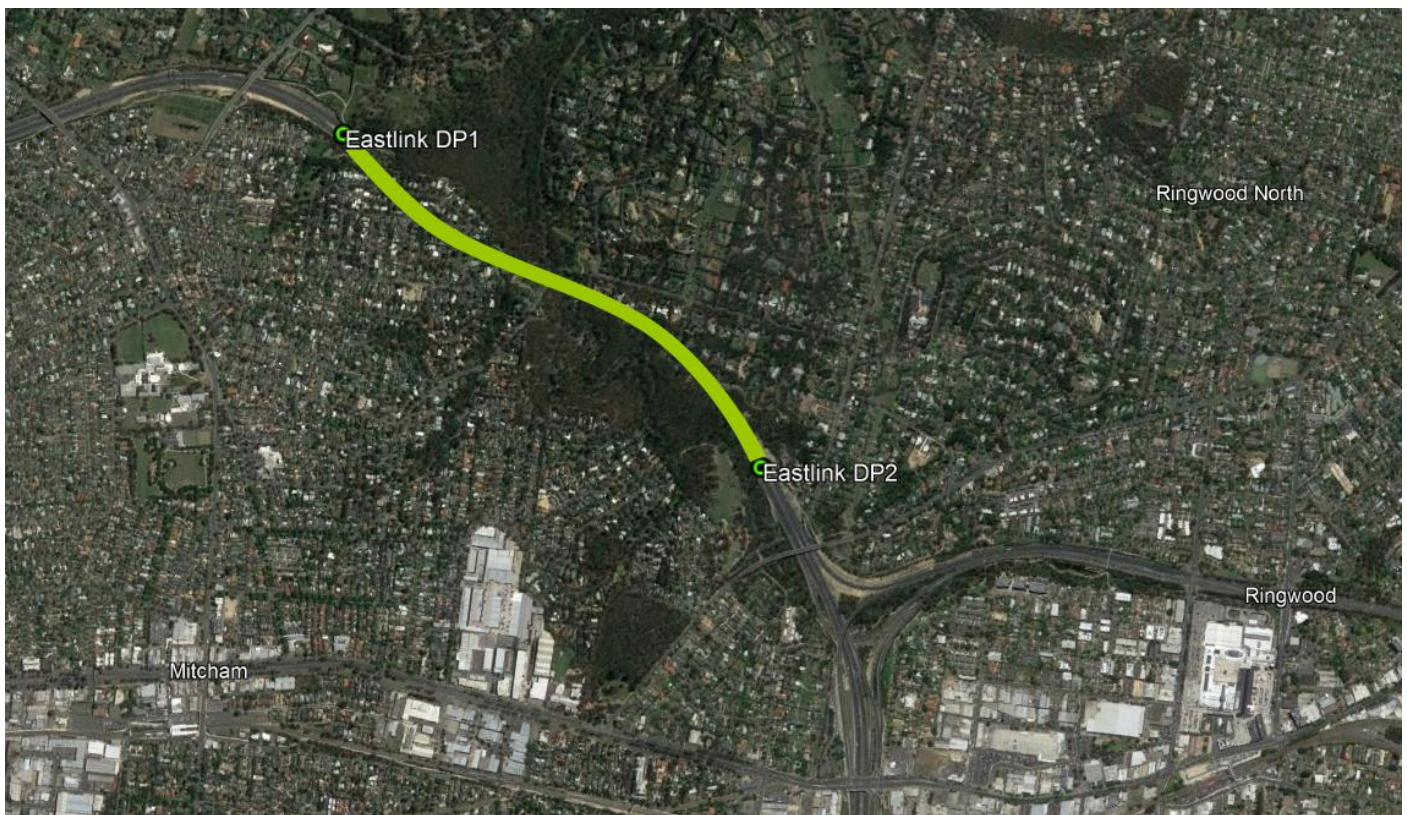


Figure 1: EastLink Tunnel ventilation stack locations

4.3 Data Collection

At each Air Quality Monitoring Station, data is logged to an EnviDAS data logger at 1 minute average intervals. Each 1-minute average is calculated from data sampled at 10 second intervals.

Data is transferred automatically to Norditech's data collection software via a TCP/IP link over 4G cellular network, at a frequency of not less than 1-hour. Two datasets are maintained by Norditech, one for data validation and reporting purposes, and a non-validated data set for reference purposes.

4.4 Data Validation

Data validation is performed as per Norditech's data validation procedure TP.022. The data validation process identifies any data that is deemed not to be valid. This data is flagged as invalid in the database and is removed from the reported data.

Data may be deemed invalid for several reasons, including but not limited to:

- Instrument fault.
- Instrument calibration out of tolerance.
- Maintenance activities.

For further details and explanations of reasons for invalidating data, please refer to Appendix 1 – Data Validation Explanations.

Initial visual inspection of data is performed by inspection of graphs to identify any anomalies in the data set.

Site visit logs and maintenance and calibration certificates are cross referenced to the data set and any data affected by maintenance activities are flagged.

Instrument drift and calibration tolerances are checked, and data flagged in the database as necessary as per NATA compliance requirements.

4.5 Reporting and Calculations

All calculations and averages are calculated from 1 minute average base data and are reported as 'end time' when the averaging periods of eight hours or less. IE the average data for 01:00 is the data from 00:00 through to 01:00. One-hour averages are calculated based on a clock hour. One day averages are calculated based on calendar days. All averages are based on a minimum of 75% valid readings within the averaging period.

All data is reported at Australian Eastern Standard Time.

Validated data for Quarter 2 Month 1 is presented in the Excel workbook named "202407 EastLink Q3M1 Validated data.xlsx"

The workbooks each consist of the following sheets:

- Sheet 1: Cover
- Sheet 2: M1 Data kg1h – Hourly data in kg/h
- Sheet 3: M1 Data g5m – 5-minute data in grams/5m
- Sheet 4: M1 Data mgm3 1h – 1-hour data in mg/m³
- Sheet 5: M1 Data mgm3 5m – 5-minute data in mg/m³
- Sheet 6: Eastern Validation Data
- Sheet 7: Western Validation Data

Validated data for Quarter 2 Month 2 is presented in the Excel workbook named "202408 EastLink Q3M2 Validated data.xlsx"

The workbooks each consist of the following sheets:

- Sheet 1: Cover
- Sheet 2: M2 Data kg1h – Hourly data in kg/h
- Sheet 3: M2 Data g5m – 5-minute data in grams/5m
- Sheet 4: M2 Data mgm3 1h – 1-hour data in mg/m³
- Sheet 5: M2 Data mgm3 5m – 5-minute data in mg/m³
- Sheet 6: Eastern Validation Data
- Sheet 7: Western Validation Data

Validated data for Quarter 2 Month 3 is presented in the Excel workbook named "202409 EastLink Q3M3 Validated data.xlsx"

The workbook consists of the following sheets:

- Sheet 1: Cover
- Sheet 2: M3 Data kg1h – Hourly data in kg/h
- Sheet 3: M3 Data g5m – 5-minute data in grams/5m
- Sheet 4: M3 Data mgm3 1h – 1-hour data in mg/m³
- Sheet 5: M3 Data mgm3 5m – 5-minute data in mg/m³
- Sheet 6: Eastern Validation Data
- Sheet 7: Western Validation Data

4.5.1 Data Availability

Data availability refers to the amount of available 1-hour data for the reporting period. Data availability is calculated using the following formula:

$$\text{Data availability \%} = \frac{\text{sum of available data points}}{\text{sum of possible data points}} * 100$$

Where:

- Sum of available data points is the number of validated 1-hour average data points for the reporting period.
- Sum of possible data points is the number of theoretically available 1-hour data points for the reporting period.

4.5.2 Unit Conversions

Stack velocity readings are converted to flow rate using the following stack areas:

- Western Stack area 35 m²
- Eastern Stack area 35 m²

Pollutant and flow data are reported at actual conditions.

5 Calibrations and Maintenance

5.1 Units and Uncertainties

EastLink Ventilation Stack Instrument Units and Uncertainties				
Parameter	Units	Resolution	Uncertainty	Measurement Range
CO	mg/m ³	0.01	± 8.2% of reading at 62.5mg/m ³ (k=1.96)	0 to 200
NO	mg/m ³	0.01	± 8.1% of reading for range 25.7 – 32.8mg/m ³ (k=1.96)	0 to 150
NO ₂	mg/m ³	0.01	± 8.5% of reading at 25.7mg/m ³ (k=1.96)	0 to 150
NO _x	mg/m ³	0.01	± 8.1% of reading for range 25.7 – 32.8mg/m ³ (k=1.96)	0 to 150
PM ₁₀	µg/m ³	0.1	±5.0 µg/m ³ or 3.6% of reading, whichever is the greater. K factor of 1.96	0 to 5000
PM _{2.5}	µg/m ³	0.1	±5.0 µg/m ³ or 3.6% of reading, whichever is the greater. K factor of 1.96	0 to 5000
Temperature	°C	0.1	±2.0 °C ¹	-25 to 105
Stack Velocity	m/s	1	±0.1 m/s ¹	-40 to +40

¹ Manufacturer's stated accuracy

Table 10: Measurement units and uncertainties

5.2 Last Calibrations and Maintenance records

Instrumentation maintenance and last calibration dates are provided in Table 11, Table 12 and Table 13 below:

EastLink Ventilation Stack Maintenance and Calibrations July 2024				
Location	Parameter	Date of last scheduled maintenance	Maintenance type	Date of last calibration
Western Ventilation Stack (Discharge Point 1)	CO	11/07/2024	1 Monthly	11/07/2024
	NO, NO ₂	11/07/2024	1 Monthly	11/07/2024
	PM ₁₀	25/06/2024	12 Monthly	25/06/2024
	PM _{2.5}	25/06/2024	12 Monthly	25/06/2024
	Stack Velocity	31/08/2022	12 Monthly	31/08/2022
	Stack Temperature	25/06/2024	12 Monthly	25/06/2024
Eastern Ventilation Stack (Discharge Point 2)	CO	10/07/2024	1 Monthly	10/07/2024
	NO, NO ₂	10/07/2024	1 Monthly	10/07/2024
	PM ₁₀	27/06/2024	12 Monthly	27/06/2024
	PM _{2.5}	27/06/2024	12 Monthly	27/06/2024
	Stack Velocity	31/08/2022	12 Monthly	31/08/2022
	Stack Temperature	27/06/2024	12 Monthly	27/06/2024

Table 11: July 2024 Instrument calibration dates

EastLink Ventilation Stack Maintenance and Calibrations August 2024				
Location	Parameter	Date of last scheduled maintenance	Maintenance type	Date of last calibration
Western Ventilation Stack (Discharge Point 1)	CO	15/08/2024	1 Monthly	15/08/2024
	NO, NO ₂	15/08/2024	1 Monthly	15/08/2024
	PM ₁₀	25/06/2024	12 Monthly	25/06/2024
	PM _{2.5}	25/06/2024	12 Monthly	25/06/2024
	Stack Velocity	20/08/2024	12 Monthly	20/08/2024
	Stack Temperature	25/06/2024	12 Monthly	25/06/2024
Eastern Ventilation Stack (Discharge Point 2)	CO	15/08/2024	1 Monthly	15/08/2024
	NO, NO ₂	15/08/2024	1 Monthly	15/08/2024
	PM ₁₀	27/06/2024	12 Monthly	27/06/2024
	PM _{2.5}	27/06/2024	12 Monthly	27/06/2024
	Stack Velocity	22/08/2024	12 Monthly	22/08/2024
	Stack Temperature	27/06/2024	12 Monthly	27/06/2024

Table 12: August 2024 Instrument calibration dates

EastLink Ventilation Stack Maintenance and Calibrations September 2024				
Location	Parameter	Date of last scheduled maintenance	Maintenance type	Date of last calibration
Western Ventilation Stack (Discharge Point 1)	CO	16/09/2024	3 Monthly	16/09/2024
	NO, NO ₂	16/09/2024	3 Monthly	16/09/2024
	PM ₁₀	16/09/2024	3 Monthly	16/09/2024
	PM _{2.5}	16/09/2024	3 Monthly	16/09/2024
	Stack Velocity	20/08/2024	12 Monthly	20/08/2024
	Stack Temperature	25/06/2024	12 Monthly	25/06/2024
Eastern Ventilation Stack (Discharge Point 2)	CO	16/09/2024	3 Monthly	16/09/2024
	NO, NO ₂	16/09/2024	3 Monthly	16/09/2024
	PM ₁₀	16/09/2024	3 Monthly	16/09/2024
	PM _{2.5}	16/09/2024	3 Monthly	16/09/2024
	Stack Velocity	22/08/2024	12 Monthly	22/08/2024
	Stack Temperature	27/06/2024	12 Monthly	27/06/2024

Table 13: September 2024 Instrument calibration dates

5.3 Automatic Instrument Calibration Checks

Table 14 below identifies the times at which the daily gaseous parameter automatic span and zero checks are performed.

This data is removed from the dataset, however, are not included in the data validation tables of data.

Nightly span and zero times for NO, NO ₂ and CO		
Location	Parameter	Span / Zero cycle time
Western (to 25/07/2024)	CO	00:00 - 00:34
	NO, NO ₂	01:00 - 01:44
Western (from 26/07/2024)	CO	01:00 - 01:44
	NO, NO ₂	01:00 - 01:44
Eastern	CO	01:34 - 02:13
	NO, NO ₂	01:34 - 02:13

Table 14: Nightly span, zero and CO reference times.

6 Results

6.1 July 2024

6.1.1 Data Availability

Data availability for the in the ventilation stack parameters are provided in Table 15 below. For further information on data availability please refer to section 6.1.5.

EastLink Ventilation Stack Data Availability July 2024								
Station		NO	NO ₂	CO	PM _{2.5}	PM ₁₀	Stack Velocity	Stack Temp.
Western	Data Availability	94.8%	94.8%	94.8%	96.4%	99.5%	100.0%	100.0%
	Collected Periods	705.0	705.0	705.0	717.0	740.0	744.0	744.0
	Available Periods	744.0	744.0	744.0	744.0	744.0	744.0	744.0
Eastern	Data Availability	95.0%	95.0%	95.0%	99.2%	99.3%	100.0%	100.0%
	Collected Periods	707.0	707.0	707.0	738.0	739.0	744.0	744.0
	Available Periods	744.0	744.0	744.0	744.0	744.0	744.0	744.0

Table 15: July 2024 ventilation stack data availability

6.1.2 Exceedances

Instances of the ventilation stack pollutants exceeding the EPA Limits goals during the reporting period are presented in Table 16 below. Maximum mass rates are provided for comparison to the limits.

There were nil exceedances of the prescribed limits during the reporting period.

EastLink Ventilation Stack Air Quality Limit Exceedances July 2024								
Location	Parameter	Time Period	Licence Limit	Units	Maximum Mass Rate	Number of exceedances	Value of exceedance	Date and Time of exceedance
Western Ventilation Stack (Discharge Point 1)	NO ₂	1-hour	3.98	kg/h	0.34	-	-	-
	CO	1-hour	112	kg/h	5.51	-	-	-
	PM _{2.5}	1-hour	2.4	kg/h	0.14	-	-	-
	PM ₁₀	1-hour	2.6	kg/h	0.54	-	-	-
Eastern Ventilation Stack (Discharge Point 2)	NO ₂	1-hour	3.98	kg/h	0.51	-	-	-
	CO	1-hour	112	kg/h	6.21	-	-	-
	PM _{2.5}	1-hour	2.4	kg/h	0.11	-	-	-
	PM ₁₀	1-hour	2.6	kg/h	0.32	-	-	-

Table 16: July 2024 Exceedances of EPA Goals

6.1.3 Tabulated Results

6.1.3.1 Statistical Summary of 1-hour Mass Rate Data Western and Eastern Ventilation Stacks

Table 17 presents 1-hour mass rate statistical data for the Western and Eastern ventilation stacks.

