Tollaust Pty Ltd - Lane Cove Tunnel

CO In Tunnel Air Quality Monitoring Validated Data Report

1 September 2022 to 30 September 2022

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1 Executive Summary

The Lane Cove Tunnel runs for 3.6km between North Ryde and Artarmon, linking the M2 Motorway and the Gore Hill Freeway and forms part of Sydney's motorway network. The tunnel commenced operation in March 2007.

To ensure that carbon monoxide levels within the tunnel are kept within acceptable levels, a network of 28 air quality sensors are installed in strategic locations throughout the tunnel. Data from these sensors are recorded, validated and reported on a monthly basis.

This report presents the monthly validated data for September 2022 to Tollaust Pty Ltd for the Lane Cove Tunnel.

1.1 Compliance to limits

The Minister's Conditions of Approval (MCoA) designates limits to which air quality inside the tunnel must meet. These limits relate to the maximum concentration of carbon monoxide in the air inside the tunnel.

There were no measured exceedances of the carbon monoxide limits during the reporting period of September 2022

For further information relating to exceedance reporting please refer to sections Compliance Limits, and Exceedances.

2 Introduction

Norditech were contracted by Tollaust Pty Ltd in December 2018 to provide in tunnel data validation and reporting services for Lane Cove Tunnel.

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

This report presents the validated in tunnel CO data for September 2022.

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

3 Compliance Limits

Air quality goals provided are provided in Condition 160 and 161 of the Minister's Conditions of Approval issued by the Director-General for the Lane Cove Tunnel project. The air quality goals are shown in the table below.

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 1: MCoA Compliance Goals

4 Explanation of Monitoring

4.1 Methodology

Carbon monoxide (CO) levels are measured inside the tunnel using a network of 28 separate CO monitors attached to the walls of both eastbound and westbound tunnels. The monitors measure CO using an analytical method known as non-dispersive infra red absorption with gas filter correlation. Basically, this involves projecting an infra-red beam across a 3 metre section of the tunnel and measuring the amount of infra-red light absorbed by CO molecules in the path of the beam. The quantity of infrared light absorbed is proportional to the concentration of CO in the path of the beam. The monitors used were specially designed for use in road tunnels where access for routine essential maintenance is restricted by the need to minimise traffic disruption. Similar monitors are widely used in other road tunnels in Australia and worldwide.

This method of analysis is similar to the standard method AM-6 outlined in “NSW EPA 2001, Approved Methods for Sampling and Analysis of Pollutants in New South Wales.” However the method differs from the standard principally by the use of the open beam type instrument as described above in place of a closed analytical cell and sample delivery pump as typically used in ambient air monitoring stations. This deviation from the standard method has been approved by the Department of Planning on the advice of an independent consultant with specialist expertise in the field of air quality monitoring.

The number and locations of the CO monitors has been selected using computer generated modelling to provide a representative profile of CO levels inside the tunnel.

The instruments being used for in tunnel CO monitoring are Codel TunnelCraft III Open Path Infra-red gas cell correlation instruments.

4.2 Monitoring Locations

The 28 CO monitors are located strategically in portal and tunnel wall locations. Specific monitor locations and identifiers are detailed in the table and schematic Figure 1 below.

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: Location and identification of CO in tunnel monitors

