October 2009

TRANSFIELD SERVICES PTY. LTD., RINGWOOD, VICTORIA

EastLink Ventilation Stack Emission Monitoring Report July-September 2009

Submitted to:
Transfield Services Pty. Ltd.

REPORT

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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, commisioned Golder Associates Pty. Ltd. {trading as 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 1st July, 2009 to 30th September, 2009 inclusive are contained in the following report.

Your attention is drawn to the document - "Limitations", which is included in Attachment A of this report. The statements presented in this document are intended to advise you of what your realistic expectations of this report should be. The document is not intended to reduce the level of responsibility accepted by Golder, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

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 (PM_{10});
- Total oxides of nitrogen (NO_x);
- Nitric oxide (NO);
- Nitrogen dioxide (NO_2);
- 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 (PM_{10} WINS head fitted with a $PM_{2.5}$ sharp cut cyclone (SCC)) at 1 m^3/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 – PM_{10} Continuous Direct Mass Method Using a Tapered Element Oscillating Microbalance Analyser"*.

4.2 PM_{10}

PM_{10} 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_{10} size selective inlet (PM_{10} WINS head) at 1 m^3/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_{10} 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 – PM_{10} 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, NO_2 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

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: 01/07/2009 – 31/07/2009

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 1st July to 31st July, 2009 are shown in Table 3. Averages were only collected for those periods where the 5-minute data constituted 75% data capture.

Section 6.3 provides further information on the reasons for invalid data periods.

Table 3: Data Capture Statistics - 1 Hour Averages

Parameter	Station	Collected Periods	Available Periods	Data Capture
$PM_{2.5}$	Eastern	738	744	99.2%
	Western	738	744	99.2%
PM_{10}	Eastern	738	744	99.2%
	Western	741	744	99.6%
NO, NO_2	Eastern	705	744	94.8%
	Western	673	744	90.5%
CO	Eastern	670	744	90.1%
	Western	706	744	94.9%

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	99th	98th	95th	90th	75th	50th
Eastern	0.46	0.24	0.18	0.16	0.14	0.11	0.04
Western	0.32	0.22	0.21	0.17	0.14	0.11	0.04

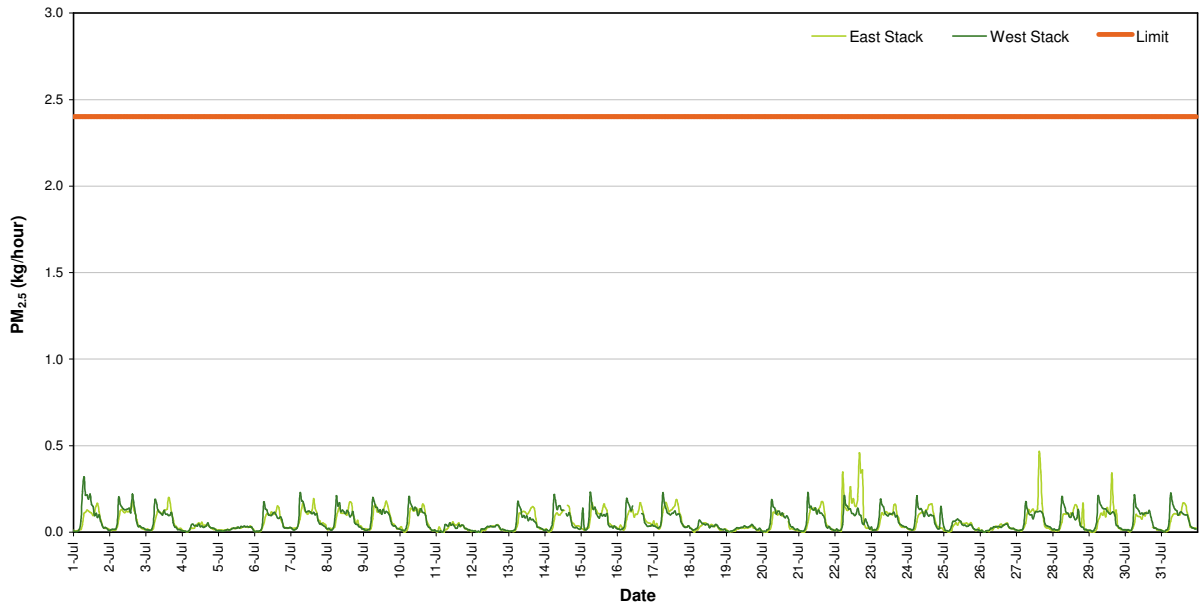

Figure 2: $PM_{2.5}$ Mass Rate (1 Hour Average)

6.2.2 PM_{10}

PM_{10} was continuously monitored and 5 minute averages logged. The 5 minute average data was then transformed to 1 hour averages for reporting.

PM_{10} (1 hour average) mass rate of emission statistics for the reporting period are given in Table 5. A plot of PM_{10} (1 hour average) mass rate of emission for the reporting period is presented in Figure 3.

Table 5: PM_{10} Mass Rate Percentiles (1 Hour Average)

Station	PM_{10} Mass Rate (kg/h) (1-Hour Average)						
	Maximum	99th	98th	95th	90th	75th	50th
Eastern	0.54	0.33	0.28	0.24	0.20	0.16	0.06
Western	0.45	0.36	0.33	0.26	0.22	0.15	0.06

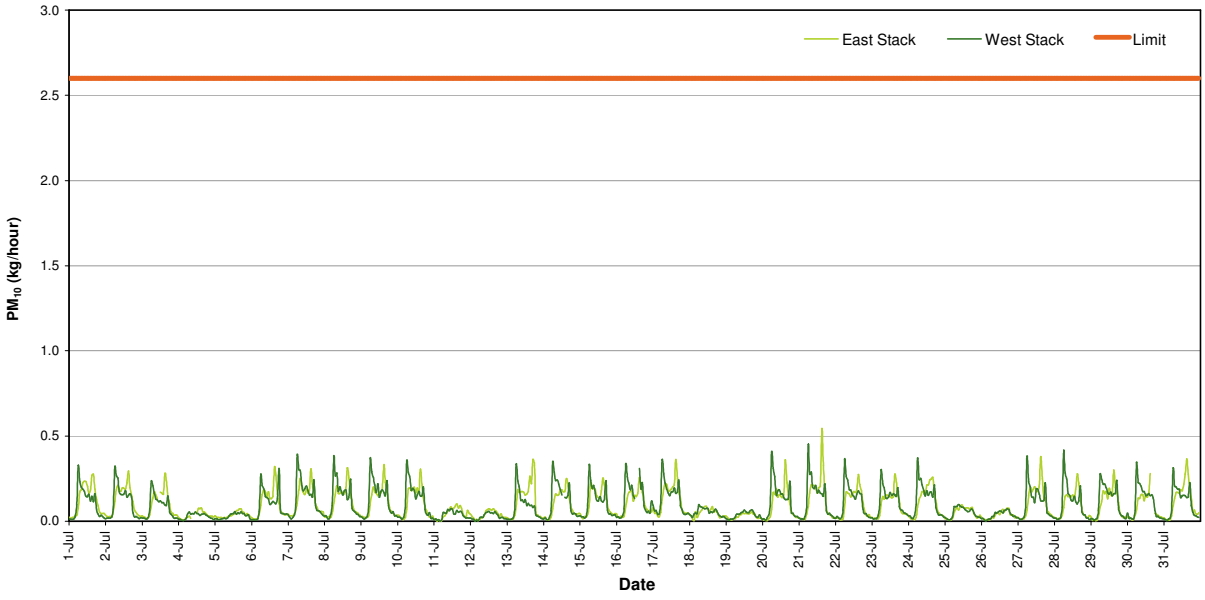

Figure 3: PM_{10} Mass Rate (1 Hour Average)

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	99th	98th	95th	90th	75th	50th
Eastern	27	22	21	19	15	10	6.8
Western	31	25	24	20	16	11	7.9

