APPENDIX 3B – AIR QUALITY MONITORING

Table 5 Air Quality Impact Assessment Criteria

Pollutant	Averaging Period	Maximum Increase (from the Mine)	[d] Criterion
Deposited dust [c]	Annual	[b] 2 g/m^2/month	[a] 4 g/m^2/month
PM_{10}	Annual	-	[a] 30 $\mu g/m^3$
PM_{10}	24 hour	-	[a] 50 $\mu g/m^3$
TSP	Annual	-	[a] 90 $\mu g/m^3$

Notes: g/m^2/month = grams per square metre per month. $\mu g/m^3$ = micrograms per cubic metre. a Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources); b Incremental impact (i.e. incremental increase in concentrations due to the development on its own); c Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method; and d Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed by the Director-General.

Dust Deposition

Table 6 Summary of Annual Average Dust Deposition

EPL 12425 ID No.	3	4	-	6	-	9	10	11	12	26
Monitoring ID No.	**DG4**	**DG5***	**DG7****	**DG8**	**DG10**	**DG11**	**DG12**	**DG13**	**DG14**	**DG15**
2011 Annual Average Total Insoluble Matter (g/m^2/month)	0.90	1.13	1.22	0.94	3.02	1.30	3.73	1.95	1.88	-
2012 Annual Average Total Insoluble Matter (g/m^2/month)	1.05	0.73	1.52	1.03	1.19	1.41	6.52	2.38	2.18	-
2013 Annual Average Total Insoluble Matter (g/m^2/month)	0.87	0.60	-	1.43	2.04	2.1	3.26	1.94	1.04	0.8
2014 Annual Average Total Insoluble Matter (g/m^2/month)	1.68	0.83	-	1.48	3.31	1.28	3.28	2.81	1.43	0.85
2015 Annual Average Total Insoluble Matter (g/m^2/month)	0.90	0.80	-	1.10	3.60	1.90	2.90	4.30	1.30	0.70

Notes: Shaded cells indicated internal dust depositional monitoring sites. * The 4 g/m^2/month limit only applies to DG5, the limit has been removed from all other dust gauges by the EPA. **At the end of the 2012 reporting period DG7 was relocated from the Mittaville Property to Araluen Road. Araluen Road is situated to the north east of Wollar Village. The new dust gauge is identified as DG15.

Comparison with Data from Project EA Predictions

Table 7 Predicted Dust Deposition Against 2015 Results

Dust Depositional Gauge	Receptor ID*	Year 9 Predicted Annual Av. Dust Deposition (MOD3)	Year 10 Predicted Annual Av. Dust Deposition (MOD6)	2015 Annual Average Dust Deposition Results
DG5	900 & 942 & 150	1.6 g/m^2/month	1.2 - 1.3 g/m^2/month	0.80 g/m^2/month
DG15	146 & 129 & 135	1.6 g/m^2/month	1.2 g/m^2/month	0.70 g/m^2/month

Note: * Nearest private receptor ID to dust depositional gauge.

Total Suspended Particulate (TSP) Matter & PM_{10}

Table 8 Summary of TSP and PM_{10} Results

	Monitoring Locations[#]						
EPL 12425 ID No.	**13**	**19**	**20**	**27**	**-**	**25**	**28**
Monitoring ID No.	**HV1**	**HV3**	**HV4**	**HV5**	**TEOM1^**	**TEOM3**	**TEOM4**
2012 Results							
PM_{10} (µg/m^3) recorded range*	2.8 – 21.7	-	12.0 – 21.8	**	3.4 - 60.3	**	**
PM_{10} (µg/m^3) annual average	9.1	-	9.7	**	9.7	**	**
TSP (µg/m^3) recorded range*	-	1.9 – 47.0	-	-	-	-	-
TSP (µg/m^3) annual average	-	18.8	-	-	-	-	-
2013 Results							
PM10 (µg/m^3) recorded range*	1.2 – 43.7	-	2 – 55.1	1.8 – 49.8	3.0 – 82.5	2.4 – 55.6	0.7 – 68.9
PM10 (µg/m^3) annual average	10.84	-	12.4	15.71	18.5	13.1	16.8
TSP (µg/m^3) recorded range*	-	3.1 – 77.6	-	-	-	-	-
TSP (µg/m^3) annual average	-	27.45	-	-	-	-	-
2014 Results							
PM10 (µg/m^3) recorded range*	1.70 - 41.20	-	1.80 – 37.70	2.80 – 47.80		2.65 – 59.12	1.18 – 53.96
PM10 (µg/m^3) annual average	11.15	-	11.95	14.58	17.3	13.2	15.3
TSP (µg/m^3) recorded range*	-	7.20 – 59.0	-	-	-	-	-
TSP (µg/m^3) annual average	-	23.09	-	-	-	-	-
2015 Results							
PM10 (µg/m^3) recorded range*	1.1 – 29.3	-	1.9 – 40.0	1.0 – 35.3	-	1.4 – 78.5	0.9 – 77.3
PM10 (µg/m^3) annual average	9.79	-	11.52	11.68	-	11.69	9.35
TSP (µg/m^3) recorded range*	-	3.7 – 68.7	-	-	-	-	-
TSP (µg/m^3) annual average	-	22.61	-		-	-	-

Notes: * Data presented is the range of minimum and maximum 24 hour averages. ^ Data recorded at these sites is not for compliance, but for management purposes only. [#] Refer to **Figure 7 & 8.**

Comparison with Data from Project EA Predictions

Table 9 Predicted PM_{10} & TSP Against 2014 Results

PM_{10} /TSP Monitor	Receptor ID*	Yr 9 Predicted Annual Average (MOD 3) (µg/m^3)		Yr 10 Predicted Annual Average (MOD 6) (µg/m^3)		2015 Annual Average PM_{10} Results (µg/m^3)	
		PM_{10}	TSP	PM_{10}	TSP	PM_{10}	TSP
HV1 TEOM3	900	14	-	14.2	24.0	11.69	9.79
HV5 TEOM4	128 &129	16	-	14.7	24.9	9.35	11.68

Note: * Nearest receptor ID to PM10/TSP monitoring site.

Figure 3 – Air Quality Monitoring Stations

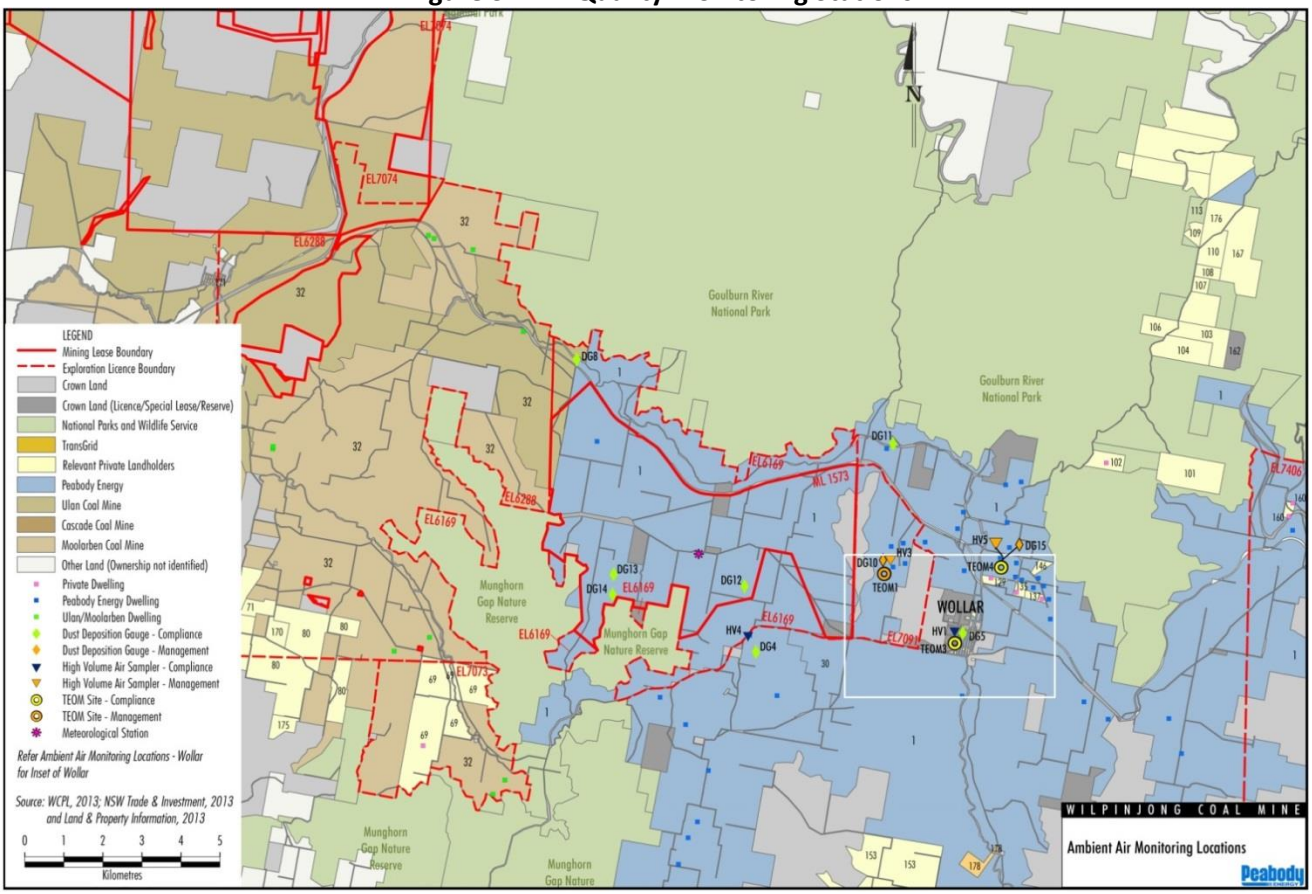
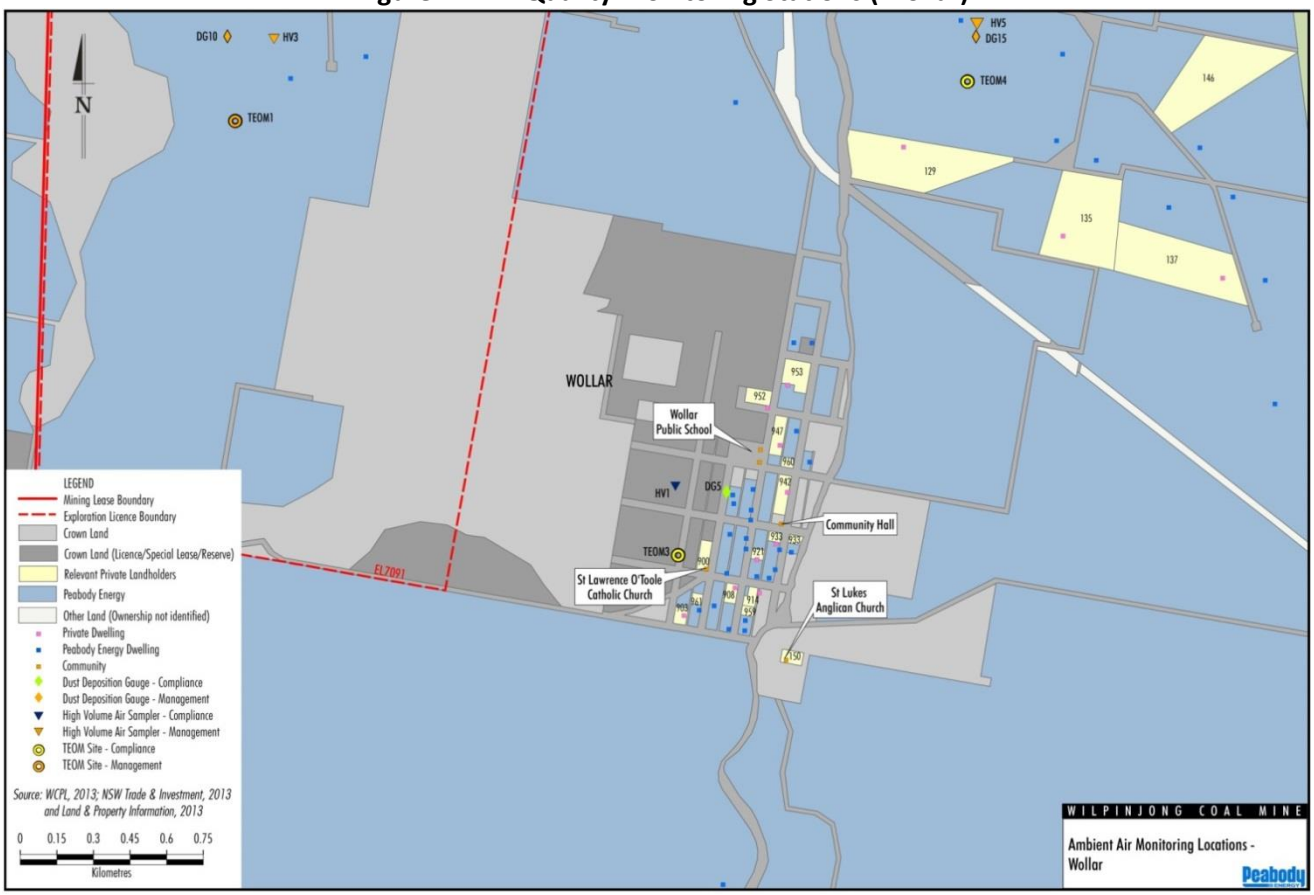


Figure 4 – Air Quality Monitoring Stations (Wollar)



2015 Ambient Air Quality Monitoring Reports

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WORLD RECOGNISED ACCREDITATION

Peabody Energy

Wilpinjong Coal
Wollar

Ambient Air Quality Monitoring

Validated Report

1st January – 31st January 2015

Report No.: DAT9105

Report issue date: 27th February 2015

Maintenance contract: MC951

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Revision History			
Revision	**Report ID**	**Date**	**Analyst**
0	DAT9105	27/02/2015	Robyn EDWARDS

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1.0 Executive Summary

Peabody Energy has commissioned Ecotech P/L to conduct air quality monitoring for the Wilpinjong Mine at Wollar. Measured parameters at Wollar are NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene and *p*-Xylene. A wind sensor is also installed at the Wollar site.

The Wollar station was commissioned in March 2013.

This report presents the data collected from the Wollar station for January 2015. Data capture for the different pollutants is presented in Table 9

2.0 Introduction

Ecotech Pty Ltd was commissioned by Peabody Energy to provide monitoring and data reporting for the Wilpinjong Mine at Wollar, located as detailed in Table 1. Ecotech commenced data collection from the Wilpinjong Station on the 1st March 2013.

This report presents the data for January 2015.

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

3.1. Siting Details

The Wilpinjong Mine consists of one ambient air quality monitoring station. The station location and siting details are described below.

Table 1: Wilpinjong Mine monitoring site location

Site Name	Geographical Coordinates	Height Above Sea Level (m)
Wollar	Lat: -32.360105 Long: 149.949509	366

A siting audit to assess for compliance with AS/NZS 3580.1.1:2007 has not yet been completed. The audit will be completed at the next suitable maintenance visit.

Figure 1: Wilpinjong Mine Monitoring Station Location

3.2. Monitored Parameters

Table 2 below details the parameters monitored and the instruments used at Wilpinjong Mine monitoring station. Appendix 1 defines any abbreviated parameter names used throughout the report.

For meteorological sensors, the elevation given in the table below is the height above ground level at the monitoring station.

Table 2: Parameters measured at the Wilpinjong Mine monitoring station

Parameter Measured	Instrument and Measurement Technique
BTX (Benzene, Toluene and *p*-Xylene)	Synspec GC955 - Gas Chromatography
H_2S	Ecotech EC9852 - fluorescence
NO, NO_2, NO_x	Ecotech EC9841 gas phase chemiluminescence
SO_2	Ecotech EC9850 – fluorescence
Wind Speed (horizontal, 10m)	Vaisala WS425 – ultrasonic
Wind Direction (10m)	Vaisala WS425 – ultrasonic

3.3. Data Collection Methods

Table 3 below shows the methods used for data collection. Any deviations from the stated methods are detailed in section 3.3.1.

Table 3: Methods

Parameter Measured	Data Collection Methods Used	Description of Method
NO, NO_2, NO_x	AS 3580.5.1-2011	Methods for sampling and analysis of ambient air. Method 5.1: Determination of oxides of nitrogen – chemiluminescence method
	Ecotech Laboratory Manual	In-house method 6.1 Oxides of nitrogen by chemiluminescence
SO_2	AS 3580.4.1 - 2008	Methods for sampling and analysis of ambient air. Method 4.1: Determination of sulfur dioxide – Direct reading instrumental method
	Ecotech Laboratory Manual	In-house method 6.2 Sulfur dioxide by fluorescence
H_2S	Ecotech Laboratory Manual	In-house method 6.5 Hydrogen sulfide by fluorescence
BTX (Benzene, Toluene and *p*-Xylene)	Synspec GC955 Series Manual	Synspec GC955 - Gas Chromatography
Vector Wind Speed (Horizontal)	AS 3580.14 2011	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.1 Wind speed (Horizontal) by anemometer
Vector Wind Direction	AS 3580.14 2011	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.3 Wind direction by anemometer

3.3.1. Compliance with Standards

Unless stated below, parameters are monitored at the Wilpinjong Mine site according to the methods detailed in Table 3 above.

- Measurement of wind data does not comply with AS 3580.14 2011 and is not covered by Ecotech's NATA scope of accreditation due to current unavailability of a suitable wind tunnel calibration certificate.
- Measurement of benzene, toluene and *p*-Xylene (BTX) is not covered by Ecotech's NATA scope of accreditation.
- Measurement of hydrogen sulfide (H_2S) is not covered by Ecotech's scope of accreditation due to the frequency of calibration checks.

3.3.2. Data Acquisition

Data acquisition is performed using a PC based WinAQMS logger (using WinAQMS® Version 2.0) situated at the monitoring site. Each logger is equipped with a 3G modem for remote data collection. The recorded data is remotely collected from the AQMS logger on a daily basis (using Airodis™ version 5.0) and stored at Ecotech's Environmental Reporting Services (ERS) department in Melbourne, Australia. Data samples are logged in 5 minute intervals.

3.4. Data Validation and Reporting

3.4.1. Validation

The Ecotech ERS department performs 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.

Details of all invalid or missing data are recorded in the Valid Data Exception Tables.

Validation is performed by the analyst, and the validation is reviewed. Graphs and tables are generated based on the validated five minute data.

3.4.2. Reporting

The reported data is in a Microsoft Excel format file named "*Wilpingjong Coal Validated Data Report Jan-15.xls*". The Excel file consists of 5 Excel worksheets:

1. Cover
2. Wollar 5 Minute Averages
3. Wollar 1 Hour Averages
4. Wollar 24 Hour Averages
5. Valid Data Exception Table

The data contained in this report is based on Australian Eastern Standard Time.

All averages are calculated from the five minute data. Averages are based on a minimum of 75% valid readings within the averaging period.

Averaging periods of eight hours or less are reported for the end of the period, i.e. the hourly average 02:00 is for the data collected from 01:00 to 02:00. One hour averages are calculated based on a clock hour. One day averages are calculated based on calendar days.

4.0 Air Quality Goals

The air quality goals for pollutants monitored at the Wilpinjong Wollar monitoring station are based on the Australian National Environmental Council (NEPC) Ambient Air Quality (NEPM). These air quality goals are shown in Table 4 below.

Table 4: Wilpinjong Air Quality Goals (NEPM)

Parameter	Time Period	Exceedence Level	Units	Maximum allowable exceedences
NO_2	1 year	30	ppb	None
NO_2	1 hour	120	ppb	1 day a year
SO_2	1 hour	200	ppb	1 day a year
SO_2	1 day	80	ppb	1 day a year
SO_2	1 year	20	ppb	None

4.1. Air Quality Summary

Table 5 below, details any exceedences of the NEPM Standard that were observed during this reporting period.

Table 5: Exceedences Recorded

Parameter	Time Period	Value of Exceedence	Date of Exceedence
NO_2	1 hour	-	-
SO_2	1 hour	-	-
SO_2	1 day	-	-

5.0 Calibrations and Maintenance

5.1. Units and Uncertainties

The uncertainties for each parameter have been determined by the manufacturer's tolerance limits of the equipment's parameters, and by the data collection standard method.

The reported uncertainties are expanded uncertainties, calculated using coverage factors which give a level of confidence of approximately 95%.

Table 6: Units and Uncertainties

Parameter	Units	Resolution	Uncertainty	Measurement Range[1]
NO, NO_x (EC9841)	ppm	1 ppb	± 14 ppb K factor of 2.01	0 ppb to 500 ppb
NO_2 (EC9841)	ppm	1 ppb	± 16 ppb K factor of 2.01	0 ppb to 500 ppb
SO_2 (EC9850)	ppm	1 ppb	± 14 ppb K factor of 2.01	0 ppb to 500 ppb
H_2S	ppm	1 ppb	15.2% of reading or ± 19 ppb, whichever is greater K factor of 2	0 ppb to 500 ppb
Benzene, Toluene and *p*-Xylene (BTX)	ppb	0.03 ppb	15.1% of reading or 3.8ppb, whichever is greater K factor of 2	0 ppb to 300 ppb
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
Vector Wind Direction	Deg	1 deg	±4 deg K factor of 2.11	0 deg to 360 deg Starting threshold: 0 m/s

[1] Uncertainties may not be calculated based on the full measurement range. Uncertainty for NO, NO_2 and NO_x by EC 9841 and SO_2 by EC9850 are calculated based on a measurement range of 0-125 ppb.

5.2. Automatic Checks

Automatic span and zero calibration checks run each night for NO, NO_2, NO_x and SO_2.

Background checks run each night for SO_2 and H_2S.

See Table 7 below for additional details. Data points associated with these checks are invalidated but are not referred to in the Valid Data Exception Tables.

Table 7: Automatic checks for NO, NO_2, NO_x, SO_2, and H_2S

Parameter	Span / Zero cycle time (approximate)	Background cycle time (approximate)
NO, NO_2, NO_x	01:00 to 01:45	N/A
SO_2	01:00 to 01:40	23:50 to 00:00
H_2S	N/A	23:50 to 00:05

5.3. Maintenance

Scheduled monthly maintenance was performed on 21/01/2015 in accordance with Ecotech's site specific maintenance checklist.

5.3.1. Calibration & Maintenance Summary Tables

The last calibrations for the following parameters were performed on the indicated dates. Data supplied after this time is subject to further validation, to be performed at the next calibration cycle.

Note: Maintenance and calibration dates may differ, as calibrations may be less frequent than scheduled maintenance visits.

Table 8 indicates when the gas and meteorological equipment was last maintained / calibrated.

Table 8: Wilpinjong Wollar Maintenance Table

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	21/01/2015	Monthly	21/01/2015	Monthly
SO_2	21/01/2015	Monthly	21/01/2015	Monthly
H_2S	21/01/2015	Monthly	21/01/2015	Monthly
BTX	21/01/2015	Monthly	21/01/2015	Monthly
Wind Speed	21/01/2015	Monthly	TBA	2-Yearly
Wind Direction	21/01/2015	Monthly	TBA	2-Yearly

Wind sensor calibration certificates not yet received, last calibration will be updated when available

6.0 Results

6.1. Data Capture

Data capture is based on 1 hour averages, calculated from 5 minute data, and refers to the amount of available data collected during the report period.

The percentage of data captured is calculated using the following equation:
Data capture = (Reported air quality data / Total data) x 100%
Where:

- Reported air quality data = Number of instrument readings which have been validated through a quality assured process 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 displays data capture statistics for January 2015. **Bold** values in the table indicate data capture below 95%.

Details of all invalid or missing data affecting data affecting data capture are included in the Valid Data Exception Tables, and attached Excel file.

Table 9: Data Capture for Wilpinjong Wollar Station

Parameter	Data Capture %
NO, NO_2, NO_x	**83.8**
SO_2	**83.0**
H_2S	**80.3**
BTX	**79.8**
WS, WD	**86.9**

6.2. Graphic Representations

Validated 5 minute data for NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene and *p*-Xylene were used to construct the following graphical representations.

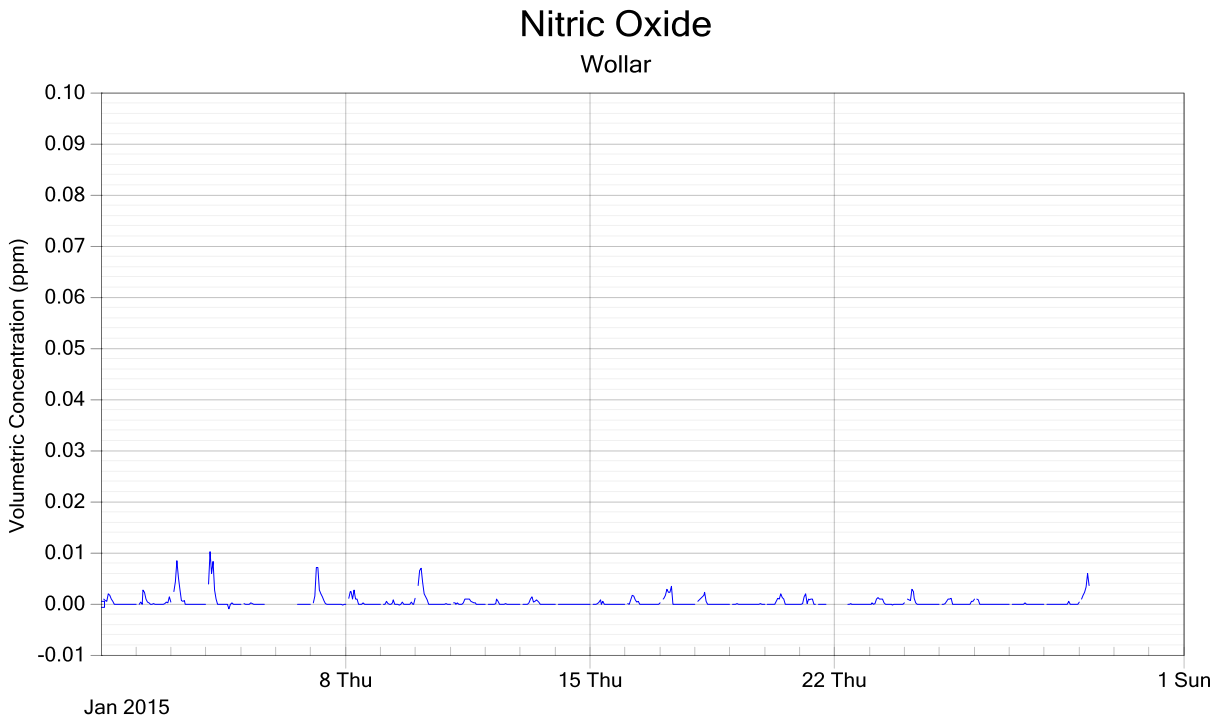

Figure 2: NO - 1 hour data

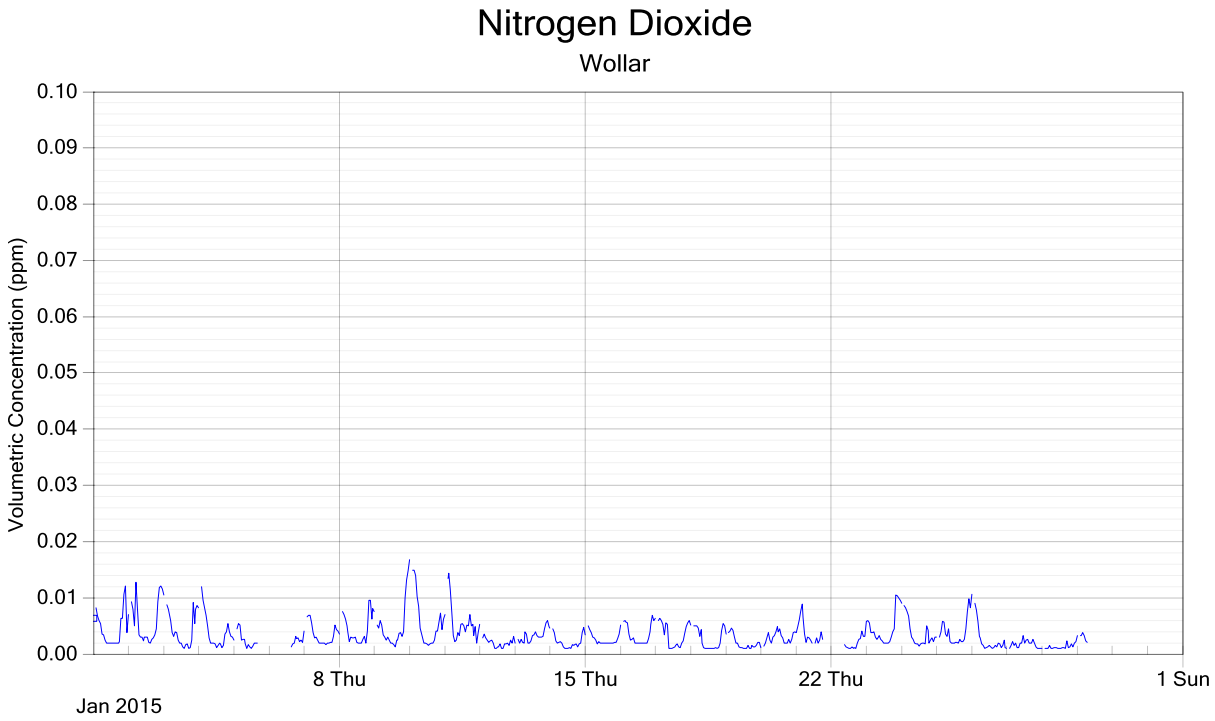

Figure 3: NO_2 - 1 hour data

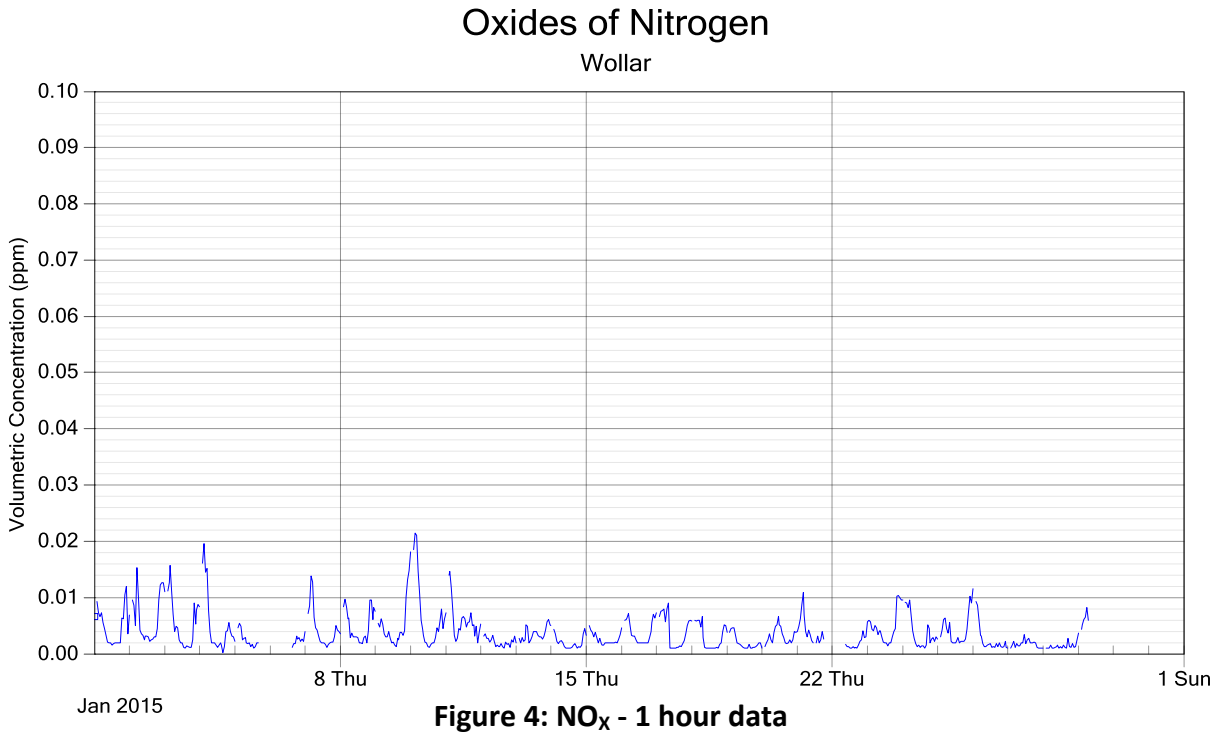

Figure 4: NO_X - 1 hour data

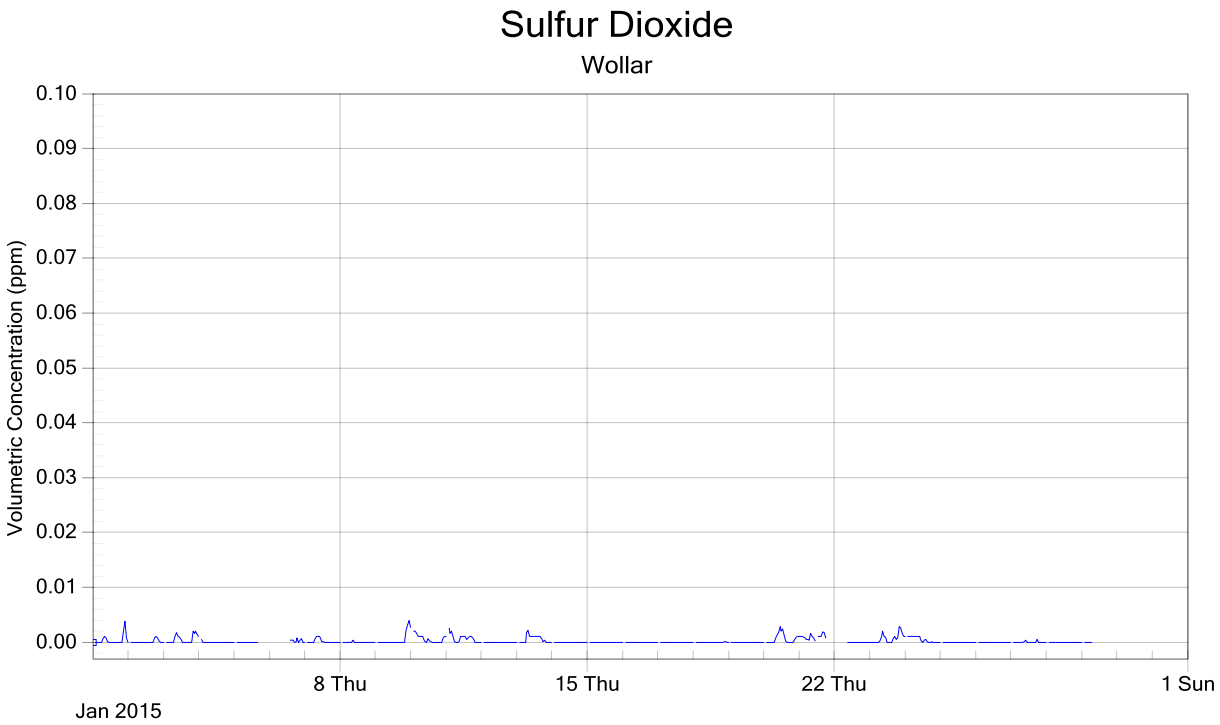

Figure 5: SO_2 - 1 hour data

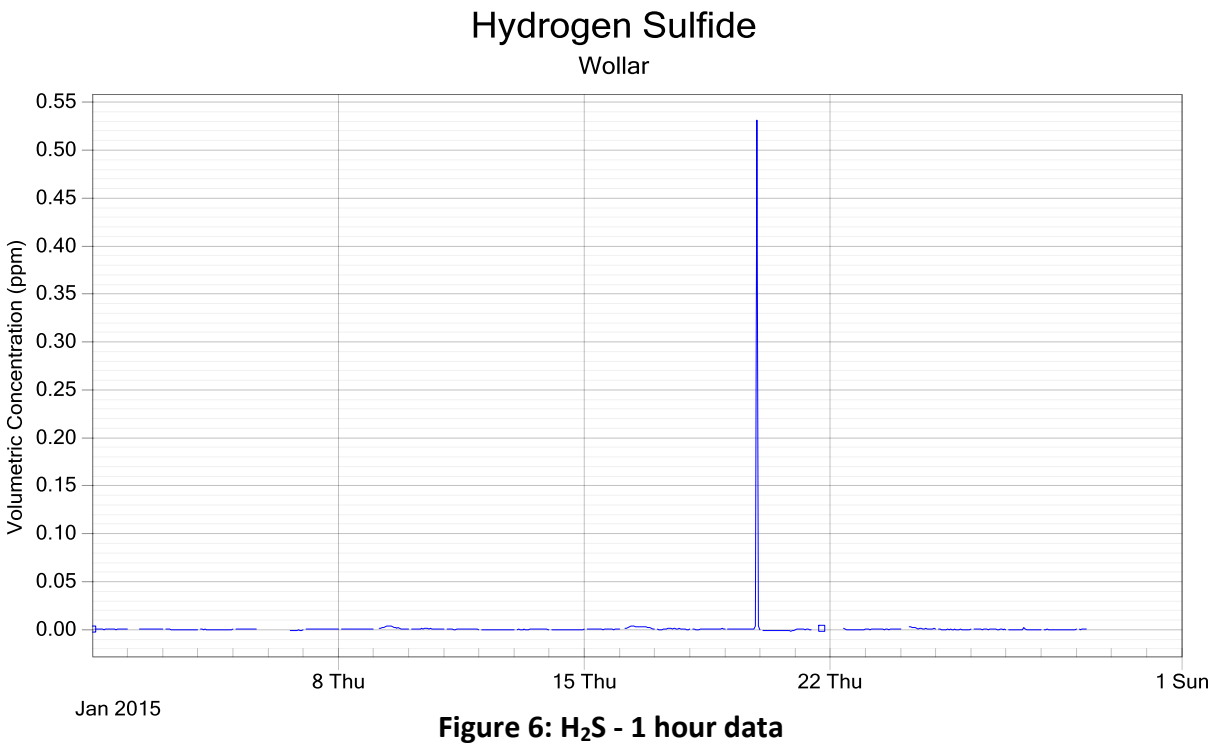

Figure 6: H_2S - 1 hour data

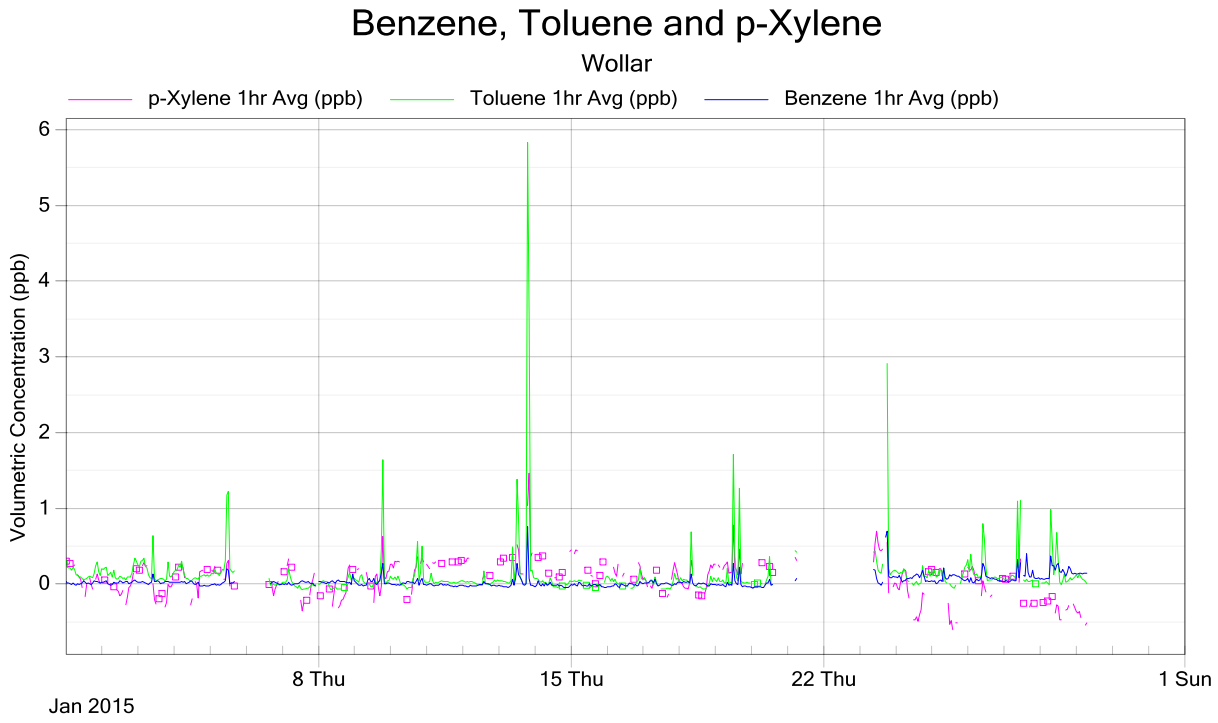

Figure 7: BTX - 1 hour data

7.0 Valid Data Exception Tables

The tables below details all changes made to the raw data set during the validation process. An explanation of reasons given in the table can be found in Appendix 2.

Table 10: Wollar Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
01/01/2015 00:00	05/01/2015 17:20	Static offset of +0.2 ppb applied to correct the baseline, continued from Dec-14	Toluene	RE	18/02/2015
01/01/2015 01:10	29/01/2015 05:20	Intermittent unrealistic negative data	Toluene, *p*-Xylene	RE	18/02/2015
02/01/2015 01:55	24/01/2015 06:00	Intermittent automatic calibration cycles and subsequent instrument stabilisation	H_2S	RE	18/02/2015
05/01/2015 17:25	06/01/2015 15:15	Power interruption and subsequent BTX instrument stabilisation	All parameters	RE	18/02/2015
07/01/2015 22:45	27/01/2015 12:15	Intermittent short power interruptions and subsequent BTX instrument stabilisation	H_2S, BTX, WS and WD	RE	18/02/2015
13/01/2015 13:45	24/01/2015 21:00	Intermittent data transmission errors	All parameters	RE	18/02/2015
20/01/2015 15:35	21/01/2015 05:00	Unknown instrument fault	BTX	RE	18/02/2015
21/01/2015 06:55	21/01/2015 19:00	Scheduled monthly maintenance – intermittent data affected	All parameters	RE	18/02/2015
21/01/2015 19:05	22/01/2015 07:30	Power interruption – data unrecoverable	All parameters	RE	18/02/2015
22/01/2015 07:35	22/01/2015 08:50	Power restored and subsequent analyser instruments stabilisation	All parameters	RE	18/02/2015

Start Date	End Date	Reason	Change Details	User Name	Change Date
22/01/2015 07:35	23/01/2015 08:25	Instrument fault	BTX	RE	18/02/2015
23/01/2015 08:30	29/01/2015 08:30	Static offset of +0.2 ppb applied to correct the baseline	Toluene	RE	18/02/2015
29/01/2015 08:35	01/02/2015 00:00	Loss of connection – restored on 02/02/2015	All parameters	RE	18/02/2015

8.0 Report Summary

The data capture for Wollar was below 95% for the reporting for all measured parameters. This was impacted by intermittent loss of connection during the month, and loss of connection from 29/01/2015 to 02/02/2015.

Continued instrument faults and unrealistic negative data with the BTX analyser resulted in further loss of data.

High H_2S readings were recorded on 19/01/2015 between 21:55 and 23:00 with readings reaching a maximum of 1.659 ppm at 22:15. These data points have been highlighted in red on the corresponding excel data report for Jan-15.

Measurement of a number of parameters in this report does not comply with applicable standards and/or is not covered by Ecotech's NATA scope of accreditation. Please refer to section 3.3.1 for details.

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

Appendix 1 - Definitions & Abbreviations

BTX	Benzene, Toluene and *p*-Xylene
H_2S	Hydrogen sulfide
m/s	Metres per second
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
ppb	Parts per billion
SO_2	Sulphur dioxide
WD	Vector Wind Direction
WS	Vector Wind Speed

Appendix 2 - Explanation of Exception Table

Automatic background check refers to when analyser samples zero air and measures the level of the concentration voltage. This voltage is taken as the zero signal level and this value is subtracted from any subsequent readings as an active zero compensation. This is the analyser's fine zero measurement.

Calibration check outside tolerance refers to when the calibration values are outside the tolerance limits set for the precision check.

Calibration correction factor applied to data refers to an offset or multiplier applied to the data. This operation may be performed for a number of reasons including: (a) when a clear trend / drift outside the tolerance limit can be demonstrated by repeated operation precision checks, (b) when a correction is required on previously logged data due to a calibration check being outside the allowable tolerance

Commissioning refers to the initial setup and calibration of the instrument when it is first installed. For some instruments there may be a stabilisation period before normal operation commences.

Data affected by environmental conditions – wind speed / wind speed gust spike refers to when a one-off high reading occurs due to a natural occurrence such as a bird sitting on the wind sensor, or some other event causing the readings to spike.