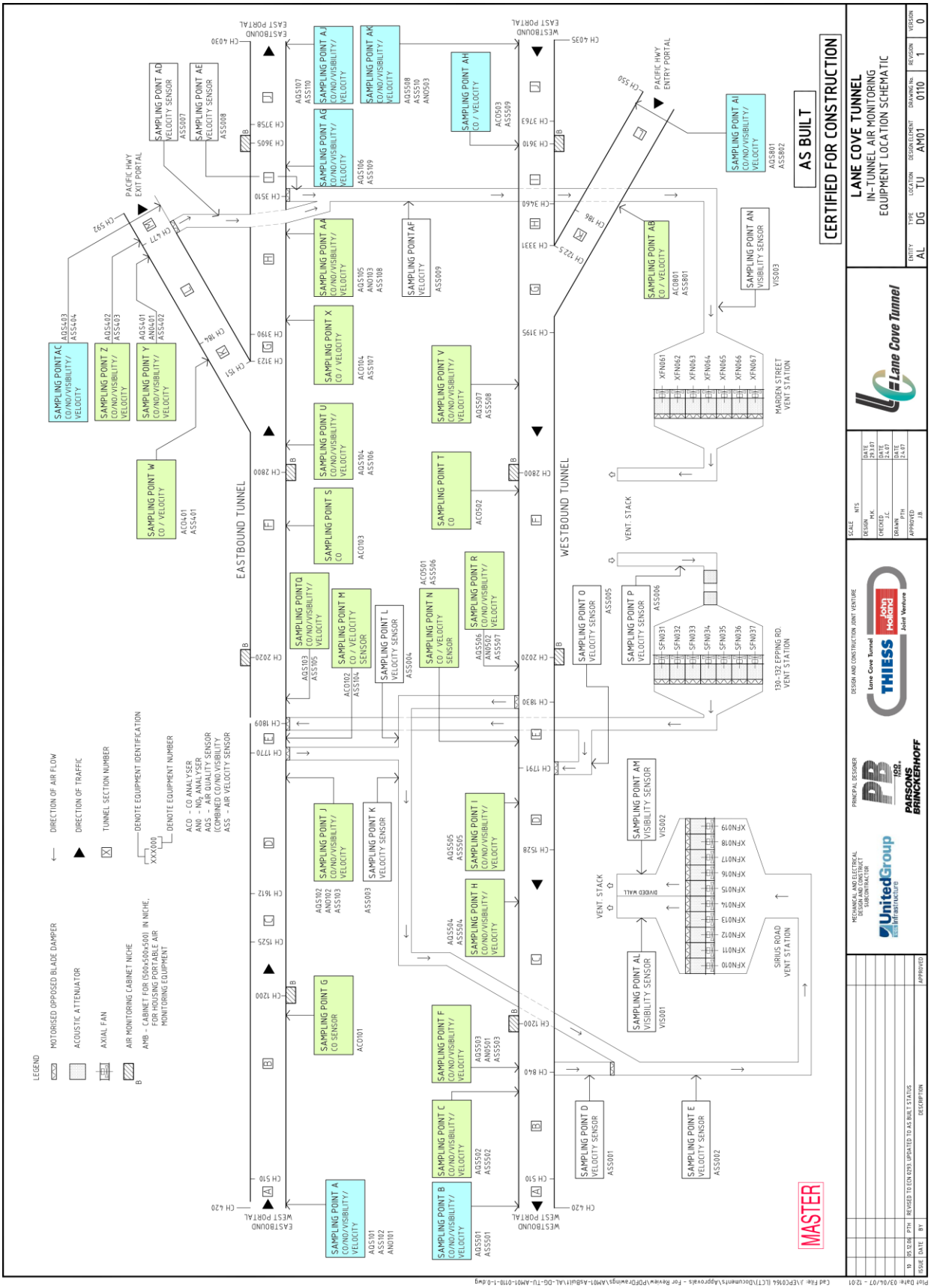

Figure 1: Lane Cove Tunnel CO in tunnel monitor locations

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4.3 Data Collection

Data is collected on the Lane Cove Tunnel PMCS, and is provided to Norditech on a weekly basis via email. Data is then imported into a SQL database. Data is logged in 1 minute average periods. All calculations are based on this 1 minute average data.

4.4 Data Validation

Data validation is performed as per Norditech's data validation procedure. 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

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.

4.5 Reporting

This report presents the validated in tunnel CO data for September 2022.

All calculations are based on 1 minute average data and are reported as 'end time'. IE the average data for 01:03 is the data from 01:00 through to 01:03.

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

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

Where:

- Sum of available data points is the number of validated 3 minute 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

Data is presented in the format of an Excel workbook named "202209 LCT In Tunnel Validated CO data.xlsx".

The workbook consists of the following sheets:

1. Cover
2. Max Single Point 3, 15 and 30m averages
3. Data Validation

5 Instrumentation units and accuracy

Instrumentation details are provided in the table below

Location ID	Units	Resolution	Uncertainty	Measurement Range
AQS101	ppm	0.1 ppm	± 1.0 ppm or 2% of span value	0 ppm to 200 ppm
AQS501				
AQS502				
AQS503				
ACO101				
AQS504				
AQS505				
AQS102				
ACO102				
ACO501				
AQS103				
AQS506				
ACO103				
ACO502				
AQS104				
AQS507				
ACO401				
ACO104				
AQS401				
AQS402				
AQS105				
ACO801				
AQS403				
AQS106				
ACO503				
AQS801				
AQS107				
AQS508				

Table 3: Instrument details and calibration dates

6 Results

6.1 Data Availability

Data availability for the in tunnel CO sensors are provided in the table below. Locations with data availability less than 75% are indicated in red italics. Please refer to the Data Validation Table in the accompanying data file for further details regarding missing or removed data.

