Tollaust Pty Ltd - Lane Cove Tunnel

In-Tunnel Air Quality Monitoring (CO & Visibility) Validated Data Report

1 October 2025 to 31 October 2025

Ref: DR.202510.LCT
Issue Date: 28/11/2025
Report prepared by: Tim Allfrey

Document Control

Revision	Date	Details	Prepared By	Approved By
0	28/11/2025	Original	TA	BN

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28 November 2025

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Norditech Accreditations

We operate a fully compliant NATA-approved lab, and our engineers are factory-trained in the repair and maintenance of most types of gas analysers on the market, including circuit board level repairs. Our instrument technicians' training is constantly updated to stay current with the latest gas analyser market trends.

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NATA WORLD RECOGNISED ACCREDITATION

Accreditation number: 19660

Table of Contents

Figures

Tables

Glossary

The following terms and abbreviations are used in this report

Abbreviation	Meaning
LCT	Lane Cove Tunnel
MCoA	Minister's Conditions of Approval
PMCS	Plant Monitoring & Control System
m^{-1}	Inverse meters (visibility dimming coefficient)
CO	Carbon monoxide
ppm	Parts per million

1. Executive Summary

The Lane Cove Tunnel (LCT) is a 3.6 km road tunnel between North Ryde and Artarmon, linking the M2 Motorway and the Gore Hill Freeway as part of Sydney's motorway network. The tunnel commenced operation in March 2007.

To manage in-tunnel air quality, a network of sensors continuously monitors carbon monoxide (CO) and visibility at strategic locations. Data from these sensors are recorded, validated, and reported monthly to Tollaust Pty Ltd.

This report presents validated in-tunnel CO and visibility results for October 2025.

1.1 Scope and Reporting Period

Results cover 01 October 2025 to 31 October 2025, derived from 1-minute measurements and reported as rolling averages (3-, 15-, and 30-minute for CO; 3-minute for visibility) using the end-time convention.

1.2 Compliance to limits (CO) and Visibility Context

Carbon monoxide (CO) is assessed against the Minister's Conditions of Approval (MCoA) in-tunnel goals, which specify maximum allowable CO concentrations inside the tunnel. Visibility has no prescribed regulatory limit for Lane Cove Tunnel; it is reported to support operational decision-making and trend tracking rather than compliance. For how exceedances are defined and reported, see Compliance Limits and Exceedances.

2. Project Context

Norditech Pty Ltd was contracted by Tollaust Pty Ltd in December 2018 to validate and report in-tunnel air-quality data for Lane Cove Tunnel on a monthly basis. This consolidated edition combines carbon monoxide (CO) and visibility into a single report for efficiency and consistency. CO results are assessed against the Minister's Conditions of Approval (MCoA) in-tunnel goals, while visibility is presented for operational context and trend tracking (no prescribed regulatory limit for LCT).

Addresses of relevant parties:

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

Tollaust Pty Ltd
5 Sirius Rd
Lane Cove West NSW 2066

3. Introduction

This report presents validated in-tunnel CO and visibility data for October 2025. It describes the monitoring program and methods, summarises results for the reporting period, and explains how compliance is assessed for CO under the MCoA. Visibility is included to support operational decision-making and long-term trend evaluation. Where relevant, any CO exceedances are identified and documented in the Compliance Limits and Exceedances sections. All data have been quality-assured in accordance with Norditech's validation procedures.

3.1 Project Background

The Lane Cove Tunnel was delivered under a design–construct–operate concession, with construction commencing in 2004 by the Thiess–John Holland joint venture. The scope incorporated twin driven tunnels alongside extensive surface works, including carriageway widening, ramp connections, and dedicated bus-lane modifications. During excavation, ground stability issues resulted in a roof collapse event in 2005, requiring remediation and revised support systems. Despite these challenges, commissioning was achieved ahead of schedule, and operational control transferred to Transurban in 2010.

Since December 2018, Norditech has provided monthly data validation and reporting services for Lane Cove Tunnel under contract to Tollaust Pty Ltd. Historically, CO and visibility were issued as separate reports; they are now combined to streamline distribution, avoid duplication, and present a unified view of in-tunnel air quality.

