Eastlink Ambient
Air Quality Monitoring
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Transfield Services Limited

Eastlink Ambient Air Quality Monitoring System Report

1st June 2010 – 30th June 2010

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This document is issued in accordance with NATA's accreditation requirements.
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Revision History

Report	Revision	Date	Analyst
DAT4594	0	15/07/10	AK

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1.0 Executive Summary

EastLink is a motorway, which runs between Donvale in Melbourne's north east, to Frankston in the south-east of Melbourne. Transfield services are responsible for the operation and maintenance of the 39 kilometre road and have commissioned Ecotech P/L to monitor the ambient air quality outside the two Eastlink tunnels and provide maintenance and reporting services. CO, NO_x and particulate data are monitored, along with meteorological data. Monitoring of these parameters allows any changes in the ambient air quality to be quickly identified and recorded.

The three ambient Eastlink sites are located around the north east end of the Eastlink freeway at Chaim Crt, Craig Rd and Heads Rd. Ecotech P/L commenced monitoring of these sites on June 16th 2010.

The overall percentage availability at Chaim Crt, Craig Rd and Heads Rd was above 95% for the reporting period.

No readings over the State Environmental Planning Policy (SEPP) intervention levels were recorded during the reporting period.

2.0 Introduction

Ecotech P/L was commissioned by Transfield Services to provide monitoring and data reporting for the Eastlink ambient air quality monitoring network, located as detailed in Table 1. Ecotech commenced data collection from the Eastlink network on the 16th June 2010.

This report presents the data for June 2010.

The data presented in this report:

- Describes air quality measurements
- Compares monitoring results
- Has been quality assured
- Complies with NATA accreditation requirements, where applicable

3.0 Monitoring and Data Collection

The Eastlink monitoring network consists of three ambient air quality monitoring stations. Station locations and parameters monitored are described below.

Table 1: Eastlink monitoring network sites geographical co-ordinates

Site Name	Geographical Coordinates
Chaim Crt	37°48'30.55"S, 145°12'36.59"E
Craig Rd	37°48'7.85"S, 145°12'24.14"E
Heads Rd	37°48'7.39"S, 145°11'43.50"E

A siting audit conducted on 17 June 2010 showed that the siting of these stations complies with *AS/NZS 3580.1.1:2007 Methods for sampling and analysis of ambient air.*

These sites are classified as neighbourhood stations according to *AS/NZS 3580.1.1:2007 Methods for sampling and analysis of ambient air*.

3.1 Station Parameters

The Eastlink monitoring stations are equipped to measure the following parameters:

Table 2: Parameters measured at the Eastlink ambient monitoring sites

Station	Parameter Measured	Instrument
Chaim Crt	NO, NO_2, NO_x	Ecotech EC9841
	CO	Ecotech EC9830
	PM_{10}	Rupprecht & Patashnick TEOM
	$PM_{2.5}$	Rupprecht & Patashnick TEOM FDMS
	Wind Speed	Vaisala WS425
	Wind Direction	Vaisala WS425
	Ambient Temperature	Vaisala HMP45A
	Relative Humidity	Vaisala HMP45A
	Solar Radiation	Middleton Solar Pyranometer SK-01-D2
Craig Rd	NO, NO_2, NO_x	Ecotech EC9841
	CO	Ecotech EC9830
	PM_{10}	Rupprecht & Patashnick TEOM
	Wind Speed	Vaisala WS425
	Wind Direction	Vaisala WS425
	Ambient Temperature	Vaisala HMP45A
	Relative Humidity	Vaisala HMP45A
Heads Rd	NO, NO_2, NO_x	Ecotech EC9841
	CO	Ecotech EC9830
	PM_{10}	Rupprecht & Patashnick TEOM
	Wind Speed	Vaisala WS425
	Wind Direction	Vaisala WS425
	Ambient Temperature	Vaisala HMP45A
	Relative Humidity	Vaisala HMP45A

3.2 Data Collection Methods

The following methods are used for data collection:

Table 3: Methods

Parameter Measured	Method	Description
NO, NO_2, NO_x	AS 3580.5.1-1993	Methods for sampling and analysis of ambient air. Method 5.1: Determination of oxides of nitrogen – Chemiluminescence method
CO	AS 3580.7.1-1993	Methods for sampling and analysis of ambient air. Method 7.1: Determination of carbon monoxide – Direct-reading instrumental method
PM_{10} (TEOM)	AS 3580.9.8-2008	Methods for sampling and analysis of ambient air. Method 9.8: Determination of suspended particulate matter - PM_{10} continuous direct mass method using a tapered element oscillating microbalance analyser.
$PM_{2.5}$ (TEOM FDMS)	In-house method 7.3	In-house Method 7.3: Determination of suspended particulate matter – PM_{10} and $PM_{2.5}$ continuous direct mass method using a tapered element oscillating microbalance analyser.
Wind Speed	AS 2923-1987	Ambient Air – Guide for measurement of horizontal wind for air quality applications
Wind Direction	AS 2923-1987	Ambient Air – Guide for measurement of horizontal wind for air quality applications

Table 3: Methods (continued)

