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REPORT

AMBIENT AIR MONITORING REPORT - WILPINJONG COAL

Wilpinjong Coal Mine

Job No: **7983**

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EXECUTIVE SUMMARY

As a result of community concern related to odour from spontaneous combustion, Wilpinjong Coal Mine (WCM) has measured ambient concentrations of the following pollutants that can be released during spontaneous combustion events.

- Oxides of Nitrogen (NO_x)
- Sulfur Dioxide (SO_2)
- Hydrogen Sulfide (H_2S)
- Polycyclic Aromatic Hydrocarbons (PAHs)
- Volatile Organic Compounds (VOCs).

Monitoring was completed at two locations (Wollar Village and Cooks Gap) between March and June 2013. The air quality monitoring was completed by Ecotech and ALS.

This report provides a discussion on the causes of spontaneous combustion and the pollutants released from spontaneous combustion events together with an overview of the health effects of the pollutants measured and current ambient concentrations in NSW. It presents the air quality criteria against which the measured concentrations have been compared, and an analysis of the monitoring data and comparison with Australian air quality criteria.

All measured concentrations of nitrogen dioxide, polycyclic aromatic hydrocarbons, and volatile organic compounds were significantly below the relevant assessment criteria.

With the exception of one ten-minute period, which is likely to be related to equipment malfunction, all SO_2 concentrations are also below relevant assessment criteria.

Whilst the H_2S concentrations are all below the relevant ambient air quality criteria, there are occasions when a complaint coincided with higher H_2S concentrations, which could explain some of the odour complaints received.

Whilst it is difficult to determine the source of these pollutants on the basis of the prevailing wind directions, it is apparent from the data that the WCM is not indicated as the primary source of any pollutant.

Given the low concentrations of all pollutants measured, and that there is no clear indication the WCM is the primary source of any of them, it is difficult to make any recommendations for ongoing monitoring. Fence-line monitoring of H_2S concentrations could be used as early detection measure that a spontaneous combustion event is occurring, however, there are currently no known applications of monitoring of this type in the mining industry.

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1 INTRODUCTION

As a result of community concern related to odour from spontaneous combustion, Wilpinjong Coal Mine (WCM) implemented a monitoring program to measure the ambient concentrations of a range of pollutants at two locations (Wollar Village and Cooks Gap) between March and June 2013.

This report presents the following:

- a discussion on the causes of spontaneous combustion and the pollutants released from spontaneous combustion events (see **Section 2.2**)
- an overview of health effects of the pollutants measured and current ambient concentrations in NSW (see **Section 2.3**)
- the air quality criteria against which the measured concentrations have been compared (**Section 2.3.5**)
- an assessment of the monitoring data and comparison of measured concentrations with Australian air quality criteria (see **Section 3**)
- conclusions (see **Section 4**)

2 SPONTANEOUS COMBUSTION

2.1 Introduction

Spontaneous combustion is a type of combustion which occurs without an external heat source. Coal can ignite spontaneously when exposed to oxygen which causes it to react and heat up when there is insufficient ventilation for cooling. In open-cut coal mines, such as the WCM, self-heating can occur in the waste material and raw coal stockpiles. The WCM has developed a Spontaneous Combustion Management Plan which details the controls to be implemented for the management of spontaneous combustion at the site.

2.2 Air pollutants from spontaneous combustion

Whilst there has been a substantial amount of research completed on the prevention and control of spontaneous combustion, and the release of greenhouse gases (that is, carbon dioxide (CO_2) and methane (CH_4)), there is limited information on other air pollutants that are emitted (**Carras et. al., 2005**; **Day, 2008)**.

A review of the literature has identified the following air pollutants may result from spontaneous combustion:

- Particulates
- Carbon Monoxide (CO)
- Oxides of Nitrogen (NO_x)
- Sulfur Dioxide (SO_2)
- Hydrogen Sulfide (H_2S)
- Polycyclic Aromatic Hydrocarbons (PAHs)
- Volatile Organic Compounds (VOCs).

The monitoring completed on behalf of the WCM has measured all the pollutants listed above, except particulates and CO. A detailed description and analysis of the monitoring completed is provided in **Section 3**.

Since open-cut mining is itself a source of particulate emissions, it would be difficult, if not impossible, to isolate particulate emissions generated as result of spontaneous combustion from other particulate emissions generated by the mining activities.

Emissions of CO are not considered to be a significant concern in the ambient air of what is effectively a rural air shed. Thus in this instance it is not considered a significant limitation of the monitoring study that this parameter was not explicitly evaluated.

2.3 Air pollutants – human health aspects

This section provides an overview of each pollutant, the associated human health aspects, and where available, information on current levels in NSW.

2.3.1 Oxides of Nitrogen

Oxides of nitrogen (NO_x) are produced during spontaneous combustion and are comprised mainly of nitric oxide (NO) and nitrogen dioxide (NO_2). NO is much less harmful to humans than NO_2 and is not generally considered an air quality problem at the concentrations normally found in Australia. In open-cut mining, such as the WCM, there is also potential for NO_2 to form as a result of the oxidation of ammonium nitrate during blasting. A recent report published by ACARP(Australian Coal Association Research Program) measured NO_2 concentrations in the ambient air near the fence line of a large open-cut coal mine in the Hunter Valley between April 2011 and October 2012 (**Day et. al. 2013**). The report concluded that most of the NO_2 present in ambient air at the monitoring locations appeared to be derived from sources other than blasting, with vehicle operation within the mine apparently a major source along with other significant sources from outside the mine e.g. power stations, traffic on nearby roads, and railways.

NO_2 is the regulated oxide of nitrogen in NSW and effects of exposure to NO_2 include irritation of the lungs and lower resistance to respiratory infections such as influenza. The effects of short-term exposure are still unclear, however, continued or frequent exposure to concentrations that are typically much higher than those normally found in the ambient air may cause increased incidence of acute respiratory illness in children. Concern with NO is related to its transformation to NO_2 and its role in the formation of photochemical smog.

The NSW State of the Environment report 2012 (**NSW EPA, 2012**) states that measured concentrations have not exceeded the 1-hour-average standard since 1998; from 2002–2007 the highest 1-hour value recorded in Sydney was only 75% of the standard. Over this period, maximum concentrations were lower still in the Illawarra and Lower Hunter regions.

2.3.2 Sulfur dioxide

Sulfur dioxide (SO_2) belongs to the family of sulfur oxide gases (SO_x). These gases are formed when for instance fuel containing sulfur (mainly coal and oil) is burned (or spontaneously combusts). The major health concerns associated with exposure to high concentrations of SO_2 include effects on breathing, respiratory illness, alterations in pulmonary defences, and aggravation of existing cardiovascular disease. SO_2 is a major precursor to acid rain, which is associated with the acidification of lakes and streams, accelerated corrosion of buildings and monuments, and reduced visibility.

Current scientific evidence links short-term exposures to SO_2, ranging from 5 minutes to 24 hours, with an array of adverse respiratory effects including bronchoconstriction and increased asthma symptoms. These effects are particularly important for asthmatics at elevated ventilation rates (e.g., while exercising or playing).

As a result of regulatory efforts, from 1994 to 2011 concentrations of SO_2 in NSW have been low, with no exceedances recorded. Maximum hourly ambient concentrations in Sydney were less than 25% of the standard. Higher concentrations are observed in the Illawarra and Lower Hunter regions as a result of industrial emissions, although these are also below the standard (**NSW EPA, 2012**).

2.3.3 Hydrogen sulfide

Hydrogen sulphide (H_2S) is a flammable, colourless gas with a characteristic odour of rotten eggs. H_2S occurs both naturally and from human processes. It is released from volcanoes, sulfur springs, undersea vents, swamps, salt marshes, and stagnant bodies of water, and is found in association with crude petroleum and natural gas. It is also associated with municipal sewers and sewage treatment plants, landfill gases, manure handling operations, and pulp and paper operations.

H_2S odour can be easily detected at concentrations much lower than are harmful to health, with its smell being easily perceptible at concentrations well below 1 part per million (ppm) in air. The literature reports a wide range of odour thresholds for H_2S (that is the level at which it can be smelt), with the lowest reported to be at levels of between 0.0005 – 0.01 ppm (**Ruth, 1986**). Others have reported the odour threshold to be in the range 0.003 - 0.02 ppm (**US EPA, 2003**).

The odour increases as the gas becomes more concentrated, with the strong rotten egg smell recognisable up to 30 ppm. Above this level, the gas is reported to have a sickeningly sweet odour up to around 100 ppm. However, at concentrations above 100 ppm, a person's ability to detect the gas is affected by rapid temporary paralysis of the olfactory nerves in the nose, leading to a loss of the sense of smell. This means that the gas can be present at dangerously high concentrations, with no perceivable odour.

No measurements of H_2S in ambient air in Australia were identified. However, **World Health Organisation, 2003** states that the concentration of hydrogen sulfide in air in unpolluted areas is very low, between 0.03 $\mu g/m^3$ (0.00002 ppm) and 0.1 $\mu g/m^3$ (0.00007 ppm).

2.3.4 Volatile organic compounds (VOCs)

VOCs are a very large group of compounds that can be found in ambient air. As would be expected with a very large group of compounds, the potential health effects can vary quite widely. The range of effects can be from irritation of the skin or the respiratory tract (e.g., wheezing, coughing, difficulty breathing) to an increased risk of developing cancer with long-term inhalation exposure. The VOCs measured in real-time as part of this monitoring program were benzene, toluene and xylene (BTX). Further information on each of these is provided in the following paragraphs. Other VOCs were also measured using summa canisters.

Benzene

The health effects of benzene depend on how much benzene you have been exposed to, for how long, and your current state of health. Exposure can result in symptoms such as skin and eye irritations, drowsiness, dizziness, headaches, and vomiting. Benzene is carcinogenic and long-term exposure at various levels can affect normal blood production and can be harmful to the immune system. It can cause Leukaemia (cancer of the tissues that form white blood cells) and has also been linked with birth defects in animals and humans.

Benzene evaporates very quickly and so the most common exposure is from breathing air containing benzene. Most people are exposed outdoors to low levels of benzene from tobacco smoke and vehicle exhaust. Smoking cigarettes and passive smoking, especially indoors, increases the intake of benzene to higher levels. People living near industries that produce or use benzene, or near busy roads may also be exposed to higher levels in the surrounding air.

Xylenes

Xylenes may irritate the eyes, nose and throat. They may cause stomach problems, drowsiness, loss of memory, poor concentration, nausea, vomiting, abdominal pain and incoordination. Xylene will enter the body if we breathe in contaminated air, or breathe tobacco smoke. It can also be absorbed through the skin if liquid xylene is in contact with the skin. The most common ways to be exposed to xylene are from petrol, automotive exhaust or when using consumer products containing xylene, especially if there is not good ventilation.

Toluene

Toluene is a colourless, flammable liquid. It occurs naturally in petroleum crude oil. Petroleum crude oil is by far the largest source of toluene. The most likely way to be exposed to toluene is by smoking or using consumer products containing toluene (paints, varnish, nail polish, paint cleaners, stain removers, etc.) especially if there is not good ventilation. Short-term exposure to high levels of toluene results first in light-headedness and euphoria, followed by dizziness, sleepiness, unconsciousness, and in some cases death.

2.3.5 Polycyclic aromatic hydrocarbons (PAHs)

Polycyclic aromatic hydrocarbons (PAHs) are a mixture of organic compounds released into the atmosphere as gases or particles during the incomplete combustion of organic material.

PAHs have a number of sources including:

- mobile-cars, trucks, ships and aircraft
- industrial-power generation, steelworks, coke ovens, aluminium production, cement kilns, oil refining and waste incineration
- domestic-primarily combustion for heating and cooking, especially solid fuel heaters using wood and coal
- fires-burning of vegetation in agricultural processes and bushfires.

Although many different PAHs have been identified, there is limited published toxicological data on them. One of the best characterised and most toxic PAH is benzo(a)pyrene, which is generally used as the indicator PAH.

2.4 Ambient Air Quality Standards

In Australia, *ambient air quality standards* are set in the National Environment Protection (Ambient Air Quality) Measure (AAQ NEPM) for CO, nitrogen dioxide (NO_2), photochemical oxidants (as ozone), sulfur dioxide (SO_2), lead, and particles (as PM_{10}). Advisory reporting standards are also set for particles (as $PM_{2.5}$) (**NEPM, 2003**). The National Environment Protection (Air Toxics) Measure (Air Toxics NEPM) sets investigation levels for the VOCs (benzene, toluene, xylenes, formaldehyde) and benzo(a)pyrene (as a marker for PAHs) (**NEPM, 2011**). "Investigation level" means the concentration of an air toxic which, if exceeded, requires an appropriate form of further investigation and evaluation. It is important to note that ambient air quality monitoring to demonstrate compliance with the NEPM standards/investigation levels is only required in locations with populations greater than 25,000 people.

In New South Wales, the Environment Protection Authority (NSW EPA) does not specify ambient air quality standards but sets *impact assessment criteria* for the assessment of projects (**NSW DEC, 2005**). For the purposes of project assessment, NSW EPA has adopted the AAQ NEPM standards but also specifies impact assessment criteria for a wider range of other pollutants and averaging periods not listed in the AAQ NEPM. For example, whilst the Air Toxics NEPM sets ambient air quality standards for air toxics, the standards are set as annual averages. NSW EPA has set impact assessment criteria as 1-hour averages for these pollutants, based on the EPA Victoria design criteria (**Victorian Government Gazette, 2001**). For the purposes of this assessment, reference has also been made to other EPA Victoria design criteria (**Victorian Government Gazette, 2001)**, as these are set as 3-minute averages and are also set to protect against both odour and toxic health effects. For hydrogen sulfide, it is not possible to make a direct comparison of the measured concentrations against the NSW impact assessment criteria as they are designed for comparison against dispersion modelling outputs, not concentrations in ambient air. However, New Zealand Ministry for the Environment (NZ MfE) sets an ambient guideline value based on hourly average hydrogen sulfide concentrations to prevent odour annoyance and the resulting impacts on well-being, rather than specific health effects (**Ministry for the Environment, 2002**).

It is important to note that the NSW EPA impact assessment criteria and EPA Victoria design criteria are set to assess the air quality impacts from a single industrial operation prior to it being granted permission to operate. When concentrations of pollutants are measured in ambient air, as has been completed in this assessment, there are generally multiple sources of most pollutants contributing to the measured concentrations. However, in the absence of specific ambient air quality standards, the NSW EPA impact assessment criteria, EPA Victoria design criteria, and New Zealand ambient guideline value have been used as de-facto standards, against which the measured concentrations have been compared. The criteria against which the measured data have been compared are listed in **Table 2-1**.

Table 2-1: Assessment criteria

Pollutant	Averaging period (basis of criteria)	Goal		Source
		ppm	mg/m^3	
Carbon monoxide (CO)	15 minutes	87	100	NSW EPA
	1 hour	25	30	NSW EPA
	8 hours	9	10	NEPM
Toluene (VOC)	1 hour	0.09	0.36	NSW EPA
	3 minutes (odour)	0.17	0.65	EPA Victoria
	3 minutes (toxicity)	3.2	12.3	EPA Victoria
Xylenes (VOC)	1 hour	0.04	0.19	NSW EPA
	3 minutes (odour)	0.08	0.35	EPA Victoria
	3 minutes (toxicity)	2.7	11.4	EPA Victoria
Pollutant	**Averaging period**	**ppm**	**µg/m^3**	
Sulfur dioxide (SO_2)	10 minutes	0.25	712	NSW EPA
	1 hour	0.20	570	NEPM
	24 hours	0.08	228	NEPM
	Annual	0.02	60	NEPM
Nitrogen dioxide (NO_2)	1 hour	0.12	246	NEPM
	Annual	0.03	62	NEPM
Benzene (VOC)	1 hour	0.009	0.029	NSW EPA
	3 minutes (carcinogen)	0.017	53	EPA Victoria
Hydrogen sulfide (H_2S)	1 hour	0.005	7	NZ MfE
PAHs (as benzo[a]pyrene)	1 hour	N/A	0.4	NSW EPA

mg/m^3 – milligrams per cubic metre
ppm – parts per million
µg/m^3 – micrograms per cubic metre

3 MONITORING COMPLETED, RESULTS, AND ANALYSIS

3.1 Study Area

The study area is shown in **Figure 3-1**, showing the location of the Wollar Village and Cooks Gap monitors, along with the meteorological monitoring station on the WCM. The Wollar Village and Cooks Gap monitors are representative of residential areas near to the WCM.