Data availability for the reporting period is summarized below:

Lane Cove Tunnel In Tunnel CO Data Availability September 2022			
Monitoring Location	Equipment Identification	Data Availability (%)	Comment
A	AQS101	*0.0*	Instrument removed from tunnel, requires replacement
B	AQS501	*0.0*	Communication fault between analyser and PLC/OMCS
C	AQS502	99.4	
F	AQS503	99.4	
G	ACO101	99.4	
H	AQS504	99.4	
I	AQS505	99.4	
J	AQS102	99.4	
M	ACO102	*0.0*	Instrument removed from tunnel for repair
N	ACO501	*0.0*	Instrument fault
Q	AQS103	99.4	
R	AQS506	99.4	
S	ACO103	99.4	
T	ACO502	99.4	
U	AQS104	99.4	
V	AQS507	99.4	
W	ACO401	99.4	
X	ACO104	99.3	
Y	AQS401	99.4	
Z	AQS402	99.4	
AA	AQS105	*0.0*	Communication fault between analyser and PLC/OMCS
AB	ACO801	99.4	
AC	AQS403	*0.0*	Communication fault between analyser and PLC/OMCS
AG	AQS106	*0.0*	Instrument removed from tunnel, requires replacement
AH	ACO503	99.4	
AI	AQS801	99.4	
AJ	AQS107	99.4	
AK	AQS508	99.4	

Table 4: In tunnel CO data availability

6.2 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 September 2022						
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 5: Exceedances of MCoA Goals

6.3 Graphical Representations

The graphical representations are constructed from 1 minute average data, re-averaged to the 3 minute, 15 minute, and 30 minute rolling averages.