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.

Equipment malfunction/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.

Gap in data/data not available refers to a period of time when either data has been lost or could not be collected.

Instrument Alarm refers to an alarm produced by the instrument. A range of alarms can be produced depending on how operation of the instrument is being affected.

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

Linear offset or multiplier refers to when an offset or multiplier has been applied between two points where the values of the offset or multiplier are different and the correction is interpolated between the two points.

Logger error refers to when an error occurs and instrument readings are not correctly recorded by the logger.

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

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NATA
WORLD RECOGNISED ACCREDITATION

Peabody Energy

Wilpinjong Coal
Wollar

Ambient Air Quality Monitoring

Validated Report

1st February – 28th February 2015

Report No.: DAT9303

Report issue date: 27th March 2015

Maintenance contract: MC951

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Revision History			
Revision	**Report ID**	**Date**	**Analyst**
0	DAT9303	27/03/2015	Robyn EDWARDS

Report by: Robyn EDWARDS

Approved Signatory: Jon ALEXANDER

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1.0 Executive Summary

Peabody Energy has commissioned Ecotech P/L to conduct air quality monitoring for the Wilpinjong Mine at Wollar. Measured parameters at Wollar are NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene and *p*-Xylene. A wind sensor is also installed at the Wollar site.

The Wollar station was commissioned in March 2013.

This report presents the data collected from the Wollar station for February 2015. Data capture for the different pollutants is presented in Table 9

2.0 Introduction

Ecotech Pty Ltd was commissioned by Peabody Energy to provide monitoring and data reporting for the Wilpinjong Mine at Wollar, located as detailed in Table 1. Ecotech commenced data collection from the Wilpinjong Station on the 1st March 2013.

This report presents the data for February 2015.

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

3.1. Siting Details

The Wilpinjong Mine consists of one ambient air quality monitoring station. The station location and siting details are described below.

Table 1: Wilpinjong Mine monitoring site location

Site Name	Geographical Coordinates	Height Above Sea Level (m)
Wollar	Lat: -32.360105 Long: 149.949509	366

A siting audit was conducted on 27th February 2015 to assess for compliance with *AS/NZS 3580.1.1:2007 "Methods for sampling and analysis of ambient air – guide to siting air monitoring equipment"*.

This siting of this station complies with AS/NZS 3580.1.1:2007. The station is classified as a neighbourhood station according to *AS/NZS 3580.1.1:2007*.

Figure 1: Wilpinjong Mine Monitoring Station Location

3.2. Monitored Parameters

Table 2 below details the parameters monitored and the instruments used at Wilpinjong Mine monitoring station. Appendix 1 defines any abbreviated parameter names used throughout the report.

For meteorological sensors, the elevation given in the table below is the height above ground level at the monitoring station.

Table 2: Parameters measured at the Wilpinjong Mine monitoring station

Parameter Measured	Instrument and Measurement Technique
BTX (Benzene, Toluene and *p*-Xylene)	Synspec GC955 - Gas Chromatography
H_2S	Ecotech EC9852 - fluorescence
NO, NO_2, NO_x	Ecotech EC9841 gas phase chemiluminescence
SO_2	Ecotech EC9850 – fluorescence
Wind Speed (horizontal, 10m)	Vaisala WS425 – ultrasonic
Wind Direction (10m)	Vaisala WS425 – ultrasonic

3.3. Data Collection Methods

Table 3 below shows the methods used for data collection. Any deviations from the stated methods are detailed in section 3.3.1.

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Parameter Measured	Data Collection Methods Used	Description of Method
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3.3.1. Compliance with Standards

Unless stated below, parameters are monitored at the Wilpinjong Mine site according to the methods detailed in Table 3 above.

- Measurement of wind data does not comply with AS 3580.14 2011 and is not covered by Ecotech's NATA scope of accreditation due to current unavailability of a suitable wind tunnel calibration certificate.
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3.3.2. Data Acquisition

Data acquisition is performed using a PC based WinAQMS logger (using WinAQMS® Version 2.0) situated at the monitoring site. Each logger is equipped with a 3G modem for remote data collection. The recorded data is remotely collected from the AQMS logger on a daily basis (using Airodis™ version 5.0) and stored at Ecotech's Environmental Reporting Services (ERS) department in Melbourne, Australia. Data samples are logged in 5 minute intervals.

3.4. Data Validation and Reporting

3.4.1. Validation

The Ecotech ERS department performs 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.

Details of all invalid or missing data are recorded in the Valid Data Exception Tables.

Validation is performed by the analyst, and the validation is reviewed. Graphs and tables are generated based on the validated five minute data.

3.4.2. Reporting

The reported data is in a Microsoft Excel format file named "*Wilpingjong Coal Validated Data Report Feb-15.xls*". The Excel file consists of 5 Excel worksheets:

1. Cover
2. Wollar 5 Minute Averages
3. Wollar 1 Hour Averages
4. Wollar 24 Hour Averages
5. Valid Data Exception Table

The data contained in this report is based on Australian Eastern Standard Time.

All averages are calculated from the five minute data. Averages are based on a minimum of 75% valid readings within the averaging period.

Averaging periods of eight hours or less are reported for the end of the period, i.e. the hourly average 02:00 is for the data collected from 01:00 to 02:00. One hour averages are calculated based on a clock hour. One day averages are calculated based on calendar days.

4.0 Air Quality Goals

The air quality goals for pollutants monitored at the Wilpinjong Wollar monitoring station are based on the Australian National Environmental Council (NEPC) Ambient Air Quality (NEPM). These air quality goals are shown in Table 4 below.

Table 4: Wilpinjong Air Quality Goals (NEPM)

Parameter	Time Period	Exceedence Level	Units	Maximum allowable exceedences
NO_2	1 year	30	ppb	None
NO_2	1 hour	120	ppb	1 day a year
SO_2	1 hour	200	ppb	1 day a year
SO_2	1 day	80	ppb	1 day a year
SO_2	1 year	20	ppb	None

4.1. Air Quality Summary

Table 5 below, details any exceedences of the NEPM Standard that were observed during this reporting period.

Table 5: Exceedences Recorded

Parameter	Time Period	Value of Exceedence	Date of Exceedence
NO_2	1 hour	-	-
SO_2	1 hour	-	-
SO_2	1 day	-	-

5.0 Calibrations and Maintenance

5.1. Units and Uncertainties

The uncertainties for each parameter have been determined by the manufacturer's tolerance limits of the equipment's parameters, and by the data collection standard method.

The reported uncertainties are expanded uncertainties, calculated using coverage factors which give a level of confidence of approximately 95%.

Table 6: Units and Uncertainties

Parameter	Units	Resolution	Uncertainty	Measurement Range[1]
NO, NO_x (EC9841)	ppm	1 ppb	± 14 ppb K factor of 2.01	0 ppb to 500 ppb
NO_2 (EC9841)	ppm	1 ppb	± 16 ppb K factor of 2.01	0 ppb to 500 ppb
SO_2 (EC9850)	ppm	1 ppb	± 14 ppb K factor of 2.01	0 ppb to 500 ppb
H_2S	ppm	1 ppb	15.2% of reading or ± 19 ppb, whichever is greater K factor of 2	0 ppb to 500 ppb
Benzene, Toluene and *p*-Xylene (BTX)	ppb	0.03 ppb	15.1% of reading or 3.8ppb, whichever is greater K factor of 2	0 ppb to 300 ppb
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
Vector Wind Direction	Deg	1 deg	±4 deg K factor of 2.11	0 deg to 360 deg Starting threshold: 0 m/s

[1] Uncertainties may not be calculated based on the full measurement range. Uncertainty for NO, NO_2 and NO_x by EC 9841 and SO_2 by EC9850 are calculated based on a measurement range of 0-125 ppb.

5.2. Automatic Checks

Automatic span and zero calibration checks run each night for NO, NO_2, NO_x and SO_2.

Background checks run each night for SO_2 and H_2S.

See Table 7 below for additional details. Data points associated with these checks are invalidated but are not referred to in the Valid Data Exception Tables.

Table 7: Automatic checks for NO, NO_2, NO_x, SO_2, and H_2S

Parameter	Span / Zero cycle time (approximate)	Background cycle time (approximate)
NO, NO_2, NO_x	01:00 to 01:45	N/A
SO_2	01:00 to 01:40	23:50 to 00:00
H_2S	01:55 to 03:50 (weekly)	23:50 to 00:05

5.3. Maintenance

Scheduled monthly maintenance was performed on 26/02/2015 in accordance with Ecotech's site specific maintenance checklist. Further calibrations were performed on the BTX analyser on 27/02/2015.

5.3.1. Calibration & Maintenance Summary Tables

The last calibrations for the following parameters were performed on the indicated dates. Data supplied after this time is subject to further validation, to be performed at the next calibration cycle.

Note: Maintenance and calibration dates may differ, as calibrations may be less frequent than scheduled maintenance visits.

Table 8 indicates when the gas and meteorological equipment was last maintained / calibrated.

Table 8: Wilpinjong Wollar Maintenance Table

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	26/02/2015	Monthly	26/02/2015	Monthly
SO_2	26/02/2015	Monthly	26/02/2015	Monthly
H_2S	26/02/2015	Monthly	26/02/2015	Monthly
BTX	27/02/2015	Monthly	27/02/2015	Monthly
Wind Speed	26/02/2015	Monthly	TBA	2-Yearly
Wind Direction	26/02/2015	Monthly	TBA	2-Yearly

Wind sensor calibration certificates not yet received, last calibration will be updated when available

6.0 Results

6.1. Data Capture

Data capture is based on 1 hour averages, calculated from 5 minute data, and refers to the amount of available data collected during the report period.

The percentage of data captured is calculated using the following equation:
Data capture = (Reported air quality data / Total data) x 100%
Where:

- Reported air quality data = Number of instrument readings which have been validated through a quality assured process 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 displays data capture statistics for February 2015. **Bold** values in the table indicate data capture below 95%.

Details of all invalid or missing data affecting data affecting data capture are included in the Valid Data Exception Tables, and attached Excel file.

Table 9: Data Capture for Wilpinjong Wollar Station

Parameter	Data Capture %
NO, NO_2, NO_x	**92.9**
SO_2	**92.9**
H_2S	**53.6**
Benzene	**89.3**
Toluene	**89.3**
p-Xylene	**50.0**
WS, WD	**92.9**

6.2. Graphic Representations

Validated 5 minute data for NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene and *p*-Xylene were used to construct the following graphical representations.

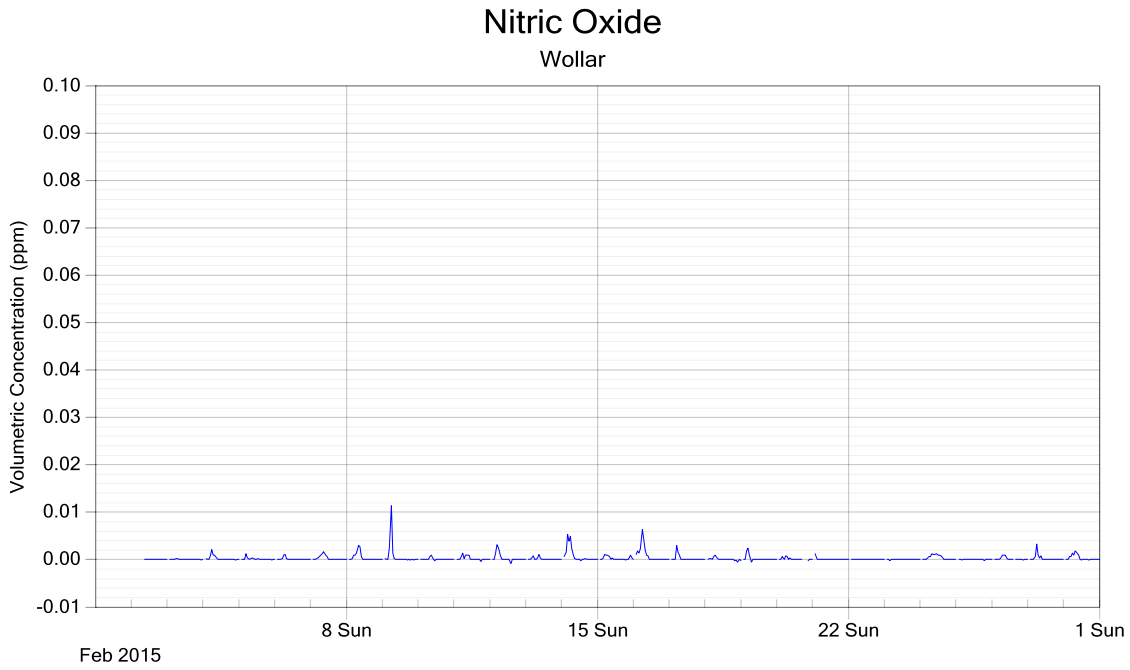

Figure 2: NO - 1 hour data

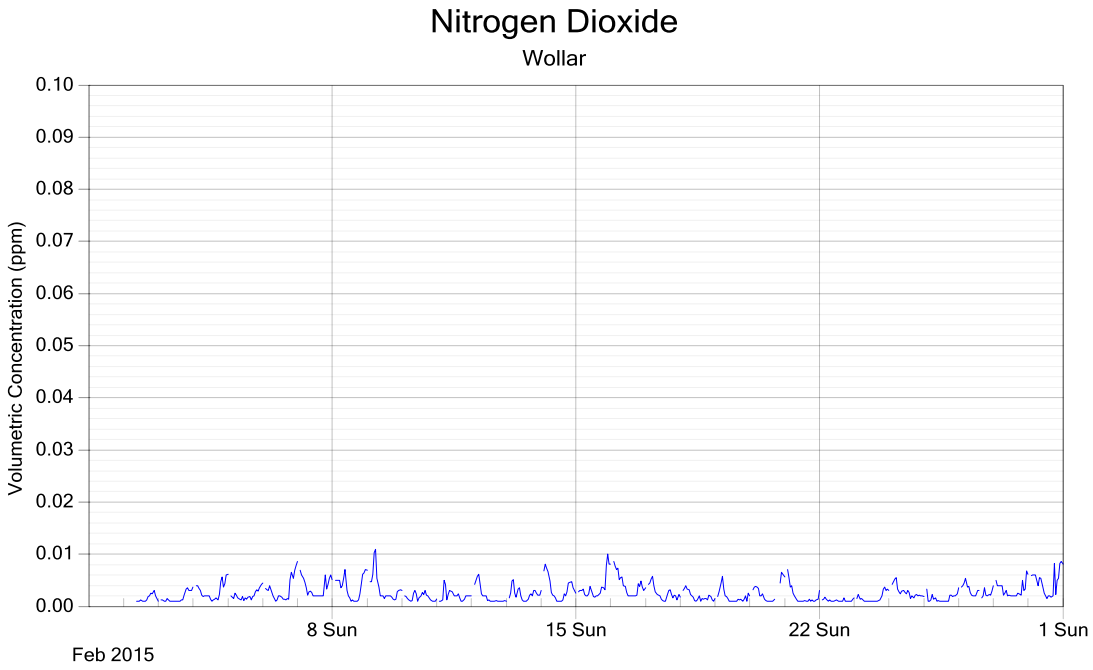

Figure 3: NO_2 - 1 hour data

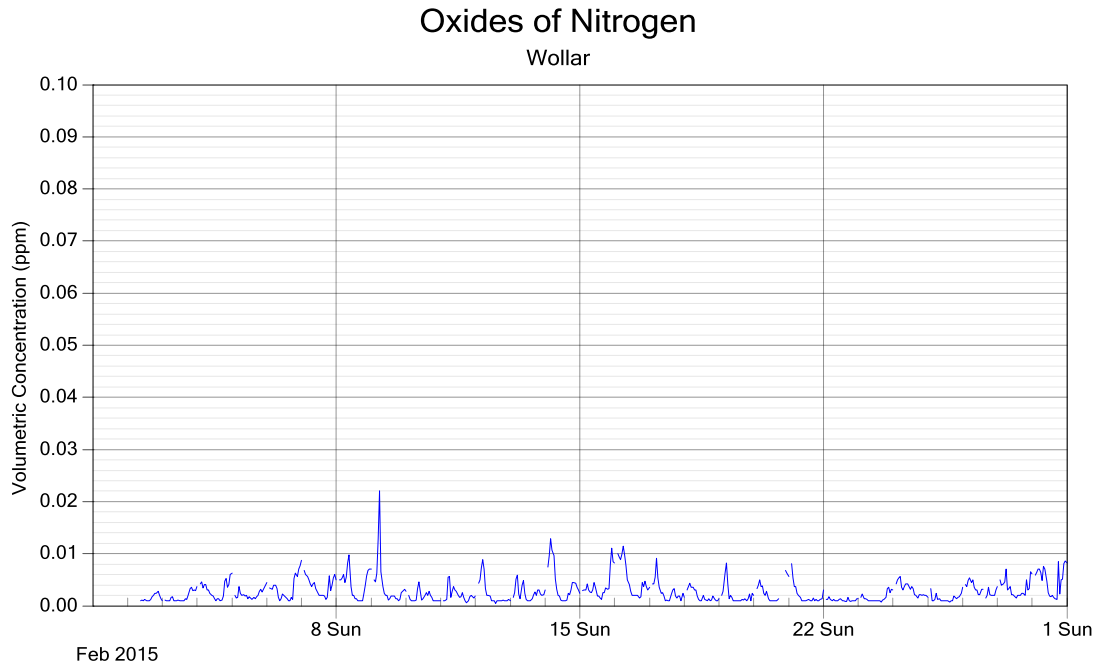

Figure 4: NO_X - 1 hour data

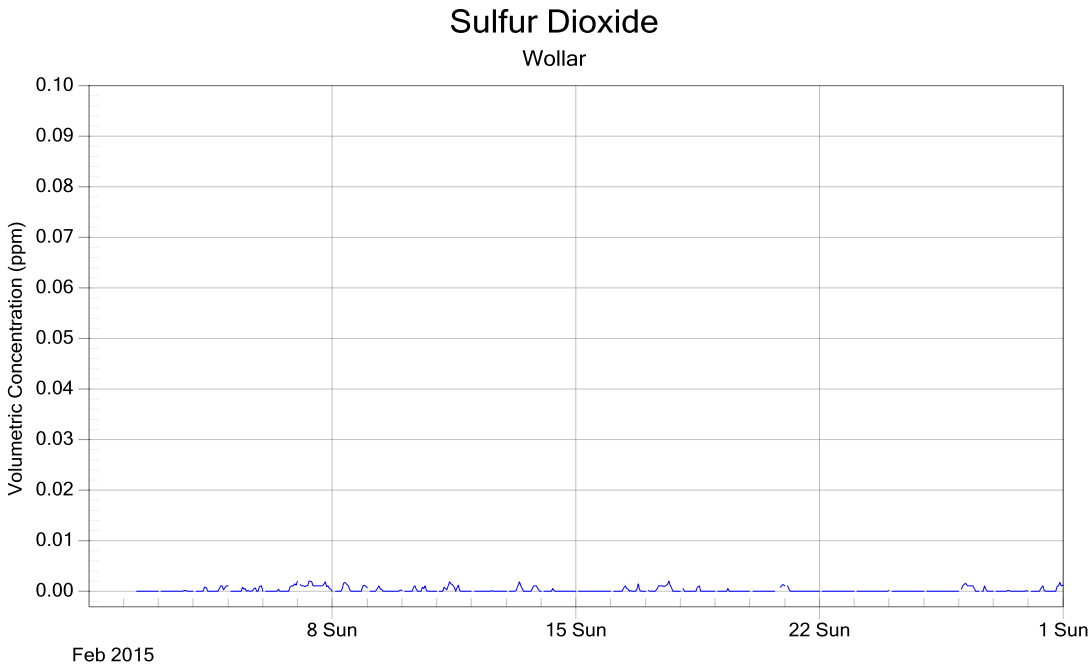

Figure 5: SO_2 - 1 hour data

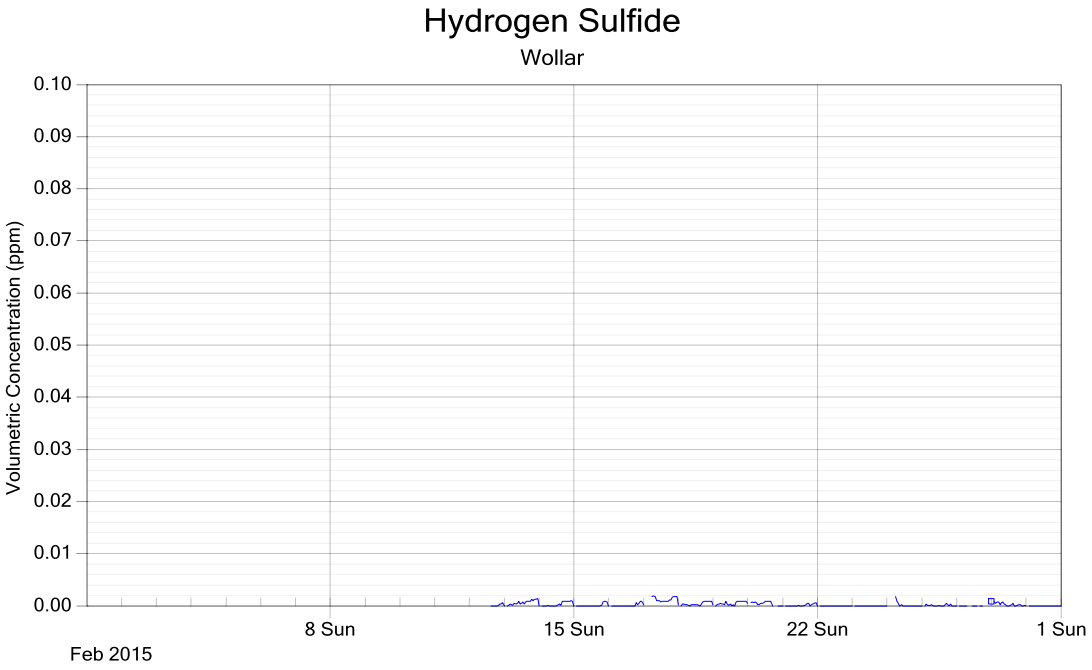

Figure 6: H_2S - 1 hour data

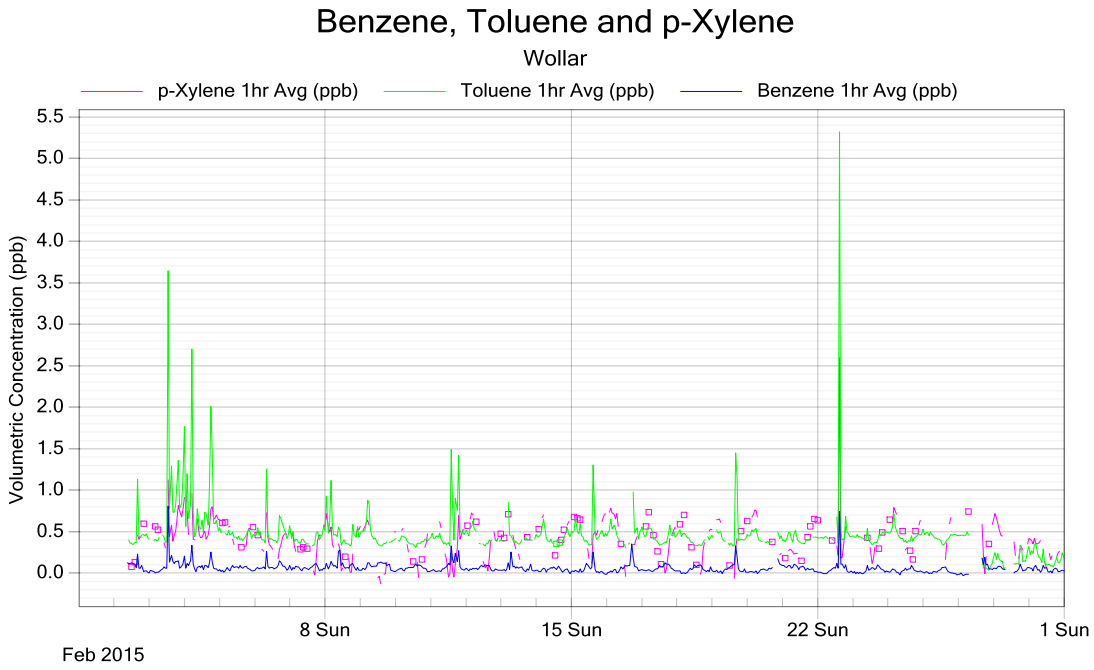

Figure 7: BTX - 1 hour data

7.0 Valid Data Exception Tables

The tables below details all changes made to the raw data set during the validation process. An explanation of reasons given in the table can be found in Appendix 2.

Table 10: Wollar Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
29/01/2015 8:35	2/02/2015 8:05	Loss of connection continued from Jan-15	All parameters	RE	N/A
2/02/2015 8:10	2/02/2015 8:45	Connection restored and subsequent SO_2 and BTX instrument stabilisation	All parameters	RE	25/03/2015
2/02/2015 8:30	12/02/2015 11:15	Instrument out of service due to high zero readings	H_2S	RE	25/03/2015
2/02/2015 8:50	26/02/2015 8:15	Static offset of +0.65 ppb applied to correct baseline	Benzene	RE	25/03/2015
2/02/2015 9:00	1/03/2015 0:00	Outliers – intermittent drop outs	Toluene and *p*-Xylene	RE	26/03/2015
2/02/2015 9:50	26/02/2015 8:15	Static offset of -0.8 ppb applied to correct baseline	*p*-Xylene	RE	26/03/2015
8/02/2015 1:50	28/02/2015 1:40	Instrument stabilisation following automatic overnight calibration cycle	NO, NO_2 and NO_X	RE	25/03/2015
12/02/2015 11:25	12/02/2015 14:30	Calibration performed to correct zero readings and subsequent instrument stabilisation	H_2S	RE	25/03/2015
12/02/2015 14:35	26/02/2015 8:30	Static offset of +0.001 applied to correct zero baseline	H_2S	RE	25/03/2015
12/02/2015 14:35	26/02/2015 19:25	Static multiplier of +0.88 applied to correct out of tolerance spans on 17/02/2015 and 24/02/2015	H_2S	RE	26/03/2015

Start Date	End Date	Reason	Change Details	User Name	Change Date
17/02/2015 3:55	24/02/2015 5:15	Intermittent instrument stabilisation following weekly automatic calibration cycle	H_2S	RE	25/03/2015
20/02/2015 18:05	20/02/2015 20:20	Loss of connection	All parameters	RE	N/A
20/02/2015 20:25	20/02/2015 21:20	Connection restored and subsequent instrument stabilisation	All parameters	RE	25/03/2015
26/02/2015 8:20	26/02/2015 16:05	Scheduled monthly maintenance – intermittent data affected throughout the day	All parameters	RE	25/03/2015
26/02/2015 15:50	27/02/2015 9:30	Static offset of 0.4 ppb applied to correct baseline	*p*-Xylene	RE	26/03/2015
27/02/2015 9:40	27/02/2015 13:20	Unscheduled maintenance – multiple calibrations performed to correct spans	BTX	RE	26/03/2015
27/02/2015 13:25	1/03/2015 0:00	Static offset of +3.4 ppb applied to correct baseline	Benzene	RE	25/03/2015
27/02/2015 13:25	1/03/2015 0:00	Static offset of -3.0 ppb applied to correct baseline	Toluene	RE	26/03/2015
27/02/2015 13:25	1/03/2015 0:00	Static offset of -16.7 ppb applied to correct baseline	*p*-Xylene	RE	26/03/2015

8.0 Report Summary

The data capture for Wollar was below 95% for the reporting for all measured parameters. This was largely impacted by loss of connection at the beginning of the month and again on 20/02/2015.

Continued instrument faults and unrealistic negative data with the BTX analyser resulted in further loss of data, with *p*-Xylene having significant loss of data due to this negative data.

A large amount of data was invalidated for H_2S due to instrument fault resulting in an incorrect zero reading.

Measurement of a number of parameters in this report does not comply with applicable standards and/or is not covered by Ecotech's NATA scope of accreditation. Please refer to section 3.3.1 for details.

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

Appendix 1 - Definitions & Abbreviations

BTX	Benzene, Toluene and *p*-Xylene
H_2S	Hydrogen sulfide
m/s	Metres per second
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
ppb	Parts per billion
SO_2	Sulphur dioxide
WD	Vector Wind Direction
WS	Vector Wind Speed

Appendix 2 - Explanation of Exception Table

Automatic background check refers to when analyser samples zero air and measures the level of the concentration voltage. This voltage is taken as the zero signal level and this value is subtracted from any subsequent readings as an active zero compensation. This is the analyser's fine zero measurement.

Calibration check outside tolerance refers to when the calibration values are outside the tolerance limits set for the precision check.

Calibration correction factor applied to data refers to an offset or multiplier applied to the data. This operation may be performed for a number of reasons including: (a) when a clear trend / drift outside the tolerance limit can be demonstrated by repeated operation precision checks, (b) when a correction is required on previously logged data due to a calibration check being outside the allowable tolerance

Commissioning refers to the initial setup and calibration of the instrument when it is first installed. For some instruments there may be a stabilisation period before normal operation commences.

Data affected by environmental conditions – wind speed / wind speed gust spike refers to when a one-off high reading occurs due to a natural occurrence such as a bird sitting on the wind sensor, or some other event causing the readings to spike.

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.

Equipment malfunction/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.

Gap in data/data not available refers to a period of time when either data has been lost or could not be collected.

Instrument Alarm refers to an alarm produced by the instrument. A range of alarms can be produced depending on how operation of the instrument is being affected.

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

Linear offset or multiplier refers to when an offset or multiplier has been applied between two points where the values of the offset or multiplier are different and the correction is interpolated between the two points.

Logger error refers to when an error occurs and instrument readings are not correctly recorded by the logger.

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

Overnight span/zero out of tolerance refers to when the span/zero reading measured by the analyser during an automatic precision check falls outside of the expected concentration limits.

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NATA
WORLD RECOGNISED ACCREDITATION

Peabody Energy

Wilpinjong Coal
Wollar

Ambient Air Quality Monitoring

Validated Report

1st March – 31st March 2015

Report No.: DAT9421

Report issue date: 28th April 2015

Maintenance contract: MC951

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Revision History			
Revision	**Report ID**	**Date**	**Analyst**
0	DAT9421	28/04/2015	Robyn EDWARDS

Report by: Robyn EDWARDS

Approved Signatory: Jon ALEXANDER

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3.4. Data Validation and Reporting

3.4.1. Validation

The Ecotech ERS department performs 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.

Details of all invalid or missing data are recorded in the Valid Data Exception Tables.

Validation is performed by the analyst, and the validation is reviewed. Graphs and tables are generated based on the validated five minute data.

3.4.2. Reporting

The reported data is in a Microsoft Excel format file named "*Wilpingjong Coal Validated Data Report Mar-15.xls*". The Excel file consists of 5 Excel worksheets:

1. Cover
2. Wollar 5 Minute Averages
3. Wollar 1 Hour Averages
4. Wollar 24 Hour Averages
5. Valid Data Exception Table

The data contained in this report is based on Australian Eastern Standard Time.

All averages are calculated from the five minute data. Averages are based on a minimum of 75% valid readings within the averaging period.

Averaging periods of eight hours or less are reported for the end of the period, i.e. the hourly average 02:00 is for the data collected from 01:00 to 02:00. One hour averages are calculated based on a clock hour. One day averages are calculated based on calendar days.

4.0 Air Quality Goals

The air quality goals for pollutants monitored at the Wilpinjong Wollar monitoring station are based on the Australian National Environmental Council (NEPC) Ambient Air Quality (NEPM). These air quality goals are shown in Table 4 below.

Table 4: Wilpinjong Air Quality Goals (NEPM)

Parameter	Time Period	Exceedence Level	Units	Maximum allowable exceedences
NO_2	1 year	30	ppb	None
NO_2	1 hour	120	ppb	1 day a year
SO_2	1 hour	200	ppb	1 day a year
SO_2	1 day	80	ppb	1 day a year
SO_2	1 year	20	ppb	None

4.1. Air Quality Summary

Table 5 below, details any exceedences of the NEPM Standard that were observed during this reporting period.

Table 5: Exceedences Recorded

Parameter	Time Period	Value of Exceedence	Date of Exceedence
NO_2	1 hour	-	-
SO_2	1 hour	-	-
SO_2	1 day	-	-

5.0 Calibrations and Maintenance

5.1. Units and Uncertainties

The uncertainties for each parameter have been determined by the manufacturer's tolerance limits of the equipment's parameters, and by the data collection standard method.

The reported uncertainties are expanded uncertainties, calculated using coverage factors which give a level of confidence of approximately 95%.

Table 6: Units and Uncertainties

Parameter	Units	Resolution	Uncertainty	Measurement Range[1]
NO, NO_x (EC9841)	ppb	1 ppb	± 14 ppb K factor of 2.01	0 ppb to 500 ppb
NO_2 (EC9841)	ppb	1 ppb	± 16 ppb K factor of 2.01	0 ppb to 500 ppb
SO_2 (EC9850)	ppb	1 ppb	± 14 ppb K factor of 2.01	0 ppb to 500 ppb
H_2S	ppb	1 ppb	15.2% of reading or ± 19 ppb, whichever is greater K factor of 2	0 ppb to 500 ppb
Benzene, Toluene and *p*-Xylene (BTX)	ppb	0.03 ppb	15.1% of reading or 3.8ppb, whichever is greater K factor of 2	0 ppb to 300 ppb
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
Vector Wind Direction	Deg	1 deg	±4 deg K factor of 2.11	0 deg to 360 deg Starting threshold: 0 m/s

[1] Uncertainties may not be calculated based on the full measurement range. Uncertainty for NO, NO_2 and NO_x by EC 9841 and SO_2 by EC9850 are calculated based on a measurement range of 0-125 ppb.

5.2. Automatic Checks

Automatic span and zero calibration checks run each night for NO, NO_2, NO_x and SO_2.

Background checks run each night for SO_2 and H_2S.

See Table 7 below for additional details. Data points associated with these checks are invalidated but are not referred to in the Valid Data Exception Tables.

Table 7: Automatic checks for NO, NO_2, NO_x, SO_2, and H_2S

Parameter	Span / Zero cycle time (approximate)	Background cycle time (approximate)
NO, NO_2, NO_x	01:00 to 01:45	N/A
SO_2	01:00 to 01:40	23:50 to 00:00
H_2S	01:55 to 03:50 (weekly)	23:50 to 00:05

5.3. Maintenance

Scheduled monthly maintenance was performed on 26/03/2015 in accordance with Ecotech's site specific maintenance checklist. The post-calibration check on the BTX analyser was performed on 27/03/2015.

5.3.1. Calibration & Maintenance Summary Tables

The last calibrations for the following parameters were performed on the indicated dates. Data supplied after this time is subject to further validation, to be performed at the next calibration cycle.

Note: Maintenance and calibration dates may differ, as calibrations may be less frequent than scheduled maintenance visits.

Table 8 indicates when the gas and meteorological equipment was last maintained / calibrated.

Table 8: Wilpinjong Wollar Maintenance Table

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	26/03/2015	Monthly	26/03/2015	Monthly
SO_2	26/03/2015	Monthly	26/03/2015	Monthly
H_2S	26/03/2015	Monthly	26/03/2015	Monthly
BTX	27/03/2015	Monthly	27/03/2015	Monthly
Wind Speed	26/03/2015	Monthly	TBA	2-Yearly
Wind Direction	26/03/2015	Monthly	TBA	2-Yearly

Wind sensor calibration certificates not yet received, last calibration will be updated when available

6.0 Results

6.1. Data Capture

Data capture is based on 1 hour averages, calculated from 5 minute data, and refers to the amount of available data collected during the report period.

The percentage of data captured is calculated using the following equation:
Data capture = (Reported air quality data / Total data) x 100%
Where:

- Reported air quality data = Number of instrument readings which have been validated through a quality assured process 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 displays data capture statistics for March 2015. **Bold** values in the table indicate data capture below 95%.

Details of all invalid or missing data affecting data affecting data capture are included in the Valid Data Exception Tables, and attached Excel file.

Table 9: Data Capture for Wilpinjong Wollar Station

Parameter	Data Capture %
NO, NO_2, NO_x	100.0
SO_2	96.8
H_2S	96.8
Benzene	**93.5**
Toluene	**93.5**
p-Xylene	**77.4**
WS, WD	100.0

6.2. Graphic Representations

Validated 5 minute data for NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene and *p*-Xylene were used to construct the following graphical representations.

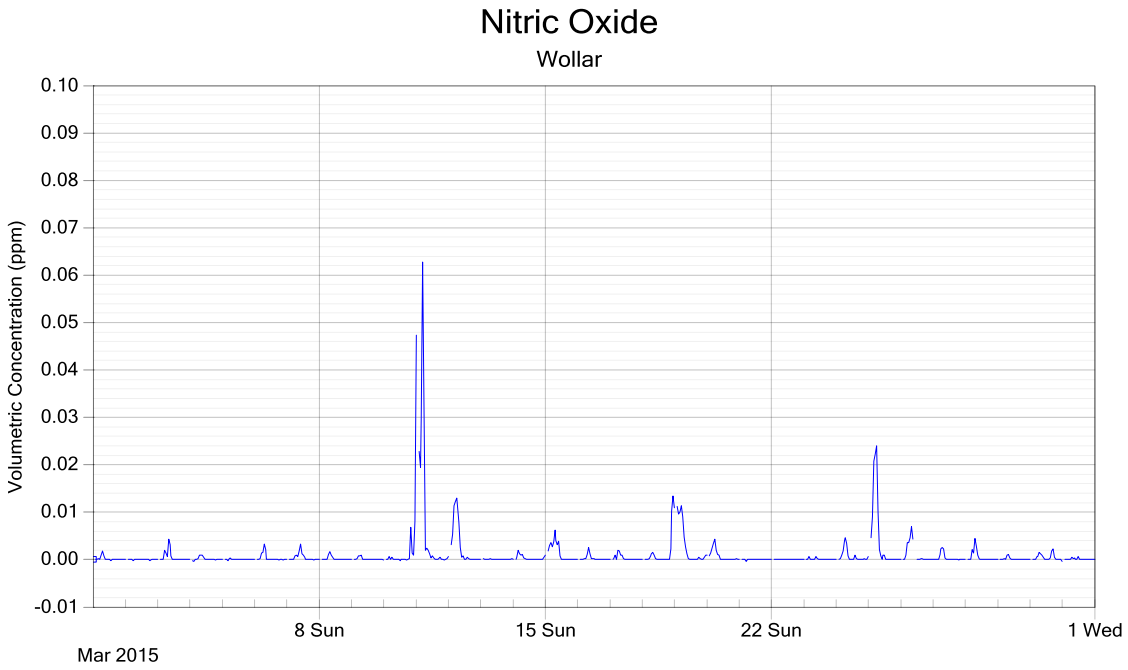

Figure 2: NO - 1 hour data

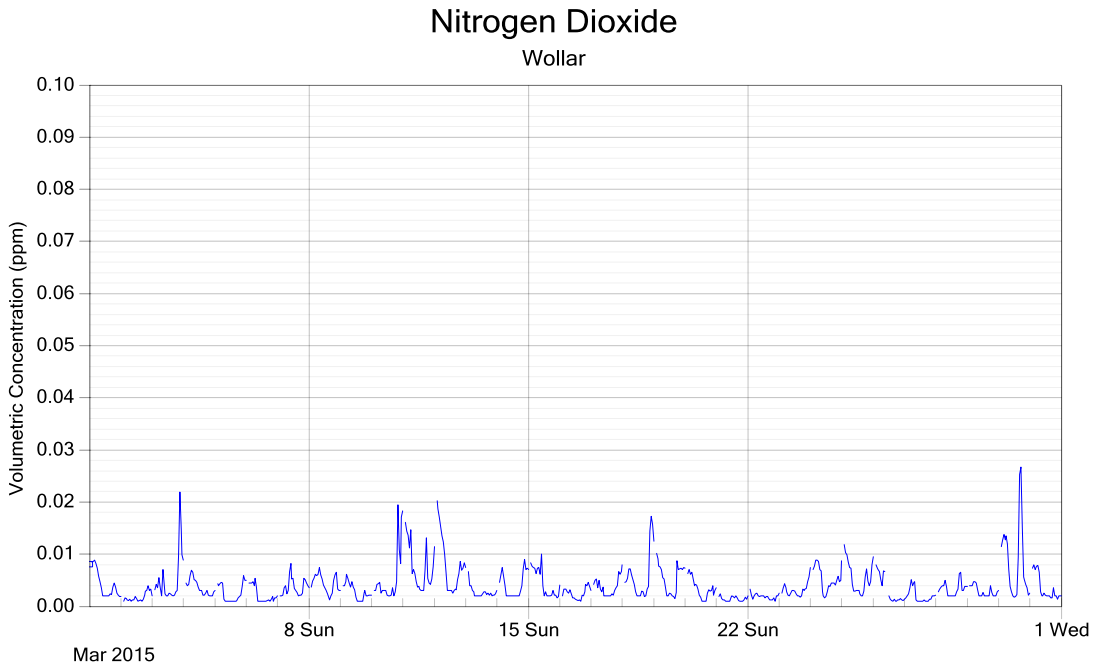

Figure 3: NO_2 - 1 hour data

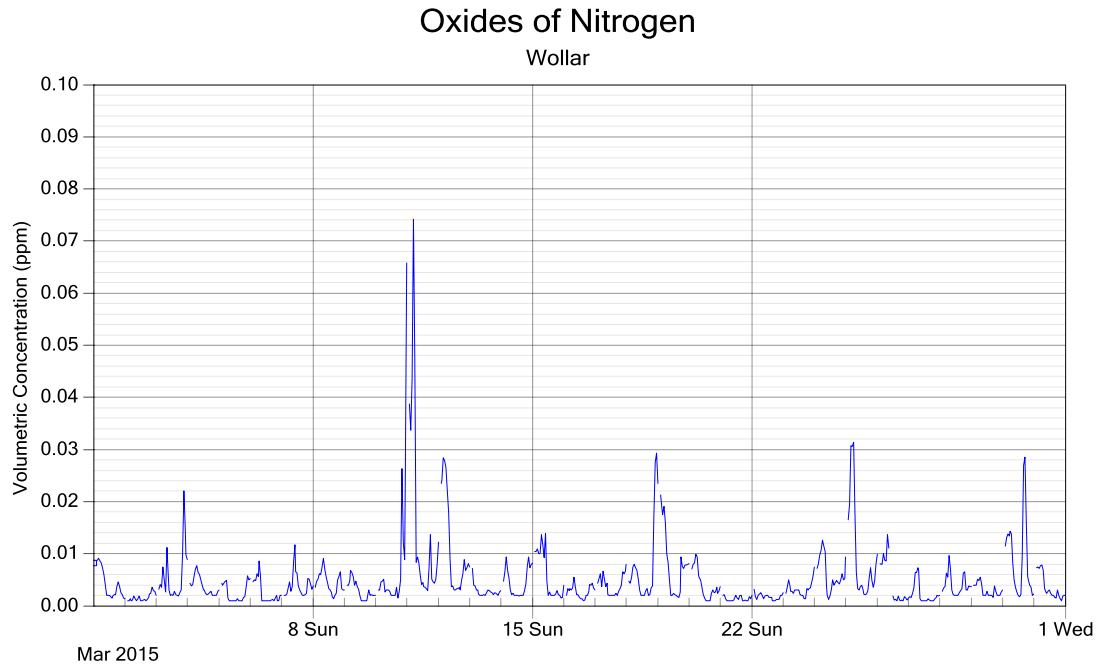

Figure 4: NO_X - 1 hour data

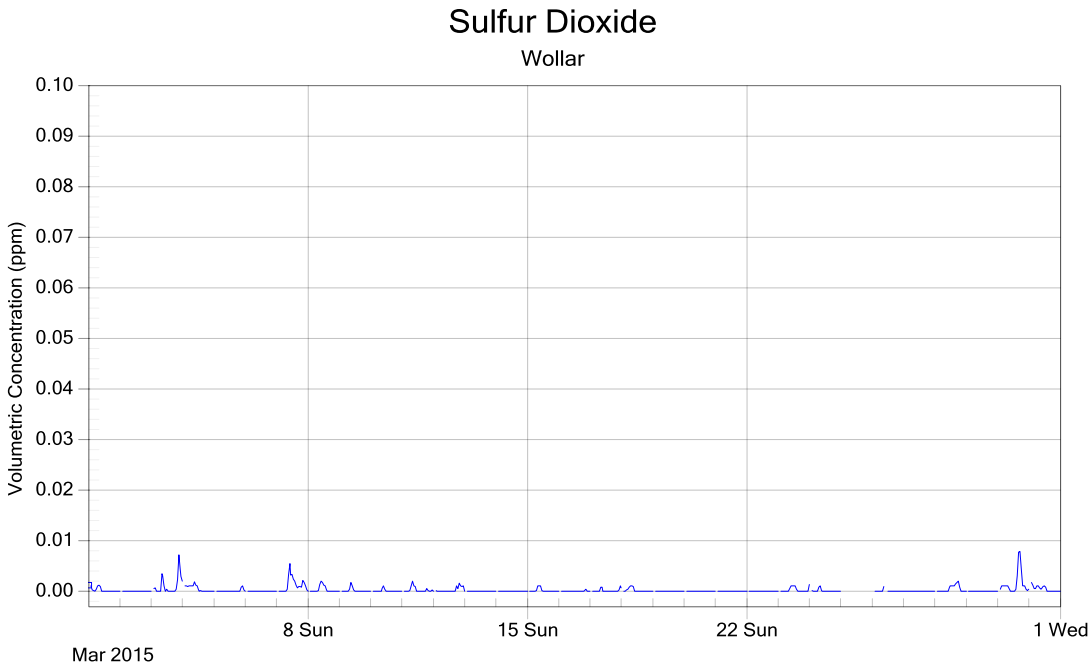

Figure 5: SO_2 - 1 hour data

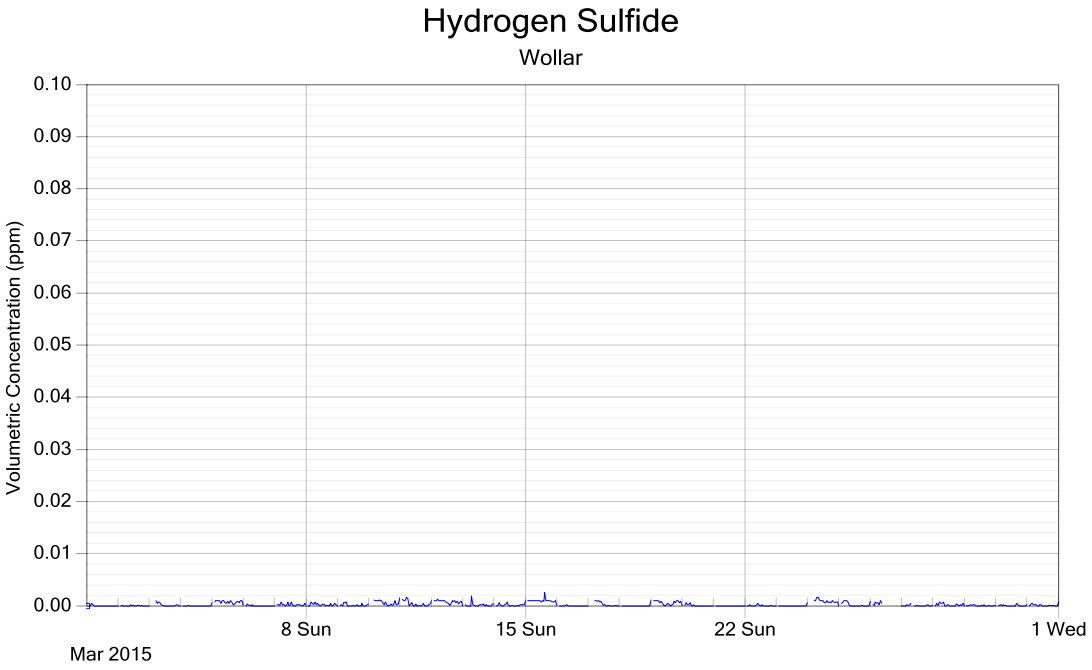

Figure 6: H_2S - 1 hour data

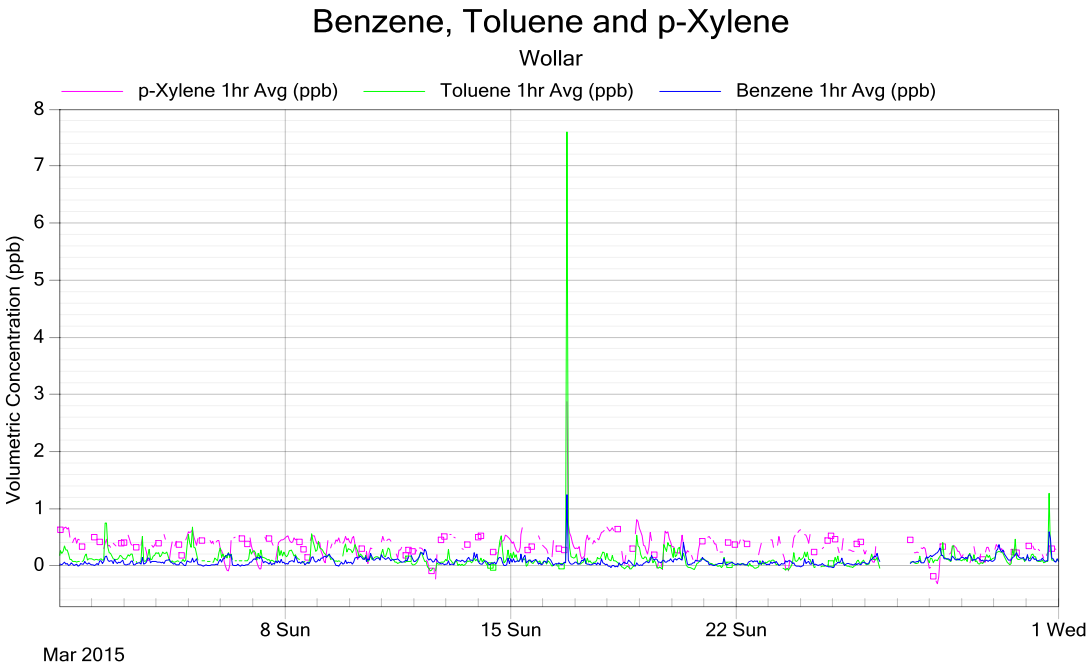

Figure 7: BTX - 1 hour data

7.0 Valid Data Exception Tables

The tables below details all changes made to the raw data set during the validation process. An explanation of reasons given in the table can be found in Appendix 2.

