



A·W·N Pty. Ltd. ACN 083 198 001 ABN 74 083 198 001
Consulting Environmental Engineers/Scientists – Pollution Monitoring and Control

Transfield Services
Ringwood, Victoria

**EastLink Ventilation Stack Emission
Monitoring Report**

July – September 2008

Report No: T144/4
Report Date of Issue: 24/10/2008



Accreditation
No. 1910

Document Control

A•W•N (Air Water Noise) Consultants ABN 74 083 198 001
(NATA Laboratory Accreditation No. 1910)

3 & 4/18 Thomas Street, Ferntree Gully, Victoria 3156
Telephone: (03) 9758-7299 Facsimile: (03) 9752-2694 Email: awn@awn.com.au
© **A•W•N** (Air Water Noise) Consultants


Disclaimer:

This document was prepared by A.W.N. (Air Water Noise) Consultants ("AWN") on behalf of Transfield Services ("the Commissioning Party"). This document and the information contained within it remains the property of A.W.N. at all times. The document may only be used for the purpose for which it was commissioned by the Commissioning Party, and in accordance with the Terms of Engagement for the commission. The information contained within this document reflects A.W.N.'s best judgement at the time of preparation based on the material provided to A.W.N. Every care is taken by A.W.N. to ensure the information contained in this document is current and accurate, however, A.W.N. disclaims all liability (including without limitation, liability in negligence) for all expenses, losses, damages and costs you may incur as a result of the information being inaccurate or incomplete in any way for any reason.

Any unauthorised use of this document in any form whatsoever is expressly prohibited and A.W.N. hereby disclaims all liability for any loss or damage whatsoever and howsoever incurred in reliance upon the document and the information contained within it by any party other than the Commissioning Party.

Project	Transfield Services, Ringwood, Victoria: EastLink Ventilation Stack Emission Monitoring Report
Project No.	T144/4
Prepared by	A.W.N. (Air Water Noise) Consultants, 3 & 4/18 Thomas Street, Ferntree Gully, 3156
Project Manager	Mr. Mark Tulau
Prepared for	Ms. A. Monson, Transfield Services, EastLink Operations Centre, 2 Hillcrest Avenue, Ringwood, 3134

Approval for Issue

Revision	Author	Reviewed By	Name: Title	Signature	Date
Original			Frank Fleer, Managing Director		24/10/2008

Revision History

Revision	Date Issued	Reason/Comments
Original	24/10/2008	Initial issue.

Distribution

Revision	Copy No.	Location
Original	1	Transfield Services
Original	2	A.W.N. (Air Water Noise) Consultants: Project file



Table of Contents

1.0 INTRODUCTION	1.1
2.0 DISCHARGES TO AIR.....	2.1
3.0 VENTILATION STACK MONITORING PARAMETERS.....	3.1
4.0 METHODS.....	4.1 - 4.2
4.1 PM _{2.5}	4.1
4.2 PM ₁₀	4.1
4.3 Carbon Monoxide.....	4.1
4.4 Oxides of Nitrogen	4.2
4.5 Stack Velocity.....	4.2
5.0 MEASUREMENT UNCERTAINTY	5.1
6.0 VENTILATION STACK EMISSION MONITORING PERIOD: 29/06/2008 – 31/07/2008	6.1 - 6.7
6.1 Data Capture.....	6.1
6.2 Results	6.1
6.2.1 PM _{2.5}	6.1
6.2.2 PM ₁₀	6.3
6.2.3 Carbon Monoxide.....	6.4
6.2.4 Oxides Of Nitrogen.....	6.5
6.2.5 Stack Velocity.....	6.7
7.0 VENTILATION STACK EMISSION MONITORING PERIOD: 01/08/2008 – 31/08/2008	7.1 - 7.7
7.1 Data Capture.....	7.1
7.2 Results	7.1
7.2.1 PM _{2.5}	7.1
7.2.2 PM ₁₀	7.3
7.2.3 Carbon Monoxide.....	7.4
7.2.4 Oxides Of Nitrogen.....	7.5
7.2.5 Stack Velocity.....	7.7



Table of Contents

8.0	VENTILATION STACK EMISSION MONITORING PERIOD: 01/09/2008 – 30/09/2008	8.1 - 8.7
8.1	Data Capture	8.1
8.2	Results	8.1
8.2.1	PM _{2.5}	8.1
8.2.2	PM ₁₀	8.3
8.2.3	Carbon Monoxide	8.4
8.2.4	Oxides Of Nitrogen	8.5
8.2.5	Stack Velocity	8.7
9.0	DISCUSSION	9.1
9.1	Comparison with Licence Limits	9.1

TABLES

Table 1	Discharges to Air	2.1
Table 2	Measurement Uncertainty	5.1
Table 3	Data Capture Statistics – 1 hour Averages	6.1
Table 4	PM _{2.5} Mass Rate Percentiles (1-Hour Average)	6.2
Table 5	PM ₁₀ Mass Rate Percentiles (1-Hour Average)	6.3
Table 6	Carbon Monoxide Mass Rate Percentiles (1 Hour Average)	6.4
Table 7	Nitric Oxide Mass Rate Percentiles (1 Hour Average)	6.5
Table 8	Nitrogen Dioxide Mass Rate Percentiles (1-Hour Average)	6.6
Table 9	Data Capture Statistics – 1 hour Averages	7.1
Table 10	PM _{2.5} Mass Rate Percentiles (1-Hour Average)	7.2
Table 11	PM ₁₀ Mass Rate Percentiles (1-Hour Average)	7.3
Table 12	Carbon Monoxide Mass Rate Percentiles (1 Hour Average)	7.4
Table 13	Nitric Oxide Mass Rate Percentiles (1 Hour Average)	7.5
Table 14	Nitrogen Dioxide Mass Rate Percentiles (1-Hour Average)	7.6
Table 15	Data Capture Statistics – 1 hour Averages	8.1
Table 16	PM _{2.5} Mass Rate Percentiles (1-Hour Average)	8.2
Table 17	PM ₁₀ Mass Rate Percentiles (1-Hour Average)	8.3
Table 18	Carbon Monoxide Mass Rate Percentiles (1 Hour Average)	8.4
Table 19	Nitric Oxide Mass Rate Percentiles (1 Hour Average)	8.5
Table 20	Nitrogen Dioxide Mass Rate Percentiles (1-Hour Average)	8.6
Table 21	Maximum (1 Hour Average) Mass Rate (29/06/2008 – 30/09/2008)	9.1



Table of Contents

FIGURES

Figure 1	Ventilation Stack Locations.....	2.1
Figure 2	PM _{2.5} Mass Rate (1 Hour Average).....	6.2
Figure 3	PM ₁₀ Mass Rate (1 Hour Average).....	6.3
Figure 4	Carbon Monoxide Mass Rate (1 Hour Average).....	6.4
Figure 5	Nitric Oxide Mass Rate (1 Hour Average).....	6.5
Figure 6	Nitrogen Dioxide Mass Rate (1 Hour Average).....	6.6
Figure 7	Stack Velocity (1 Hour Average).....	6.7
Figure 8	PM _{2.5} Mass Rate (1 Hour Average).....	7.2
Figure 9	PM ₁₀ Mass Rate (1 Hour Average).....	7.3
Figure 10	Carbon Monoxide Mass Rate (1 Hour Average).....	7.4
Figure 11	Nitric Oxide Mass Rate (1 Hour Average).....	7.5
Figure 12	Nitrogen Dioxide Mass Rate (1 Hour Average).....	7.6
Figure 13	Stack Velocity (1 Hour Average).....	7.7
Figure 14	PM _{2.5} Mass Rate (1 Hour Average).....	8.2
Figure 15	PM ₁₀ Mass Rate (1 Hour Average).....	8.3
Figure 16	Carbon Monoxide Mass Rate (1 Hour Average).....	8.4
Figure 17	Nitric Oxide Mass Rate (1 Hour Average).....	8.5
Figure 18	Nitrogen Dioxide Mass Rate (1 Hour Average).....	8.6
Figure 19	Stack Velocity (1 Hour Average).....	8.7

1.0 Introduction

EastLink is a 39-kilometre motorway running between Donvale in Melbourne's north east to Frankston in Melbourne's south east with two tunnels under the Mullum Mullum Valley. Transfield Services, who are responsible for operation and maintenance of the road, commissioned A.W.N. (Air Water Noise) Consultants to provide continuous emission monitoring services for the EastLink Road project. The services provided include:

- Operations and maintenance services for the EastLink ventilation stack continuous emission monitoring systems (CEMS);
- NATA endorsed emission monitoring reports.