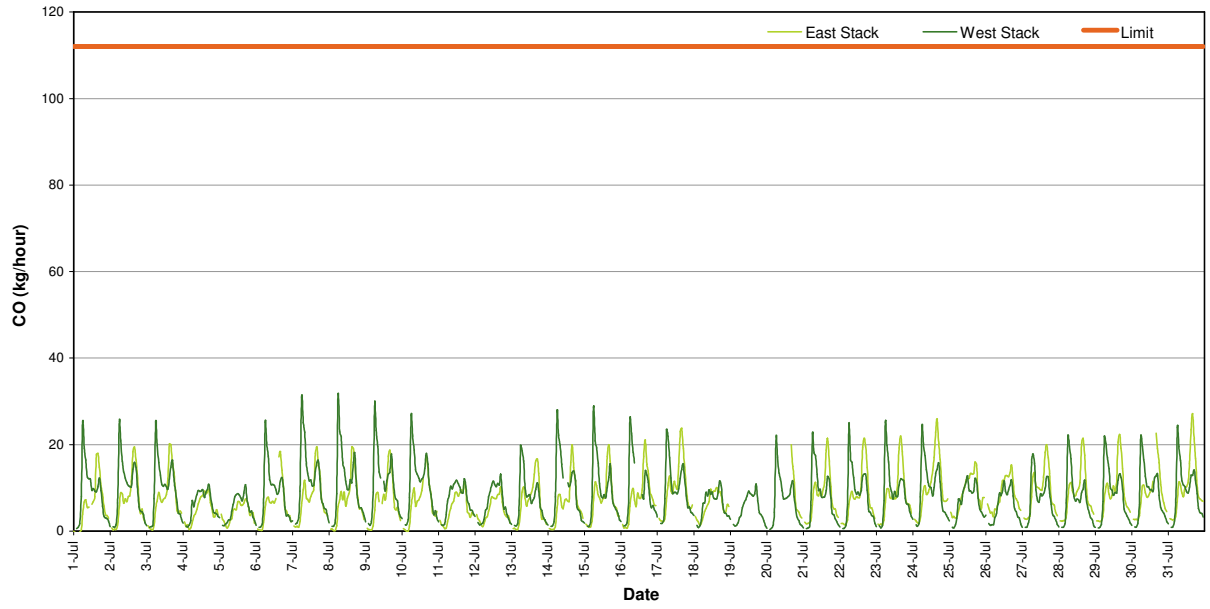

Figure 4: Carbon Monoxide Mass Rate (1 Hour Average)

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 Percentile (1 Hour Average)

Station	Nitric Oxide Concentration (ppm) (1-Hour Average)						
	Maximum	99th	98th	95th	90th	75th	50th
Eastern	4.5	4.1	3.8	3.4	2.9	2.3	1.3
Western	10	8.1	7.3	5.8	5.0	3.1	1.9

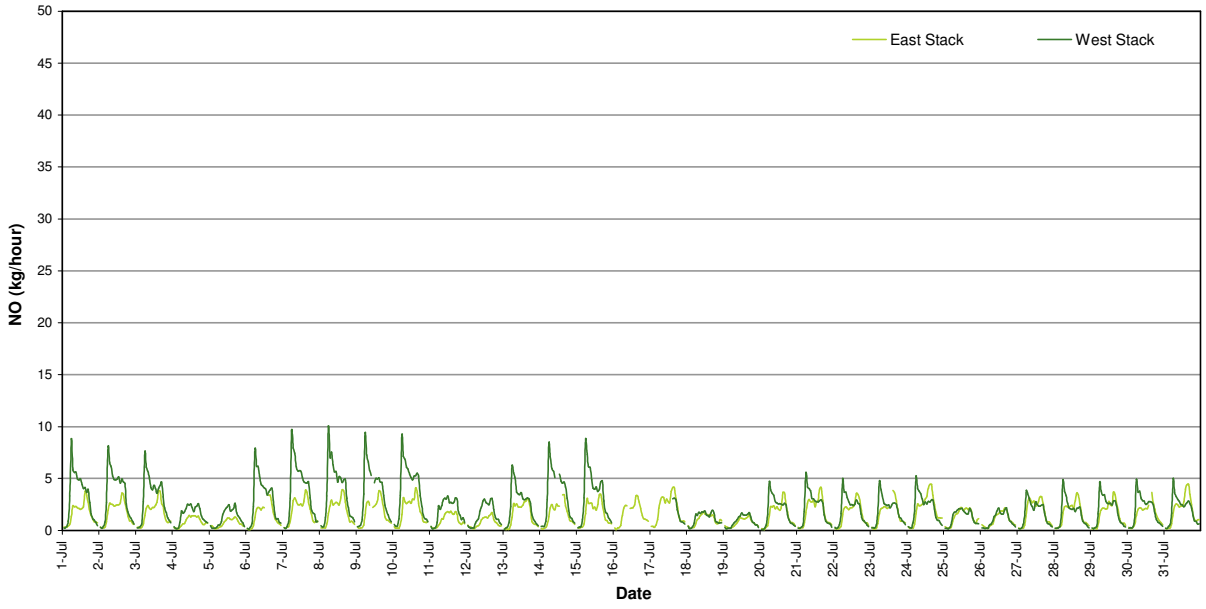

Figure 5: Nitric Oxide Mass Rate (1 Hour Average)

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	99th	98th	95th	90th	75th	50th
Eastern	0.5	0.4	0.4	0.3	0.3	0.2	0.1
Western	1.3	1.1	1.0	0.8	0.7	0.4	0.2

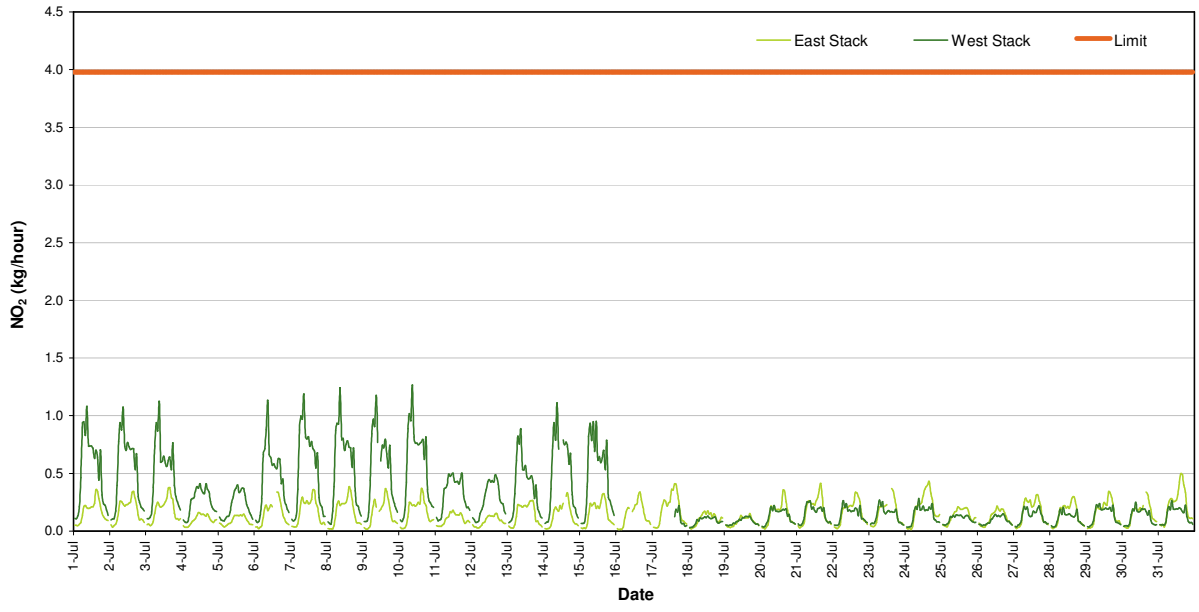

Figure 6: Nitrogen Dioxide Mass Rate (1 Hour Average)