6.3.1 Monthly CO maximum 3 minute rolling averages

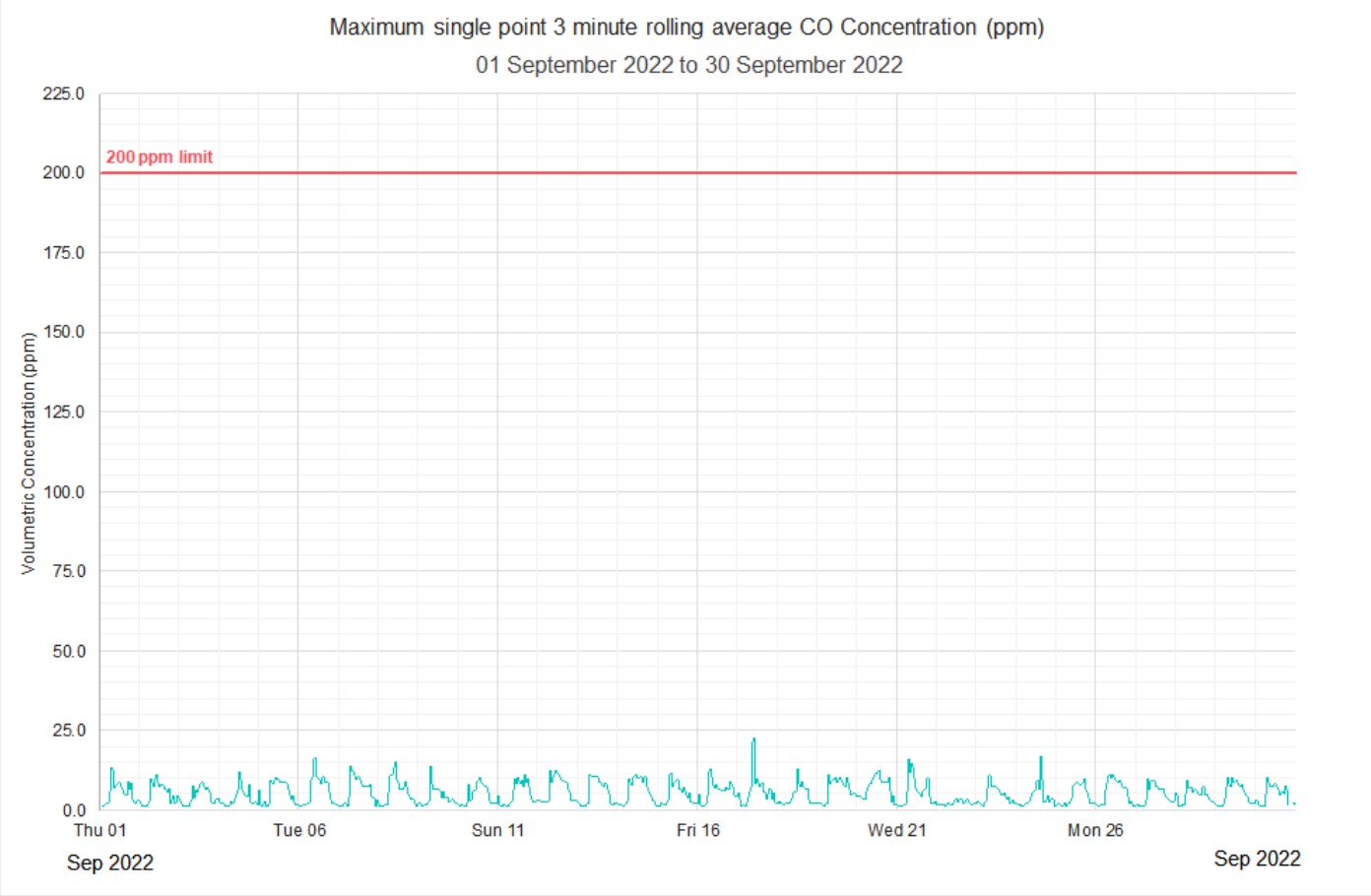

Figure 2: Monthly CO maximum hourly 3 minute rolling averages

6.3.2 Monthly CO maximum 15 minute rolling averages

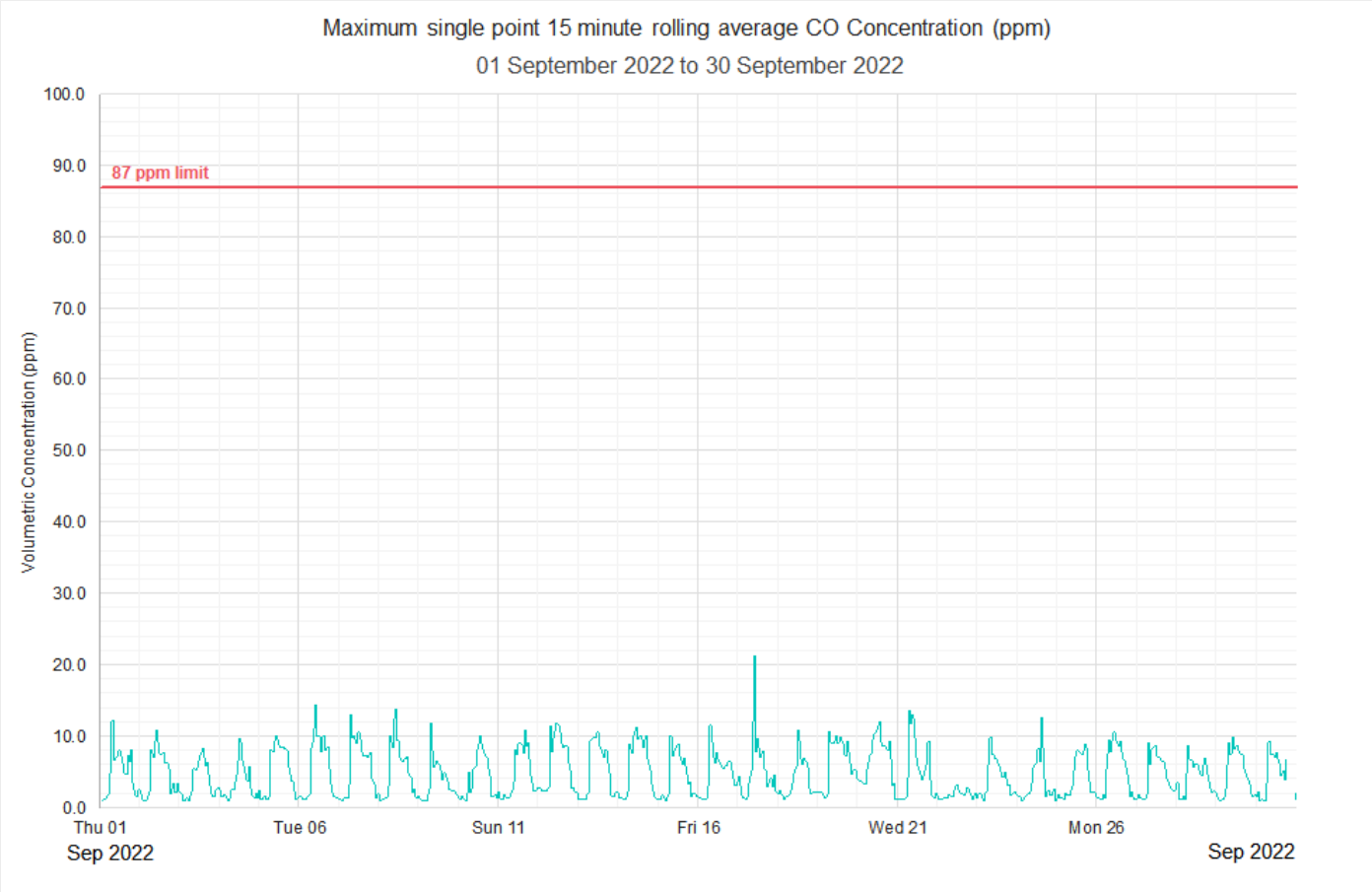