Monitoring commenced on the 29th June 2008 with the opening of the EastLink motorway. Results for the sampling period 29th June 2008 to 30th September 2008 inclusive are contained in the following report.

2.0 Discharges to Air

EastLink has discharges to air servicing two road tunnels. Discharge Point No. 1 (DP1) services the inbound (Melba) tunnel and Discharge Point No. 2 (DP2) services the outbound (Mullum Mullum) tunnel.

The locations of the discharges to air are described in Table 1 and presented in Figure 1.

Table 1 Discharges to Air

DISCHARGE POINT NO.	STATION NAME	LOCATION
1	Western ventilation stack	Western end of inbound tunnel (Melba) - Donvale
2	Eastern ventilation stack	Eastern end outbound tunnel (Mullum Mullum) – Ringwood

Monitoring equipment is housed in temperature controlled cabinets located at the base of each of the ventilation stacks. Particulate and gaseous sample inlets are installed inside the plenum chamber of each of the ventilation stacks.



Figure 1 Ventilation Stack Locations

3.0 Ventilation Stack Monitoring Parameters

The following parameters are monitored continuously, with averages logged at 5 minute intervals.

- Particulate matter with an equivalent aerodynamic diameter less than 2.5 microns (PM_{2.5});
- Particulate matter with an equivalent aerodynamic diameter less than 10 microns (PM₁₀);
- Total oxides of nitrogen (NO_x);
- Nitric oxide (NO);
- Nitrogen dioxide (NO₂);
- Carbon monoxide (CO);
- Stack velocity;
- Stack temperature and
- Ambient pressure.

4.0 Methods

4.1 PM_{2.5}

PM_{2.5} concentrations in the tunnel ventilation stacks are determined using a 1400 Series Tapered Element Oscillating Microbalance (TEOM) analyser, located in the plenum chamber of the ventilation stacks.

Exhaust gas is drawn through a PM_{2.5} size selective inlet (PM₁₀ WINS head fitted with a PM_{2.5} sharp cut cyclone (SCC)) at 1 m³/h. The flow is then isokinetically split into two streams; 1 l/min stream which passes through the filter on the mass transducer and a 15.7 l/min bypass stream.

The sample stream is heated to 50°C to maintain a low and therefore relatively constant humidity.

Measurements are made in real-time (2 s intervals) with the 5-minute averages logged. 1-hour averages are then calculated from the logged data.

The PM_{2.5} monitoring method is based on the requirements of Australian Standard AS 3580.9.8, *"Methods for Sampling and Analysis of Ambient Air: Determination of Suspended Particulate Matter – PM₁₀ Continuous Direct Mass Method Using a Tapered Element Oscillating Microbalance Analyser"*.

4.2 PM₁₀

PM₁₀ concentrations in the tunnel ventilation stacks are determined using a 1400 Series Tapered Element Oscillating Microbalance (TEOM) analyser, located in the plenum chamber of the ventilation stacks.

Exhaust gas is drawn through a PM₁₀ size selective inlet (PM₁₀ WINS head) at 1 m³/h. The flow is then isokinetically split into two streams; 1 l/min stream which passes through the filter on the mass transducer and a 15.7 l/min bypass stream.

The sample stream is heated to 50°C to maintain a low and therefore relatively constant humidity.

Measurements are made in real-time (2 s intervals) with the 5-minute averages logged. 1-hour averages are then calculated from the logged data.

The PM₁₀ monitoring method is based on the requirements of Australian Standard AS 3580.9.8, *"Methods for Sampling and Analysis of Ambient Air: Determination of Suspended Particulate Matter – PM₁₀ Continuous Direct Mass Method Using a Tapered Element Oscillating Microbalance Analyser"*.

4.3 Carbon Monoxide

Carbon monoxide concentrations in the tunnel ventilation stacks are determined by infra-red gas filter correlation analysers.

Automatic calibrations are carried out daily against a NATA certified reference gas mixture. Manual calibrations are conducted at one month intervals.

The carbon monoxide monitoring method is based on the requirements of Australian Standard AS 3580.7.1-1992, *"Determination of Carbon Monoxide – Direct Reading Instrumental Method"*.



4.4 Oxides of Nitrogen

Oxides of nitrogen concentrations in the tunnel ventilation stacks are determined by chemiluminescence gas analysers.

Automatic calibrations are carried out daily against a NATA certified reference gas mixture. Manual calibrations are conducted at one month intervals.

The oxides of nitrogen (NO, NO₂ and NO_x) monitoring method is based on the requirements of Australian Standard AS 3580.5.1-1993, *“Determination of Oxides of Nitrogen – Chemiluminescence Method”*.

4.5 Stack Velocity

Stack gas velocity was determined using an optical flow sensor that complies with USEPA Code of Federal Regulations (CFR 40) Part 75, *“Continuous Emission Monitoring”* requirements.

5.0 Measurement Uncertainty

The estimated measurement uncertainty associated with each measured parameter is specified in Table 2.

Table 2 Measurement Uncertainty

PARAMETER	METHOD	ESTIMATED UNCERTAINTY
PM ₁₀	TEOM	± 5%
PM _{2.5}	TEOM	± 5%
NO, NO ₂ , NO _x	Chemiluminescence	± 10%
CO	Infra-red gas filter correlation	± 10%
Stack velocity	Optical flow sensor	± 0.1 m/s or 5% of reading, whichever is greater

6.0 Ventilation Stack Emission Monitoring Period: 29/06/2008 – 31/07/2008

6.1 Data Capture

Data capture is defined as the number of valid data periods collected divided by the number of available data periods. Valid data excludes periods where the instrument is unavailable due to calibration and maintenance and excludes periods where the data has been rejected due to quality assurance/data validation procedures.

The data capture statistics for the reporting period 29th June to 31st July 2008 are shown in Table 3. Averages were only collected for those periods where the 5-minute data constituted 75% data capture.

Table 3 Data Capture Statistics – 1 hour Averages

PARAMETER	STATION	COLLECTED PERIODS	AVAILABLE PERIODS	DATA CAPTURE
PM _{2.5}	Eastern	789	792	99.6%
	Western	789	729	99.6%
PM ₁₀	Eastern	788	792	99.5%
	Western	788	792	99.5%
NO, NO ₂	Eastern	757	792	95.6%
	Western	752	792	94.9%
CO	Eastern	757	792	95.6%
	Western	757	792	95.6%

6.2 Results

6.2.1 PM_{2.5}

PM_{2.5} was continuously monitored and 5-minute averages logged. The 5-minute average data was then transformed to 1-hour averages for reporting.

PM_{2.5} (1-hour average) mass rate of emission statistics for the reporting period are given in Table 4. A plot of PM_{2.5} (1-hour average) mass rate of emission for the reporting period is presented in Figure 2.

Table 4 PM_{2.5} Mass Rate Percentiles (1-Hour Average)

STATION	PM _{2.5} MASS RATE (kg/h) (1-HOUR AVERAGE)						
	MAXIMUM	99 TH	98 TH	95 TH	90 TH	75 TH	50 TH
Eastern	0.51	0.31	0.28	0.25	0.21	0.17	0.06
Western	0.28	0.25	0.24	0.21	0.19	0.15	0.06

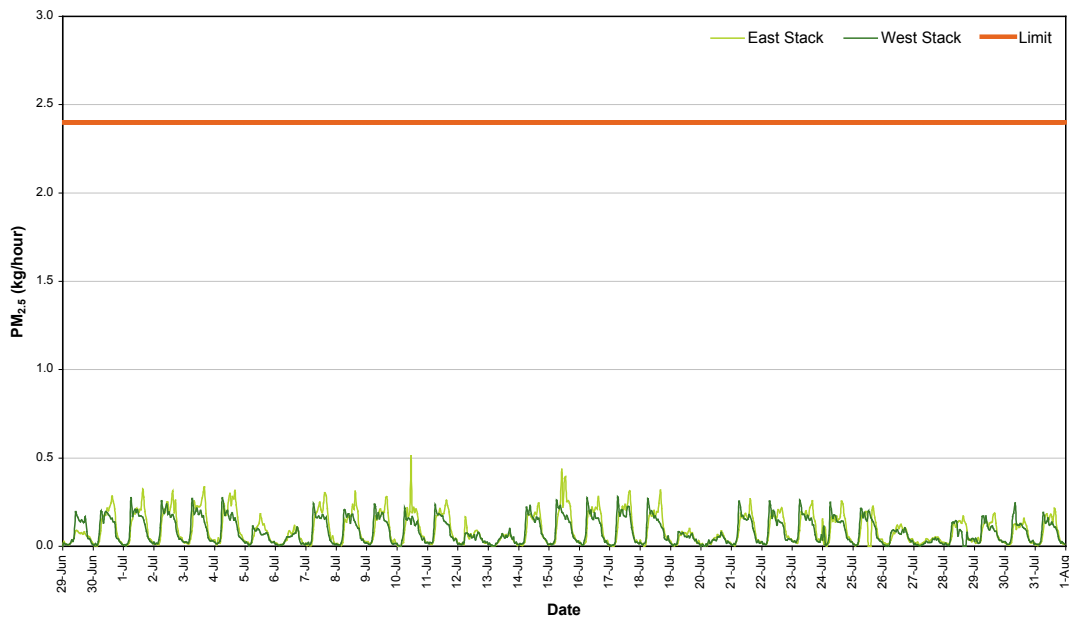


Figure 2 PM_{2.5} Mass Rate (1 Hour Average)

6.2.2 PM₁₀

PM₁₀ was continuously monitored and 5-minute averages logged. The 5-minute average data was then transformed to 1-hour averages for reporting.