Parameter Measured	Method	Description
Sigma	AS 2923-1987	Ambient Air – Guide for measurement of horizontal wind for air quality applications
Ambient Temperature	US EPA 454/R-99-005	Meterological Monitoring Guidance for Regulatory Modeling Applications
Relative Humidity	US EPA 454/R-99-005	Meterological Monitoring Guidance for Regulatory Modeling Applications
Solar Radiation	US EPA 454/R-99-005	Meterological Monitoring Guidance for Regulatory Modeling Applications

3.2.1 Data Acquisition

Data acquisition is done using a PC based WinAQMS logger (using WinCollect® Version 4.0 & WinAQMS® Version 2.0) situated at each of the three monitoring sites; Chaim Crt, Craig Rd and Heads Rd. Each logger is equipped with a 3G modem for remote data collection. The recorded data is remotely collected from the AQMS loggers on a daily basis and stored at Ecotech's Environmental Reporting Services (ERS) department in Melbourne. Data samples are logged in 5 minute intervals.

3.3 Data Validation and Reporting

3.3.1 Validation

The Ecotech ERS department perform daily data checks to ensure maximum data capture rates are maintained. Any equipment failures are communicated to the responsible field engineers for urgent rectification. Ecotech ERS maintains two distinct databases containing non-validated and validated data respectively.

The validated database is created by duplicating the non-validated database and then flagging data affected by instrument faults, calibrations and other maintenance activities. The data validation software requires the analyst to supply a valid reason (e.g. backed by maintenance notes, calibration sheets etc) in the database for flagging any data as invalid.

Validation is performed by the operator, and the validation is reviewed. All data is checked and graphs and reports are generated based on the verified 5 minute data.

3.3.2 Reporting

The reported data is in 3 Microsoft Excel format files named *"Chaim Crt Data Report_Jun10.xls", "Craig Rd Data Report_Jun10"* and *"Heads Rd Data Report_Jun10".*

Each Excel file consists of 3 Excel spreadsheets:

1. 1 Hour Data
2. 24 Hour Data
3. Valid Data Exception Table

The data contained in these reports is based on Australian Eastern Standard Time. Data is for all parameters measured continuously. All averages are calculated from the 5 minute data.

Averaging times are reported for the end of the period, i.e. the hourly average 02:00am is for the data collected from 1:00am to 2:00am.

4.0 Air Quality Goals

The air quality goal requirements for particulates at the Eastlink monitoring network sites are shown below.

Table 4: SEPP Schedule B Intervention Levels

Parameter	Time Period	Intervention Level	Units
NO_2	1 hour	140	ppb
CO	1 hour	29	ppm
PM_{10}	24 hour	60	$\mu g/m^3$
$PM_{2.5}$	24 hour	36	$\mu g/m^3$

5.0 Calibrations and Maintenance

5.1 Units and Uncertainties

The uncertainties for each parameter have been determined by the manufacturers tolerance limits of the equipment's parameters, and by the applicable Australian Standard.

Table 5: Units and Uncertainties

Parameter	Units	Resolution	Uncertainty	Range
NO	ppb	1 ppb	± 14 ppb K factor of 2.01	0 ppb to 500 ppb
NO_2	ppb	1 ppb	± 16 ppb K factor of 2.01	0 ppb to 500 ppb
NO_x	ppb	1 ppb	± 14 ppb K factor of 2.01	0 ppb to 500 ppb
CO	ppm	0.1 ppm	± 1.1 ppm K factor of 2	0 ppm to 50 ppm

Table 5: Units and Uncertainties (continued)

Parameter	Units	Resolution	Uncertainty	Range
PM_{10} (TEOM)	$\mu g/m^3$	0.1 $\mu g/m^3$	±1.8% of reading or ±2.5 $\mu g/m^3$ whichever is greater K factor of 1.96	0 $\mu g/m^3$ to several g/m^3
$PM_{2.5}$ (TEOM FDMS)	$\mu g/m^3$	0.1 $\mu g/m^3$	1.8% of reading or ±2.5 $\mu g/m^3$ whichever is greater K factor of 1.96	0 $\mu g/m^3$ to several g/m^3
Vector Wind Speed	m/s	0.1 m/s	±0.22 m/s or 3.0% of reading, whichever is greater K factor of 1.96	0 m/s to 15 m/s
Solar Radiation	W/m^2	1 W/m^2	± 5 % of reading or ±32 w/m^2 or whichever is greater K factor of 1.96	0 to 1100 W/m^2
Ambient Temperature	˚C	0.1˚C	± 0.25˚C K factor of 2.01	0˚C to 50˚C
Relative Humidity	%	1%	± 5% K factor of 2.31	0-100%

5.2 Maintenance

The last calibrations for the following parameters have been performed on the indicated date. Data supplied after this time is subject to verification to be performed at the next calibration cycle.

Tables 6, 7 and 8 indicate when the particulate, gas and meteorological equipment were last calibrated.

Table 6: Chaim Court Maintenance Table June 2010

Parameter	Scheduled Maintenance Performed	Date Scheduled Maintenance performed	Last Calibration Date
NO, NO_2, NO_x	Yes	N/A	N/A
CO	Yes	N/A	N/A
PM_{10}	Yes	N/A	N/A
$PM_{2.5}$	Yes	N/A	N/A
Wind Speed*	Yes	N/A	N/A
Wind Direction*	Yes	N/A	N/A
Ambient Temperature	Yes	N/A	N/A
Relative Humidity	Yes	N/A	N/A
Solar Radiation	Yes	N/A	N/A

*Instrument not covered by NATA scope of accreditation. Instrument was not maintained according to AS 2923-1987.