6.2.5 Stack Velocity

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

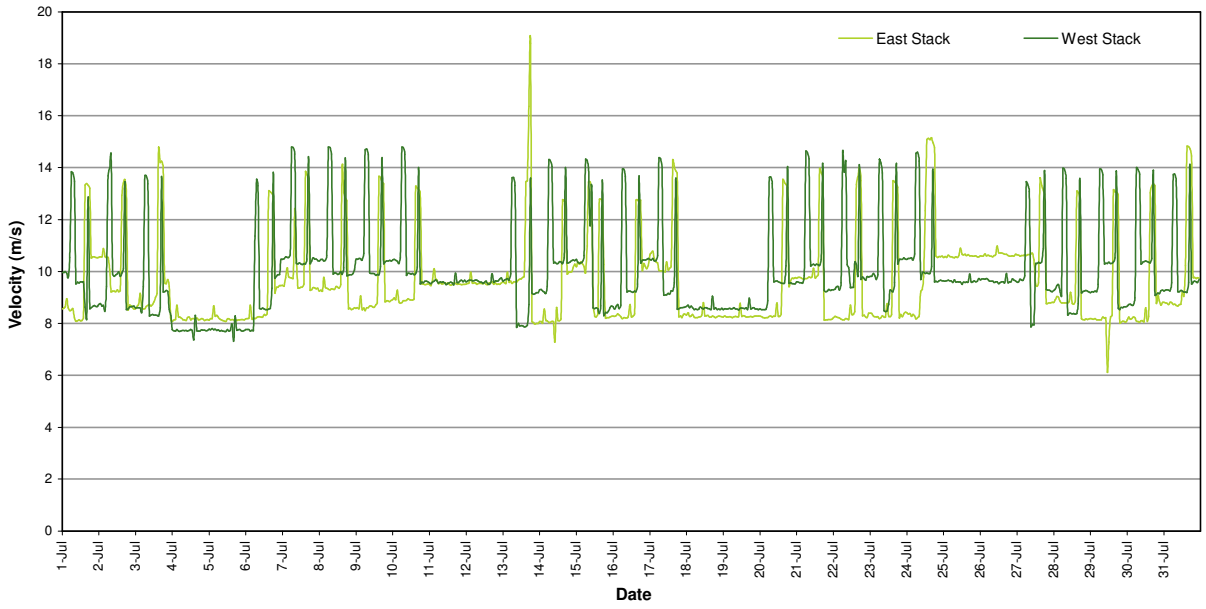

Figure 7: Stack Velocity (1 Hour Average)

6.3 Data Validation and Exception

Data contained in the report has been validated against performance and calibration requirements for each instrument. Data during maintenance and calibration periods has been removed from the validated data sets. Tables 9 and 10 list the data exceptions for the eastern and western ventilation stacks respectively. Data during automatic calibrations of the gaseous atmospheric contaminants has also been removed from the data sets.

Table 9: Date Exceptions - Eastern Ventilation Stack: July 2009

Eastern Ventilation Stack			
Start	**End**	**Parameter**	**Reason**
1/07/2009 11:40	1/07/2009 12:10	CO	Maintenance/calibration
3/07/2009 11:30	3/07/2009 12:00	PM_{10}	Invalid data[1]
4/07/2009 9:00	4/07/2009 11:45	PM_{10}	Invalid data[1]
6/07/2009 13:35	6/07/2009 14:15	NO, NO_2, NO_x	Maintenance/calibration
6/07/2009 13:50	6/07/2009 14:15	CO	Maintenance/calibration
9/07/2009 9:55	9/07/2009 11:00	NO, NO_2, NO_x	Maintenance/calibration
10/07/2009 15:20	10/07/2009 15:35	CO	Maintenance/calibration
14/07/2009 14:00	14/07/2009 15:00	NO, NO_2, NO_x	Maintenance/calibration
14/07/2009 14:35	14/07/2009 15:05	$PM_{2.5}$	Maintenance/calibration
16/07/2009 10:35	16/07/2009 10:50	NO, NO_2, NO_x	Maintenance/calibration
17/07/2009 12:55	17/07/2009 13:05	NO, NO_2, NO_x	Maintenance/calibration
19/07/2009 3:00	20/07/2009 15:45	CO	Invalid data - span drift[1]
20/07/2009 15:40	20/07/2009 16:40	$PM_{2.5}$	Maintenance/calibration
23/07/2009 13:00	23/07/2009 14:20	NO, NO_2, NO_x	Maintenance/calibration
30/07/2009 15:15	30/07/2009 15:35	NO, NO_2, NO_x	Maintenance/calibration
30/07/2009 15:35	30/07/2009 15:55	CO	Maintenance/calibration
30/07/2009 15:20	30/07/2009 17:55	$PM_{2.5}$	Maintenance/calibration
30/07/2009 16:20	30/07/2009 17:40	PM_{10}	Maintenance/calibration

Note:

[1] In the opinion of the data reviewer.

Table 10: Data Exceptions - Western Ventilation Stack: July 2009

Western Ventilation Stack			
Start	**End**	**Parameter**	**Reason**
9/07/2009 11:30	9/07/2009 12:00	NO, NO_2, NO_x	Instrument out of service
9/07/2009 11:35	9/07/2009 12:00	CO	Maintenance/calibration
14/07/2009 10:55	14/07/2009 13:10	NO, NO_2, NO_x	Maintenance/calibration
14/07/2009 10:55	14/07/2009 12:15	CO	Maintenance/calibration
14/07/2009 13:00	14/07/2009 13:40	$PM_{2.5}$	Maintenance/calibration
14/07/2009 13:15	14/07/2009 14:00	PM_{10}	Maintenance/calibration
16/07/2009 3:00	16/07/2009 23:55	NO, NO_2, NO_x	Invalid data - span drift[1]
16/07/2009 9:50	16/07/2009 13:40	CO	Maintenance/calibration
16/07/2009 11:25	16/07/2009 15:45	$PM_{2.5}$	Maintenance/calibration
16/07/2009 13:05	16/07/2009 14:55	PM_{10}	Maintenance/calibration
17/07/2009 3:00	17/07/2009 15:05	NO, NO_2, NO_x	Invalid data - span drift[1]

Note:

[1] In the opinion of the data reviewer.

7.0 VENTILATION STACK EMISSION MONITORING PERIOD: 01/08/2009 – 31/08/2009

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, 2009 are shown in Table 11. Averages were only collected for those periods where the 5-minute data constituted 75% data capture.

Section 7.3 provides further information on the reasons for invalid data periods.

Table 11: Data Capture Statistics - 1 Hour Averages

Parameter	Station	Collected Periods	Available Periods	Data Capture
$PM_{2.5}$	Eastern	736	744	98.9%
	Western	739	744	99.3%
PM_{10}	Eastern	742	744	99.7%
	Western	740	744	99.5%
NO, NO_2	Eastern	664	744	89.2%
	Western	670	744	90.1%
CO	Eastern	709	744	95.3%
	Western	711	744	95.6%

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 12. A plot of $PM_{2.5}$ (1 hour average) mass rate of emission for the reporting period is presented in Figure 8.

Table 12: $PM_{2.5}$ Mass Rate Percentiles (1 Hour Average)

Station	$PM_{2.5}$ Mass Rate (kg/h) (1-Hour Average)						
	Maximum	99th	98th	95th	90th	75th	50th
Eastern	0.28	0.18	0.17	0.15	0.13	0.10	0.03
Western	0.25	0.22	0.21	0.17	0.14	0.10	0.04

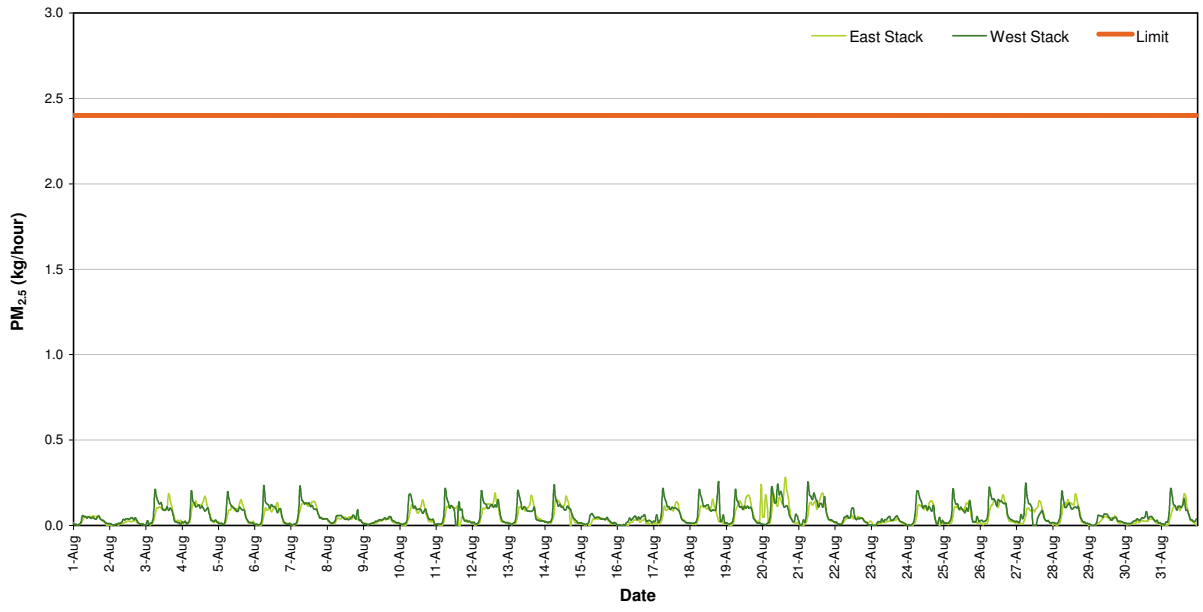

Figure 8: $PM_{2.5}$ Mass Rate (1 Hour Average)

7.2.2 PM_{10}

PM_{10} was continuously monitored and 5-minute averages logged. The 5 minute average data was then transformed to 1 hour averages for reporting.