PM₁₀ (1-hour average) mass rate of emission statistics for the reporting period are given in Table 5. A plot of PM₁₀ (1-hour average) mass rate of emission for the reporting period is presented in Figure 3.

Table 5 PM₁₀ Mass Rate Percentiles (1-Hour Average)

STATION	PM ₁₀ MASS RATE (kg/h) (1-HOUR AVERAGE)						
	MAXIMUM	99 th	98 th	95 th	90 th	75 th	50 th
Eastern	0.76	0.62	0.52	0.43	0.34	0.25	0.11
Western	1.2	0.59	0.51	0.42	0.34	0.25	0.11

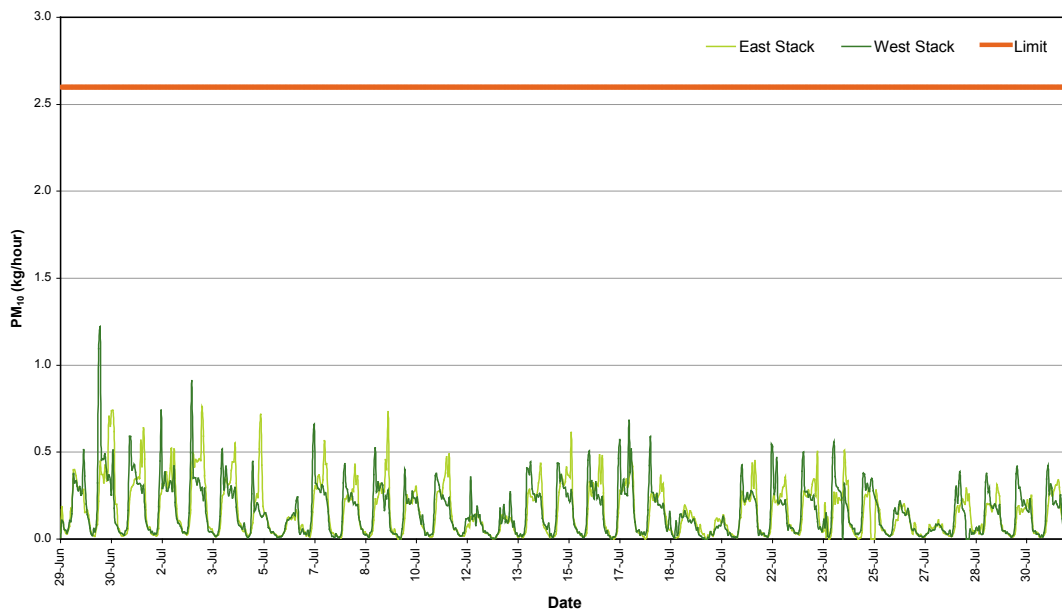


Figure 3 PM₁₀ Mass Rate (1 Hour Average)

6.2.3 Carbon Monoxide

Carbon monoxide (1-hour average) mass rate of emission statistics for the reporting period are given in Table 6. A plot of carbon monoxide (1-hour average) mass rate for the reporting period is presented in Figure 4.

Table 6 Carbon Monoxide Mass Rate Percentiles (1 Hour Average)

STATION	CARBON MONOXIDE MASS RATE (kg/h) (1-HOUR AVERAGE)						
	MAXIMUM	99 th	98 th	95 th	90 th	75 th	50 th
Eastern	76	43	39	35	29	18	12
Western	49	42	39	33	28	22	15

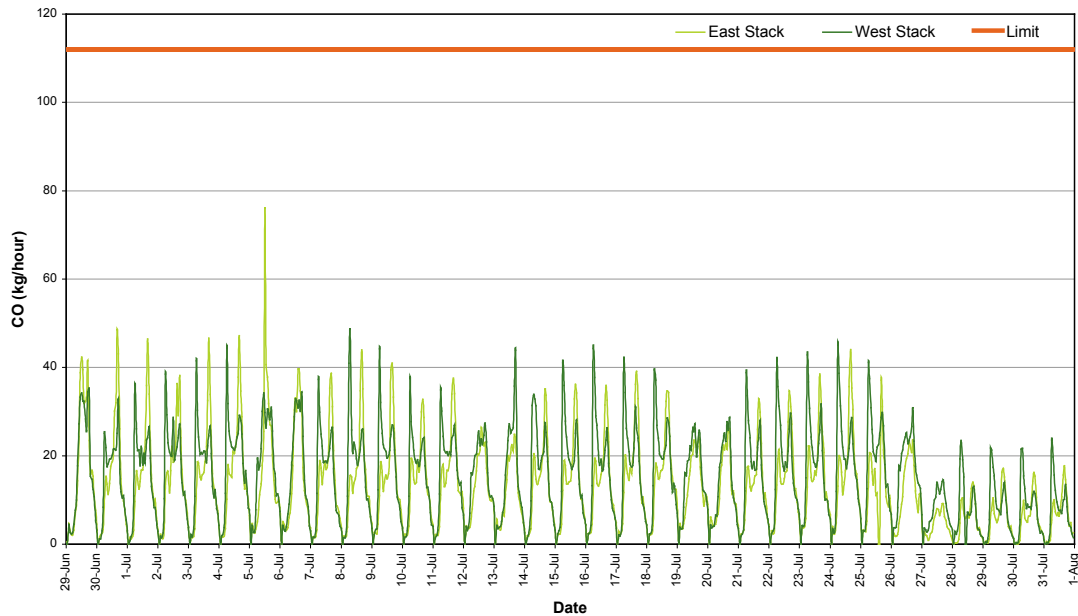


Figure 4 Carbon Monoxide Mass Rate (1 Hour Average)

6.2.4 Oxides Of Nitrogen

6.2.4.1 Nitric Oxide

Nitric oxide (1-hour average) mass rate of emission statistics for the reporting period are given in Table 7. A plot of nitric oxide (1-hour average) mass rate for the reporting period is presented in Figure 5.

Table 7 Nitric Oxide Mass Rate Percentiles (1 Hour Average)

STATION	NITRIC OXIDE MASS RATE (kg/h) (1-HOUR AVERAGE)						
	MAXIMUM	99 th	98 th	95 th	90 th	75 th	50 th
Eastern	5.8	5.4	5.0	4.5	4.0	3.3	2.1
Western	6.0	5.3	4.8	4.1	3.7	3.2	2.1

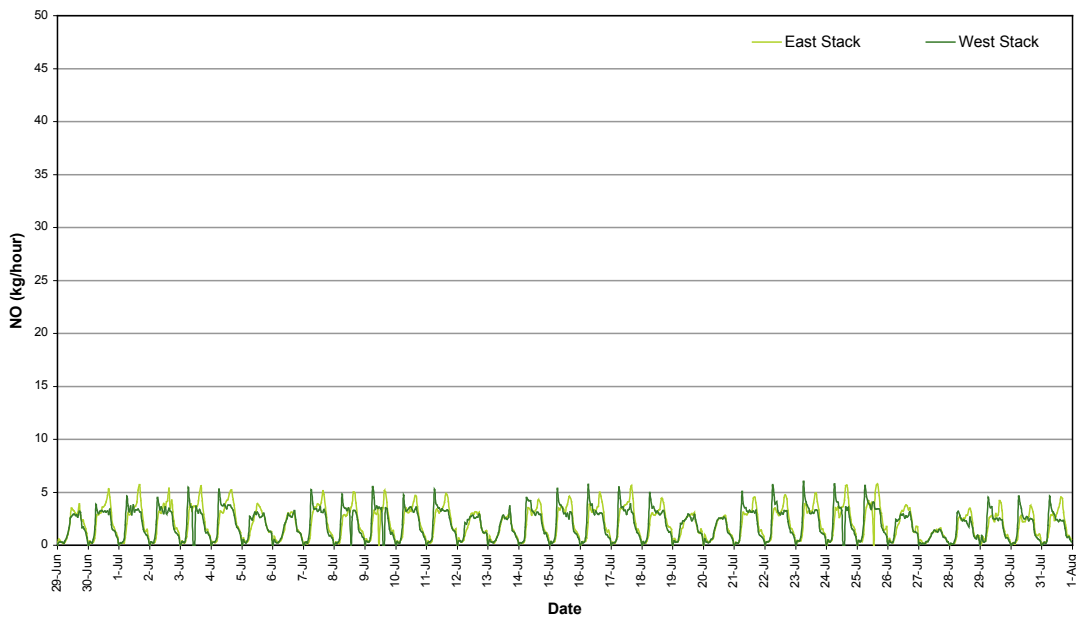


Figure 5 Nitric Oxide Mass Rate (1 Hour Average)

6.2.4.2 Nitrogen Dioxide

Nitrogen dioxide (1-hour average) mass rate of emission statistics for the reporting period are given in Table 8. A plot of nitrogen dioxide (1-hour average) mass rate for the reporting period is presented in Figure 6.