1-hour mass rates are calculated from 1 minute average data.

EastLink Ventilation Stack Summary July 2024								
Location	Parameter	Maximum	99 th Percentile	98 th Percentile	95 th Percentile	90 th Percentile	75 th Percentile	50 th Percentile
Western Ventilation Stack	NO (kg/h)	2.31	2.04	1.96	1.63	1.25	0.90	0.47
	NO ₂ (kg/h)	0.34	0.30	0.27	0.24	0.17	0.14	0.10
	CO (kg/h)	5.51	3.99	3.87	3.55	3.20	2.53	1.93
	PM _{2.5} (kg/h)	0.1	0.1	0.1	0.1	0.0	0.0	0.0
	PM ₁₀ (kg/h)	0.5	0.2	0.2	0.1	0.1	0.1	0.0
Eastern Ventilation Stack	NO (kg/h)	2.35	2.13	2.02	1.78	1.60	1.30	0.48
	NO ₂ (kg/h)	0.51	0.45	0.42	0.37	0.32	0.25	0.13
	CO (kg/h)	6.21	4.31	3.98	3.62	2.96	2.37	1.79
	PM _{2.5} (kg/h)	0.1	0.1	0.1	0.1	0.1	0.0	0.0
	PM ₁₀ (kg/h)	0.3	0.2	0.2	0.2	0.2	0.1	0.0

Table 17: July 2024 Summary of 1-hour mass rate pollutant data

6.1.4 Graphical Representations

The following charts present 1-hour mass rate data for NO, NO₂, CO, PM_{2.5}, PM₁₀ and Stack Velocity for the Western and Eastern ventilation stacks.

1-hour mass rates are calculated from 1 minute average data.