PM_{10} (1 hour average) mass rate of emission statistics for the reporting period are given in Table 13. A plot of PM_{10} (1 hour average) mass rate of emission for the reporting period is presented in Figure 9.

Table 13: PM_{10} Mass Rate Percentiles (1 Hour Average)

Station	PM_{10} Mass Rate (kg/h) (1-Hour Average)						
	Maximum	99th	98th	95th	90th	75th	50th
Eastern	0.52	0.38	0.34	0.26	0.22	0.17	0.06
Western	0.88	0.38	0.32	0.25	0.20	0.14	0.06

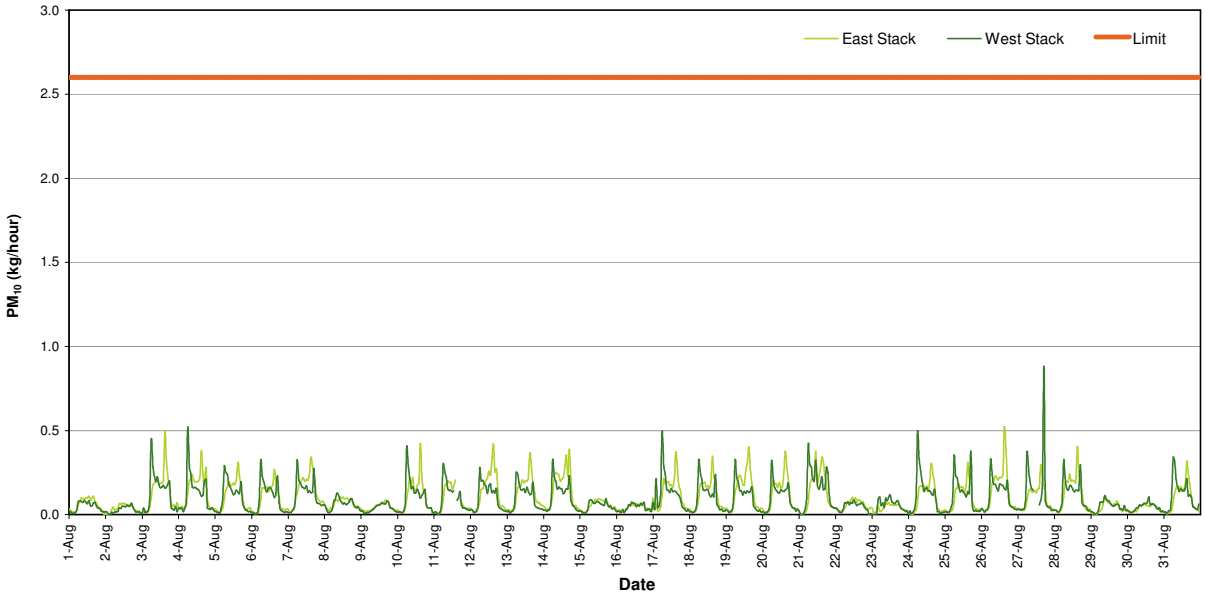

Figure 9: PM_{10} Mass Rate (1 Hour Average)

7.2.3 Carbon Monoxide

Carbon monoxide (1 hour average) mass rate of emission statistics for the reporting period are given in Table 14. A plot of carbon monoxide (1 hour average) mass rate for the reporting period is presented in Figure 10.

Table 14: Carbon Monoxide Mass Rate Percentiles (1 Hour Average)

Station	Carbon Monoxide Mass Rate (kg/h) (1-Hour Average)						
	Maximum	99th	98th	95th	90th	75th	50th
Eastern	27	22	21	19	14	10	7.3
Western	25	23	22	18	13	10	7.3

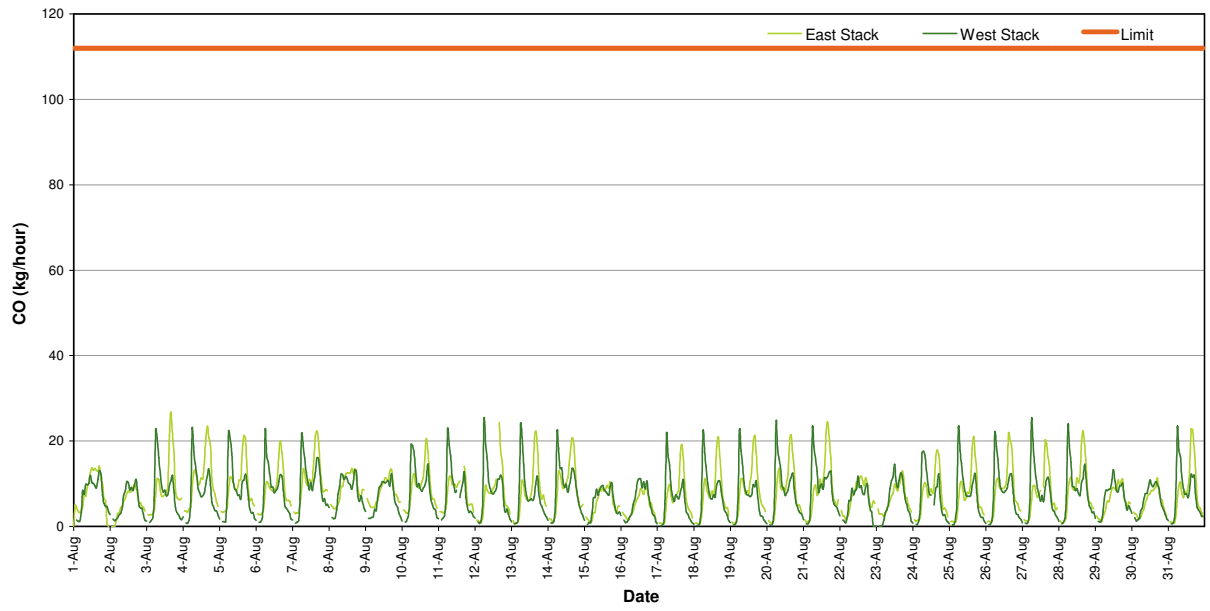

Figure 10: Carbon Monoxide Mass Rate (1 Hour Average)

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 15. A plot of nitric oxide (1-hour average) mass rate for the reporting period is presented in Figure 11.

Table 15: Nitric Oxide Mass Rate Percentiles (1 Hour Average)

Station	Nitric Oxide Concentration (ppm) (1-Hour Average)						
	Maximum	99th	98th	95th	90th	75th	50th
Eastern	4.4	4.1	3.9	3.4	2.9	2.2	1.2
Western	5	4.8	4.6	3.5	2.8	2.3	1.5

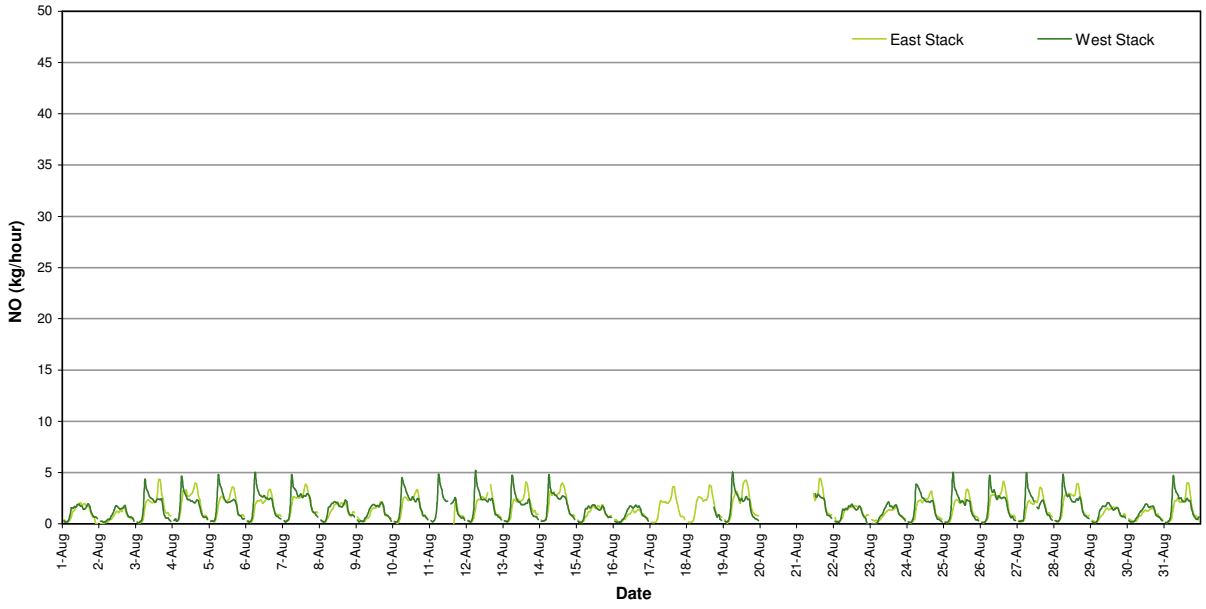

Figure 11: Nitric Oxide Mass Rate (1 Hour Average)