Table 10: Wollar Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
27/02/2015 13:10	26/03/2015 00:00	Static offset of -3.0 ppb applied to correct baseline	Toluene	RE	26/03/2015
27/02/2015 13:10	11/03/2015 21:10	Static offset of 3.4 ppb applied to correct baseline	Benzene	RE	25/03/2015
28/02/2015 23:55	12/03/2015 19:40	Intermittent unknown instrument fault	*p*-Xylene	RE	26/03/2015
01/03/2015 01:00	11/03/2015 21:10	Static offset of -16.5 ppb applied to correct baseline	*p*-Xylene	RE	25/03/2015
01/03/2015 02:40	31/03/2015 23:50	Outliers – intermittent drop outs	Toluene and *p*-Xylene	RE	01/04/2015
02/03/2015 07: 15	02/03/2015 07:15	Wind speed spike	WS and WD	RE	27/04/2015
03/03/2015 03:45	24/03/2015 04:15	Intermittent instrument stabilisation following weekly automatic calibration cycle	H_2S	RE	27/03/2015
04/03/2015 21:40	04/03/2015 21:40	Data transmission error	H_2S	RE	N/A
10/03/2015 16:55	10/03/2015 17:20	Intermittent unrealistic negative data	NO, NO_2 and NO_X	RE	28/04/2015
11/03/2015 21:15	11/03/2015 22:00	Short power interruption and subsequent instrument stabilisation	H_2S, BTX, WS and WD	RE	25/03/2015

Start Date	End Date	Reason	Change Details	User Name	Change Date
11/03/2015 21:50	26/03/2015 12:00	Static offset of +3.3 ppb applied to correct baseline	Benzene	RE	26/03/2015
11/03/2015 22:05	26/03/2015 12:00	Static offset of -16.0 ppb applied to correct baseline	*p*-Xylene	RE	26/03/2015
16/03/2015 07:50	16/03/2015 08:00	Instrument fault – possibly NO_X present in sample line	H_2S	RE	16/04/2015
20/03/2015 01:40	20/03/2015 01:45	Instrument stabilisation following automatic overnight calibration cycle	SO_2	RE	16/04/2015
25/03/2015 01:40	26/03/2015 00:55	Instrument fault – remained in calibration mode following overnight cycle	SO_2	RE	N/A
26/03/2015 10:30	26/03/2015 15:50	Scheduled monthly maintenance – intermittent data affected	All parameters	RE	27/03/2015
26/03/2015 12:05	27/03/2015 09:25	Maintenance – performed zero checks	BTX	RE	N/A
26/03/2015 13:55	26/03/2015 23:40	Maintenance – performed zero check	H_2S	RE	27/03/2015

8.0 Report Summary

The data capture for Wollar was above 95% for the reporting for all measured parameters with the exception of Benzene, Toluene and p-Xylene.

- Benzene and Toluene had a data capture of 93.5% and both parameters were affected by zero checks being performed as part of scheduled maintenance.
- *P*-Xylene had a data capture of 77.4% and was impacted by a zero check as part of scheduled maintenance, and outliers.

Measurement of a number of parameters in this report does not comply with applicable standards and/or is not covered by Ecotech's NATA scope of accreditation. Please refer to section 3.3.1 for details.

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

Appendix 1 - Definitions & Abbreviations

BTX	Benzene, Toluene and *p*-Xylene
H_2S	Hydrogen sulfide
m/s	Metres per second
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
ppb	Parts per billion
SO_2	Sulphur dioxide
WD	Vector Wind Direction
WS	Vector Wind Speed

Appendix 2 - Explanation of Exception Table

Automatic background check refers to when analyser samples zero air and measures the level of the concentration voltage. This voltage is taken as the zero signal level and this value is subtracted from any subsequent readings as an active zero compensation. This is the analyser's fine zero measurement.

Calibration check outside tolerance refers to when the calibration values are outside the tolerance limits set for the precision check.

Calibration correction factor applied to data refers to an offset or multiplier applied to the data. This operation may be performed for a number of reasons including: (a) when a clear trend / drift outside the tolerance limit can be demonstrated by repeated operation precision checks, (b) when a correction is required on previously logged data due to a calibration check being outside the allowable tolerance

Commissioning refers to the initial setup and calibration of the instrument when it is first installed. For some instruments there may be a stabilisation period before normal operation commences.

Data affected by environmental conditions – wind speed / wind speed gust spike refers to when a one-off high reading occurs due to a natural occurrence such as a bird sitting on the wind sensor, or some other event causing the readings to spike.

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.

Equipment malfunction/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.

Gap in data/data not available refers to a period of time when either data has been lost or could not be collected.

Instrument Alarm refers to an alarm produced by the instrument. A range of alarms can be produced depending on how operation of the instrument is being affected.

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

Linear offset or multiplier refers to when an offset or multiplier has been applied between two points where the values of the offset or multiplier are different and the correction is interpolated between the two points.

Logger error refers to when an error occurs and instrument readings are not correctly recorded by the logger.

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

Overnight span/zero out of tolerance refers to when the span/zero reading measured by the analyser during an automatic precision check falls outside of the expected concentration limits.

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

Remote Calibration refers to when a technician remotely connects to the station and manually performs a span check.

Static offset or multiplier refers to when a single offset or multiplier has been applied to the data between two points either to increase or decrease the measured value.

Warm up after power interruption refers to the startup period of an instrument after power has been restored.

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NATA
WORLD RECOGNISED ACCREDITATION

Peabody Energy

Wilpinjong Coal
Wollar

Ambient Air Quality Monitoring

Validated Report

1st April – 30th April 2015

Report No.: DAT9490

Report issue date: 28th May 2015

Maintenance contract: MC951

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Revision History			
Revision	**Report ID**	**Date**	**Analyst**
0	DAT9490	28/05/2015	Robyn EDWARDS

Report by: Robyn EDWARDS

Approved Signatory: Jon ALEXANDER

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1.0 Executive Summary

Peabody Energy has commissioned Ecotech P/L to conduct air quality monitoring for the Wilpinjong Mine at Wollar. Measured parameters at Wollar are NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene and *p*-Xylene. A wind sensor is also installed at the Wollar site.

The Wollar station was commissioned in March 2013.

This report presents the data collected from the Wollar station for April 2015. Data capture for the different pollutants is presented in Table 9

2.0 Introduction

Ecotech Pty Ltd was commissioned by Peabody Energy to provide monitoring and data reporting for the Wilpinjong Mine at Wollar, located as detailed in Table 1. Ecotech commenced data collection from the Wilpinjong Station on the 1st March 2013.

This report presents the data for April 2015.

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

3.1. Siting Details

The Wilpinjong Mine consists of one ambient air quality monitoring station. The station location and siting details are described below.

Table 1: Wilpinjong Mine monitoring site location

Site Name	Geographical Coordinates	Height Above Sea Level (m)
Wollar	Lat: -32.360105 Long: 149.949509	366

A siting audit was conducted on 27th February 2015 to assess for compliance with *AS/NZS 3580.1.1:2007 "Methods for sampling and analysis of ambient air – guide to siting air monitoring equipment"*.

This siting of this station complies with AS/NZS 3580.1.1:2007. The station is classified as a neighbourhood station according to *AS/NZS 3580.1.1:2007*.

Figure 1: Wilpinjong Mine Monitoring Station Location

3.2. Monitored Parameters

Table 2 below details the parameters monitored and the instruments used at Wilpinjong Mine monitoring station. Appendix 1 defines any abbreviated parameter names used throughout the report.

For meteorological sensors, the elevation given in the table below is the height above ground level at the monitoring station.

Table 2: Parameters measured at the Wilpinjong Mine monitoring station

Parameter Measured	Instrument and Measurement Technique
BTX (Benzene, Toluene and *p*-Xylene)	Synspec GC955 - Gas Chromatography
H_2S	Ecotech EC9852 - fluorescence
NO, NO_2, NO_x	Ecotech EC9841 gas phase chemiluminescence
SO_2	Ecotech EC9850 – fluorescence
Wind Speed (horizontal, 10m)	Vaisala WS425 – ultrasonic
Wind Direction (10m)	Vaisala WS425 – ultrasonic

3.3. Data Collection Methods

Table 3 below shows the methods used for data collection. Any deviations from the stated methods are detailed in section 3.3.1.

Table 3: Methods

Parameter Measured	Data Collection Methods Used	Description of Method
NO, NO_2, NO_x	AS 3580.5.1-2011	Methods for sampling and analysis of ambient air. Method 5.1: Determination of oxides of nitrogen – chemiluminescence method
	Ecotech Laboratory Manual	In-house method 6.1 Oxides of nitrogen by chemiluminescence
SO_2	AS 3580.4.1 - 2008	Methods for sampling and analysis of ambient air. Method 4.1: Determination of sulfur dioxide – Direct reading instrumental method
	Ecotech Laboratory Manual	In-house method 6.2 Sulfur dioxide by fluorescence
H_2S	Ecotech Laboratory Manual	In-house method 6.5 Hydrogen sulfide by fluorescence
BTX (Benzene, Toluene and *p*-Xylene)	Synspec GC955 Series Manual	Synspec GC955 - Gas Chromatography
Vector Wind Speed (Horizontal)	AS 3580.14 2011	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.1 Wind speed (Horizontal) by anemometer
Vector Wind Direction	AS 3580.14 2011	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.3 Wind direction by anemometer

3.3.1. Compliance with Standards

Unless stated below, parameters are monitored at the Wilpinjong Mine site according to the methods detailed in Table 3 above.

- Measurement of wind data does not comply with AS 3580.14 2011 and is not covered by Ecotech's NATA scope of accreditation due to current unavailability of a suitable wind tunnel calibration certificate.
- Measurement of benzene, toluene and *p*-xylene (BTX) is not covered by Ecotech's NATA scope of accreditation.
- Measurement of hydrogen sulfide (H_2S) is not covered by Ecotech's scope of accreditation due to the frequency of calibration checks.

3.3.2. Data Acquisition

Data acquisition is performed using a PC based WinAQMS logger (using WinAQMS® Version 2.0) situated at the monitoring site. Each logger is equipped with a 3G modem for remote data collection. The recorded data is remotely collected from the AQMS logger on a daily basis (using Airodis™ version 5.0) and stored at Ecotech's Environmental Reporting Services (ERS) department in Melbourne, Australia. Data samples are logged in 5 minute intervals.

3.4. Data Validation and Reporting

3.4.1. Validation

The Ecotech ERS department performs 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.

Details of all invalid or missing data are recorded in the Valid Data Exception Tables.

Validation is performed by the analyst, and the validation is reviewed. Graphs and tables are generated based on the validated five minute data.

3.4.2. Reporting

The reported data is in a Microsoft Excel format file named "*Wilpingjong Coal Validated Data Report Apr-15.xls*". The Excel file consists of 5 Excel worksheets:

1. Cover
2. 5 Minute Averages
3. Hourly Averages
4. Daily Averages
5. Valid Data Exception Table

The data contained in this report is based on Australian Eastern Standard Time.

All averages are calculated from the five minute data. Averages are based on a minimum of 75% valid readings within the averaging period.

Averaging periods of eight hours or less are reported for the end of the period, i.e. the hourly average 02:00 is for the data collected from 01:00 to 02:00. One hour averages are calculated based on a clock hour. One day averages are calculated based on calendar days.

4.0 Air Quality Goals

The air quality goals for pollutants monitored at the Wilpinjong Wollar monitoring station are based on the Australian National Environmental Council (NEPC) Ambient Air Quality (NEPM). These air quality goals are shown in Table 4 below.

Table 4: Wilpinjong Air Quality Goals (NEPM)

Parameter	Time Period	Exceedence Level	Units	Maximum allowable exceedences
NO_2	1 year	30	ppb	None
NO_2	1 hour	120	ppb	1 day a year
SO_2	1 hour	200	ppb	1 day a year
SO_2	1 day	80	ppb	1 day a year
SO_2	1 year	20	ppb	None

4.1. Air Quality Summary

Table 5 below, details any exceedences of the NEPM Standard that were observed during this reporting period.

Table 5: Exceedences Recorded

Parameter	Time Period	Value of Exceedence	Date of Exceedence
NO_2	1 hour	-	-
SO_2	1 hour	-	-
SO_2	1 day	-	-

5.0 Calibrations and Maintenance

5.1. Units and Uncertainties

The uncertainties for each parameter have been determined by the manufacturer's tolerance limits of the equipment's parameters, and by the data collection standard method.

The reported uncertainties are expanded uncertainties, calculated using coverage factors which give a level of confidence of approximately 95%.

Table 6: Units and Uncertainties

Parameter	Units	Resolution	Uncertainty	Measurement Range[1]
NO, NO_x (EC9841)	ppm	1 ppb	± 14 ppb K factor of 2.01	0 ppb to 500 ppb
NO_2 (EC9841)	ppm	1 ppb	± 16 ppb K factor of 2.01	0 ppb to 500 ppb
SO_2 (EC9850)	ppm	1 ppb	± 14 ppb K factor of 2.01	0 ppb to 500 ppb
H_2S	ppm	1 ppb	15.2% of reading or ± 19 ppb, whichever is greater K factor of 2	0 ppb to 500 ppb
Benzene, Toluene and *p*-Xylene (BTX)	ppb	0.03 ppb	15.1% of reading or 3.8ppb, whichever is greater K factor of 2	0 ppb to 300 ppb
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
Vector Wind Direction	Deg	1 deg	±4 deg K factor of 2.11	0 deg to 360 deg Starting threshold: 0 m/s

[1] Uncertainties may not be calculated based on the full measurement range. Uncertainty for NO, NO_2 and NO_x by EC 9841 and SO_2 by EC9850 are calculated based on a measurement range of 0-125 ppb.

5.2. Automatic Checks

Automatic span and zero calibration checks run each night for NO, NO_2, NO_x and SO_2.

Background checks run each night for SO_2 and H_2S.

See Table 7 below for additional details. Data points associated with these checks are invalidated but are not referred to in the Valid Data Exception Tables.

Table 7: Automatic checks for NO, NO_2, NO_x, SO_2, and H_2S

Parameter	Span / Zero cycle time (approximate)	Background cycle time (approximate)
NO, NO_2, NO_x	01:00 to 01:45	N/A
SO_2	01:00 to 01:40	23:50 to 00:00
H_2S	01:55 to 03:50 (weekly)	23:50 to 00:05

5.3. Maintenance

A maintenance visit was performed on 30/04/2015 and calibrations performed on all analysers prior to the removal of the existing gas bottle. Scheduled yearly maintenance was then performed following the installation of the new gas bottle.

Yearly maintenance was continued on 01/05/2015 and details will be included in the next report.

5.3.1. Calibration & Maintenance Summary Tables

The last calibrations for the following parameters were performed on the indicated dates. Data supplied after this time is subject to further validation, to be performed at the next calibration cycle.

Note: Maintenance and calibration dates may differ, as calibrations may be less frequent than scheduled maintenance visits.

Table 8 indicates when the gas and meteorological equipment was last maintained / calibrated.

Table 8: Wilpinjong Wollar Maintenance Table

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	30/04/2015	Yearly	30/04/2015	Monthly
SO_2	30/04/2015	Yearly	30/04/2015	Monthly
H_2S	30/04/2015	Exit calibration	30/04/2015	Monthly
BTX	27/03/2015	Monthly	27/03/2015	Monthly
Wind Speed	26/03/2015	Monthly	TBA	2-Yearly
Wind Direction	26/03/2015	Monthly	TBA	2-Yearly

Wind sensor calibration certificates not yet received, last calibration will be updated when available

6.0 Results

6.1. Data Capture

Data capture is based on 1 hour averages, calculated from 5 minute data, and refers to the amount of available data collected during the report period.

The percentage of data captured is calculated using the following equation:
Data capture = (Reported air quality data / Total data) x 100%
Where:

- Reported air quality data = Number of instrument readings which have been validated through a quality assured process 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 displays data capture statistics for April 2015. **Bold** values in the table indicate data capture below 95%.

Details of all invalid or missing data affecting data affecting data capture are included in the Valid Data Exception Tables, and attached Excel file.

Table 9: Data Capture for Wilpinjong Wollar Station

Parameter	Data Capture %
NO, NO_2, NO_x	**91.1**
SO_2	**89.4**
H_2S	**89.4**
Benzene	**94.9**
Toluene	**86.9**
p-Xylene	**62.5**
WS, WD	96.1

6.2. Graphic Representations

Validated 5 minute data for NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene and *p*-Xylene were used to construct the following graphical representations.

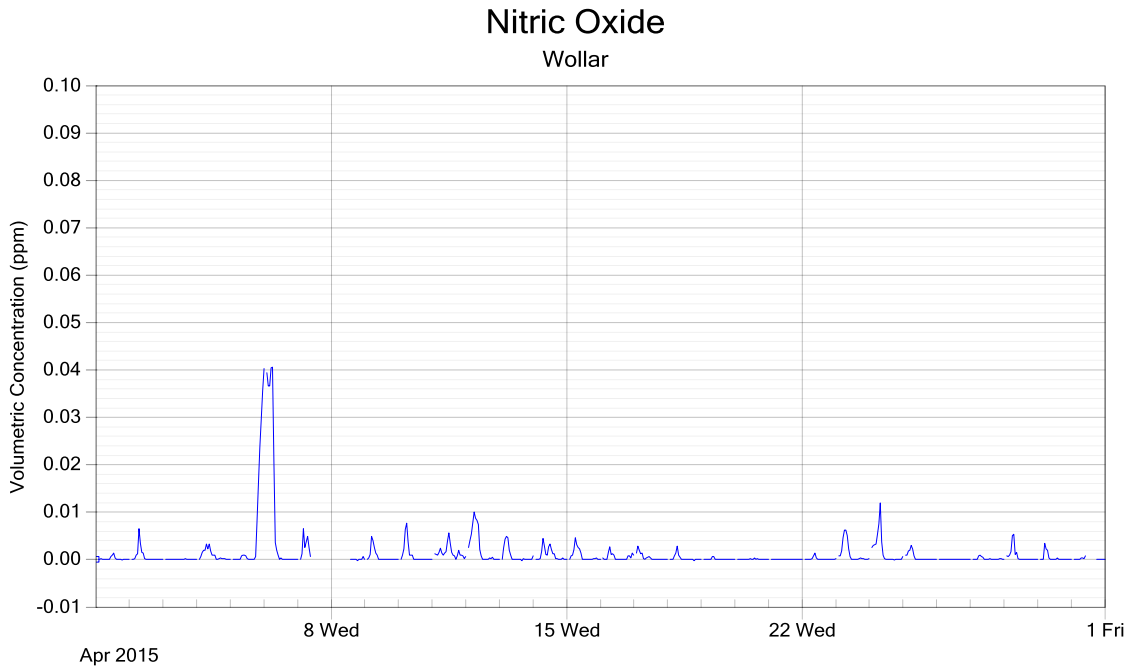

Figure 2: NO - 1 hour data

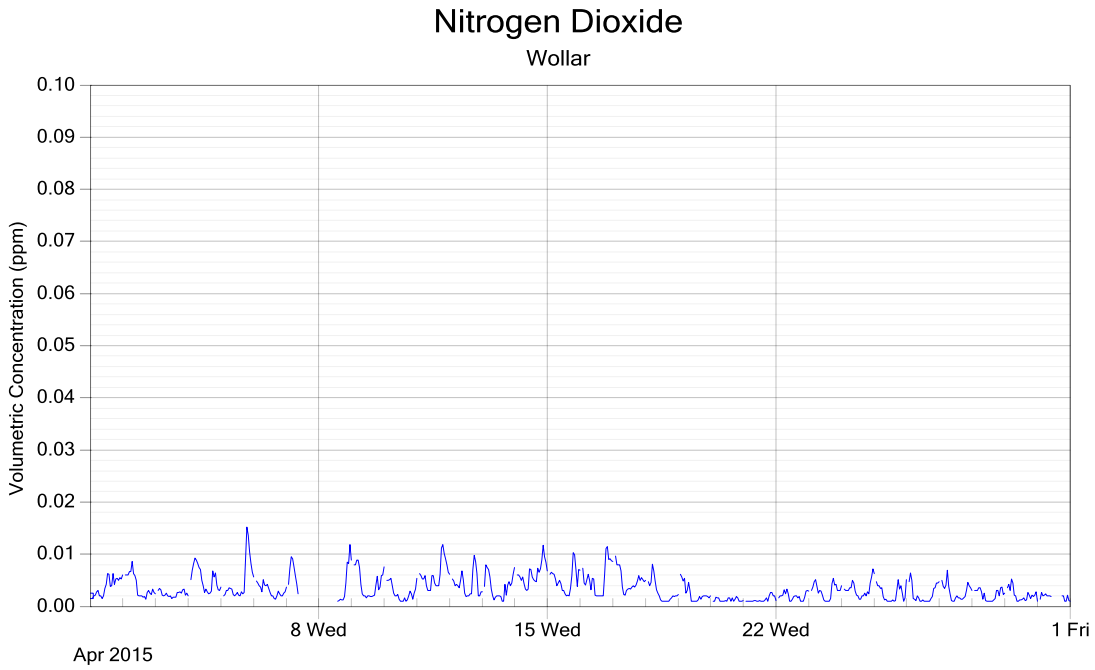

Figure 3: NO_2 - 1 hour data

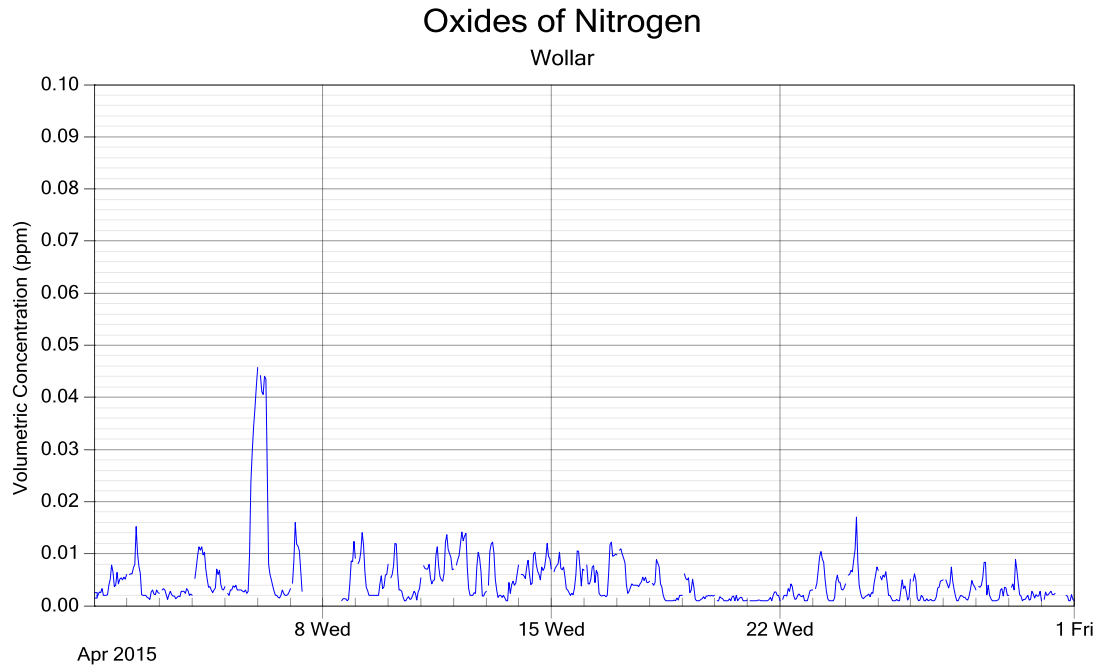

Figure 4: NO_X - 1 hour data

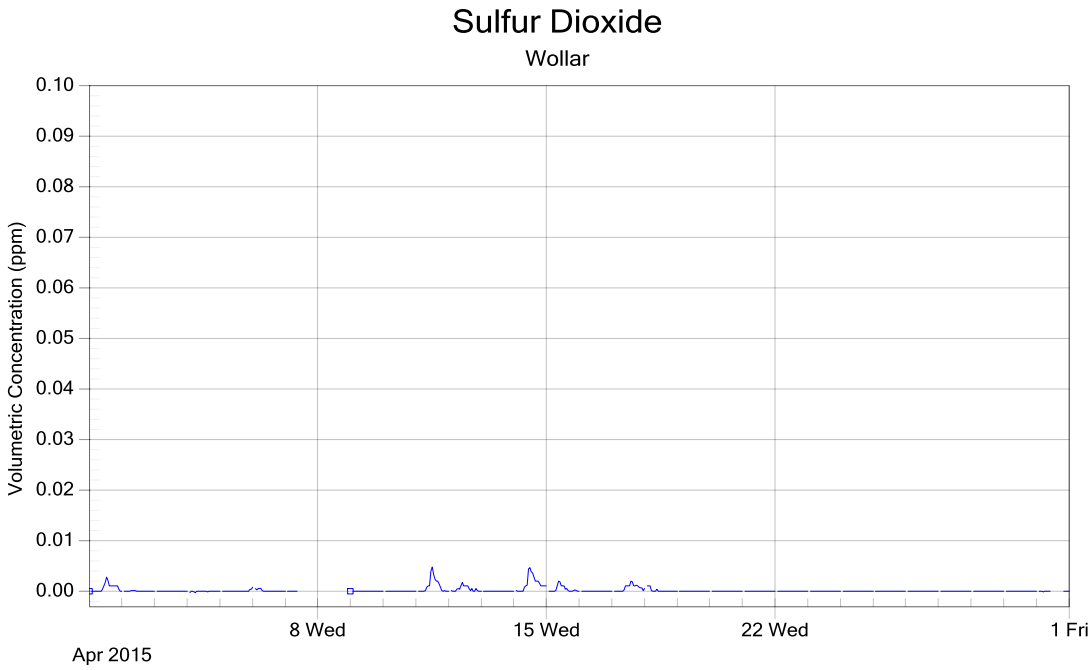

Figure 5: SO_2 - 1 hour data

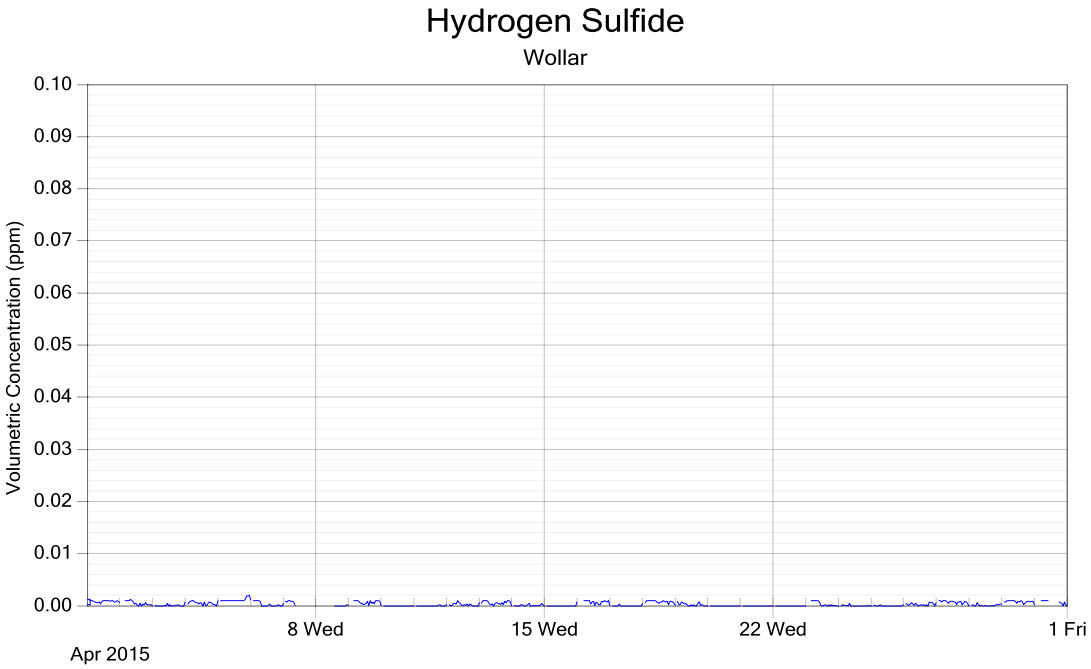

Figure 6: H_2S - 1 hour data

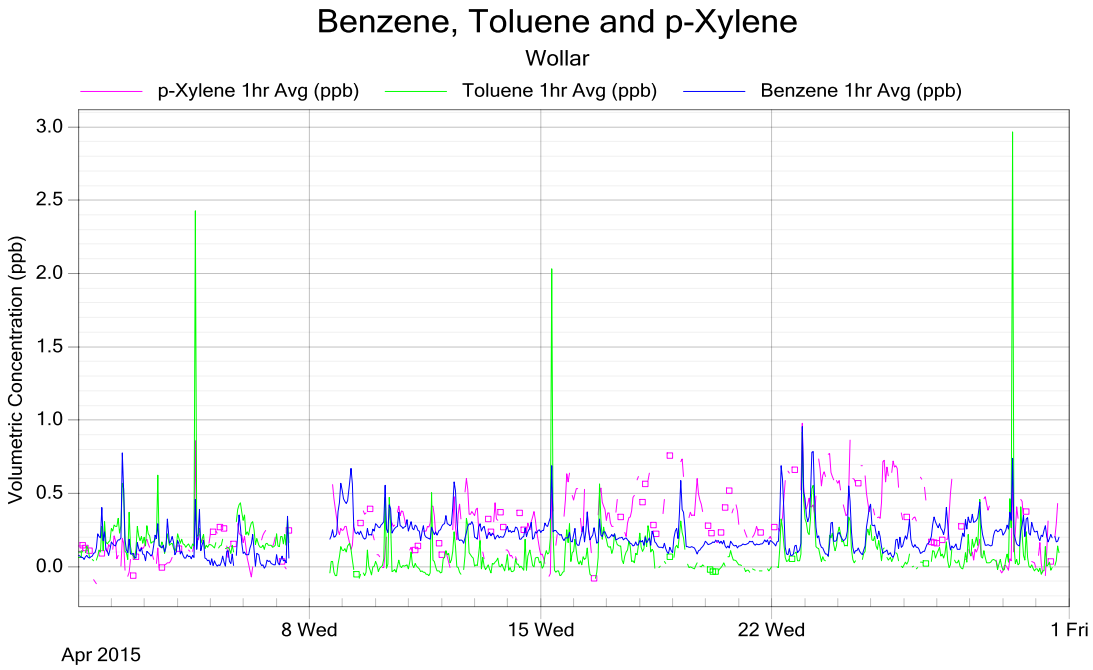

Figure 7: BTX - 1 hour data

7.0 Valid Data Exception Tables

The tables below details all changes made to the raw data set during the validation process. An explanation of reasons given in the table can be found in Appendix 2.

Table 10: Wollar Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
01/04/2015 00:20	30/04/2015 17:50	Outliers – intermittent drop outs	Toluene and *p*-Xylene	RE	19/05/2015
02/04/2015 03:45	30/04/2015 04:15	Instrument stabilisation following weekly automatic calibration cycle	H_2S	RE	19/05/2015
05/04/2015 17:55	05/04/2015 18:25	Short power interruption and subsequent instrument stabilisation	BTX	RE	19/05/2015
07/04/2015 10:20	18/04/2015 10:10	Intermittent wind speed spikes	WS and WD	RE	19/05/2015
07/04/2015 10:25	09/04/2015 00:05	Power interruption and subsequent gas instrument stabilisation upon restart. Stabilisation periods differ between instruments	All parameters	RE	19/05/2015
13/04/2015 01:40	25/04/2015 01:45	Intermittent instrument stabilisation following automatic overnight calibration cycle	NO, NO_2 and NO_x	RE	19/05/2015
30/04/2015 11:40	30/04/2015 19:15	Maintenance – installation of new gas bottle. Intermittent data affected	NO, NO_2, NO_x, SO_2 and H_2S	RE	19/05/2015
30/04/2015 12:55	30/04/2015 13:20	Data affected by gas instrument maintenance	BTX, WS and WD	RE	19/05/2015
30/04/2015 17:55	30/04/2015 23:55	Instrument in “out of service” mode in preparation for maintenance on 01/05/2015	BTX	RE	19/05/2015

8.0 Report Summary

The data capture for Wollar was below 95% for the reporting for all measured parameters. This was largely due to a power interruption between 07/04/2015 and 09/04/2015. In addition;

- Benzene and Toluene had a data capture of 93.5% and both parameters were affected by zero checks being performed as part of scheduled maintenance.
- *P*-Xylene had a data capture of 77.4% and was impacted by a zero check as part of scheduled maintenance, and outliers.

Measurement of a number of parameters in this report does not comply with applicable standards and/or is not covered by Ecotech's NATA scope of accreditation. Please refer to section 3.3.1 for details.

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

Appendix 1 - Definitions & Abbreviations

BTX	Benzene, Toluene and *p*-Xylene
H_2S	Hydrogen sulfide
m/s	Metres per second
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
ppb	Parts per billion
SO_2	Sulphur dioxide
WD	Vector Wind Direction
WS	Vector Wind Speed

Appendix 2 - Explanation of Exception Table

Automatic background check refers to when analyser samples zero air and measures the level of the concentration voltage. This voltage is taken as the zero signal level and this value is subtracted from any subsequent readings as an active zero compensation. This is the analyser's fine zero measurement.

Calibration check outside tolerance refers to when the calibration values are outside the tolerance limits set for the precision check.

Calibration correction factor applied to data refers to an offset or multiplier applied to the data. This operation may be performed for a number of reasons including: (a) when a clear trend / drift outside the tolerance limit can be demonstrated by repeated operation precision checks, (b) when a correction is required on previously logged data due to a calibration check being outside the allowable tolerance

Commissioning refers to the initial setup and calibration of the instrument when it is first installed. For some instruments there may be a stabilisation period before normal operation commences.

Data affected by environmental conditions – wind speed / wind speed gust spike refers to when a one-off high reading occurs due to a natural occurrence such as a bird sitting on the wind sensor, or some other event causing the readings to spike.

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.

Equipment malfunction/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.

Gap in data/data not available refers to a period of time when either data has been lost or could not be collected.

Instrument Alarm refers to an alarm produced by the instrument. A range of alarms can be produced depending on how operation of the instrument is being affected.

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

Linear offset or multiplier refers to when an offset or multiplier has been applied between two points where the values of the offset or multiplier are different and the correction is interpolated between the two points.

Logger error refers to when an error occurs and instrument readings are not correctly recorded by the logger.

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

Overnight span/zero out of tolerance refers to when the span/zero reading measured by the analyser during an automatic precision check falls outside of the expected concentration limits.

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

Remote Calibration refers to when a technician remotely connects to the station and manually performs a span check.

Static offset or multiplier refers to when a single offset or multiplier has been applied to the data between two points either to increase or decrease the measured value.

Warm up after power interruption refers to the startup period of an instrument after power has been restored.

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NATA
WORLD RECOGNISED ACCREDITATION

Peabody Energy

Wilpinjong Coal
Wollar

Ambient Air Quality Monitoring

Validated Report

1st May – 31st May 2015

Report No.: DAT9621

Report issue date: 29th June 2015

Maintenance contract: MC951

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Revision History			
Revision	**Report ID**	**Date**	**Analyst**
0	DAT9621	29/06/2015	Robyn EDWARDS

Report by: Robyn EDWARDS

Approved Signatory: Amanda ELLIOTT

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List of Tables

1.0 Executive Summary

Peabody Energy has commissioned Ecotech P/L to conduct air quality monitoring for the Wilpinjong Mine at Wollar. Measured parameters at Wollar are NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene and *p*-Xylene. A wind sensor is also installed at the Wollar site.

The Wollar station was commissioned in March 2013.

This report presents the data collected from the Wollar station for May 2015. Data capture for the different pollutants is presented in Table 9

2.0 Introduction

Ecotech Pty Ltd was commissioned by Peabody Energy to provide monitoring and data reporting for the Wilpinjong Mine at Wollar, located as detailed in Table 1. Ecotech commenced data collection from the Wilpinjong Station on the 1st March 2013.

This report presents the data for 1st – 31st May 2015.

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

3.1. Siting Details

The Wilpinjong Mine consists of one ambient air quality monitoring station. The station location and siting details are described below.

Table 1: Wilpinjong Mine monitoring site location

Site Name	Geographical Coordinates	Height Above Sea Level (m)
Wollar	Lat: -32.360105 Long: 149.949509	366

A siting audit was conducted on 27th February 2015 to assess for compliance with *AS/NZS 3580.1.1:2007 "Methods for sampling and analysis of ambient air – guide to siting air monitoring equipment"*.

This siting of this station complies with AS/NZS 3580.1.1:2007. The station is classified as a neighbourhood station according to *AS/NZS 3580.1.1:2007*.

Figure 1: Wilpinjong Mine Monitoring Station Location

3.2. Monitored Parameters

Table 2 below details the parameters monitored and the instruments used at Wilpinjong Mine monitoring station. Appendix 1 defines any abbreviated parameter names used throughout the report.

For meteorological sensors, the elevation given in the table below is the height above ground level at the monitoring station.

Table 2: Parameters measured at the Wilpinjong Mine monitoring station

Parameter Measured	Instrument and Measurement Technique
BTX (Benzene, Toluene and *p*-Xylene)	Synspec GC955 - Gas Chromatography
H_2S	Ecotech EC9852 - fluorescence
NO, NO_2, NO_x	Ecotech EC9841 gas phase chemiluminescence
SO_2	Ecotech EC9850 – fluorescence
Wind Speed (horizontal, 10m)	Vaisala WS425 – ultrasonic
Wind Direction (10m)	Vaisala WS425 – ultrasonic

3.3. Data Collection Methods

Table 3 below shows the methods used for data collection. Any deviations from the stated methods are detailed in section 3.3.1.

Table 3: Methods

Parameter Measured	Data Collection Methods Used	Description of Method
NO, NO_2, NO_x	AS 3580.5.1-2011	Methods for sampling and analysis of ambient air. Method 5.1: Determination of oxides of nitrogen – chemiluminescence method
	Ecotech Laboratory Manual	In-house method 6.1 Oxides of nitrogen by chemiluminescence
SO_2	AS 3580.4.1 - 2008	Methods for sampling and analysis of ambient air. Method 4.1: Determination of sulfur dioxide – Direct reading instrumental method
	Ecotech Laboratory Manual	In-house method 6.2 Sulfur dioxide by fluorescence
H_2S	Ecotech Laboratory Manual	In-house method 6.5 Hydrogen sulfide by fluorescence
BTX (Benzene, Toluene and *p*-Xylene)	Synspec GC955 Series Manual	Synspec GC955 - Gas Chromatography
Vector Wind Speed (Horizontal)	AS 3580.14 2011	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.1 Wind speed (Horizontal) by anemometer
Vector Wind Direction	AS 3580.14 2011	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.3 Wind direction by anemometer

3.3.1. Compliance with Standards

Unless stated below, parameters are monitored at the Wilpinjong Mine site according to the methods detailed in Table 3 above.

- Measurement of wind data does not comply with AS 3580.14 2011 and is not covered by Ecotech's NATA scope of accreditation due to current unavailability of a suitable wind tunnel calibration certificate.
- Measurement of benzene, toluene and *p*-xylene (BTX) is not covered by Ecotech's NATA scope of accreditation.
- Measurement of hydrogen sulfide (H_2S) is not covered by Ecotech's scope of accreditation due to the frequency of calibration checks.