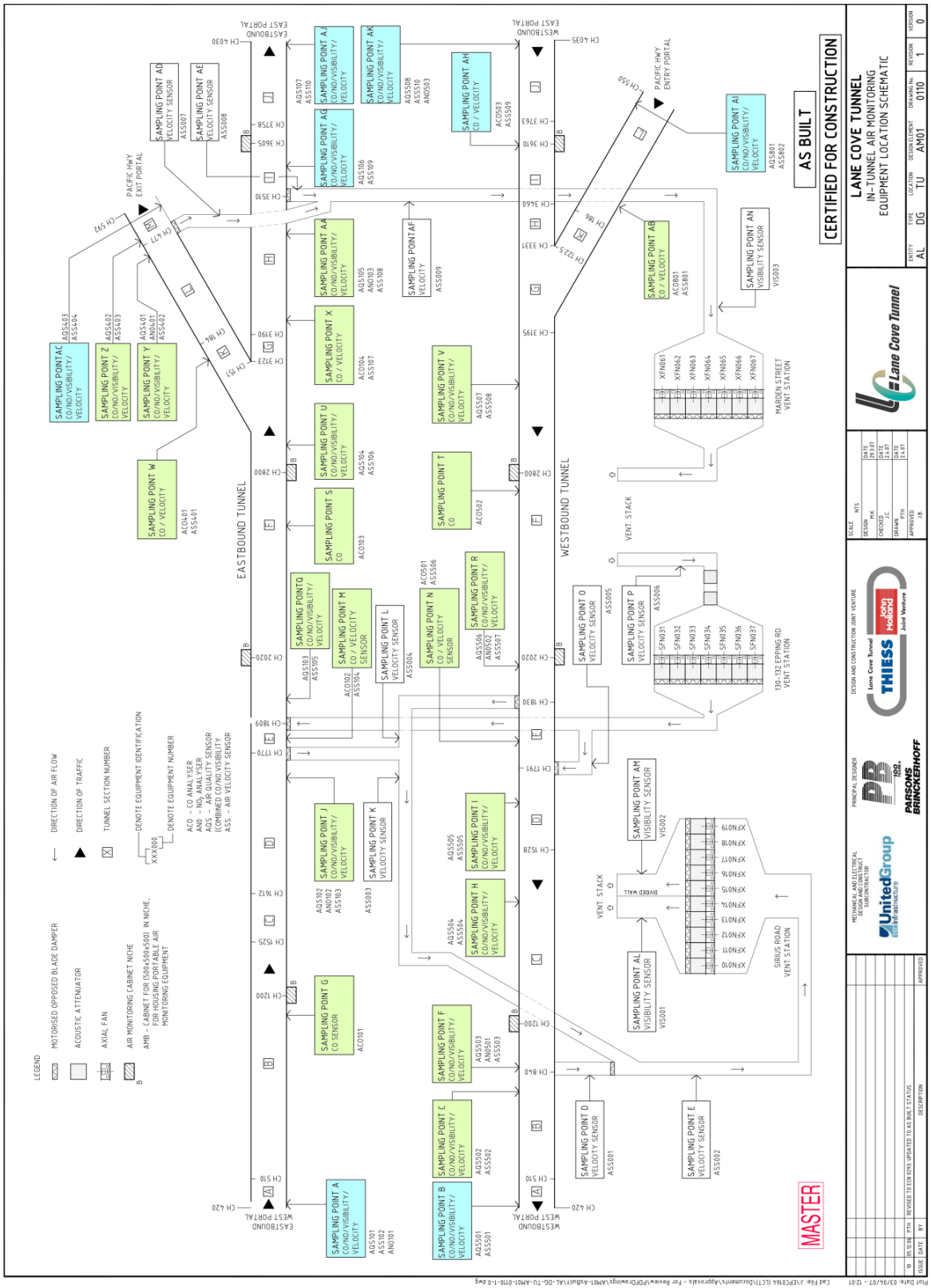

Figure 1. Lane Cove Tunnel Road network

3.2 Purpose

The purpose of this document is to provide an accurate and concise account of in-tunnel air-quality conditions for the period October 2025 by:

- describing the measurements and monitoring network,
- stating how CO compliance is assessed under the MCoA and how findings are reported,
- presenting visibility results for operational context and trend analysis, and
- documenting validation and quality-assurance steps applied to the dataset.

4. Monitoring Network and Methods

4.1 Parameters and Units

- **Carbon Monoxide (CO)**: reported in ppm (parts per million).
- **Visibility (dimming coefficient)**: reported in m^{-1} (reciprocal meters).

4.2 Methodology

Visibility is measured with 22 wall-mounted monitors across the Lane Cove Tunnel and ventilation system—10 eastbound, 9 westbound, and 3 within the stacks. Carbon monoxide (CO) is measured with 28 wall-mounted monitors distributed across the eastbound and westbound tunnels to provide a representative profile of in-tunnel concentrations (locations selected using computer-generated modelling).

Principle of measurement:

- Visibility is determined using open-path transmissivity instrument: a transceiver projects visible light to a reflector at an approximate 3 m pathlength; the returned signal is analysed to derive the dimming coefficient (m^{-1}).
- CO is measured by non-dispersive infrared (NDIR) absorption with gas-filter correlation over an open beam of about 3 m. The quantity of infrared light absorbed is proportional to the concentration of CO in the path of the beam.

Both parameters are monitored using Codel TunnelCraft III open-path instruments (LED transmissivity for visibility; infrared gas-filter correlation for CO). The CO analytical approach is consistent with the intent of NSW EPA AM-6 ("Approved Methods for Sampling and Analysis of Pollutants in NSW, 2001"), with a recognised deviation: an open-path beam replaces a closed analytical cell and sample-delivery system typically used in ambient stations. This deviation has been approved by the Department of Planning following independent expert advice. The visibility method and equipment are suitable under PIARC Road Tunnels guidance for tunnel air-quality monitoring.

4.3 Monitoring Locations

The in-tunnel network comprises 28 CO monitors and 22 visibility monitors installed at strategic portal and tunnel-wall positions (with visibility units also deployed within the ventilation stack system). Monitor identifiers and exact positions are provided in the tables below, and the air quality sensors network layout is shown schematically in Figure 1.