7.2.4.2 Nitrogen Dioxide

Nitrogen dioxide (1 hour average) mass rate of emission statistics for the reporting period are given in Table 16. A plot of nitrogen dioxide (1 hour average) mass rate for the reporting period is presented in Figure 12.

Table 16: Nitrogen Dioxide Mass Rate Percentiles (1 Hour Average)

Station	Nitrogen Dioxide Mass Rate (kg/h) (1-Hour Average)						
	Maximum	99th	98th	95th	90th	75th	50th
Eastern	0.5	0.4	0.4	0.4	0.3	0.2	0.1
Western	0.3	0.2	0.2	0.2	0.2	0.1	0.1

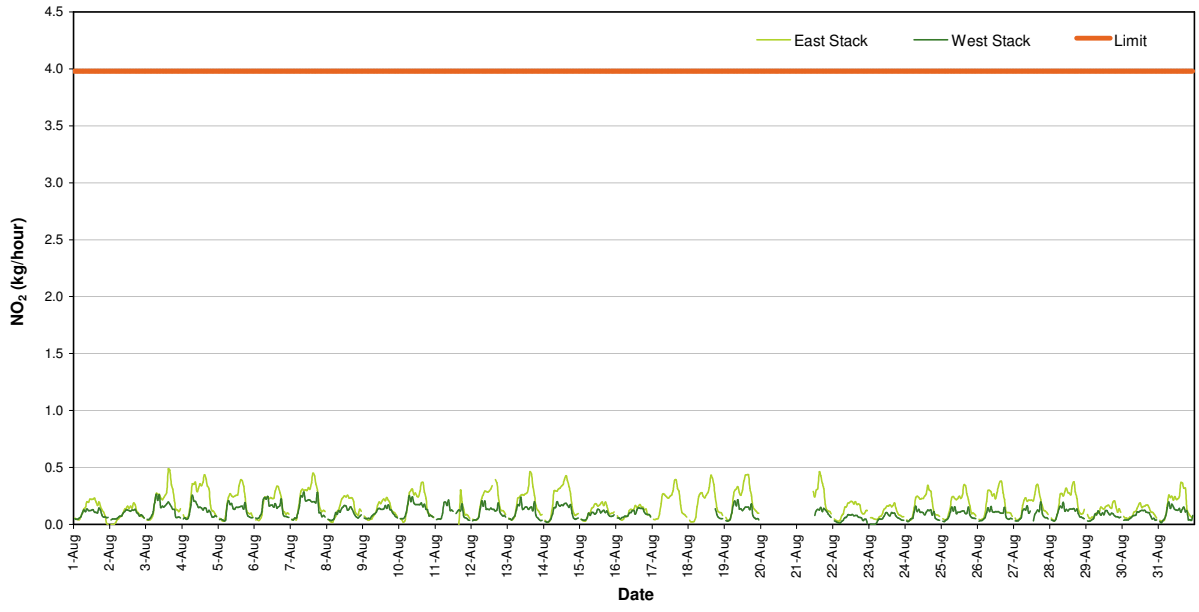

Figure 12: Nitrogen Dioxide Mass Rate (1 Hour Average)

7.2.5 Stack Velocity

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

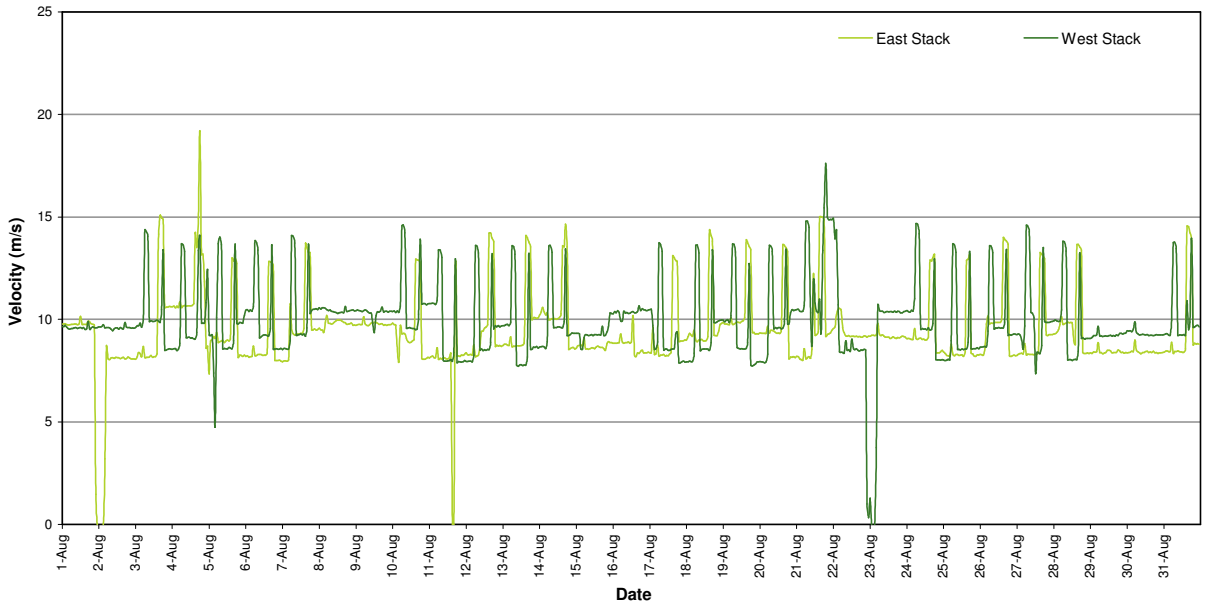

Figure 13: Stack Velocity (1 Hour Average)

7.3 Data Validation and Exception

Data contained in the report has been validated against performance and calibration requirements for each instrument. Data during maintenance and calibration periods has been removed from the validated data sets. Tables 17 and 18 list the data exceptions for the eastern and western ventilation stacks respectively. Data during automatic calibrations of the gaseous atmospheric contaminants has also been removed from the data sets.

Table 17: Data Exceptions - Eastern Ventilation Stack: August 2009

Eastern Ventilation Stack			
Start	**End**	**Parameter**	**Reason**
11/08/2009 3:00	11/08/2009 15:25	NO, NO_2, NO_x	Invalid data - Span drift[1]
11/08/2009 15:20	11/08/2009 16:05	$PM_{2.5}$	Maintenance/calibration
11/08/2009 15:35	11/08/2009 16:15	CO	Maintenance/calibration
11/08/2009 15:35	11/08/2009 16:20	PM_{10}	Maintenance/calibration
12/08/2009 3:00	12/08/2009 3:10	PM_{10}	Invalid data[1]
12/08/2009 15:05	12/08/2009 15:30	CO	Maintenance/calibration
12/08/2009 15:30	12/08/2009 15:50	NO, NO_2, NO_x	Maintenance/calibration
14/08/2009 17:15	14/08/2009 17:55	$PM_{2.5}$	Invalid data[1]
15/08/2009 5:45	15/08/2009 6:30	$PM_{2.5}$	Invalid data[1]
16/08/2009 4:30	16/08/2009 7:45	$PM_{2.5}$	Invalid data[1]
20/08/2009 3:00	21/08/2009 10:45	NO, NO_2, NO_x	Invalid data - Span drift[1]
27/08/2009 13:35	27/08/2009 14:00	CO	Maintenance/calibration

Note:

[1] In the opinion of the data reviewer.