6.1.4.1 July 2024 - Monthly 1-hour mass rate NO₂

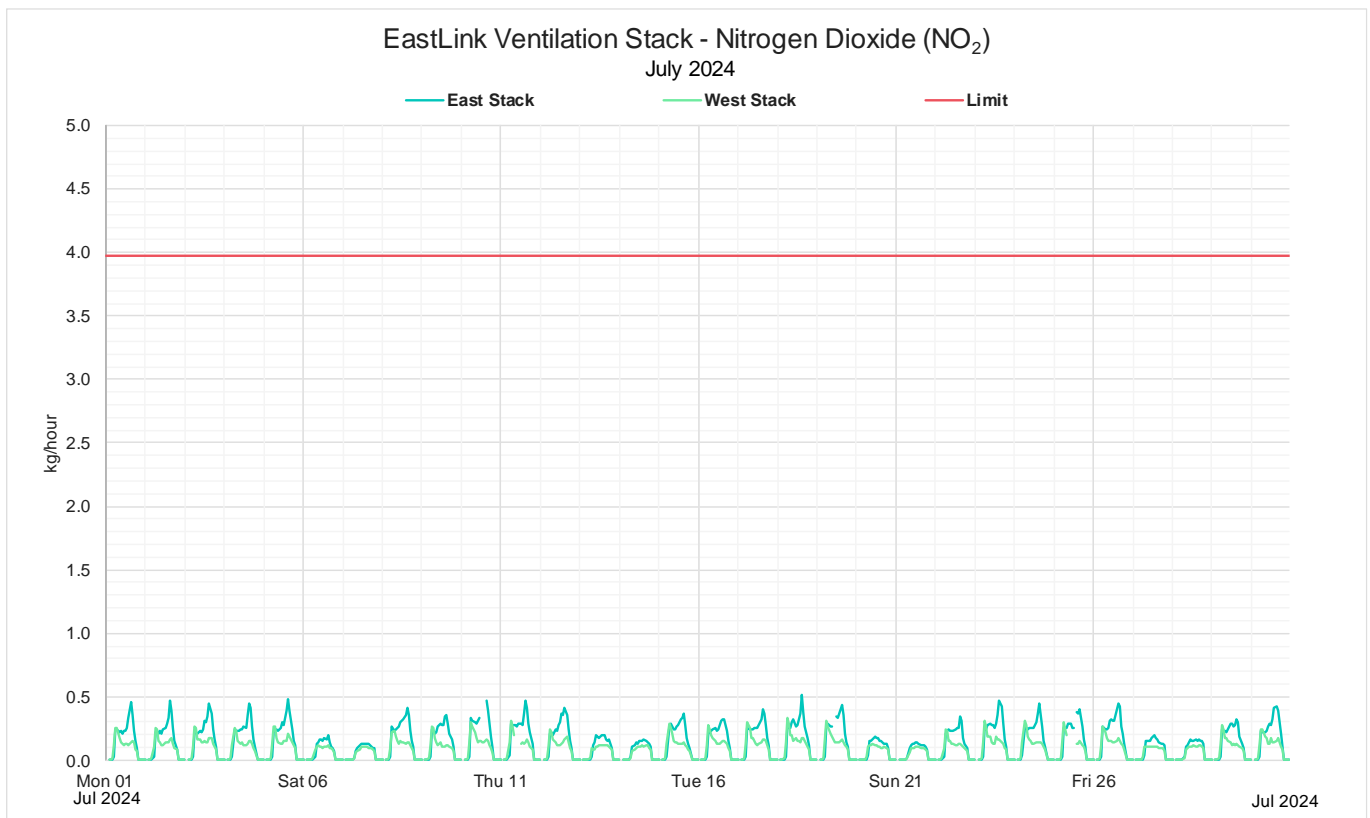


Figure 2: July 2024 Monthly 1-hour mass rate NO₂

6.1.4.2 July 2024 - Monthly 1-hour mass rate NO

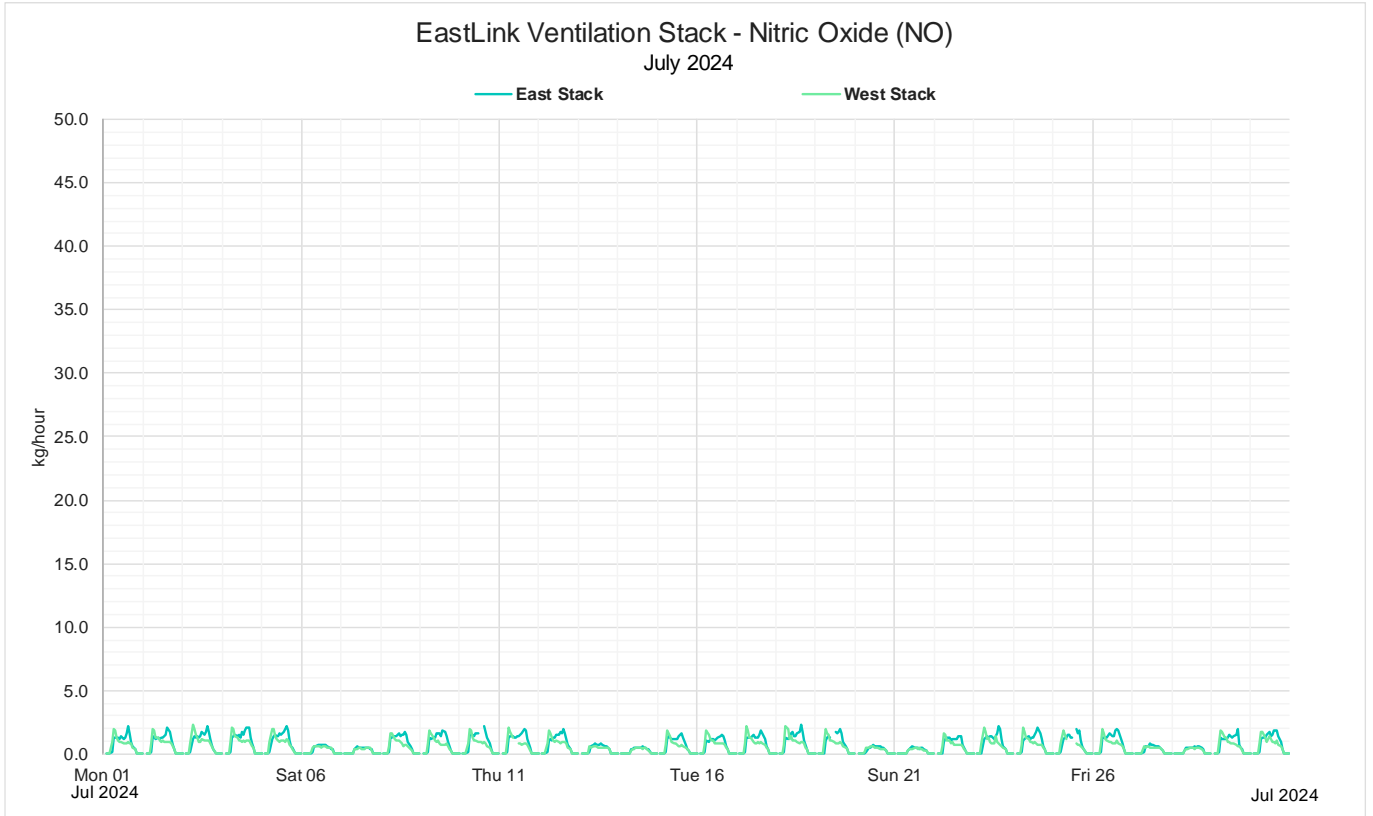


Figure 3: July 2024 Monthly 1-hour mass rate NO

6.1.4.3 July 2024 - Monthly 1-hour mass rate CO

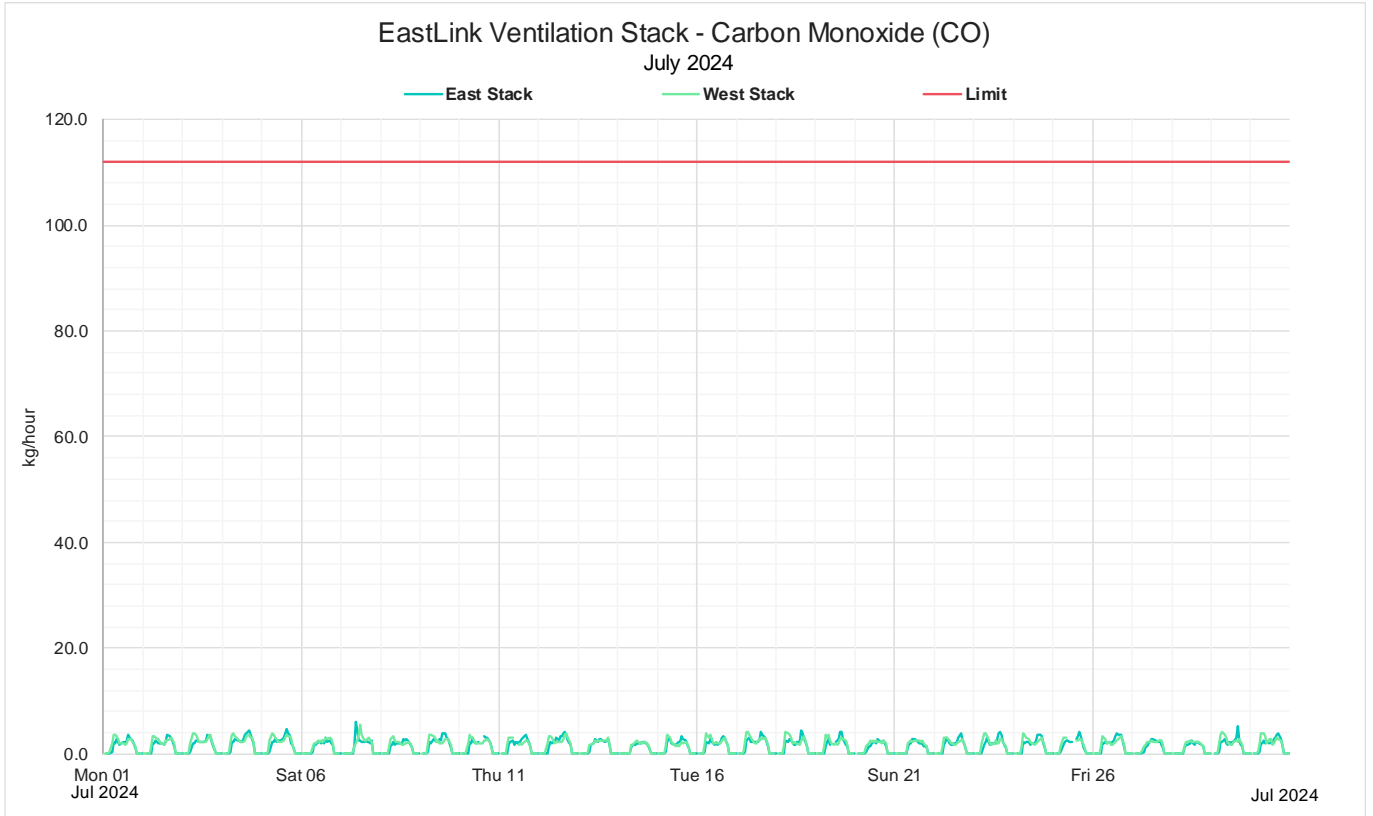


Figure 4: July 2024 Monthly 1-hour mass rate CO

6.1.4.4 July 2024 - Monthly 1-hour mass rate PM_{2.5}

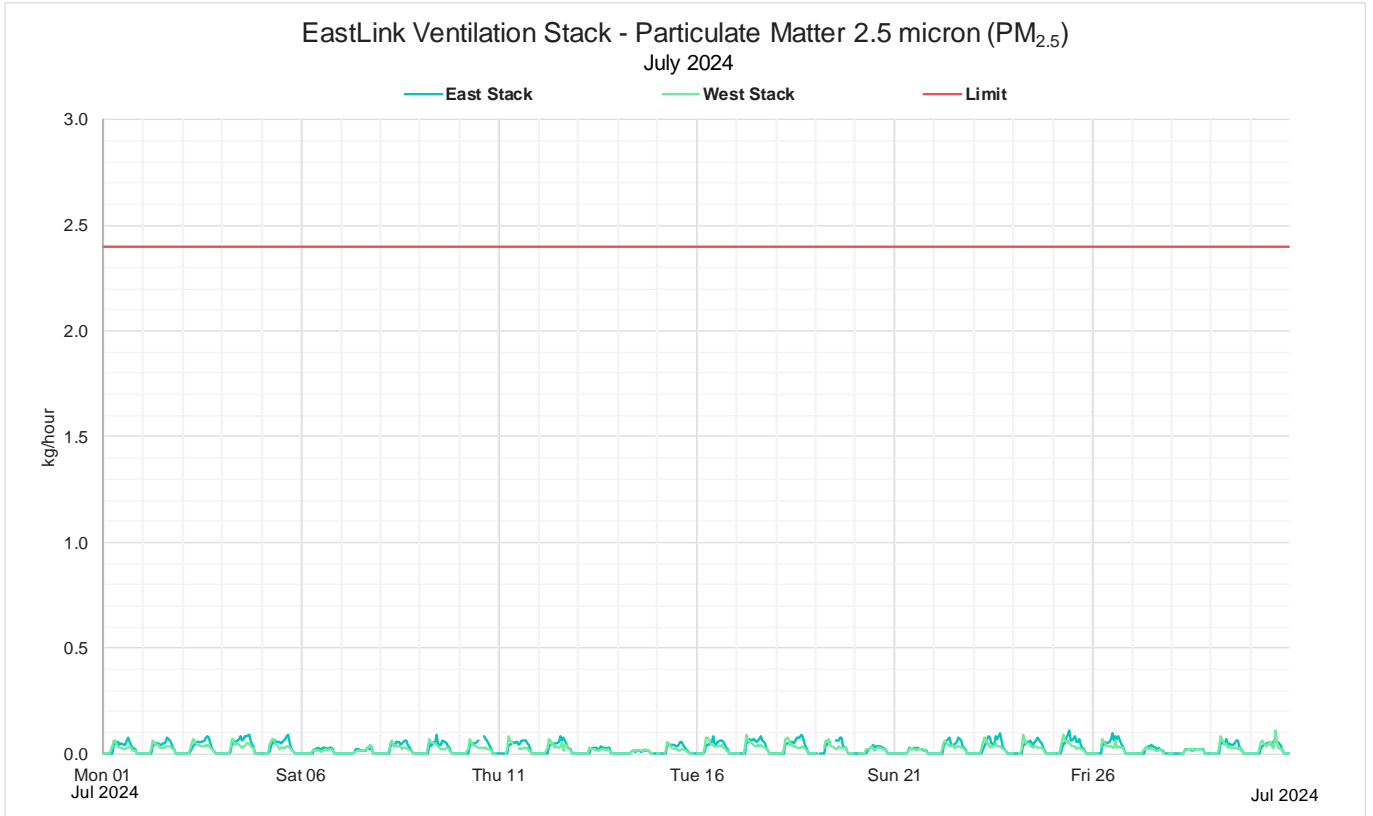


Figure 5: July 2024 Monthly 1-hour mass rate PM_{2.5}

6.1.4.5 July 2024 - Monthly 1-hour mass rate PM₁₀

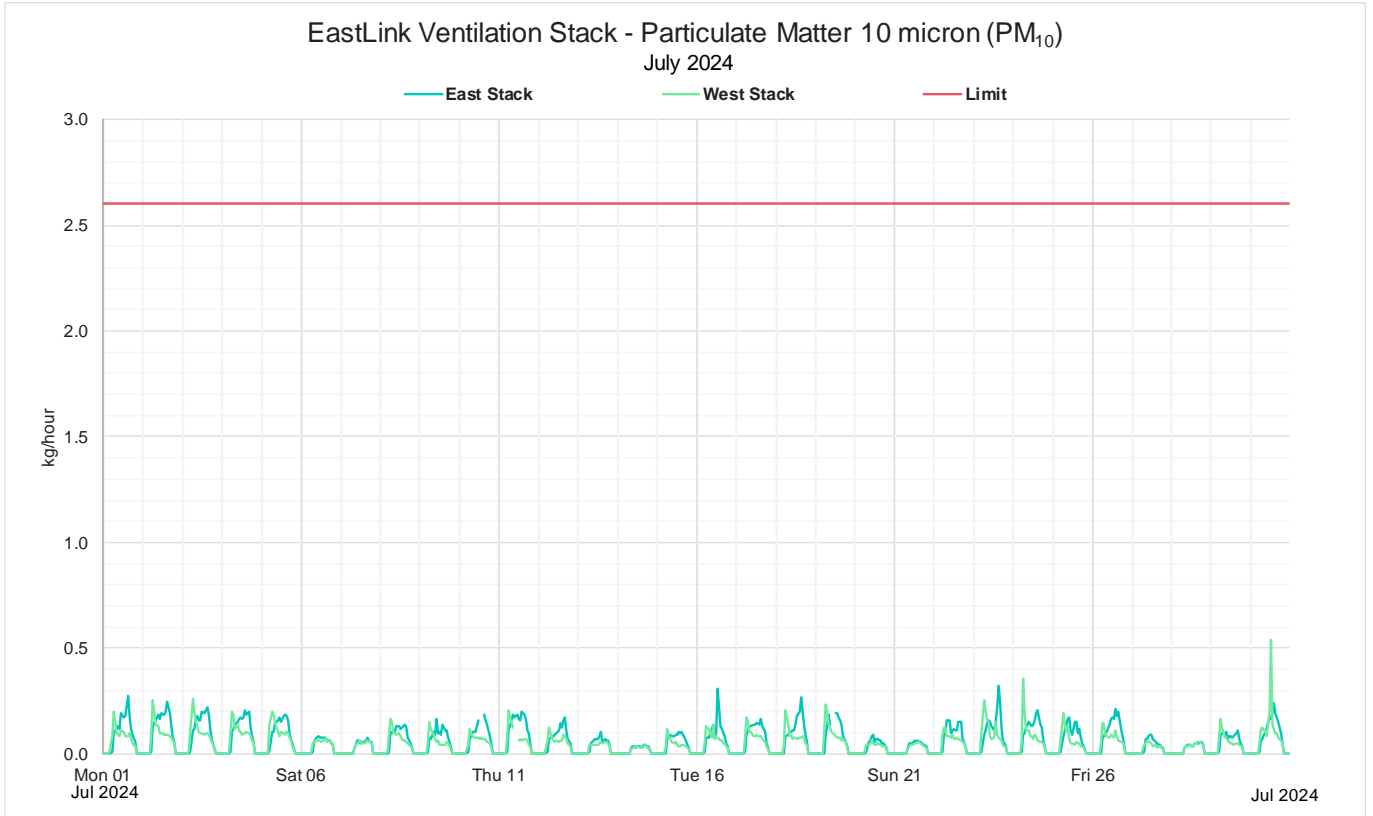


Figure 6: July 2024 Monthly 1-hour mass rate PM₁₀

6.1.4.6 July 2024 - Monthly 1-hour average stack velocity

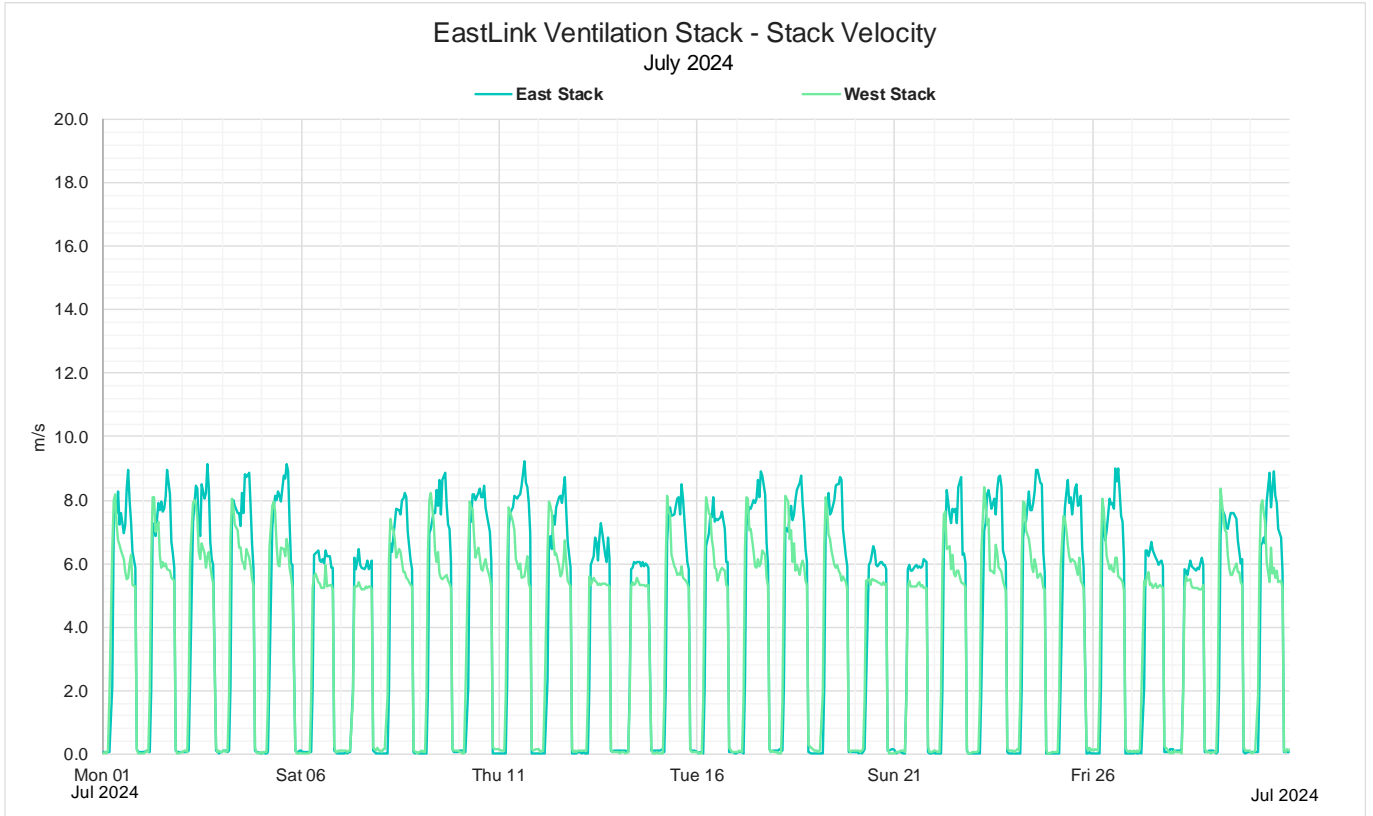


Figure 7: July 2024 Monthly 1-hour average stack velocity

6.1.4.7 July 2024 - Monthly 1-hour average stack temperature

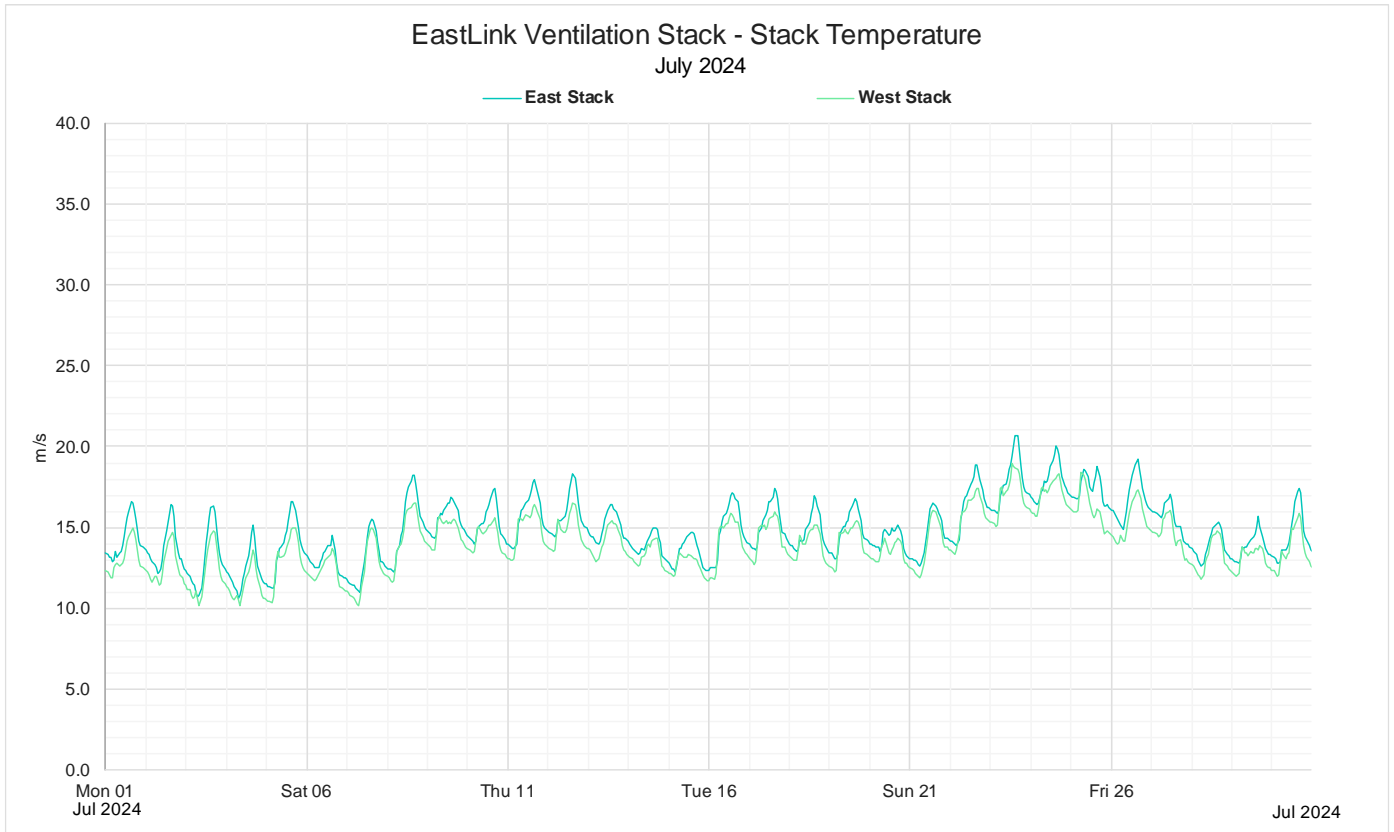


Figure 8: July 2024 Monthly 1-hour average stack temperature

6.1.5 Data Validation Table

Data validation details for the ventilation stack parameters are provided in the Table 18 and Table 19 below.

6.1.5.1 July 2024 - Western Ventilation Stack

Eastlink Tunnel Western Ventilation Stack Data Validation July 2024						
Start Date	End Date	Parameters	Reason	Hours affected	User Name	Change Date
6/07/2024 00:16	31/07/2024 20:38	PM _{2.5} , PM ₁₀	Intermittent unrealistic data - negative	N/A	TA	23/10/2024
11/07/2024 09:27	11/07/2024 11:19	CO, NO, NO ₂ , NO _x , PM _{2.5} , PM ₁₀	Maintenance	1.9	TA	23/10/2024
25/07/2024 09:18	25/07/2024 14:13	CO, NO, NO ₂ , NO _x	Maintenance	4.9	TA	23/10/2024
25/07/2024 12:01	25/07/2024 12:01	Stack Velocity, Stack Temperature	Missing data	0.0	TA	23/10/2024

This table details any missing data, data removed due to being deemed invalid, or data that has been adjusted.