Figure 3: Monthly CO maximum hourly 15 minute rolling averages

6.3.3 Monthly CO maximum 30 minute rolling averages

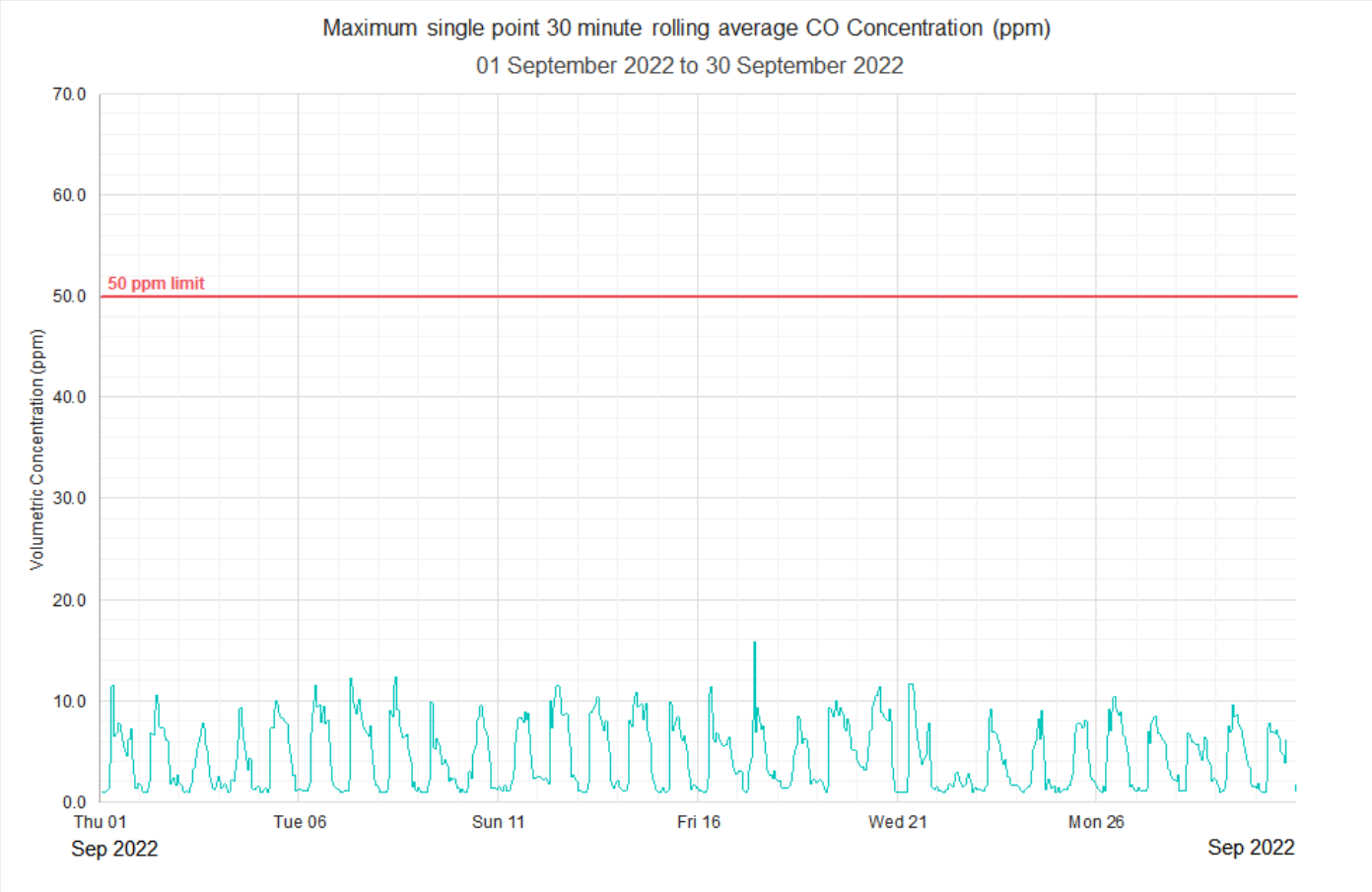

Figure 4: Monthly CO maximum hourly 30 minute rolling averages