3.3.2. Data Acquisition

Data acquisition is performed using a PC based WinAQMS logger (using WinAQMS® Version 2.0) situated at the monitoring site. Each logger is equipped with a 3G modem for remote data collection. The recorded data is remotely collected from the AQMS logger on a daily basis (using Airodis™ version 5.1) and stored at Ecotech's Environmental Reporting Services (ERS) department in Melbourne, Australia. Data samples are logged in 5 minute intervals.

3.4. Data Validation and Reporting

3.4.1. Validation

The Ecotech ERS department performs 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.

Details of all invalid or missing data are recorded in the Valid Data Exception Tables.

Validation is performed by the analyst, and the validation is reviewed. Graphs and tables are generated based on the validated five minute data.

3.4.2. Reporting

The reported data is in a Microsoft Excel format file named "*Wilpingjong Coal Validated Data Report May-15.xls*". The Excel file consists of 5 Excel worksheets:

1. Cover
2. 5 Minute Averages
3. Hourly Averages
4. Daily Averages
5. Valid Data Exception Table

The data contained in this report is based on Australian Eastern Standard Time.

All averages are calculated from the five minute data. Averages are based on a minimum of 75% valid readings within the averaging period.

Averaging periods of eight hours or less are reported for the end of the period, i.e. the hourly average 02:00 is for the data collected from 01:00 to 02:00. One hour averages are calculated based on a clock hour. One day averages are calculated based on calendar days.

4.0 Air Quality Goals

The air quality goals for pollutants monitored at the Wilpinjong Wollar monitoring station are based on the Australian National Environmental Council (NEPC) Ambient Air Quality (NEPM). These air quality goals are shown in Table 4 below.

Table 4: Wilpinjong Air Quality Goals (NEPM)

Parameter	Time Period	Exceedence Level	Units	Maximum allowable exceedences
NO_2	1 year	30	ppb	None
NO_2	1 hour	120	ppb	1 day a year
SO_2	1 hour	200	ppb	1 day a year
SO_2	1 day	80	ppb	1 day a year
SO_2	1 year	20	ppb	None

4.1. Air Quality Summary

Table 5 below, details any exceedences of the NEPM Standard that were observed during this reporting period.

Table 5: Exceedences Recorded

Parameter	Time Period	Value of Exceedence	Date of Exceedence
NO_2	1 hour	-	-
SO_2	1 hour	-	-
SO_2	1 day	-	-

5.0 Calibrations and Maintenance

5.1. Units and Uncertainties

The uncertainties for each parameter have been determined by the manufacturer's tolerance limits of the equipment's parameters, and by the data collection standard method.

The reported uncertainties are expanded uncertainties, calculated using coverage factors which give a level of confidence of approximately 95%.

Table 6: Units and Uncertainties

Parameter	Units	Resolution	Uncertainty	Measurement Range[1]
NO, NO_x (EC9841)	ppm	1 ppb	± 14 ppb K factor of 2.01	0 ppb to 500 ppb
NO_2 (EC9841)	ppm	1 ppb	± 16 ppb K factor of 2.01	0 ppb to 500 ppb
SO_2 (EC9850)	ppm	1 ppb	± 14 ppb K factor of 2.01	0 ppb to 500 ppb
H_2S	ppm	1 ppb	15.2% of reading or ± 19 ppb, whichever is greater K factor of 2	0 ppb to 500 ppb
Benzene, Toluene and *p*-Xylene (BTX)	ppb	0.03 ppb	15.1% of reading or 3.8ppb, whichever is greater K factor of 2	0 ppb to 300 ppb
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
Vector Wind Direction	Deg	1 deg	±4 deg K factor of 2.11	0 deg to 360 deg Starting threshold: 0 m/s

[1] Uncertainties may not be calculated based on the full measurement range. Uncertainty for NO, NO_2 and NO_x by EC 9841 and SO_2 by EC9850 are calculated based on a measurement range of 0-125 ppb.

5.2. Automatic Checks

Automatic span and zero calibration checks run each night for NO, NO_2, NO_x and SO_2.

Background checks run each night for SO_2 and H_2S.

See Table 7 below for additional details. Data points associated with these checks are invalidated but are not referred to in the Valid Data Exception Tables.

Table 7: Automatic checks for NO, NO_2, NO_x, SO_2, and H_2S

Parameter	Span / Zero cycle time (approximate)	Background cycle time (approximate)
NO, NO_2, NO_x	01:00 to 01:45	N/A
SO_2	01:00 to 01:40	23:50 to 00:00
H_2S	01:55 to 03:50 (weekly)	23:50 to 00:05

5.3. Maintenance

Yearly maintenance was performed on 30/04/2015 and completed on 01/05/2015. Data was checked remotely on 02/05/2015 before the Ecotech technician returned to the Sydney offices.

5.3.1. Calibration & Maintenance Summary Tables

The last calibrations for the following parameters were performed on the indicated dates. Data supplied after this time is subject to further validation, to be performed at the next calibration cycle.

Note: Maintenance and calibration dates may differ, as calibrations may be less frequent than scheduled maintenance visits.

Table 8 indicates when the gas and meteorological equipment was last maintained / calibrated.

Table 8: Wilpinjong Wollar Maintenance Table

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	30/04/2015	Yearly	30/04/2015	Monthly
SO_2	30/04/2015	Yearly	30/04/2015	Monthly
H_2S	01/05/2015	Yearly	01/05/2015	Monthly
BTX	01/05/2015	3-monthly	01/05/2015	Monthly
Wind Speed	01/05/2015	3-monthly	TBA	2-Yearly
Wind Direction	01/05/2015	3-monthly	TBA	2-Yearly

Wind sensor calibration certificates not yet received, last calibration will be updated when available

6.0 Results

6.1. Data Capture

Data capture is based on 1 hour averages, calculated from 5 minute data, and refers to the amount of available data collected during the report period.

The percentage of data captured is calculated using the following equation:
Data capture = (Reported air quality data / Total data) x 100%
Where:

- Reported air quality data = Number of instrument readings which have been validated through a quality assured process 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 displays data capture statistics for 1st – 31st May 2015. **Bold** values in the table indicate data capture below 95%.

Details of all invalid or missing data affecting data affecting data capture are included in the Valid Data Exception Tables, and attached Excel file.

Table 9: Data Capture for Wilpinjong Wollar Station

Parameter	Data Capture %
NO, NO_2, NO_x	97.2
SO_2	**94.7**
H_2S	**92.6**
Benzene	97.5
Toluene	**93.2**
p-Xylene	**78.2**
WS, WD	99.9

6.2. Graphic Representations

Validated 5 minute data for NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene and *p*-Xylene were used to construct the following graphical representations.

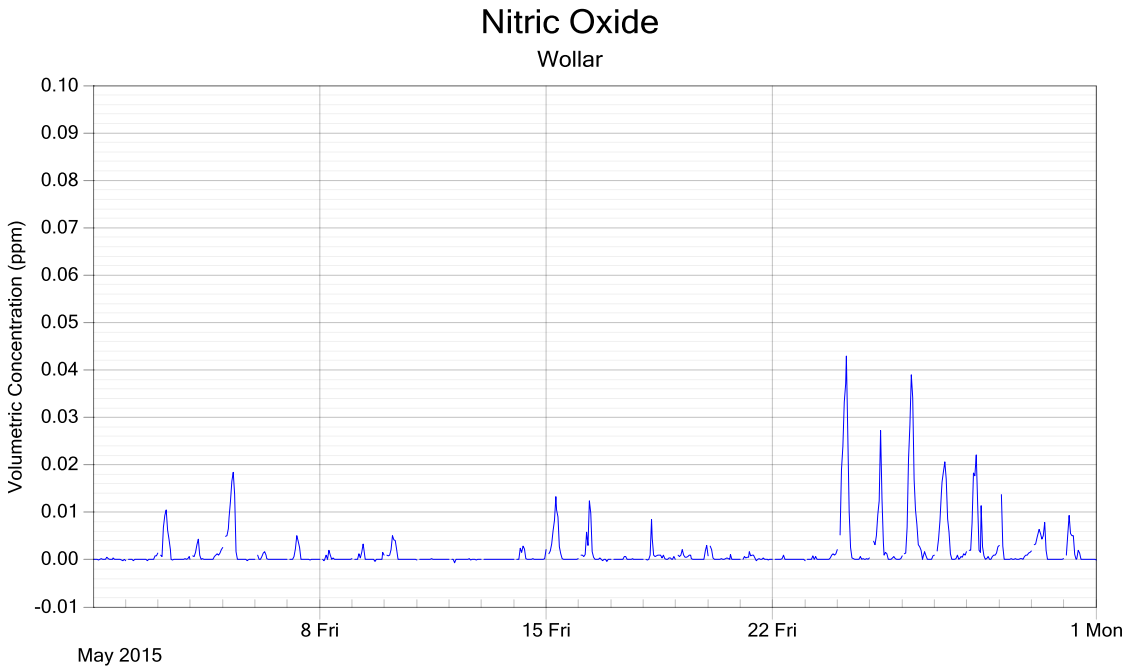

Figure 2: NO - 1 hour data

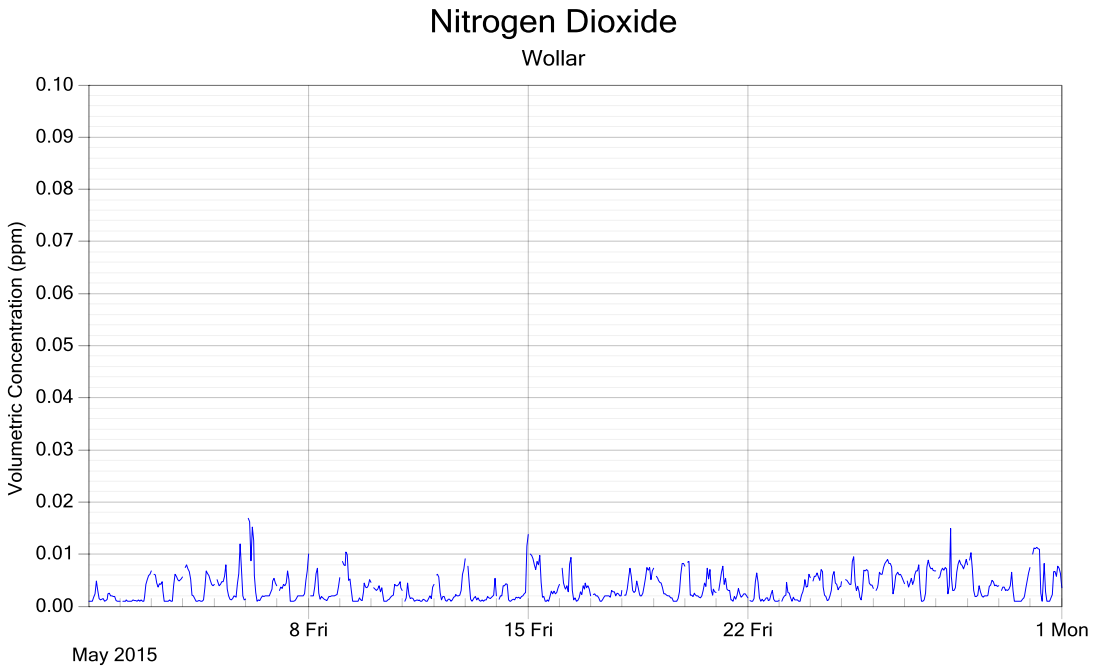

Figure 3: NO_2 - 1 hour data

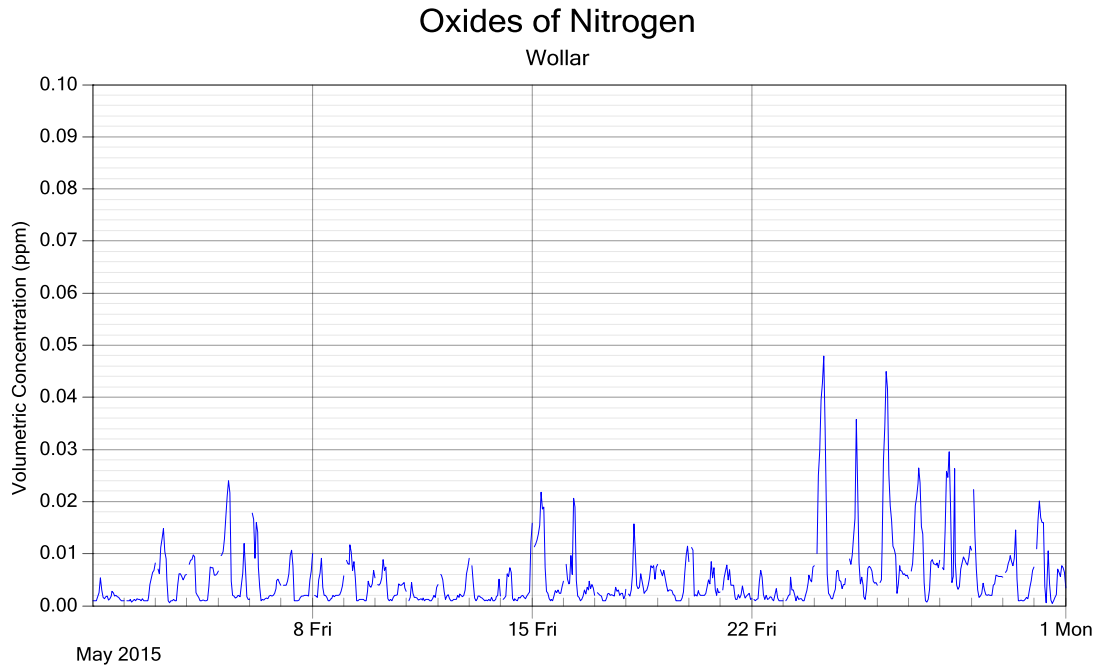

Figure 4: NO_X - 1 hour data

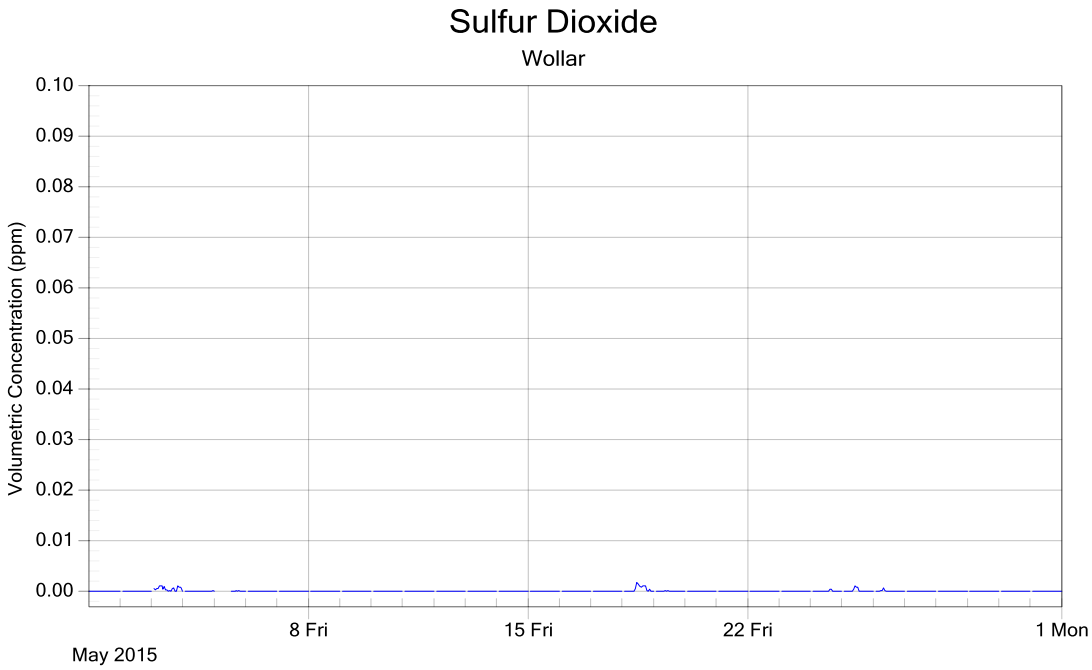

Figure 5: SO_2 - 1 hour data

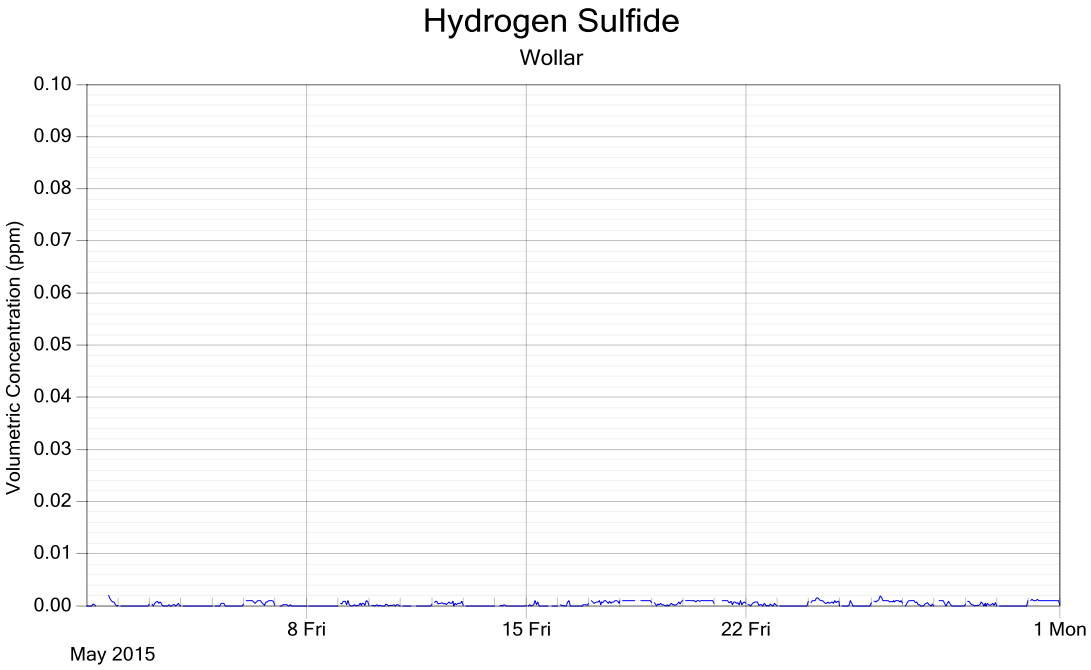

Figure 6: H_2S - 1 hour data

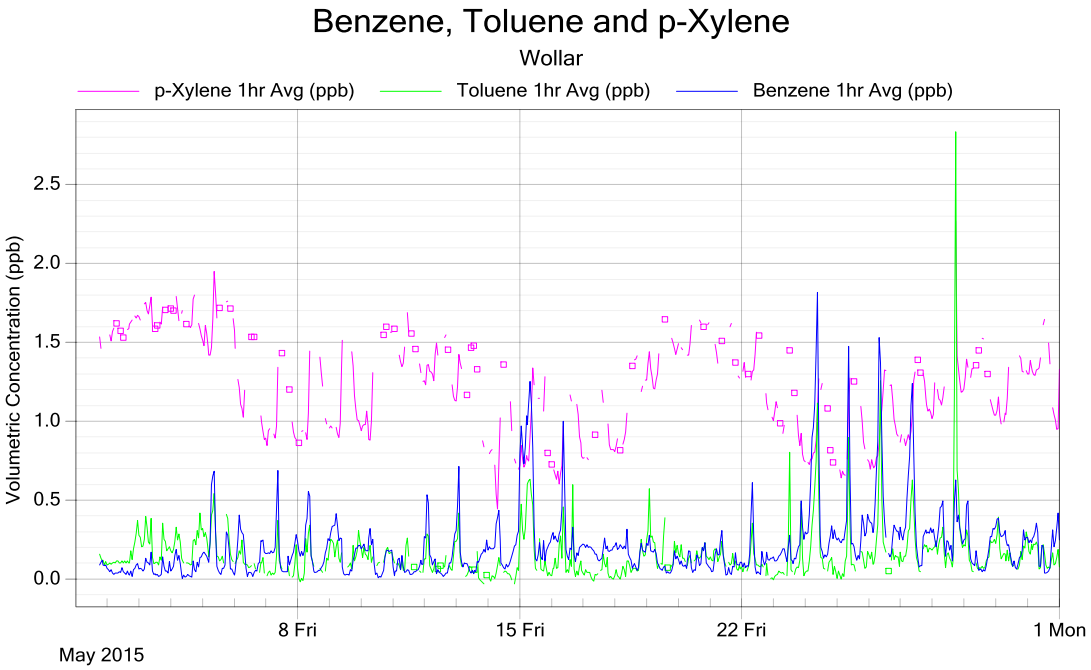

Figure 7: BTX - 1 hour data

7.0 Valid Data Exception Tables

The tables below details all changes made to the raw data set during the validation process. An explanation of reasons given in the table can be found in Appendix 2.

Table 10: Wollar Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
01/05/2015 00:00	01/05/2015 08:05	Instrument in "out of service" mode in preparation for maintenance (continued from Apr-15)	H_2S and BTX	RE	19/05/2015
01/05/2015 07:40	05/05/2015 00:55	Linear multiplier applied to correct out of tolerance spans where A = 0.87 and B = 0.93	NO, NO_2 and NO_x	RE	26/05/2015
01/05/2015 08:10	01/05/2015 17:45	Scheduled yearly maintenance and subsequent instrument stabilisation	BTX	RE	19/05/2015
01/05/2015 17:50	04/06/2015 14:05	Static offset of 1.34 ppb applied to correct baseline	*p*-Xylene	RE	29/06/2015
01/05/2015 20:15	31/05/2015 18:50	Outliers – intermittent drop outs	Toluene and *p*-Xylene	RE	25/06/2015
03/05/2015 07:20	16/05/2015 07:20	Intermittent wind speed spikes	WS and WD	RE	25/06/2015
05/05/2015 01:40	05/05/2015 12:55	Instrument fault – remained in calibration mode following overnight calibration cycle	SO_2	RE	05/05/2015
10/05/2015 01:40	25/05/2015 02:25	Intermittent instrument stabilisation following automatic overnight calibration cycle	NO, NO_2 and NO_x	RE	19/05/2015
11/05/2015 09:35	18/05/2015 15:40	Intermittent additional automatic calibration cycles	H_2S	RE	18/05/2015

Start Date	End Date	Reason	Change Details	User Name	Change Date
21/05/2015 03:45	21/05/2015 04:30	Instrument stabilisation following automatic calibration cycle	H_2S	RE	25/06/2015
26/05/2015 13:50	26/05/2015 14:20	Short power interruption and subsequent instrument stabilisation	BTX	RE	25/06/2015

8.0 Report Summary

The data capture for Wollar was above 95% for all measured parameters with the exception of the following;

- SO_2 had a data capture of 94.7% and was impacted by an instrument fault on 05/05/2015.
- H_2S had a data capture of 92.6% and was impacted by intermittent data transmission errors.
- *p*-Xylene had a data capture of 78.2% and was impacted by a zero check as part of scheduled maintenance, and outliers.

Measurement of a number of parameters in this report does not comply with applicable standards and/or is not covered by Ecotech's NATA scope of accreditation. Please refer to section 3.3.1 for details.

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

Appendix 1 - Definitions & Abbreviations

BTX	Benzene, Toluene and *p*-Xylene
H_2S	Hydrogen sulfide
m/s	Metres per second
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
ppb	Parts per billion
SO_2	Sulphur dioxide
WD	Vector Wind Direction
WS	Vector Wind Speed

Appendix 2 - Explanation of Exception Table

Automatic background check refers to when analyser samples zero air and measures the level of the concentration voltage. This voltage is taken as the zero signal level and this value is subtracted from any subsequent readings as an active zero compensation. This is the analyser's fine zero measurement.

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Equipment malfunction/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.

Gap in data/data not available refers to a period of time when either data has been lost or could not be collected.

Instrument Alarm refers to an alarm produced by the instrument. A range of alarms can be produced depending on how operation of the instrument is being affected.

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Overnight span/zero out of tolerance refers to when the span/zero reading measured by the analyser during an automatic precision check falls outside of the expected concentration limits.

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

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Warm up after power interruption refers to the startup period of an instrument after power has been restored.

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Accreditation No. 14184.

NATA
WORLD RECOGNISED ACCREDITATION

Peabody Energy

Wilpinjong Coal
Wollar

Ambient Air Quality Monitoring

Validated Report

1st June – 30th June 2015

Report No.: DAT9737

Report issue date: 28th July 2015

Maintenance contract: MC951

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Revision History			
Revision	**Report ID**	**Date**	**Analyst**
0	DAT9737	28/07/2015	Robyn EDWARDS

Report by: Robyn EDWARDS

Approved Signatory: Jon ALEXANDER

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List of Tables

1.0 Executive Summary

Peabody Energy has commissioned Ecotech P/L to conduct air quality monitoring for the Wilpinjong Mine at Wollar. Measured parameters at Wollar are NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene and *p*-Xylene. A wind sensor is also installed at the Wollar site.

The Wollar station was commissioned in March 2013.

This report presents the data collected from the Wollar station for June 2015. Data capture for the different pollutants is presented in Table 9

2.0 Introduction

Ecotech Pty Ltd was commissioned by Peabody Energy to provide monitoring and data reporting for the Wilpinjong Mine at Wollar, located as detailed in Table 1. Ecotech commenced data collection from the Wilpinjong Station on the 1st March 2013.

This report presents the data for 1st – 30th June 2015.

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

3.1. Siting Details

The Wilpinjong Mine consists of one ambient air quality monitoring station. The station location and siting details are described below.

Table 1: Wilpinjong Mine monitoring site location

Site Name	Geographical Coordinates	Height Above Sea Level (m)
Wollar	Lat: -32.360105 Long: 149.949509	366

A siting audit was conducted on 27th February 2015 to assess for compliance with *AS/NZS 3580.1.1:2007 "Methods for sampling and analysis of ambient air – guide to siting air monitoring equipment"*.

This siting of this station complies with AS/NZS 3580.1.1:2007. The station is classified as a neighbourhood station according to *AS/NZS 3580.1.1:2007*.

Figure 1: Wilpinjong Mine Monitoring Station Location

3.2. Monitored Parameters

Table 2 below details the parameters monitored and the instruments used at Wilpinjong Mine monitoring station. Appendix 1 defines any abbreviated parameter names used throughout the report.

For meteorological sensors, the elevation given in the table below is the height above ground level at the monitoring station.

Table 2: Parameters measured at the Wilpinjong Mine monitoring station

Parameter Measured	Instrument and Measurement Technique
BTX (Benzene, Toluene and *p*-Xylene)	Synspec GC955 - Gas Chromatography
H_2S	Ecotech EC9852 - fluorescence
NO, NO_2, NO_x	Ecotech EC9841 gas phase chemiluminescence
SO_2	Ecotech EC9850 – fluorescence
Wind Speed (horizontal, 10m)	Vaisala WS425 – ultrasonic
Wind Direction (10m)	Vaisala WS425 – ultrasonic

3.3. Data Collection Methods

Table 3 below shows the methods used for data collection. Any deviations from the stated methods are detailed in section 3.3.1.

Table 3: Methods

Parameter Measured	Data Collection Methods Used	Description of Method
NO, NO_2, NO_x	AS 3580.5.1-2011	Methods for sampling and analysis of ambient air. Method 5.1: Determination of oxides of nitrogen – chemiluminescence method
	Ecotech Laboratory Manual	In-house method 6.1 Oxides of nitrogen by chemiluminescence
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Vector Wind Direction	AS 3580.14 2011	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.3 Wind direction by anemometer

3.3.1. Compliance with Standards

Unless stated below, parameters are monitored at the Wilpinjong Mine site according to the methods detailed in Table 3 above.

- Measurement of wind data does not comply with AS 3580.14 2011 and is not covered by Ecotech's NATA scope of accreditation due to current unavailability of a suitable wind tunnel calibration certificate.
- Measurement of benzene, toluene and *p*-xylene (BTX) is not covered by Ecotech's NATA scope of accreditation.
- Measurement of hydrogen sulfide (H_2S) is not covered by Ecotech's scope of accreditation due to the frequency of calibration checks.

3.3.2. Data Acquisition

Data acquisition is performed using a PC based WinAQMS logger (using WinAQMS® Version 2.0) situated at the monitoring site. Each logger is equipped with a 3G modem for remote data collection. The recorded data is remotely collected from the AQMS logger on a daily basis (using Airodis™ version 5.1) and stored at Ecotech's Environmental Reporting Services (ERS) department in Melbourne, Australia. Data samples are logged in 5 minute intervals.

3.4. Data Validation and Reporting

3.4.1. Validation

The Ecotech ERS department performs 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.

Details of all invalid or missing data are recorded in the Valid Data Exception Tables.

Validation is performed by the analyst, and the validation is reviewed. Graphs and tables are generated based on the validated five minute data.

3.4.2. Reporting

The reported data is in a Microsoft Excel format file named "*Wilpingjong Coal Validated Data Report Jun-15.xls*". The Excel file consists of 5 Excel worksheets:

1. Cover
2. 5min Averages
3. Hourly Averages
4. Daily Averages
5. Valid Data Exception Table

The data contained in this report is based on Australian Eastern Standard Time.

All averages are calculated from the five minute data. Averages are based on a minimum of 75% valid readings within the averaging period.

Averaging periods of eight hours or less are reported for the end of the period, i.e. the hourly average 02:00 is for the data collected from 01:00 to 02:00. One hour averages are calculated based on a clock hour. One day averages are calculated based on calendar days.

4.0 Air Quality Goals

The air quality goals for pollutants monitored at the Wilpinjong Wollar monitoring station are based on the Australian National Environmental Council (NEPC) Ambient Air Quality (NEPM). These air quality goals are shown in Table 4 below.

Table 4: Wilpinjong Air Quality Goals (NEPM)

Parameter	Time Period	Exceedence Level	Units	Maximum allowable exceedences
NO_2	1 year	30	ppb	None
NO_2	1 hour	120	ppb	1 day a year
SO_2	1 hour	200	ppb	1 day a year
SO_2	1 day	80	ppb	1 day a year
SO_2	1 year	20	ppb	None

4.1. Air Quality Summary

Table 5 below, details any exceedences of the NEPM Standard that were observed during this reporting period.

Table 5: Exceedences Recorded

Parameter	Time Period	Value of Exceedence	Date of Exceedence
NO_2	1 hour	-	-
SO_2	1 hour	-	-
SO_2	1 day	-	-

5.0 Calibrations and Maintenance

5.1. Units and Uncertainties

The uncertainties for each parameter have been determined by the manufacturer's tolerance limits of the equipment's parameters, and by the data collection standard method.

The reported uncertainties are expanded uncertainties, calculated using coverage factors which give a level of confidence of approximately 95%.

Table 6: Units and Uncertainties

Parameter	Units	Resolution	Uncertainty	Measurement Range[1]
NO, NO_x (EC9841)	ppm	1 ppb	± 14 ppb K factor of 2.01	0 ppb to 500 ppb
NO_2 (EC9841)	ppm	1 ppb	± 16 ppb K factor of 2.01	0 ppb to 500 ppb
SO_2 (EC9850)	ppm	1 ppb	± 14 ppb K factor of 2.01	0 ppb to 500 ppb
H_2S	ppm	1 ppb	15.2% of reading or ± 19 ppb, whichever is greater K factor of 2	0 ppb to 500 ppb
Benzene, Toluene and *p*-Xylene (BTX)	ppb	0.03 ppb	15.1% of reading or 3.8ppb, whichever is greater K factor of 2	0 ppb to 300 ppb
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
Vector Wind Direction	Deg	1 deg	±4 deg K factor of 2.11	0 deg to 360 deg Starting threshold: 0 m/s

[1] Uncertainties may not be calculated based on the full measurement range. Uncertainty for NO, NO_2 and NO_x by EC 9841 and SO_2 by EC9850 are calculated based on a measurement range of 0-125 ppb.

5.2. Automatic Checks

Automatic span and zero calibration checks run each night for NO, NO_2, NO_x and SO_2.

Background checks run each night for SO_2 and H_2S.

See Table 7 below for additional details. Data points associated with these checks are invalidated but are not referred to in the Valid Data Exception Tables.

Table 7: Automatic checks for NO, NO_2, NO_x, SO_2, and H_2S

Parameter	Span / Zero cycle time (approximate)	Background cycle time (approximate)
NO, NO_2, NO_x	01:00 to 01:45	N/A
SO_2	01:00 to 01:40	23:50 to 00:00
H_2S	01:55 to 03:50 (weekly)	23:50 to 00:05

5.3. Maintenance

Scheduled monthly maintenance was carried out on 04/06/2015 and 05/06/2015.

Yearly maintenance for the NO_X analyser performed in May-15, was concluded on 04/06/2015.

5.3.1. Calibration & Maintenance Summary Tables

The last calibrations for the following parameters were performed on the indicated dates. Data supplied after this time is subject to further validation, to be performed at the next calibration cycle.

Note: Maintenance and calibration dates may differ, as calibrations may be less frequent than scheduled maintenance visits.

Table 8 indicates when the gas and meteorological equipment was last maintained / calibrated.

Table 8: Wilpinjong Wollar Maintenance Table

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	04/06/2015	Yearly	04/06/215	Monthly
SO_2	04/06/2015	Monthly	04/06/2015	Monthly
H_2S	04/06/2015	Monthly	04/06/2015	Monthly
BTX	05/06/2015	Monthly	05/06/2015	Monthly
Wind Speed	05/06/2015	6-monthly	TBA	2-Yearly
Wind Direction	05/06/2015	6-monthly	TBA	2-Yearly

Wind sensor calibration certificates not yet received, last calibration will be updated when available

6.0 Results

6.1. Data Capture

Data capture is based on 1 hour averages, calculated from 5 minute data, and refers to the amount of available data collected during the report period.

The percentage of data captured is calculated using the following equation:
Data capture = (Reported air quality data / Total data) x 100%
Where:

- Reported air quality data = Number of instrument readings which have been validated through a quality assured process 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 displays data capture statistics for 1st – 30th June 2015. **Bold** values in the table indicate data capture below 95%.

Details of all invalid or missing data affecting data affecting data capture are included in the Valid Data Exception Tables, and attached Excel file.

Table 9: Data Capture for Wilpinjong Wollar Station

Parameter	Data Capture %
NO, NO_2, NO_x	**92.8**
SO_2	95.0
H_2S	**92.3**
Benzene	95.4
Toluene	**94.4**
p-Xylene	**84.7**
WS, WD	99.2

6.2. Graphic Representations

Validated 5 minute data for NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene and *p*-Xylene were used to construct the following graphical representations.

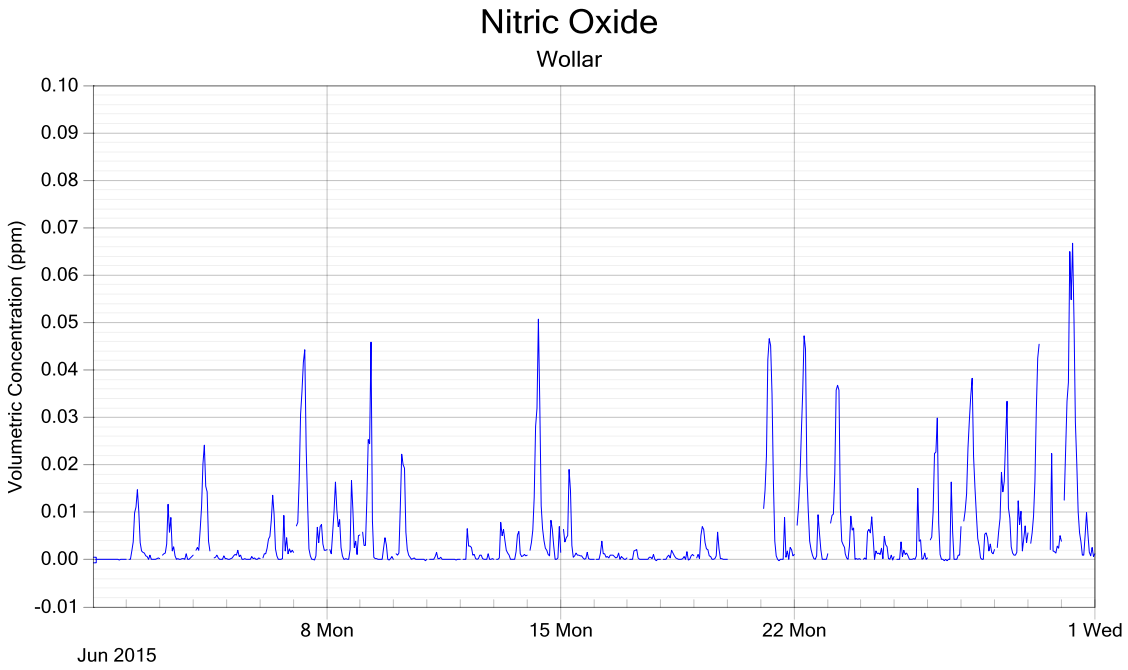

Figure 2: NO - 1 hour data

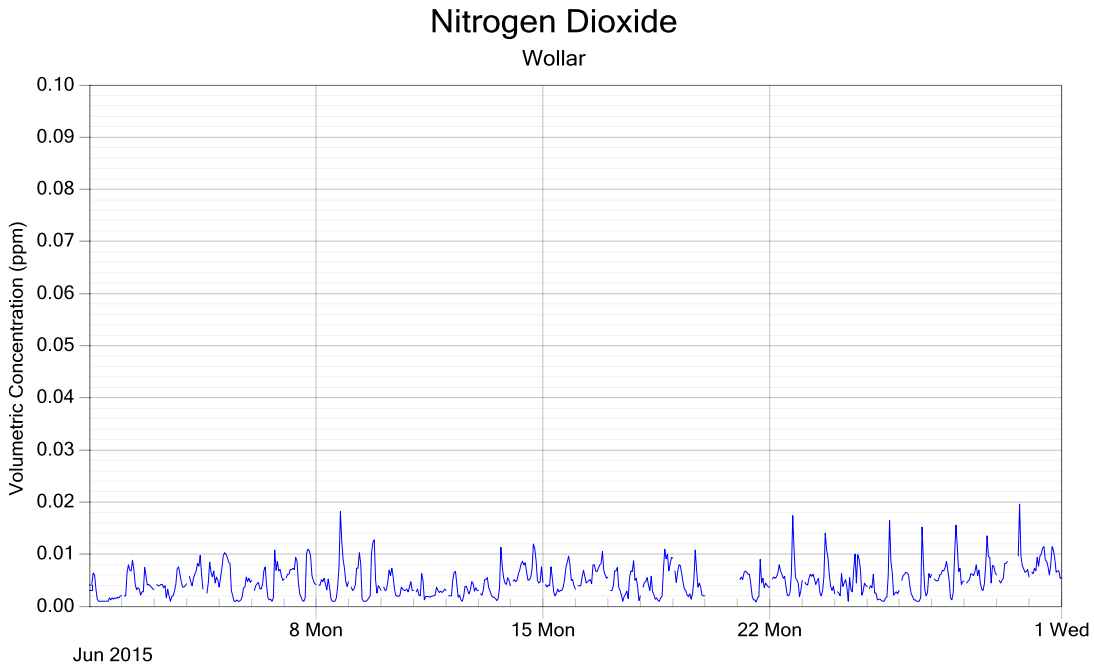

Figure 3: NO_2 - 1 hour data

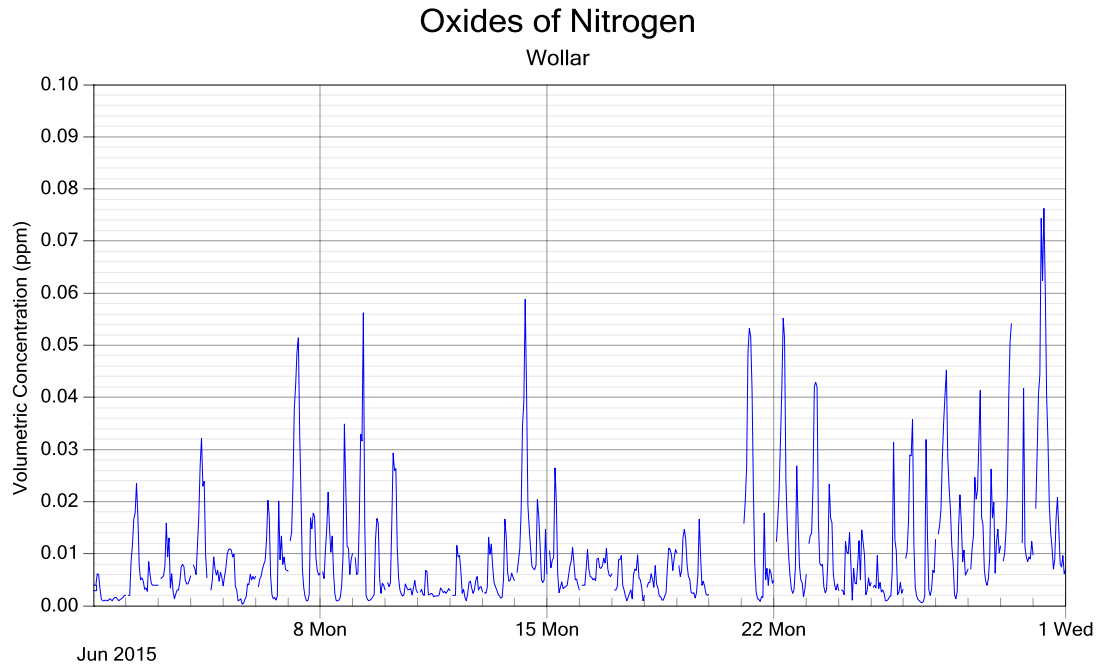

Figure 4: NO_X - 1 hour data

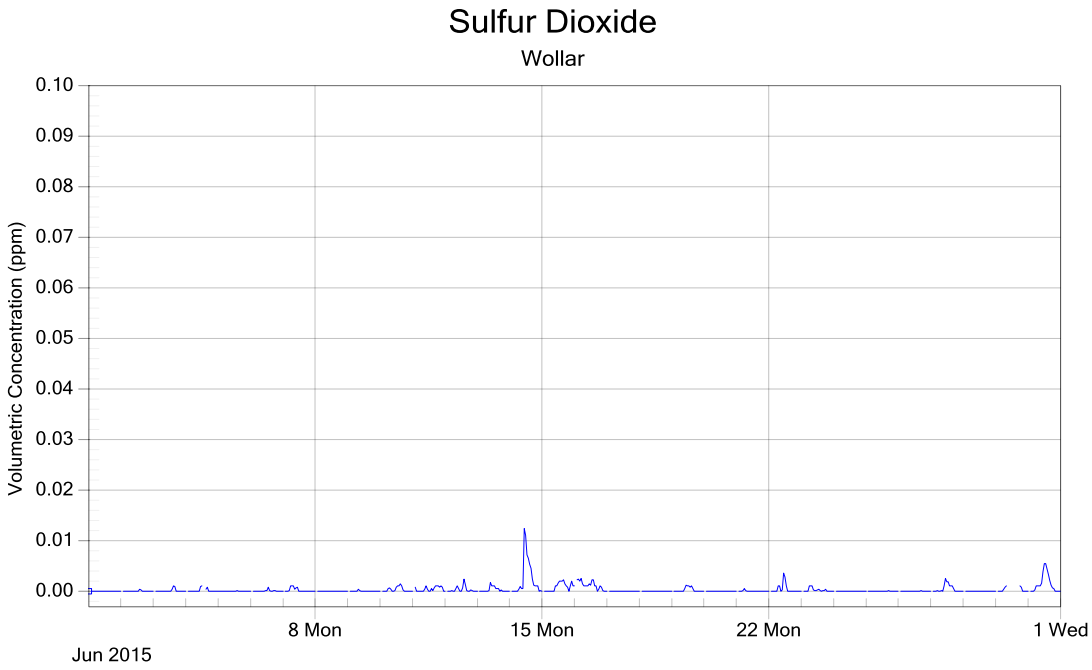

Figure 5: SO_2 - 1 hour data

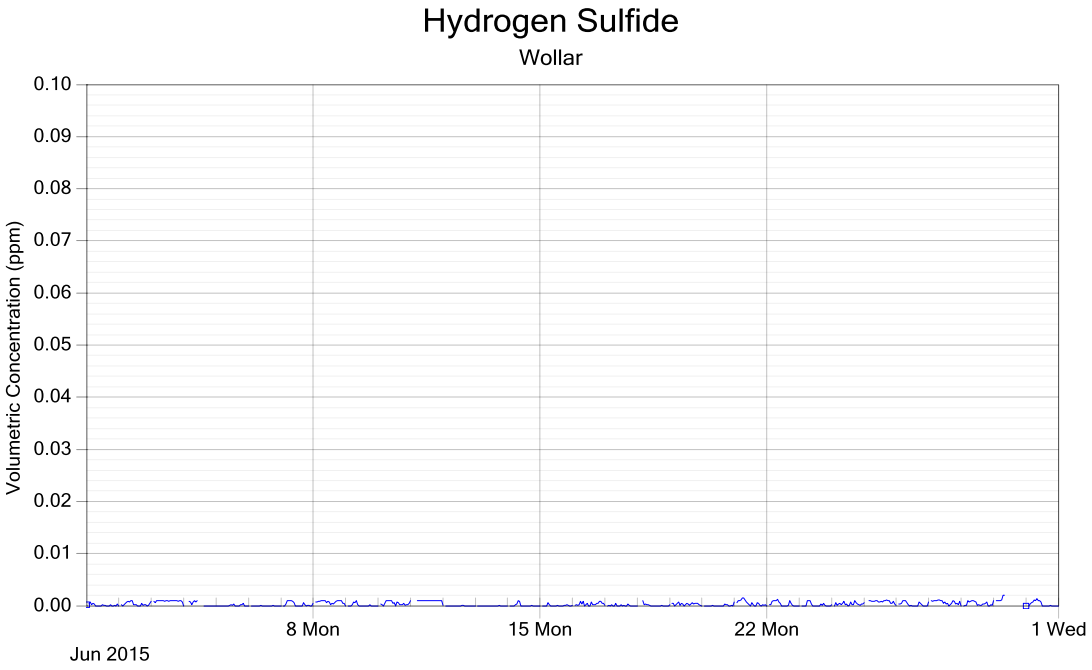

Figure 6: H_2S - 1 hour data

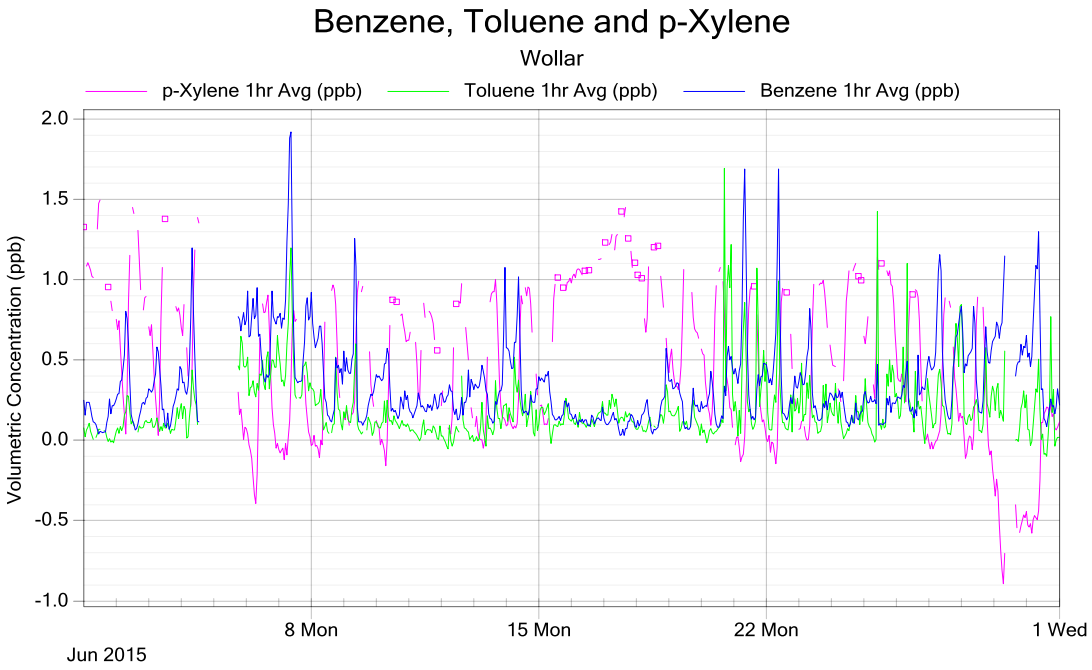

Figure 7: BTX - 1 hour data

7.0 Valid Data Exception Tables

The tables below details all changes made to the raw data set during the validation process. An explanation of reasons given in the table can be found in Appendix 2.