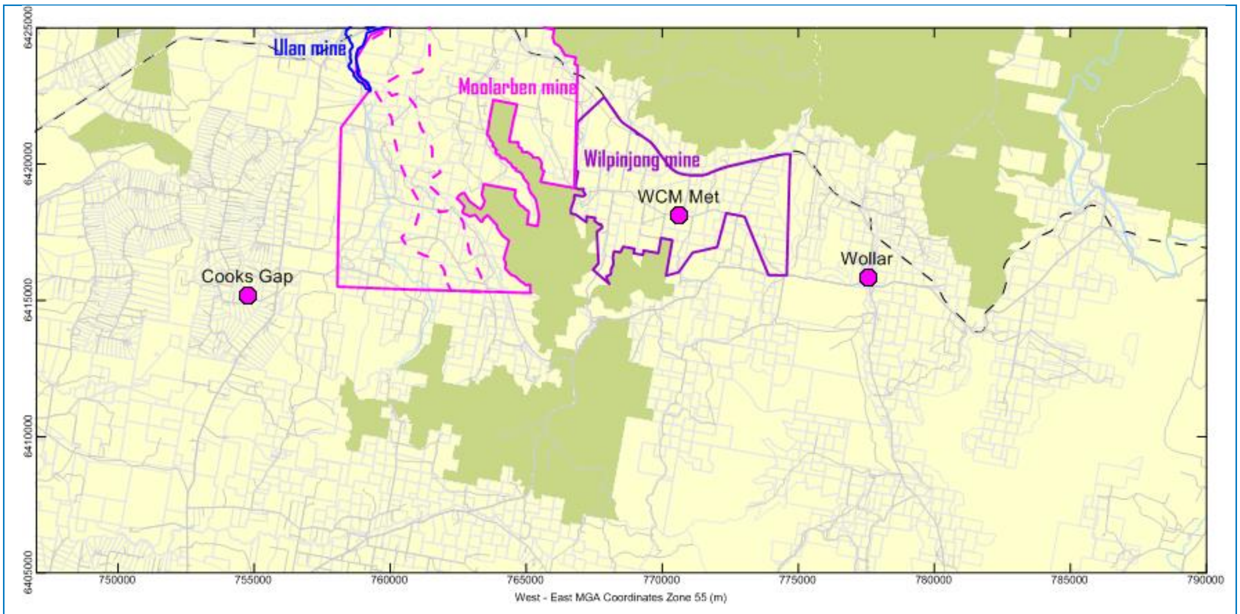


Figure 3-1: Study area

The pollutants measured at each monitoring location are listed in **Table 3-1**. **Section 3.5.2** to **Section 3.5.6** compares the measured concentrations with the relevant assessment criteria. Additional analysis is presented in **Section 3.6** considering both the pollutant concentrations and prevailing wind directions.

Table 3-1: Pollutants measured at each air monitoring site

Pollutant	Wollar Village	Cooks Gap
Nitric oxide (NO)	1 March 2013 - 23 June 2013	1 March 2013 - 23 June 2013
Nitrogen dioxide (NO_2)	1 March 2013 - 23 June 2013	1 March 2013 - 23 June 2013
Sulfur dioxide (SO_2)	1 March 2013 - 23 June 2013	1 March 2013 - 23 June 2013
Hydrogen sulfide (H_2S)	1 March 2013 - 23 June 2013	1 March 2013 - 23 June 2013
Benzene	17 April 2013 – 19 June 2013*	27 May 2013 - 23 June 2013
Toluene	17 April 2013 – 19 June 2013*	27 May 2013 - 23 June 2013
Xylene	17 April 2013 – 19 June 2013*	27 May 2013 - 23 June 2013

There was a good capture rate on the majority of data, other than the BTX data at Wollar Village, due to a problem with the first instrument that was installed (see **Appendix A** for further information).

3.2 Monitoring methods

The monitoring locations were selected in consultation with NSW EPA. The sampling and analysis for all pollutants (except PAHs and summa canisters) was completed on behalf of the WCM by Ecotech (see **Appendix B** for Ecotech credentials). The analysis of the summa canisters and PAHs was completed by ALS.

A copy of the analysis report provided to the WCM by Ecotech is provided in **Appendix C**. An example of the summa canister analysis report is provided in **Appendix D**, and an example of a PAH analysis report is provided in **Appendix E**.

Table 3-2 and **Table 3-3** present a summary of the data collection and analysis methods used by Ecotech and ALS, respectively.

Table 3-2: Summary of data collection and analysis methods – Ecotech

Parameter Measured	Data Collection Methods Used	Description of Method
NO, NO_2, NO_x	AS 3580.5.1-1993	Methods for sampling and analysis of ambient air. Method 5.1: Determination of oxides of nitrogen – chemiluminescence method
	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
Volatile organic compounds (Benzene, toluene, para-xylene	Gas Chromatography Synspec GC955 Series Manual	
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 speed (Horizontal) by anemometer

Table 3-3: Summary of data collection and analysis methods - ALS

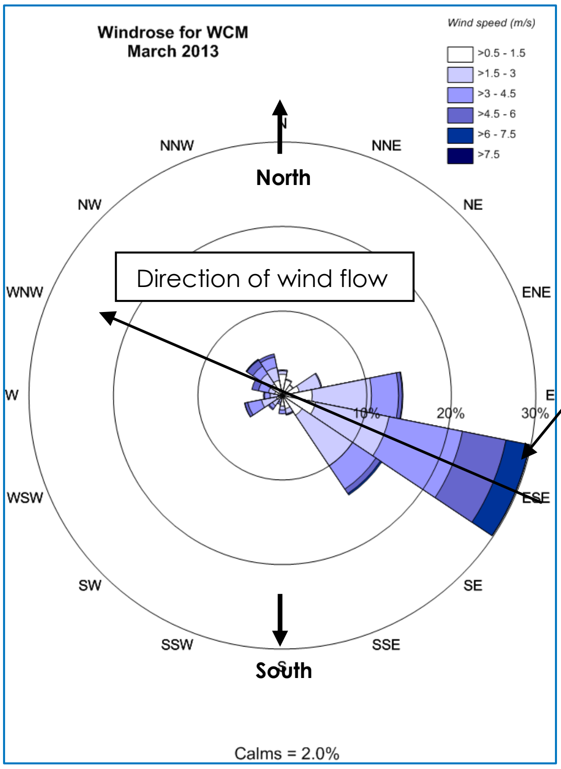
Parameter Measured	Data Collection Methods Used	Description of Method
PAHs	AS 3580.9.6–1990	Method for sampling of particulate matter – PM_{10} – high volume sampler with size-selective inlet
	EP077A	Analysis of HVAS filter paper for polynuclear aromatic hydrocarbons
Volatile organic compounds	Summa Canister	US EPA Method TO15 Determination Of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters And Analyzed By Gas Chromatography/ Mass Spectrometry (GC/MS)

3.3 Data analysis

3.3.1 Wind directions

Data on wind direction were available at the Cooks Gap and Wollar Village monitors from 16 April 2013 (Cooks Gap) and 3 May 2013 (Wollar Village). As wind direction data were not available for the entire period due to equipment problems, data from the WCM site meteorological station have also been used, along with data from a noise monitor located close to the Wollar Village air pollution monitor.

Windroses show the frequency of occurrence of winds by direction and strength (see **Figure 3-2**). The bars correspond to the 16 compass points – N, NNE, NE, etc. The bar at the top of each windrose diagram represents winds blowing from the north (i.e. northerly winds), and so on. The length of the bar represents the frequency of occurrence of winds from that direction, and the colour of the bar sections correspond to wind speed categories, the lighter colour representing the lightest winds.



The length of bar represents the frequency of winds from this direction. In this example, 30% of winds are <u>from</u> the east-south-east-east <u>to</u> the west-north-west.

The lighter colours on the bar represent the lightest winds. In this example, winds from the east-south-east are made up of approximately:

- 10% between 1.5 m/s and 3 m/s
- 10% between 3 m/s and 4.5 m/s
- 7% between 4.5 m/s and 6 m/s
- 3% between 6 m/s and 7.5 m/s.

Figure 3-2: How to read wind roses

Wind roses, showing wind speed and direction recorded at each of the meteorological monitoring sites are shown in **Figure 3-3**. The wind roses show that there is some variation between the various sites. At the WCM site, winds during the monitoring period were mainly from the east-northeast with a smaller component from the west-northwest. This reflects the valley flows in this area. The Wollar Village air pollution monitor shows winds to be mainly from the south-southwest, with most recorded winds falling between east-southeast and west-southwest. The Wollar Village noise monitor recorded winds to be mainly from the east-southeast and southwest. The Cooks Gap air pollution monitor showed winds mainly from the west in April, east-northeast in May and the south in June.

The terrain surrounding the WCM site is shown in **Figure 3-4**. The local terrain is complex, with many hills and valleys, which would cause wind patterns to vary significantly across the local area. Winds blowing from the WCM toward the Wollar Village air pollution monitor are (approximately) those blowing from the west to north-north west. Winds blowing from the WCM toward the Cooks Gap air pollution monitor are (approximately) those blowing from the east-northeast to east.

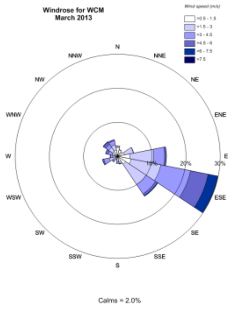
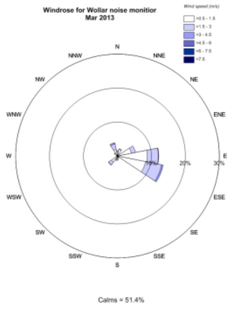
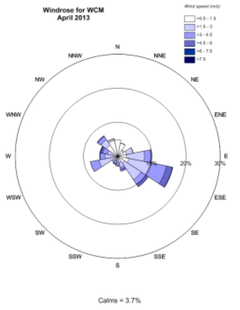
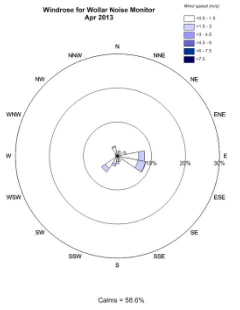
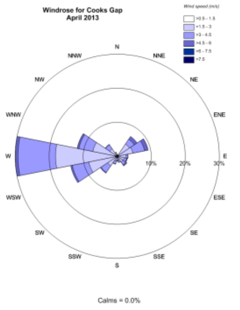
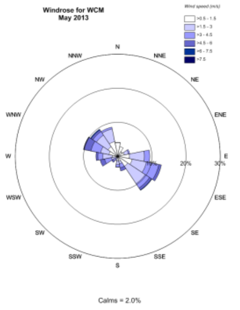
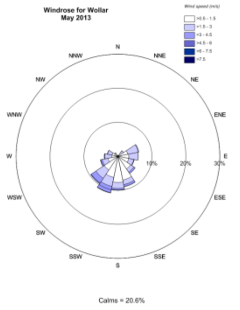
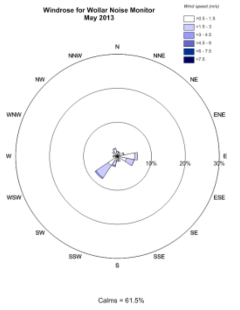
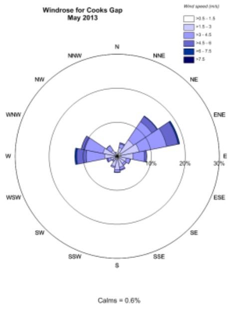
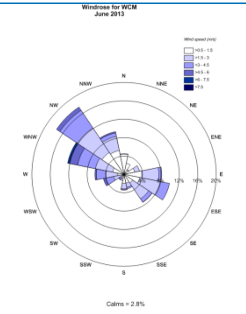
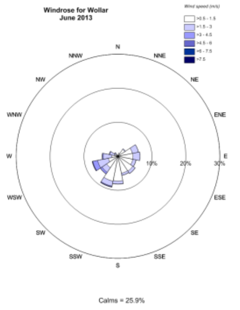
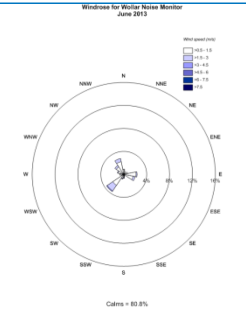
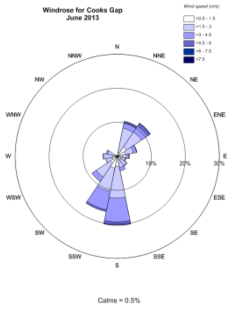
	Wilpinjong mine site (WCM)	Wollar air pollution monitor	Wollar noise monitor	Cooks Gap air pollution monitor
March		Not available due to equipment issues		Not available due to equipment issues
April		Not available due to equipment issues		
May				
June				

Figure 3-3: Windroses

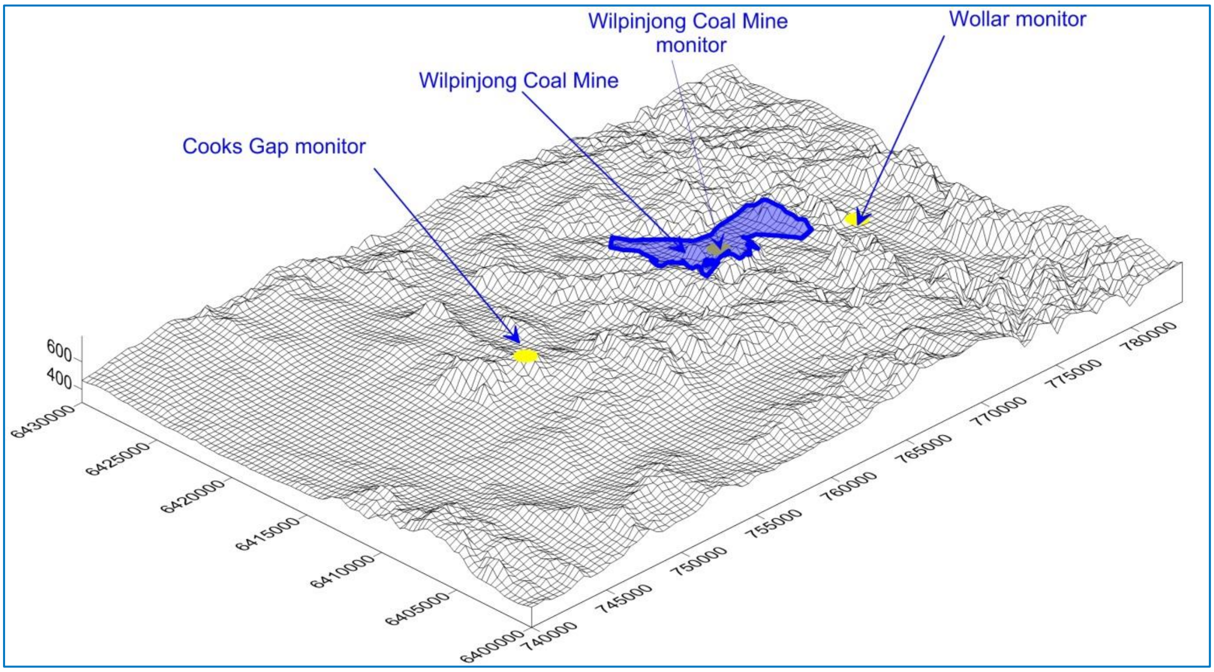


Figure 3-4: Terrain in the vicinity of WCM and the monitoring locations

3.5 Monitored Pollutant Concentrations

3.5.1 Introduction

Table 3-4 presents a summary of the maximum measured concentrations for all pollutants, compared with the relevant assessment criteria detailed in **Section 2.4**.