Table 8 Nitrogen Dioxide Mass Rate Percentiles (1-Hour Average)

STATION	NITROGEN DIOXIDE MASS RATE (kg/h) (1-HOUR AVERAGE)						
	MAXIMUM	99 th	98 th	95 th	90 th	75 th	50 th
Eastern	0.43	0.39	0.37	0.32	0.28	0.23	0.14
Western	0.47	0.38	0.37	0.33	0.31	0.27	0.18

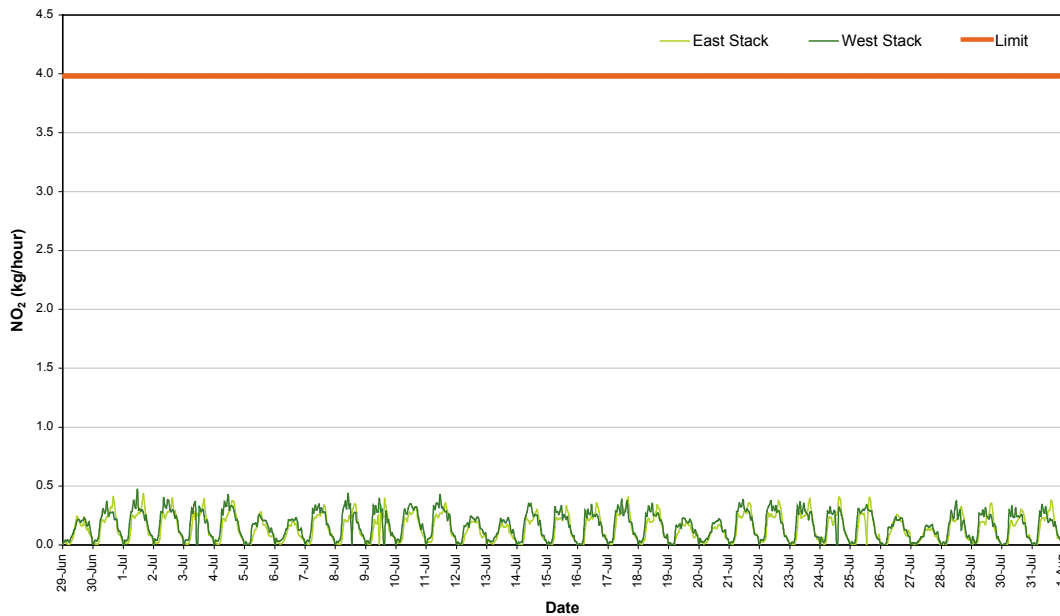


Figure 6 Nitrogen Dioxide Mass Rate (1 Hour Average)

6.2.5 Stack Velocity

The stack velocity (1 hour average) plot for the reporting period is presented in Figure 7.

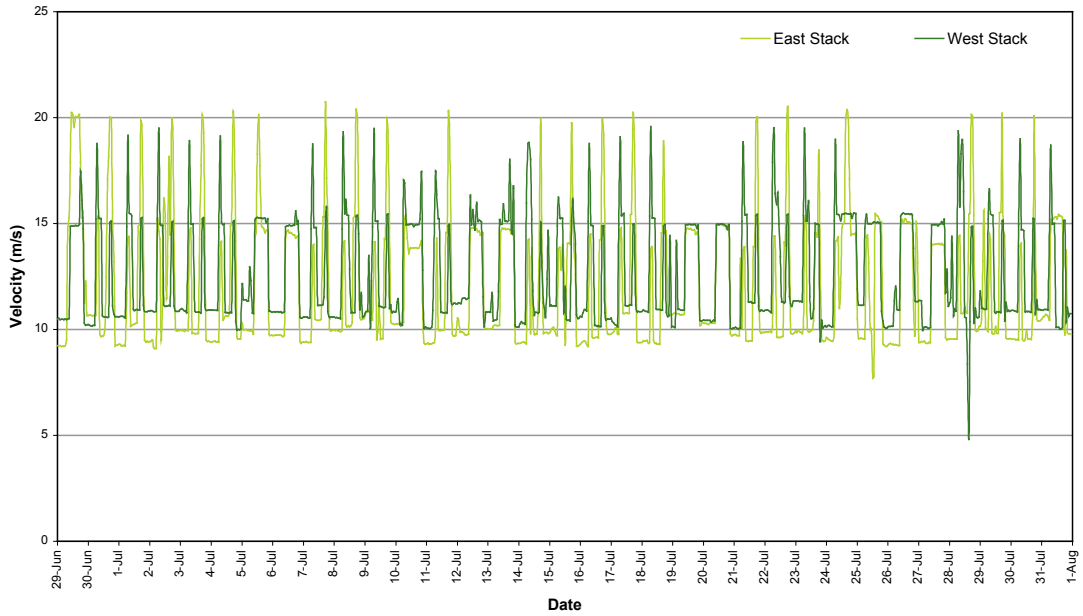


Figure 7 Stack Velocity (1 Hour Average)

7.0 Ventilation Stack Emission Monitoring Period: 01/08/2008 – 31/08/2008

7.1 Data Capture

Data capture is defined as the number of valid data periods collected divided by the number of available data periods. Valid data excludes periods where the instrument is unavailable due to calibration and maintenance and excludes periods where the data has been rejected due to quality assurance/data validation procedures.

The data capture statistics for the reporting period 1st August to 31st August 2008 are shown in Table 9. Averages were only collected for those periods where the 5-minute data constituted 75% data capture.

Table 9 Data Capture Statistics – 1 hour Averages

PARAMETER	STATION	COLLECTED PERIODS	AVAILABLE PERIODS	DATA CAPTURE
PM _{2.5}	Eastern	739	744	99.3%
	Western	743	744	99.9%
PM ₁₀	Eastern	744	744	100.0%
	Western	744	744	100.0%
NO, NO ₂	Eastern	709	744	95.3%
	Western	713	744	95.8%
CO	Eastern	711	744	95.6%
	Western	713	744	95.8%

7.2 Results

7.2.1 PM_{2.5}

PM_{2.5} was continuously monitored and 5-minute averages logged. The 5-minute average data was then transformed to 1-hour averages for reporting.

PM_{2.5} (1-hour average) mass rate of emission statistics for the reporting period are given in Table 10. A plot of PM_{2.5} (1-hour average) mass rate of emission for the reporting period is presented in Figure 8.