Visibility Monitors	
Monitoring Location	**Equipment Identification**
A	AQS101
B	AQS501
C	AQS502
F	AQS503
H	AQS504
I	AQS505
J	AQS102
Q	AQS506
R	AQS103
U	AQS104
V	AQS507
Y	AQS401
Z	AQS402
AA	AQS105
AC	AQS403
AG	AQS106
AI	AQS801
AJ	AQS107
AK	AQS508
AL	VIS001
AM	VIS002
AN	VIS003

Portal Monitor	
Tunnel Wall Monitor	
In ventilation stack monitor	

Table 1. Visibility monitors — locations and IDs (in-tunnel)

CO monitors	
Monitoring Location	**Equipment Identification**
A	AQS101
B	AQS501
C	AQS502
F	AQS503
G	ACO101
H	AQS504
I	AQS505
J	AQS102
M	ACO102
N	ACO501
Q	AQS103
R	AQS506
S	ACO103
T	ACO502
U	AQS104
V	AQS507
W	ACO401
X	ACO104
Y	AQS401
Z	AQS402
AA	AQS105
AB	ACO801
AC	AQS403
AG	AQS106
AH	ACO503
AI	AQS801
AJ	AQS107
AK	AQS508

Portal Monitor	
Tunnel Wall Monitor	

Table 2. CO monitors — locations and IDs (in-tunnel)

4.4 Last Calibration Dates and Accuracy

The instruments ID, last calibration dates, and accuracy for in-tunnel CO and visibility are summarised below.

Last Calibration Dates – Visibility sensors - October 2025					
Location ID	**Last Calibration Date**	**Units**	**Resolution**	**Accuracy**	**Measurement Range**
East Bound		m^{-1}	± 0.0001 m^{-1}	± 0.0002 m^{-1}	0 - 0.015 m^{-1}
AQS101	23/09/2025				
AQS102	23/09/2025				
AQS103	23/09/2025				
AQS104	22/09/2025				
AQS105	17/06/2025				
AQS106	18/06/2025				
AQS107	18/06/2025				
AQS401	18/06/2025				
AQS402	19/06/2025				
AQS403	25/09/2025				
West Bound					
AQS501	23/09/2025				
AQS502	24/09/2025				
AQS503	24/09/2025				
AQS504	24/09/2025				
AQS505	25/09/2025				
AQS506	17/06/2025				
AQS507	17/06/2025				
AQS508	25/09/2025				
AQS801	21/03/2025				
Ventilation Shafts					
VIS001	17/03/2025				
VIS002	17/03/2025				
VIS003	17/03/2025				

Table 3. Visibility instruments — details and calibration dates

Last Calibration Dates – CO sensors - October 2025					
Location ID	**Last Calibration Date**	**Units**	**Resolution**	**Uncertainty**	**Measurement Range**
East Bound		ppm	0.1 ppm	± 1.0 ppm or 2% of span value	0 ppm to 200 ppm
AQS101	23/09/2025				
AQS102	23/09/2025				
AQS103	23/09/2025				
AQS104	22/09/2025				
AQS105	17/06/2025				
AQS106	18/06/2025				
AQS107	18/06/2025				
AQS401	18/06/2025				
AQS402	19/06/2025				
AQS403	25/09/2025				
ACO101	17/06/2025				
ACO102	17/06/2025				
ACO103	22/09/2025				
ACO104	18/06/2025				
ACO401	18/06/2025				
West Bound					
AQS501	23/09/2025				
AQS502	24/09/2025				
AQS503	24/09/2025				
AQS504	24/09/2025				
AQS505	25/09/2025				
AQS506	17/06/2025				
AQS507	17/06/2025				
AQS508	25/09/2025				
AQS801	21/03/2025				
ACO501	24/09/2025				
ACO502	17/06/2025				
ACO503	21/11/2023				
ACO801	23/05/2024				

Table 4. CO instruments — details and calibration dates

5. Data Acquisition, Validation & Reporting

5.1 Data Collection

Data is collected by the Lane Cove Tunnel PMCS and provided to Norditech weekly via email. Upon receipt, files are imported into a database. Measurements are logged as 1-minute averages, and all calculations in this report are based on the 1-minute data.

5.2 Validation Approach

Data validation is undertaken in accordance with Norditech's data-validation procedure to identify and remove any measurements that are not fit for reporting. The process begins with a visual screening of the 1-minute time series (graphical review) to identify anomalies. Site-visit logs and maintenance/calibration certificates are then cross-referenced to the dataset, and any periods affected by maintenance or configuration changes are flagged. Instrument drift and calibration tolerances are checked; where out-of-tolerance conditions or faults are confirmed, the affected intervals are marked invalid in the database. All invalid data are excluded from calculations and reporting.

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

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

5.3 Reporting

This report presents validated in-tunnel CO and visibility data for October 2025. All calculations use 1-minute averaged measurements and are reported by end-time; i.e., the value at 01:01 represents the average over 01:00–01:01.

5.3.1 Data Availability

Data availability refers to the amount of available 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 3-minute, 15-min, and 30-min rolling average data points for the reporting period
- Sum of possible data points is the number of theoretically available data points for the reporting period

5.3.2 Documentation

Validated data is delivered in two separate Excel workbooks, consistent with stakeholder requirements:
1) "202510 LCT In Tunnel Validated CO data.xlsx"
Sheets

1. Cover
2. CO – Max hourly 3-, 15-, 30-min rolling averages
3. Data Validation

2) "202510 LCT In Tunnel Validated Visibility data.xlsx"
Sheets

1. Cover
2. Visibility – 3-minute averages
3. Data Validation

6. Compliance Limits & Operational Targets

6.1 CO MCoA Goals and Exceedance Rules

This report assesses in-tunnel carbon monoxide (CO) against the Condition 160 and 161 of Minister's Conditions of Approval (MCoA) using rolling-average metrics derived from 1-minute measurements. Rolling averages are reported using the end-time convention.