Section 3.5.2 to **Section 3.5.6** presents further discussion on the measured concentrations for each pollutant.

All measured concentrations are below the relevant assessment criteria, with the exception of one 10-munute SO_2 concentration measured at Cooks Gap which is considered to be an inaccurate result (see **Section 3.5.3** for further details).

Table 3-4: Measured concentrations compared with assessment criteria

Pollutant	Averaging period (basis of criteria)	Goal ppm	Maximum measured	
			Wollar (ppm)	Cooks Gap (ppm)
Toluene (VOC)	1 hour	0.09	0.000673	0.0011
	3 minutes (odour)	0.17	0.00075	0.008
	3 minutes (toxicity)	3.2		
Xylenes (VOC)	1 hour	0.04	0.00025	0.00081
	3 minutes (odour)	0.08	0.00067	0.001
	3 minutes (toxicity)	2.7		
Pollutant	**Averaging period**	**ppm**	**Wollar (ppm)**	**Cooks Gap (ppm)**
Sulfur dioxide (SO_2)	10 minutes	0.25	0.047	0.382*
	1 hour	0.2	0.015	0.036
	24 hours	0.08	0.0025	0.0047
	Annual	0.02	N/A	N/A
Nitrogen dioxide (NO_2)	1 hour	0.12	0.017	0.025
	Annual	0.03	N/A	N/A
Benzene (VOC)	1 hour	0.009	0.00036	0.001
	3 minutes (carcinogen)	0.017	0.00041	0.00823
Hydrogen sulfide (H_2S)	1 hour	0.005	0.002	0.0014
PAHs (as benzo[a]pyrene)	1 hour	0.4**	0.0025**	N/A

* As discussed in **Section 3.5.3**, this is considered to be an anomalous result.

**units are µg/m^3

3.5.2 Nitrogen dioxide (NO_2)

The 1-hour average NO_2 concentrations measured at Wollar Village and Cooks Gap are presented in **Figure 3-5**. All the measured concentrations are significantly below the NEPM ambient air quality criterion of 0.12 ppm.

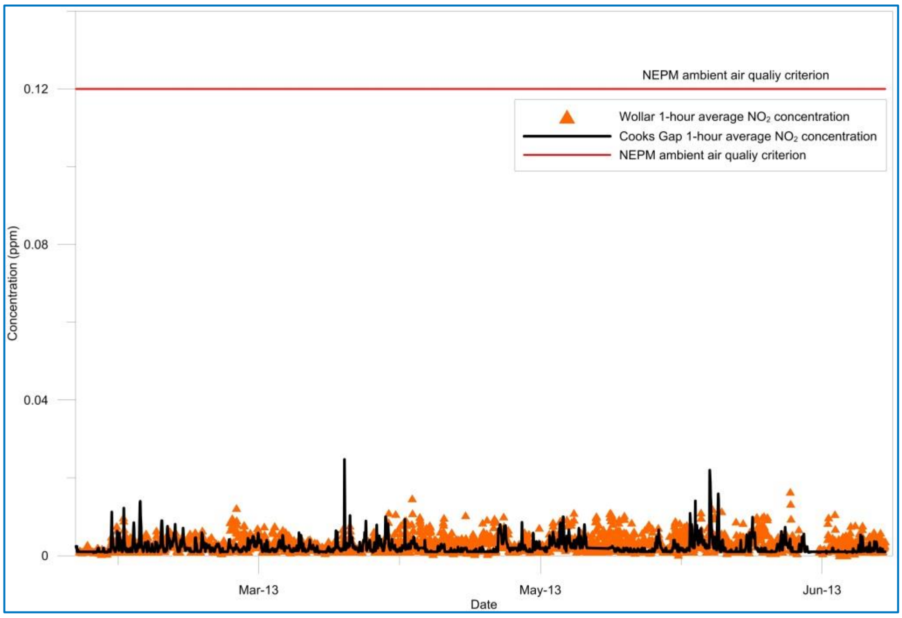


Figure 3-5: 1-hour average NO_2 concentrations (ppm)

3.5.3 Sulfur dioxide (SO_2)

The 10-minute average SO_2 concentrations measured at Wollar Village and Cooks Gap are presented in **Figure 3-6**. All the measured concentrations at Wollar Village are significantly below the NSW EPA impact assessment criterion of 0.25 ppm.

The Cooks Gap data shows one 10-minute average which exceeds the impact assessment criteria. Analysis of the raw 5-minute average data shows that there were two consecutive periods (on 12 June at 9.05 am and 9.10 am) with elevated concentrations of 0.382 ppm and 0.380 ppm, respectively. However, there were no data recorded for the five minutes immediately prior to these elevated concentrations and no data recorded until 20 minutes after the elevated reading at 9.10 am. As the recorded concentrations at 9.00 am and 9.30 am (i.e. immediately before and after the elevated concentrations were recorded) were 0.001 ppm, it is considered that this measured concentration is as a result of equipment malfunction, as opposed to being a true elevated reading.

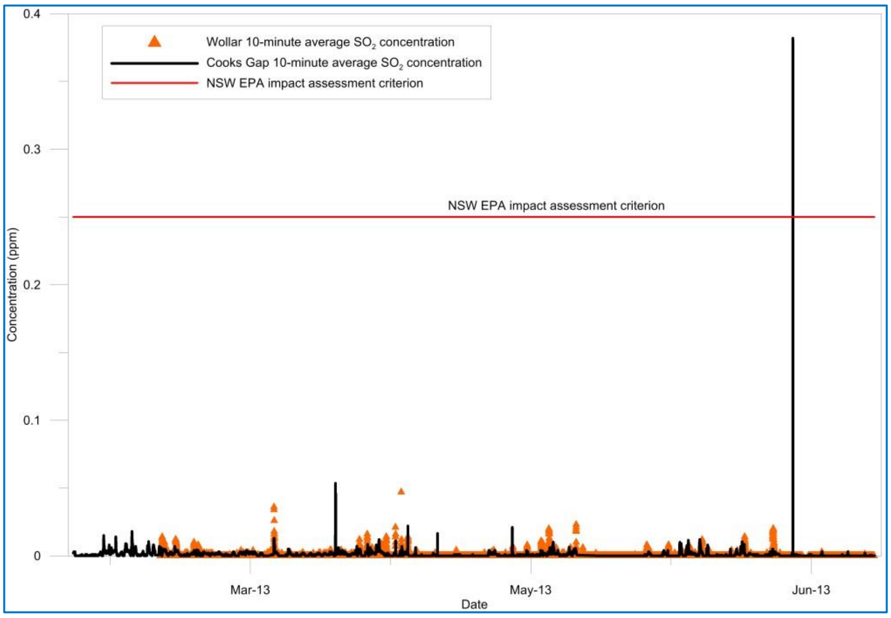


Figure 3-6: 10-minute average SO_2 concentrations (ppm)

3.5.4 Hydrogen sulfide (H_2S)

As discussed in **Section 2.3.3**, H_2S can be smelt at very low concentrations. The characteristic odour of rotten eggs is the most common complaint related to spontaneous combustion events. **Table 3-5** presents a summary of the time and date of each complaint received by the WCM, together with a description of the complaint received.

Table 3-5: Summary of complaints received during monitoring campaign

Date	Location	Time	Description
14/03/2013	Wollar	8:51 AM	Odour
2/04/2013	Wollar	8:36 AM	Spon. com. odour
8/04/2013	Wollar	7:54 AM	Spon. com. odour
12/04/2013	Wollar	7:58 AM	Spon. com. odour
14/04/2013	Wollar	8:24 AM	Odour
15/04/2013	Wollar	6:23 AM	Sulfur odour
20/04/2013	Wollar	8:13 AM	Sulfur odour
22/04/2013	Wollar	8:42 AM	Sulfur odour
25/04/2013	Wollar	8:22 AM	Sulfur odour
27/04/2013	Wollar	8:03 AM	Odour
29/04/2013	Wollar	8:00 AM	Sulfur odour
1/05/2013	Wollar	8:34 AM	Odour
12/05/2013	Wollar	7:06 PM	Sulfur odour
15/05/2013	Wollar	8:34 AM	Sulfur odour
17/05/2013	Wollar	8:32 PM	Sulfur odour
21/05/2013	Wollar	8:32 AM	Sulfur odour
27/05/2013	Wollar	9:00 AM	Sulfur odour
30/05/2013	Wollar	9:32 AM	Gas smell
5/06/2013	Wollar	8:39 AM	Odour
22/06/2013	Wollar	8:30 AM	Odour

Figure 3-7 and **Figure 3-8** show the 1-hour average H_2S concentrations for Wollar Village and Cooks Gap, respectively. The plots also show when complaints regarding odour were received by WCM, and the average H_2S concentrations for the preceding hour.

The 1-hour average concentrations at both Wollar Village and Cooks Gap are significantly below the NZ MfE guideline value for ambient air.

There are occasions when a complaint coincided with higher H_2S concentrations. However the majority of complaints were received when no H_2S was detected by the monitor. It is important to note that the lowest concentration of H_2S that the monitor can record is 0.001 ppm, therefore any concentration equal to or greater than 0.0005 ppm will be reported as 0.001 ppm, but any concentration lower than 0.0005 ppm (for example, 0.00049 ppm) will be reported as 0 ppm. As discussed in **Section 2.3.3**, the odour threshold of H_2S has been reported to be as low as 0.0005 ppm, which would have been recorded as 0.001 ppm. However, due to the level of detection afforded by the monitor, it is possible concentrations close to the lowest detectable limit of 0.0005 ppm have been measured but recorded as 0 ppm and that there are members of the local population that are extremely sensitive to H_2S odour at concentrations below the level at which the monitors can detect it, but can be detected by a human nose.

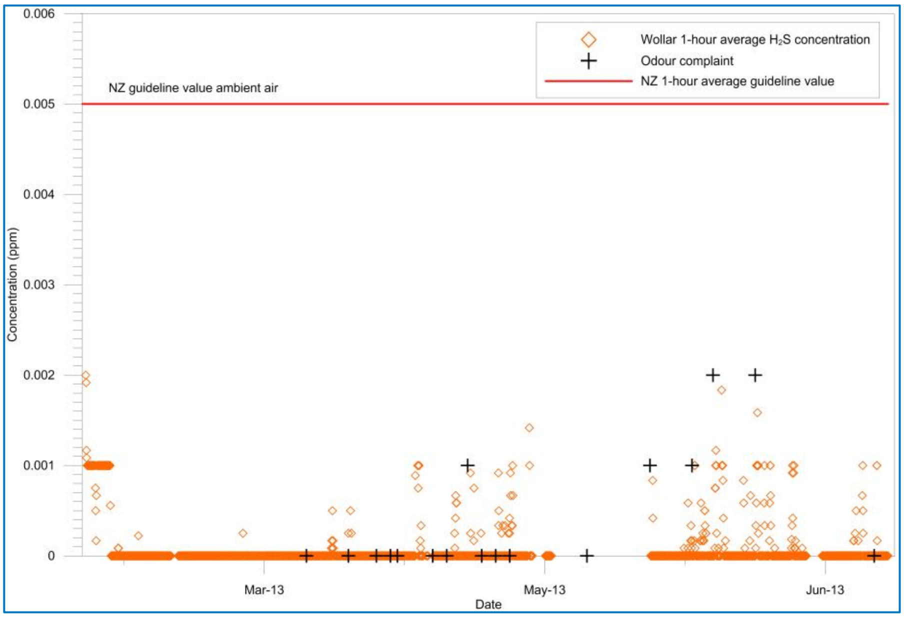


Figure 3-7: 1-hour average H_2S concentrations - Wollar (ppm)

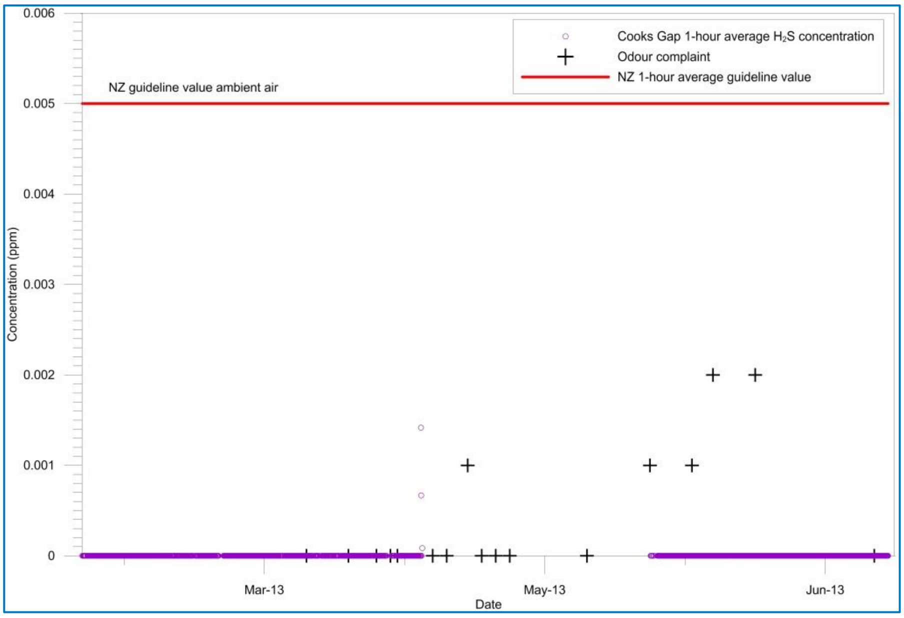


Figure 3-8: 1-hour average H_2S concentrations – Cooks Gap (ppm)

3.5.5 Volatile organic compounds

Samples of volatile organic compounds were collected and analysed using two different techniques:

- Summa canisters[a] can be used to measure a much wider range of VOCs than field gas chromatography. A canister was deployed at both sites on 15 and 29 May and exposed for 24-hours.
- Field gas chromatography was completed by Ecotech to measure concentrations of benzene, toluene and xylene every 5-minutes.

As shown in **Table 3-6**, the results from the summa canisters were almost all below the Level of Recognition (LOR). The LOR is the lowest level the monitoring equipment can measure. Concentrations that were above the LOR are shown shaded.

Section 3.5.5.1 to **Section 3.5.5.4** discuss the field gas chromatography results for benzene, toluene and xylene, and summa canister results for those pollutants where concentrations above the LOR were recorded.