Table 18: July 2024 Western Ventilation Stack data validation

6.1.5.2 July 2024 - Eastern Ventilation Stack

Eastlink Tunnel Eastern Ventilation Stack Data Validation July 2024						
Start Date	End Date	Parameters	Reason	Hours affected	User Name	Change Date
1/07/2024 00:00	31/07/2024 23:59	CO	Offset applied to data: Offset A: -0.1 Offset B: -0.3	N/A	TA	23/10/2024
2/07/2024 06:42	2/07/2024 06:42	CO, NO, NO ₂ , NO _x , PM _{2.5} , PM ₁₀	Missing data	0.0	TA	23/10/2024
5/07/2024 23:49	28/07/2024 03:08	PM _{2.5} , PM ₁₀	Intermittent unrealistic data - negative	N/A	TA	23/10/2024
8/07/2024 02:14	10/07/2024 12:31	NO, NO ₂ , NO _x	Multiplier applied to data: Multiplier A: 1.139314 Multiplier B: 1.139314	N/A	TA	23/10/2024
10/07/2024 12:31	10/07/2024 12:33	Stack Temperature	Maintenance	0.0	TA	23/10/2024
10/07/2024 12:31	10/07/2024 14:28	CO, NO, NO ₂ , NO _x , PM _{2.5} , PM ₁₀	Maintenance	2.0	TA	23/10/2024
11/07/2024 02:14	19/07/2024 10:26	NO, NO ₂ , NO _x	Multiplier applied to data: Multiplier A: 0.918228 Multiplier B: 0.879514	N/A	TA	23/10/2024
19/07/2024 10:26	19/07/2024 11:22	PM ₁₀	Maintenance	0.9	TA	23/10/2024
25/07/2024 13:31	25/07/2024 14:13	CO, NO, NO ₂ , Nox	Maintenance	0.7	TA	23/10/2024
25/07/2024 14:14	31/07/2024 23:59	NO, NO ₂ , NO _x	Multiplier applied to data: Multiplier A: 1.049015 Multiplier B: 1.049015	N/A	TA	23/10/2024
30/07/2024 07:24	30/07/2024 07:24	All parameters	Missing data	0.0	TA	23/10/2024

This table details any missing data, data removed due to being deemed invalid, or data that has been adjusted.

Table 19: July 2024 Eastern Ventilation Stack data validation

6.2 August 2024

6.2.1 Data Availability

Data availability for the in the ventilation stack parameters are provided in Table 20 below. For further information on data availability please refer to section 6.1.5.

EastLink Ventilation Stack Data Availability August 2024								
Station		NO	NO ₂	CO	PM _{2.5}	PM ₁₀	Stack Velocity	Stack Temp.
Western	Data Availability	95.6%	95.6%	95.6%	96.6%	99.6%	100.0%	100.0%
	Collected Periods	711	711	711	719	741	744	744
	Available Periods	744	744	744	744	744	744	744
Eastern	Data Availability	95.4%	95.4%	95.4%	99.1%	99.2%	100.0%	100.0%
	Collected Periods	710	710	710	737	738	744	744
	Available Periods	744	744	744	744	744	744	744

Table 20: August 2024 ventilation stack data availability

6.2.2 Exceedances

Instances of the ventilation stack pollutants exceeding the EPA Limits goals during the reporting period are presented in Table 21 below. Maximum mass rates are provided for comparison to the limits.

There were two exceedances of the prescribed limits during the reporting period.

EastLink Ventilation Stack Air Quality Limit Exceedances August 2024								
Location	Parameter	Time Period	Licence Limit	Units	Maximum Mass Rate	Number of exceedances	Value of exceedance	Date and Time of exceedance
Western Ventilation Stack (Discharge Point 1)	NO ₂	1-hour	3.98	kg/h	0.37	-	-	-
	CO	1-hour	112	kg/h	4.35	-	-	-
	PM _{2.5}	1-hour	2.4	kg/h	0.14	-	-	-
	PM ₁₀	1-hour	2.6	kg/h	0.34	-	-	-
Eastern Ventilation Stack (Discharge Point 2)	NO ₂	1-hour	3.98	kg/h	0.54	-	-	-
	CO	1-hour	112	kg/h	4.95	-	-	-
	PM _{2.5}	1-hour	2.4	kg/h	0.36	-	-	-
	PM ₁₀	1-hour	2.6	kg/h	3.94	2	3.9	16/08/2024 08:00
3.7							16/08/2024 09:00	

Table 21: August 2024 Exceedances of EPA Goals

6.2.3 Tabulated Results

6.2.3.1 Statistical Summary of 1-hour Mass Rate Data Western and Eastern Ventilation Stacks

Table 22 presents 1-hour mass rate statistical data for the Western and Eastern ventilation stacks.

1-hour mass rates are calculated from 1 minute average data.

EastLink Ventilation Stack Summary August 2024								
Location	Parameter	Maximum	99 th Percentile	98 th Percentile	95 th Percentile	90 th Percentile	75 th Percentile	50 th Percentile
Western Ventilation Stack	NO (kg/h)	2.33	2.13	1.99	1.62	1.22	0.88	0.49
	NO ₂ (kg/h)	0.37	0.32	0.31	0.24	0.19	0.15	0.11
	CO (kg/h)	4.35	4.04	3.87	3.66	3.22	2.70	1.93
	PM _{2.5} (kg/h)	0.1	0.1	0.1	0.1	0.1	0.0	0.0
	PM ₁₀ (kg/h)	0.3	0.2	0.2	0.2	0.1	0.1	0.1
Eastern Ventilation Stack	NO (kg/h)	2.37	2.10	2.03	1.84	1.66	1.33	0.49
	NO ₂ (kg/h)	0.54	0.48	0.45	0.41	0.35	0.27	0.14
	CO (kg/h)	4.95	4.35	4.04	3.60	3.03	2.42	1.76
	PM _{2.5} (kg/h)	0.4	0.2	0.1	0.1	0.1	0.1	0.0
	PM ₁₀ (kg/h)	3.9	0.7	0.3	0.2	0.2	0.2	0.1

Table 22: August 2024 Summary of 1-hour mass rate pollutant data

6.2.4 Graphical Representations

The following charts present 1-hour mass rate data for NO, NO₂, CO, PM_{2.5}, PM₁₀ and Stack Velocity for the Western and Eastern ventilation stacks.

1-hour mass rates are calculated from 1 minute average data.