Parameter	Averaging Period	Goal Limit	Units	Applicable MCoA
Carbon Monoxide (CO)	3-minute rolling average	200	ppm	MCoA 161
	15-minute rolling average	87	ppm	MCoA 160
	30-minute rolling average	50	ppm	MCoA 160

Table 5. MCoA CO In-Tunnel Compliance Goals

6.2 Visibility (No Prescribed Regulatory Limit)

There are no prescribed regulatory limits for visibility in the Lane Cove Tunnel (LCT). Visibility measurements are reported to support operational decision-making and trend analysis (e.g., ventilation management, traffic conditions, and incident response). Accordingly, no exceedance assessment is presented for visibility; results are provided as time series and summary statistics only.

7. Results

7.1 Data Availability (CO & Visibility)

Data availability for in-tunnel visibility and in-tunnel CO sensors for the reporting period is summarised below. Locations with data availability < 75% are indicated in red italics. Please refer to the Data Validation sheet in the accompanying workbook for details of missing or removed data (e.g., maintenance, calibration, comms outages).
Note on "N/A". "N/A" appears where a daily statistic cannot be reported due to insufficient valid data for that calendar day (valid day defined as ≥ 75% of expected samples).

Lane Cove Tunnel In-Tunnel Visibility Data Availability - October 2025			
Monitoring Location	**Equipment Identification**	**Data Availability (%)**	**Comments**
East Bound			
A	AQS101	99.9%	
J	AQS102	99.9%	
R	AQS103	99.9%	
U	AQS104	99.9%	
AA	AQS105	98.2%	
AG	AQS106	99.9%	
AJ	AQS107	0.0%	Missing data
Y	AQS401	99.9%	
Z	AQS402	99.9%	
AC	AQS403	99.4%	
West Bound			
B	AQS501	98.2%	
C	AQS502	99.9%	
F	AQS503	91.1%	
H	AQS504	99.9%	
I	AQS505	99.9%	
Q	AQS506	99.9%	
V	AQS507	99.9%	
AK	AQS508	0.0%	Missing data
AI	AQS801	0.0%	Instrument flatlined the whole month – all data removed.
Ventilation Shafts			
AL	VIS001	97.2%	
AM	VIS002	98.0%	
AN	VIS003	99.9%	

Table 6. In-Tunnel Visibility — Data Availability

Lane Cove Tunnel In-Tunnel CO Data Availability - October 2025			
Monitoring Location	**Equipment Identification**	**Data Availability (%)**	**Comment**
East Bound			
A	AQS101	99.9%	
J	AQS102	99.9%	
Q	AQS103	99.9%	
U	AQS104	99.9%	
AA	AQS105	99.6%	
AG	AQS106	99.9%	
AJ	AQS107	99.3%	
Y	AQS401	99.9%	
Z	AQS402	99.9%	
AC	AQS403	99.3%	
G	ACO101	99.9%	
M	ACO102	99.9%	
S	ACO103	75.7%	
X	ACO104	99.9%	
W	ACO401	73.4%	Instrument flatlined – some data removed
West Bound			
B	AQS501	98.8%	
C	AQS502	99.9%	
F	AQS503	90.2%	
H	AQS504	99.9%	
I	AQS505	99.9%	
R	AQS506	99.9%	
V	AQS507	99.9%	
AK	AQS508	99.3%	
AI	AQS801	99.9%	
N	ACO501	99.9%	
T	ACO502	99.9%	
AH	ACO503	0.0%	Unrealistic data – all data removed.
AB	ACO801	94.4%	

Table 7. In-Tunnel CO — Data Availability

7.2 CO Exceedances

If any instances of the in-tunnel CO levels exceeded the MCoA goals during the reporting period, they will be presented in the table below.

Lane Cove Tunnel In-Tunnel CO Exceedances - October 2025						
Parameter	**Averaging Period**	**Goal Limit**	**Units**	**Value of exceedance**	**Date and time of exceedance**	**Station**
Carbon Monoxide (CO)	3-minute rolling average	200	ppm	-	-	-
	15-minute rolling average	87	ppm	-	-	-
	30-minute rolling average	50	ppm	-	-	-

Table 8. Exceedances of MCoA Goals

7.3 Graphical Representations

The figures are derived from 1-minute measurements and re-averaged to 3-minute, 15-minute, and 30-minute rolling averages for reporting of CO, while the visibility graphical representations are constructed from 1 minute average data, re-averaged to 3-minute average data.