Table 3-6: Summa canister VOC results (ppb)

Compound	LOR (ppb)	Wollar	Cooks Gap	Wollar	Cooks Gap
		15-May-13		29-May-13	
Freon 12	0.5	**0.6**	**0.6**	<0.5	<0.5
Chloromethane	0.5	**0.6**	**0.5**	**0.8**	**1.1**
Freon 114	0.5	<0.5	<0.5	<0.5	<0.5
Vinyl chloride	0.5	<0.5	<0.5	<0.5	<0.5
Bromomethane	0.5	<0.5	<0.5	<0.5	<0.5
Chloroethane	0.5	<0.5	<0.5	<0.5	<0.5
Freon 11	0.5	<0.5	<0.5	<0.5	<0.5
1.1-Dichloroethene	0.5	<0.5	<0.5	<0.5	<0.5
Dichloromethane	0.5	**0.5**	<0.5	<0.5	<0.5
Freon 113	0.5	<0.5	<0.5	<0.5	<0.5
1.1-Dichloroethane	0.5	<0.5	<0.5	<0.5	<0.5
cis-1.2-Dichloroethene	0.5	<0.5	<0.5	<0.5	<0.5
Chloroform	0.5	<0.5	<0.5	<0.5	<0.5
1.2-Dichloroethane	0.5	<0.5	<0.5	<0.5	<0.5
1.1.1-Trichloroethane	0.5	<0.5	<0.5	<0.5	<0.5
Benzene	0.5	<0.5	<0.5	<0.5	<0.5
Carbon Tetrachloride	0.5	<0.5	<0.5	<0.5	<0.5
1.2-Dichloropropane	0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethene	0.5	<0.5	<0.5	<0.5	<0.5
cis-1.3-Dichloropropylene	0.5	<0.5	<0.5	<0.5	<0.5
trans-1.3-Dichloropropene	0.5	<0.5	<0.5	<0.5	<0.5
1.1.2-Trichloroethane	0.5	<0.5	<0.5	<0.5	<0.5
Toluene	0.5	**1.7**	<0.5	**0.7**	**0.5**
1.2-Dibromoethane (EDB)	0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethene	0.5	<0.5	<0.5	<0.5	<0.5
Chlorobenzene	0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	1.0	<1.0	<1.0	<1.0	<1.0
Styrene	0.5	<0.5	<0.5	<0.5	<0.5
1.1.2.2-Tetrachloroethane	0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	0.5	<0.5	<0.5	<0.5	<0.5
4-Ethyltoluene	0.5	<0.5	<0.5	<0.5	<0.5
1.3.5-Trimethylbenzene	0.5	<0.5	<0.5	<0.5	<0.5
1.2.4-Trimethylbenzene	0.5	<0.5	<0.5	<0.5	<0.5
1.3-Dichlorobenzene	0.5	<0.5	<0.5	<0.5	<0.5
1.4-Dichlorobenzene	0.5	<0.5	<0.5	<0.5	<0.5
1.2-Dichlorobenzene	0.5	<0.5	<0.5	<0.5	<0.5
1.2.4-Trichlorobenzene	0.5	<0.5	<0.5	<0.5	<0.5
Hexachlorobutadiene	0.5	<0.5	<0.5	<0.5	<0.5

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[a] A Summa canister is a stainless steel container that has had the internal surfaces specially passivated (i.e. the material is treated to become "passive," so it is less affected by environmental factors such as air or water) using a "Summa" process. This process combines an electropolishing step with a chemical deactivation step to produce a surface that is nearly chemically inert. A Summa surface has the appearance of a mirror: bright, shiny and smooth. The degree of chemical inertness of a whole air sample container is crucial to minimizing reactions with the sample and maximizing recovery of target compounds from the container.

3.5.5.1 Benzene

Figure 3-9 shows the 5-minute average concentrations of benzene as measured using field gas chromatography, together with the LOR for the summa canisters. The summa canisters recorded no benzene concentrations above the LOR.

All the measured concentrations from gas chromatography are significantly below the relevant EPA Victoria design criterion to protect against the carcinogenic effects of benzene.

Whilst there are some spikes of higher concentrations in the Cooks Gaps data, the highest concentration of 8.26 ppb (measured at 10.35 am on 18 April 2013) is considered to be an irregularity in the data. The previous concentration measured was 0.01 ppb at 9am, there are no recorded concentrations from 9am until the maximum measured at 10.35am. Following this there are no measured concentrations until 2.35 pm when a value of 0 ppb was recorded. On average, both sites measure similar concentrations.

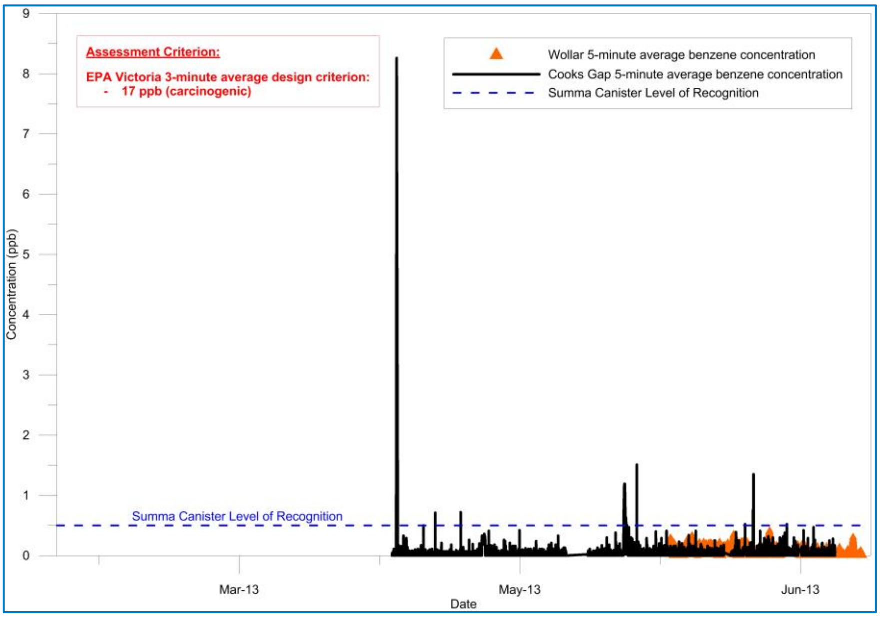


Figure 3-9: 5-minute average benzene concentrations (ppb)

3.5.5.2 Toluene

Figure 3-10 shows the 5-minute average concentrations of toluene as measured using field gas chromatography, together with the maximum measured concentration from the summa canisters.

The maximum measured toluene concentration was 1.7 ppb on 15 May. Since the summa canisters are exposed for 24 hours, it is not accurate to make a direct comparison against the air quality standards, which are based on a 3-minute averaging period. However, all the measured concentrations from gas chromatography are significantly below the relevant EPA Victoria design criterion to protect against odour issues and the higher concentration design criteria to protect against the toxic effects.

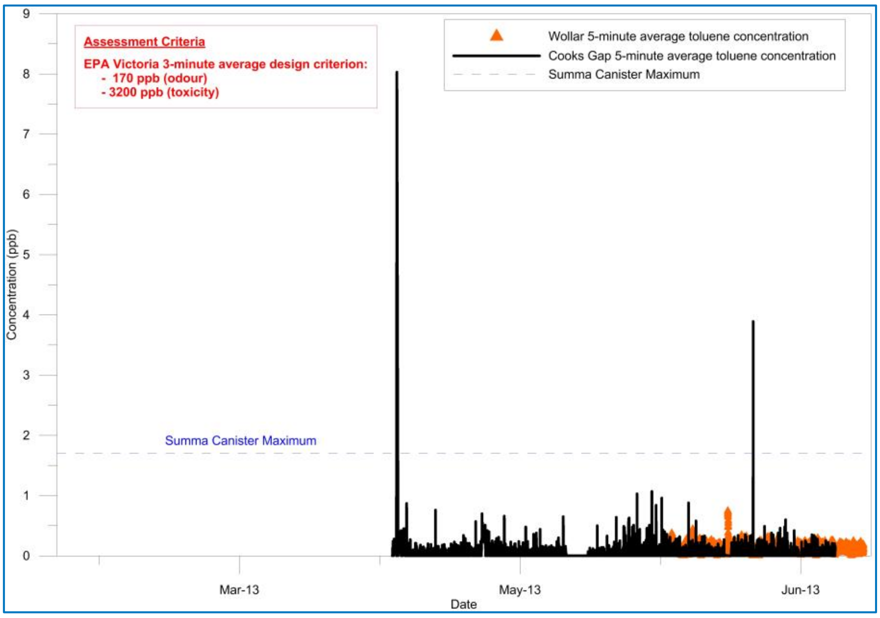


Figure 3-10: 5-minute average toluene concentrations (ppb)

3.5.5.3 Xylene

Figure 3-11 shows the 5-minute average concentrations of xylene as measured using field gas chromatography, together with the LOR for the summa canisters. The summa canisters recorded no xylene concentrations above the LOR.

All the measured concentrations from gas chromatography are significantly below the relevant EPA Victoria design criterion to protect against odour issues and the higher concentration design criteria for to protect against the toxic effects.

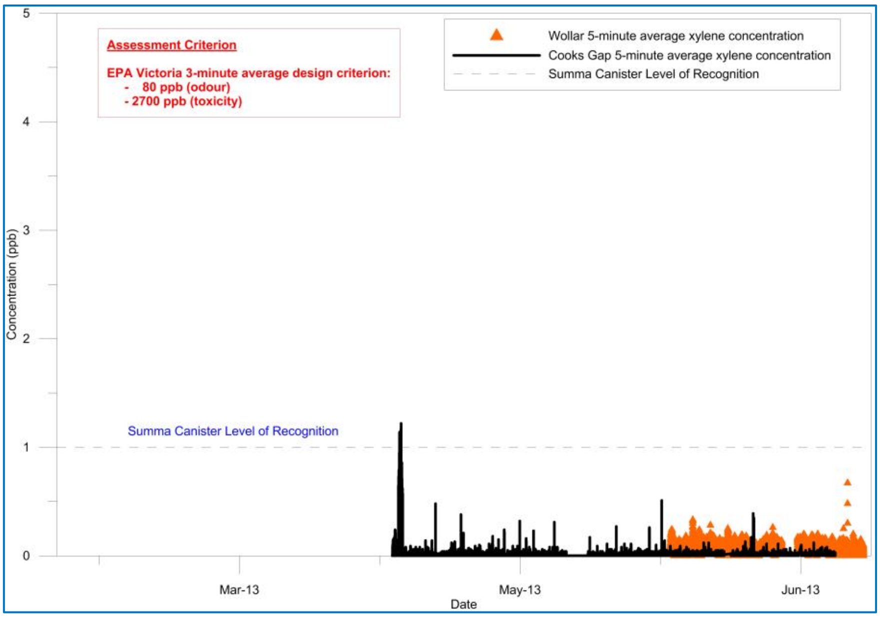


Figure 3-11: 5-minute average xylene concentrations (ppb)

3.5.5.4 Other VOCs

The only other VOCs that were detected by the summa canisters were Freon-12, Chloromethane, Dichloromethane.

Freon-12 is a refrigerant and aerosol spray propellant. Manufacturing of Freon-12 was discontinued in the 1990s due to concerns relating to the ozone layer. Freons remain in the atmosphere for many years and their presence in air samples is not unusual. The maximum measured concentration was 0.6 ppb on 15 May at both sites, only just above the LOR of 0.5 ppb. There are no air quality standards for Freon-12.

Chloromethane was also once widely used as a refrigerant. The maximum measured concentration was 1.1 ppb on 29 May at Cooks Gap. NSW EPA sets an impact assessment criterion of 0.9 ppm (900 ppb) for a 1-hour average. Since the summa canisters are exposed for 24 hours, it is not accurate to make a direct comparison, however, even if all the measured chloromethane had been detected by the canisters in a single one hour period, it is significantly below the assessment criteria.

Dichloromethane (also known as methylene chloride) is used as a solvent. The maximum measured concentration was 0.5 ppb on 15 May at Wollar. NSW EPA sets an impact assessment criteria of 0.9 ppm (900 ppb) for a 1-hour average. Since the summa canisters are exposed for 24 hours, it is not accurate to make a direct comparison, however, even if all the measured dichloromethane had been detected by the canisters in a single one hour period, it is significantly below the assessment criteria.

Whilst these chloromethane and dichloromethane do have odours associated with them, Freon 12 is an odourless gas. An odour complaint was received on 15 May, which coincides with the highest concentration of dichloromethane, however, the odour detection thresholds (that is, the concentration above which they can be smelt) is significantly higher than the measured concentration. It is therefore unlikely that these are responsible for odour complaints. The odour thresholds are:

Chloromethane:	10 ppm (10,000 ppb)
Dichloromethane:	250 ppm (250,000 ppb)

3.5.6 Polycyclic aromatic hydrocarbons (PAHs)

PAH concentrations were determined by ALS by analysing the filter papers from the high volume air sampler (HVAS) in Wollar. A summary of the results is presented in **Table 3-7**. The majority of the samples were below the level of recognition (LOR) of the analysis method. Those that were above the LOR are shown as shaded.

In order to determine compliance with the NSW EPA impact assessment criterion, the recorded values of micrograms (μg) per filter paper is combined with the flow-rate through the HVAS to determine the concentration. The concentration of each PAH is then multiplied by a potency equivalency factor (PEF) and summed to express the total PAH concentration as "benzo[a]pyrene equivalents". The result is numerically equivalent to summing up risks attributable to individual PAH in the mixture for comparison against criterion (see **Table 3-8**). Based on this analysis, all measured PAH levels are significantly below the NSW impact assessment criteria.

Table 3-7: Summary of PAH results (µg/filter paper)

		Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Chrysene
Sample Run Date	**Sample Run Time**	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*
05/10/2012	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
11/10/2012	48:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
17/10/2012	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
23/10/2012	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
29/10/2012	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
04/11/2012	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
10/11/2012	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
16/11/2012	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
22/11/2012	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
28/11/2012	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
04/12/2012	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
10/12/2012	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
16/12/2012	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
22/12/2012	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
09/01/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
15/01/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
21/01/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
27/01/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
02/02/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
08/02/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
16/02/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
26/02/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
04/03/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
10/03/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
16/03/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
22/03/2013	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
28/03/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
03/04/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
09/04/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
15/04/2013	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
21/04/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
29/04/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
03/05/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
09/05/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
15/05/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
21/05/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
27/05/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20

Table 3-4 continued

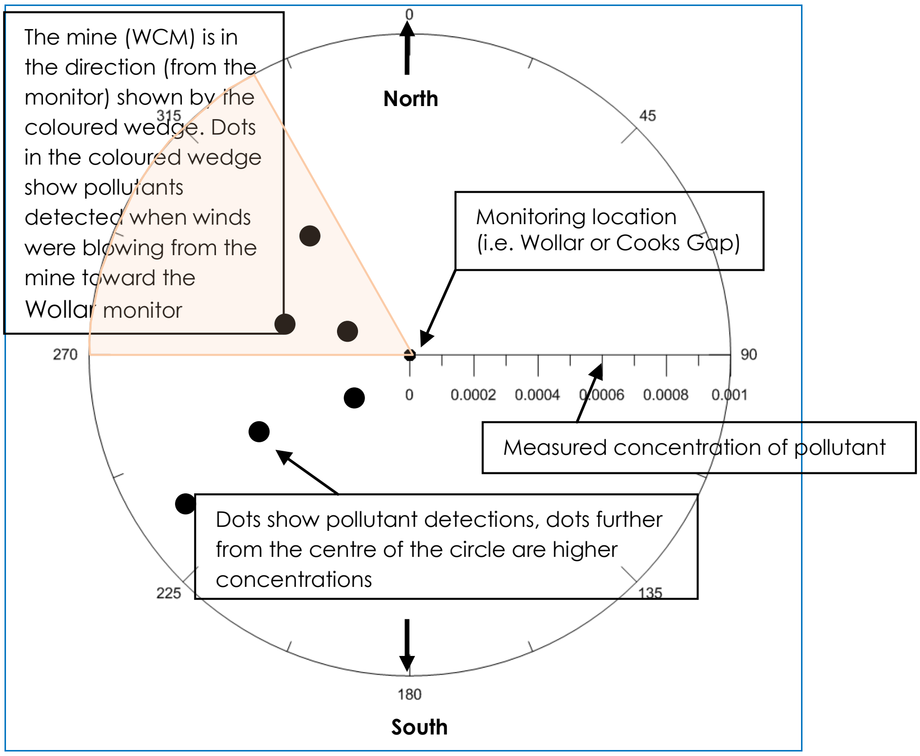
Sample Run Date	Sample Run Time	Benzo(a)anthracene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3.cd)pyrene	Dibenzo(a,h)anthracene	Benzo(g.h.i)perylene
		Level of Recognition (LOR) (µg)						
		0.05	0.05	0.05	0.05	0.05	0.05	0.05
05/10/2012	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
11/10/2012	48:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
17/10/2012	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
23/10/2012	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
29/10/2012	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
04/11/2012	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
10/11/2012	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
16/11/2012	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
22/11/2012	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
28/11/2012	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
04/12/2012	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
10/12/2012	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
16/12/2012	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
22/12/2012	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
09/01/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
15/01/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
21/01/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
27/01/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
02/02/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
08/02/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
16/02/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
26/02/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
04/03/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
10/03/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
16/03/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
22/03/2013	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
28/03/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
03/04/13	24:00	<0.20	<0.20	<0.20	<0.20	0.22	<0.20	0.23
09/04/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
15/04/2013	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
21/04/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
29/04/13	24:00	<0.20	<0.20	<0.20	0.21	0.24	<0.20	0.26
03/05/13	24:00	<0.20	0.32	<0.20	<0.20	<0.20	<0.20	<0.20
09/05/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
15/05/13	24:00	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
21/05/13	24:00	<0.20	0.43	<0.20	<0.20	<0.20	<0.20	<0.20
27/05/13	24:00	<0.20	0.30	<0.20	<0.20	<0.20	<0.20	<0.20

Table 3-8: PAH as benzo[a]pyrene equivalents (µg/m^3)

Date	***PAH***	***µg/filter***	***µg/m^3***	***PEF***	***BaP equivalency (µg/m^3)***	***Total BaP equivalent (µg/m^3) Criteria = 0.4 µg/m^3***
03/04/13	Benzo(g.h.i)perylene	0.23	0.0002	0.1	0.00002	0.00002
29/04/13	Benzo(a)pyrene	0.21	0.0002	1	0.00020	0.00025
	Indeno(1.2.3.cd)pyrene	0.24	0.0002	0.1	0.00002	
	Benzo(g.h.i)perylene	0.26	0.0003	0.1	0.00003	
03/05/13	Benzo(a)anthracene	0.32	0.0003	0.1	0.00003	0.00003
21/05/13	Benzo(a)anthracene	0.43	0.0004	0.1	0.00004	0.00004
27/05/13	Benzo(a)anthracene	0.30	0.0003	0.1	0.00003	0.00003

3.6 Pollution Roses

Pollution roses can be a helpful tool in understanding where pollutants are coming from. They show pollutant concentrations detected at monitors for different wind directions. The concentrations shown on the pollution roses cannot necessarily be compared against air quality criteria, as they typically represent averaging times different to the criteria. However they are useful in determining the source of the pollution. **Figure 3-12** shows an explanation of the different components of a pollution rose.