Table 10: Wollar Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
01/06/2015 00:00	04/06/2015 14:05	Static offset of 1.34 ppb applied to correct baseline (continued from May-15)	*p*-Xylene	RE	29/06/2015
01/06/2015 01:15	30/06/2015 14:10	Outliers – intermittent drop outs	Toluene and *p*-Xylene	RE	28/07/2015
02/06/2015 01:40	26/06/2015 01:45	Intermittent instrument stabilisation following automatic overnight calibration cycle	NO, NO_2 and NO_x	RE	28/07/2015
04/06/2015 11:25	04/06/2015 14:25	Scheduled maintenance and subsequent instrument stabilisation	NO, NO_2, NO_X, SO_2 and H_2S	RE	28/07/2015
04/06/2015 14:30	05/06/2015 17:55	Scheduled maintenance performed over 2 days	BTX	RE	28/07/2015
05/06/2015 18:00	01/07/2015 13:05	Static offset of 0.19 ppb applied to correct baseline	Benzene	RE	28/07/2015
11/06/2015 03:45	18/06/2015 03:50	Intermittent instrument stabilisation following automatic weekly calibration cycle	H_2S	RE	28/07/2015
18/06/2015 06:40	27/06/2015 09:15	Intermittent wind speed spikes	WS and WD	RE	28/07/2015
20/06/2015 01:40	21/06/2015 00:55	Instrument fault – remained in calibration mode following overnight calibration cycle	NO, NO_2 and NO_x	RE	28/07/2015
29/06/2015 09:35	29/06/2015 23:45	Power interruption and subsequent instrument stabilisation. Stabilisation periods differ between instruments	All parameters	RE	28/07/2015

8.0 Report Summary

The data capture for Wollar was above 95% for all measured parameters with the exception of the following;

- NO, NO_2 and NO_x had a data capture of 92.8% and was impacted by and instrument fault on 20/06/2015.
- H_2S had a data capture of 92.3% and was impacted by weekly calibration cycles and subsequent instrument stabilisation.
- Toluene had a data capture of 94.4% and was impacted by scheduled maintenance and intermittent outliers.
- *p*-Xylene had a data capture of 84.7% and was impacted by scheduled maintenance and intermittent outliers.
- All parameters were affected by a power interruption on 29/06/2015.

Measurement of a number of parameters in this report does not comply with applicable standards and/or is not covered by Ecotech's NATA scope of accreditation. Please refer to section 3.3.1 for details.

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

Appendix 1 - Definitions & Abbreviations

BTX	Benzene, Toluene and *p*-Xylene
H_2S	Hydrogen sulfide
m/s	Metres per second
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
ppb	Parts per billion
SO_2	Sulphur dioxide
WD	Vector Wind Direction
WS	Vector Wind Speed

Appendix 2 - Explanation of Exception Table

Automatic background check refers to when analyser samples zero air and measures the level of the concentration voltage. This voltage is taken as the zero signal level and this value is subtracted from any subsequent readings as an active zero compensation. This is the analyser's fine zero measurement.

Calibration check outside tolerance refers to when the calibration values are outside the tolerance limits set for the precision check.

Calibration correction factor applied to data refers to an offset or multiplier applied to the data. This operation may be performed for a number of reasons including: (a) when a clear trend / drift outside the tolerance limit can be demonstrated by repeated operation precision checks, (b) when a correction is required on previously logged data due to a calibration check being outside the allowable tolerance

Commissioning refers to the initial setup and calibration of the instrument when it is first installed. For some instruments there may be a stabilisation period before normal operation commences.

Data affected by environmental conditions – wind speed / wind speed gust spike refers to when a one-off high reading occurs due to a natural occurrence such as a bird sitting on the wind sensor, or some other event causing the readings to spike.

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Peabody Energy

Wilpinjong Coal
Wollar

Ambient Air Quality Monitoring

Validated Report

1st July – 31st July 2015

Report No.: DAT9849

Report issue date: 28th August 2015

Maintenance contract: MC951

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Revision History			
Revision	**Report ID**	**Date**	**Analyst**
0	DAT9849	28/08/2015	Robyn EDWARDS

Report by: Robyn EDWARDS

Approved Signatory: Jon ALEXANDER

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- Measurement of benzene, toluene and *p*-xylene (BTX) is not covered by Ecotech's NATA scope of accreditation.
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3.4.1. Validation

The Ecotech ERS department performs 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.

Details of all invalid or missing data are recorded in the Valid Data Exception Tables.

Validation is performed by the analyst, and the validation is reviewed. Graphs and tables are generated based on the validated five minute data.

3.4.2. Reporting

The reported data is in a Microsoft Excel format file named "*Wilpingjong Coal Validated Data Report Jul-15.xls*". The Excel file consists of 5 Excel worksheets:

1. Cover
2. 5min Averages
3. Hourly Averages
4. Daily Averages
5. Valid Data Exception Table

The data contained in this report is based on Australian Eastern Standard Time.

All averages are calculated from the five minute data. Averages are based on a minimum of 75% valid readings within the averaging period.

Averaging periods of eight hours or less are reported for the end of the period, i.e. the hourly average 02:00 is for the data collected from 01:00 to 02:00. One hour averages are calculated based on a clock hour. One day averages are calculated based on calendar days.

4.0 Air Quality Goals

The air quality goals for pollutants monitored at the Wilpinjong Wollar monitoring station are based on the Australian National Environmental Council (NEPC) Ambient Air Quality (NEPM). These air quality goals are shown in Table 4 below.

Table 4: Wilpinjong Air Quality Goals (NEPM)

Parameter	Time Period	Exceedence Level	Units	Maximum allowable exceedences
NO_2	1 year	30	ppb	None
NO_2	1 hour	120	ppb	1 day a year
SO_2	1 hour	200	ppb	1 day a year
SO_2	1 day	80	ppb	1 day a year
SO_2	1 year	20	ppb	None

4.1. Air Quality Summary

Table 5 below, details any exceedences of the NEPM Standard that were observed during this reporting period.

Table 5: Exceedences Recorded

Parameter	Time Period	Value of Exceedence	Date of Exceedence
NO_2	1 hour	-	-
SO_2	1 hour	-	-
SO_2	1 day	-	-

5.0 Calibrations and Maintenance

5.1. Units and Uncertainties

The uncertainties for each parameter have been determined by the manufacturer's tolerance limits of the equipment's parameters, and by the data collection standard method.

The reported uncertainties are expanded uncertainties, calculated using coverage factors which give a level of confidence of approximately 95%.

Table 6: Units and Uncertainties

Parameter	Units	Resolution	Uncertainty	Measurement Range[1]
NO, NO_x (EC9841)	ppm	1 ppb	± 14 ppb K factor of 2.01	0 ppb to 500 ppb
NO_2 (EC9841)	ppm	1 ppb	± 16 ppb K factor of 2.01	0 ppb to 500 ppb
SO_2 (EC9850)	ppm	1 ppb	± 14 ppb K factor of 2.01	0 ppb to 500 ppb
H_2S	ppm	1 ppb	15.2% of reading or ± 19 ppb, whichever is greater K factor of 2	0 ppb to 500 ppb
Benzene, Toluene and *p*-Xylene (BTX)	ppb	0.03 ppb	15.1% of reading or 3.8ppb, whichever is greater K factor of 2	0 ppb to 300 ppb
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
Vector Wind Direction	Deg	1 deg	±4 deg K factor of 2.11	0 deg to 360 deg Starting threshold: 0 m/s

[1] Uncertainties may not be calculated based on the full measurement range. Uncertainty for NO, NO_2 and NO_x by EC 9841 and SO_2 by EC9850 are calculated based on a measurement range of 0-125 ppb.

5.2. Automatic Checks

Automatic span and zero calibration checks run each night for NO, NO_2, NO_x and SO_2.

Background checks run each night for SO_2 and H_2S.

See Table 7 below for additional details. Data points associated with these checks are invalidated but are not referred to in the Valid Data Exception Tables.

Table 7: Automatic checks for NO, NO_2, NO_x, SO_2, and H_2S

Parameter	Span / Zero cycle time (approximate)	Background cycle time (approximate)
NO, NO_2, NO_x	01:00 to 01:45	N/A
SO_2	01:00 to 01:40	23:50 to 00:00
H_2S	01:55 to 03:50 (weekly)	23:50 to 00:05

5.3. Maintenance

A number of visits were made to site during the reporting month, detailed as follows;

On 01/07/2015, scheduled monthly maintenance was carried out on all instruments.

On 02/07/2015, monthly maintenance was completed and also included a multi-point calibration performed on the BTX analyser, the multi-point for *p*-Xylene having failed. The span and zero calibration cycles were changed to run every 2nd day for NO_x and SO_2 as the calibration gas is running low.

On 22/07/2015 it was noted that the SO_2 analyser had a high voltage failure which was rectified on 17/07/2015. In addition to this the overnight SO_2 calibration cycles were not running. An exit calibration was performed on the instrument and replaced. The mast and a wind tunnel calibrated wind sensor were also replaced during this visit, as

well as the BTX analyser. Monthly maintenance tasks were carried out on all instruments.

Note: Following the replacement of the BTX analyser, there is a vast improvement in recorded data for p-Xylene. The instrument is subject to investigation on return to the Ecotech offices in Melbourne, and past data will be reviewed once the findings have been reported. Data in this report up to the replacement of the instrument is therefore for reference purposes only.

On 23/07/2015 the monthly maintenance tasks started the day before, were completed.

A final visit to site on 29/07/2015 found a leak on the pump tube of the NO_x analyser, which was replaced and a calibration performed on the instrument.

5.3.1. Calibration & Maintenance Summary Tables

The last calibrations for the following parameters were performed on the indicated dates. Data supplied after this time is subject to further validation, to be performed at the next calibration cycle.

Note: Maintenance and calibration dates may differ, as calibrations may be less frequent than scheduled maintenance visits.

Table 8 indicates when the gas and meteorological equipment was last maintained / calibrated.

Table 8: Wilpinjong Wollar Maintenance Table

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	29/07/2015	Monthly	29/07/2015	Monthly
SO_2	22/07/2015	Monthly	05/06/2015	Monthly
H_2S	23/07/2015	Monthly	23/07/2015	Monthly

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
BTX	22/07/2015	Yearly	16/07/2015	Monthly
Wind Speed	22/07/2015	2-Yearly	21/05/2015	2-Yearly
Wind Direction	22/07/2015	2-Yearly	21/05/2015	2-Yearly

Wind sensor calibration certificates not yet received, last calibration will be updated when available

6.0 Results

6.1. Data Capture

Data capture is based on 1 hour averages, calculated from 5 minute data, and refers to the amount of available data collected during the report period.

The percentage of data captured is calculated using the following equation:
Data capture = (Reported air quality data / Total data) x 100%
Where:

- Reported air quality data = Number of instrument readings which have been validated through a quality assured process 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 displays data capture statistics for 1st – 31st July 2015. **Bold** values in the table indicate data capture below 95%.

Details of all invalid or missing data affecting data affecting data capture are included in the Valid Data Exception Tables, and attached Excel file.

Table 9: Data Capture for Wilpinjong Wollar Station

Parameter	Data Capture %
NO, NO_2, NO_x	97.3
SO_2	**85.5**
H_2S	**93.2**
Benzene	**94.7**
Toluene	**92.3**
p-Xylene	**84.3**
WS, WD	99.9

6.2. Graphic Representations

Validated 5 minute data for NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene and *p*-Xylene were used to construct the following graphical representations.

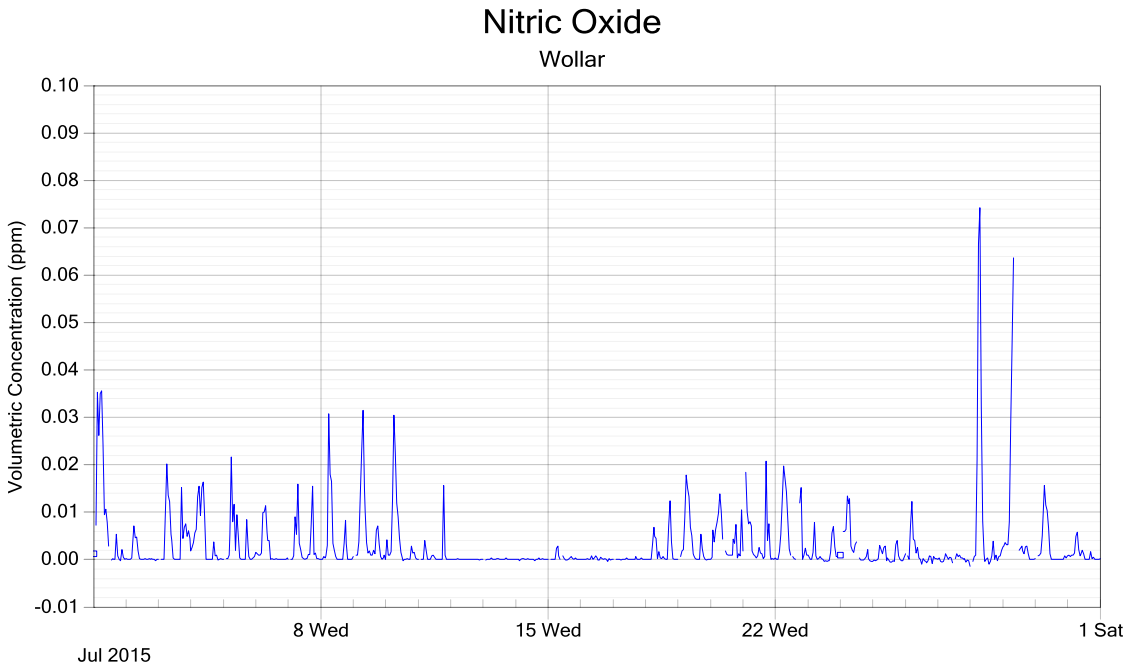

Figure 2: NO - 1 hour data

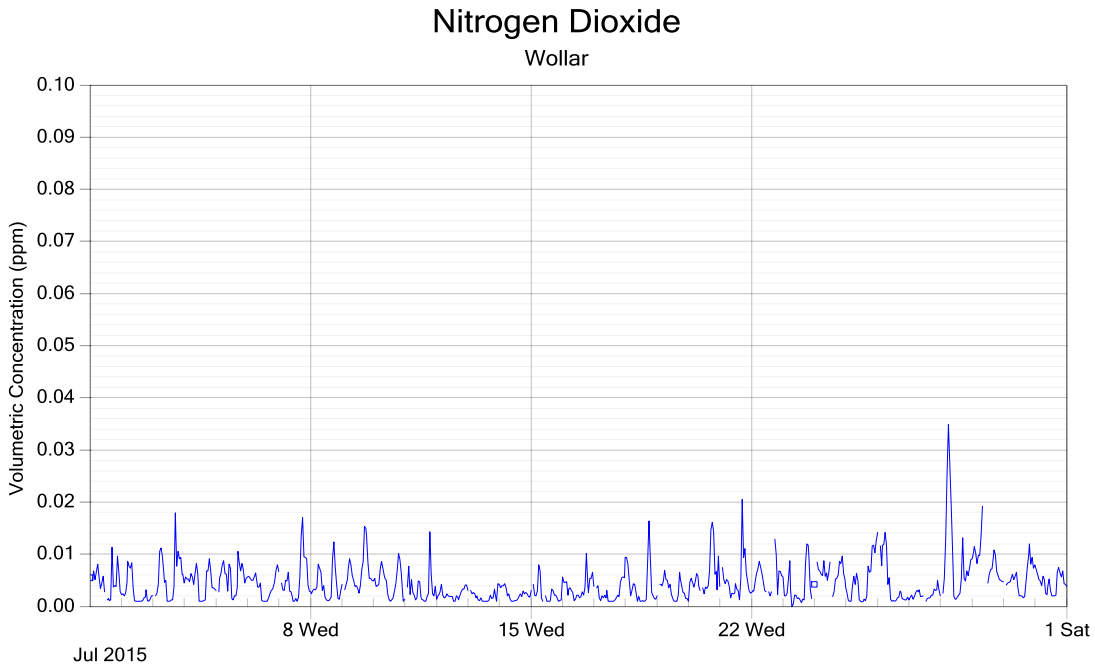

Figure 3: NO_2 - 1 hour data

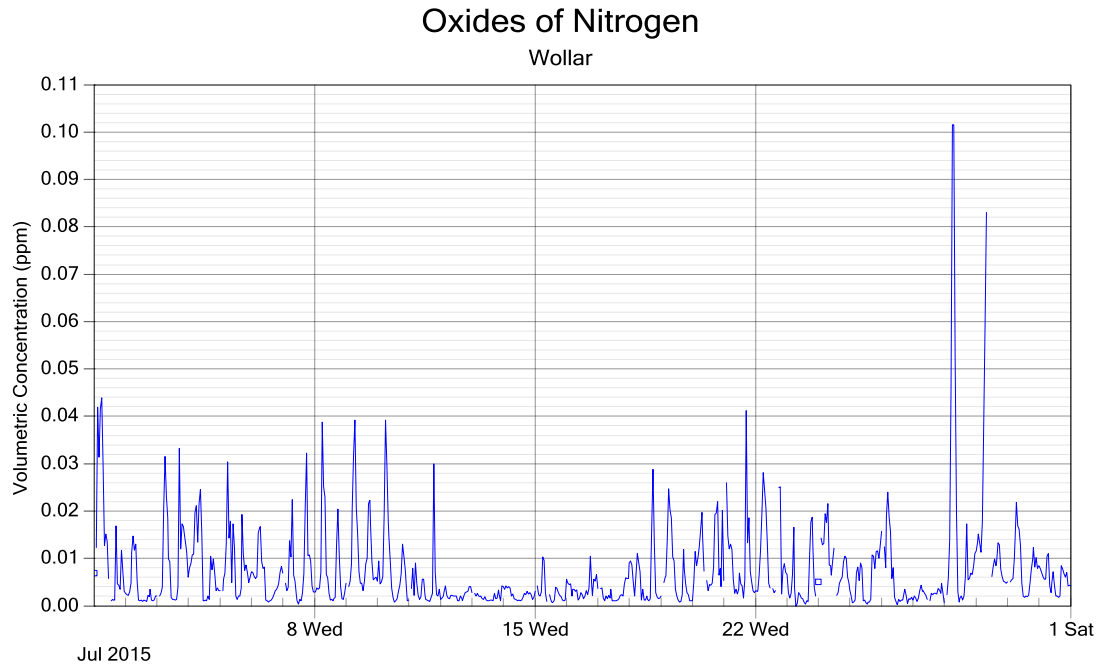

Figure 4: NO_X - 1 hour data

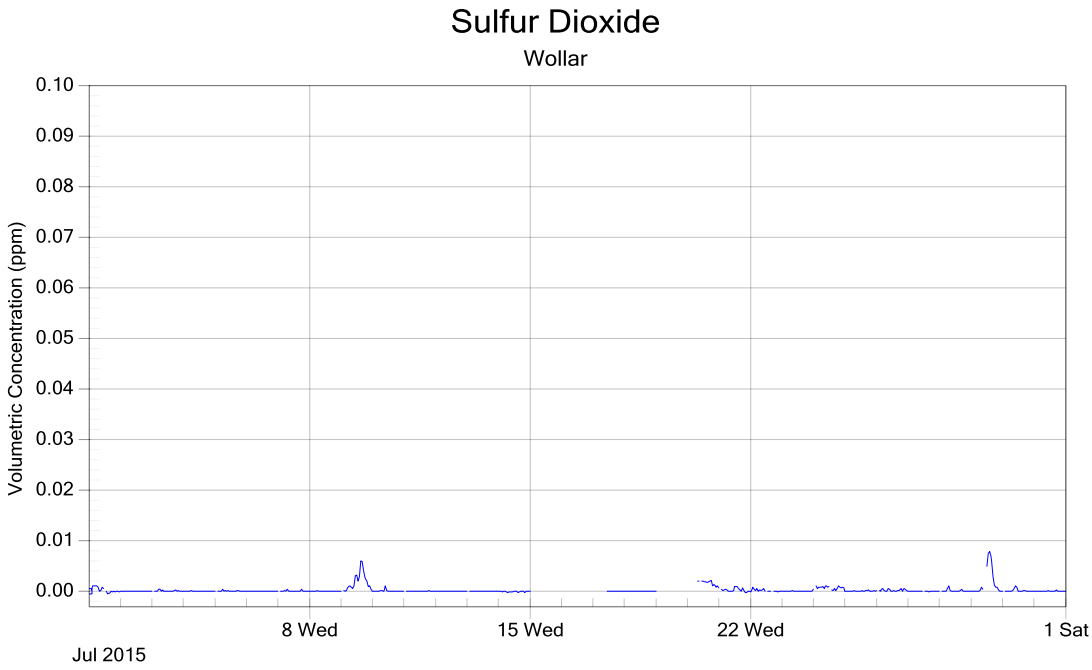

Figure 5: SO_2 - 1 hour data

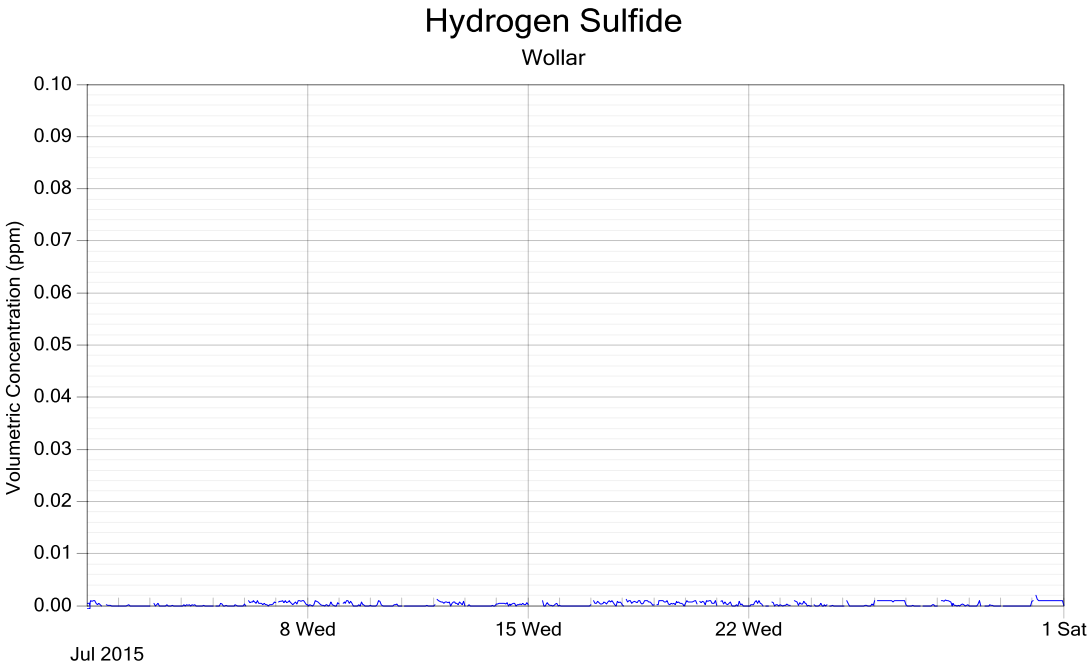

Figure 6: H_2S - 1 hour data

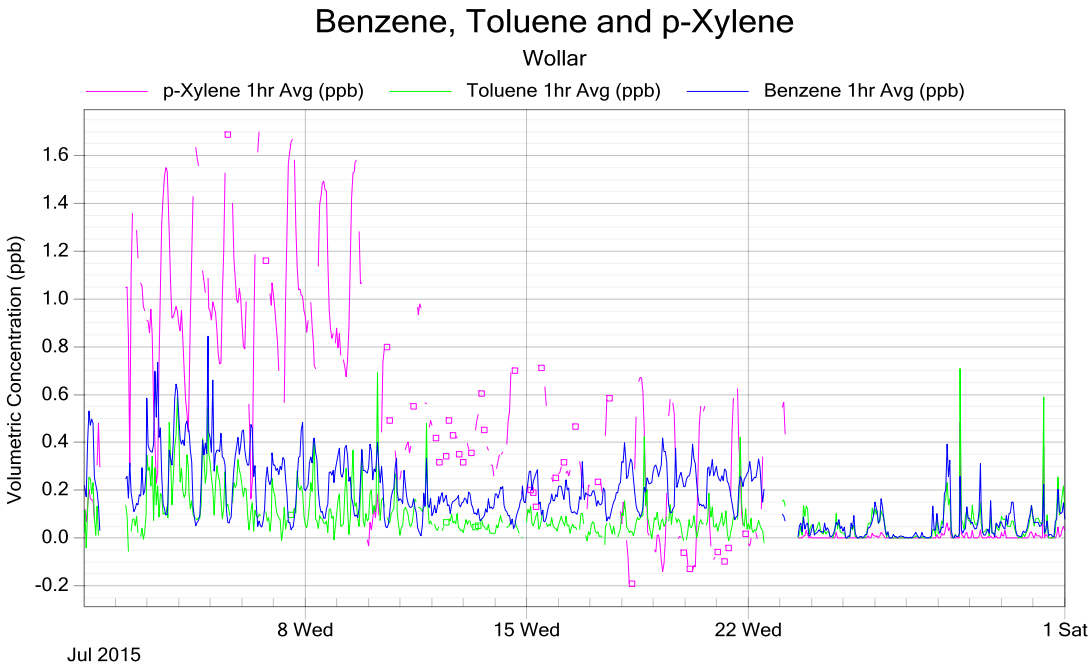

Figure 7: BTX - 1 hour data

7.0 Valid Data Exception Tables

The tables below details all changes made to the raw data set during the validation process. An explanation of reasons given in the table can be found in Appendix 2.

Table 10: Wollar Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
01/07/2015 09:358	22/07/2015 12:35	Outliers – intermittent drop outs	Toluene and *p*-Xylene	RE	28/08/2015
01/07/2015 00:00	01/07/2015 13:05	Static offset of 0.19 ppb applied to correct baseline (continued from Jun-15)	Benzene	RE	28/07/2015
01/07/2015 01:40	30/07/2015 01:45	Intermittent instrument stabilisation following automatic overnight calibration cycle	NO, NO_2 and NO_x	RE	28/08/2015
01/07/2015 11:55	01/07/2015 14:30	Scheduled maintenance and subsequent instrument stabilisation	NO, NO_2, NO_X, SO_2 and H_2S	RE	28/08/2015
01/07/2015 12:20	02/07/2015 07:30	Scheduled maintenance performed over 2 days	BTX	RE	28/08/2015
02/07/2015 07:35	22/07/2015 12:45	Static offset of 0.17 ppb applied to correct baseline	Benzene	RE	28/08/2015
02/07/2015 07:35	09/07/2015 22:30	Static offset of 0.86 ppb applied to correct baseline	*p*-Xylene	RE	28/08/2015
02/07/2015 10:55	31/07/2015 18:50	Intermittent data transmission errors	All parameters	RE	28/08/2015
10/07/2015 17:45	10/07/2015 17:50	Brief power interruption	All parameters	RE	28/08/2015
12/07/2015 03:00	31/07/2015 03:00	Instrument stabilisation following automatic weekly calibration cycle	H_2S	RE	28/08/2015
15/07/2015 02:40	17/07/2015 10:40	Instrument fault – remained in calibration mode due high voltage failure	SO_2	RE	28/08/2015
15/07/2015 10:25	15/07/2015 11:10	Maintenance – remote calibration	NO, NO_2, NO_X, SO_2 and H_2S	RE	28/08/2015

Start Date	End Date	Reason	Change Details	User Name	Change Date
19/07/2015 01:00	20/07/2015 07:50	Instrument fault – remained in calibration mode following overnight calibration cycle	SO_2	RE	28/08/2015
19/07/2015 06:55	20/07/2015 07:30	Intermittent wind speed spikes	WS and WD	RE	28/08/2015
20/07/2015 10:10	20/07/2015 10:50	Maintenance – remote calibration	NO, NO_2, NO_x, SO_2 and H_2S	RE	28/08/2015
22/07/2015 11:55	22/07/2015 17:50	Maintenance – replaced SO_2 and BTX analysers, replaced mast and wind sensor and performed monthly maintenance on all other instruments	SO_2, BTX, WS and WD, NO, NO_2 and NO_x	RE	28/08/2015
22/07/2015 18:30	23/07/2015 01:35	Unknown instrument fault	BTX	RE	28/08/2015
23/07/2015 05:05	23/07/2015 13:55	Instrument in 'out of service' mode	BTX	RE	28/08/2015
23/07/2015 08:50	23/07/2015 10:15	Maintenance on H_2S analyser	H_2S	RE	28/08/2015
29/07/2015 09:00	29/07/2015 12:00	Maintenance – leak fault on pump tube and calibration check	NO, NO_2, NO_x, SO_2 and H_2S	RE	28/08/2015

8.0 Report Summary

The data capture for Wollar was below 95% for all measured parameters with the exception of NO, NO_2, NO_x and WS and WD;

- All parameters were affected by the on-going maintenance visits throughout the month. Further details can be found in Section 5.3 Maintenance and Section 7.0 Valid Data Exception tables.
- Individual data capture percentages are detailed in Section 6.1 Table 9: Data Capture for Wilpinjong Wollar Station

Measurement of a number of parameters in this report does not comply with applicable standards and/or is not covered by Ecotech's NATA scope of accreditation. Please refer to section 3.3.1 for details.

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

Appendix 1 - Definitions & Abbreviations

BTX	Benzene, Toluene and *p*-Xylene
H_2S	Hydrogen sulfide
m/s	Metres per second
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
ppb	Parts per billion
SO_2	Sulphur dioxide
WD	Vector Wind Direction
WS	Vector Wind Speed

Appendix 2 - Explanation of Exception Table

Automatic background check refers to when analyser samples zero air and measures the level of the concentration voltage. This voltage is taken as the zero signal level and this value is subtracted from any subsequent readings as an active zero compensation. This is the analyser's fine zero measurement.

Calibration check outside tolerance refers to when the calibration values are outside the tolerance limits set for the precision check.

Calibration correction factor applied to data refers to an offset or multiplier applied to the data. This operation may be performed for a number of reasons including: (a) when a clear trend / drift outside the tolerance limit can be demonstrated by repeated operation precision checks, (b) when a correction is required on previously logged data due to a calibration check being outside the allowable tolerance

Commissioning refers to the initial setup and calibration of the instrument when it is first installed. For some instruments there may be a stabilisation period before normal operation commences.

Data affected by environmental conditions – wind speed / wind speed gust spike refers to when a one-off high reading occurs due to a natural occurrence such as a bird sitting on the wind sensor, or some other event causing the readings to spike.

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.

Equipment malfunction/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.

Gap in data/data not available refers to a period of time when either data has been lost or could not be collected.

Instrument Alarm refers to an alarm produced by the instrument. A range of alarms can be produced depending on how operation of the instrument is being affected.

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

Linear offset or multiplier refers to when an offset or multiplier has been applied between two points where the values of the offset or multiplier are different and the correction is interpolated between the two points.

Logger error refers to when an error occurs and instrument readings are not correctly recorded by the logger.

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

Overnight span/zero out of tolerance refers to when the span/zero reading measured by the analyser during an automatic precision check falls outside of the expected concentration limits.

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

Remote Calibration refers to when a technician remotely connects to the station and manually performs a span check.

Static offset or multiplier refers to when a single offset or multiplier has been applied to the data between two points either to increase or decrease the measured value.

Warm up after power interruption refers to the startup period of an instrument after power has been restored.

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NATA
WORLD RECOGNISED ACCREDITATION

Peabody Energy

Wilpinjong Coal
Wollar

Ambient Air Quality Monitoring

Validated Report

1st August – 31st August 2015

Report No.: DAT9935

Report issue date: 25th September 2015

Maintenance contract: MC951

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Revision History			
Revision	**Report ID**	**Date**	**Analyst**
0	DAT9935	25/09/2015	Robyn EDWARDS

Report by: Robyn EDWARDS

Approved Signatory: Amanda ELLIOTT

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1.0 Executive Summary

Peabody Energy has commissioned Ecotech P/L to conduct air quality monitoring for the Wilpinjong Mine at Wollar. Measured parameters at Wollar are NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene and *p*-Xylene. A wind sensor is also installed at the Wollar site.

The Wollar station was commissioned in March 2013.

This report presents the data collected from the Wollar station for August 2015. Data capture for the different pollutants is presented in Table 9

2.0 Introduction

Ecotech Pty Ltd was commissioned by Peabody Energy to provide monitoring and data reporting for the Wilpinjong Mine at Wollar, located as detailed in Table 1. Ecotech commenced data collection from the Wilpinjong Station on the 1st March 2013.

This report presents the data for 1st – 31st August 2015.

The data presented in this report:

- Describes air quality measurements;
- Compares monitoring results;
- Has been quality assured;95109
- Complies with NATA accreditation requirements, where applicable.

3.0 Monitoring and Data Collection

3.1. Siting Details

The Wilpinjong Mine consists of one ambient air quality monitoring station. The station location and siting details are described below.

Table 1: Wilpinjong Mine monitoring site location

Site Name	Geographical Coordinates	Height Above Sea Level (m)
Wollar	Lat: -32.360105 Long: 149.949509	366

A siting audit was conducted on 27th February 2015 to assess for compliance with *AS/NZS 3580.1.1:2007 "Methods for sampling and analysis of ambient air – guide to siting air monitoring equipment"*.

This siting of this station complies with AS/NZS 3580.1.1:2007. The station is classified as a neighbourhood station according to *AS/NZS 3580.1.1:2007*.

Figure 1: Wilpinjong Mine Monitoring Station Location

3.2. Monitored Parameters

Table 2 below details the parameters monitored and the instruments used at Wilpinjong Mine monitoring station. Appendix 1 defines any abbreviated parameter names used throughout the report.

For meteorological sensors, the elevation given in the table below is the height above ground level at the monitoring station.

Table 2: Parameters measured at the Wilpinjong Mine monitoring station

Parameter Measured	Instrument and Measurement Technique
BTX (Benzene, Toluene and *p*-Xylene)	Synspec GC955 - Gas Chromatography
H_2S	Ecotech EC9852 - fluorescence
NO, NO_2, NO_x	Ecotech EC9841 gas phase chemiluminescence
SO_2	Ecotech EC9850 – fluorescence
Wind Speed (horizontal, 10m)	Vaisala WS425 – ultrasonic
Wind Direction (10m)	Vaisala WS425 – ultrasonic

3.3. Data Collection Methods

Table 3 below shows the methods used for data collection. Any deviations from the stated methods are detailed in section 3.3.1.

Table 3: Methods

Parameter Measured	Data Collection Methods Used	Description of Method
NO, NO_2, NO_x	AS 3580.5.1-2011	Methods for sampling and analysis of ambient air. Method 5.1: Determination of oxides of nitrogen – chemiluminescence method
	Ecotech Laboratory Manual	In-house method 6.1 Oxides of nitrogen by chemiluminescence
SO_2	AS 3580.4.1 - 2008	Methods for sampling and analysis of ambient air. Method 4.1: Determination of sulfur dioxide – Direct reading instrumental method
	Ecotech Laboratory Manual	In-house method 6.2 Sulfur dioxide by fluorescence
H_2S	Ecotech Laboratory Manual	In-house method 6.5 Hydrogen sulfide by fluorescence
BTX (Benzene, Toluene and *p*-Xylene)	Synspec GC955 Series Manual	Synspec GC955 - Gas Chromatography
Vector Wind Speed (Horizontal)	AS 3580.14 2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.1 Wind speed (Horizontal) by anemometer
Vector Wind Direction	AS 3580.14 2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.3 Wind direction by anemometer

3.3.1. Compliance with Standards

Unless stated below, parameters are monitored at the Wilpinjong Mine site according to the methods detailed in Table 3 above.

- Measurement of benzene, toluene and *p*-xylene (BTX) is not covered by Ecotech's NATA scope of accreditation.
- Measurement of hydrogen sulfide (H_2S) is not covered by Ecotech's scope of accreditation due to the frequency of calibration checks.

3.3.2. Data Acquisition

Data acquisition is performed using a PC based WinAQMS logger (using WinAQMS® Version 2.0) situated at the monitoring site. Each logger is equipped with a 3G modem for remote data collection. The recorded data is remotely collected from the AQMS logger on a daily basis (using Airodis™ version 5.1) and stored at Ecotech's Environmental Reporting Services (ERS) department in Melbourne, Australia. Data samples are logged in 5 minute intervals.

3.4. Data Validation and Reporting

3.4.1. Validation

The Ecotech ERS department performs 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.

Details of all invalid or missing data are recorded in the Valid Data Exception Tables.

Validation is performed by the analyst, and the validation is reviewed. Graphs and tables are generated based on the validated five minute data.

3.4.2. Reporting

The reported data is in a Microsoft Excel format file named "*Wilpinjong Coal Validated Data Report Aug-15.xls*". The Excel file consists of 5 Excel worksheets:

1. Cover
2. 5 Minute Averages
3. Hourly Averages
4. Daily Averages
5. Valid Data Exception Table

The data contained in this report is based on Australian Eastern Standard Time.

All averages are calculated from the five minute data. Averages are based on a minimum of 75% valid readings within the averaging period.

Averaging periods of eight hours or less are reported for the end of the period, i.e. the hourly average 02:00 is for the data collected from 01:00 to 02:00. One hour averages are calculated based on a clock hour. One day averages are calculated based on calendar days.

4.0 Air Quality Goals

The air quality goals for pollutants monitored at the Wilpinjong Wollar monitoring station are based on the Australian National Environmental Council (NEPC) Ambient Air Quality (NEPM). These air quality goals are shown in Table 4 below.

Table 4: Wilpinjong Air Quality Goals (NEPM)

Parameter	Time Period	Exceedence Level	Units	Maximum allowable exceedences
NO_2	1 year	30	ppb	None
NO_2	1 hour	120	ppb	1 day a year
SO_2	1 hour	200	ppb	1 day a year
SO_2	1 day	80	ppb	1 day a year
SO_2	1 year	20	ppb	None

4.1. Air Quality Summary

Table 5 below, details any exceedences of the NEPM Standard that were observed during this reporting period.

Table 5: Exceedences Recorded

Parameter	Time Period	Value of Exceedence	Date of Exceedence
NO_2	1 hour	-	-
SO_2	1 hour	-	-
SO_2	1 day	-	-

5.0 Calibrations and Maintenance

5.1. Units and Uncertainties

The uncertainties for each parameter have been determined by the manufacturer's tolerance limits of the equipment's parameters, and by the data collection standard method.

The reported uncertainties are expanded uncertainties, calculated using coverage factors which give a level of confidence of approximately 95%.

Table 6: Units and Uncertainties

Parameter	Units	Resolution	Uncertainty	Measurement Range[1]
NO, NO_x (EC9841)	ppm	1 ppb	± 14 ppb K factor of 2.01	0 ppb to 500 ppb
NO_2 (EC9841)	ppm	1 ppb	± 16 ppb K factor of 2.01	0 ppb to 500 ppb
SO_2 (EC9850)	ppm	1 ppb	± 14 ppb K factor of 2.01	0 ppb to 500 ppb
H_2S	ppm	1 ppb	15.2% of reading or ± 19 ppb, whichever is greater K factor of 2	0 ppb to 500 ppb
Benzene, Toluene and *p*-Xylene (BTX)	ppb	0.03 ppb	15.1% of reading or 3.8ppb, whichever is greater K factor of 2	0 ppb to 300 ppb
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
Vector Wind Direction	Deg	1 deg	±4 deg K factor of 2.11	0 deg to 360 deg Starting threshold: 0 m/s

[1] Uncertainties may not be calculated based on the full measurement range. Uncertainty for NO, NO_2 and NO_x by EC 9841 and SO_2 by EC9850 are calculated based on a measurement range of 0-125 ppb.

5.2. Automatic Checks

Automatic span and zero calibration checks run each night for NO, NO_2, NO_x and SO_2.

Background checks run each night for SO_2 and H_2S.

See Table 7 below for additional details. Data points associated with these checks are invalidated but are not referred to in the Valid Data Exception Tables.

Table 7: Automatic checks for NO, NO_2, NO_x, SO_2, and H_2S

Parameter	Span / Zero cycle time (approximate)	Background cycle time (approximate)
NO, NO_2, NO_x	01:00 to 01:45	N/A
SO_2	01:00 to 01:40	23:50 to 00:00
H_2S	01:55 to 03:50 (weekly)	23:50 to 00:05

5.3. Maintenance

Scheduled monthly maintenance was performed on 20/08/2015 and included the replacement of the H_2S analyser. The fuse on the convertor for this analyser was found to have blown and was replaced. The controller was also showing some issue with the set temperature, and this and the catalyst assembly will be replaced at the next scheduled visit.

It was noted that the rear light and globe are missing from the trailer.

5.3.1. Calibration & Maintenance Summary Tables

The last calibrations for the following parameters were performed on the indicated dates. Data supplied after this time is subject to further validation, to be performed at the next calibration cycle.

Note: Maintenance and calibration dates may differ, as calibrations may be less frequent than scheduled maintenance visits.

Table 8 indicates when the gas and meteorological equipment was last maintained / calibrated.

Table 8: Wilpinjong Wollar Maintenance Table

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	20/08/2015	Monthly	20/08/2015	Monthly
SO_2	20/08/2015	Monthly	20/08/2015	Monthly
H_2S	20/08/2015	Monthly	20/08/2015	Monthly
BTX	20/08/2015	Yearly	16/07/2015	Monthly
Wind Speed	20/08/2015	2-Yearly	21/05/2015	2-Yearly
Wind Direction	20/08/2015	2-Yearly	21/05/2015	2-Yearly

Wind sensor calibration certificates not yet received, last calibration will be updated when available

6.0 Results

6.1. Data Capture

Data capture is based on 1 hour averages, calculated from 5 minute data, and refers to the amount of available data collected during the report period.