7.3.1 CO – Monthly Maximum Rolling Averages

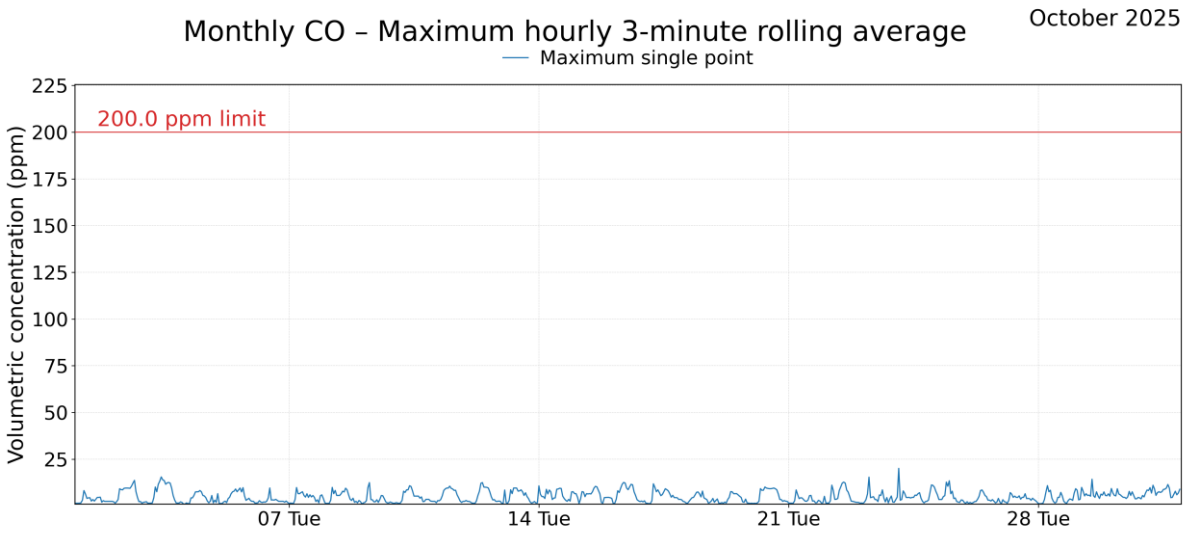

Figure 2. Monthly CO – Maximum Hourly 3-Minute Rolling Average

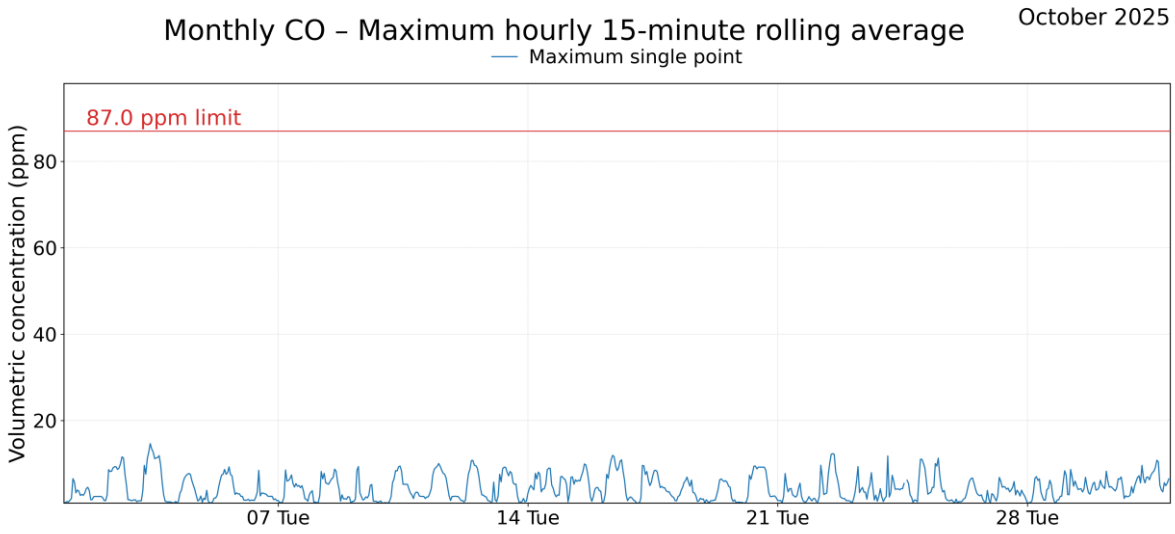

Figure 3. Monthly CO – Maximum Hourly 15-Minute Rolling Average

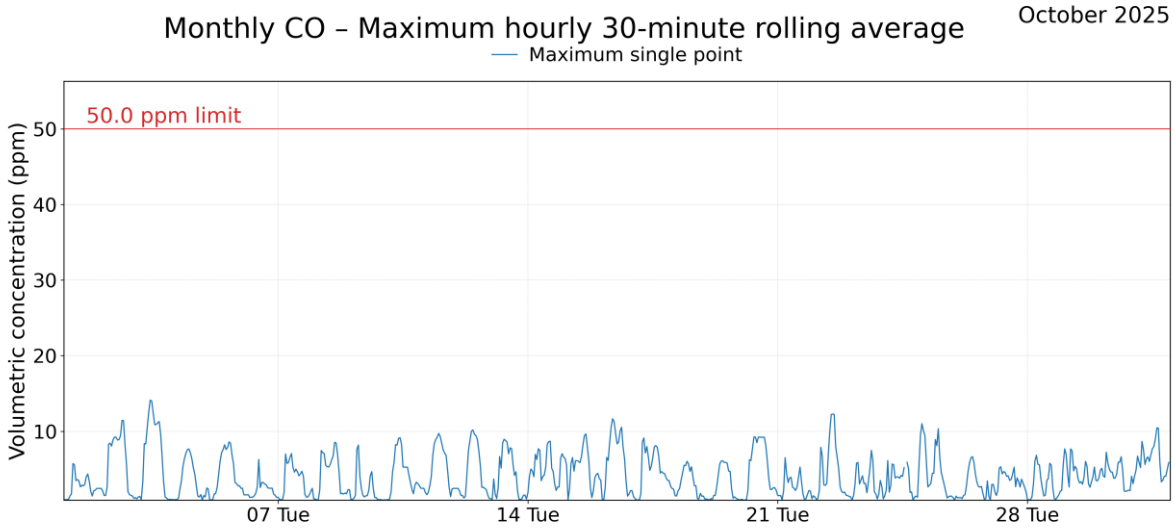