The mine (WCM) is in the direction (from the monitor) shown by the coloured wedge. Dots in the coloured wedge show pollutants detected when winds were blowing from the mine toward the Wollar monitor

Monitoring location (i.e. Wollar or Cooks Gap)

Measured concentration of pollutant

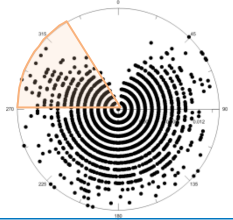
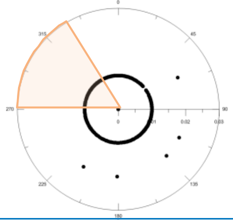
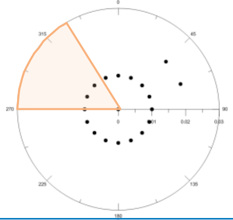
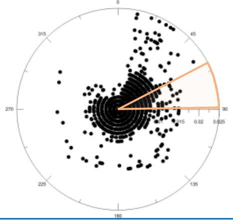
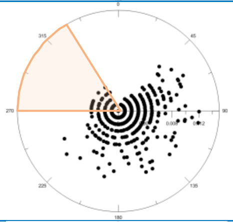
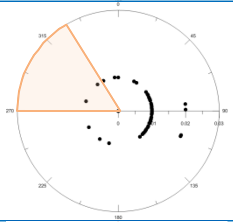
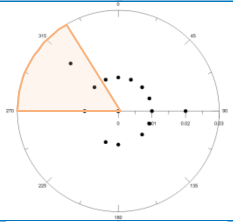
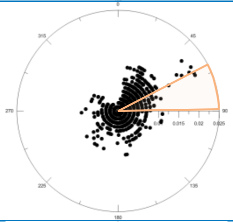
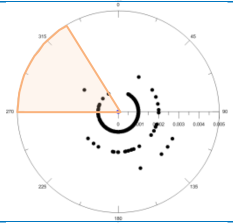
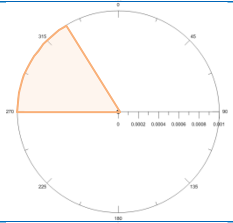
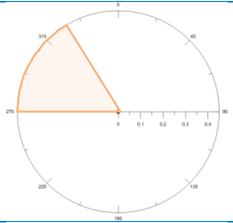
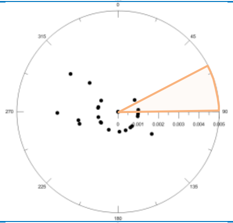
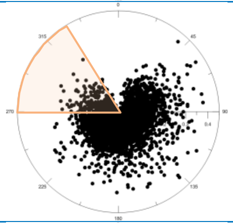
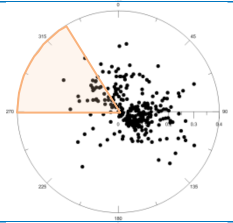
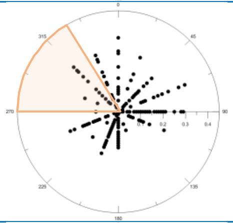
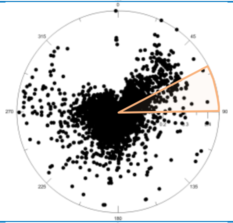
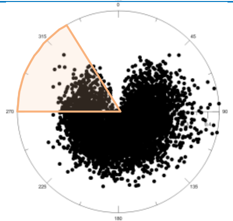
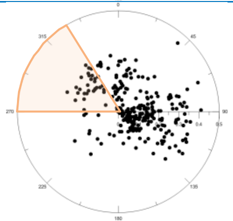
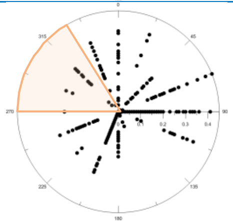
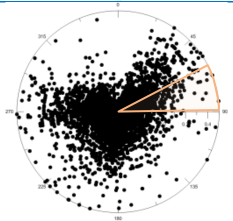
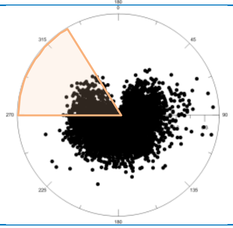
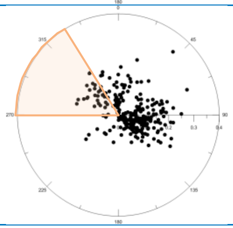
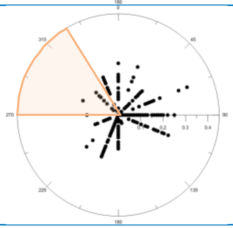
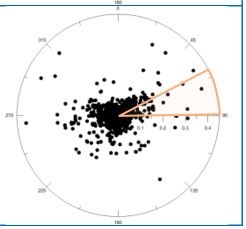
Dots show pollutant detections, dots further from the centre of the circle are higher concentrations

Figure 3-12: How to read pollution roses

Data on pollution concentrations were available for air monitoring sites at Wollar and Cooks Gap from March to June 2013, as listed in **Table 3-1**. Data on wind direction were available at the Cooks Gap and Wollar monitors as discussed in **Section 3.1**.

The pollution roses presented in **Figure 3-13** show that for both the Wollar Village and Cooks Gap monitors, a proportion of pollutant detections occur when winds are blowing from the WCM, however, a much larger proportion of the detections generally occur when winds are not blowing from the WCM.

Without completing a detailed inventory of all pollution sources in the vicinity of the monitors, it is difficult to determine the exact source of the pollutants. However, it is apparent that the WCM is not indicated as the primary source of any pollutant. Other possible sources include local traffic, domestic wood burning, and waste water treatment.

Air pollution measurement location →	Wollar air pollution monitor	Wollar air pollution monitor	Wollar air pollution monitor	Cooks Gap air pollution monitor
Wind data used →	Wollar air pollution monitor	WCM	Wollar Noise monitor	Cooks Gap air pollution monitor
	Wind data averaging period			
Pollutant	5 minute	15 minute	15 minute	5 minute
NO$_2$				
SO$_2$				
H$_2$S				
Benzene				
Toluene				
Xylene				

* PAH results are based on the analysis of HVAS filter papers and since HVASs typically operate continuously for 24 hours, it is not possible to identify if levels vary with the prevailing wind direction and are therefore not included.

Figure 3-13: Pollution roses for each pollutant

4 CONCLUSIONS AND FUTURE MONITORING

This report presents an overview of the pollutants that can be released from spontaneous combustion events and analysed monitoring data from a range of pollutants collected at two monitoring locations close to the WCM (Wollar and Cooks Gap) between March and June 2013.

All measured concentrations of NO_2, benzene, toluene and xylene and other VOCs were significantly below the relevant assessment criteria.

Other than one ten-minute period, which is likely to be related to equipment malfunction, all SO_2 concentrations are also below relevant assessment criteria.

Whilst the H_2S concentrations are all below the relevant ambient air quality criteria, there are occasions when a complaint coincided with higher H_2S concentrations. This could explain some of the odour complaints received. However, whilst the pollution roses show that a proportion of pollutant detections occur when winds are blowing from the WCM, a much larger proportion of the detections generally occur when winds are not blowing from the WCM.

Whilst it is difficult to determine the source of these pollutants on the basis of the pollution roses, it is apparent from these data that the WCM is not indicated as the primary source of any pollutant.

Given the low concentrations of all pollutants measured, and that there is no clear indication the WCM is the primary source of any of them, it is difficult to make any recommendations for ongoing monitoring. Fence-line monitoring of H_2S concentrations could be used as early detection measure that a spontaneous combustion event is occurring, however, there are currently no known applications of monitoring of this type in the mining industry.

5 REFERENCES

Carras J., Day S., Saghafi A. and Roberts O.C. (2005)
"Spontaneous Combustion in Open Cut Coal Mines – Recent Australian Research" proceedings of Coal Operators Conference, University of Wollongong & the Australian Institute of Mining and Metallurgy, 2005, 195-200.

Day, Stuart (2008)
"Spontaneous Combustion in Open Cut Coal Mines" prepared by CSIRO Energy Technology (ACARP Project C17006). May 2008.

Day, S., Azzi, M., Fry, R., Garland, E., Jacyna, D., Javanmard, H., Patterson, M., & Tibbett, A. (2013)
"Emissions from Blasting in Open Cut Coal Mining" prepared by CSIRO Energy Technology (ACARP Project C18034). June 2013.

NSW DEC (2005)
"Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW", August 2005.

NSW EPA (2012)
"NSW State of the Environment 2012" published by State of NSW and Environment Protection Authority. Available from http://www.environment.nsw.gov.au/soe/soe2012/index.htm

Ruth, J.H. (1986)
"Odor thresholds and irritation levels of several chemical substances: A review." Am. Ind. Hyg. Assoc. J. 47(3):A142-A151.

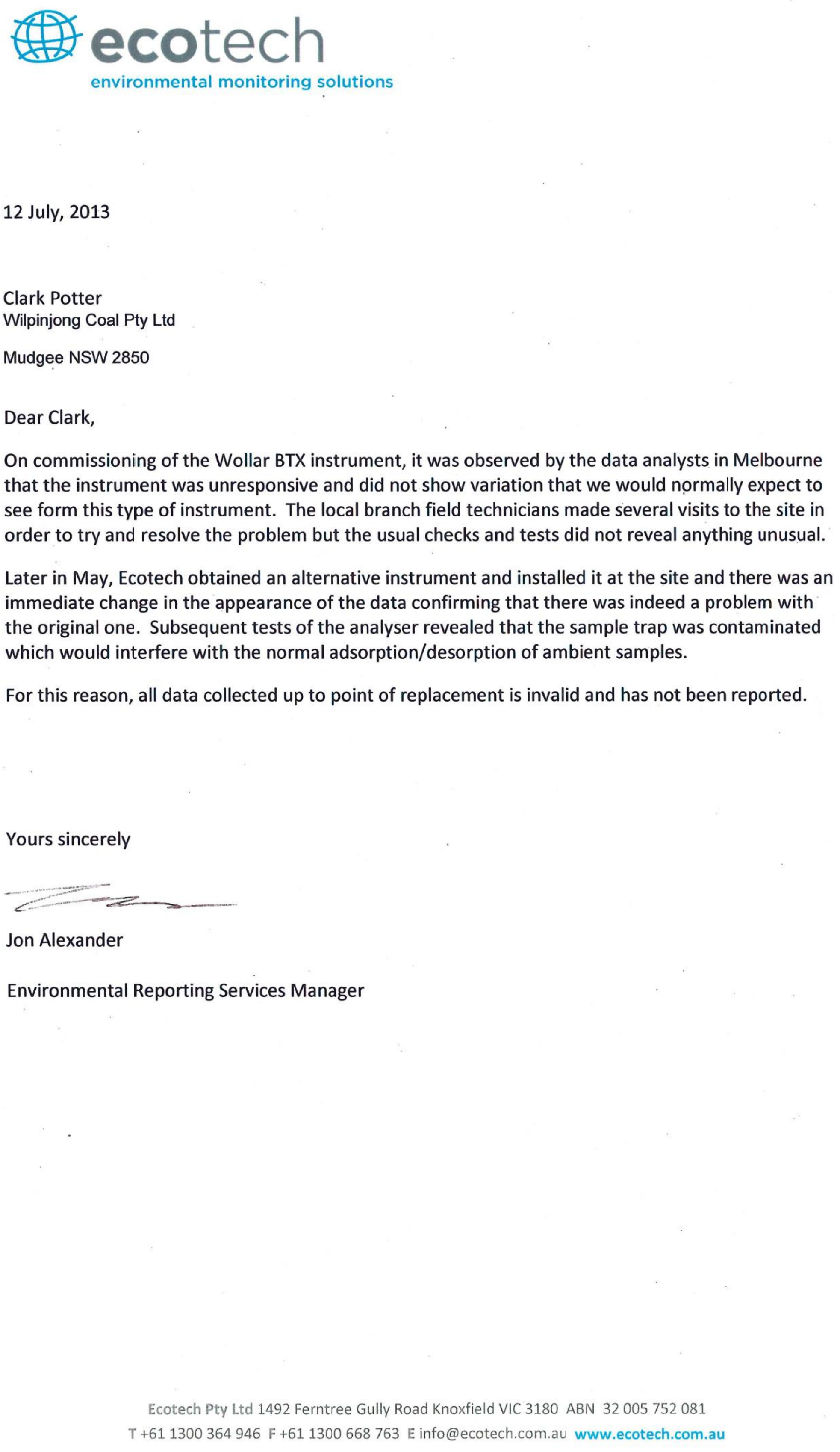
US EPA (2003)
"Toxicological review of hydrogen sulfide (CAS No. 7783-06-4) in support of summary information on the Integrated Risk Information System (IRIS)" EPA/635/R-03/005. Available from http://www.epa.gov/iris/toxreviews/0061tr.pdf

Victorian Government Gazette (2001)
"State Environment Protection Policy (Air Quality Management)", No. S 240, Friday 21 December 2001, Government of Victoria, Melbourne.
http://www.gazette.vic.gov.au/gazette/Gazettes2001/GG2001S240.pdf

World Health Organisation (2003)
"Hydrogen sulfide: Human health aspects" Concise International Chemical Assessment Document 53. World Health Organization, Geneva, 2003 Available from http://www.who.int/ipcs/publications/cicad/en/cicad53.pdf

Ministry for the Environment (2002)
"Ambient Air Quality Guidelines. 2002 Update" Air Quality Report No 32 Published in May 2002 by the Ministry for the Environment PO Box 10-362, Wellington, New Zealand ISBN: 0-478-24064-3 ME number: 438. Available from http://www.mfe.govt.nz/publications/air/ambient-air-quality-may02/ambient-guide-may02.pdf

Appendix A: Wollar BTX Instrument Problems - Ecotech letter



ecotech
environmental monitoring solutions

12 July, 2013

Clark Potter
Wilpinjong Coal Pty Ltd

Mudgee NSW 2850

Dear Clark,

On commissioning of the Wollar BTX instrument, it was observed by the data analysts in Melbourne that the instrument was unresponsive and did not show variation that we would normally expect to see form this type of instrument. The local branch field technicians made several visits to the site in order to try and resolve the problem but the usual checks and tests did not reveal anything unusual.