6.2.4.1 August 2024 - Monthly 1-hour mass rate NO₂

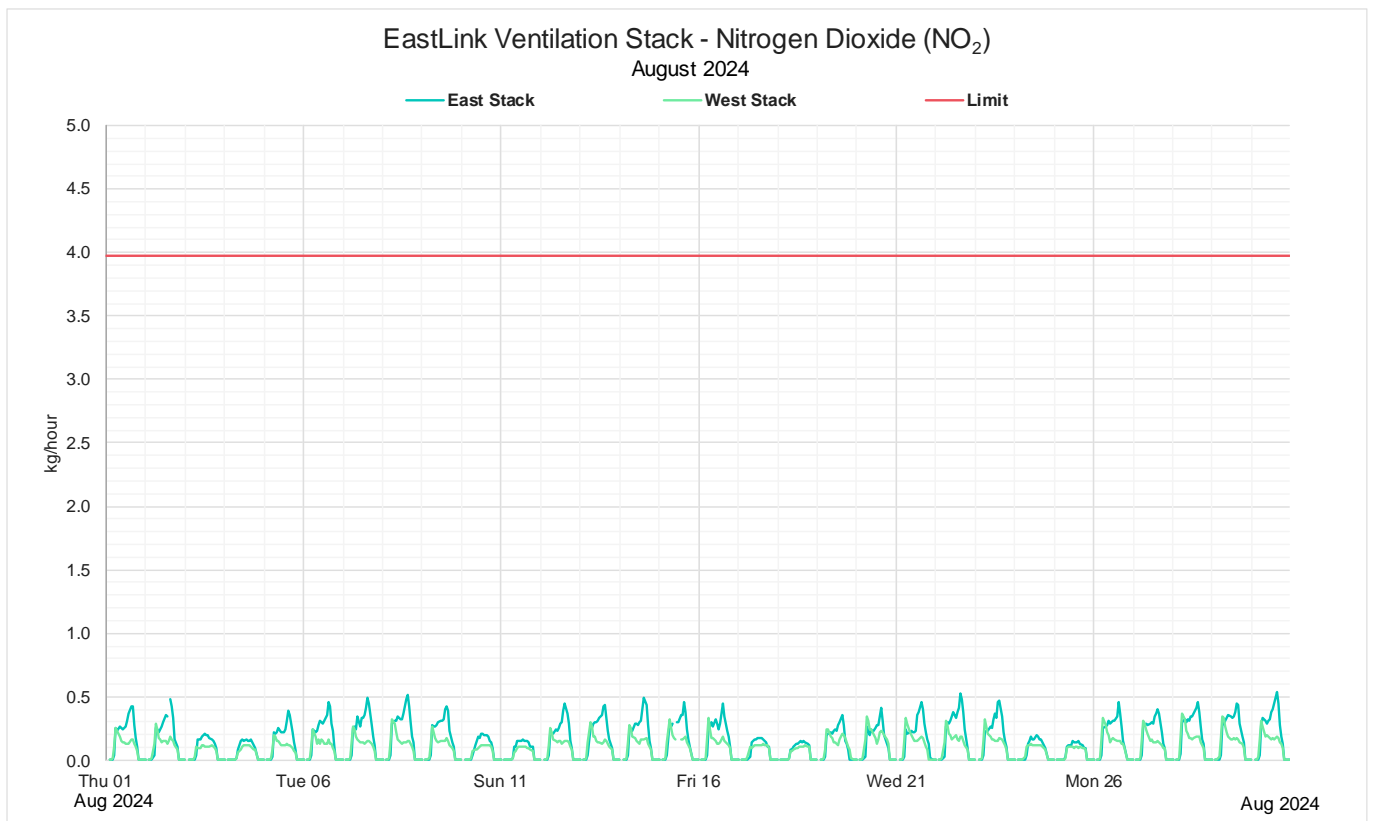


Figure 9: August 2024 Monthly 1-hour mass rate NO₂

6.2.4.2 August 2024 - Monthly 1-hour mass rate NO

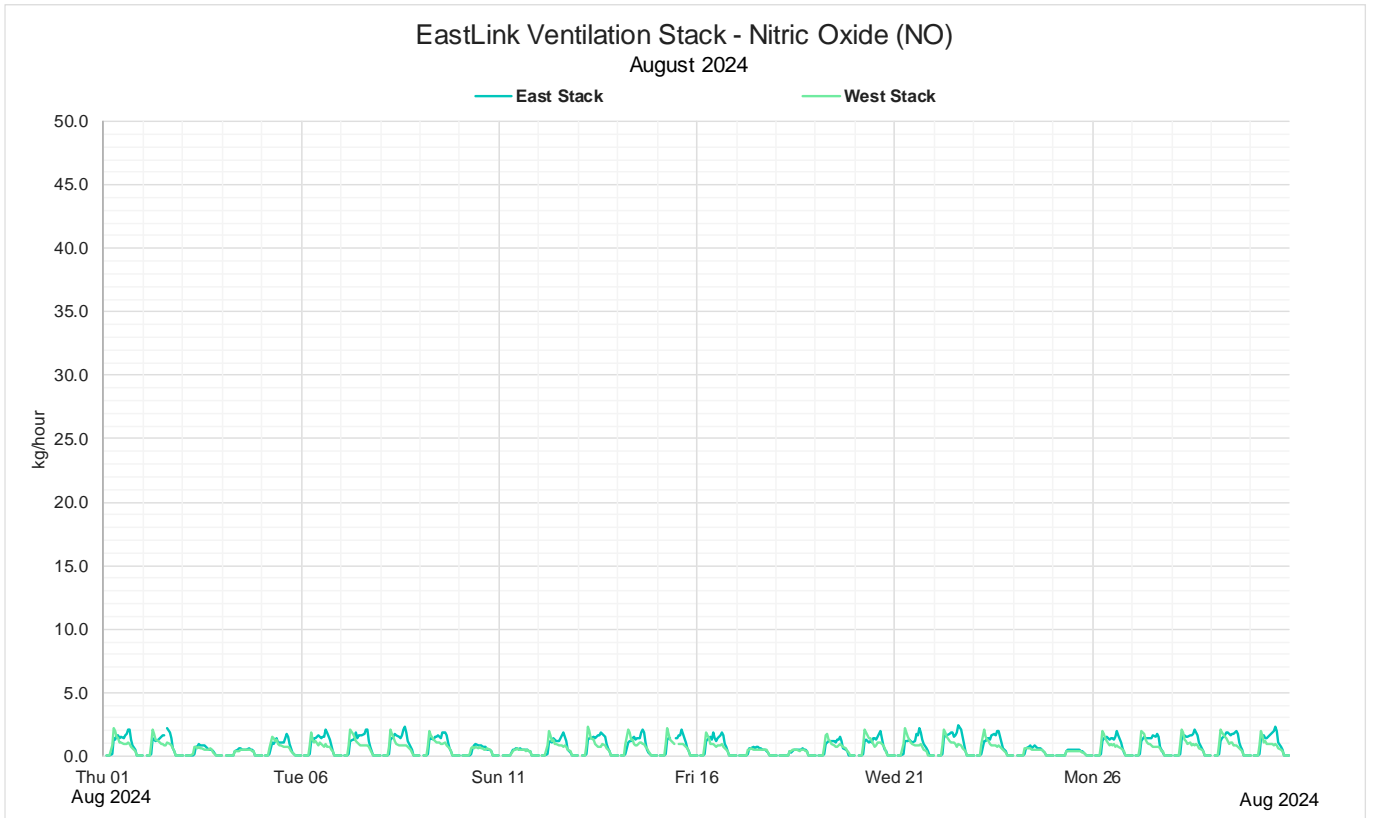


Figure 10: August 2024 Monthly 1-hour mass rate NO

6.2.4.3 August 2024 - Monthly 1-hour mass rate CO

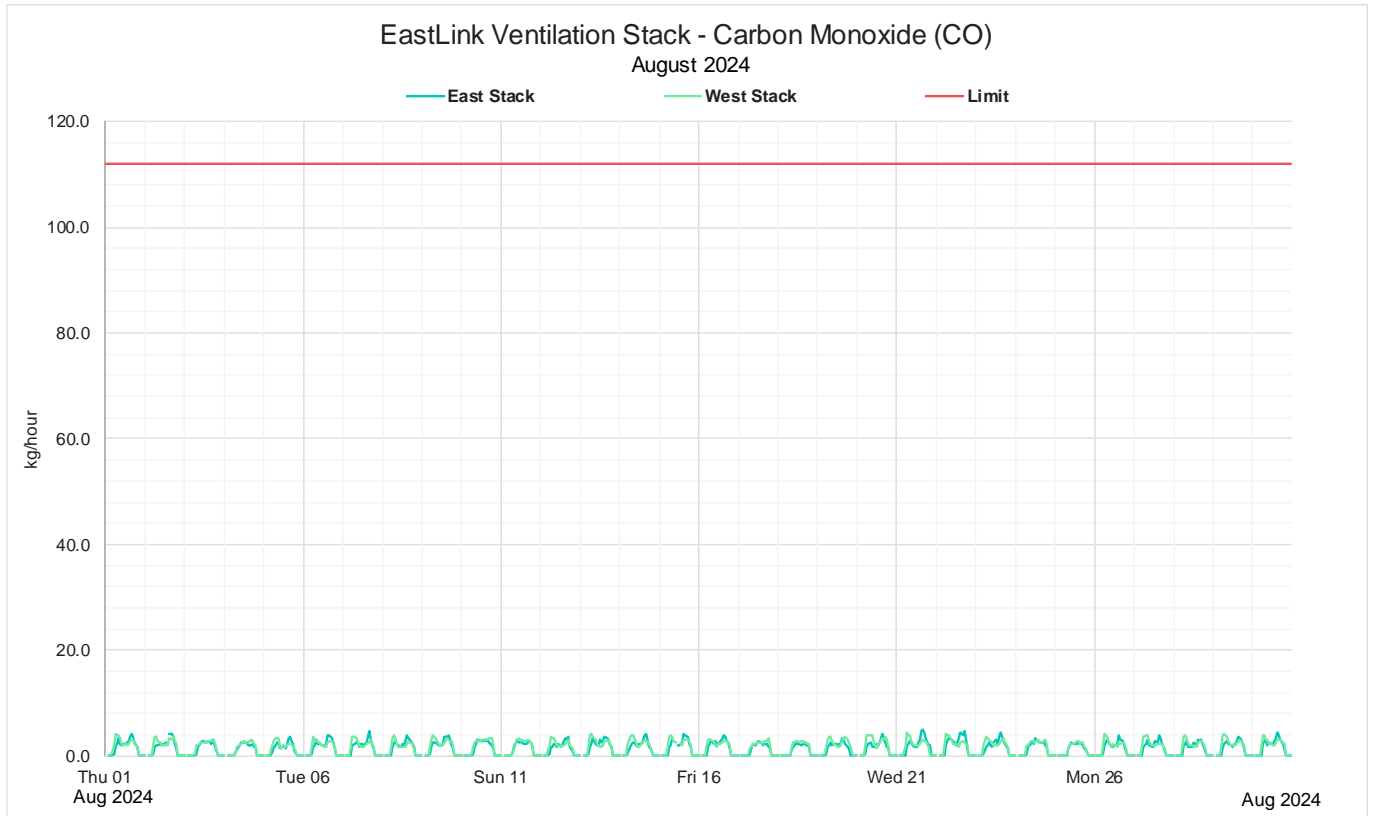


Figure 11: August 2024 Monthly 1-hour mass rate CO

6.2.4.4 August 2024 - Monthly 1-hour mass rate PM_{2.5}

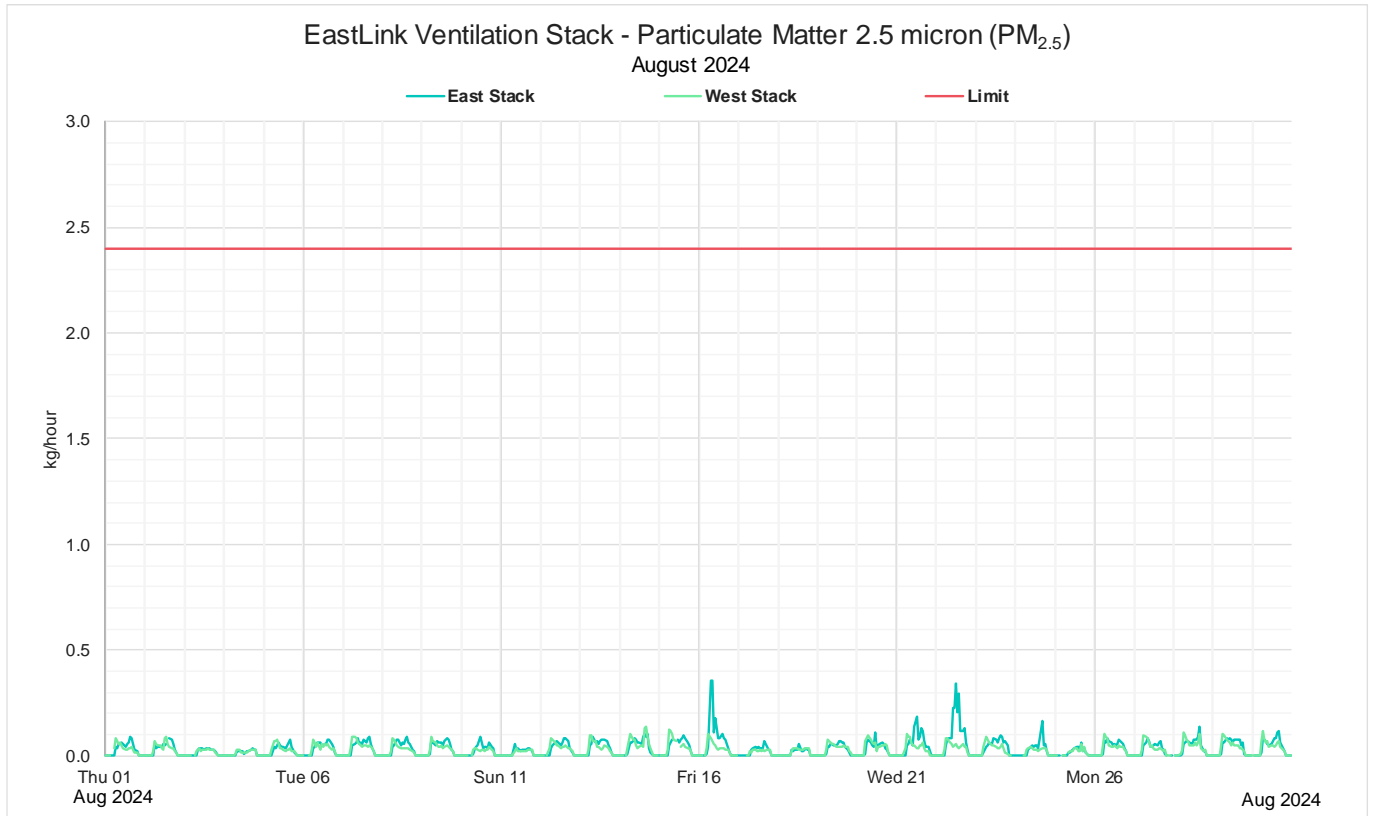


Figure 12: August 2024 Monthly 1-hour mass rate PM_{2.5}

6.2.4.5 August 2024 - Monthly 1-hour mass rate PM₁₀

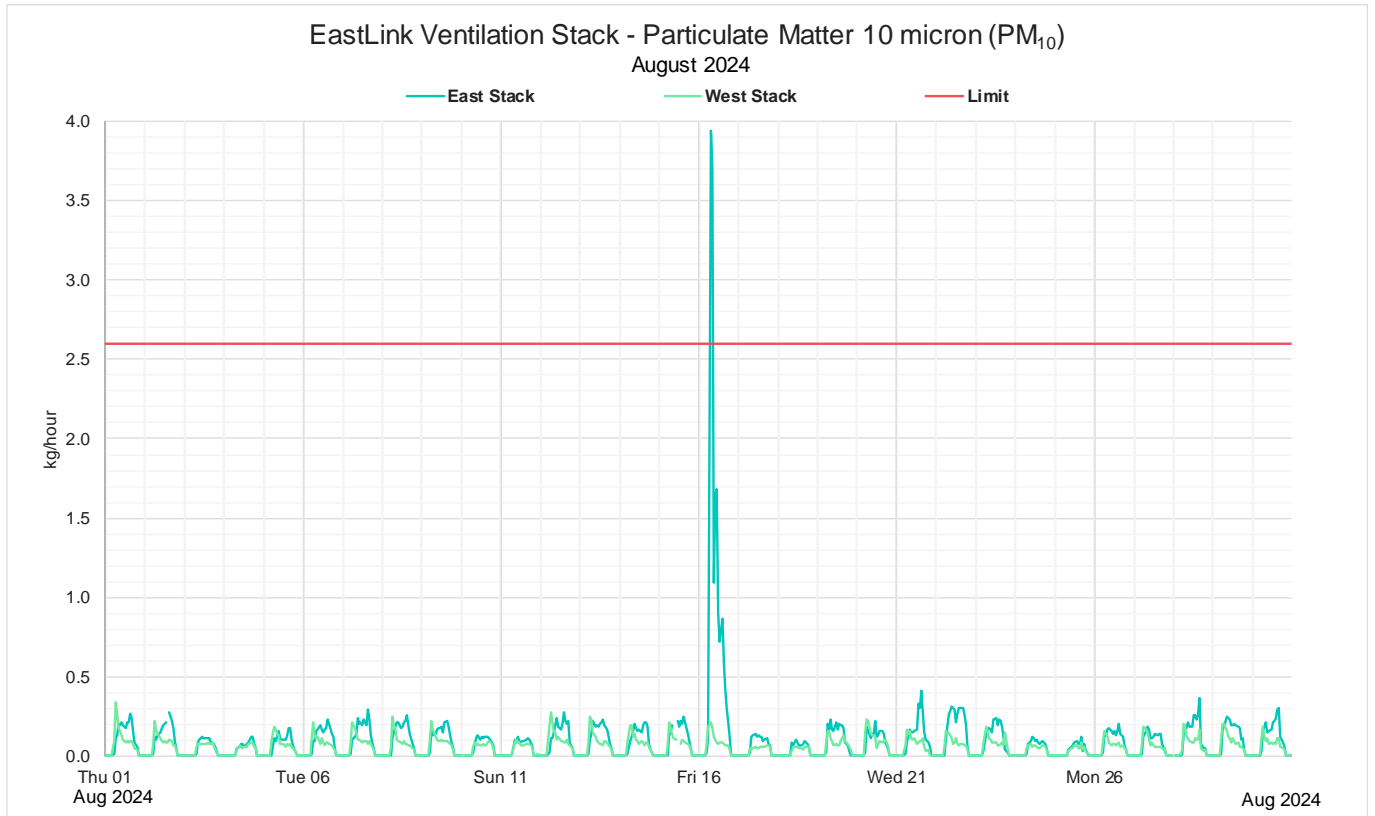


Figure 13: August 2024 Monthly 1-hour mass rate PM₁₀

6.2.4.6 August 2024 - Monthly 1-hour average stack velocity

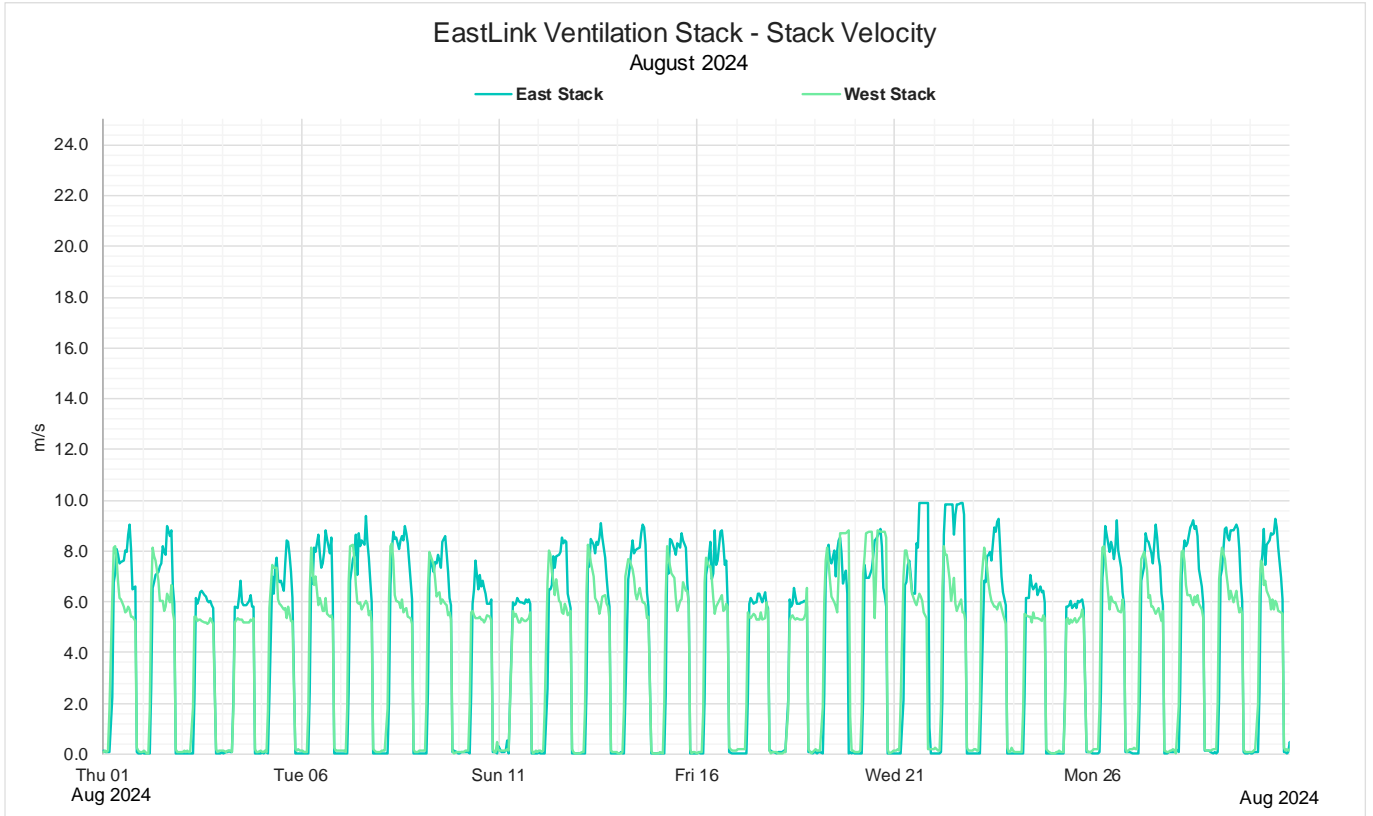


Figure 14: August 2024 Monthly 1-hour average stack velocity

6.2.4.7 August 2024 - Monthly 1-hour average stack temperature

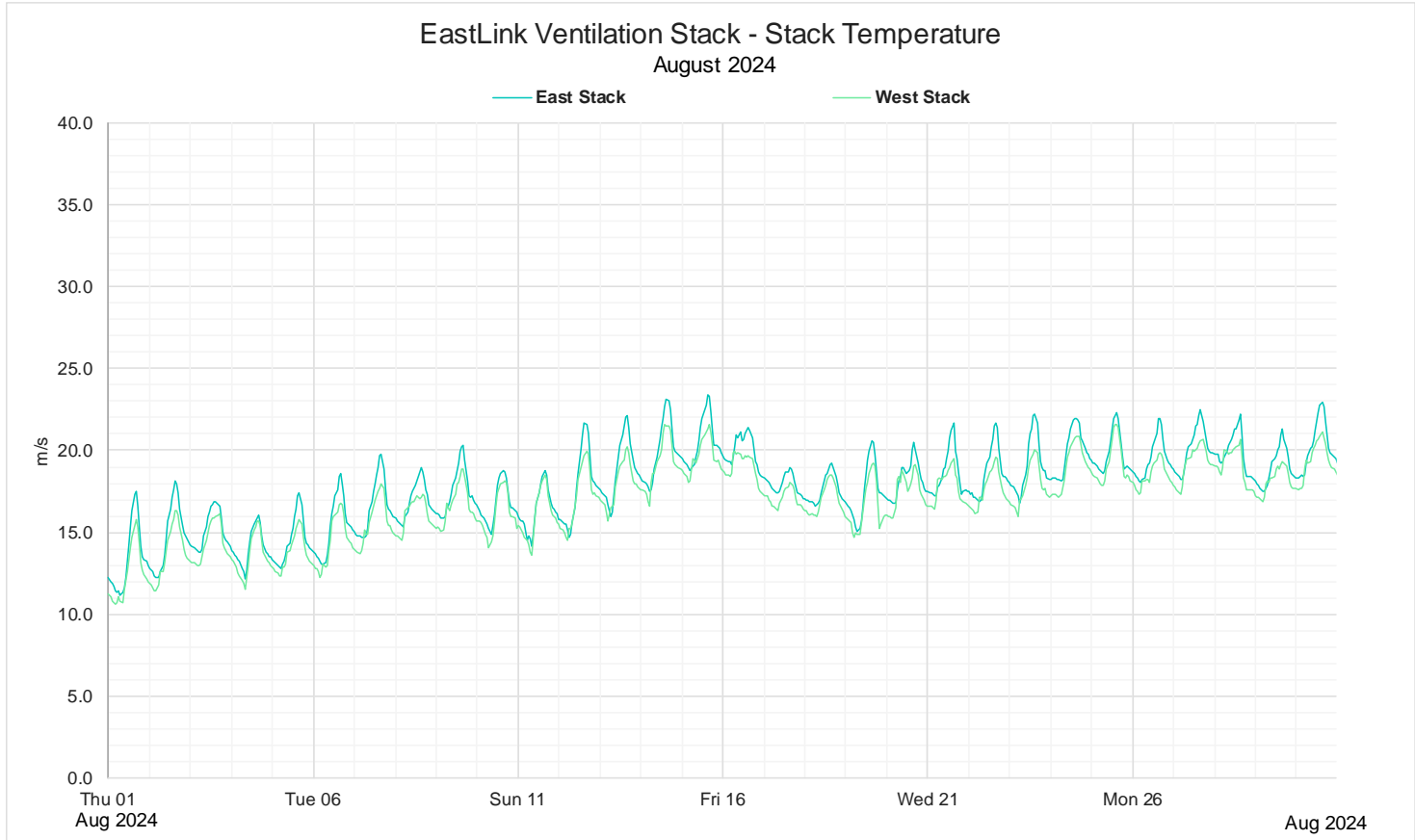


Figure 15: August 2024 Monthly 1-hour average stack temperature

6.2.5 Data Validation Table

Data validation details for the ventilation stack parameters are provided in the Table 23 and Table 24 below.