Table 10 PM_{2.5} Mass Rate Percentiles (1-Hour Average)

STATION	PM _{2.5} MASS RATE (kg/h) (1-HOUR AVERAGE)						
	MAXIMUM	99 TH	98 TH	95 TH	90 TH	75 TH	50 TH
Eastern	0.45	0.22	0.19	0.16	0.15	0.11	0.04
Western	0.32	0.22	0.20	0.18	0.15	0.11	0.04

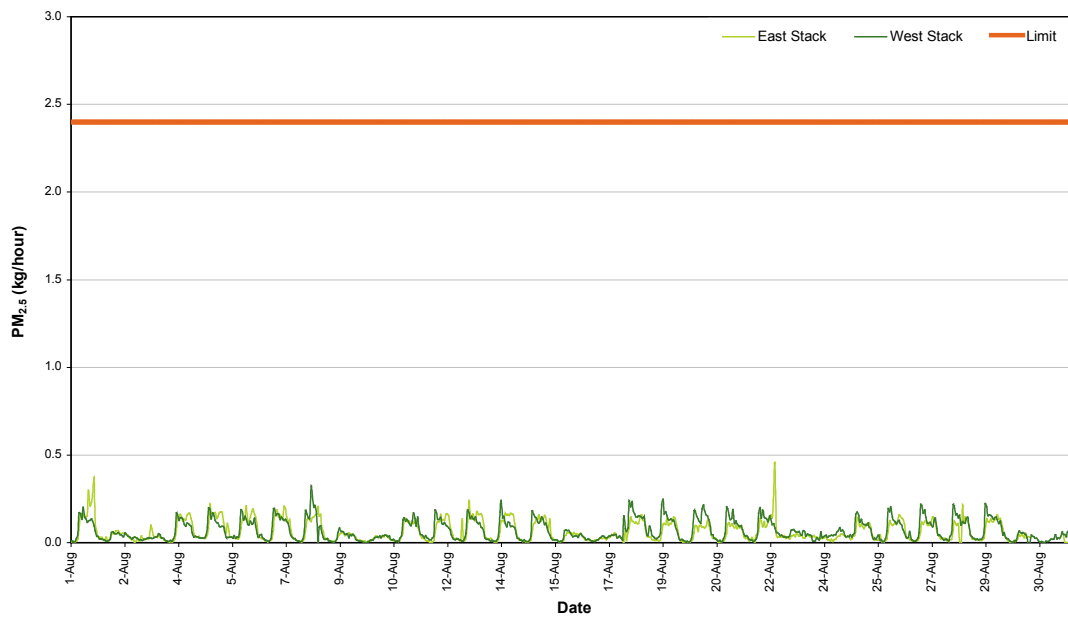


Figure 8 PM_{2.5} Mass Rate (1 Hour Average)

7.2.2 PM₁₀

PM₁₀ was continuously monitored and 5-minute averages logged. The 5-minute average data was then transformed to 1-hour averages for reporting.

PM₁₀ (1-hour average) mass rate of emission statistics for the reporting period are given in Table 11. A plot of PM₁₀ (1-hour average) mass rate of emission for the reporting period is presented in Figure 9.

Table 11 PM₁₀ Mass Rate Percentiles (1-Hour Average)

STATION	PM ₁₀ MASS RATE (kg/h) (1-HOUR AVERAGE)						
	MAXIMUM	99 th	98 th	95 th	90 th	75 th	50 th
Eastern	0.50	0.32	0.30	0.25	0.23	0.17	0.06
Western	0.74	0.50	0.40	0.29	0.23	0.17	0.07

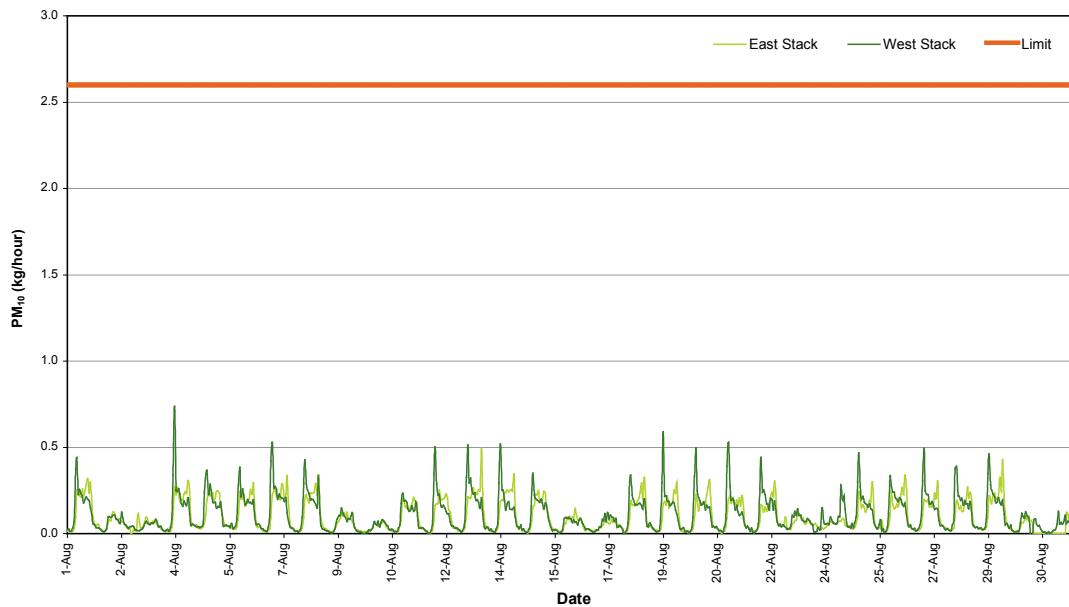


Figure 9 PM₁₀ Mass Rate (1 Hour Average)

7.2.3 Carbon Monoxide

Carbon monoxide (1-hour average) mass rate of emission statistics for the reporting period are given in Table 12. A plot of carbon monoxide (1-hour average) mass rate for the reporting period is presented in Figure 10.

Table 12 Carbon Monoxide Mass Rate Percentiles (1 Hour Average)

STATION	CARBON MONOXIDE MASS RATE (kg/h) (1-HOUR AVERAGE)						
	MAXIMUM	99 th	98 th	95 th	90 th	75 th	50 th
Eastern	22	20	19	17	13	9	7
Western	31	26	25	21	16	12	9

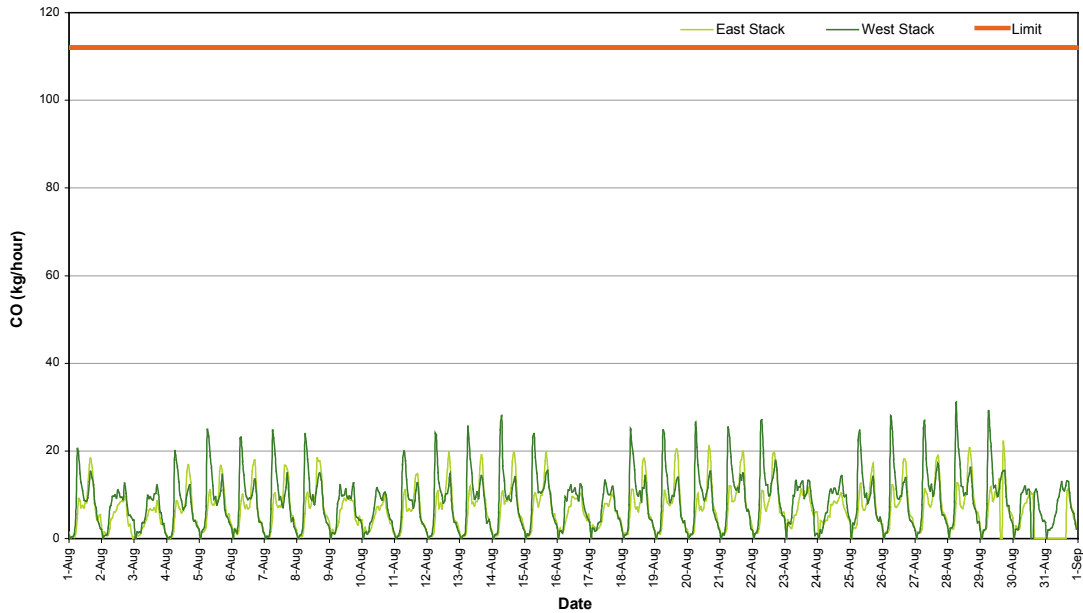


Figure 10 Carbon Monoxide Mass Rate (1 Hour Average)

7.2.4 Oxides Of Nitrogen

7.2.4.1 Nitric Oxide

Nitric oxide (1-hour average) mass rate of emission statistics for the reporting period are given in Table 13. A plot of nitric oxide (1-hour average) mass rate for the reporting period is presented in Figure 11.