Later in May, Ecotech obtained an alternative instrument and installed it at the site and there was an immediate change in the appearance of the data confirming that there was indeed a problem with the original one. Subsequent tests of the analyser revealed that the sample trap was contaminated which would interfere with the normal adsorption/desorption of ambient samples.

For this reason, all data collected up to point of replacement is invalid and has not been reported.

Yours sincerely

Jon Alexander

Environmental Reporting Services Manager

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Appendix B: Ecotech credentials

ABOUT ECOTECH

At Ecotech, design, manufacture, supply and service of turn-key environmental instrumentation is our core business. Unlike many other resellers or suppliers, we specialize in this field rather than it being a peripheral business. Ecotech has over 35 years of experience in provision of both emission and ambient air monitoring systems and services, highlighting the experience that we can bring to you. Our resources are second to none in Australia, with total personnel of 120, including 6 staff in the Sydney office. We employ a high proportion of technical staff that possesses high level expertise allowing them to safely and effectively perform work at your site(s).

With Branches in Brisbane, Sydney, Perth and the Head Office in Melbourne, Ecotech is uniquely positioned to respond and mobilise quickly to address any equipment faults or breakdowns as they arise for any site location. Ecotech have consistently demonstrated a strong commitment to numerous CEMS and ambient clients throughout Australia, and we have the capability and resources to respond promptly and effectively to service requests outside the normal routine.

Ecotech is Australian owned, ISO9001 certified and is recognised as one of the world's leading designers and manufacturers of ambient air and emission monitoring systems. Ecotech provides high quality cutting edge environmental monitoring equipment to all corners of the globe and we have won a prestigious export award. This means we have a vast inventory of spares and an in-depth first-hand knowledge and understanding of equipment. We do not claim to be perfect, but what sets us apart is the tenacity and speed with which we resolve any unforeseen technical issues that may arise from time to time in a supplied monitoring solution.

Ecotech is the only Australian based manufacturer of air pollution monitoring equipment. This ensures that our field engineers are factory trained on a continuous basis. Furthermore, field engineers have the support and an established communication channel to the design and manufacturing team as required. As a manufacturing facility, Ecotech also maintains a vast inventory of spares and consumables to remedy equipment failure at short turnaround times. Our competitors import all equipment, spares and consumables with the resultant disadvantage that their stores carry bare minimum inventory levels, and are exclusively subject to exchange rate variation.

COMPANY ACCREDITATION AND CERTIFICATIONS

Ecotech is NATA/ISO17025 accredited for the operation and maintenance of ambient air and continuous emission monitoring systems and was first accredited in 1999. We operate one of the largest networks of monitoring systems in the world, consisting of over 200 sites providing maintenance and data reporting services to customers which include Transurban, Rio Tinto, BHP, Shell to name but a few.

In addition to this, we have accredited safety and environmental certification including AS4801 (safety), ISO14001 (environmental), environmental management policy and a drug and alcohol policy. Copies of these can be found in the Attachments and all other documents required can be provided upon request.

NATA
WORLD RECOGNISED
ACCREDITATION
Accredited for compliance with ISO/IEC 17025

Accreditation No. 14184

NCS INTERNATIONAL CERTIFIED ENVIRONMENTAL MANAGEMENT SYSTEM ISO14001

NCS INTERNATIONAL CERTIFIED QUALITY MANAGEMENT SYSTEM ISO9001

JAS-ANZ

Ecotech has accredited certification to the ISO 9001 & ISO 14001 Standards.
Certification Number: 12897

ECOTECH CONCISE CAPABILITY STATEMENT

1. Australian owned and operated for more than 35 years.

2. Specializes in the design, manufacture, integration, installation, maintenance and operation of ambient air and emissions monitoring systems as well as water monitoring equipment. Equipment designed and manufactured by Ecotech includes ambient air analysers, Integrating Nephelometers, High Volume Air Samplers, gas dilution calibration systems, zero air generators, data acquisition systems, data collection and reporting software and much of the ancillary equipment used in ambient and emission monitoring systems.

3. Ecotech is an internationally recognized manufacturer of an extensive range of air pollution monitoring instrumentation and sampling equipment.

4. ISO 9001, ISO17025, ISO 14001 and AS4801 certified

5. NATA accredited for the operation and maintenance of ambient air and continuous emission monitoring systems.

6. Dedicated field engineers and technicians strategically situated in Melbourne, Sydney, Perth, Karratha, Port Hedland and Brisbane for the effective execution of operation and maintenance activities.

7. Dedicated team of engineers and scientists performing daily data checks, data validation and reporting tasks from a centralized base at Head Office according to NATA requirements.

8. Ecotech is Australian based but globally focused with a network of highly trained distributors spread throughout the world. Ecotech is actively exporting to all parts of the world which includes Asia, North and South America, Africa and Europe.

9. Ecotech employs around 100 experienced personnel distributed throughout Australia, of which a very high percentage is qualified and employed in a technical role.

10. Ecotech ploughs a considerable amount of annual revenue back into R&D.

11. The Head Office in Melbourne consists of designated areas for the testing centre / master calibration laboratory, Systems integration and testing facility, Service facility, Operation and Maintenance Centre, Research & Development Facility, Stores and Dispatch Facilities. This facility also includes a water flow calibration rig as well as the only Australian NATA certified calibration facility for solar radiation sensors and anemometer.

12. Our product range includes:
    - Ambient air quality monitoring systems & analysers
    - Portable and fixed site particulate sampling systems
    - Meteorological monitoring systems
    - Source emissions monitoring systems
    - Data acquisition systems and reporting software
    - Gas analyser calibration systems
    - Aerosol analysers
    - Water & wastewater samplers
    - Water quality analysers
    - Toxic gas monitors
    - Process gas analysers
    - Blast monitors

Appendix C: Ecotech Monitoring Report

ecotech
environmental monitoring solutions

Accredited for compliance with ISO/IEC 17025.

Accreditation No. 14184.

Peabody Energy

Wilpinjong Coal – Wollar and Cook's Gap stations

Ambient Air Quality Monitoring

Validated Report (Amended)

1st March 2013 – 31st May 2013

Report No.: DAT7272

Report issue date: 24/07/2013

Maintenance contract: MC951

ECOTECH PTY LTD. ABN: 32005752081

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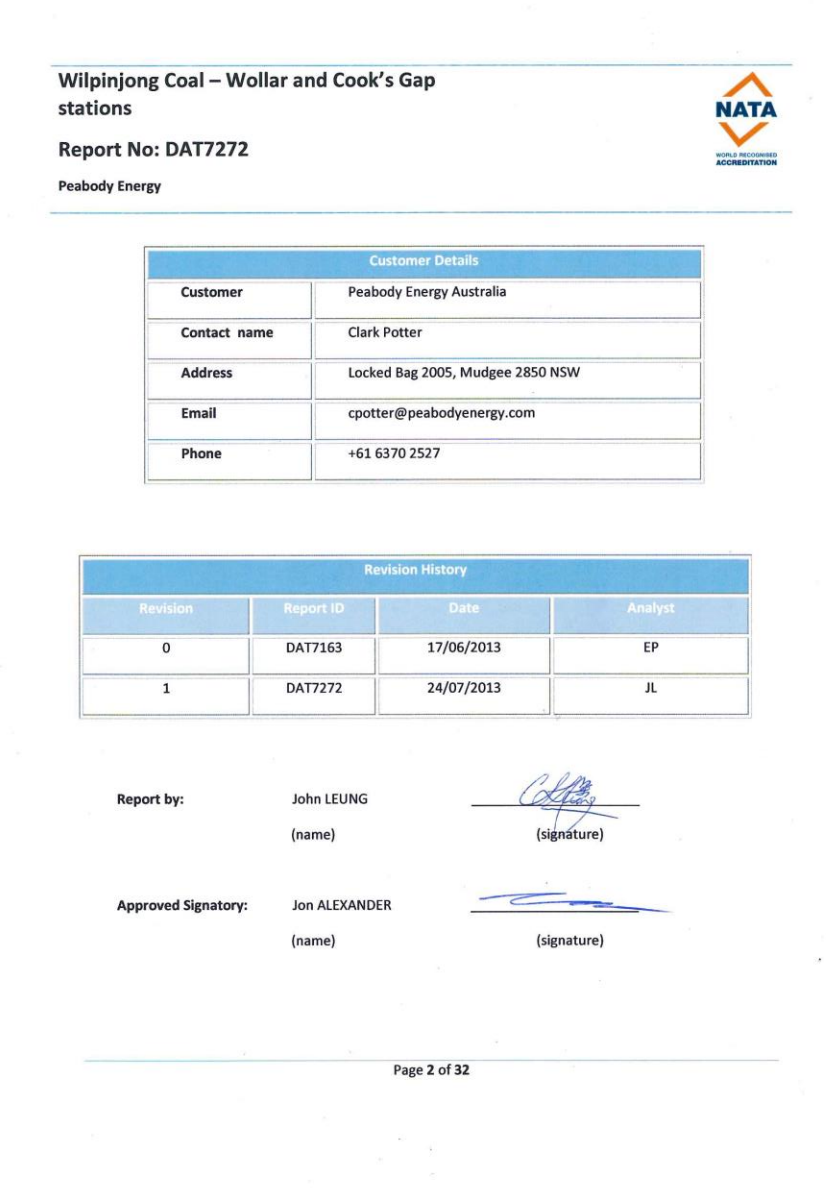

Wilpinjong Coal – Wollar and Cook's Gap stations

Report No: DAT7272

Peabody Energy

NATA
WORLD RECOGNISED ACCREDITATION

Customer Details	
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Revision History

Revision	Report ID	Date	Analyst
0	DAT7163	17/06/2013	EP
1	DAT7272	24/07/2013	JL

Report by: John LEUNG (name) (signature)

Approved Signatory: Jon ALEXANDER (name) (signature)

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Wilpinjong Coal – Wollar and Cook's Gap stations

Report No: DAT7272

Peabody Energy

Executive Summary

Peabody Energy has commissioned Ecotech P/L to conduct air quality monitoring for the Wilpinjong Mine at Wollar and Cook's Gap. The Wilpinjong monitoring network is currently comprised of two ambient monitoring stations, both equipped to measure NO, NO_2, NOx, SO_2, H_2S, Benzene, Toluene and p-Xylene. A wind sensor is installed at both stations.

The Wollar and Cook's Gap stations were commissioned in March 2013.

This report presents the data collected from the Wollar and Cook's Gap stations during the months of March to May 2013. Data capture for the different pollutants is presented in the table 1.

1.0 Introduction

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

This report presents the data for March to May 2013.

The data presented in this report:

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

2.0 Monitoring and Data Collection

2.1. Siting Details

The Wilpinjong Mine sites consist of two ambient air quality monitoring stations. The station's location and siting details are described below.

Table 1: Wilpinjong Mine monitoring sites locations

Site Name	Geographical Coordinates	Height Above Sea Level (m)
Wilpinjong Wollar	Lat: -32.360105 Long: 149.949509	366
Wilpinjong Cook's Gap	Lat: -32.371403 Long: 149.707931	625

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.

For meteorological monitoring only:

The monitoring station has been installed in accordance with the guidelines in *AS 3580.14:2011 "Methods for sampling and analysis of ambient air – Meteorological monitoring for ambient air quality monitoring applications*". Significant deviations from the guidelines are included in section 2.3.1 below.

Figure 1: Wilpinjong Mine Monitoring Station Locations

2.2. Monitored Parameters

Table 2 below details the parameters monitored and the instruments used at Wilpinjong Mine monitoring stations. 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 stations

Parameter Measured	Instrument and Measurement Technique
BTEX (Benzene, Toluene, 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

2.3. Data Collection Methods

Table 3 below shows the methods used for data collection. Any deviations from the stated methods are detailed in section 2.3.1.

Table 3: Methods

Parameter Measured	Data Collection Methods Used	Description of Method
NO, NO_2, NO_x	AS 3580.5.1-1993	Methods for sampling and analysis of ambient air. Method 5.1: Determination of oxides of nitrogen – chemiluminescence method
	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
Benzene, toluene, *para*-xylene	Gas Chromatography Synspec GC955 Series Manual	TBA
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

Parameter Measured	Data Collection Methods Used	Description of Method
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

2.3.1. Compliance with Standards

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

Measurement of wind data does not comply with standard/method 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. This statement will be removed from future reports when the certificate is obtained from the Ecotech branch.

2.3.2. Data Acquisition

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

2.4. Data Validation and Reporting

2.4.1. 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.

2.4.2. Reporting

The reported data is in a Microsoft Excel format file named "Wilpingjong Coal Validated Data Report March – May 2013.xls" included as an appendix to this report The Excel file consists of 8 Excel worksheets:

1. Cover
2. Wollar 5 Minute Averages
3. Wollar 1 Hour Averages
4. Wollar 24 Hour Averages
5. Cook's Gap 5 Minute Averages
6. Cook's Gap 1 Hour Averages
7. Cook's Gap 24 Hour Averages
8. 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 02:00am is for the data collected from 1:00am to 2:00am. One hour averages are calculated based on a clock hour. One day averages are calculated based on calendar days.

3.0 Air Quality Goals

The air quality goals for pollutants monitored at the Wilpinjong Mine Wollar and Cook's Gap sites are based on the Australian National Environmental Council (NEPC) Ambient Air Quality NEPM. The air quality goals are shown in Table 4 below.

Table 4: Wilpinjong Mine Wollar and Cook's Gap Air Quality Goals

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

4.0 Calibrations and Maintenance

4.1. 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 5: 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
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)	m/s to 15 m/s
Vector Wind Direction	Deg	1 deg	±4 deg (K factor of 2.11)	0 deg to 360 deg

---

[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.

4.2. Maintenance

4.2.1. 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.

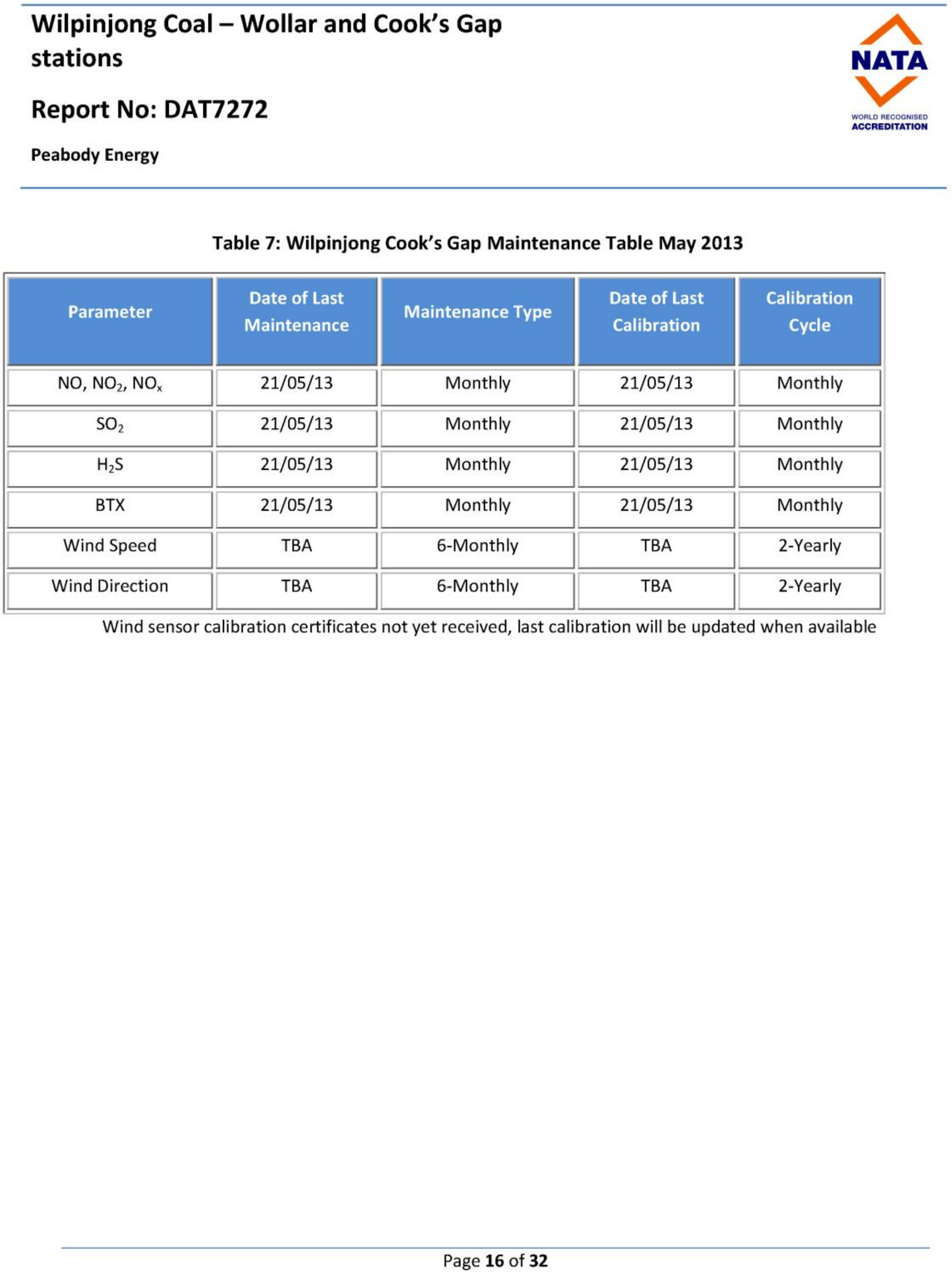
> Note: Maintenance and calibration dates may differ, as calibrations may be less frequent than scheduled maintenance visits.