Table 18: Data Exceptions - Western Ventilation Stack: August 2009

Western Ventilation Stack			
Start	**End**	**Parameter**	**Reason**
11/08/2009 13:05	11/08/2009 13:35	NO, NO_2, NO_x	Maintenance/calibration
11/08/2009 13:05	11/08/2009 14:00	CO	Maintenance/calibration
11/08/2009 13:35	11/08/2009 14:25	$PM_{2.5}$	Maintenance/calibration
11/08/2009 14:15	11/08/2009 15:00	PM_{10}	Maintenance/calibration
17/08/2009 3:00	18/08/2009 17:25	NO, NO_2, NO_x	Invalid data - Span drift[1]
20/08/2009 3:00	21/08/2009 11:45	NO, NO_2, NO_x	Invalid data - Span drift[1]
24/08/2009 13:35	24/08/2009 14:05	CO	Maintenance/calibration
27/08/2009 11:40	27/08/2009 13:40	$PM_{2.5}$	Maintenance/calibration
27/08/2009 11:40	27/08/2009 13:40	PM_{10}	Maintenance/calibration
27/08/2009 12:30	27/08/2009 12:55	NO, NO_2, NO_x	Maintenance/calibration

Note:

[1] In the opinion of the data reviewer.

8.0 VENTILATION STACK EMISSION MONITORING PERIOD: 01/09/2009 – 30/09/2009

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, 2009 are shown in Table 19. Averages were only collected for those periods where the 5 minute data constituted 75% data capture.

Section 8.3 provides further information on the reasons for invalid data periods.

Table 19: Data Capture Statistics - 1 Hour Averages

Parameter	Station	Collected Periods	Available Periods	Data Capture
$PM_{2.5}$	Eastern	715	720	99.3%
	Western	718	720	99.7%
PM_{10}	Eastern	710	720	98.6%
	Western	718	720	99.7%
NO, NO_2	Eastern	659	720	91.5%
	Western	650	720	90.3%
CO	Eastern	641	720	89.0%
	Western	676	720	93.9%

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 20. A plot of $PM_{2.5}$ (1-hour average) mass rate of emission for the reporting period is presented in Figure 14.

Table 20: $PM_{2.5}$ Mass Rate Percentiles (1 Hour Average)

Station	$PM_{2.5}$ Mass Rate (kg/h) (1-Hour Average)						
	Maximum	99th	98th	95th	90th	75th	50th
Eastern	0.27	0.21	0.19	0.17	0.15	0.11	0.03
Western	0.51	0.26	0.23	0.18	0.15	0.11	0.04

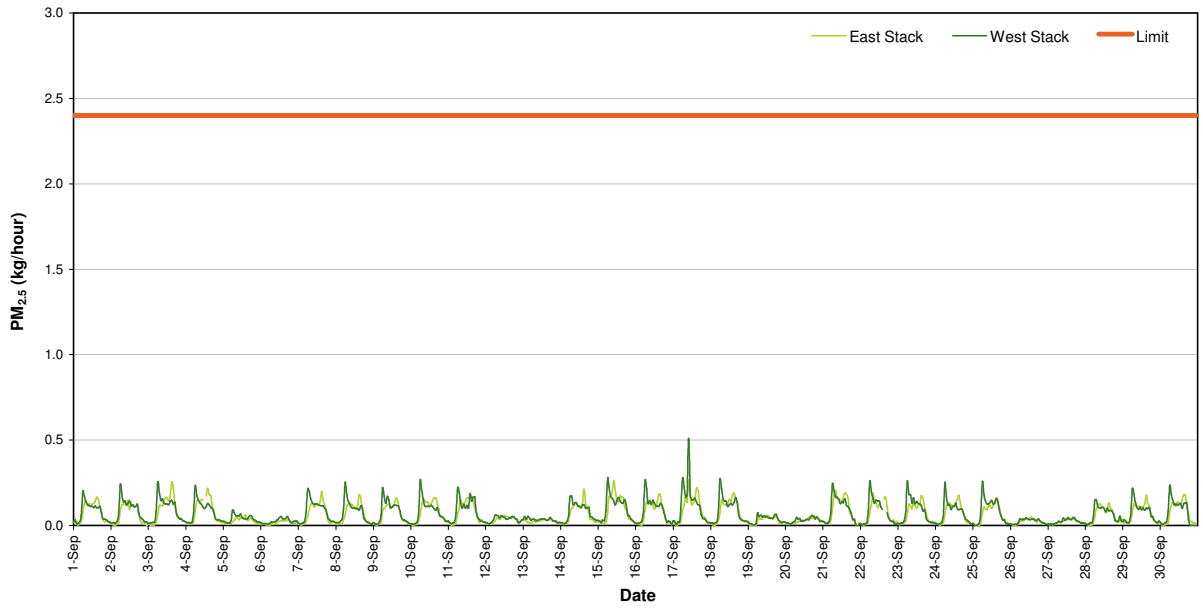

Figure 14: $PM_{2.5}$ Mass Rate (1 Hour Average)

8.2.2 PM_{10}

PM_{10} was continuously monitored and 5 minute averages logged. The 5 minute average data was then transformed to 1-hour averages for reporting.

PM_{10} (1 hour average) mass rate of emission statistics for the reporting period are given in Table 21. A plot of PM_{10} (1 hour average) mass rate of emission for the reporting period is presented in Figure 15.

Table 21: PM_{10} Mass Rate Percentiles (1 Hour Average)

Station	PM_{10} Mass Rate (kg/h) (1-Hour Average)						
	Maximum	99th	98th	95th	90th	75th	50th
Eastern	1.1	0.38	0.34	0.29	0.24	0.18	0.07
Western	0.81	0.42	0.36	0.29	0.22	0.16	0.06

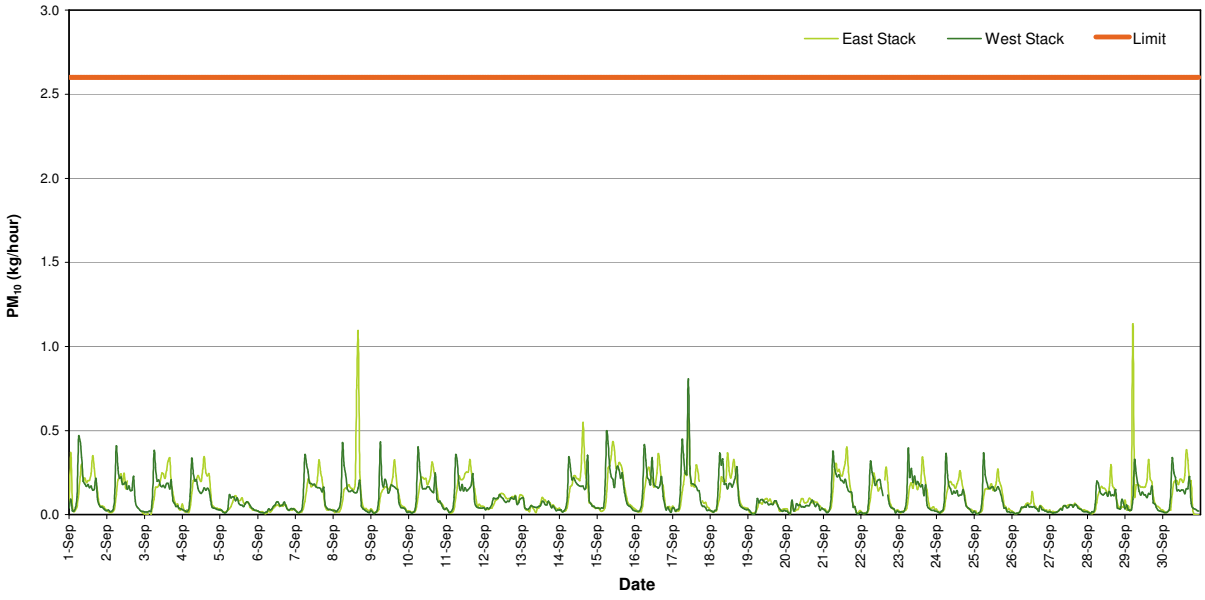

Figure 15: PM_{10} Mass Rate (1 Hour Average)

8.2.3 Carbon Monoxide

Carbon monoxide (1 hour average) mass rate of emission statistics for the reporting period are given in Table 22. A plot of carbon monoxide (1 hour average) mass rate for the reporting period is presented in Figure 16.