The percentage of data captured is calculated using the following equation:
Data capture = (Reported air quality data / Total data) x 100%
Where:

- Reported air quality data = Number of instrument readings which have been validated through a quality assured process 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 displays data capture statistics for 1st – 31st August 2015. **Bold** values in the table indicate data capture below 95%.

Details of all invalid or missing data affecting data affecting data capture are included in the Valid Data Exception Tables, and attached Excel file.

Table 9: Data Capture for Wilpinjong Wollar Station

Parameter	Data Capture %
NO, NO_2, NO_x	97.3
SO_2	97.7
H_2S	**57.5**
Benzene	100.0
Toluene	100.0
p-Xylene	100.0
WS, WD	99.9

6.2. Graphic Representations

Validated 5 minute data for NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene and *p*-Xylene were used to construct the following graphical representations.

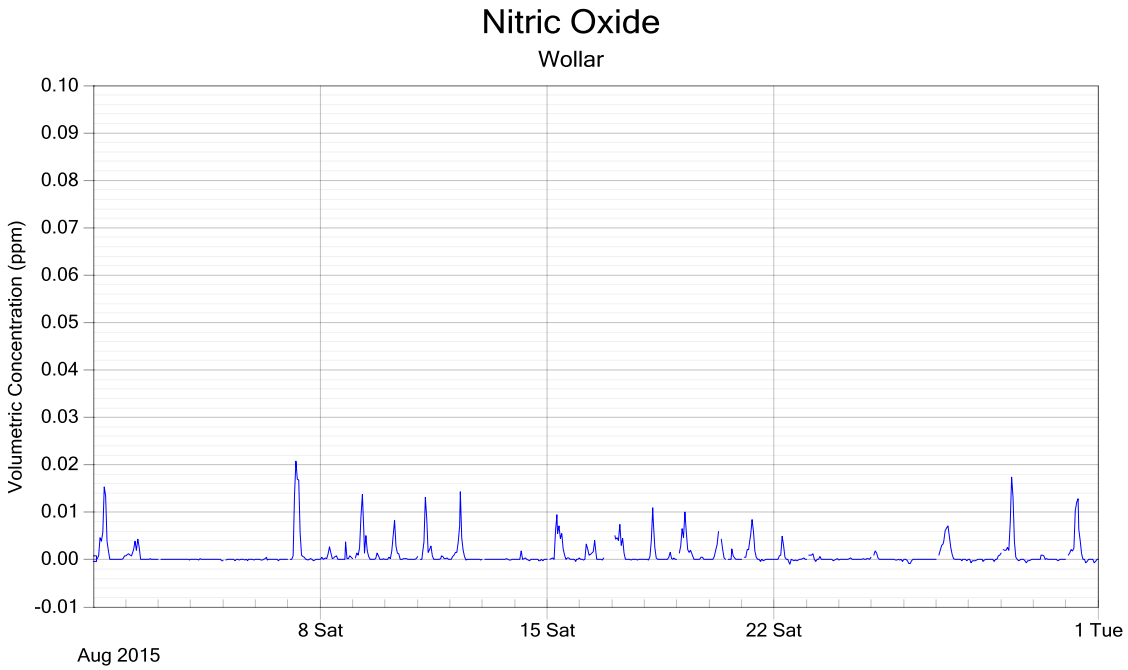

Figure 2: NO - 1 hour data

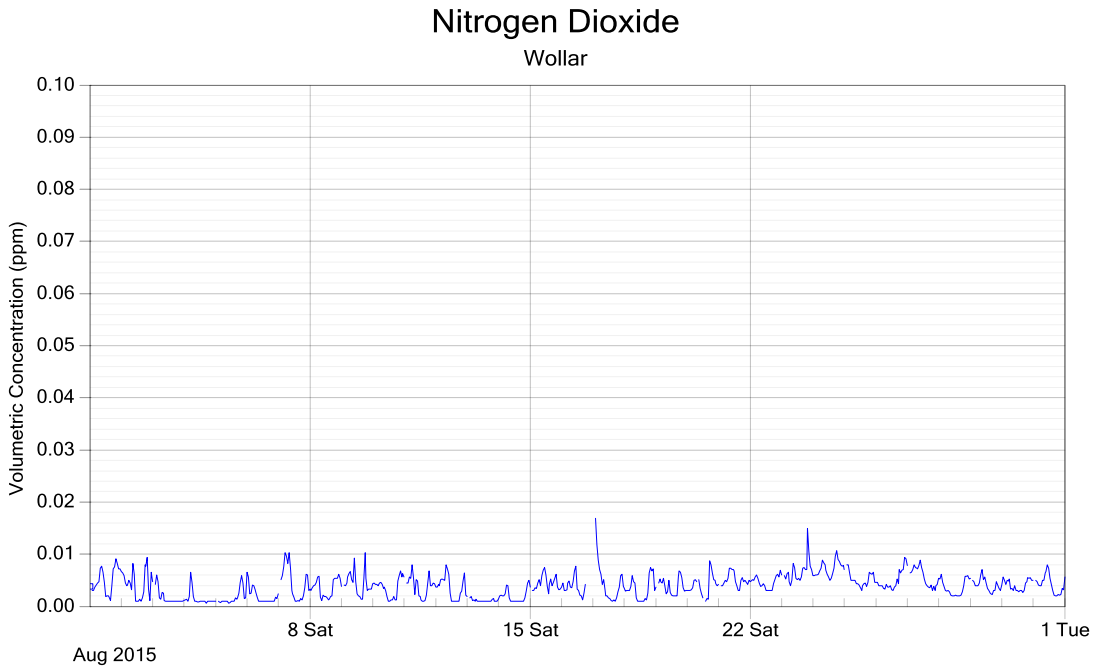

Figure 3: NO_2 - 1 hour data

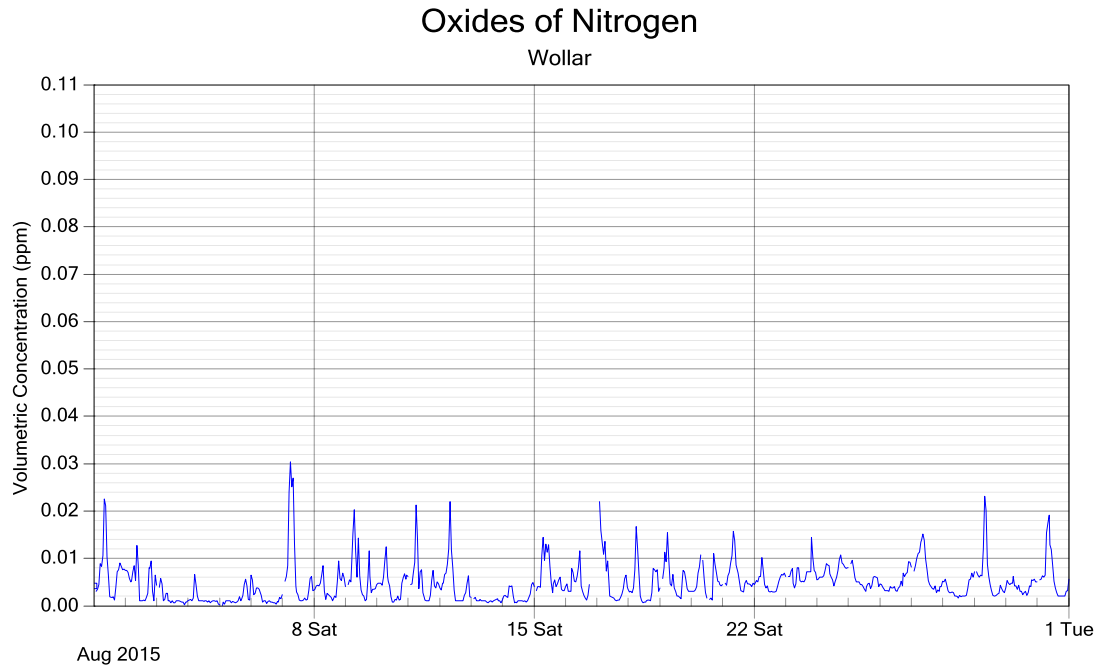

Figure 4: NO_X - 1 hour data

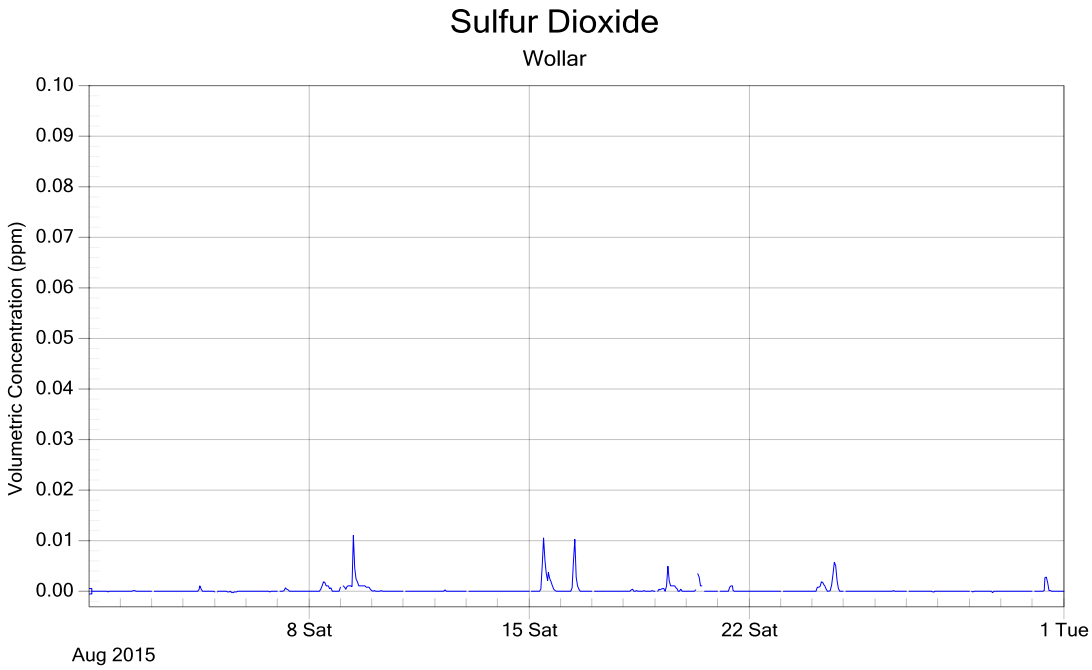

Figure 5: SO_2 - 1 hour data

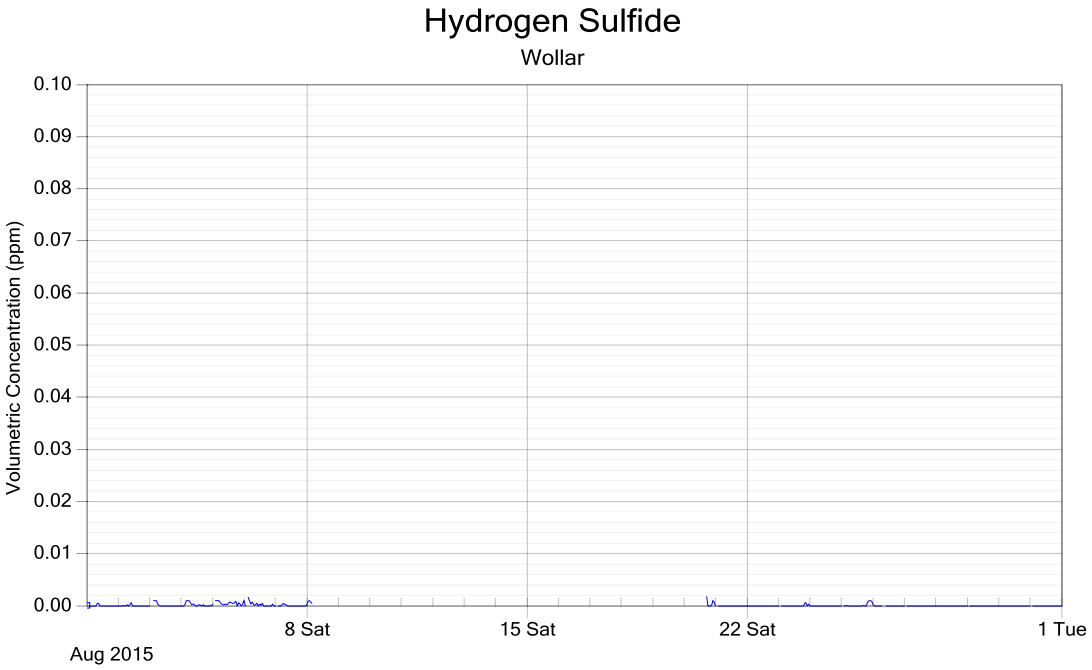

Figure 6: H_2S - 1 hour data

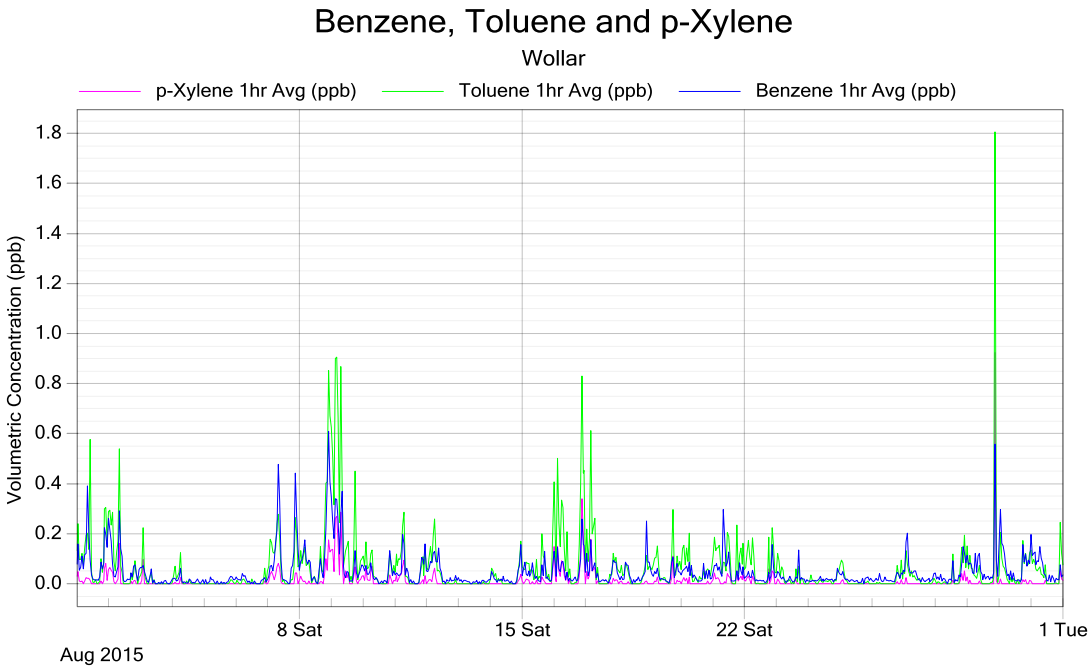

Figure 7: BTX - 1 hour data

7.0 Valid Data Exception Tables

The tables below details all changes made to the raw data set during the validation process. An explanation of reasons given in the table can be found in Appendix 2.

Table 10: Wollar Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
08/08/2015 04:50	26/08/2015 09:05	Intermittent data transmission errors	SO_2, H_2S, NO_x	RE	24/09/2015
08/08/2015 05:10	26/08/2015 09:45	Intermittent instrument fault	H_2S	RE	24/09/2015
12/08/2015 18:00	24/08/2015 19:05	Intermittent wind speed spikes	WS and WD	RE	24/09/2015
16/08/2015 19:00	17/08/2015 00:20	Instrument fault	NO, NO_2 and NO_x	RE	24/09/2015
20/08/2015 08:05	20/08/2015 17:05	Scheduled monthly maintenance and replaced H_2S analyser	NO, NO_2, NO_x, SO_2 and H_2S	RE	24/09/2015
30/08/2015 20:40	30/08/2015 20:40	Outlier	NO, NO_2 and NO_x	RE	24/09/2015

8.0 Report Summary

The data capture for Wollar was below 95% for all measured parameters with the exception of H_2S;

- Data capture for H_2S was 57.5% and was impacted by an instrument fault between the 08/08/2015 and 26/08/2015. The instrument was replaced during routine maintenance on 20/08/2015.

Measurement of a number of parameters in this report does not comply with applicable standards and/or is not covered by Ecotech's NATA scope of accreditation. Please refer to section 3.3.1 for details.

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

Appendix 1 - Definitions & Abbreviations

BTX	Benzene, Toluene and *p*-Xylene
H_2S	Hydrogen sulfide
m/s	Metres per second
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
ppb	Parts per billion
SO_2	Sulphur dioxide
WD	Vector Wind Direction
WS	Vector Wind Speed

Appendix 2 - Explanation of Exception Table

Automatic background check refers to when analyser samples zero air and measures the level of the concentration voltage. This voltage is taken as the zero signal level and this value is subtracted from any subsequent readings as an active zero compensation. This is the analyser's fine zero measurement.

Calibration check outside tolerance refers to when the calibration values are outside the tolerance limits set for the precision check.

Calibration correction factor applied to data refers to an offset or multiplier applied to the data. This operation may be performed for a number of reasons including: (a) when a clear trend / drift outside the tolerance limit can be demonstrated by repeated operation precision checks, (b) when a correction is required on previously logged data due to a calibration check being outside the allowable tolerance

Commissioning refers to the initial setup and calibration of the instrument when it is first installed. For some instruments there may be a stabilisation period before normal operation commences.

Data affected by environmental conditions – wind speed / wind speed gust spike refers to when a one-off high reading occurs due to a natural occurrence such as a bird sitting on the wind sensor, or some other event causing the readings to spike.

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.

Equipment malfunction/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.

Gap in data/data not available refers to a period of time when either data has been lost or could not be collected.

Instrument Alarm refers to an alarm produced by the instrument. A range of alarms can be produced depending on how operation of the instrument is being affected.

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

Linear offset or multiplier refers to when an offset or multiplier has been applied between two points where the values of the offset or multiplier are different and the correction is interpolated between the two points.

Logger error refers to when an error occurs and instrument readings are not correctly recorded by the logger.

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

Overnight span/zero out of tolerance refers to when the span/zero reading measured by the analyser during an automatic precision check falls outside of the expected concentration limits.

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

Remote Calibration refers to when a technician remotely connects to the station and manually performs a span check.

Static offset or multiplier refers to when a single offset or multiplier has been applied to the data between two points either to increase or decrease the measured value.

Warm up after power interruption refers to the startup period of an instrument after power has been restored.

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NATA
WORLD RECOGNISED ACCREDITATION

Peabody Energy

Wilpinjong Coal
Wollar

Ambient Air Quality Monitoring

Validated Report

1st September – 30th September 2015

Report No.: DAT10015

Report issue date: 28th October 2015

Maintenance contract: MC951

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Revision History			
Revision	**Report ID**	**Date**	**Analyst**
0	DAT10015	28/10/2015	Robyn Edwards

Report by: Robyn EDWARDS _____

Approved Signatory: Jon ALEXANDER _____

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1.0 Executive Summary

Peabody Energy has commissioned Ecotech P/L to conduct air quality monitoring for the Wilpinjong Mine at Wollar. Measured parameters at Wollar are NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene and *p*-Xylene. A wind sensor is also installed at the Wollar site.

The Wollar station was commissioned in March 2013.

This report presents the data collected from the Wollar station for 1st – 30th September 2015. Data capture for the different pollutants is presented in Table 9.

2.0 Introduction

Ecotech Pty Ltd was commissioned by Peabody Energy to provide monitoring and data reporting for the Wilpinjong Mine at Wollar, located as detailed in Table 1. Ecotech commenced data collection from the Wilpinjong Station on the 1st March 2013.

This report presents the data for 1st – 30th September 2015.

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

3.1. Siting Details

The Wilpinjong Mine consists of one ambient air quality monitoring station. The station location and siting details are described below.

Table 1: Wilpinjong Mine monitoring site location

Site Name	Geographical Coordinates	Height Above Sea Level (m)
Wollar	Lat: -32.360105 Long: 149.949509	366

A siting audit was conducted on 27th February 2015 to assess for compliance with *AS/NZS 3580.1.1:2007 "Methods for sampling and analysis of ambient air – guide to siting air monitoring equipment"*.

This siting of this station complies with AS/NZS 3580.1.1:2007. The station is classified as a neighbourhood station according to *AS/NZS 3580.1.1:2007*.

Figure 1: Wilpinjong Mine Monitoring Station Location

3.2. Monitored Parameters

Table 2 below details the parameters monitored and the instruments used at Wilpinjong Mine monitoring station. Appendix 1 defines any abbreviated parameter names used throughout the report.

For meteorological sensors, the elevation given in the table below is the height above ground level at the monitoring station.

Table 2: Parameters measured at the Wilpinjong Mine monitoring station

Parameter Measured	Instrument and Measurement Technique
BTX (Benzene, Toluene and *p*-Xylene)	Synspec GC955 - Gas Chromatography
H_2S	Ecotech EC9852 - fluorescence
NO, NO_2, NO_x	Ecotech EC9841 gas phase chemiluminescence
SO_2	Ecotech EC9850 – fluorescence
Wind Speed (horizontal, 10m)	Vaisala WS425 – ultrasonic
Wind Direction (10m)	Vaisala WS425 – ultrasonic

3.3. Data Collection Methods

Table 3 below shows the methods used for data collection. Any deviations from the stated methods are detailed in section 3.3.1.

Table 3: Methods

Parameter Measured	Data Collection Methods Used	Description of Method
NO, NO_2, NO_x	AS 3580.5.1-2011	Methods for sampling and analysis of ambient air. Method 5.1: Determination of oxides of nitrogen – chemiluminescence method
	Ecotech Laboratory Manual	In-house method 6.1 Oxides of nitrogen by chemiluminescence
SO_2	AS 3580.4.1-2008	Methods for sampling and analysis of ambient air. Method 4.1: Determination of sulfur dioxide – Direct reading instrumental method
	Ecotech Laboratory Manual	In-house method 6.2 Sulfur dioxide by fluorescence
H_2S	Ecotech Laboratory Manual	In-house method 6.5 Hydrogen sulfide by fluorescence
BTX (Benzene, Toluene and *p*-Xylene)	Synspec GC955 Series Manual	Synspec GC955 - Gas Chromatography
Vector Wind Speed (Horizontal)	AS 3580.14-2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.1 Wind speed (Horizontal) by anemometer
Vector Wind Direction	AS 3580.14-2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.3 Wind direction by anemometer

3.3.1. Compliance with Standards

Unless stated below, parameters are monitored at the Wilpinjong Mine site according to the methods detailed in Table 3 above.

- Measurement of benzene, toluene and *p*-xylene (BTX) is not covered by Ecotech's NATA scope of accreditation.
- Measurement of hydrogen sulfide (H_2S) is not covered by Ecotech's scope of accreditation due to the frequency of calibration checks.

3.3.2. Data Acquisition

Data acquisition is performed using a PC based WinAQMS logger (using WinAQMS® Version 2.0) situated at the monitoring site. Each logger is equipped with a 3G modem for remote data collection. The recorded data is remotely collected from the AQMS logger on a daily basis (using Airodis™ version 5.1) and stored at Ecotech's Environmental Reporting Services (ERS) department in Melbourne, Australia. Data samples are logged in 5 minute intervals.

3.4. Data Validation and Reporting

3.4.1. Validation

The Ecotech ERS department performs 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.

Details of all invalid or missing data are recorded in the Valid Data Exception Tables.

Validation is performed by the analyst, and the validation is reviewed. Graphs and tables are generated based on the validated five minute data.

3.4.2. Reporting

The reported data is in a Microsoft Excel format file named "*Wilpingjong Coal Validated Data Report Sept-15.xls*". The Excel file consists of 5 Excel worksheets:

1. Cover
2. 5 Minute Averages
3. Hourly Averages
4. Daily Averages
5. Valid Data Exception Table

The data contained in this report is based on Australian Eastern Standard Time.

All averages are calculated from the five minute data. Averages are based on a minimum of 75% valid readings within the averaging period.

Averaging periods of eight hours or less are reported for the end of the period, i.e. the hourly average 02:00 is for the data collected from 01:00 to 02:00. One hour averages are calculated based on a clock hour. One day averages are calculated based on calendar days.

4.0 Air Quality Goals

The air quality goals for pollutants monitored at the Wilpinjong Wollar monitoring station are based on the Australian National Environmental Council (NEPC) Ambient Air Quality (NEPM). These air quality goals are shown in Table 4 below.

Table 4: Wilpinjong Air Quality Goals (NEPM)

Parameter	Time Period	Exceedence Level	Units	Maximum allowable exceedences
NO_2	1 year	30	ppb	None
NO_2	1 hour	120	ppb	1 day a year
SO_2	1 hour	200	ppb	1 day a year
SO_2	1 day	80	ppb	1 day a year
SO_2	1 year	20	ppb	None

4.1. Air Quality Summary

Table 5 below, details any exceedences of the NEPM Standard that were observed during this reporting period.

Table 5: Exceedences Recorded

Parameter	Time Period	Value of Exceedence	Date of Exceedence
NO_2	1 hour	-	-
SO_2	1 hour	-	-
SO_2	1 day	-	-

5.0 Calibrations and Maintenance

5.1. Units and Uncertainties

The uncertainties for each parameter have been determined by the manufacturer's tolerance limits of the equipment's parameters, and by the data collection standard method.

The reported uncertainties are expanded uncertainties, calculated using coverage factors which give a level of confidence of approximately 95%.

Table 6: Units and Uncertainties

Parameter	Units	Resolution	Uncertainty	Measurement Range[1]
NO, NO_x (EC9841)	ppm	1 ppb	± 14 ppb K factor of 2.01	0 ppb to 500 ppb
NO_2 (EC9841)	ppm	1 ppb	± 16 ppb K factor of 2.01	0 ppb to 500 ppb
SO_2 (EC9850)	ppm	1 ppb	± 14 ppb K factor of 2.01	0 ppb to 500 ppb
H_2S	ppm	1 ppb	15.2% of reading or ± 19 ppb, whichever is greater K factor of 2	0 ppb to 500 ppb
Benzene, Toluene and *p*-Xylene (BTX)	ppb	0.03 ppb	15.1% of reading or 3.8ppb, whichever is greater K factor of 2	0 ppb to 300 ppb
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
Vector Wind Direction	Deg	1 deg	±4 deg K factor of 2.11	0 deg to 360 deg Starting threshold: 0 m/s

[1] Uncertainties may not be calculated based on the full measurement range. Uncertainty for NO, NO_2 and NO_x by EC 9841 and SO_2 by EC9850 are calculated based on a measurement range of 0-125 ppb.

5.2. Automatic Checks

Automatic span and zero calibration checks run each night for NO, NO_2, NO_x and SO_2.

Background checks run each night for SO_2 and H_2S.

See Table 7 below for additional details. Data points associated with these checks are invalidated but are not referred to in the Valid Data Exception Tables.

Table 7: Automatic checks for NO, NO_2, NO_x, SO_2, and H_2S

Parameter	Span / Zero cycle time (approximate)	Background cycle time (approximate)
NO, NO_2, NO_x	01:00 to 01:45	N/A
SO_2	01:00 to 01:40	23:50 to 00:00
H_2S	Refer to VDET for details	23:50 to 00:05

5.3. Maintenance

Scheduled 3-monthly maintenance was performed over two days; 29th and 30th September 2015. Calibrations were performed on all instruments and no issues were raised.

5.3.1. Calibration & Maintenance Summary Tables

The last calibrations for the following parameters were performed on the indicated dates. Data supplied after this time is subject to further validation, to be performed at the next calibration cycle.

Note: Maintenance and calibration dates may differ, as calibrations may be less frequent than scheduled maintenance visits.

Table 8 indicates when the gas and meteorological equipment was last maintained / calibrated.

Table 8: Wilpinjong Wollar Maintenance Table

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	30/09/2015	3-monthly	30/09/2015	Monthly
SO_2	30/09/2015	3-monthly	30/09/2015	Monthly
H_2S	30/09/2015	3-monthly	30/09/2015	Monthly
BTX	30/09/2015	3-monthly	30/09/2015	Monthly
Wind Speed	29/09/2015	3-monthly	21/05/2015	2-Yearly
Wind Direction	29/09/2015	3-monthly	21/05/2015	2-Yearly

Wind sensor calibration certificates not yet received, last calibration will be updated when available

6.0 Results

6.1. Data Capture

Data capture is based on 1 hour averages, calculated from 5 minute data, and refers to the amount of available data collected during the report period.

The percentage of data captured is calculated using the following equation:
Data capture = (Reported air quality data / Total data) x 100%
Where:

- Reported air quality data = Number of instrument readings which have been validated through a quality assured process 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 displays data capture statistics for 1st – 30th September 2015. **Bold** values in the table indicate data capture below 95%.

Details of all invalid or missing data affecting data affecting data capture are included in the Valid Data Exception Tables, and attached Excel file.

Table 9: Data Capture for Wilpinjong Wollar Station

Parameter	Data Capture %
NO, NO_2, NO_x	97.6
SO_2	97.5
H_2S	97.0
Benzene	99.4
Toluene	99.4
p-Xylene	99.4
WS, WD	100.0

6.2. Graphic Representations

Validated 5 minute data for NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene and *p*-Xylene were used to construct the following graphical representations.

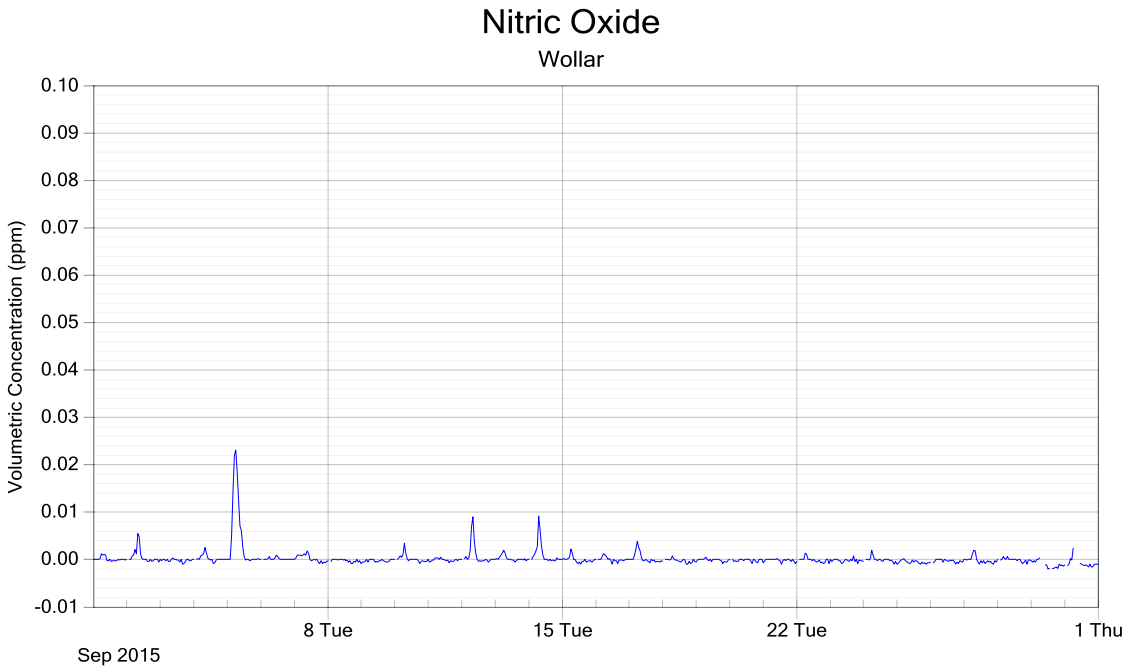

Figure 2: NO - 1 hour data

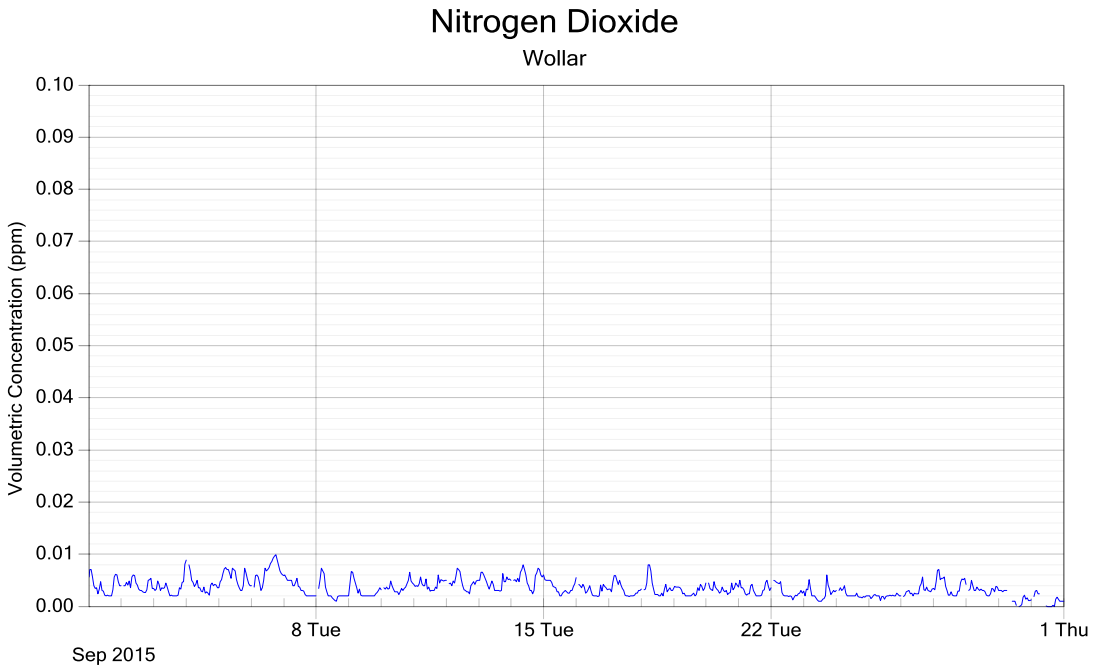

Figure 3: NO_2 - 1 hour data

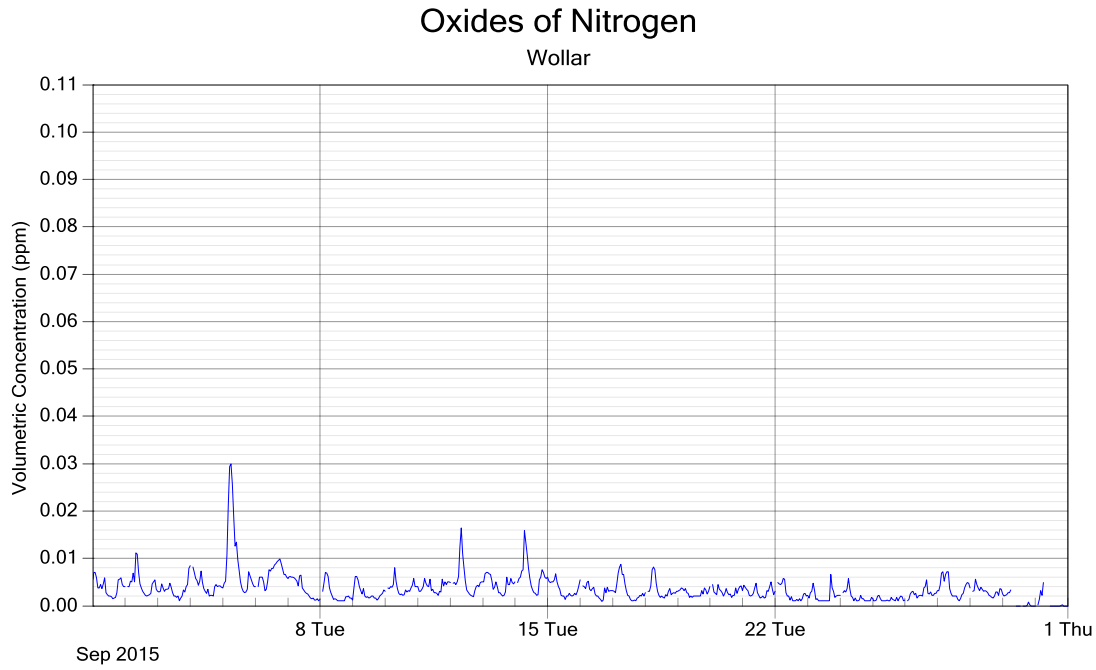

Figure 4: NO_X - 1 hour data

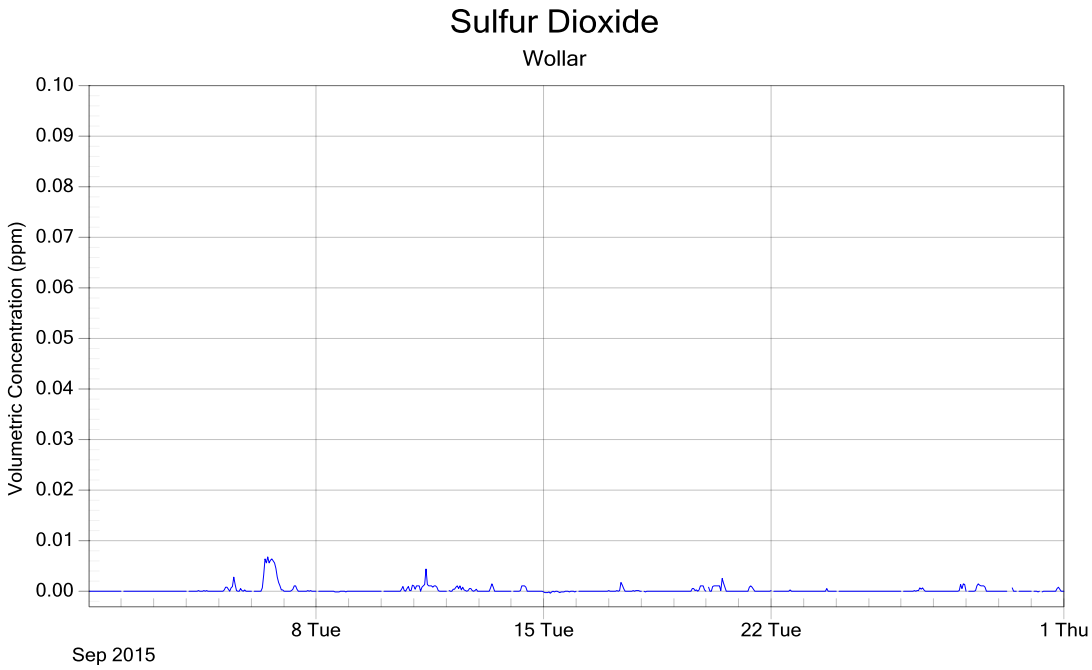

Figure 5: SO_2 - 1 hour data

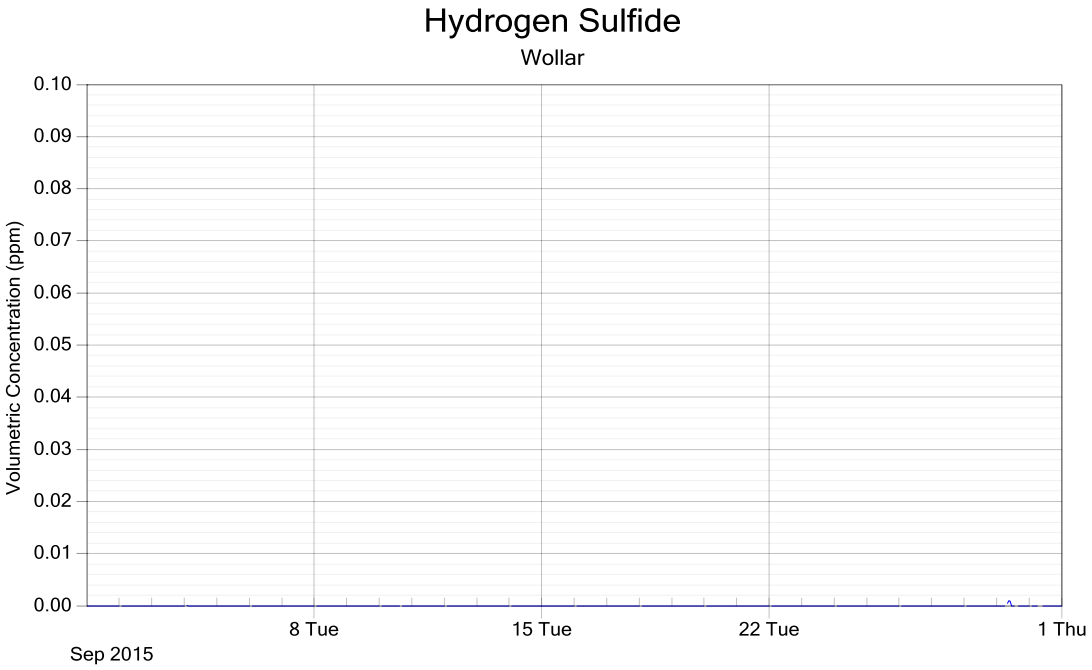

Figure 6: H_2S - 1 hour data

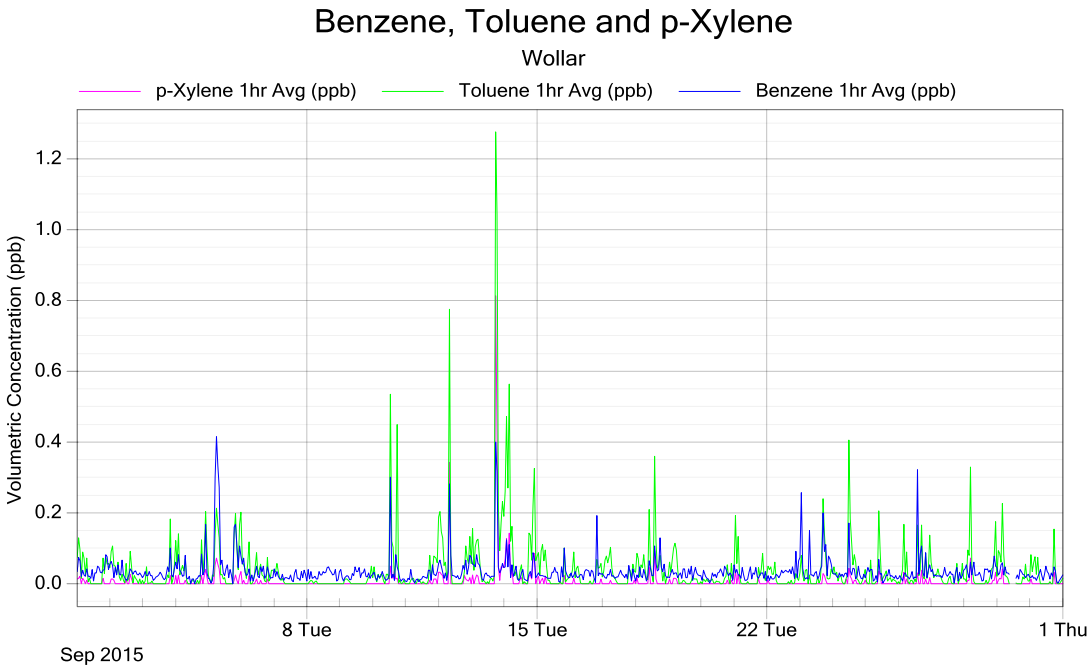

Figure 7: BTX - 1 hour data

7.0 Valid Data Exception Tables

The tables below details all changes made to the raw data set during the validation process. An explanation of reasons given in the table can be found in Appendix 2.

Table 10: Wollar Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
10/09/2015 15:50	10/09/2015 16:55	Remote calibration	H_2S	RE	26/10/2015
29/09/2015 07:30	29/09/2015 15:40	Scheduled 3-monthly maintenance – intermittent data affected	NO, NO_2, NO_x, SO_2, H_2S and BTX	RE	26/10/2015
30/09/2015 07:30	30/09/2015 11:10	Completion of 3-monthly maintenance – intermittent data affected	NO, NO_2, NO_x, SO_2 and H_2S	RE	26/10/2015

8.0 Report Summary

The data capture for Wollar was above 95% for all measured parameters.

Measurement of a number of parameters in this report does not comply with applicable standards and/or is not covered by Ecotech's NATA scope of accreditation. Please refer to section 3.3.1 for details.

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

Appendix 1 - Definitions & Abbreviations

BTX	Benzene, Toluene and *p*-Xylene
H_2S	Hydrogen sulfide
m/s	Metres per second
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
ppb	Parts per billion
SO_2	Sulphur dioxide
WD	Vector Wind Direction
WS	Vector Wind Speed

Appendix 2 - Explanation of Exception Table

Automatic background check refers to when analyser samples zero air and measures the level of the concentration voltage. This voltage is taken as the zero signal level and this value is subtracted from any subsequent readings as an active zero compensation. This is the analyser's fine zero measurement.