Table 13 Nitric Oxide Mass Rate Percentiles (1 Hour Average)

STATION	NITRIC OXIDE MASS RATE (kg/h) (1-HOUR AVERAGE)						
	MAXIMUM	99 th	98 th	95 th	90 th	75 th	50 th
Eastern	4.4	3.8	3.7	3.3	2.8	2.4	1.3
Western	5.3	4.9	4.7	4.0	3.4	2.6	1.6

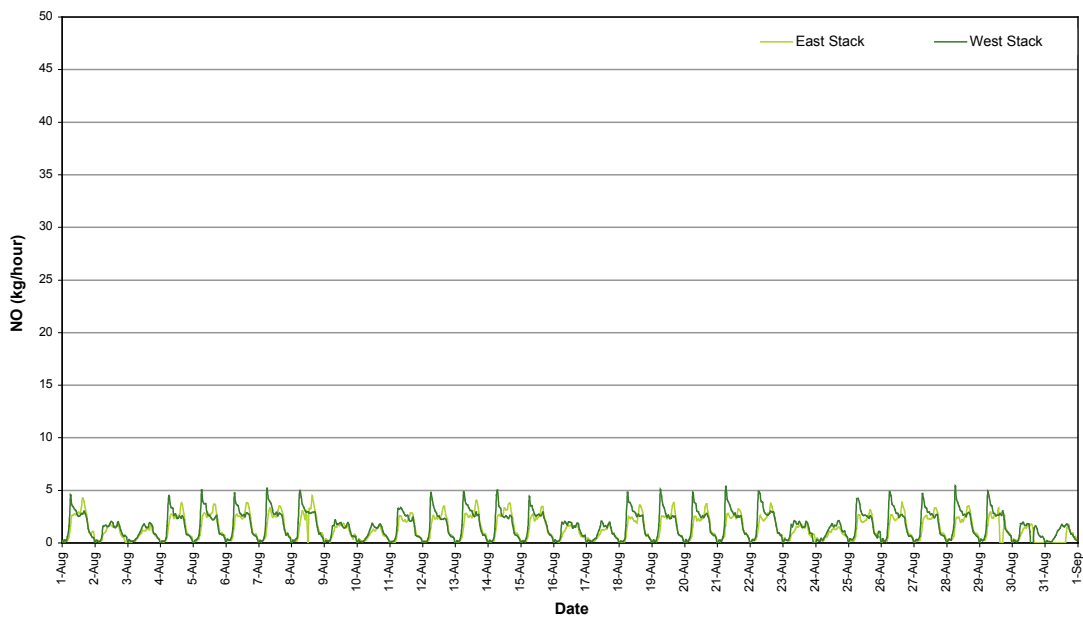


Figure 11 Nitric Oxide Mass Rate (1 Hour Average)

7.2.4.2 Nitrogen Dioxide

Nitrogen dioxide (1-hour average) mass rate of emission statistics for the reporting period are given in Table 14. A plot of nitrogen dioxide (1-hour average) mass rate for the reporting period is presented in Figure 12.

Table 14 Nitrogen Dioxide Mass Rate Percentiles (1-Hour Average)

STATION	NITROGEN DIOXIDE MASS RATE (kg/h) (1-HOUR AVERAGE)						
	MAXIMUM	99 th	98 th	95 th	90 th	75 th	50 th
Eastern	0.36	0.31	0.29	0.27	0.23	0.19	0.10
Western	0.45	0.39	0.38	0.33	0.30	0.26	0.17

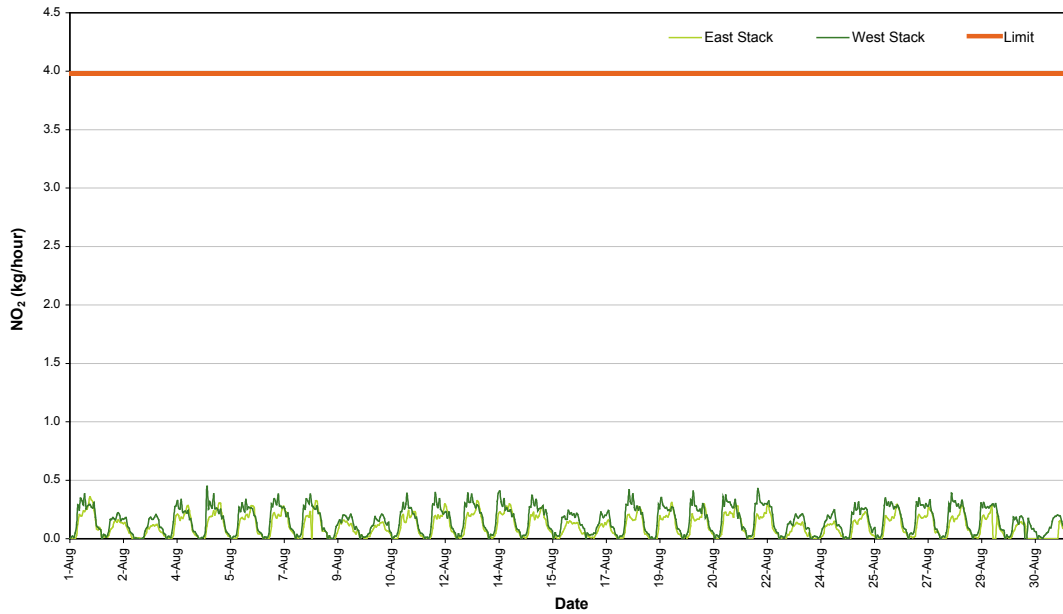


Figure 12 Nitrogen Dioxide Mass Rate (1 Hour Average)

7.2.5 Stack Velocity

The stack velocity (1 hour average) plot for the reporting period is presented in Figure 13.

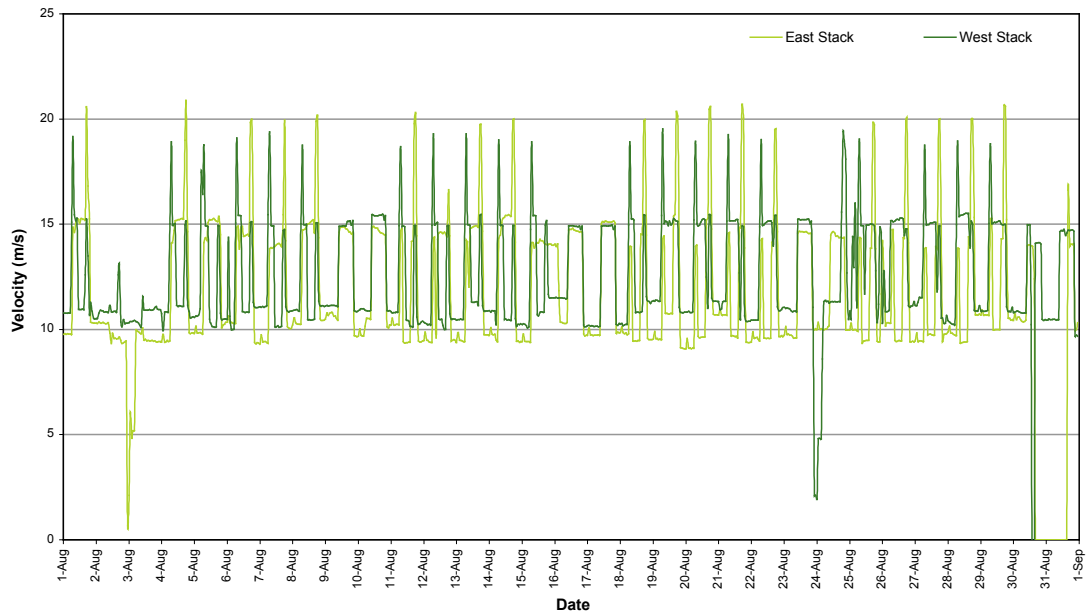


Figure 13 Stack Velocity (1 Hour Average)

8.0 Ventilation Stack Emission Monitoring Period: 01/09/2008 – 30/09/2008

8.1 Data Capture

Data capture is defined as the number of valid data periods collected divided by the number of available data periods. Valid data excludes periods where the instrument is unavailable due to calibration and maintenance and excludes periods where the data has been rejected due to quality assurance/data validation procedures.

The data capture statistics for the reporting period 1st September to 30th September 2008 are shown in Table 15. Averages were only collected for those periods where the 5-minute data constituted 75% data capture.

Table 15 Data Capture Statistics – 1 hour Averages

PARAMETER	STATION	COLLECTED PERIODS	AVAILABLE PERIODS	DATA CAPTURE
PM _{2.5}	Eastern	698	720	96.9%
	Western	716	720	99.4%
PM ₁₀	Eastern	718	720	99.7%
	Western	716	720	99.4%
NO, NO ₂	Eastern	688	720	95.6%
	Western	689	720	95.7%
CO	Eastern	688	720	95.6%
	Western	688	720	95.6%

8.2 Results

8.2.1 PM_{2.5}

PM_{2.5} was continuously monitored and 5-minute averages logged. The 5-minute average data was then transformed to 1-hour averages for reporting.

PM_{2.5} (1-hour average) mass rate of emission statistics for the reporting period are given in Table 16. A plot of PM_{2.5} (1-hour average) mass rate of emission for the reporting period is presented in Figure 14.