Table 22: Carbon Monoxide Mass Rate Percentiles (1 Hour Average)

Station	Carbon Monoxide Mass Rate (kg/h) (1-Hour Average)						
	Maximum	99th	98th	95th	90th	75th	50th
Eastern	27	24	22	20	16	10	7.4
Western	30	27	25	19	15	11	7.5

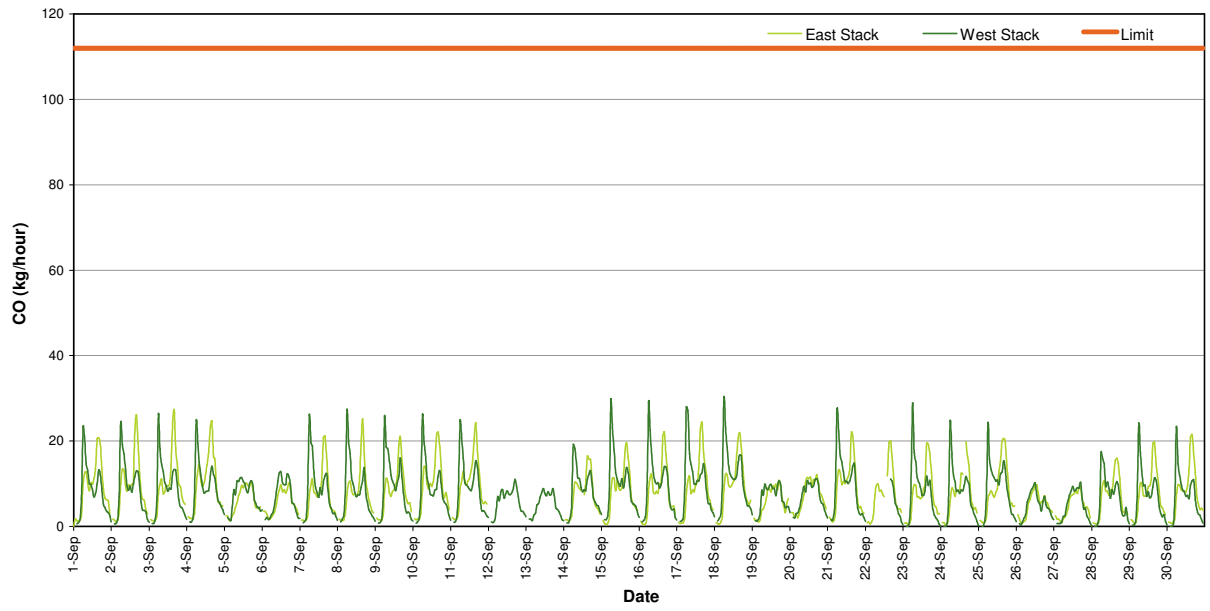

Figure 16: Carbon Monoxide Mass Rate (1 Hour Average)

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 23. A plot of nitric oxide (1-hour average) mass rate for the reporting period is presented in Figure 17.

Table 23: Nitric Oxide Mass Rate Percentiles (1 Hour Average)

Station	Nitric Oxide Concentration (ppm) (1-Hour Average)						
	Maximum	99th	98th	95th	90th	75th	50th
Eastern	6.0	4.3	4.1	3.6	3.2	2.5	1.3
Western	6.2	5.6	5.0	3.7	3.3	2.6	1.5

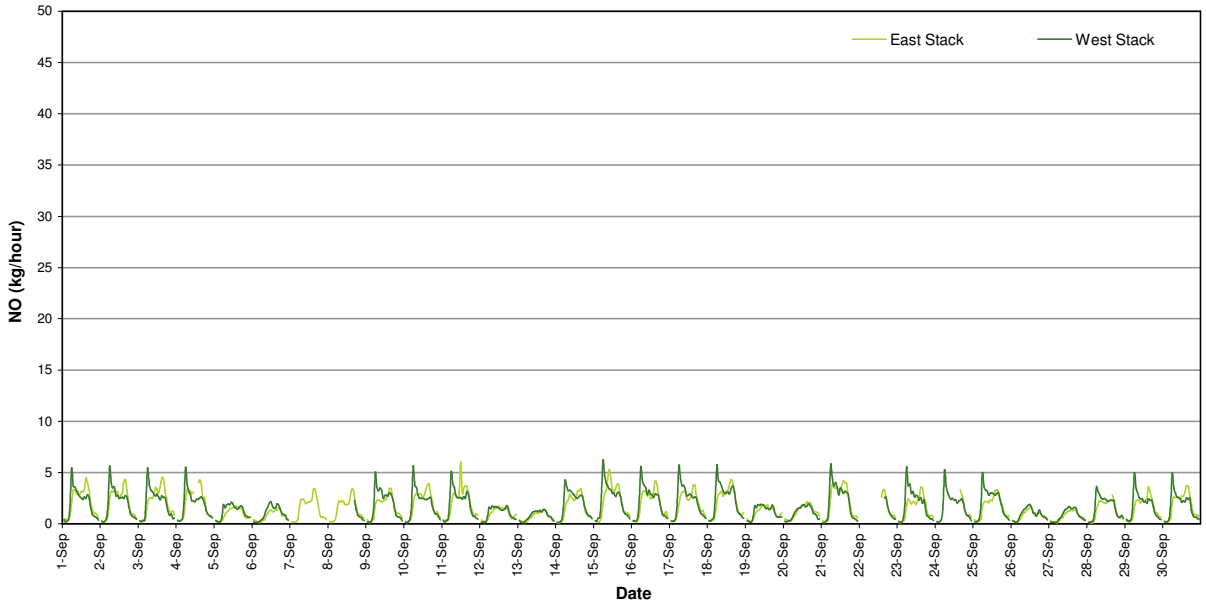

Figure 17: Nitric Oxide Mass Rate (1 Hour Average)

8.2.4.2 Nitrogen Dioxide

Nitrogen dioxide (1-hour average) mass rate of emission statistics for the reporting period are given in Table 24. A plot of nitrogen dioxide (1-hour average) mass rate for the reporting period is presented in Figure 18.

Table 24: Nitrogen Dioxide Mass Rate Percentiles (1 Hour Average)

Station	Nitrogen Dioxide Mass Rate (kg/h) (1-Hour Average)						
	Maximum	99th	98th	95th	90th	75th	50th
Eastern	0.5	0.4	0.4	0.4	0.3	0.3	0.1
Western	0.4	0.2	0.2	0.2	0.2	0.1	0.1

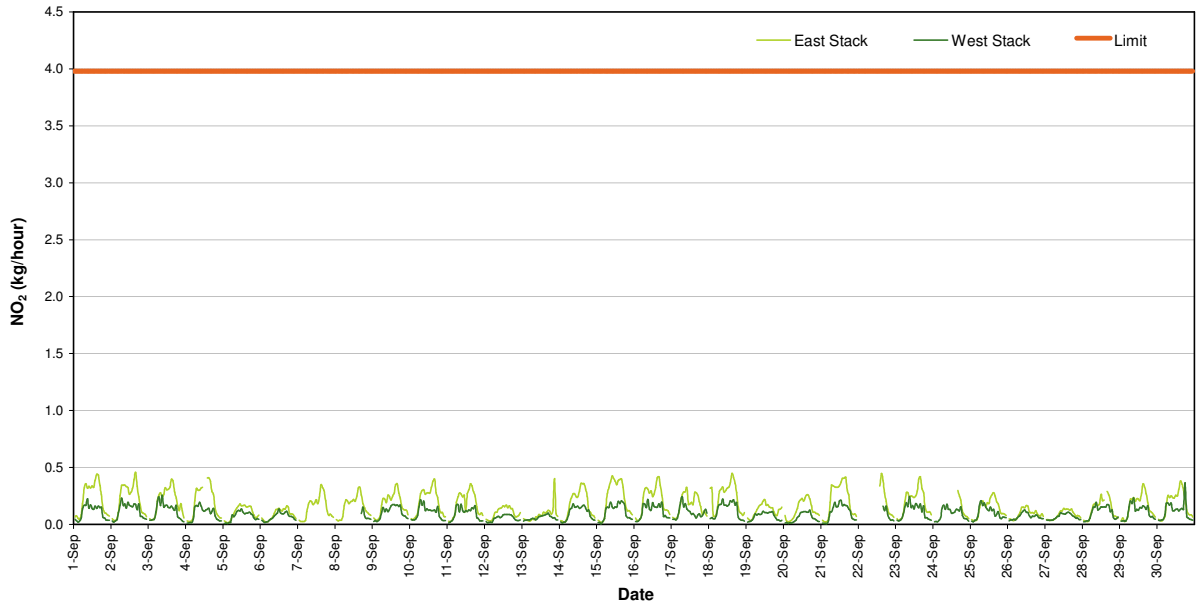

Figure 18: Nitrogen Dioxide Mass Rate (1 Hour Average)