Figure 4. Monthly CO – Maximum Hourly 30-Minute Rolling Average

7.3.2 CO – Three-Month Trend

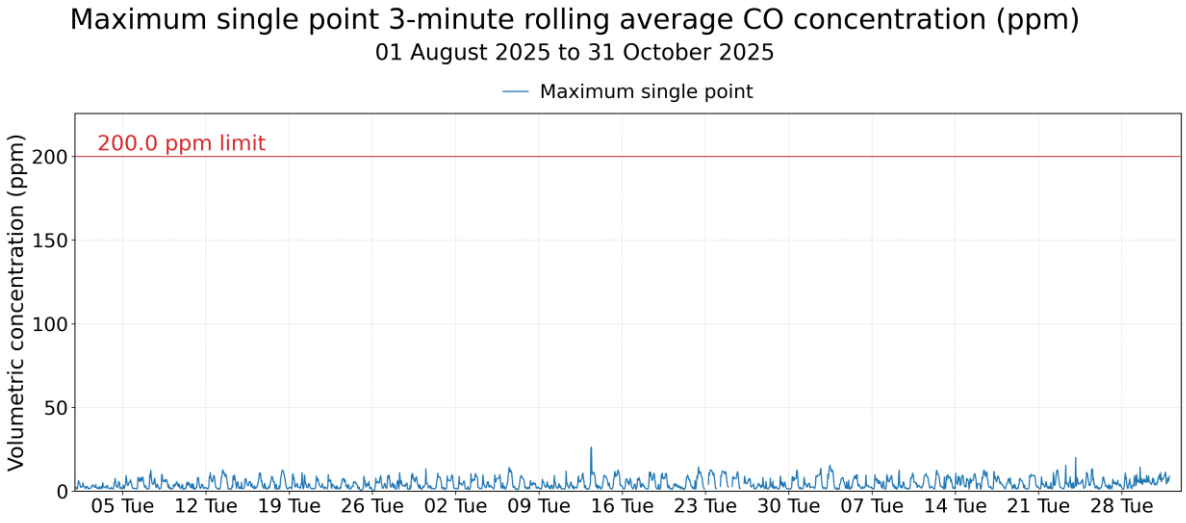

Figure 5. 3-Month CO Trends – Max Hourly 3-Minute Rolling Averages

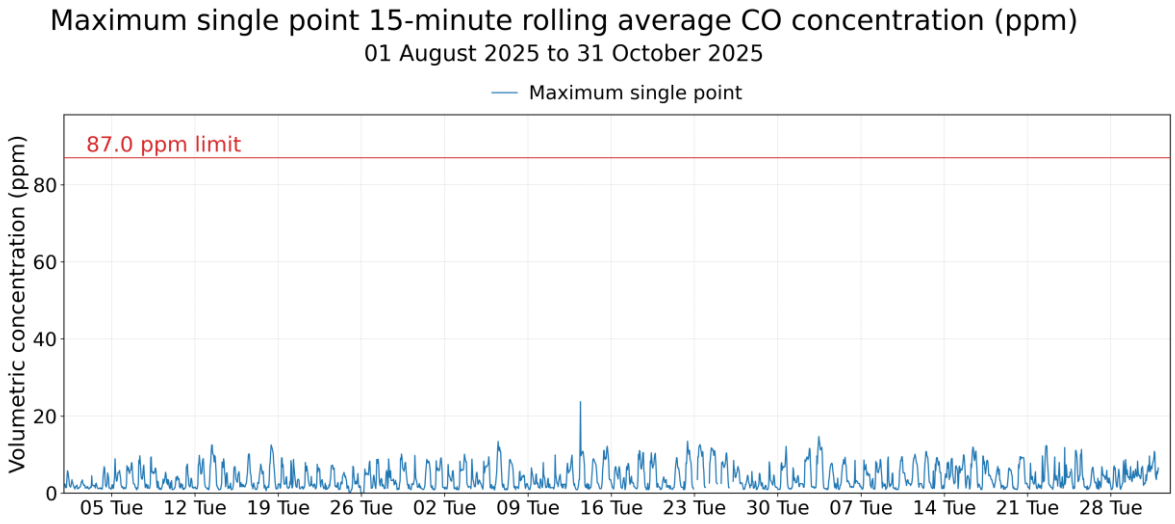

Figure 6. 3-Month CO Trends – Max Hourly 15-Minute Rolling Averages