Table 16 PM_{2.5} Mass Rate Percentiles (1-Hour Average)

STATION	PM _{2.5} MASS RATE (kg/h) (1-HOUR AVERAGE)						
	MAXIMUM	99 TH	98 TH	95 TH	90 TH	75 TH	50 TH
Eastern	0.25	0.19	0.18	0.16	0.14	0.11	0.04
Western	0.22	0.21	0.20	0.18	0.14	0.11	0.04

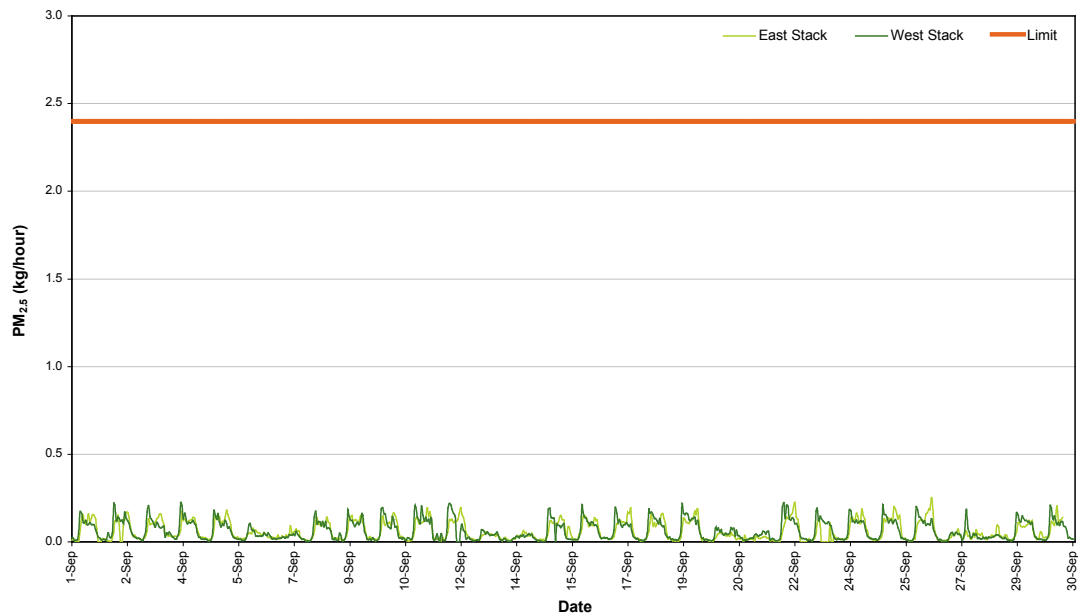


Figure 14 PM_{2.5} Mass Rate (1 Hour Average)

8.2.2 PM₁₀

PM₁₀ was continuously monitored and 5-minute averages logged. The 5-minute average data was then transformed to 1-hour averages for reporting.

PM₁₀ (1-hour average) mass rate of emission statistics for the reporting period are given in Table 17. A plot of PM₁₀ (1-hour average) mass rate of emission for the reporting period is presented in Figure 15.

Table 17 PM₁₀ Mass Rate Percentiles (1-Hour Average)

STATION	PM ₁₀ MASS RATE (kg/h) (1-HOUR AVERAGE)						
	MAXIMUM	99 th	98 th	95 th	90 th	75 th	50 th
Eastern	0.56	0.37	0.32	0.27	0.23	0.16	0.06
Western	0.70	0.49	0.41	0.32	0.23	0.17	0.07

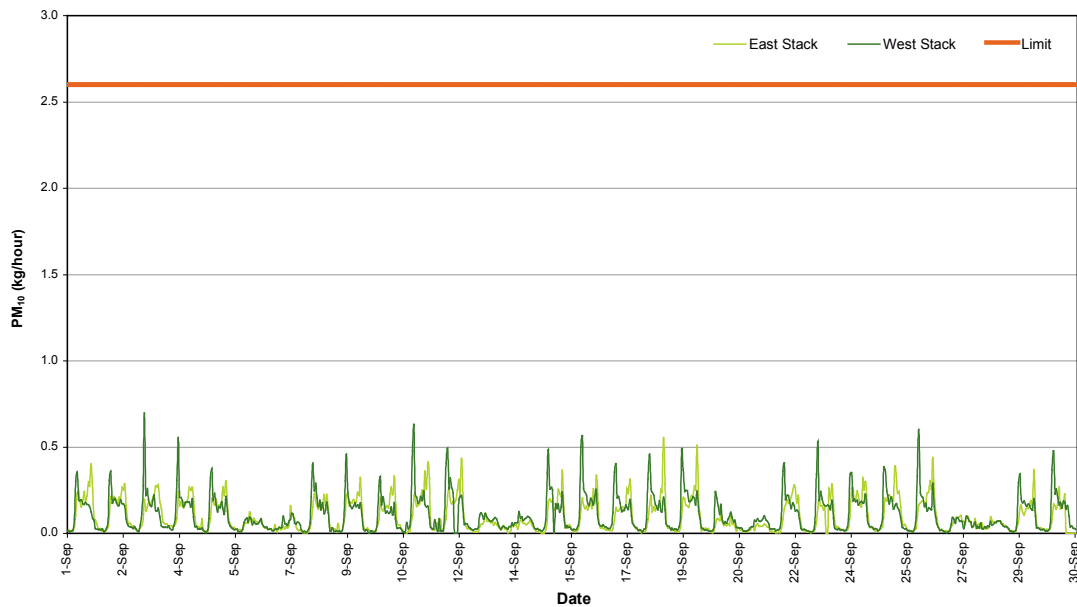


Figure 15 PM₁₀ Mass Rate (1 Hour Average)

8.2.3 Carbon Monoxide

Carbon monoxide (1-hour average) mass rate of emission statistics for the reporting period are given in Table 18. A plot of carbon monoxide (1-hour average) mass rate for the reporting period is presented in Figure 16.

Table 18 Carbon Monoxide Mass Rate Percentiles (1 Hour Average)

STATION	CARBON MONOXIDE MASS RATE (kg/h) (1-HOUR AVERAGE)						
	MAXIMUM	99 th	98 th	95 th	90 th	75 th	50 th
Eastern	22	21	19	17	13	9	6
Western	30	27	25	19	15	11	8

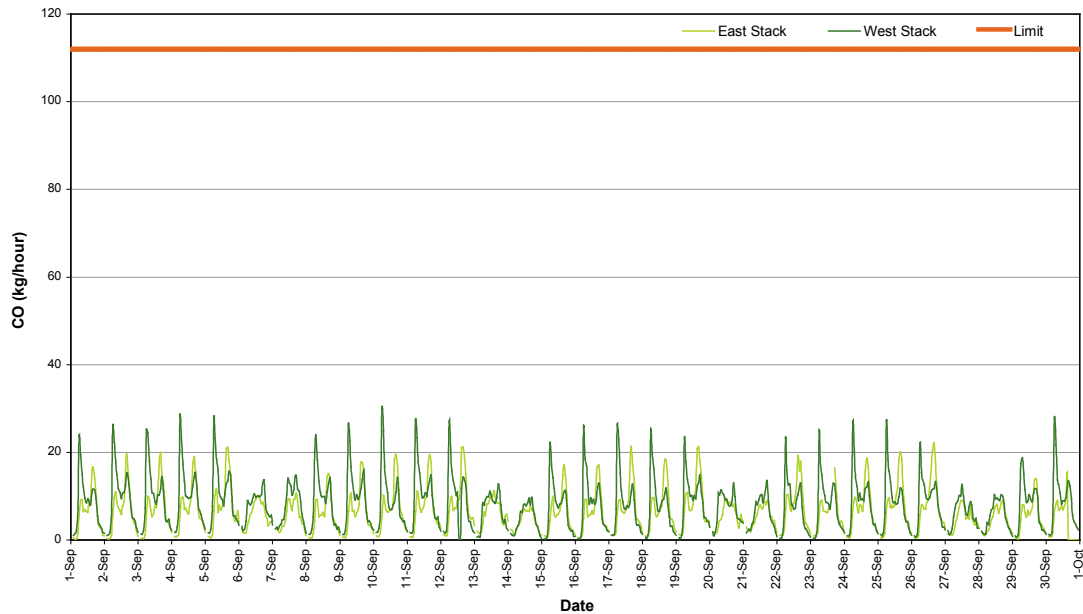


Figure 16 Carbon Monoxide Mass Rate (1 Hour Average)

8.2.4 Oxides Of Nitrogen

8.2.4.1 Nitric Oxide

Nitric oxide (1-hour average) mass rate of emission statistics for the reporting period are given in Table 19. A plot of nitric oxide (1-hour average) mass rate for the reporting period is presented in Figure 17.