6.2.5.1 August 2024 - Western Ventilation Stack

Eastlink Tunnel Western Ventilation Stack Data Validation August 2024						
Start Date	End Date	Parameters	Reason	Hours affected	User Name	Change Date
1/08/2024 04:27	31/08/2024 01:40	PM _{2.5} , PM ₁₀	Intermittent unrealistic data - negative	N/A	TA	23/10/2024
15/08/2024 11:31	15/08/2024 12:32	CO, NO, NO ₂ , NO _x , PM _{2.5} , PM ₁₀	Maintenance	1.0	TA	23/10/2024

This table details any missing data, data removed due to being deemed invalid, or data that has been adjusted.

Table 23: August 2024 Western Ventilation Stack data validation

6.2.5.2 August 2024 - Eastern Ventilation Stack

Eastlink Tunnel Eastern Ventilation Stack Data Validation August 2024						
Start Date	End Date	Parameters	Reason	Hours affected	User Name	Change Date
1/08/2024 00:00	2/08/2024 14:13	NO, NO ₂ , NO _x	Multiplier applied to data: Multiplier A: 1.049015 Multiplier B: 1.049015	N/A	TA	23/10/2024
1/08/2024 00:00	31/08/2024 23:59	CO	Offset applied to data: Offset A: -0.3 Offset B: -0.8	N/A	TA	23/10/2024
2/08/2024 14:14	2/08/2024 14:58	CO, NO, NO ₂ , NO _x , PM _{2.5} , PM ₁₀	Maintenance	0.7	TA	23/10/2024
6/08/2024 02:32	30/08/2024 02:51	PM _{2.5} , PM ₁₀	Intermittent unrealistic data - negative	N/A	TA	23/10/2024
10/08/2024 07:31	10/08/2024 07:31	CO, NO, NO ₂ , NO _x , PM _{2.5} , PM ₁₀	Missing data	0.0	TA	23/10/2024
12/08/2024 02:14	15/08/2024 09:31	NO, NO ₂ , NO _x	Multiplier applied to data: Multiplier A: 0.916591 Multiplier B: 0.916591	N/A	TA	23/10/2024
15/08/2024 09:32	15/08/2024 11:09	CO, NO, NO ₂ , NO _x , PM _{2.5} , PM ₁₀	Maintenance	1.6	TA	23/10/2024

This table details any missing data, data removed due to being deemed invalid, or data that has been adjusted.

Table 24: August 2024 Eastern Ventilation Stack data validation

6.3 September 2024

6.3.1 Data Availability

Data availability for the in the ventilation stack parameters are provided in Table 25 below. For further information on data availability please refer to section 6.2.5

EastLink Ventilation Stack Data Availability September 2024								
Station		NO	NO ₂	CO	PM _{2.5}	PM ₁₀	Stack Velocity	Stack Temp.
Western	Data Availability	95.4%	95.4%	95.4%	95.4%	98.2%	100.0%	100.0%
	Collected Periods	687.0	687.0	687.0	687.0	707.0	720.0	720.0
	Available Periods	720.0	720.0	720.0	720.0	720.0	720.0	720.0
Eastern	Data Availability	90.6%	90.6%	94.6%	96.7%	96.8%	100.0%	98.9%
	Collected Periods	652	652	681	696	697	720	712
	Available Periods	720	720	720	720	720	720	720

Table 25: September 2024 ventilation stack data availability

6.3.2 Exceedances

Instances of the ventilation stack pollutants exceeding the EPA Limits goals during the reporting period are presented in Table 26 below. Maximum mass rates are provided for comparison to the limits.

There were nil exceedances of the prescribed limits during the reporting period.

EastLink Ventilation Stack Air Quality Limit Exceedances September 2024								
Location	Parameter	Time Period	Licence Limit	Units	Maximum Mass Rate	Number of exceedances	Value of exceedance	Date and Time of exceedance
Western Ventilation Stack (Discharge Point 1)	NO ₂	1-hour	3.98	kg/h	0.40	-	-	-
	CO	1-hour	112	kg/h	5.27	-	-	-
	PM _{2.5}	1-hour	2.4	kg/h	0.11	-	-	-
	PM ₁₀	1-hour	2.6	kg/h	0.38	-	-	-
Eastern Ventilation Stack (Discharge Point 2)	NO ₂	1-hour	3.98	kg/h	0.60	-	-	-
	CO	1-hour	112	kg/h	4.76	-	-	-
	PM _{2.5}	1-hour	2.4	kg/h	0.14	-	-	-
	PM ₁₀	1-hour	2.6	kg/h	0.41	-	-	-

Table 26: September 2024 Exceedances of EPA Goals

6.3.3 Tabulated Results

6.3.3.1 Statistical Summary of 1-hour mass rate data Western and Eastern Ventilation Stacks

Table 27 presents 1-hour mass rate statistical data for the Western and Eastern ventilation stacks.

1-hour mass rates are calculated from 1 minute average data.

EastLink Ventilation Stack Summary September 2024								
Location	Parameter	Maximum	99 th Percentile	98 th Percentile	95 th Percentile	90 th Percentile	75 th Percentile	50 th Percentile
Western Ventilation Stack	NO (kg/h)	2.79	2.39	2.18	1.80	1.33	0.90	0.41
	NO ₂ (kg/h)	0.40	0.36	0.33	0.29	0.21	0.16	0.10
	CO (kg/h)	5.27	4.55	4.31	3.83	3.23	2.58	1.94
	PM _{2.5} (kg/h)	0.1	0.1	0.1	0.1	0.1	0.0	0.0
	PM ₁₀ (kg/h)	0.4	0.3	0.3	0.2	0.1	0.1	0.0
Eastern Ventilation Stack	NO (kg/h)	2.71	2.42	2.30	2.05	1.80	1.39	0.43
	NO ₂ (kg/h)	0.60	0.50	0.48	0.42	0.36	0.29	0.12
	CO (kg/h)	4.76	3.98	3.76	3.40	2.91	2.22	1.56
	PM _{2.5} (kg/h)	0.1	0.1	0.1	0.1	0.1	0.1	0.0
	PM ₁₀ (kg/h)	0.4	0.3	0.3	0.2	0.2	0.1	0.0

Table 27: September 2024 Summary of 1-hour mass rate pollutant data

6.3.4 Graphical Representations

The following charts present 1-hour mass rate data for NO, NO₂, CO, PM_{2.5}, PM₁₀ and Stack Velocity for the Western and Eastern ventilation stacks.

1-hour mass rates are calculated from 1 minute average data.