6.3.4 Three Monthly Trend CO maximum 3 minute rolling averages

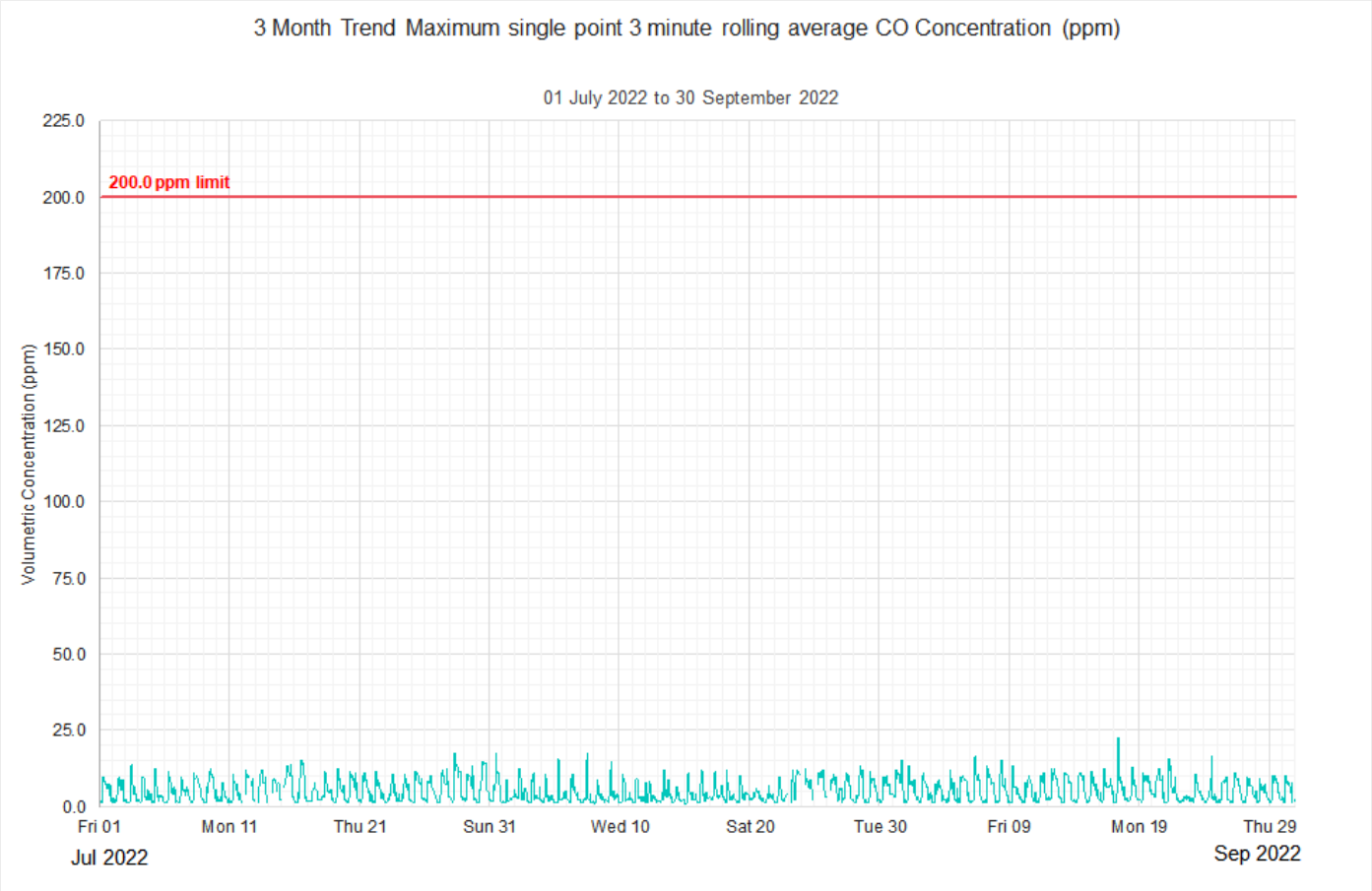

Figure 5: 3 Monthly CO maximum hourly 3 minute rolling averages

6.3.5 Three Monthly Trend CO maximum 15 minute rolling averages