Tables 6 and 7 indicate when the gas and meteorological equipment were last maintained / calibrated.

Table 6: Wilpinjong Wollar Maintenance Table May 2013

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	21/05/13	Monthly	21/05/13	Monthly
SO_2	21/05/13	Monthly	21/05/13	Monthly
H_2S	21/05/13	Monthly	21/05/13	Monthly
BTX	21/05/13	Monthly	21/05/13	Monthly
Wind Speed	TBA	6-Monthly	TBA	2-Yearly
Wind Direction	TBA	6-Monthly	TBA	2-Yearly

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



Wilpinjong Coal – Wollar and Cook's Gap stations

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Table 7: Wilpinjong Cook's Gap Maintenance Table May 2013

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	21/05/13	Monthly	21/05/13	Monthly
SO_2	21/05/13	Monthly	21/05/13	Monthly
H_2S	21/05/13	Monthly	21/05/13	Monthly
BTX	21/05/13	Monthly	21/05/13	Monthly
Wind Speed	TBA	6-Monthly	TBA	2-Yearly
Wind Direction	TBA	6-Monthly	TBA	2-Yearly

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

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5.0 Results

5.1. 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 7 and 8 below displays data capture statistics for May 2013. **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 8: 3 Data Capture for Wilpinjong Wollar Station Sites for March - May 2013

Parameter	Data Capture
NO, NO_2, NO_x	95
SO_2	93
H_2S	**76**
BTX	**9.5***
WS, WD	**31**

Table 9: 3 Data Capture for Wilpinjong Cook's Gap Station Sites for March - May 2013

Parameter	Data Capture
NO, NO_2, NO_x	92
SO_2	91
H_2S	**60**
BTX	**86***
WS, WD	**46**

*The BTX capture rate is calculated from the instrument installation date (17th April 2013) for both Wollar and Cook's Gap Stations.

Graphic Representations

Validated 5 minute data for NO, NO_2, NO_x, SO2, H2S and BTX were used to construct the following graphical representations.

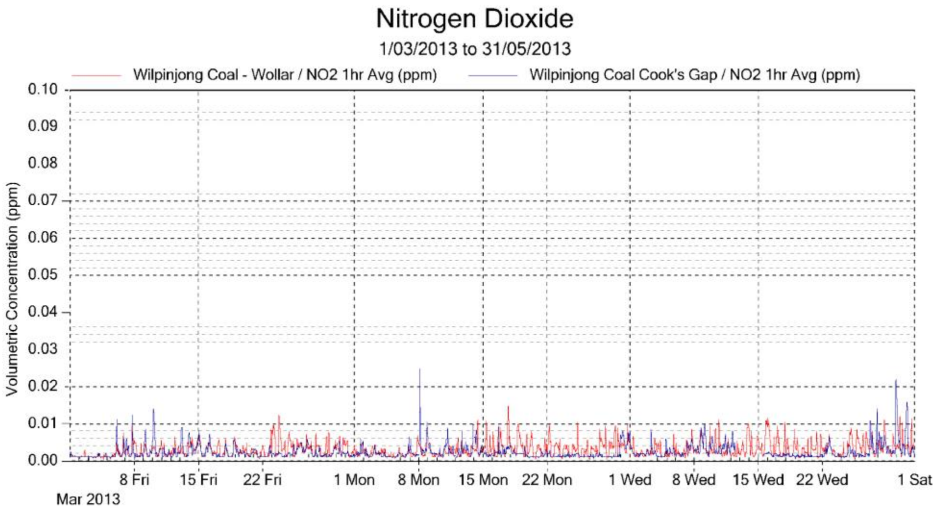

Figure 2: NO2 - 1 hour data for March – May 2013

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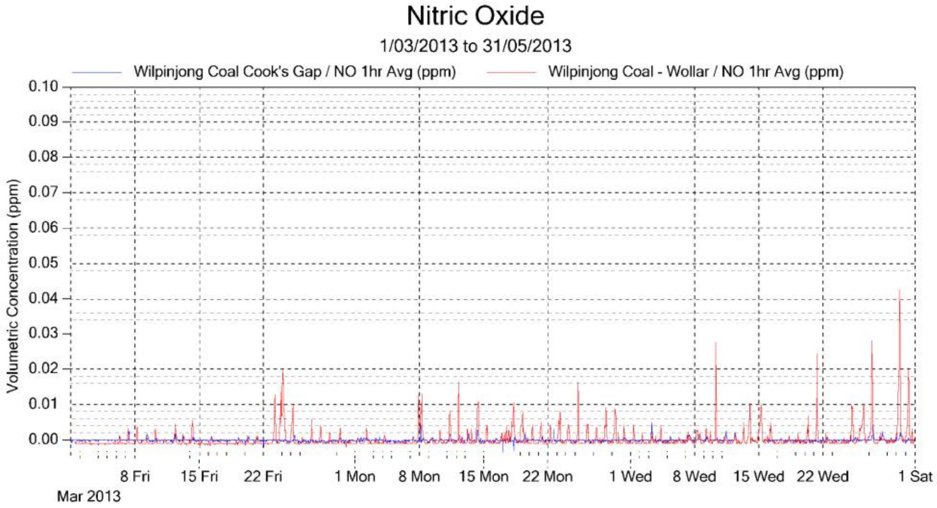


Figure 3: NO - 1 hour data for March – May 2013

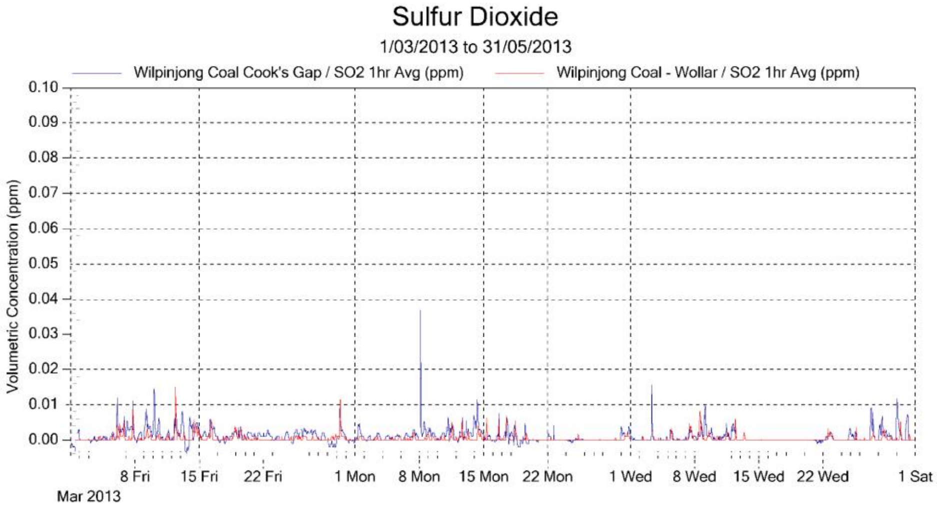


Figure 4: SO_2 - 1 hour data for March – May 2013

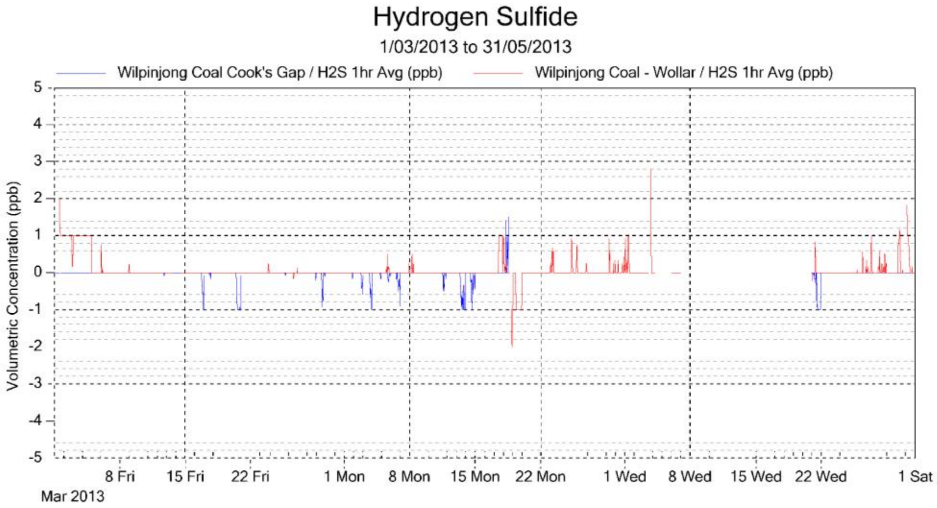


Figure 5: H_2S - 1 hour data for March – May 2013

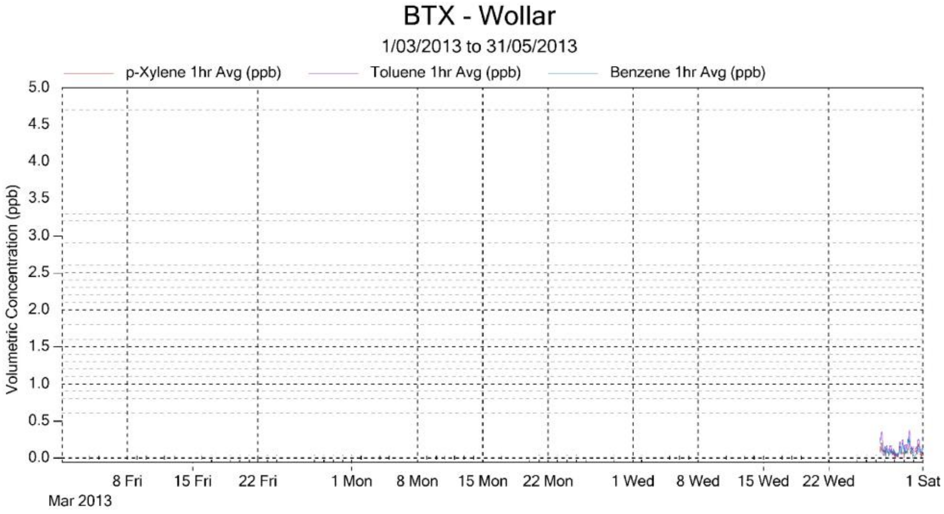


Figure 6: BTX Wollar - 1 hour data for March – May 2013

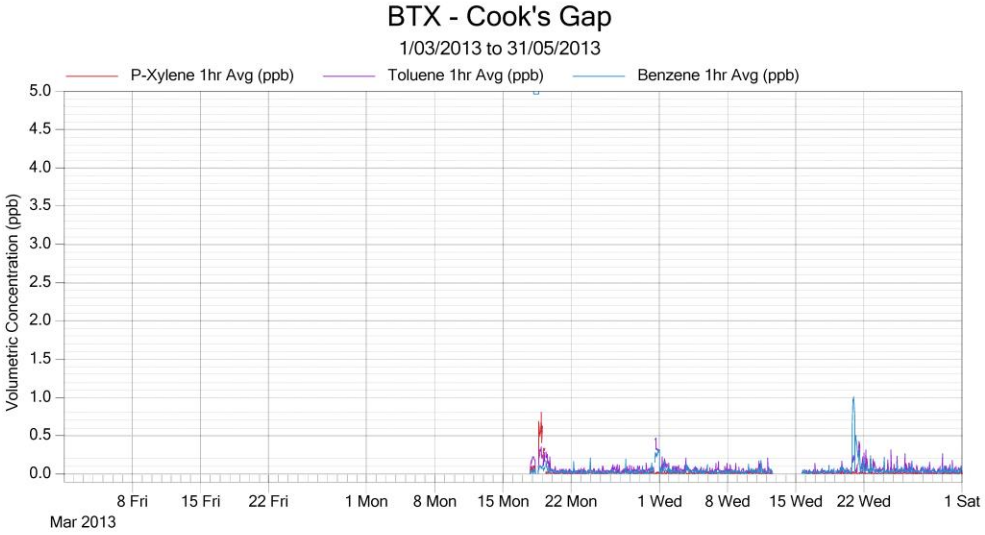


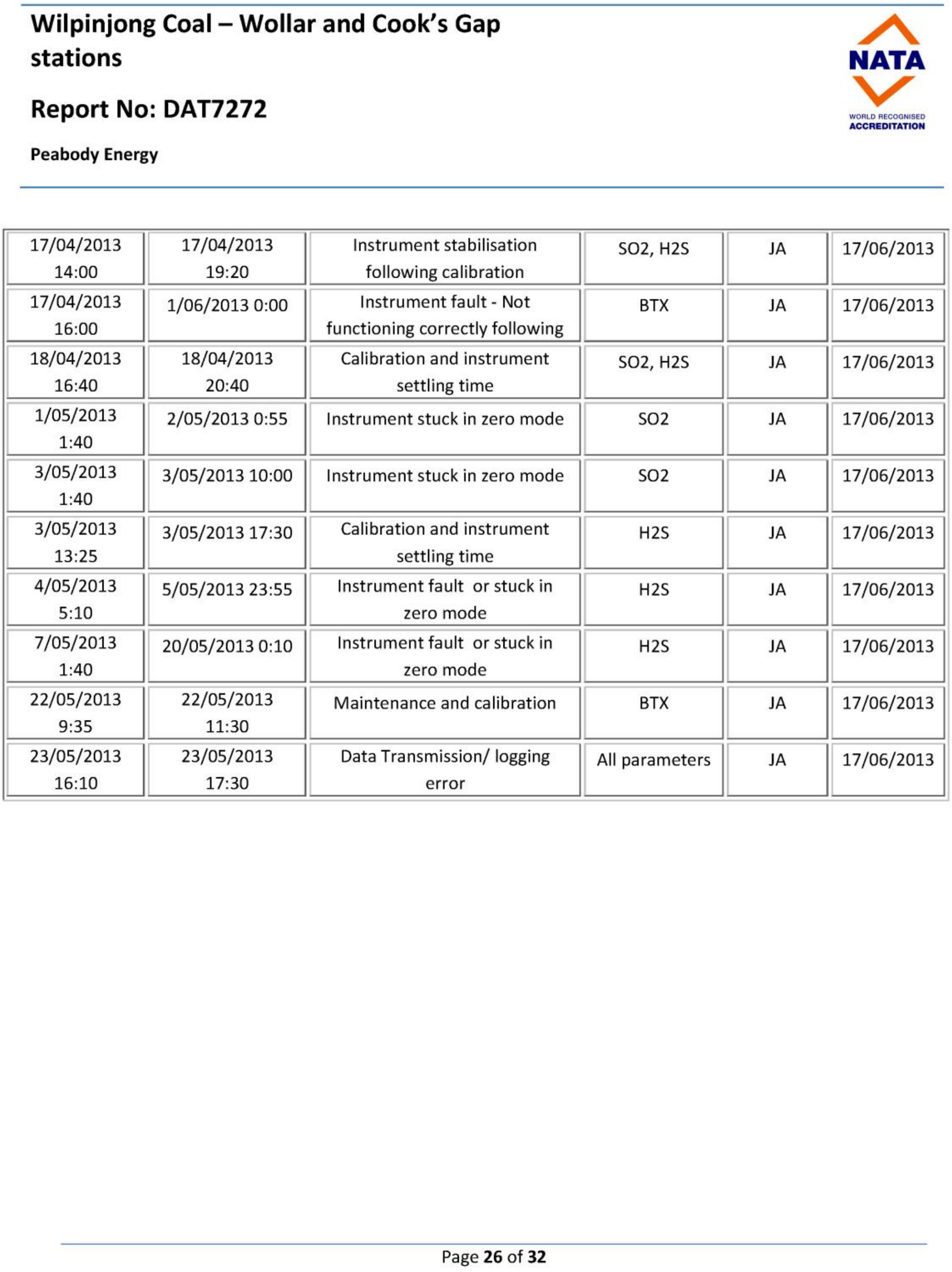
Figure 7: BTX Cooks Gap - 1 hour data for March – May 2013