6.3.4.1 September 2024 - Monthly 1-hour mass rate NO₂

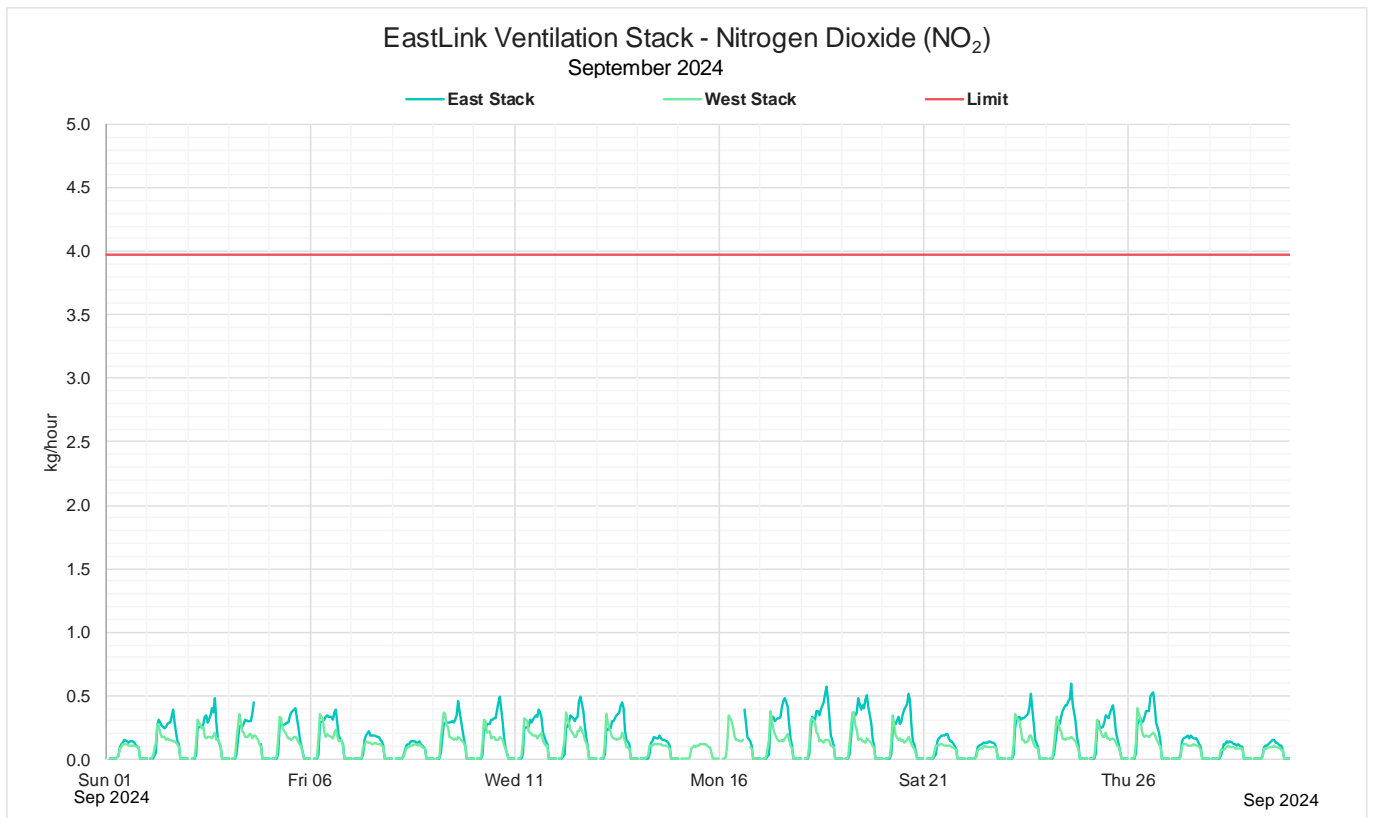


Figure 16: September 2024 Monthly 1-hour mass rate NO₂

6.3.4.2 September 2024 - Monthly 1-hour mass rate NO

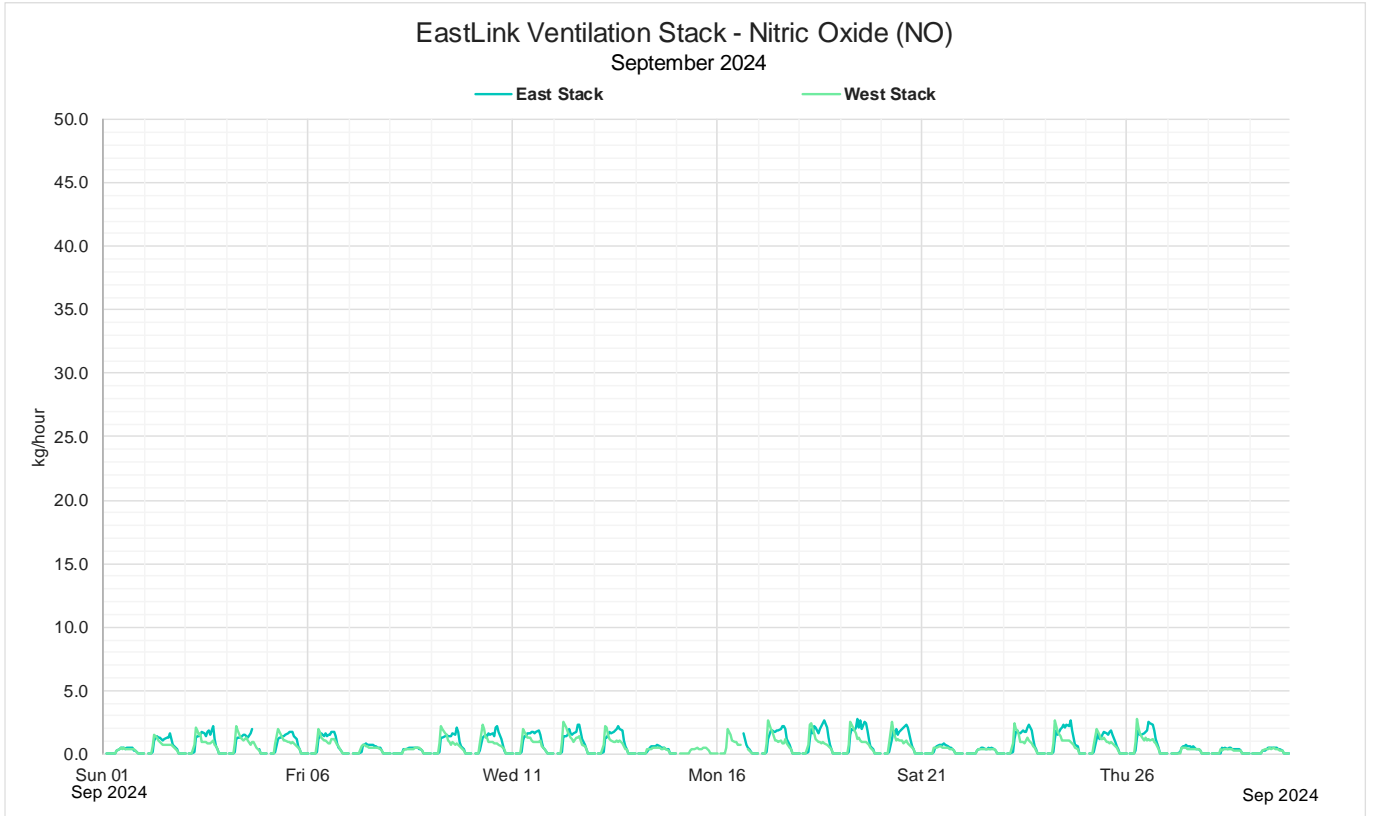


Figure 17: September 2024 Monthly 1-hour mass rate NO

6.3.4.3 September 2024 - Monthly 1-hour mass rate CO

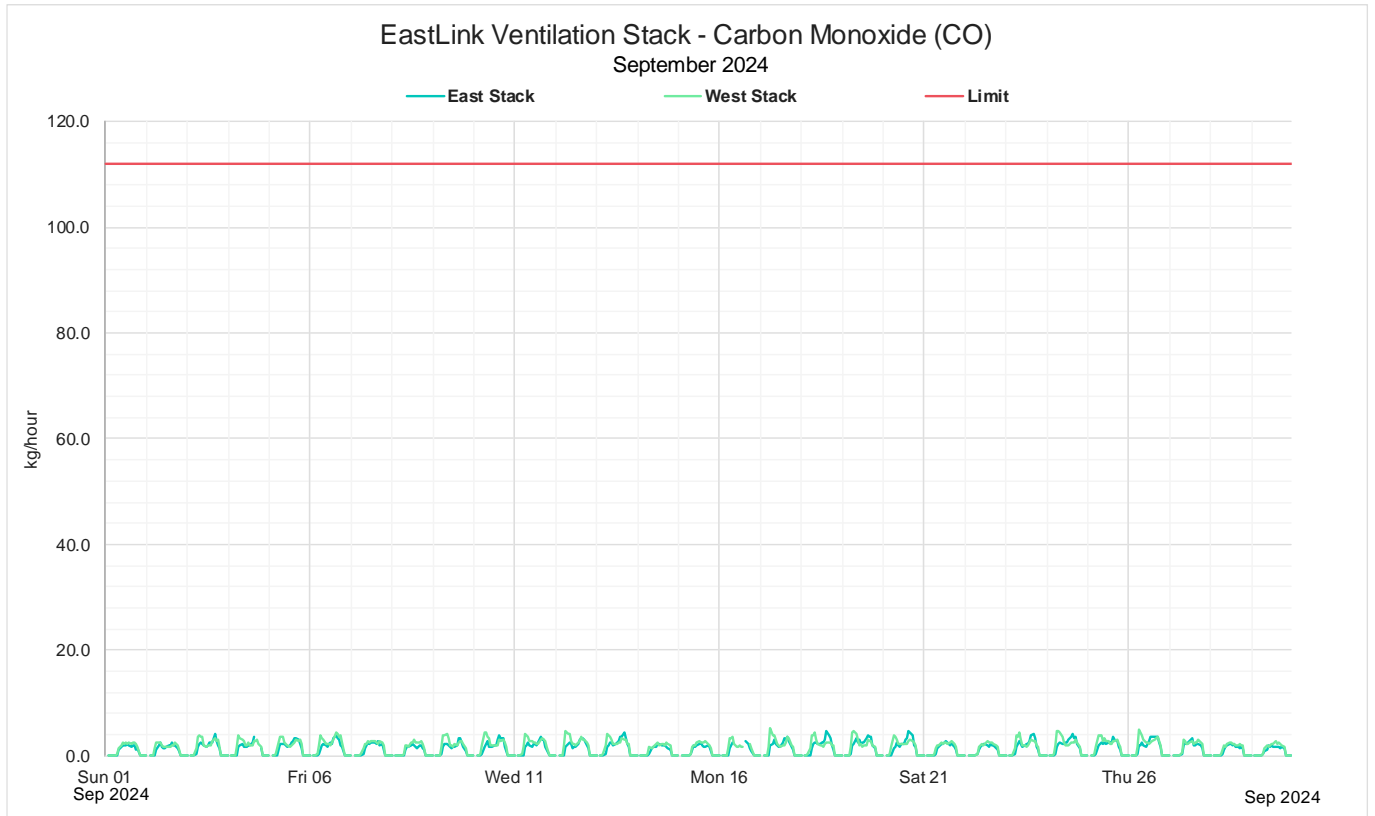


Figure 18: September 2024 Monthly 1-hour mass rate CO

6.3.4.4 September 2024 - Monthly 1-hour mass rate PM_{2.5}

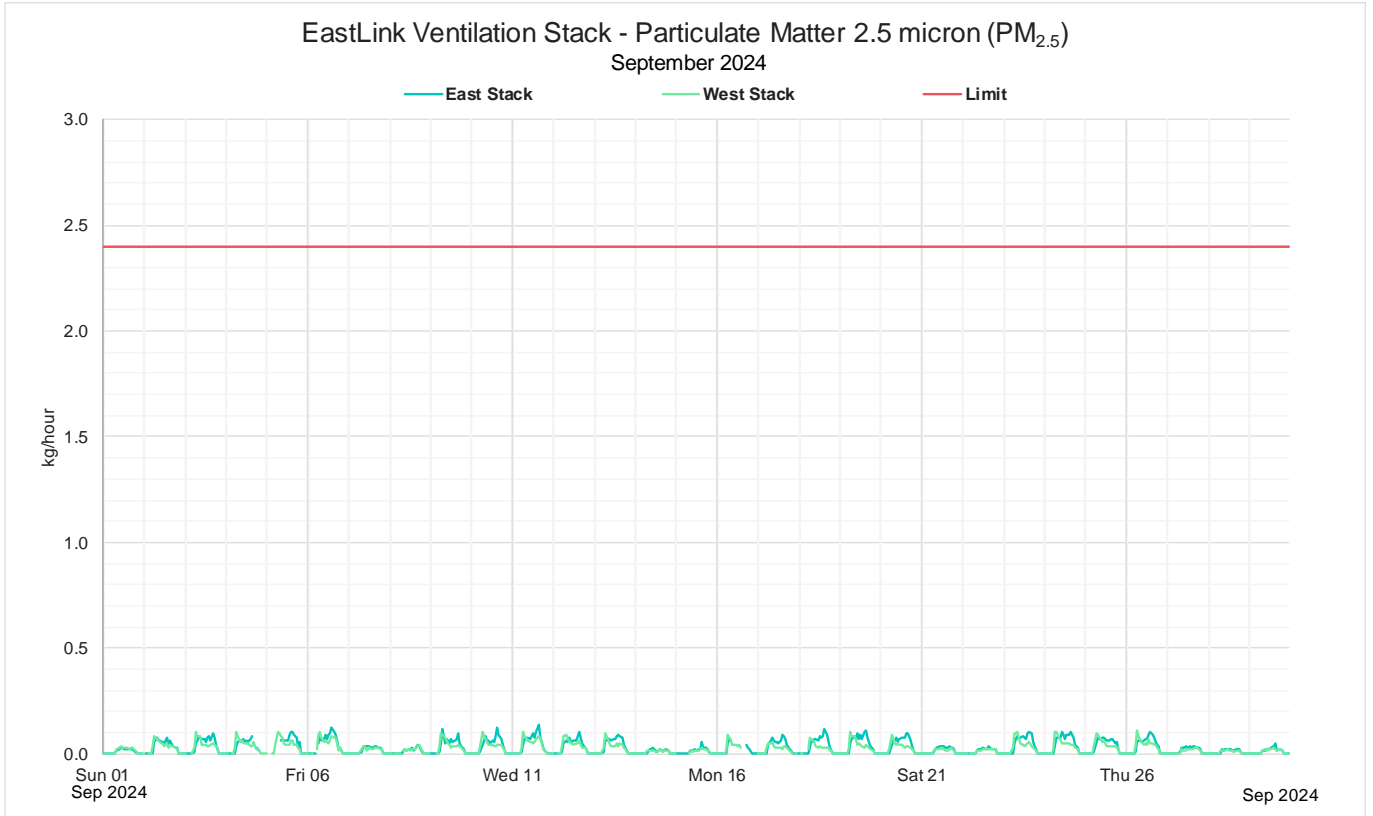


Figure 19: September 2024 Monthly 1-hour mass rate PM_{2.5}

6.3.4.5 September 2024 - Monthly 1-hour mass rate PM₁₀

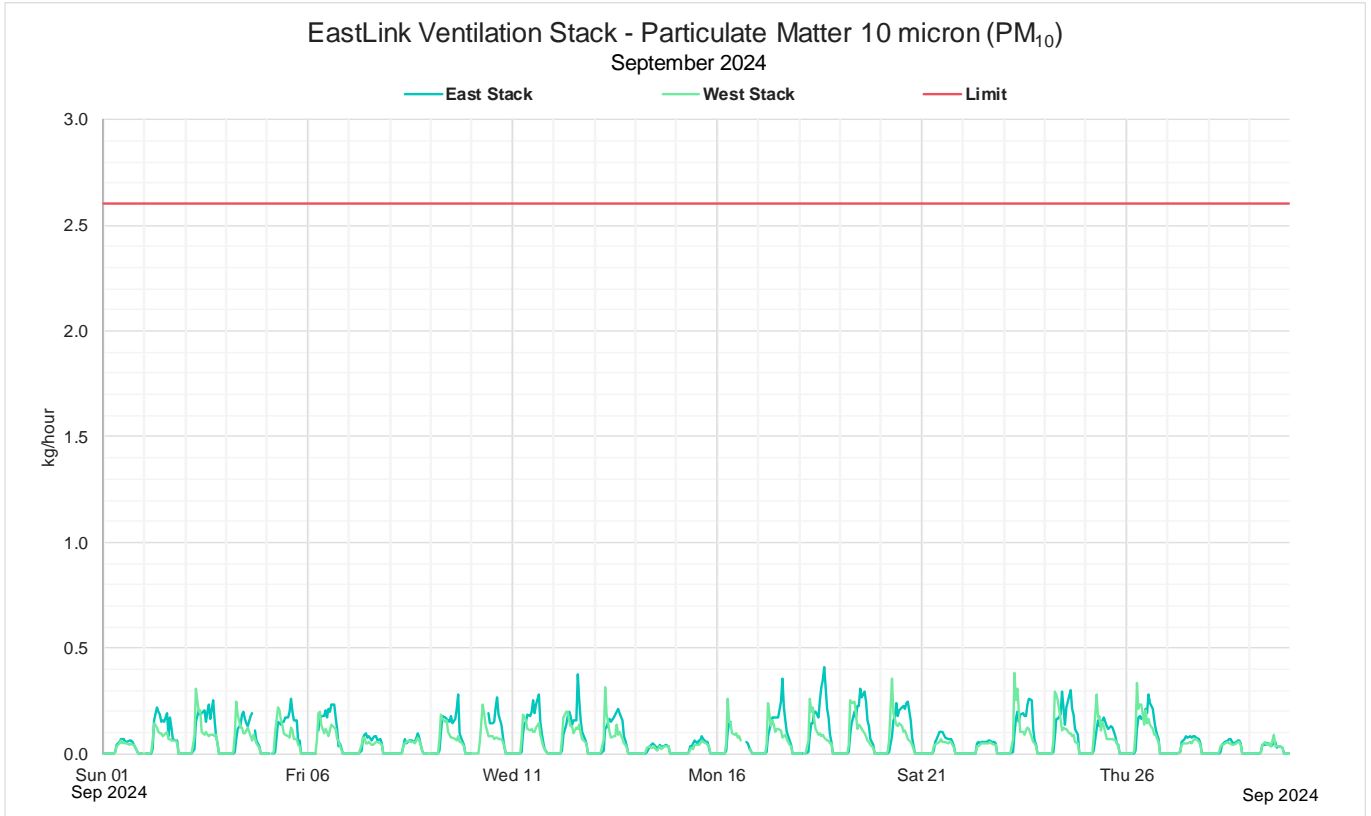


Figure 20: September 2024 Monthly 1-hour mass rate PM₁₀

6.3.4.6 September 2024 - Monthly 1-hour average stack velocity

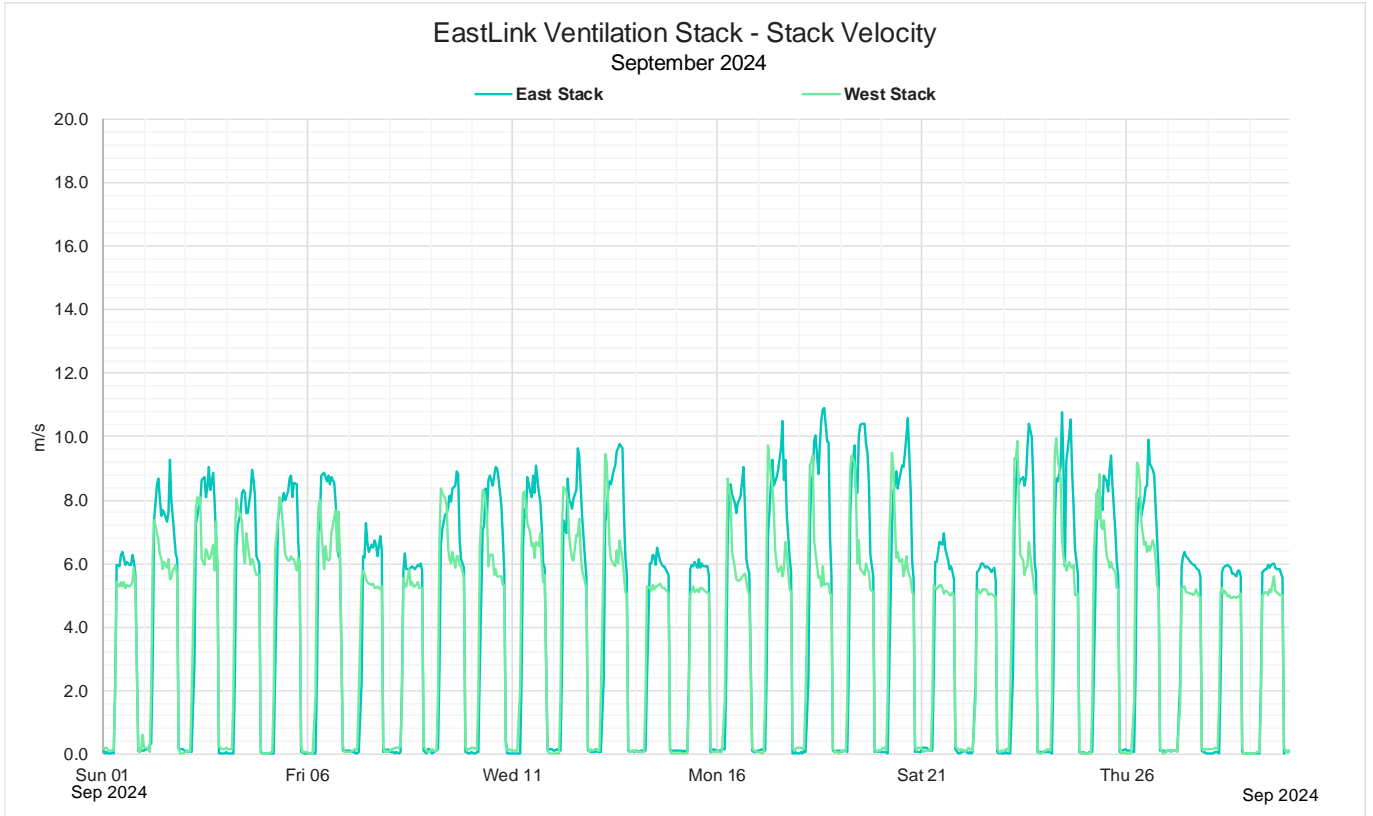


Figure 21: September 2024 Monthly 1-hour average stack velocity

6.3.4.7 September 2024 - Monthly 1-hour average stack temperature

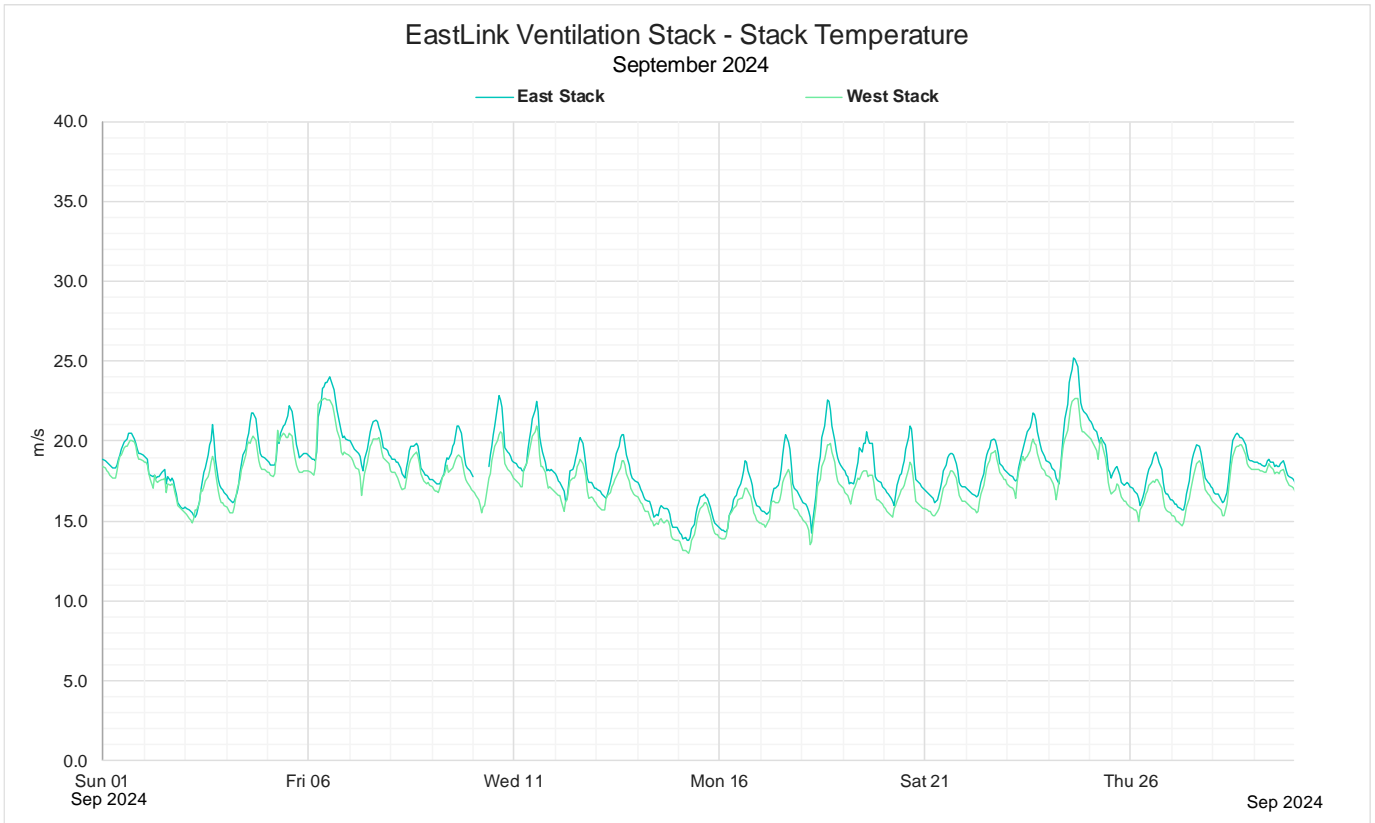


Figure 22: Septly 2024 Monthly 1-hour average stack temperature

6.3.5 Data Validation Table

Data validation details for the ventilation stack parameters are provided in the Table 28 and Table 29 below.

6.3.5.1 September 2024 - Western Ventilation Stack

Eastlink Tunnel Western Ventilation Stack Data Validation September 2024						
Start Date	End Date	Parameters	Reason	Hours affected	User Name	Change Date
1/09/2024 01:42	29/09/2024 05:07	PM _{2.5} , PM ₁₀	Intermittent unrealistic data - negative	N/A	TA	23/10/2024
16/09/2024 15:03	16/09/2024 18:04	CO, NO, NO ₂ , NO _x	Maintenance	3.0	TA	23/10/2024
16/09/2024 15:03	16/09/2024 18:38	PM _{2.5} , PM ₁₀	Maintenance	3.6	TA	23/10/2024

This table details any missing data, data removed due to being deemed invalid, or data that has been adjusted.

Table 28: September 2024 Western Ventilation Stack data validation

6.3.5.2 September 2024 - Eastern Ventilation Stack

Eastlink Tunnel Eastern Ventilation Stack Data Validation September 2024						
Start Date	End Date	Parameters	Reason	Hours affected	User Name	Change Date
1/09/2024 00:00	15/09/2024 01:33	NO, NO ₂ , NO _x	Multiplier applied to data: Multiplier A: 1.0 Multiplier B: 0.948226	N/A	TA	23/10/2024
1/09/2024 00:00	30/09/2024 23:59	CO	Offset applied to data: Offset A: -0.8 Offset B: -0.8	N/A	TA	23/10/2024
1/09/2024 23:40	29/09/2024 10:39	PM _{2.5} , PM ₁₀	Intermittent unrealistic data - negative	N/A	TA	23/10/2024
4/09/2024 16:00	4/09/2024 16:17	NO, NO ₂ , NO _x	Instrument fault	0.3	TA	23/10/2024
4/09/2024 16:00	4/09/2024 16:57	PM ₁₀	Instrument fault	1.0	TA	23/10/2024
4/09/2024 16:00	4/09/2024 17:27	CO	Instrument fault	1.5	TA	23/10/2024
4/09/2024 16:00	4/09/2024 17:57	PM _{2.5}	Instrument fault	2.0	TA	23/10/2024
4/09/2024 16:11	4/09/2024 16:14	Stack Temperature, Stack Velocity	Instrument fault	0.0	TA	23/10/2024
4/09/2024 17:58	4/09/2024 18:24	CO, NO, NO ₂ , NO _x , PM _{2.5} , PM ₁₀	Maintenance	0.4	TA	23/10/2024
4/09/2024 20:01	5/09/2024 07:55	PM _{2.5}	Instrument fault	11.9	TA	23/10/2024
10/09/2024 00:47	10/09/2024 09:58	PM ₁₀ , Stack Temperature	Instrument fault	9.2	TA	23/10/2024
15/09/2024 02:14	16/09/2024 09:37	NO, NO ₂ , NO _x	Calibration out of tolerance	31.4	TA	23/10/2024
16/09/2024 09:38	16/09/2024 14:53	CO, NO, NO ₂ , NO _x	Maintenance	5.3	TA	23/10/2024
16/09/2024 09:38	16/09/2024 16:56	PM _{2.5} , PM ₁₀	Maintenance	7.3	TA	23/10/2024
26/09/2024 02:14	30/09/2024 23:59	NO, NO ₂ , NO _x	Multiplier applied to data: Multiplier A: 1.087298 Multiplier B: 1.087298	N/A	TA	23/10/2024

This table details any missing data, data removed due to being deemed invalid, or data that has been adjusted.

Table 29: September 2024 Eastern Ventilation Stack data validation

6.4 Data Availability Year to Date

Data availability statistics for year to date (01 January 2024 to 30 September 2024) are provided in Table 30 below:

EastLink Ventilation Stack Data Availability January 2024 to September 2024							
Station	NO	NO ₂	CO	PM _{2.5}	PM ₁₀	Stack Velocity	Stack Temp.
Western	94.4%	94.4%	95.2%	92.2%	97.8%	100.0%	99.9%
Eastern	94.8%	94.8%	95.2%	97.9%	95.4%	99.9%	97.9%

Table 30: EastLink Ventilation Stack year to date data availability