8.2.5 Stack Velocity

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

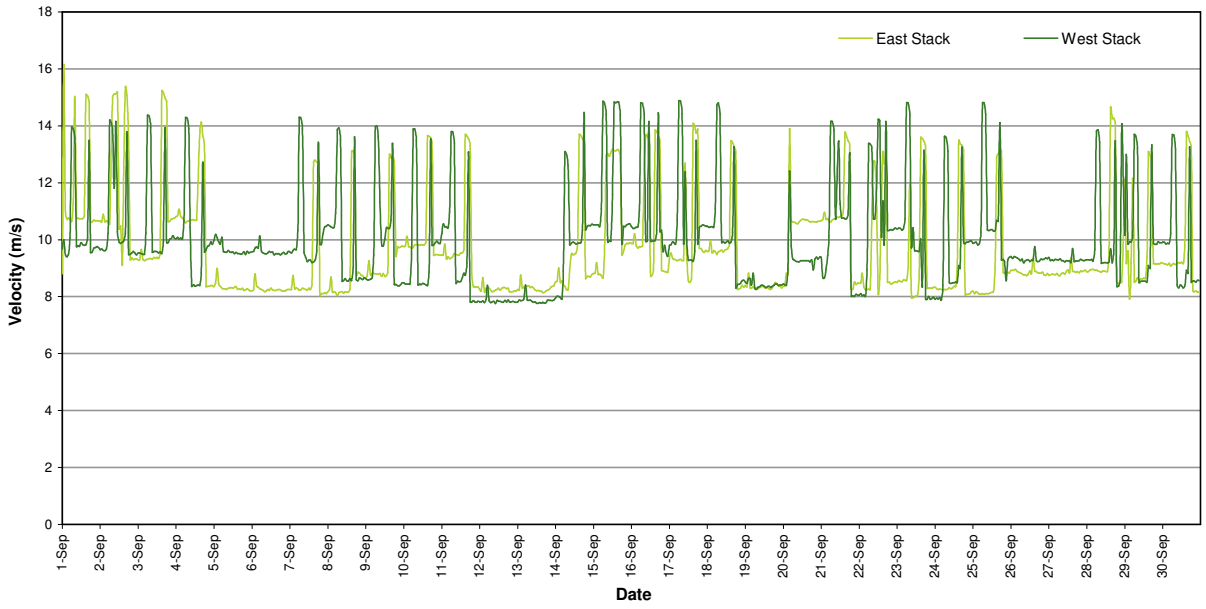

Figure 19: Stack Velocity (1 Hour Average)

8.3 Data Validation and Exception

Data contained in the report has been validated against performance and calibration requirements for each instrument. Data during maintenance and calibration periods has been removed from the validated data sets. Tables 25 and 26 list the data exceptions for the eastern and western ventilation stacks respectively. Data during automatic calibrations of the gaseous atmospheric contaminants has also been removed from the data sets.

Table 25: Data Exceptions - Eastern Ventilation Stack: September 2009

Eastern Ventilation Stack			
Start	**End**	**Parameter**	**Reason**
2/09/2009 14:40	2/09/2009 16:45	$PM_{2.5}$	Maintenance/calibration
2/09/2009 14:40	2/09/2009 21:50	PM_{10}	Maintenance/calibration
4/09/2009 12:05	4/09/2009 13:25	NO, NO_2, NO_x	Maintenance/calibration
4/09/2009 12:15	4/09/2009 12:50	$PM_{2.5}$	Maintenance/calibration
4/09/2009 12:35	4/09/2009 12:40	CO	Maintenance/calibration
12/09/2009 0:40	14/09/2009 0:00	CO	Invalid data - Span drift[1]
14/09/2009 12:20	14/09/2009 12:50	CO	Maintenance/calibration
17/09/2009 18:05	17/09/2009 18:30	PM_{10}	Invalid data[1]
22/09/2009 0:40	22/09/2009 12:50	NO, NO_2, NO_x	Invalid data - Span drift[1]
22/09/2009 12:55	22/09/2009 13:30	NO, NO_2, NO_x	Maintenance/calibration
22/09/2009 12:55	22/09/2009 13:30	CO	Maintenance/calibration
22/09/2009 13:50	22/09/2009 14:40	$PM_{2.5}$	Maintenance/calibration
22/09/2009 14:15	22/09/2009 15:05	PM_{10}	Maintenance/calibration
24/09/2009 0:40	24/09/2009 15:35	NO, NO_2, NO_x	Invalid data - Span drift[1]
24/09/2009 15:10	24/09/2009 15:35	NO, NO_2, NO_x	Maintenance/calibration
24/09/2009 15:10	24/09/2009 15:35	CO	Maintenance/calibration
28/09/2009 15:05	28/09/2009 15:40	NO, NO_2, NO_x	Maintenance/calibration
29/09/2009 10:10	29/09/2009 10:10	PM_{10}	Maintenance/calibration
29/09/2009 10:25	29/09/2009 10:35	NO, NO_2, NO_x	Maintenance/calibration

Note:

[1] In the opinion of the data reviewer.

Table 26: Data Exceptions - Western Ventilation Stack: September 2009

Western Ventilation Stack			
Start	**End**	**Parameter**	**Reason**
7/09/2009 0:40	8/09/2009 15:40	NO, NO_2, NO_x	Invalid data - Span drift[1]
7/09/2009 15:45	8/09/2009 16:20	NO, NO_2, NO_x	Maintenance/calibration
22/09/2009 0:40	22/09/2009 15:15	NO, NO_2	Invalid data - Span drift[1]
22/09/2009 0:40	22/09/2009 15:25	CO	Invalid data - Span drift[1]
22/09/2009 15:30	22/09/2009 15:40	CO	Maintenance/calibration
22/09/2009 14:55	22/09/2009 15:15	NO, NO_2, NO_x	Maintenance/calibration
22/09/2009 15:10	22/09/2009 16:50	$PM_{2.5}$	Maintenance/calibration
22/09/2009 15:35	22/09/2009 16:50	PM_{10}	Maintenance/calibration

Note:

[1] In the opinion of the data reviewer.

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 27.

Table 27: Maximum (1 Hour Average) Mass Rate (01/07/2009 - 30/09/2009)

Discharge Point No.	Discharge Description	Compound	Mass Rate ((kg/h)	Licence Limit (kg/h)
1	Western ventilation stack	$PM_{2.5}$	0.51	2.4
		PM_{10}	0.88	2.6
		NO_2	1.3	3.98
		CO	31	112
2	Eastern ventilation stack	$PM_{2.5}$	0.46	2.4
		PM_{10}	1.1	2.6
		NO_2	0.50	3.98
		CO	27	112

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

Data capture statistics for 2009 year to date (01/01/2009 – 30/09/2009) are presented in Table 28.

Table 28: Data Capture Year to Date

Station	NO_2	CO	$PM_{2.5}$	PM_{10}
Eastern	95.2	96.0	95.3	91.0
Western	92.7	96.7	84.4	99.8

Report Signature Page

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APPENDIX A

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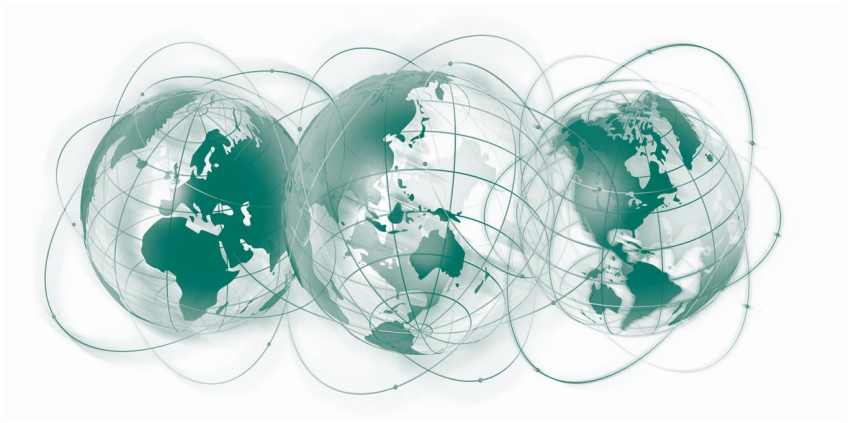

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