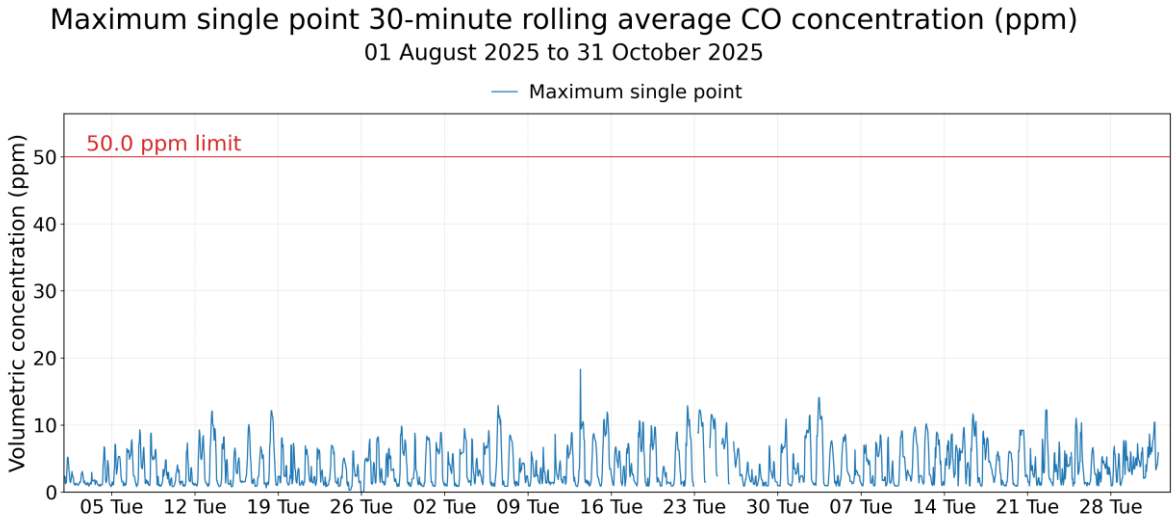

Figure 7. 3-Month CO Trends – Max Hourly 30-Minute Rolling Averages

7.3.3 Visibility – 3-Minute Average

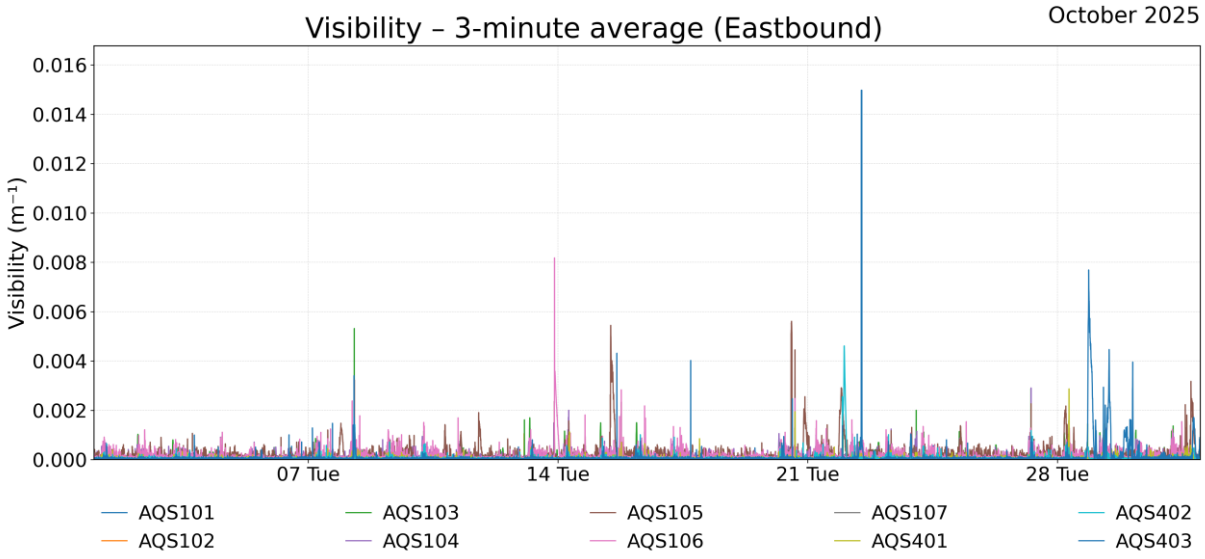

Figure 8. 3-Minute Average (Eastbound)

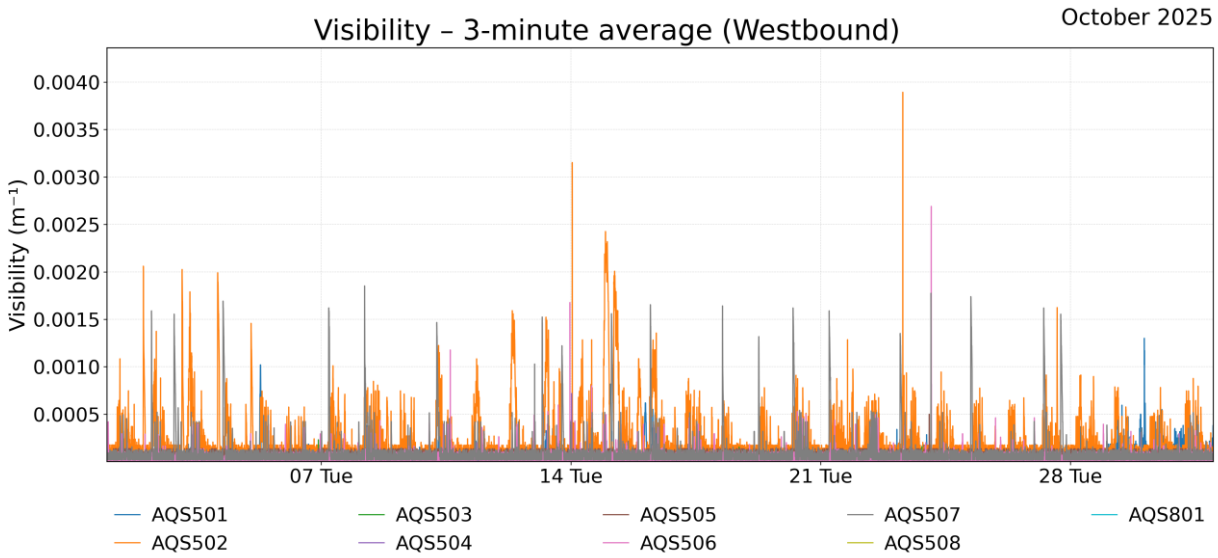

Figure 9. 3-Minute Average (Westbound)