Table 7: Craig Rd Maintenance Table June 2010

Parameter	Scheduled Maintenance Performed	Date Scheduled Maintenance performed	Last Calibration Date
NO, NO_2, NO_x	Yes	N/A	N/A
CO	Yes	N/A	N/A
PM_{10}	Yes	N/A	N/A
Wind Speed*	Yes	N/A	N/A
Wind Direction*	Yes	N/A	N/A
Ambient Temperature	Yes	N/A	N/A
Relative Humidity	Yes	N/A	N/A
Solar Radiation	Yes	N/A	N/A

*Instrument not covered by NATA scope of accreditation. Instrument was not maintained according to AS 2923-1987.

Table 8: Heads Rd Maintenance Table June 2010

Parameter	Scheduled Maintenance Performed	Date Scheduled Maintenance performed	Last Calibration Date
NO, NO_2, NO_x	Yes	N/A	N/A
CO	Yes	N/A	N/A
PM_{10}	Yes	N/A	N/A
Wind Speed*	Yes	N/A	N/A
Wind Direction*	Yes	N/A	N/A
Ambient Temperature	Yes	N/A	N/A
Relative Humidity	Yes	N/A	N/A
Solar Radiation	Yes	N/A	N/A

*Instrument not covered by NATA scope of accreditation. Instrument was not maintained according to AS 2923-1987.

6.0 Results

6.1 Percentage Availability

Percentage availability is based on 1 hour averages, calculated from 5 minute data, and refers to the amount of available data collected for June 2010.

The percentage of available data is calculated using the following equation:

Availability = (Reported air quality data / Total data) x 100%

- Reported air quality data = Number of instrument readings which have been verified through a NATA or quality assured process as appropriate and excludes all data errors, zero data collection due to calibration, failures and planned and unplanned maintenance.
- Total data = Total number of instrument readings since the start of the term assuming no maintenance, errors, loss of data or calibration.

Table 9: Monthly Percentage Availability for Eastlink Sites for June 2010[a]

Parameter	Chaim Crt %	Craig Rd %	Heads Rd %
NO, NO_2, NO_x	96	96	97
CO	95	**64**	96
PM_{10}	100	100	100
$PM_{2.5}$	100	N/A	N/A
WS, WD, Sigma	100	100	99
AT	100	100	100
RH	100	100	100
SR	100	N/A	N/A

* Bold values indicate Overall Percentage Availability below 95%

[a] Percentage availability for the month of June 2010 is calculated from the date Ecotech P/L commenced monitoring on June 16th

Table 10: Exceedences Above SEPP Intervention Levels for June 2010

Station	Parameter	Time Period	Value of Exceedence	Date of Exceedence
Chaim Crt	NO_2	1 hour	-	-
	CO	1 hour	-	-
	PM_{10}	24 hour	-	-
	$PM_{2.5}$	24 hour	-	-
Craig Rd	NO_2	1 hour	-	-
	CO	1 hour	-	-
	PM_{10}	24 hour	-	-
Heads Rd	NO_2	1 hour	-	-
	CO	1 hour	-	-
	PM_{10}	24 hour	-	-

6.2 Graphical Reports

Validated 5 minute data for NO, NO_2, NO_x, CO, PM_{10}, $PM_{2.5}$, wind speed and wind direction were used to construct the following monthly graphical representations.