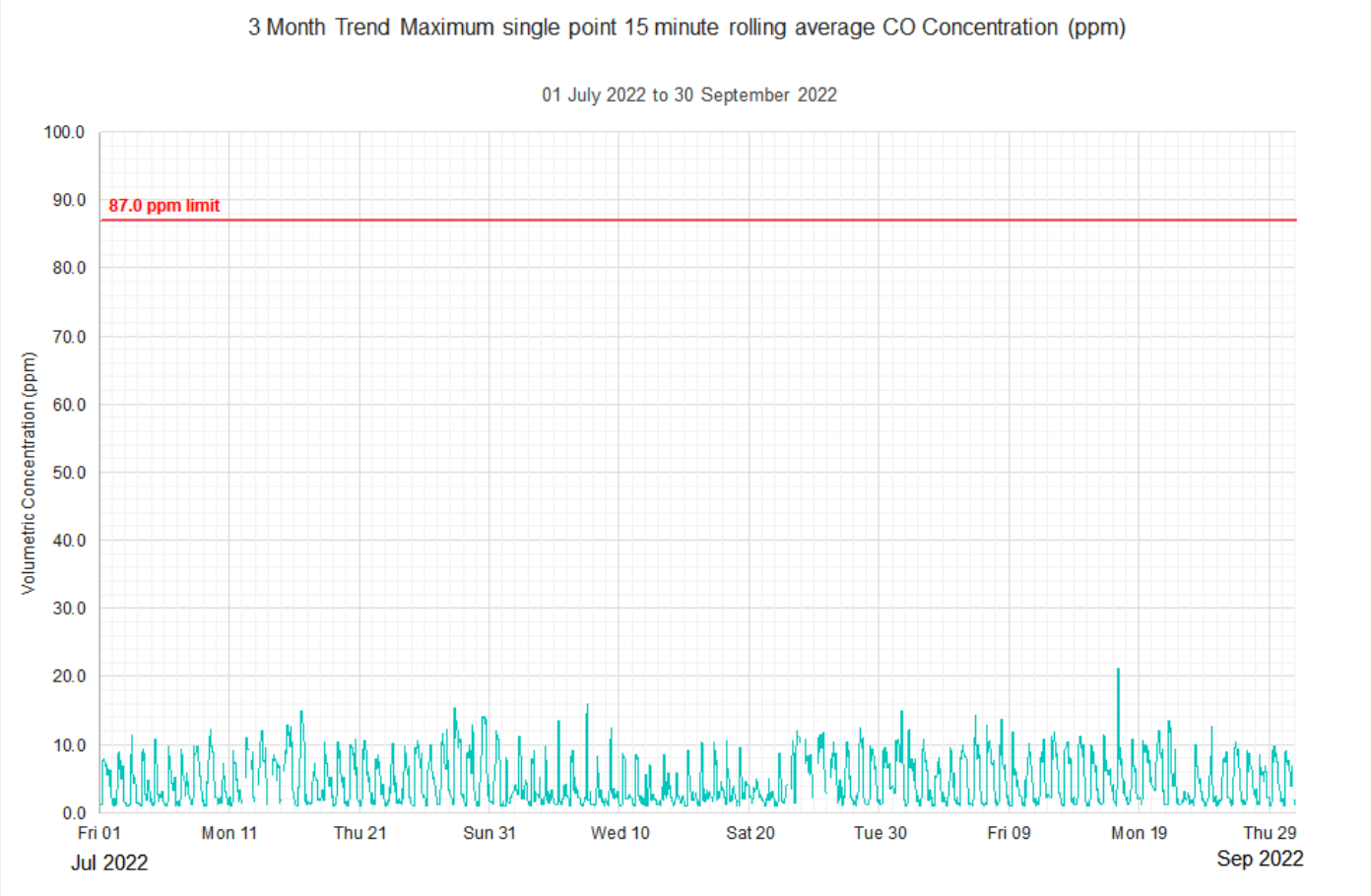

Figure 6: 3 Monthly CO maximum hourly 15 minute rolling averages

6.3.6 Three Monthly Trend CO maximum 30 minute rolling averages

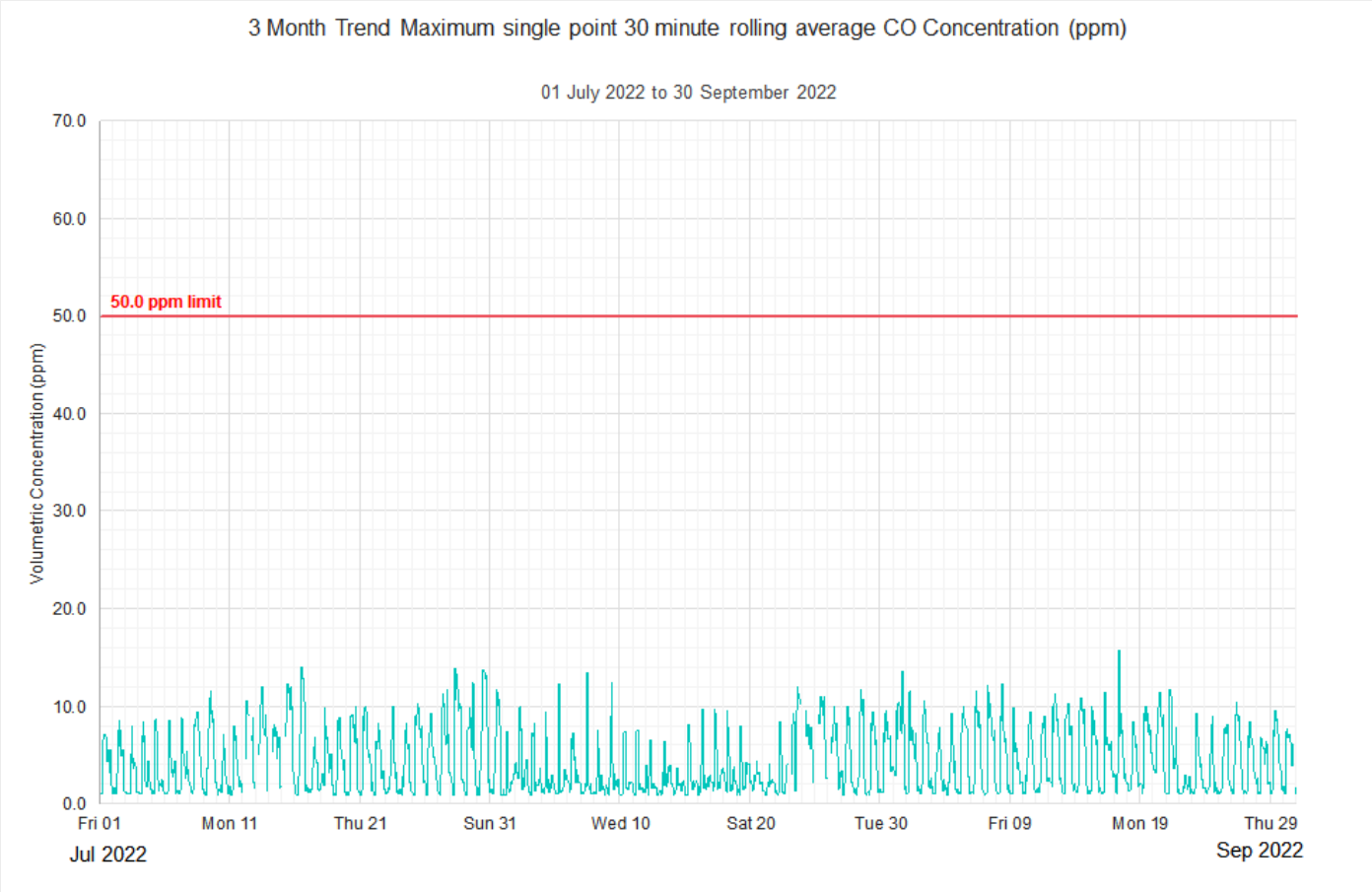

Figure 7: 3 Monthly CO maximum hourly 30 minute rolling averages

7 Glossary

The following terms and abbreviations are used in this report

CO	Carbon Monoxide
LCT	Lane Cove Tunnel
MCoA	Ministers Conditions of Approval
ppm	parts per million