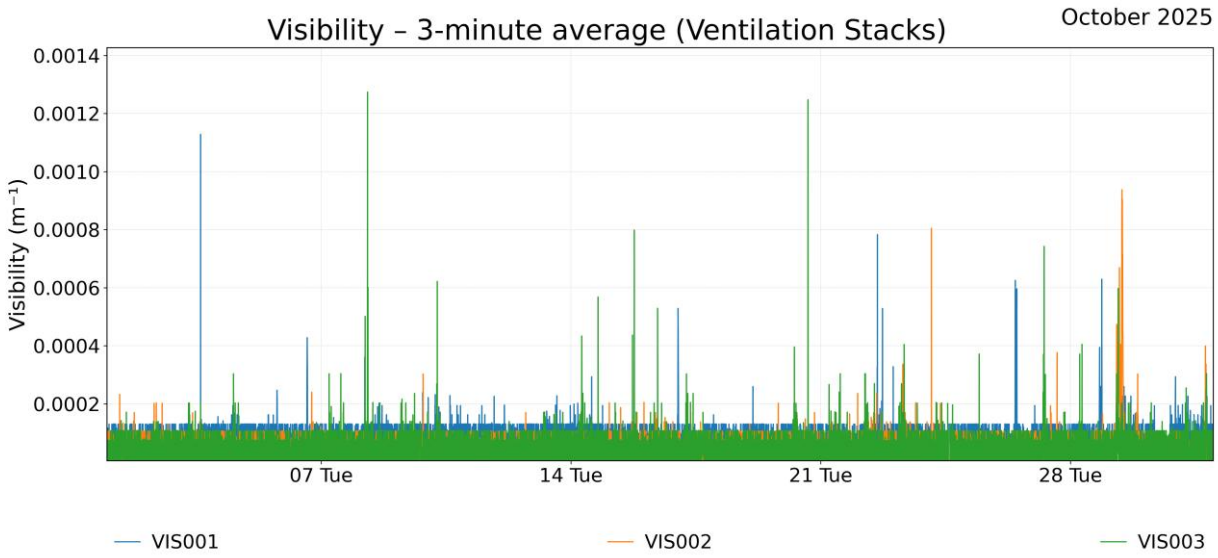

Figure 10. 3-Minute Average (Ventilation Stacks)

8. Data Exceptions

This section outlines any issues noted with the monitoring equipment during the reporting period. The following tables details any missing data, data removed due to being deemed invalid, or data that has been adjusted.

Lane Cove Tunnel - In-Tunnel – CO Data Validation Table - October 2025							
Start Date	End Date	Sensor	Reason	Change Details	Hours affected	Validation By	Change Date
01/10/2025 0:00	09/10/2025 4:11	ACO401	Instrument flatline	CO	196.2	TA	27/11/2025 0:00
01/10/2025 0:00	31/10/2025 23:59	ACO503	Unrealistic Data	CO	744.0	TA	27/11/2025 0:00
01/10/2025 0:00	04/10/2025 4:56	ACO103	Missing data	CO	76.9	TA	27/11/2025 0:00
01/10/2025 16:36	13/10/2025 8:00	AQS503	Intermittent Missing data	CO	N/A	TA	27/11/2025 0:00
05/10/2025 19:53	24/10/2025 17:56	ACO103	Intermittent Missing data	CO	N/A	TA	27/11/2025 0:00
09/10/2025 23:52	10/10/2025 1:47	AQS105	Missing data	CO	1.9	TA	27/11/2025 0:00
11/10/2025 14:08	11/10/2025 16:53	ACO801	Missing data	CO	2.8	TA	27/11/2025 0:00
17/10/2025 14:15	18/10/2025 8:22	ACO801	Missing data	CO	18.1	TA	27/11/2025 0:00
20/10/2025 21:50	21/10/2025 2:00	ACO801	Missing data	CO	4.2	TA	27/11/2025 0:00
22/10/2025 17:21	23/10/2025 4:36	ACO801	Missing data	CO	11.3	TA	27/11/2025 0:00
22/10/2025 20:55	23/10/2025 0:26	AQS107, AQS403, AQS508	Missing data	CO	3.5	TA	27/11/2025 0:00

Table 9. CO Data Validation Table

Lane Cove Tunnel - In-Tunnel – Visibility Data Validation Table - October 2025							
Start Date	End Date	Sensor	Reason	Change Details	Hours affected	Validation By	Change Date
01/10/2025 0:00	31/10/2025 23:59	AQS107	Missing data	VIS	744.0	TA	27/11/2025
01/10/2025 0:00	31/10/2025 23:59	AQS508	Missing data	VIS	744.0	TA	27/11/2025
01/10/2025 0:00	31/10/2025 23:59	AQS801	Unrealistic Data - flatline	VIS	744.0	TA	27/11/2025
01/10/2025 16:36	13/10/2025 8:00	AQS503	Intermittent missing data	VIS	N/A	TA	27/11/2025
07/10/2025 13:19	07/10/2025 15:13	VIS001, VIS002	Missing data	VIS	1.9	TA	27/11/2025
09/10/2025 23:43	10/10/2025 12:29	AQS403	Unrealistic Data - instrument drift	VIS	12.8	TA	27/11/2025
14/10/2025 0:28	14/10/2025 12:46	AQS501	Unrealistic Data - instrument drift	VIS	12.3	TA	27/11/2025
15/10/2025 20:25	15/10/2025 20:35	AQS501	Missing data	VIS	0.2	TA	27/11/2025
17/10/2025 11:25	17/10/2025 16:40	VIS001	Missing data	VIS	5.3	TA	27/11/2025
22/10/2025 20:52	23/10/2025 0:23	AQS403	Missing data	VIS	3.5	TA	27/11/2025
28/10/2025 11:32	28/10/2025 13:42	VIS002	Missing data	VIS	2.2	TA	27/11/2025
30/10/2025 8:36	30/10/2025 18:54	VIS001, VIS002	Missing data	VIS	10.3	TA	27/11/2025
31/10/2025 8:47	31/10/2025 11:02	VIS001	Missing data	VIS	2.3	TA	27/11/2025

Table 10. Visibility Data Validation Table