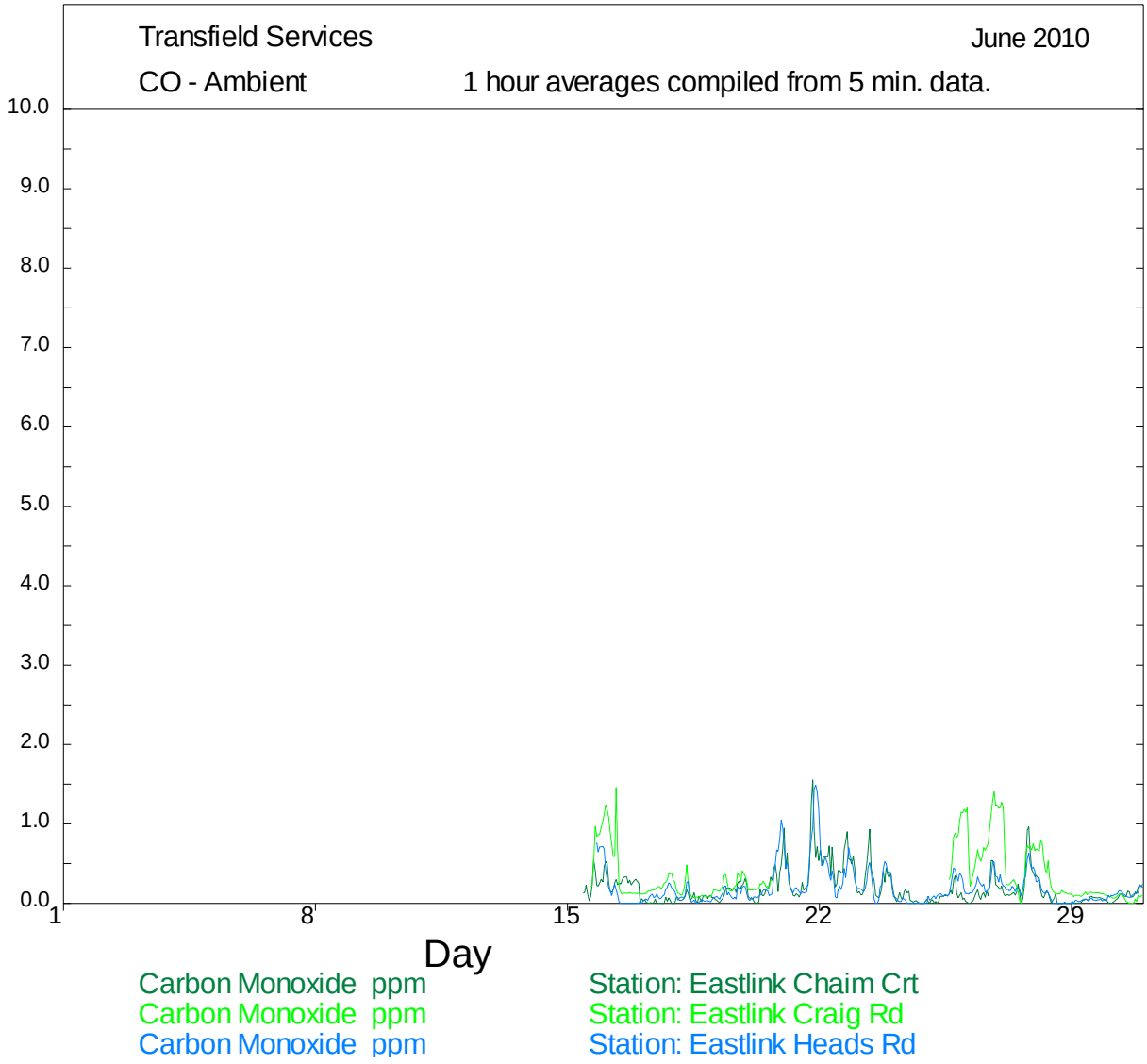

Figure 1: CO 1-hour Averages for June 2010

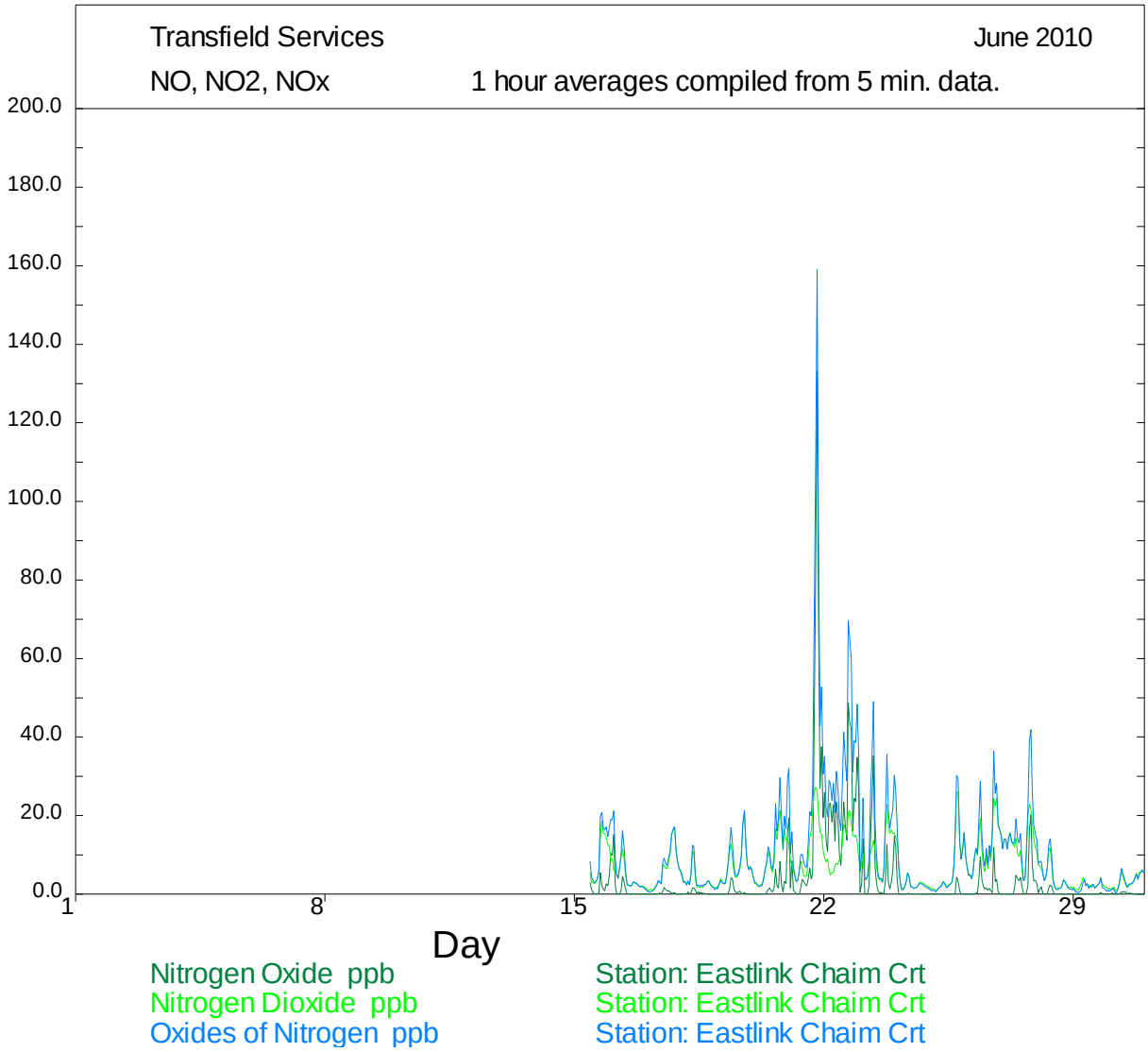

Figure 2: Chaim Crt NO, NO_2, NO_x 1-hour Averages for June 2010

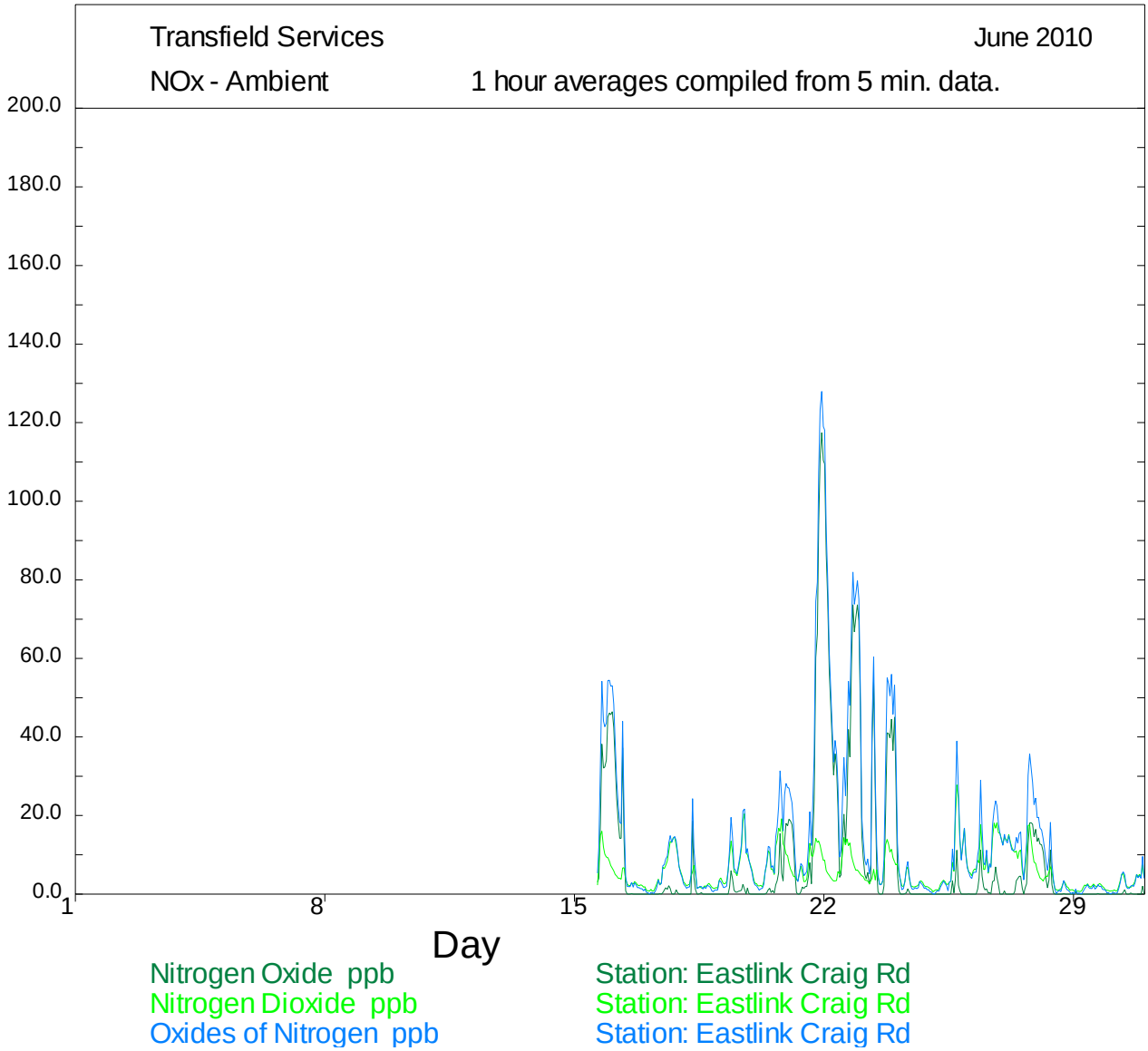

Figure 3: Craig Rd NO, NO_2, NO_x 1-hour Averages for June 2010

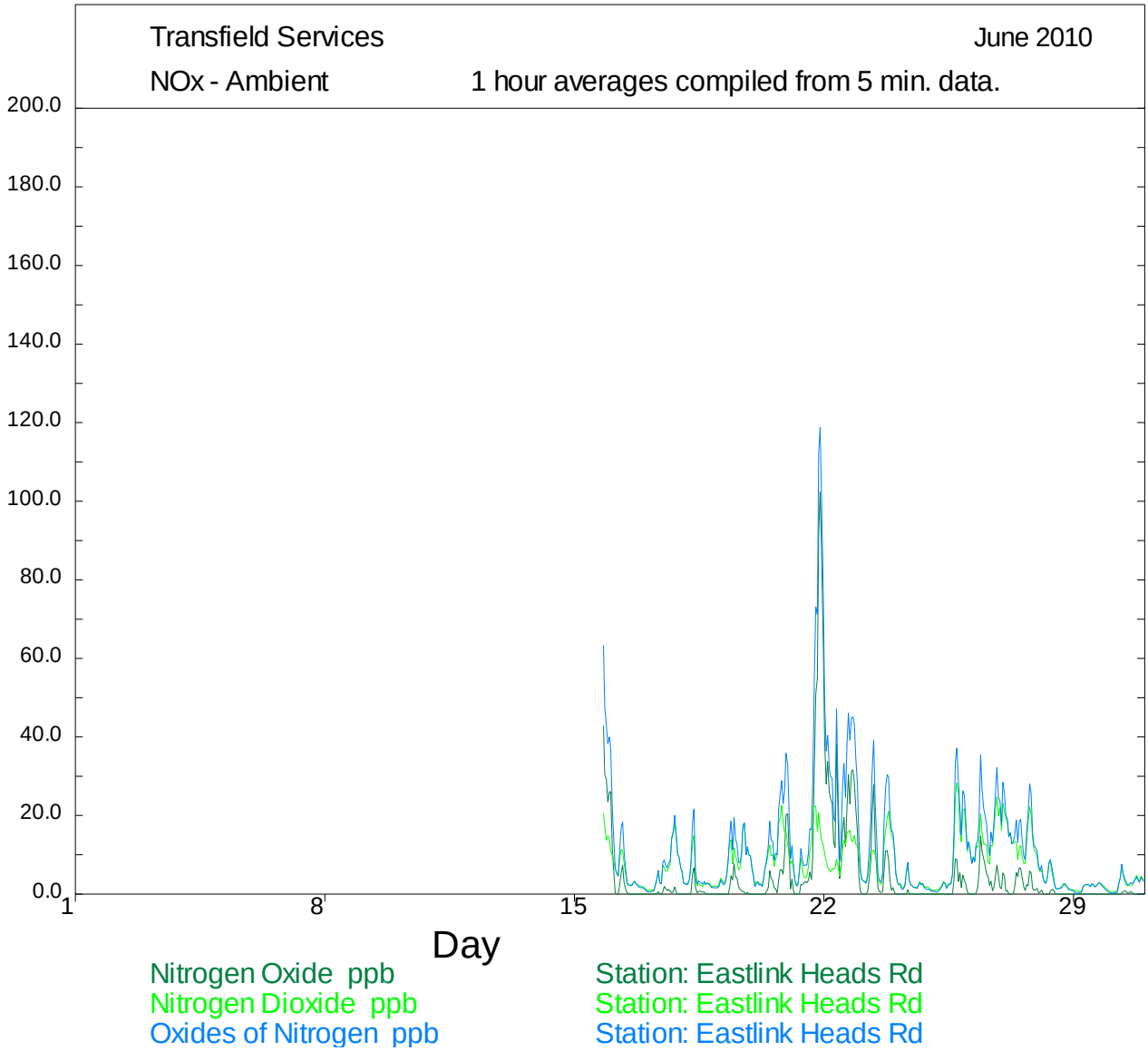

Figure 4: Heads Rd NO, NO_2, NO_x 1-hour Averages for June 2010

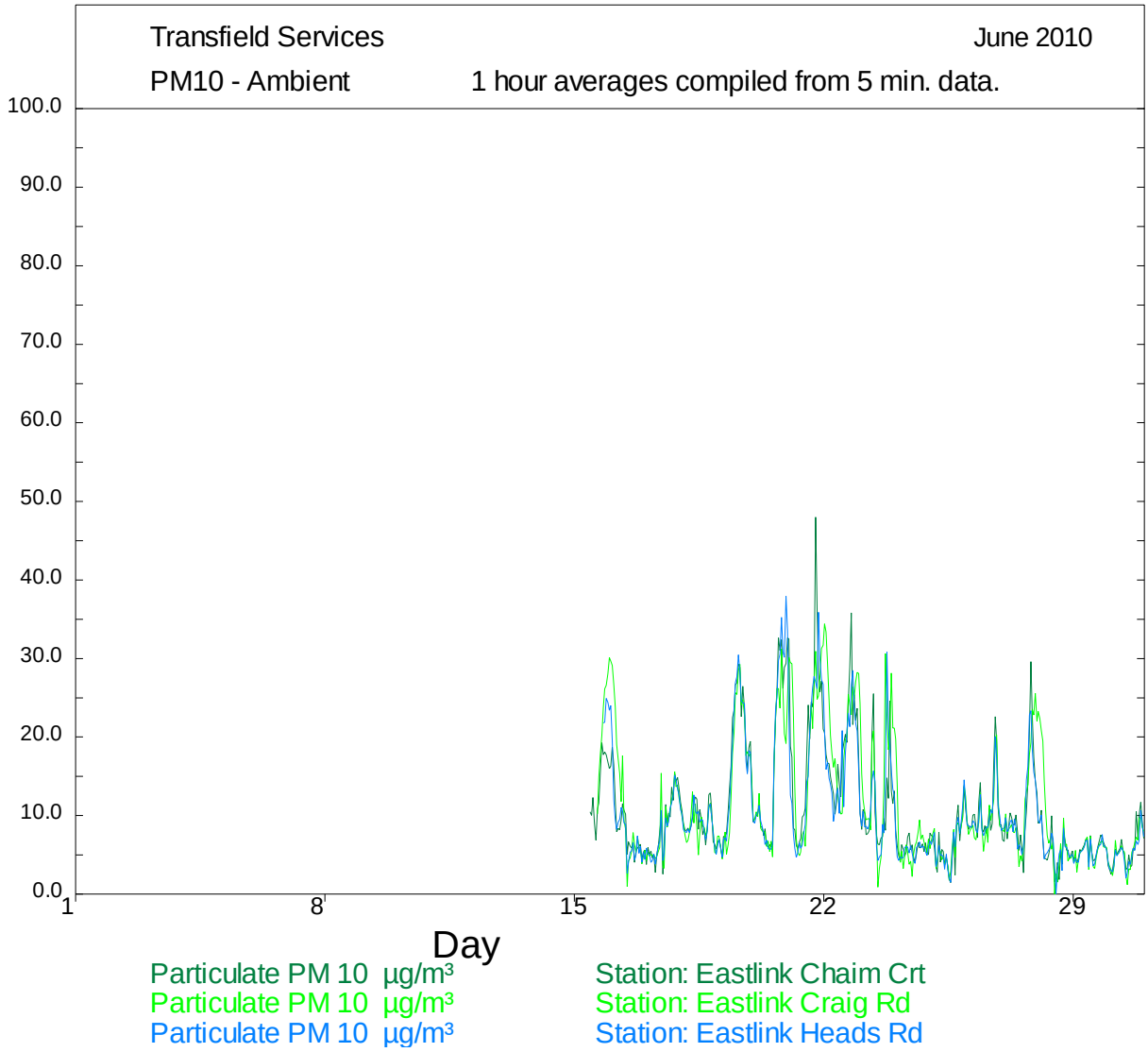

Figure 5: PM_{10} 1-hour Averages for June 2010

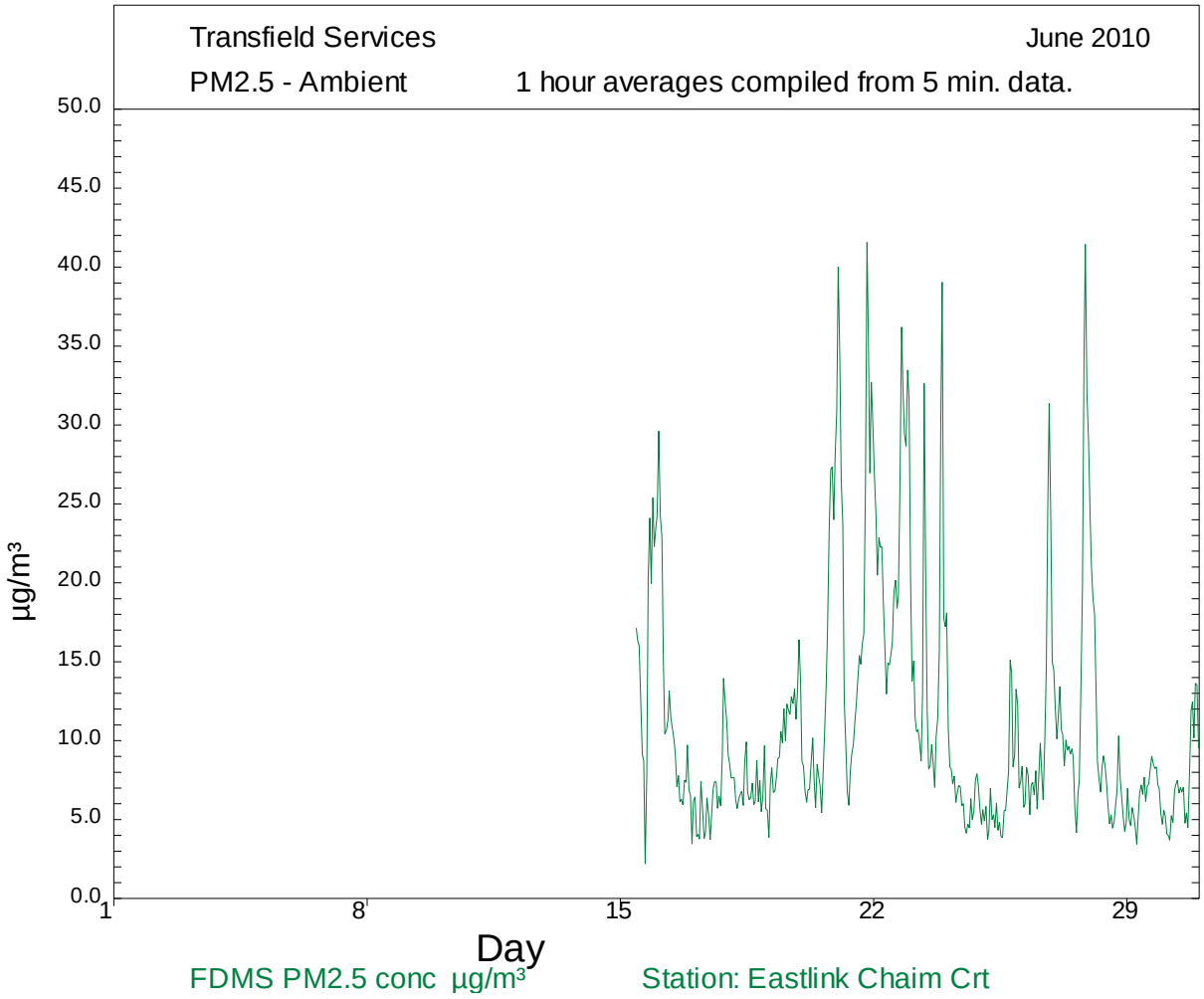

Figure 6: $PM_{2.5}$ 1-hour Averages for June 2010

7.0 Valid Data Exception Tables

Table 11: Chaim Crt Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
15/06/2010 09:55	15/06/2010 10:15	Logger update and site integration	All channels	AK	9/07/2010
15/06/2010 15:45	15/06/2010 16:25	TEOM filter change	PM10	AK	9/07/2010