Table 19 Nitric Oxide Mass Rate Percentiles (1 Hour Average)

STATION	NITRIC OXIDE MASS RATE (kg/h) (1-HOUR AVERAGE)						
	MAXIMUM	99 th	98 th	95 th	90 th	75 th	50 th
Eastern	4.3	3.9	3.8	3.4	2.8	2.3	1.2
Western	5.2	4.8	4.6	3.5	3.0	2.3	1.4

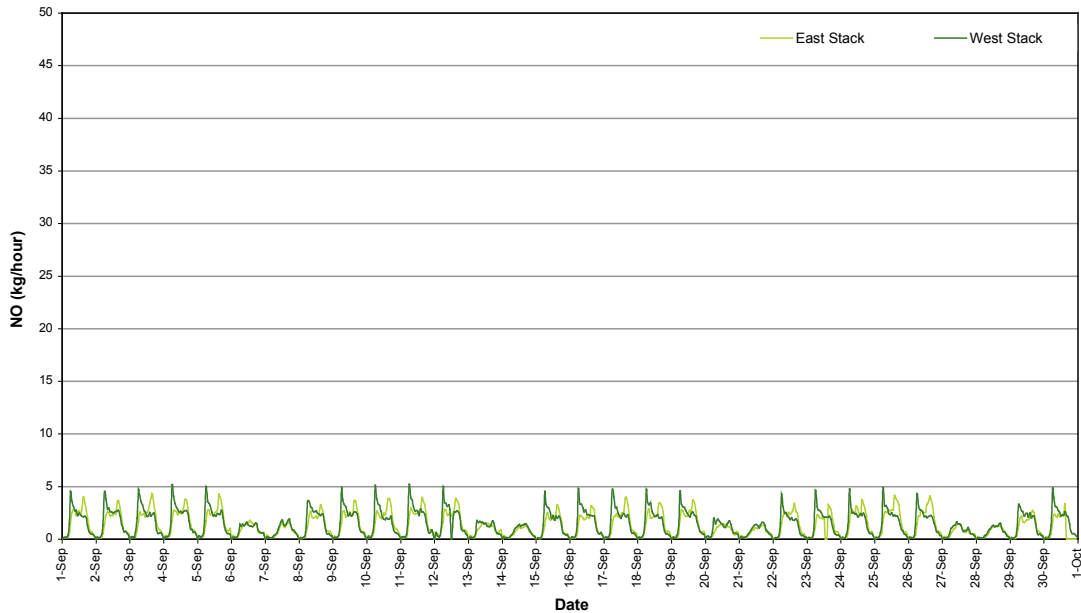


Figure 17 Nitric Oxide Mass Rate (1 Hour Average)

8.2.4.2 Nitrogen Dioxide

Nitrogen dioxide (1-hour average) mass rate of emission statistics for the reporting period are given in Table 20. A plot of nitrogen dioxide (1-hour average) mass rate for the reporting period is presented in Figure 18.

Table 20 Nitrogen Dioxide Mass Rate Percentiles (1-Hour Average)

STATION	NITROGEN DIOXIDE MASS RATE (kg/h) (1-HOUR AVERAGE)						
	MAXIMUM	99 th	98 th	95 th	90 th	75 th	50 th
Eastern	0.36	0.33	0.31	0.27	0.23	0.18	0.10
Western	0.42	0.34	0.32	0.28	0.25	0.18	0.12

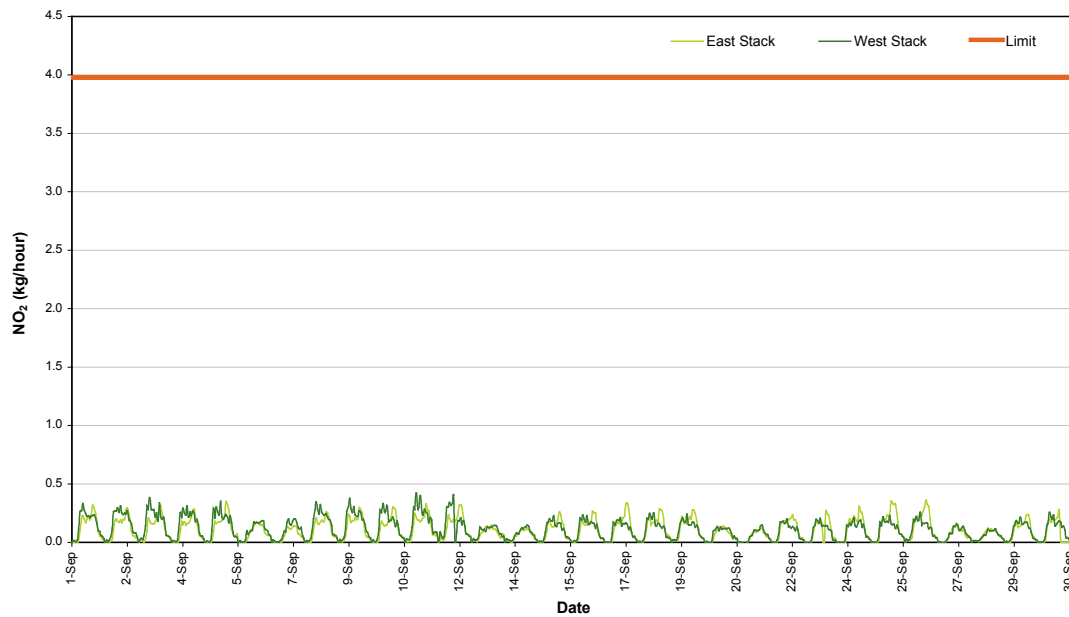


Figure 18 Nitrogen Dioxide Mass Rate (1 Hour Average)

8.2.5 Stack Velocity

The stack velocity (1 hour average) plot for the reporting period is presented in Figure 19.

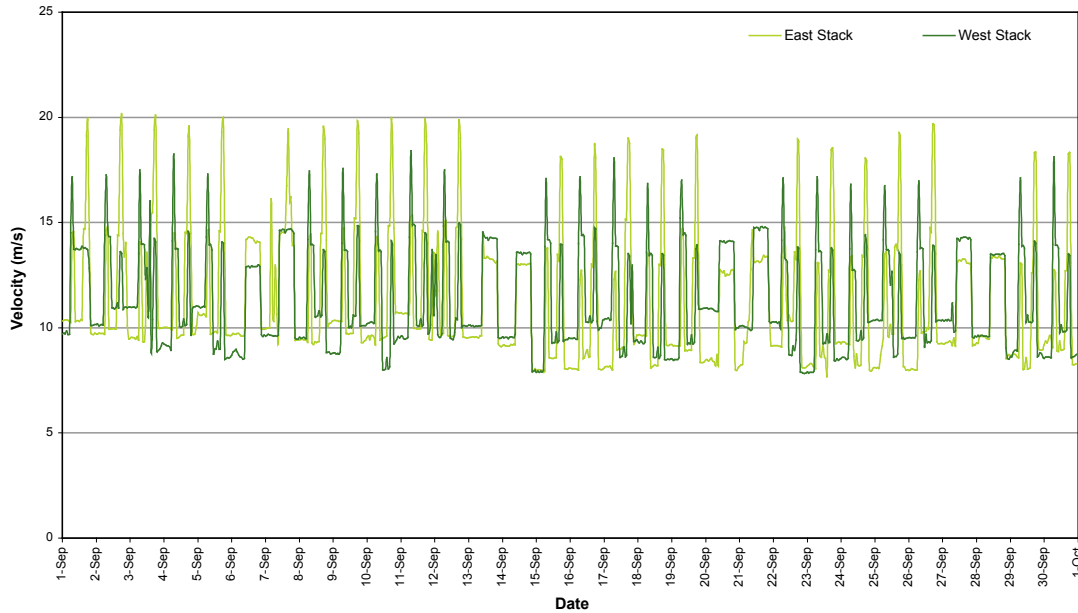


Figure 19 Stack Velocity (1 Hour Average)

9.0 Discussion

9.1 Comparison with Licence Limits

EastLink emissions to air from the road tunnel ventilation stacks DP1 and DP2 are subject to the licence requirements contained in Environment Protection Authority (Victoria) Waste Discharge Licence No. EA 63607.

The maximum measured 1 hour average mass rate for each parameter is compared with the applicable licence limit in Table 21.

Table 21 Maximum (1 Hour Average) Mass Rate (29/06/2008 – 30/09/2008)

DISCHARGE POINT NO.	DISCHARGE DESCRIPTION	COMPOUND	MASS RATE ((kg/h)	LICENCE LIMIT (kg/h)
1	Western ventilation stack	PM _{2.5}	0.32	2.4
		PM ₁₀	1.2	2.6
		NO ₂	0.47	3.98
		CO	49	112
2	Eastern ventilation stack	PM _{2.5}	0.51	2.4
		PM ₁₀	0.76	2.6
		NO ₂	0.43	3.98
		CO	76	112

There were no exceedences of the licence limits for DP1 and DP2 during the reporting period.