6.5 Annual Performance Statement Bubble Limits

The EPA License 2043 Condition LI_DA1 designates annual emission rate bubble limits for discharge points 1 and 2. Annual emission rates are calculated from 1st July to 30th June each year to coincide with the Annual Performance Statement (APS) reporting period. Ventilation Stack emission rates year to date (01 July 2024 to 30 September 2024) are shown in Table 31 below.

EastLink Ventilation Stack Mass Rate July 2024 to September 2024				
Location	NO ₂	CO	PM _{2.5}	PM ₁₀
	Tonnes	Tonnes	Tonnes	Tonnes
Western Ventilation Stack (Discharge Point 1)	0.197	3.344	0.053	0.113
Eastern Ventilation Stack (Discharge Point 2)	0.301	2.924	0.065	0.170
Total	0.498	6.268	0.118	0.283
Percentage of Licence limit	1.4%	0.6%	0.6%	1.2%
Annual Limit (Tonnes)	35	980	21	23

Table 31: Annual Performance Statement stack emission rates

Figure 23 below presents the ventilation stack emissions of each parameter as a percentage of the Licence limit compared with the percentage of elapse APS Reporting period.

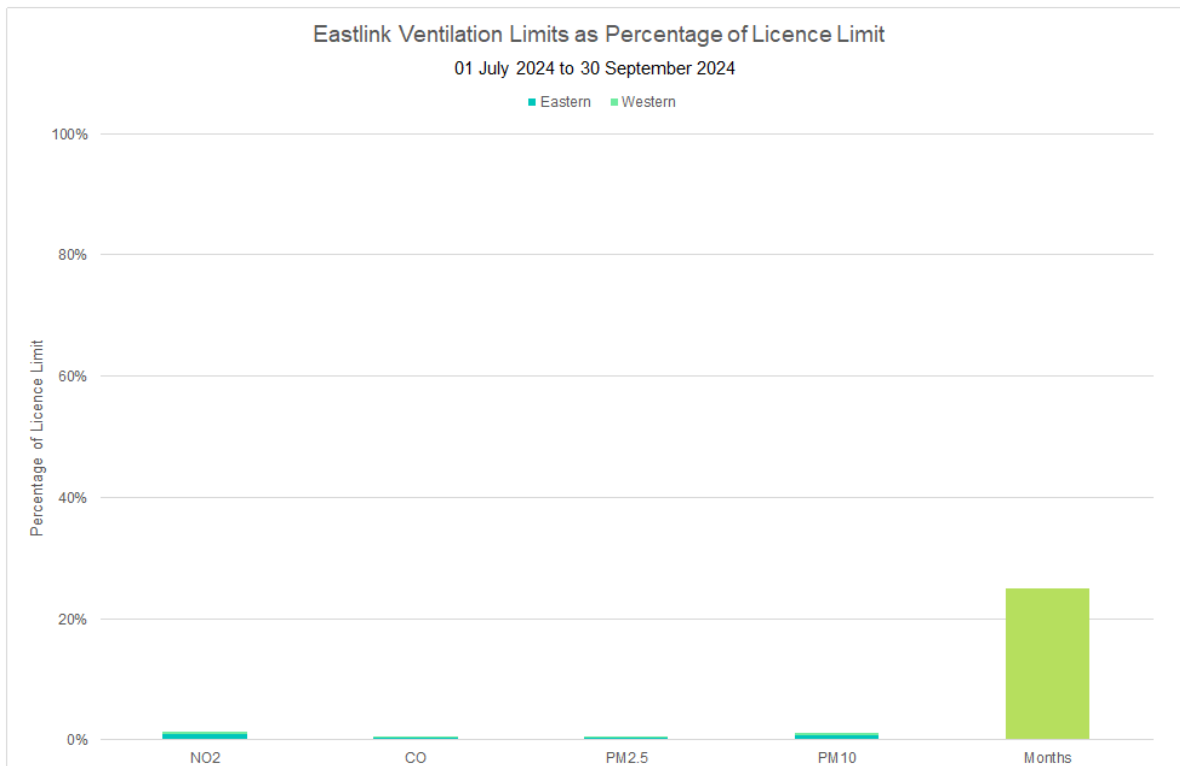


Figure 23: Annual Performance Statement stack emission rates

7 Report Summary

- There were two exceedances of the prescribed limits during the reporting period.

Appendix 1

Glossary

The following terms and abbreviations are used in this report

CO	Carbon monoxide
DP1	Discharge Point 1
DP2	Discharge Point 2
kg/hour	Kilograms per hour
g/5m	Grams per 5 minutes
m ³ /s	Cubic meters per second
mg/m ³	Milligrams per cubic meter at dry, standard temperature and pressure (0°C and 101.3 kPa)
NO	Nitric oxide
NO ₂	Nitrogen dioxide
PM ₁₀	Particulate less than 10 microns in equivalent aerodynamic diameter
PM _{2.5}	Particulate less than 2.5 microns in equivalent aerodynamic diameter

Data Validation Explanations

Automatic background check refers to when analyser samples zero air and measures the level of the concentration voltage. This voltage is taken as the zero signal level and this value is subtracted from any subsequent readings as an active zero compensation. This is the analyser’s fine zero measurement.

Calibration check outside tolerance refers to when the calibration values are outside the tolerance limits set for the precision check.

Offset or Multiplier Applied to data refers to an offset or multiplier applied to the data. This operation may be performed for a number of reasons including: (a) when a clear trend / drift outside the tolerance limit can be demonstrated by repeated operation precision checks, (b) when a correction is required on previously logged data due to a calibration check being outside the allowable tolerance

Data transmission error refers to a period of time when the instrument could not transmit data. This may be due to a communication fault between the logger and instrument.

Equipment malfunction/instrument fault refers to a period of time when the instrument was not in the normal operating mode and did not measure a representative value of the existing conditions.

Missing data/data not available refers to a period of time when either data has been lost or could not be collected.

Instrument Alarm refers to an alarm produced by the instrument. A range of alarms can be produced depending on how operation of the instrument is being affected.

Instrument out of service refers to an unavailability of data due to an instrument being shut down for repair, maintenance, or factory calibration.

Logger error refers to when an error occurs and instrument readings are not correctly recorded by the logger.

Maintenance refers to a period of time when the logger / instrument was unavailable due to maintenance.

Overnight span/zero out of tolerance refers to when the span/zero reading measured by the analyser during an automatic precision check falls outside of the expected concentration limits.

Power Interruption refers to no power to the station therefore no data was collected at this time.

Remote Calibration refers to when a technician remotely connects to the station and manually performs a span check.

Warm up after power interruption refers to the start up period of an instrument after power has been restored.