15/06/2010 15:45	15/06/2010 16:30	TEOM filter change	PM2.5	AK	9/07/2010
18/06/2010 12:45	18/06/2010 14:45	Intermittent zero reference checks	CO	AK	9/07/2010
28/06/2010 17:05	28/06/2010 17:10	Data affected by environmental conditions - wind speed spike	WS, WD, Sigma	AK	9/07/2010

Table 12: Craig Rd Valid Data Exception

Start Date	End Date	Reason	Change Details	User Name	Change Date
15/06/2010 15:15	15/06/2010 15:35	Logger update and site integration	All channels	AK	9/07/2010
15/06/2010 16:05	15/06/2010 16:10	Data transmission error	All channels	AK	9/07/2010
19/06/2010 20:50	22/06/2010 11:55	Intermittent instrument fault - zero flow error	CO	AK	9/07/2010
20/06/2010 13:05	25/06/2010 15:55	Data affected intermittently by environmental conditions - wind speed spike	WS, WD, Sigma	AK	9/07/2010
22/06/2010 12:05	22/06/2010 13:30	Maintenance - repair CO flow error	CO	AK	9/07/2010
22/06/2010 13:35	25/06/2010 13:35	Overnight span out of tolerance	CO	AK	9/07/2010
25/06/2010 11:00	25/06/2010 11:45	Maintenance - remote calibration	CO, NO, NO2, NOx	AK	9/07/2010
25/06/2010 13:40	25/06/2010 14:30	CO analyser swapped out for service	CO, NO, NO2, NOx	AK	9/07/2010

Table 13: Heads Rd Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
15/06/2010 10:55	15/06/2010 19:10	Logger update and site integration	All channels	AK	9/07/2010
17/06/2010 13:10	30/06/2010 17:20	Data affected intermittently by environmental conditions - wind speed spike	WS, WD, Sigma	AK	9/07/2010

8.0 Discussion

- Percentage availability for all parameters at Chaim Crt was above 95% from June 16th 2010, when monitoring by Ecotech P/L commenced, until the end of the month.