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Calibration correction factor applied to data refers to an offset or multiplier applied to the data. This operation may be performed for a number of reasons including: (a) when a clear trend / drift outside the tolerance limit can be demonstrated by repeated operation precision checks, (b) when a correction is required on previously logged data due to a calibration check being outside the allowable tolerance

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Logger error refers to when an error occurs and instrument readings are not correctly recorded by the logger.

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

Overnight span/zero out of tolerance refers to when the span/zero reading measured by the analyser during an automatic precision check falls outside of the expected concentration limits.

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

Remote Calibration refers to when a technician remotely connects to the station and manually performs a span check.

Static offset or multiplier refers to when a single offset or multiplier has been applied to the data between two points either to increase or decrease the measured value.

Warm up after power interruption refers to the startup period of an instrument after power has been restored.

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NATA
WORLD RECOGNISED ACCREDITATION

Peabody Energy

Wilpinjong Coal
Wollar

Ambient Air Quality Monitoring

Validated Report

1st October – 31st October 2015

Report No.: DAT10169

Report issue date: 30th November 2015

Maintenance contract: MC951

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Revision History			
Revision	**Report ID**	**Date**	**Analyst**
0	DAT10169	30/11/2015	Robyn Edwards

Report by: Robyn EDWARDS _____

Approved Signatory: Jon ALEXANDER _____

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List of Tables

1.0 Executive Summary

Peabody Energy has commissioned Ecotech P/L to conduct air quality monitoring for the Wilpinjong Mine at Wollar. Measured parameters at Wollar are NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene and *p*-Xylene. A wind sensor is also installed at the Wollar site.

The Wollar station was commissioned in March 2013.

This report presents the data collected from the Wollar station for 1st – 31st October 2015. Data capture for the different pollutants is presented in Table 9.

2.0 Introduction

Ecotech Pty Ltd was commissioned by Peabody Energy to provide monitoring and data reporting for the Wilpinjong Mine at Wollar, located as detailed in Table 1. Ecotech commenced data collection from the Wilpinjong Station on the 1st March 2013.

This report presents the data for 1st – 31st October 2015.

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

3.1. Siting Details

The Wilpinjong Mine consists of one ambient air quality monitoring station. The station location and siting details are described below.

Table 1: Wilpinjong Mine monitoring site location

Site Name	Geographical Coordinates	Height Above Sea Level (m)
Wollar	Lat: -32.360105 Long: 149.949509	366

A siting audit was conducted on 27th February 2015 to assess for compliance with *AS/NZS 3580.1.1:2007 "Methods for sampling and analysis of ambient air – guide to siting air monitoring equipment"*.

This siting of this station complies with AS/NZS 3580.1.1:2007. The station is classified as a neighbourhood station according to *AS/NZS 3580.1.1:2007*.

Figure 1: Wilpinjong Mine Monitoring Station Location

3.2. Monitored Parameters

Table 2 below details the parameters monitored and the instruments used at Wilpinjong Mine monitoring station. Appendix 1 defines any abbreviated parameter names used throughout the report.

For meteorological sensors, the elevation given in the table below is the height above ground level at the monitoring station.

Table 2: Parameters measured at the Wilpinjong Mine monitoring station

Parameter Measured	Instrument and Measurement Technique
BTX (Benzene, Toluene and *p*-Xylene)	Synspec GC955 - Gas Chromatography
H_2S	Ecotech EC9852 - fluorescence
NO, NO_2, NO_x	Ecotech EC9841 gas phase chemiluminescence
SO_2	Ecotech EC9850 – fluorescence
Wind Speed (horizontal, 10m)	Vaisala WS425 – ultrasonic
Wind Direction (10m)	Vaisala WS425 – ultrasonic

3.3. Data Collection Methods

Table 3 below shows the methods used for data collection. Any deviations from the stated methods are detailed in section 3.3.1.

Table 3: Methods

Parameter Measured	Data Collection Methods Used	Description of Method
NO, NO_2, NO_x	AS 3580.5.1-2011	Methods for sampling and analysis of ambient air. Method 5.1: Determination of oxides of nitrogen – chemiluminescence method
	Ecotech Laboratory Manual	In-house method 6.1 Oxides of nitrogen by chemiluminescence
SO_2	AS 3580.4.1-2008	Methods for sampling and analysis of ambient air. Method 4.1: Determination of sulfur dioxide – Direct reading instrumental method
	Ecotech Laboratory Manual	In-house method 6.2 Sulfur dioxide by fluorescence
H_2S	Ecotech Laboratory Manual	In-house method 6.5 Hydrogen sulfide by fluorescence
BTX (Benzene, Toluene and *p*-Xylene)	Synspec GC955 Series Manual	Synspec GC955 - Gas Chromatography
Vector Wind Speed (Horizontal)	AS 3580.14-2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
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Vector Wind Direction	AS 3580.14-2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.3 Wind direction by anemometer

3.3.1. Compliance with Standards

Unless stated below, parameters are monitored at the Wilpinjong Mine site according to the methods detailed in Table 3 above.

- Measurement of benzene, toluene and *p*-xylene (BTX) is not covered by Ecotech's NATA scope of accreditation.
- Measurement of hydrogen sulfide (H_2S) is not covered by Ecotech's scope of accreditation due to the frequency of calibration checks.

3.3.2. Data Acquisition

Data acquisition is performed using a PC based WinAQMS logger (using WinAQMS® Version 2.0) situated at the monitoring site. Each logger is equipped with a 3G modem for remote data collection. The recorded data is remotely collected from the AQMS logger on a daily basis (using Airodis™ version 5.1) and stored at Ecotech's Environmental Reporting Services (ERS) department in Melbourne, Australia. Data samples are logged in 5 minute intervals.

3.4. Data Validation and Reporting

3.4.1. Validation

The Ecotech ERS department performs 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.

Details of all invalid or missing data are recorded in the Valid Data Exception Tables.

Validation is performed by the analyst, and the validation is reviewed. Graphs and tables are generated based on the validated five minute data.

3.4.2. Reporting

The reported data is in a Microsoft Excel format file named "*Wilpingjong Coal Validated Data Report Oct-15.xls*". The Excel file consists of 5 Excel worksheets:

1. Cover
2. 5 Minute Averages
3. Hourly Averages
4. Daily Averages
5. Valid Data Exception Table

The data contained in this report is based on Australian Eastern Standard Time.

All averages are calculated from the five minute data. Averages are based on a minimum of 75% valid readings within the averaging period.

Averaging periods of eight hours or less are reported for the end of the period, i.e. the hourly average 02:00 is for the data collected from 01:00 to 02:00. One hour averages are calculated based on a clock hour. One day averages are calculated based on calendar days.

4.0 Air Quality Goals

The air quality goals for pollutants monitored at the Wilpinjong Wollar monitoring station are based on the Australian National Environmental Council (NEPC) Ambient Air Quality (NEPM). These air quality goals are shown in Table 4 below.

Table 4: Wilpinjong Air Quality Goals (NEPM)

Parameter	Time Period	Exceedence Level	Units	Maximum allowable exceedences
NO_2	1 year	30	ppb	None
NO_2	1 hour	120	ppb	1 day a year
SO_2	1 hour	200	ppb	1 day a year
SO_2	1 day	80	ppb	1 day a year
SO_2	1 year	20	ppb	None

4.1. Air Quality Summary

Table 5 below, details any exceedences of the NEPM Standard that were observed during this reporting period.

Table 5: Exceedences Recorded

Parameter	Time Period	Value of Exceedence	Date of Exceedence
NO_2	1 hour	-	-
SO_2	1 hour	-	-
SO_2	1 day	-	-

5.0 Calibrations and Maintenance

5.1. Units and Uncertainties

The uncertainties for each parameter have been determined by the manufacturer's tolerance limits of the equipment's parameters, and by the data collection standard method.

The reported uncertainties are expanded uncertainties, calculated using coverage factors which give a level of confidence of approximately 95%.

Table 6: Units and Uncertainties

Parameter	Units	Resolution	Uncertainty	Measurement Range[1]
NO, NO_x (EC9841)	ppm	1 ppb	± 14 ppb K factor of 2.01	0 ppb to 500 ppb
NO_2 (EC9841)	ppm	1 ppb	± 16 ppb K factor of 2.01	0 ppb to 500 ppb
SO_2 (EC9850)	ppm	1 ppb	± 14 ppb K factor of 2.01	0 ppb to 500 ppb
H_2S	ppm	1 ppb	15.2% of reading or ± 19 ppb, whichever is greater K factor of 2	0 ppb to 500 ppb
Benzene, Toluene and *p*-Xylene (BTX)	ppb	0.03 ppb	15.1% of reading or 3.8ppb, whichever is greater K factor of 2	0 ppb to 300 ppb
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
Vector Wind Direction	Deg	1 deg	±4 deg K factor of 2.11	0 deg to 360 deg Starting threshold: 0 m/s

[1] Uncertainties may not be calculated based on the full measurement range. Uncertainty for NO, NO_2 and NO_x by EC 9841 and SO_2 by EC9850 are calculated based on a measurement range of 0-125 ppb.

5.2. Automatic Checks

Automatic span and zero calibration checks run every second day for NO, NO_2, NO_x and SO_2.

Background checks run each night for SO_2 and H_2S.

See Table 7 below for additional details. Data points associated with these checks are invalidated but are not referred to in the Valid Data Exception Tables.

Table 7: Automatic checks for NO, NO_2, NO_x, SO_2, and H_2S

Parameter	Span / Zero cycle time (approximate)	Background cycle time (approximate)
NO, NO_2, NO_x	01:00 to 01:45 every 2nd day	N/A
SO_2	01:00 to 01:40	23:50 to 00:00
H_2S	Refer to VDET for details	23:50 to 00:05

5.3. Maintenance

Unscheduled maintenance was performed on 14/10/2015 due to loss of communication with the H_2S analyser. This was followed up with a remote calibration on 15/10/2015.

A further unscheduled visit was made on 16/10/2015 due to flat lined data. Possible lightning in the area caused power to be lost, which was reset.

Monthly maintenance was performed over 2-days on 28/10/2015 and 29/10/2015, which included the replacement of the BTX analyser; recently calibrated and fully serviced in Melbourne. Please note that the analyser was calibrated against a non-NATA compliant gas bottle.

5.3.1. Calibration & Maintenance Summary Tables

The last calibrations for the following parameters were performed on the indicated dates. Data supplied after this time is subject to further validation, to be performed at the next calibration cycle.

Note: Maintenance and calibration dates may differ, as calibrations may be less frequent than scheduled maintenance visits.

Table 8 indicates when the gas and meteorological equipment was last maintained / calibrated.

Table 8: Wilpinjong Wollar Maintenance Table

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	28/10/2015	Monthly	28/10/2015	Monthly
SO_2	28/10/2015	Monthly	28/10/2015	Monthly
H_2S	28/10/2015	Monthly	28/10/2015	Monthly
BTX	29/10/2015	Monthly	29/10/2015	Monthly
Wind Speed	28/10/2015	Monthly	21/05/2015	2-Yearly
Wind Direction	28/10/2015	Monthly	21/05/2015	2-Yearly

Wind sensor calibration certificates not yet received, last calibration will be updated when available

6.0 Results

6.1. Data Capture

Data capture is based on 1 hour averages, calculated from 5 minute data, and refers to the amount of available data collected during the report period.

The percentage of data captured is calculated using the following equation:
Data capture = (Reported air quality data / Total data) x 100%
Where:

- Reported air quality data = Number of instrument readings which have been validated through a quality assured process 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 displays data capture statistics for 1st – 1st October 2015. **Bold** values in the table indicate data capture below 95%.

Details of all invalid or missing data affecting data affecting data capture are included in the Valid Data Exception Tables, and attached Excel file.

Table 9: Data Capture for Wilpinjong Wollar Station

Parameter	Data Capture %
NO, NO_2, NO_x	97.2
SO_2	97.6
H_2S	**76.8**
Benzene	95.8
Toluene	95.8
p-Xylene	95.8
WS, WD	**80.7**

6.2. Graphic Representations

Validated 5 minute data for NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene and *p*-Xylene were used to construct the following graphical representations.

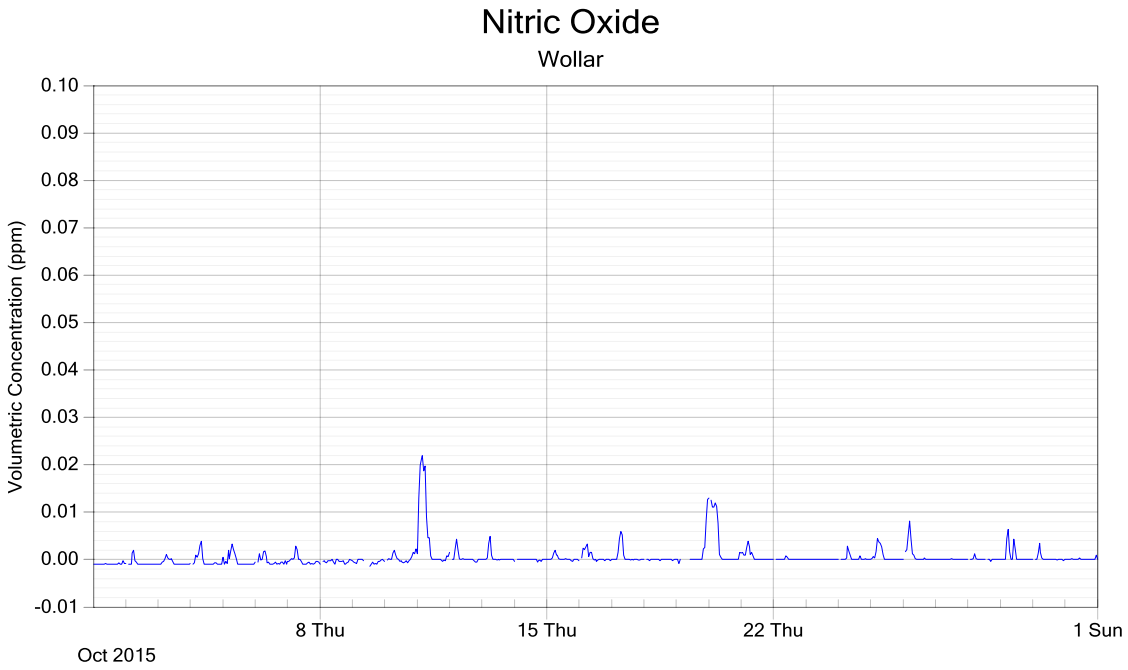

Figure 2: NO - 1 hour data

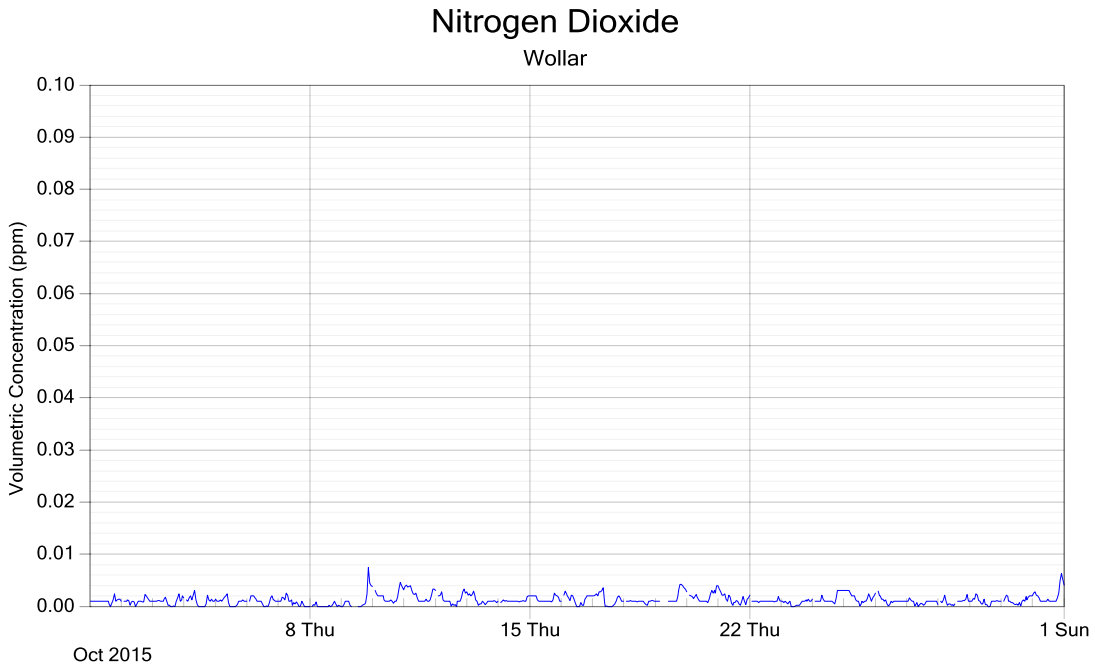

Figure 3: NO_2 - 1 hour data

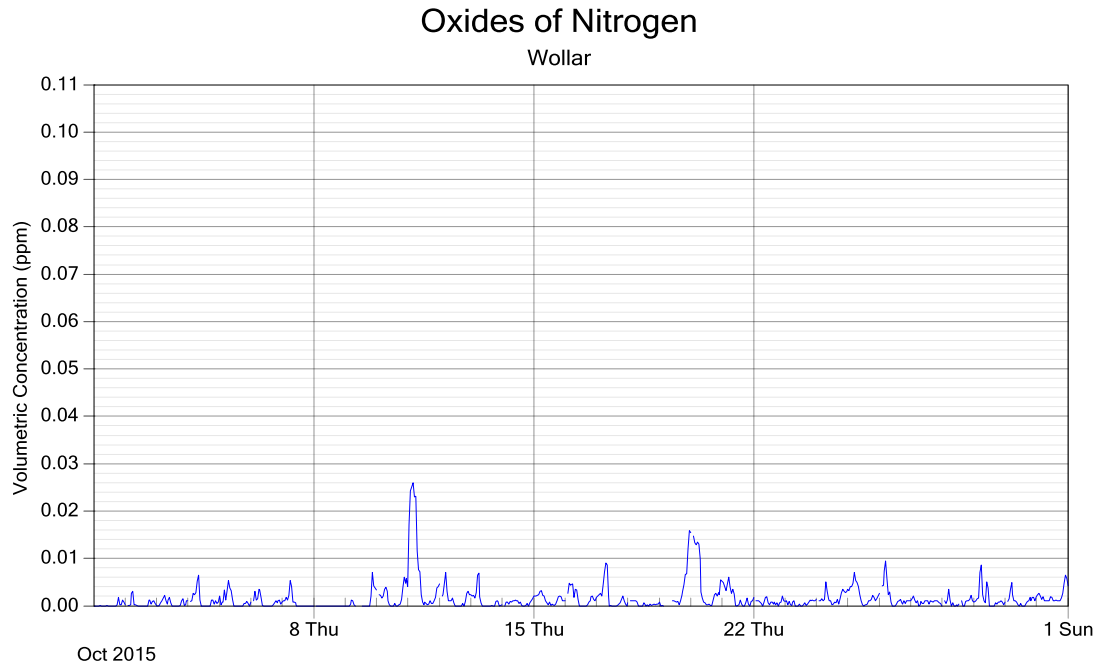

Figure 4: NO_X - 1 hour data

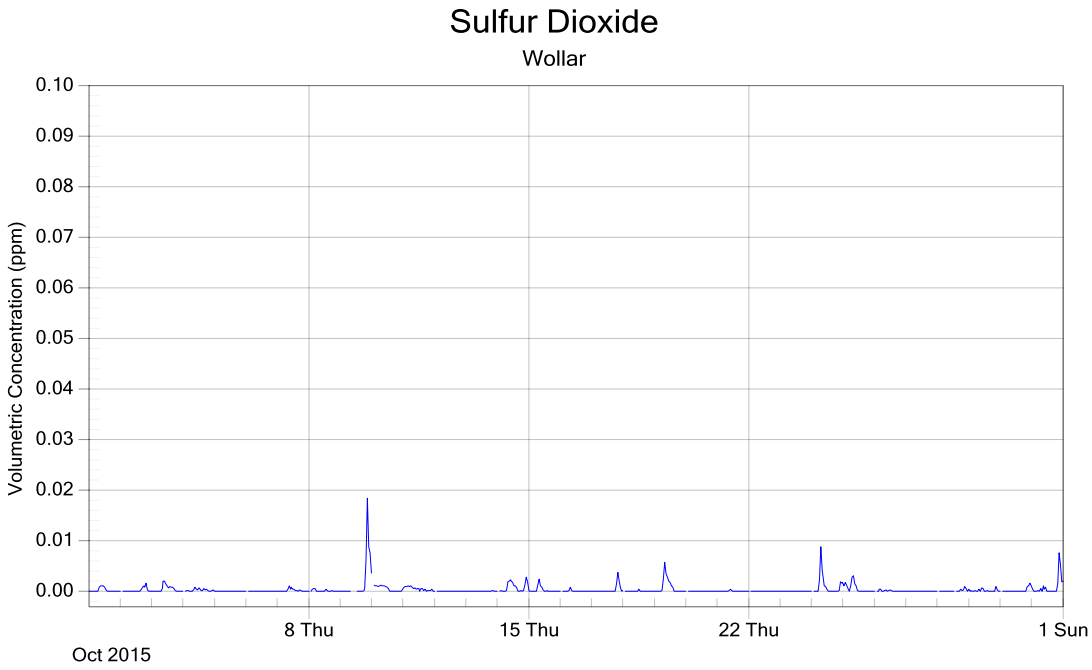

Figure 5: SO_2 - 1 hour data

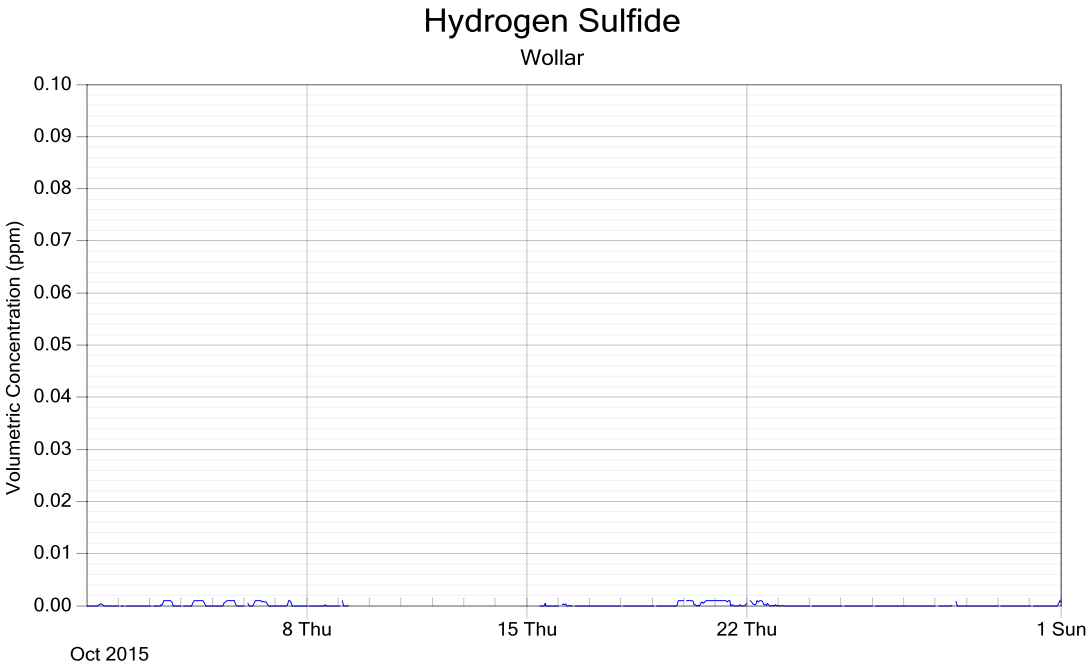

Figure 6: H_2S - 1 hour data

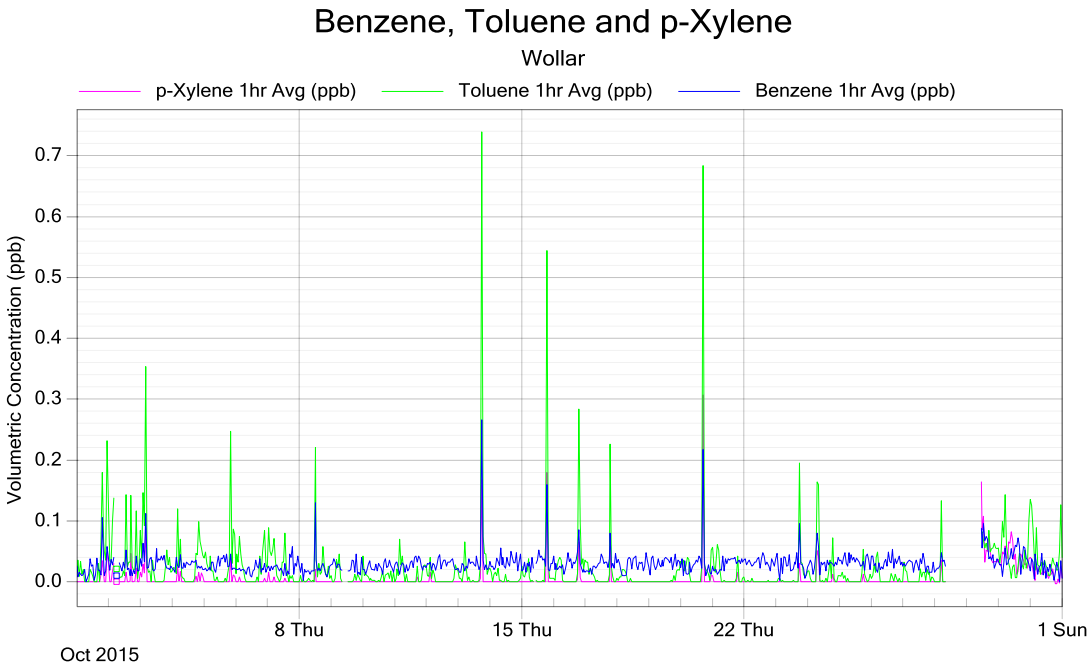

Figure 7: BTX - 1 hour data

7.0 Valid Data Exception Tables

The tables below details all changes made to the raw data set during the validation process. An explanation of reasons given in the table can be found in Appendix 2.

Table 10: Wollar Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
02/10/2015 05:30	02/10/2015 07:55	Intermittent BTX instrument fault – SO_2, H_2S, WS and WD intermittently affected	BTX,SO_2, H_2S, WS and WD	RE	27/11/2015
04/10/2015 07:25	31/10/2015 02:50	Intermittent span/zero calibration cycles	H_2S	RE	27/11/2015
09/10/2015 09:15	09/10/2015 12:40	Power interruption	All parameters	RE	27/11/2015
09/10/2015 12:45	09/10/2015 13:10	Extended power interruption	BTX	RE	27/11/2015
09/10/2015 12:45	14/10/2015 10:15	Instrument fault – connection not restored following power interruption	H_2S	RE	27/11/2015
10/10/2015 16:35	16/10/2015 12:20	Instrument fault – possibly caused by lightning in the area	WS, WD and Sigma	RE	27/11/2015
14/10/2015 10:20	14/10/2015 15:45	Unscheduled maintenance – restore communications following power interruption	H_2S	RE	27/11/2015
14/10/2015 15:50	15/10/2015 08:15	Overnight calibration check outside of measurement tolerance	H_2S	RE	27/11/2015
15/10/2015 08:20	15/10/2015 10:10	Remote calibration performed following maintenance	H_2S	RE	27/11/2015
15/10/2015 10:10	15/10/2015 10:25	Remote calibration performed	BTX	RE	27/11/2015
15/10/2015 14:25	27/10/2015 11:55	Intermittent unrealistic data where NO exceeds NO_x	NO, NO_2 and NO_x	RE	27/11/2015

Start Date	End Date	Reason	Change Details	User Name	Change Date
16/10/2015 12:25	16/10/2015 12:40	Unscheduled maintenance – resolve wind sensor instrument fault	WS, WD and Sigma	RE	27/11/2015
19/10/2015 04:20	19/10/2015 09:30	Instrument fault – not enough samples for 5min averaging	NO, NO_2 and NO_x	RE	27/11/2015
28/10/2015 09:25	28/10/2015 16:00	Scheduled monthly maintenance and replacement of BTX analyser – intermittent data affected	All parameters	RE	27/11/2015
28/10/2015 16:05	29/10/2015 07:10	Instrument left in 'out of service mode' for continued maintenance	BTX	RE	27/11/2015
29/10/2015 07:15	29/10/2015 11:10	Maintenance completed on BTX analyser	BTX	RE	27/11/2015
29/10/2015 11:15	31/10/2015 23:55	Static offset of 0.25 ppb applied to correct baseline (continues into Nov-15)	*p*-Xylene	RE	27/11/2015
29/10/2015 11:15	31/10/2015 23:55	Static offset of 0.1 ppb applied to correct baseline (continues into Nov-15)	Toluene	RE	27/11/2015
29/10/2015 11:15	31/10/2015 23:55	Static offset of 0.12 ppb applied to correct baseline (continues into Nov-15)	Benzene	RE	27/11/2015

8.0 Report Summary

The data capture for Wollar was above 95% for all measured parameters, with the exception of H_2S, WS and WD;

- Data capture for H_2S was 76.8% and this was impacted by the instrument not restoring connection following a power interruption
- Data capture for WS and WD was 80.7% and this was impacted by an instrument fault, possibly caused by lightning in the area, resulting in flat lined data

Measurement of a number of parameters in this report does not comply with applicable standards and/or is not covered by Ecotech's NATA scope of accreditation. Please refer to section 3.3.1 for details.

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

Appendix 1 - Definitions & Abbreviations

BTX	Benzene, Toluene and *p*-Xylene
H_2S	Hydrogen sulfide
m/s	Metres per second
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
ppb	Parts per billion
SO_2	Sulphur dioxide
WD	Vector Wind Direction
WS	Vector Wind Speed

Appendix 2 - Explanation of Exception Table

Automatic background check refers to when analyser samples zero air and measures the level of the concentration voltage. This voltage is taken as the zero signal level and this value is subtracted from any subsequent readings as an active zero compensation. This is the analyser's fine zero measurement.

Calibration check outside tolerance refers to when the calibration values are outside the tolerance limits set for the precision check.

Calibration correction factor applied to data refers to an offset or multiplier applied to the data. This operation may be performed for a number of reasons including: (a) when a clear trend / drift outside the tolerance limit can be demonstrated by repeated operation precision checks, (b) when a correction is required on previously logged data due to a calibration check being outside the allowable tolerance

Commissioning refers to the initial setup and calibration of the instrument when it is first installed. For some instruments there may be a stabilisation period before normal operation commences.

Data affected by environmental conditions – wind speed / wind speed gust spike refers to when a one-off high reading occurs due to a natural occurrence such as a bird sitting on the wind sensor, or some other event causing the readings to spike.

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.

Equipment malfunction/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.

Gap in data/data not available refers to a period of time when either data has been lost or could not be collected.

Instrument Alarm refers to an alarm produced by the instrument. A range of alarms can be produced depending on how operation of the instrument is being affected.

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

Linear offset or multiplier refers to when an offset or multiplier has been applied between two points where the values of the offset or multiplier are different and the correction is interpolated between the two points.

Logger error refers to when an error occurs and instrument readings are not correctly recorded by the logger.

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

Overnight span/zero out of tolerance refers to when the span/zero reading measured by the analyser during an automatic precision check falls outside of the expected concentration limits.

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

Remote Calibration refers to when a technician remotely connects to the station and manually performs a span check.

Static offset or multiplier refers to when a single offset or multiplier has been applied to the data between two points either to increase or decrease the measured value.

Warm up after power interruption refers to the startup period of an instrument after power has been restored.

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Accreditation No. 14184.

NATA
WORLD RECOGNISED ACCREDITATION

Peabody Energy

Wilpinjong Coal
Wollar

Ambient Air Quality Monitoring

Validated Report

1st November – 30th November 2015

Report No.: DAT10240

Report issue date: 24th December 2015

Maintenance contract: MC951

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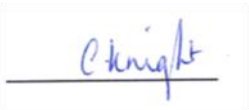
Revision History			
Revision	**Report ID**	**Date**	**Analyst**
0	DAT10240	24/12/2015	Caroline Knight

Report by: Caroline KNIGHT



Approved Signatory: Jon ALEXANDER

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3.0 Monitoring and Data Collection

3.1. Siting Details

The Wilpinjong Mine consists of one ambient air quality monitoring station. The station location and siting details are described below.

Table 1: Wilpinjong Mine monitoring site location

Site Name	Geographical Coordinates	Height Above Sea Level (m)
Wollar	Lat: -32.360105 Long: 149.949509	366

A siting audit was conducted on 27th February 2015 to assess for compliance with *AS/NZS 3580.1.1:2007 "Methods for sampling and analysis of ambient air – guide to siting air monitoring equipment"*.

This siting of this station complies with AS/NZS 3580.1.1:2007. The station is classified as a neighbourhood station according to *AS/NZS 3580.1.1:2007*.

Figure 1: Wilpinjong Mine Monitoring Station Location

3.2. Monitored Parameters

Table 2 below details the parameters monitored and the instruments used at Wilpinjong Mine monitoring station. Appendix 1 defines any abbreviated parameter names used throughout the report.

For meteorological sensors, the elevation given in the table below is the height above ground level at the monitoring station.

Table 2: Parameters measured at the Wilpinjong Mine monitoring station

Parameter Measured	Instrument and Measurement Technique
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H_2S	Ecotech EC9852 - fluorescence
NO, NO_2, NO_x	Ecotech EC9841 gas phase chemiluminescence
SO_2	Ecotech EC9850 – fluorescence
Wind Speed (horizontal, 10m)	Vaisala WS425 – ultrasonic
Wind Direction (10m)	Vaisala WS425 – ultrasonic

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Table 3 below shows the methods used for data collection. Any deviations from the stated methods are detailed in section 3.3.1.

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	Ecotech Laboratory Manual	In-house method 8.3 Wind direction by anemometer

3.3.1. Compliance with Standards

Unless stated below, parameters are monitored at the Wilpinjong Mine site according to the methods detailed in Table 3 above.

- Measurement of benzene, toluene and *p*-xylene (BTX) is not covered by Ecotech's NATA scope of accreditation.
- Measurement of hydrogen sulfide (H_2S) is not covered by Ecotech's scope of accreditation due to the frequency of calibration checks.

3.3.2. Data Acquisition

Data acquisition is performed using a PC based WinAQMS logger (using WinAQMS® Version 2.0) situated at the monitoring site. Each logger is equipped with a 3G modem for remote data collection. The recorded data is remotely collected from the AQMS logger on a daily basis (using Airodis™ version 5.1) and stored at Ecotech's Environmental Reporting Services (ERS) department in Melbourne, Australia. Data samples are logged in 5 minute intervals.

3.4. Data Validation and Reporting

3.4.1. Validation

The Ecotech ERS department performs 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.

Details of all invalid or missing data are recorded in the Valid Data Exception Tables.

Validation is performed by the analyst, and the validation is reviewed. Graphs and tables are generated based on the validated five minute data.

3.4.2. Reporting

The reported data is in a Microsoft Excel format file named "*Wilpinjong Coal Validated Data Report Nov-15.xls*". The Excel file consists of 5 Excel worksheets:

1. Cover
2. 5 Minute Averages
3. Hourly Averages
4. Daily Averages
5. Valid Data Exception Table

The data contained in this report is based on Australian Eastern Standard Time.

All averages are calculated from the five minute data. Averages are based on a minimum of 75% valid readings within the averaging period.

Averaging periods of eight hours or less are reported for the end of the period, i.e. the hourly average 02:00 is for the data collected from 01:00 to 02:00. One hour averages are calculated based on a clock hour. One day averages are calculated based on calendar days.

4.0 Air Quality Goals

The air quality goals for pollutants monitored at the Wilpinjong Wollar monitoring station are based on the Australian National Environmental Council (NEPC) Ambient Air Quality (NEPM). These air quality goals are shown in Table 4 below.

Table 4: Wilpinjong Air Quality Goals (NEPM)

Parameter	Time Period	Exceedence Level	Units	Maximum allowable exceedences
NO_2	1 year	30	ppb	None
NO_2	1 hour	120	ppb	1 day a year
SO_2	1 hour	200	ppb	1 day a year
SO_2	1 day	80	ppb	1 day a year
SO_2	1 year	20	ppb	None

4.1. Air Quality Summary

Table 5 below, details any exceedences of the NEPM Standard that were observed during this reporting period.

Table 5: Exceedences Recorded

Parameter	Time Period	Value of Exceedence	Date of Exceedence
NO_2	1 hour	-	-
SO_2	1 hour	-	-
SO_2	1 day	-	-

5.0 Calibrations and Maintenance

5.1. Units and Uncertainties

The uncertainties for each parameter have been determined by the manufacturer's tolerance limits of the equipment's parameters, and by the data collection standard method.

The reported uncertainties are expanded uncertainties, calculated using coverage factors which give a level of confidence of approximately 95%.

Table 6: Units and Uncertainties

Parameter	Units	Resolution	Uncertainty	Measurement Range[1]
NO, NO_x (EC9841)	ppm	1 ppb	± 14 ppb K factor of 2.01	0 ppb to 500 ppb
NO_2 (EC9841)	ppm	1 ppb	± 16 ppb K factor of 2.01	0 ppb to 500 ppb
SO_2 (EC9850)	ppm	1 ppb	± 14 ppb K factor of 2.01	0 ppb to 500 ppb
H_2S	ppm	1 ppb	15.2% of reading or ± 19 ppb, whichever is greater K factor of 2	0 ppb to 500 ppb
Benzene, Toluene and *p*-Xylene (BTX)	ppb	0.03 ppb	15.1% of reading or 3.8ppb, whichever is greater K factor of 2	0 ppb to 300 ppb
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
Vector Wind Direction	Deg	1 deg	±4 deg K factor of 2.11	0 deg to 360 deg Starting threshold: 0 m/s

[1] Uncertainties may not be calculated based on the full measurement range. Uncertainty for NO, NO_2 and NO_x by EC 9841 and SO_2 by EC9850 are calculated based on a measurement range of 0-125 ppb.

5.2. Automatic Checks

Automatic span and zero calibration checks run every second day for NO, NO_2, NO_x and SO_2.

Background checks run each night for SO_2 and H_2S.

See Table 7 below for additional details. Data points associated with these checks are invalidated but are not referred to in the Valid Data Exception Tables.

Table 7: Automatic checks for NO, NO_2, NO_x, SO_2, and H_2S

Parameter	Span / Zero cycle time (approximate)	Background cycle time (approximate)
NO, NO_2, NO_x	01:00 to 01:45 every 2nd day	N/A
SO_2	01:00 to 01:40	23:50 to 00:00
H_2S	Refer to VDET for details	23:50 to 00:05

5.3. Maintenance

Unscheduled maintenance was performed on 04/11/2015 and 05/11/2015 to confirm BTX offsets and run a zero check.

A further unscheduled visit was made on 10/11/2015, the H_2S analyser was reset following a power interruption which caused it to stop logging data. Follow up maintenance was performed on the 13/11/2015 to perform a calibration on the H_2S instrument.

Monthly maintenance was performed over 2-days on 18/11/2015 and 19/11/2015 for all parameters, and included running a zero check on the BTX analyser, and an adjustment of offsets.

BTX data from 1/11/2015 to the maintenance on 18/11/2015 is provided for reference purposes only due to the calibration check performed on 18/11/2015 finding the instrument to be out of tolerance.

5.3.1. Calibration & Maintenance Summary Tables

The last calibrations for the following parameters were performed on the indicated dates. Data supplied after this time is subject to further validation, to be performed at the next calibration cycle.

Note: Maintenance and calibration dates may differ, as calibrations may be less frequent than scheduled maintenance visits.

Table 8 indicates when the gas and meteorological equipment was last maintained / calibrated.

Table 8: Wilpinjong Wollar Maintenance Table

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	18/11/2015	Monthly	18/11/2015	Monthly
SO_2	19/11/2015	Monthly	19/11/2015	Monthly
H_2S	18/11/2015	Monthly	18/11/2015	Monthly
BTX	19/11/2015	Unscheduled	18/11/2015	Monthly
Wind Speed	18/11/2015	Monthly	21/05/2015	2-Yearly
Wind Direction	18/11/2015	Monthly	21/05/2015	2-Yearly

Wind sensor calibration certificates not yet received, last calibration will be updated when available

6.0 Results

6.1. Data Capture

Data capture is based on 1 hour averages, calculated from 5 minute data, and refers to the amount of available data collected during the report period.

The percentage of data captured is calculated using the following equation:
Data capture = (Reported air quality data / Total data) x 100%
Where:

- Reported air quality data = Number of instrument readings which have been validated through a quality assured process 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 displays data capture statistics for 1st – 30th November 2015. **Bold** values in the table indicate data capture below 95%.

Details of all invalid or missing data affecting data affecting data capture are included in the Valid Data Exception Tables, and attached Excel file.

Table 9: Data Capture for Wilpinjong Wollar Station

Parameter	Data Capture %
NO, NO_2, NO_x	97.2
SO_2	96.9
H_2S	**85.8**
Benzene	96.7
Toluene	96.7
p-Xylene	96.3
WS, WD	99.7

6.2. Graphic Representations

Validated 5 minute data for NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene and *p*-Xylene were used to construct the following graphical representations.

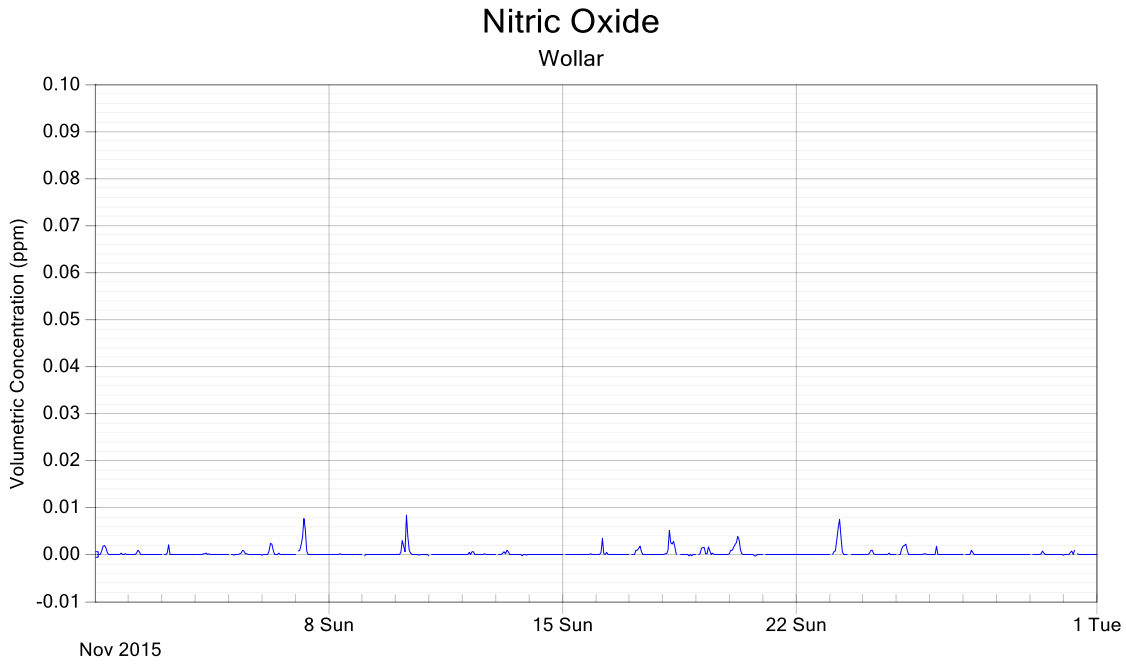

Figure 2: NO - 1 hour data

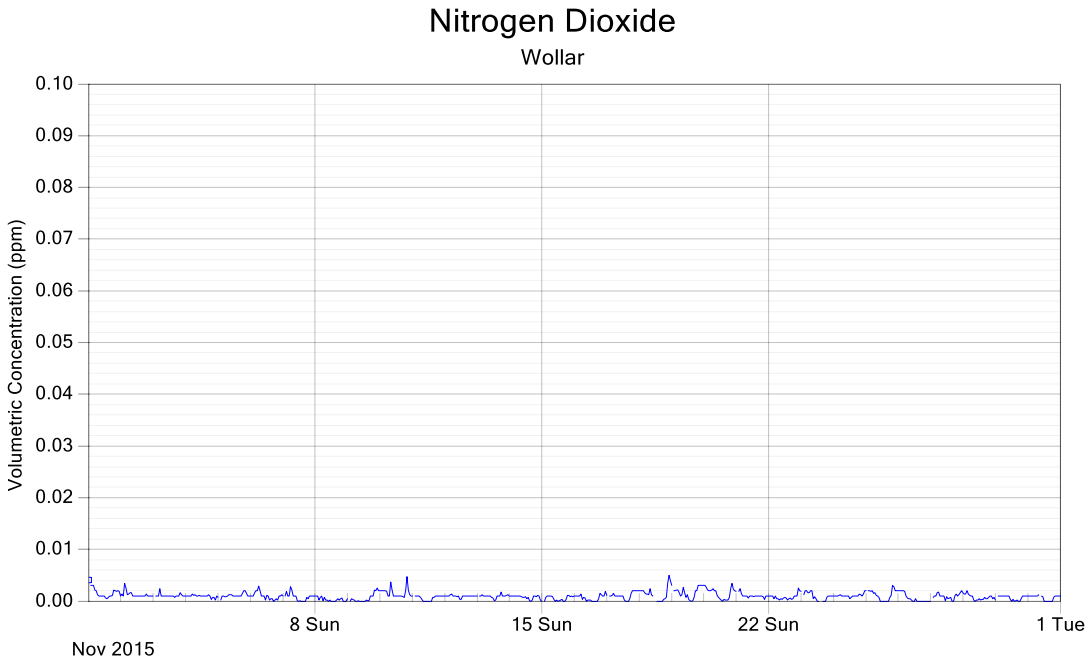

Figure 3: NO_2 - 1 hour data

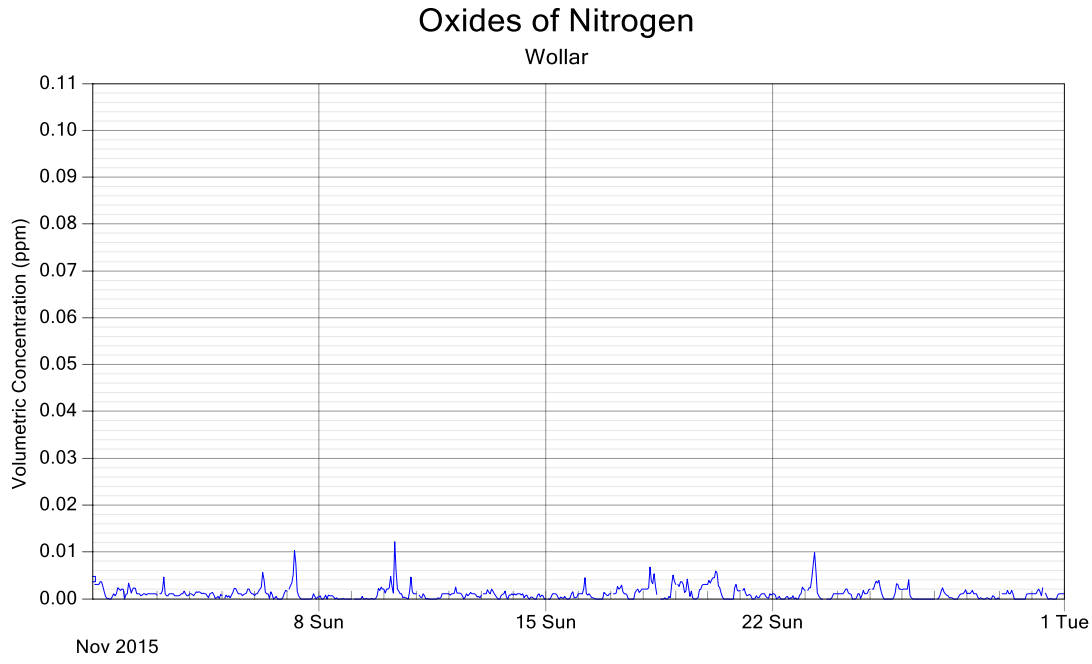

Figure 4: NO_X - 1 hour data

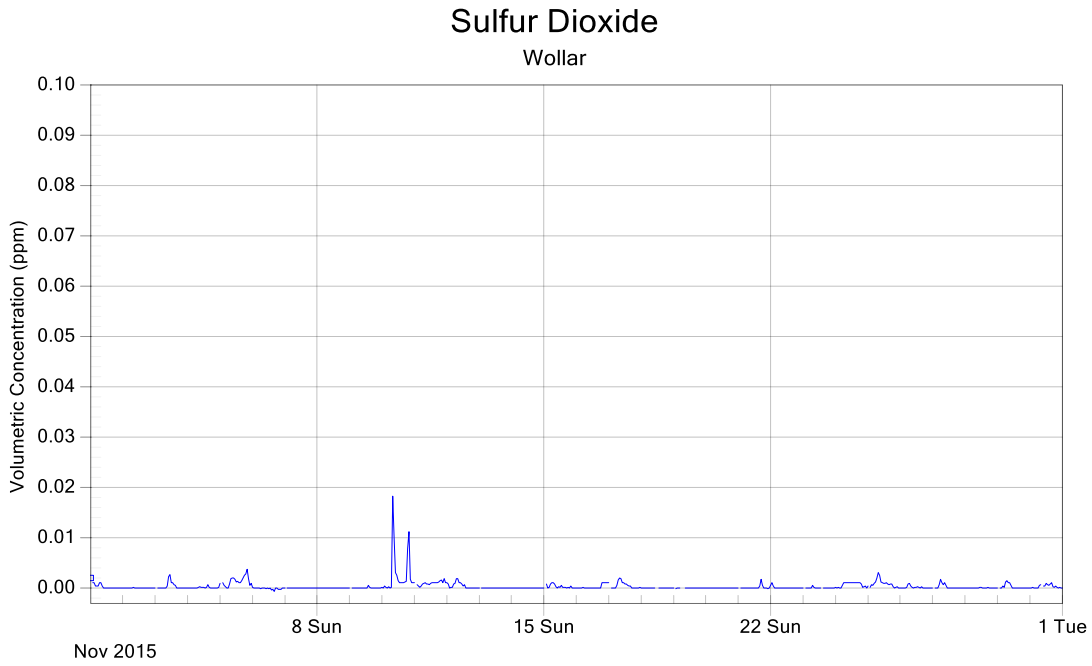

Figure 5: SO_2 - 1 hour data

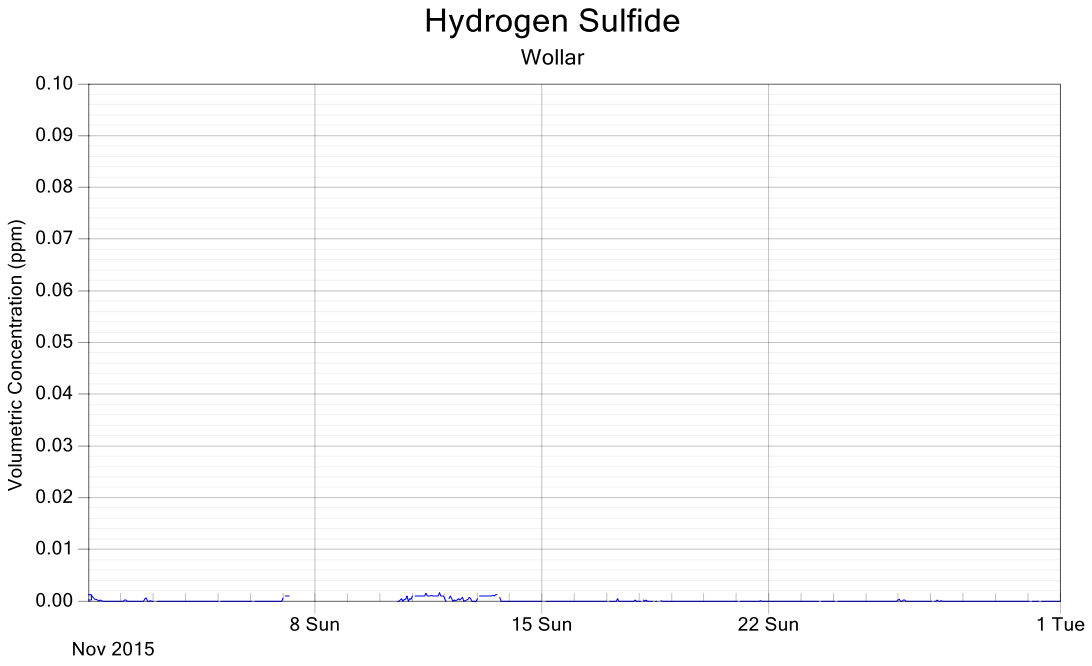

Figure 6: H_2S - 1 hour data

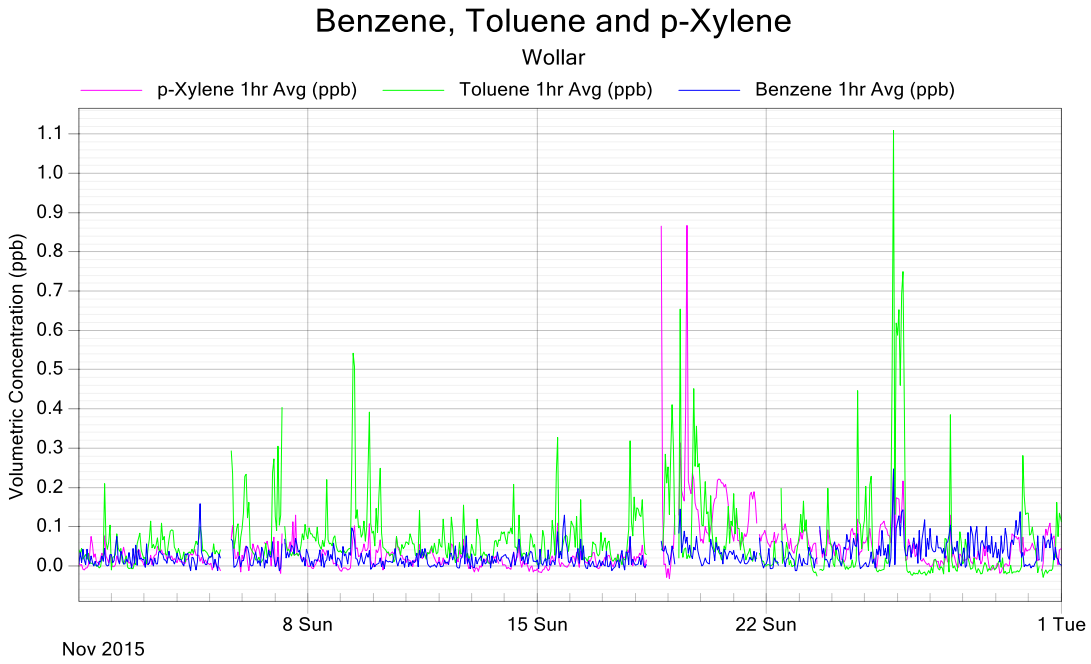

Figure 7: BTX - 1 hour data

7.0 Valid Data Exception Tables

The tables below details all changes made to the raw data set during the validation process. An explanation of reasons given in the table can be found in Appendix 2.

Table 10: Wollar Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
1/11/2015 0:00	4/11/2015 8:45	Static offset of 0.25 ppb applied to correct baseline (continues into Nov-15)	p-Xylene	RE	27/11/2015
1/11/2015 0:00	4/11/2015 8:45	Static offset of 0.1 ppb applied to correct baseline (continues into Nov-15)	Toluene	RE	27/11/2015
1/11/2015 0:00	4/11/2015 8:45	Static offset of 0.12 ppb applied to correct baseline (continues into Nov-15)	Benzene	RE	27/11/2015
3/11/2015 1:45	30/11/2015 2:50	Intermittent span/zero calibration cycles	H_2S	CK	17/12/2015
4/11/2015 8:50	4/11/2015 8:50	Instrument stabilisation following maintenance	BTX	CK	17/12/2015
5/11/2015 9:05	5/11/2015 15:35	Non-scheduled maintenance - zeros check performed, and instrument stabilisation following maintenance	BTX	CK	17/12/2015
6/11/2015 15:30	13/11/2015 21:20	Intermittent data transmission errors	p-Xylene	RE	17/12/2015
7/11/2015 5:45	7/11/2015 6:20	Power interruption and instrument stabilisation	BTX, H_2S, WS, WD, Sigma	CK	17/12/2015
7/11/2015 5:45	10/11/2015 12:35	Instrument offline due to failing back up battery. Instrument settings reset.	H_2S	CK	17/12/2015
7/11/2015 6:25	10/11/2015 10:05	Static offset -0.15ppb applied to data to correct baseline	p-Xylene	CK	17/12/2015
10/11/2015 12:35	10/11/2015 12:35	Instrument reset	H_2S	CK	17/12/2015

Start Date	End Date	Reason	Change Details	User Name	Change Date
12/11/2015 14:50	12/11/2015 14:55	Unrealistic negative data	H_2S	CK	17/12/2015
13/11/2015 15:45	13/11/2015 16:55	Non-scheduled maintenance - instrument calibration	H_2S	CK	17/12/2015
18/11/2015 9:15	18/11/2015 18:20	Scheduled monthly maintenance and instrument stabilisation	BTX	CK	17/12/2015
18/11/2015 11:15	18/11/2015 11:40	Replaced analyser battery	H_2S	CK	17/12/2015
18/11/2015 11:20	18/11/2015 15:40	Scheduled monthly maintenance	BTX, H_2S, SO_2, NO, NO_2, NO_x	CK	17/12/2015
18/11/2015 18:25	30/11/2015 8:40	Static offset +0.10 ppb applied to data to correct baseline	p-Xylene	CK	17/12/2015
19/11/2015 6:25	19/11/2015 8:15	Non-scheduled maintenance, zero check performed	BTX	CK	17/12/2015
19/11/2015 6:25	19/11/2015 8:25	Non-scheduled maintenance, calibration	SO_2	CK	17/12/2015
21/11/2015 17:45	21/11/2015 18:15	Power interruption and instrument stabilisation	BTX, H_2S, SO_2, WS, WD, Sigma	CK	17/12/2015
22/11/2015 10:35	22/11/2015 11:05	Power interruption and instrument stabilisation	BTX, H_2S, SO_2, WS, WD, Sigma	CK	17/12/2015
23/11/2015 14:05	23/11/2015 15:25	Power interruption and instrument stabilisation	All channels	CK	17/12/2015
23/11/2015 15:05	24/11/2015 0:00	Offset +0.002ppm applied to data to correct baseline	H_2S	CK	17/12/2015
30/11/2015 8:45	30/11/2015 9:55	Power interruption and instrument stabilisation	All channels	CK	17/12/2015

8.0 Report Summary

The data capture for Wollar was above 95% for all measured parameters, with the exception of H_2S;

- Data capture for H_2S was 85.8% and this was impacted by the instrument not restoring connection following a power interruption

Measurement of a number of parameters in this report does not comply with applicable standards and/or is not covered by Ecotech's NATA scope of accreditation. Please refer to section 3.3.1 for details.

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

Appendix 1 - Definitions & Abbreviations

BTX	Benzene, Toluene and *p*-Xylene
H_2S	Hydrogen sulfide
m/s	Metres per second
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
ppb	Parts per billion
SO_2	Sulphur dioxide
WD	Vector Wind Direction
WS	Vector Wind Speed

Appendix 2 - Explanation of Exception Table

Automatic background check refers to when analyser samples zero air and measures the level of the concentration voltage. This voltage is taken as the zero signal level and this value is subtracted from any subsequent readings as an active zero compensation. This is the analyser's fine zero measurement.

Calibration check outside tolerance refers to when the calibration values are outside the tolerance limits set for the precision check.

Calibration correction factor applied to data refers to an offset or multiplier applied to the data. This operation may be performed for a number of reasons including: (a) when a clear trend / drift outside the tolerance limit can be demonstrated by repeated operation precision checks, (b) when a correction is required on previously logged data due to a calibration check being outside the allowable tolerance

Commissioning refers to the initial setup and calibration of the instrument when it is first installed. For some instruments there may be a stabilisation period before normal operation commences.

Data affected by environmental conditions – wind speed / wind speed gust spike refers to when a one-off high reading occurs due to a natural occurrence such as a bird sitting on the wind sensor, or some other event causing the readings to spike.

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.

Equipment malfunction/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.

Gap in data/data not available refers to a period of time when either data has been lost or could not be collected.

Instrument Alarm refers to an alarm produced by the instrument. A range of alarms can be produced depending on how operation of the instrument is being affected.

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

Linear offset or multiplier refers to when an offset or multiplier has been applied between two points where the values of the offset or multiplier are different and the correction is interpolated between the two points.

Logger error refers to when an error occurs and instrument readings are not correctly recorded by the logger.

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

Overnight span/zero out of tolerance refers to when the span/zero reading measured by the analyser during an automatic precision check falls outside of the expected concentration limits.

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

Remote Calibration refers to when a technician remotely connects to the station and manually performs a span check.

Static offset or multiplier refers to when a single offset or multiplier has been applied to the data between two points either to increase or decrease the measured value.

Warm up after power interruption refers to the startup period of an instrument after power has been restored.

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NATA
WORLD RECOGNISED ACCREDITATION

Peabody Energy

Wilpinjong Coal
Wollar

Ambient Air Quality Monitoring

Validated Report

1st December – 31st December 2015

Report No.: DAT10380

Report issue date: 28th January 2016

Maintenance contract: MC951

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Revision History			
Revision	**Report ID**	**Date**	**Analyst**
0	DAT10380	28/01/2016	Elmira Parto

Report by: Elmira PARTO

Approved Signatory: Jon ALEXANDER

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1.0 Executive Summary

Peabody Energy has commissioned Ecotech P/L to conduct air quality monitoring for the Wilpinjong Mine at Wollar. Measured parameters at Wollar are NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene and *p*-Xylene. A wind sensor is also installed at the Wollar site.

The Wollar station was commissioned in March 2013.

This report presents the data collected from the Wollar station for 1st – 31st December 2015. Data capture for the measured pollutants is presented in Table 9.

2.0 Introduction

Ecotech Pty Ltd was commissioned by Peabody Energy to provide monitoring and data reporting for the Wilpinjong Mine at Wollar, located as detailed in Table 1. Ecotech commenced data collection from the Wilpinjong Station on the 1st March 2013.

This report presents the data for 1st – 31st December 2015.

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

3.1. Siting Details

The Wilpinjong Mine consists of one ambient air quality monitoring station. The station location and siting details are described below.

Table 1: Wilpinjong Mine monitoring site location

Site Name	Geographical Coordinates	Height Above Sea Level (m)
Wollar	Lat: -32.360105 Long: 149.949509	366

A siting audit was conducted on 27th February 2015 to assess for compliance with *AS/NZS 3580.1.1:2007 "Methods for sampling and analysis of ambient air – guide to siting air monitoring equipment"*.

This siting of this station complies with AS/NZS 3580.1.1:2007. The station is classified as a neighbourhood station according to *AS/NZS 3580.1.1:2007*.

Figure 1: Wilpinjong Mine Monitoring Station Location

3.2. Monitored Parameters

Table 2 below details the parameters monitored and the instruments used at Wilpinjong Mine monitoring station. Appendix 1 defines any abbreviated parameter names used throughout the report.

For meteorological sensors, the elevation given in the table below is the height above ground level at the monitoring station.

Table 2: Parameters measured at the Wilpinjong Mine monitoring station

Parameter Measured	Instrument and Measurement Technique
BTX (Benzene, Toluene and *p*-Xylene)	Synspec GC955 - Gas Chromatography
H_2S	Ecotech EC9852 - fluorescence
NO, NO_2, NO_x	Ecotech EC9841 gas phase chemiluminescence
SO_2	Ecotech EC9850 – fluorescence
Wind Speed (horizontal, 10m)	Vaisala WS425 – ultrasonic
Wind Direction (10m)	Vaisala WS425 – ultrasonic

3.3. Data Collection Methods

Table 3 below shows the methods used for data collection. Any deviations from the stated methods are detailed in section 3.3.1.

Table 3: Methods

Parameter Measured	Data Collection Methods Used	Description of Method
NO, NO_2, NO_x	AS 3580.5.1-2011	Methods for sampling and analysis of ambient air. Method 5.1: Determination of oxides of nitrogen – chemiluminescence method
	Ecotech Laboratory Manual	In-house method 6.1 Oxides of nitrogen by chemiluminescence
SO_2	AS 3580.4.1-2008	Methods for sampling and analysis of ambient air. Method 4.1: Determination of sulfur dioxide – Direct reading instrumental method
	Ecotech Laboratory Manual	In-house method 6.2 Sulfur dioxide by fluorescence
H_2S	Ecotech Laboratory Manual	In-house method 6.5 Hydrogen sulfide by fluorescence
BTX (Benzene, Toluene and *p*-Xylene)	Synspec GC955 Series Manual	Synspec GC955 - Gas Chromatography
Vector Wind Speed (Horizontal)	AS 3580.14-2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.1 Wind speed (Horizontal) by anemometer
Vector Wind Direction	AS 3580.14-2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.3 Wind direction by anemometer

3.3.1. Compliance with Standards

Unless stated below, parameters are monitored at the Wilpinjong Mine site according to the methods detailed in Table 3 above.

- Measurement of benzene, toluene and *p*-xylene (BTX) is not covered by Ecotech's NATA scope of accreditation.
- Measurement of hydrogen sulfide (H_2S) is not covered by Ecotech's scope of accreditation due to the frequency of calibration checks.

3.3.2. Data Acquisition

Data acquisition is performed using a PC based WinAQMS logger (using WinAQMS® Version 2.0) situated at the monitoring site. Each logger is equipped with a 3G modem for remote data collection. The recorded data is remotely collected from the AQMS logger on a daily basis (using Airodis™ version 5.1) and stored at Ecotech's Environmental Reporting Services (ERS) department in Melbourne, Australia. Data samples are logged in 5 minute intervals.

3.4. Data Validation and Reporting

3.4.1. Validation

The Ecotech ERS department performs 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.

Details of all invalid or missing data are recorded in the Valid Data Exception Tables.

Validation is performed by the analyst, and the validation is reviewed. Graphs and tables are generated based on the validated five minute data.

3.4.2. Reporting

The reported data is in a Microsoft Excel format file named "*Wilpinjong Coal Validated Data Report Dec-15.xls*". The Excel file consists of 5 Excel worksheets:

1. Cover
2. 5 Minute Averages
3. Hourly Averages
4. Daily Averages
5. Valid Data Exception Table

The data contained in this report is based on Australian Eastern Standard Time.

All averages are calculated from the five minute data. Averages are based on a minimum of 75% valid readings within the averaging period.

Averaging periods of eight hours or less are reported for the end of the period, i.e. the hourly average 02:00 is for the data collected from 01:00 to 02:00. One hour averages are calculated based on a clock hour. One day averages are calculated based on calendar days.

4.0 Air Quality Goals

The air quality goals for pollutants monitored at the Wilpinjong Wollar monitoring station are based on the Australian National Environmental Council (NEPC) Ambient Air Quality (NEPM). These air quality goals are shown in Table 4 below.

Table 4: Wilpinjong Air Quality Goals (NEPM)

Parameter	Time Period	Exceedence Level	Units	Maximum allowable exceedences
NO_2	1 year	30	ppb	None
NO_2	1 hour	120	ppb	1 day a year
SO_2	1 hour	200	ppb	1 day a year
SO_2	1 day	80	ppb	1 day a year
SO_2	1 year	20	ppb	None

4.1. Air Quality Summary

Table 5 below, details any exceedences of the NEPM Standard that were observed during this reporting period.

Table 5: Exceedences Recorded

Parameter	Time Period	Value of Exceedence	Date of Exceedence
NO_2	1 hour	-	-
SO_2	1 hour	-	-
SO_2	1 day	-	-

5.0 Calibrations and Maintenance

5.1. Units and Uncertainties

The uncertainties for each parameter have been determined by the manufacturer's tolerance limits of the equipment's parameters, and by the data collection standard method.

The reported uncertainties are expanded uncertainties, calculated using coverage factors which give a level of confidence of approximately 95%.

Table 6: Units and Uncertainties

Parameter	Units	Resolution	Uncertainty	Measurement Range[1]
NO, NO_x (EC9841)	ppm	1 ppb	± 14 ppb K factor of 2.01	0 ppb to 500 ppb
NO_2 (EC9841)	ppm	1 ppb	± 16 ppb K factor of 2.01	0 ppb to 500 ppb
SO_2 (EC9850)	ppm	1 ppb	± 14 ppb K factor of 2.01	0 ppb to 500 ppb
H_2S	ppm	1 ppb	15.2% of reading or ± 19 ppb, whichever is greater K factor of 2	0 ppb to 500 ppb
Benzene, Toluene and *p*-Xylene (BTX)	ppb	0.03 ppb	15.1% of reading or 3.8ppb, whichever is greater K factor of 2	0 ppb to 300 ppb
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
Vector Wind Direction	Deg	1 deg	±4 deg K factor of 2.11	0 deg to 360 deg Starting threshold: 0 m/s

[1] Uncertainties may not be calculated based on the full measurement range. Uncertainty for NO, NO_2 and NO_x by EC 9841 and SO_2 by EC9850 are calculated based on a measurement range of 0-125 ppb.

5.2. Automatic Checks

Automatic span and zero calibration checks run every second day for NO, NO_2, NO_x and SO_2.

Background checks run each night for SO_2 and H_2S.

See Table 7 below for additional details. Data points associated with these checks are invalidated but are not referred to in the Valid Data Exception Tables.

Table 7: Automatic checks for NO, NO_2, NO_x, SO_2, and H_2S

Parameter	Span / Zero cycle time (approximate)	Background cycle time (approximate)
NO, NO_2, NO_x	01:00 to 01:45 every 2nd day	N/A
SO_2	01:00 to 01:40	23:50 to 00:00
H_2S	Refer to VDET for details	23:50 to 00:05

5.3. Maintenance

Unscheduled maintenance was performed on 16/12/2015 and 29/12/2015; to confirm BTX offsets and run a zero check.

A further unscheduled visit was made on 21/12/2015; to investigate a low span fault for H_2S analyser. The H_2S scrubber replaced and suspected leak on the system fixed. Overnight zero/span for H_2S has changed to daily to make sure the problem has been completely rectified.

Monthly maintenance was performed over 2-days on 29/12/2015 and 13/12/2015 for all parameters, and included running a zero check on the BTX analyser, and an adjustment of offsets.

5.3.1. Calibration & Maintenance Summary Tables

The last calibrations for the following parameters were performed on the indicated dates. Data supplied after this time is subject to further validation, to be performed at the next calibration cycle.

Note: Maintenance and calibration dates may differ, as calibrations may be less frequent than scheduled maintenance visits.

Table 8 indicates when the gas and meteorological equipment was last maintained / calibrated.

Table 8: Wilpinjong Wollar Maintenance Table

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	29/12/2015	Monthly	29/12/2015	Monthly
SO_2	29/12/2015	Monthly	29/12/2015	Monthly
H_2S	29/12/2015	Monthly	29/12/2015	Monthly
BTX	29/12/2015	Monthly	29/12/2015	Monthly
Wind Speed	29/12/2015	Monthly	21/05/2015	2-Yearly
Wind Direction	29/12/2015	Monthly	21/05/2015	2-Yearly

Wind sensor calibration certificates not yet received, last calibration will be updated when available

6.0 Results

6.1. Data Capture

Data capture is based on 1 hour averages, calculated from 5 minute data, and refers to the amount of available data collected during the report period.

The percentage of data captured is calculated using the following equation:
Data capture = (Reported air quality data / Total data) x 100%
Where:

- Reported air quality data = Number of instrument readings which have been validated through a quality assured process 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 displays data capture statistics for 1st – 31st December 2015. **Bold** values in the table indicate data capture below 95%.

Details of all invalid or missing data affecting data affecting data capture are included in the Valid Data Exception Tables, and attached Excel file.

Table 9: Data Capture for Wilpinjong Wollar Station

Parameter	Data Capture %
NO, NO_2, NO_x	98.2
SO_2	97.8
H_2S	95.0
Benzene	97.9
Toluene	97.8
p-Xylene	97.8
WS, WD	**62.5**

6.2. Graphic Representations

Validated 5 minute data for NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene and *p*-Xylene were used to construct the following graphical representations.

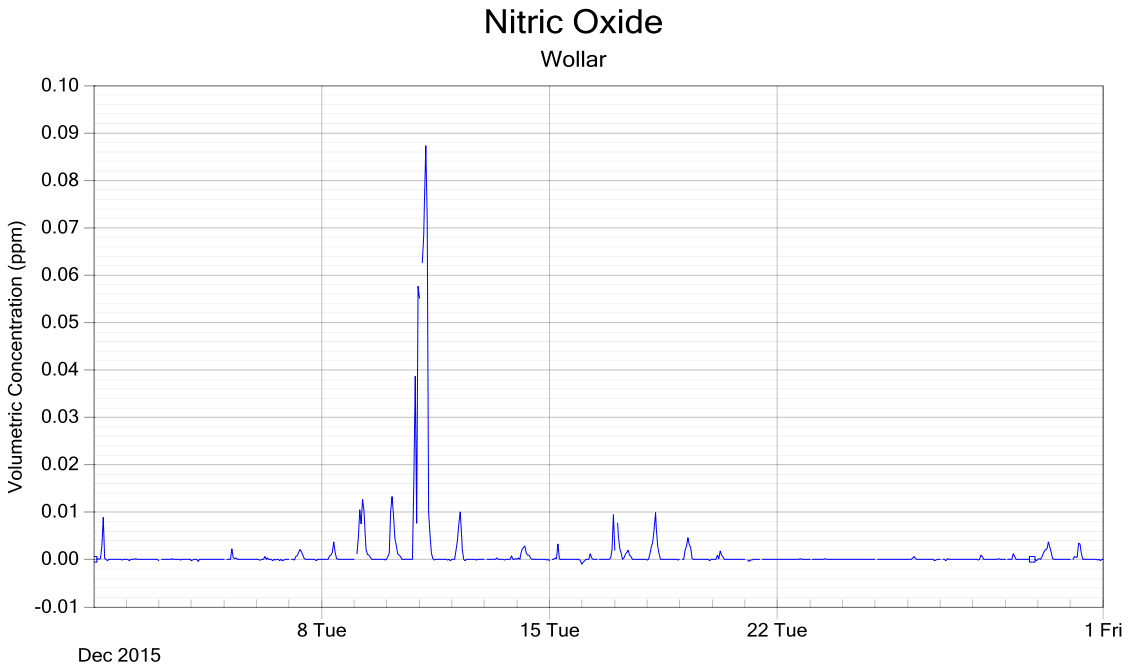

Figure 2: NO - 1 hour data

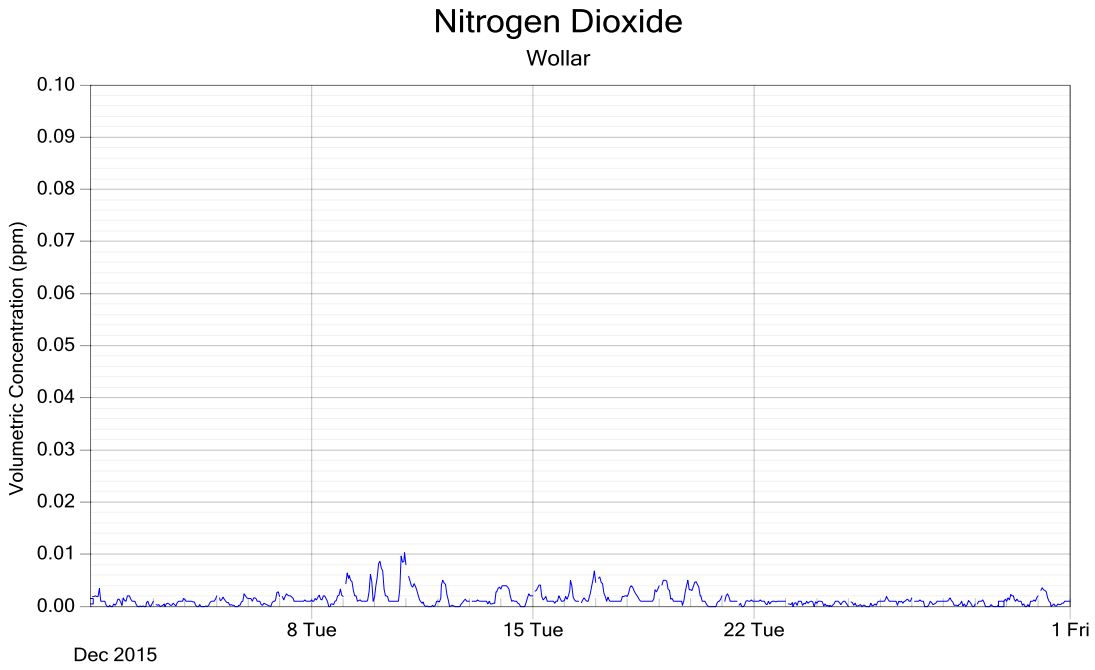

Figure 3: NO_2 - 1 hour data

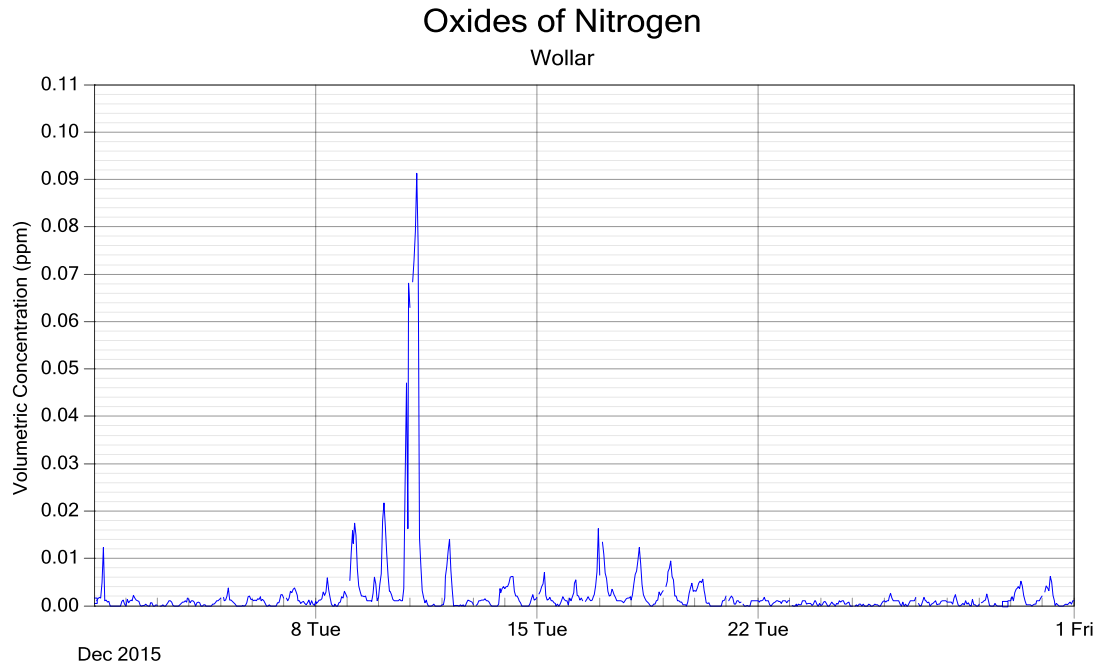

Figure 4: NO_X - 1 hour data

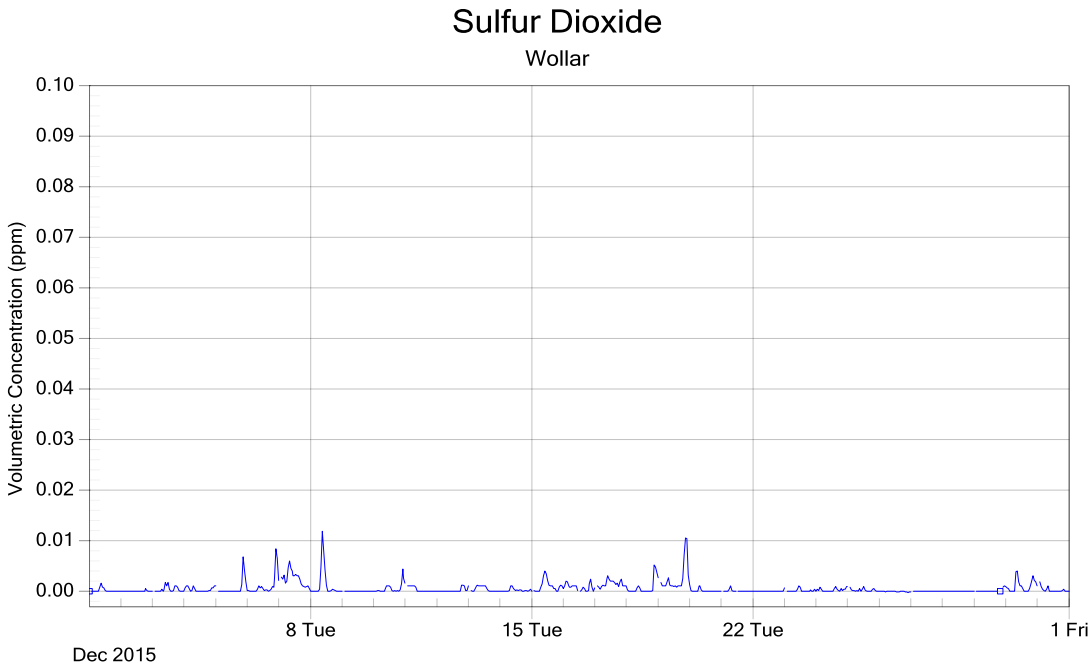

Figure 5: SO_2 - 1 hour data

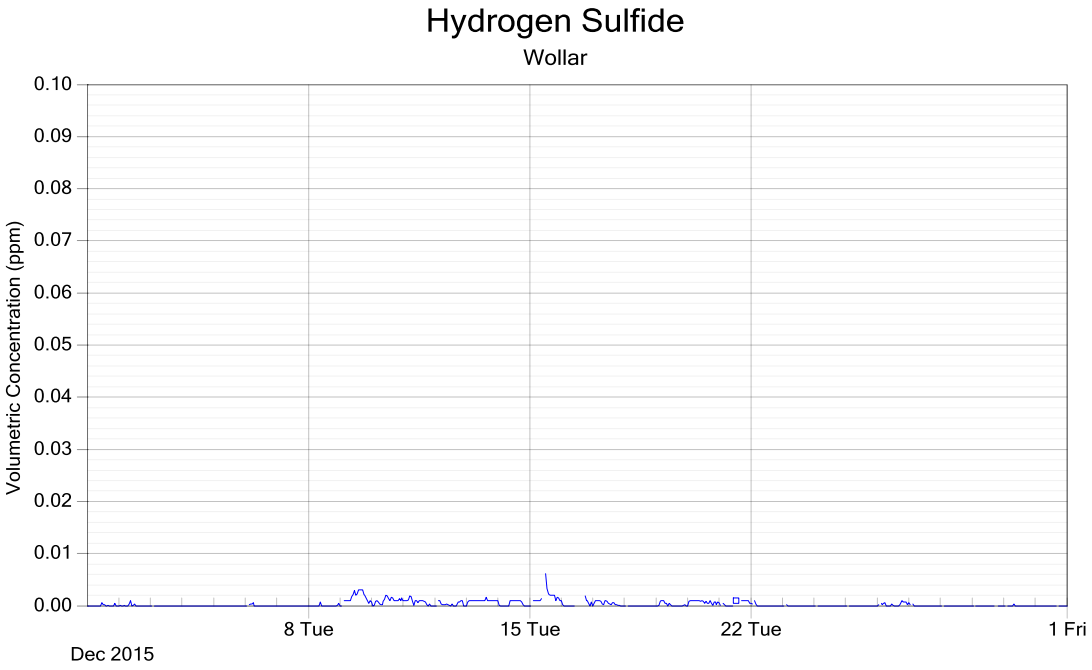

Figure 6: H_2S - 1 hour data

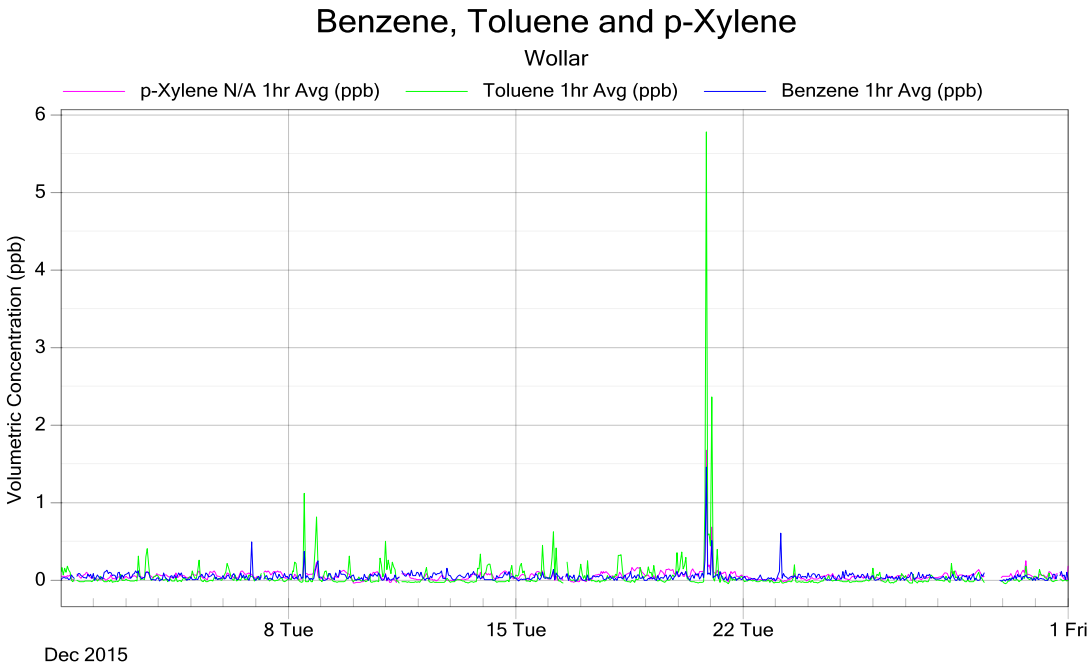

Figure 7: BTX - 1 hour data

7.0 Valid Data Exception Tables

The tables below details all changes made to the raw data set during the validation process. An explanation of reasons given in the table can be found in Appendix 2.

Table 10: Wollar Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
1/12/2015 10:45	1/12/2015 11:10	Power interruption and instrument stabilisation	BTX, WS, WD, sigma, H_2S, SO_2	EP	27/01/2016
6/12/2015 2:55	18/12/2015 1:40	Due to the absence of automatic span checks for more than 5 days, data does not comply with Australian Standard. Data included for reference only	H_2S	EP	27/01/2016
7/12/2015 4:55	7/12/2015 5:25	Power interruption and instrument stabilisation	BTX, WS, WD, sigma, H_2S, SO_2	EP	27/01/2016
10/12/2015 6:05	27/12/2015 15:25	Intermittent instrument fault	WS, WD, Sigma	EP	27/01/2016
11/12/2015 11:25	11/12/2015 11:55	Power interruption and instrument stabilisation	BTX, WS, WD, sigma, H_2S, SO_2	EP	27/01/2016
16/12/2015 11:25	16/12/2015 17:20	Non-scheduled maintenance, calibration	BTX, NO, NO_2, NO_x, H_2S, SO_2	EP	27/01/2016
16/12/2015 13:15	31/12/2015 16:55	Static offset of 0.05 ppb applied to correct baseline	*p*-Xylene	EP	27/01/2016
21/12/2015 11:15	21/12/2015 13:05	Non-scheduled maintenance, calibration	NO, NO_2, NO_x, H_2S, SO_2	EP	27/01/2016
23/12/2015 14:10	1/01/2016 0:00	Intermittent zero check performed	BTX	EP	27/01/2016
29/12/2015 10:50	29/12/2015 22:55	Scheduled monthly maintenance and instrument stabilisation	BTX	EP	27/01/2016

Start Date	End Date	Reason	Change Details	User Name	Change Date
29/12/2015 18:15	29/12/2015 21:55	Scheduled monthly maintenance and instrument stabilisation	WS, WD, sigma, NO, NO_2, NO_x, H_2S, SO_2	EP	27/01/2016
29/12/2015 22:20	31/12/2015 16:55	Static offset of 0.03 ppb applied to correct baseline	Toluene	EP	27/01/2016
31/12/2015 17:00	31/12/2015 17:35	Power interruption and instrument stabilisation	BTX, WS, WD, sigma, H_2S, SO_2	EP	27/01/2016
31/12/2015 17:40	1/01/2016 0:00	Static offset of - 0.2 ppb applied to correct baseline (continues into Jan-16)	*p*-Xylene	EP	27/01/2016

8.0 Report Summary

The data capture for Wollar was above 95% for all measured parameters, with the exception of wind data;

- Data capture for WS and WD was 62.5% and this was impacted by an instrument fault.

Measurement of a number of parameters in this report does not comply with applicable standards and/or is not covered by Ecotech's NATA scope of accreditation. Please refer to section 3.3.1 for details.

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

Appendix 1 - Definitions & Abbreviations

BTX	Benzene, Toluene and *p*-Xylene
H_2S	Hydrogen sulfide
m/s	Metres per second
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
ppb	Parts per billion
SO_2	Sulphur dioxide
WD	Vector Wind Direction
WS	Vector Wind Speed