- Percentage availability for oxides of nitrogen, meteorological and particulate parameters at the Craig Rd station was above 95% for the reporting period, however CO fell below this threshold, 64%. The CO availability was low due to a flow error in the CO analyzer, and the overnight span checks being out of tolerance for three days. The CO analyzer was swapped out for repair on June 25th.

- The percentage availability for all parameters at the Heads Rd site were above 95% for the reporting month.

- There were no recorded readings over the SEPP intervention levels for the reporting period.

----------END OF REPORT----------

Appendix 1

Definitions

NO: Nitric oxide

NO_2: Nitrogen dioxide

NO_x: Oxides of nitrogen

CO: Carbon monoxide

PM_{10}: Particulate less than 10 microns

$PM_{2.5}$: Particulate less than 2.5 microns

$PM_{2.5}$_B: $PM_{2.5}$ base mass (without volatiles)

$PM_{2.5}$_R: $PM_{2.5}$ with volatiles

WS: Wind Speed

WD: Wind Direction

AT: Ambient Temperature

RH: Relative Humidity

SR: Solar Radiation

ppb: Parts per billion

ppm: Parts per million

µg/m^3: micrograms per cubic metre @ standard temperature and pressure (0°C and 101.3 kPa)

m/s: metres per second

deg: degrees (True North)

W/m^2: Watts per square metre

Appendix 2

Explanation of Exception Table

Logger update and site integration refers to the initial handover and setup time of the instrument when it is first installed and the channels are stabilizing.

Data transmission error refers to a period of time when the instrument could not transmit data. This may be due to interference, or a problem with the phone line or modem.

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

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

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

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