6.0 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: Wilpinjong Wollar Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
1/03/2013 0:00	1/03/2013 0:05	Installation and commissioning	All parameters	JA	17/06/2013
1/03/2013 0:00	17/04/2013 15:50	Instrument not installed	BTX	JA	17/06/2013
1/03/2013 0:10	3/05/2013 12:25	Installation and commissioning	WSWD	JA	17/06/2013
1/03/2013 16:45	31/05/2013 0:00	Intermittent data transmission errors	All parameters	JA	17/06/2013
1/03/2013 23:50	31/05/2013 0:00	Background reference check 23:50 to 00:05 daily	SO2	JA	17/06/2013
2/03/2013 0:15	31/05/2013 0:00	Background reference check 00:15 to 00:25 daily	H2S	JA	17/06/2013
12/03/2013 14:45	12/03/2013 17:25	Maintenance and calibration	All parameters	JA	17/06/2013
13/03/2013 16:15	13/03/2013 16:15	Maintenance and calibration	NOx, NO, NO2, SO2, H2S	JA	17/06/2013
14/03/2013 14:15	14/03/2013 15:45	Maintenance and calibration	NOx, NO, NO2, SO2, H2S	JA	17/06/2013
21/03/2013 12:25	21/03/2013 13:55	Maintenance and calibration	NOx, NO, NO2, SO2, H2S	JA	17/06/2013
29/03/2013 7:25	10/05/2013 7:45	Intermittent outlier - spikes on NO channel	NOx, NO, NO2	JA	17/06/2013
17/04/2013 11:35	17/04/2013 15:55	Installation and commissioning	BTX	JA	17/06/2013
17/04/2013 13:35	17/04/2013 13:55	Maintenance and calibration	NOx, NO, NO2, SO2, H2S	JA	17/06/2013



17/04/2013 14:00	17/04/2013 19:20	Instrument stabilisation following calibration	SO2, H2S	JA	17/06/2013
17/04/2013 16:00	1/06/2013 0:00	Instrument fault - Not functioning correctly following	BTX	JA	17/06/2013
18/04/2013 16:40	18/04/2013 20:40	Calibration and instrument settling time	SO2, H2S	JA	17/06/2013
1/05/2013 1:40	2/05/2013 0:55	Instrument stuck in zero mode	SO2	JA	17/06/2013
3/05/2013 1:40	3/05/2013 10:00	Instrument stuck in zero mode	SO2	JA	17/06/2013
3/05/2013 13:25	3/05/2013 17:30	Calibration and instrument settling time	H2S	JA	17/06/2013
4/05/2013 5:10	5/05/2013 23:55	Instrument fault or stuck in zero mode	H2S	JA	17/06/2013
7/05/2013 1:40	20/05/2013 0:10	Instrument fault or stuck in zero mode	H2S	JA	17/06/2013
22/05/2013 9:35	22/05/2013 11:30	Maintenance and calibration	BTX	JA	17/06/2013
23/05/2013 16:10	23/05/2013 17:30	Data Transmission/ logging error	All parameters	JA	17/06/2013

Wilpinjong Coal – Wollar and Cook's Gap stations

Report No: DAT7272

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Table 11: Wilpinjong Cook's Gap Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
1/03/2013 0:00	16/04/2013 11:30	Instrument not installed	WS, WD	PC	17/05/2013
1/03/2013 0:00	17/04/2013 18:35	Instrument not installed	BTX	PC	17/05/2013
1/03/2013 0:00	31/05/2013 1:35	Automatic overnight span/zero checks performed every night	NO, NO2, NOx, SO2, H2S	PC	17/05/2013
1/03/2013 12:55	1/03/2013 14:30	Maintenance - Instrument calibration	NO, NO2, NOx, SO2, H2S	PC	17/05/2013
1/03/2013 14:35	1/03/2013 17:50	Instrument stabilisation following maintenance	SO2, H2S	PC	17/05/2013
1/03/2013 15:00	31/05/2013 23:50	Intermittent data transmission errors	NO, NO2, NOx, SO2, H2S, BTX	PC	17/05/2013
13/03/2013 14:10	13/03/2013 14:45	Power failure	All channels	PC	17/05/2013
13/03/2013 16:05	13/03/2013 16:10	Brief power failure	All channels	PC	17/05/2013
13/03/2013 16:15	13/03/2013 16:25	Instrument stabilisation following brief power failure	H2S	PC	17/05/2013
14/03/2013 1:50	18/04/2013 2:50	Intermittent instrument stabilisation following overnight	H2S	PC	17/05/2013
14/03/2013 8:20	14/03/2013 9:20	Instrument stabilisation	H2S	PC	17/05/2013
16/04/2013 11:30	16/04/2013 11:30	Installation and commissioning	WS, WD	PC	17/05/2013
17/04/2013 18:40	17/04/2013 18:40	Installation and commissioning	BTX	PC	17/05/2013
18/04/2013 9:00	18/04/2013 14:30	Maintenance and calibration	BTX	PC	17/05/2013
18/04/2013 14:30	20/05/2013 18:45	Instrument fault	H2S	PC	17/05/2013

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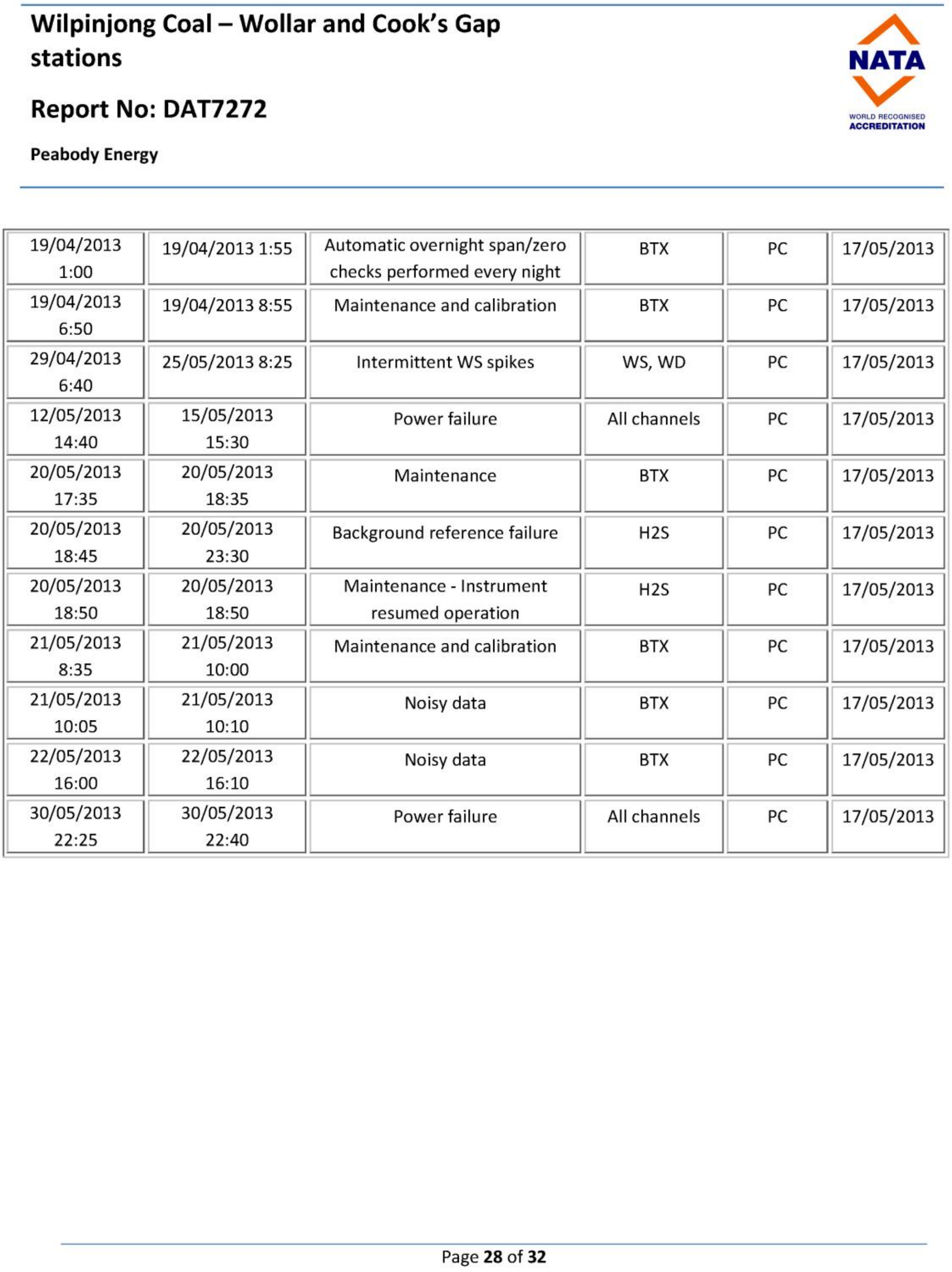

Wilpinjong Coal – Wollar and Cook's Gap stations

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19/04/2013 1:00	19/04/2013 1:55	Automatic overnight span/zero checks performed every night	BTX	PC	17/05/2013
19/04/2013 6:50	19/04/2013 8:55	Maintenance and calibration	BTX	PC	17/05/2013
29/04/2013 6:40	25/05/2013 8:25	Intermittent WS spikes	WS, WD	PC	17/05/2013
12/05/2013 14:40	15/05/2013 15:30	Power failure	All channels	PC	17/05/2013
20/05/2013 17:35	20/05/2013 18:35	Maintenance	BTX	PC	17/05/2013
20/05/2013 18:45	20/05/2013 23:30	Background reference failure	H2S	PC	17/05/2013
20/05/2013 18:50	20/05/2013 18:50	Maintenance - Instrument resumed operation	H2S	PC	17/05/2013
21/05/2013 8:35	21/05/2013 10:00	Maintenance and calibration	BTX	PC	17/05/2013
21/05/2013 10:05	21/05/2013 10:10	Noisy data	BTX	PC	17/05/2013
22/05/2013 16:00	22/05/2013 16:10	Noisy data	BTX	PC	17/05/2013
30/05/2013 22:25	30/05/2013 22:40	Power failure	All channels	PC	17/05/2013

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7.0 Report Summary

- A number of parameters at the Wilpinjong site had capture rates below 95% for the reporting period. This was largely due to late installation of some parameters such as BTX and Met and the failure of the Wollar BTX instrument until it's replacement at the end of May. More details are given in the previous section's tables.

- There were no recorded readings over the Exceedence Levels for the reporting period.

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

Appendix 1 - Definitions & Abbreviations

BTX	Benzene, Toluene and 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.

Automatic span/zero check. The E-Sampler is programmed to perform a zero calibration check whereby air is passed through filter element, removing particulates, before entering the sensor in the analyser. Data is invalidated when these checks occur.

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.

Overnight zero out of tolerance refers to when the automatic zero reading measured by the analyser falls outside the expected 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 start up period of an instrument after power has been restored.

Appendix D: ALS Summa Canister Monitoring Report

ALS Group

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **EN1301834**	Page	: 1 of 6
Client	: **WILPINJONG COAL**	Laboratory	: Environmental Division Newcastle
Contact	: Kieren Bennetts	Contact	: Peter Keyte
Address	: Peabody Energy Locked Bag 2005 MUDGEE NSW 2850	Address	: 5 Rosegum Road Warabrook NSW Australia 2304
E-mail	: kbennetts@peabodyenergy.com	E-mail	: peter.keyte@als.com.au
Telephone	: ----	Telephone	: 61-2-4968-9433
Facsimile	: ----	Facsimile	: +61-2-4968 0349
Project	: BENZENE MONITORING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 17-MAY-2013
Sampler	: CLARK POTTER	Issue Date	: 27-MAY-2013
Site	: ----		
		No. of samples received	: 2
Quote number	: ----	No. of samples analysed	: 2

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

NATA

WORLD RECOGNISED
ACCREDITATION

NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Daniel Junek	Senior Air Analyst	Newcastle
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Page : 2 of 6
Work Order : EN1301834
Client : WILPINJONG COAL
Project : BENZENE MONITORING

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

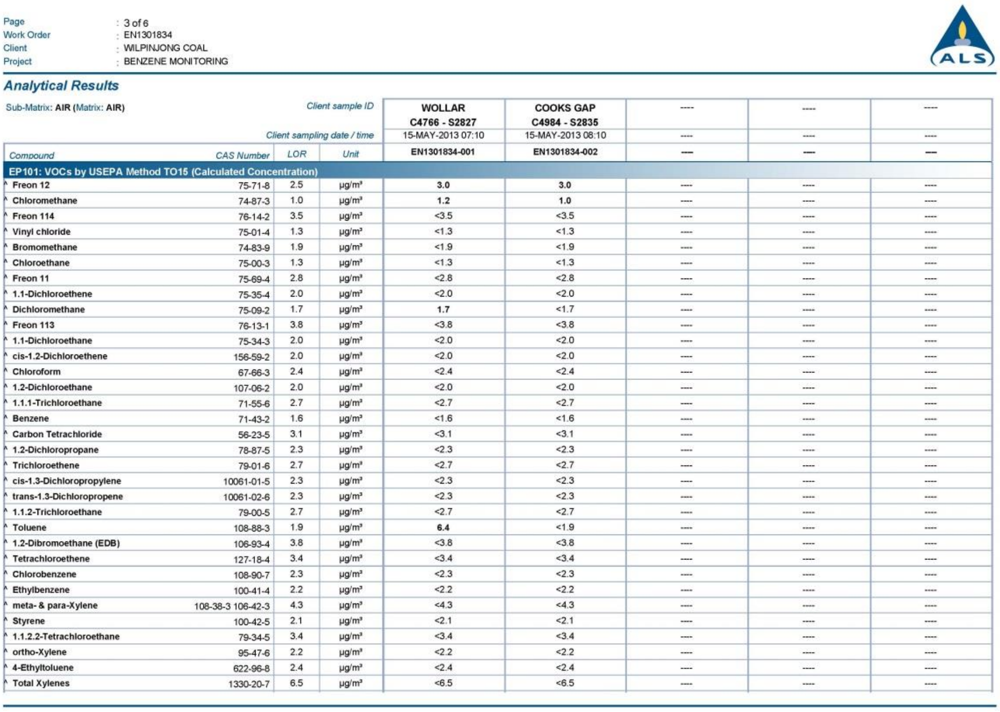
Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **Canister Sampling QA: Results for Pressure - As Received are expressed as an Absolute Pressure. The Gauge Pressure - As Received is equal to this pressure minus the laboratory pressure at the time of measurement.**
- **EP101: Results reported in µg/m³ are calculated from PPBV results based on a temperature of 25°C and atmospheric pressure of 101.3 kPa. µg/m³ results may be corrected to account for actual conditions during sampling.**



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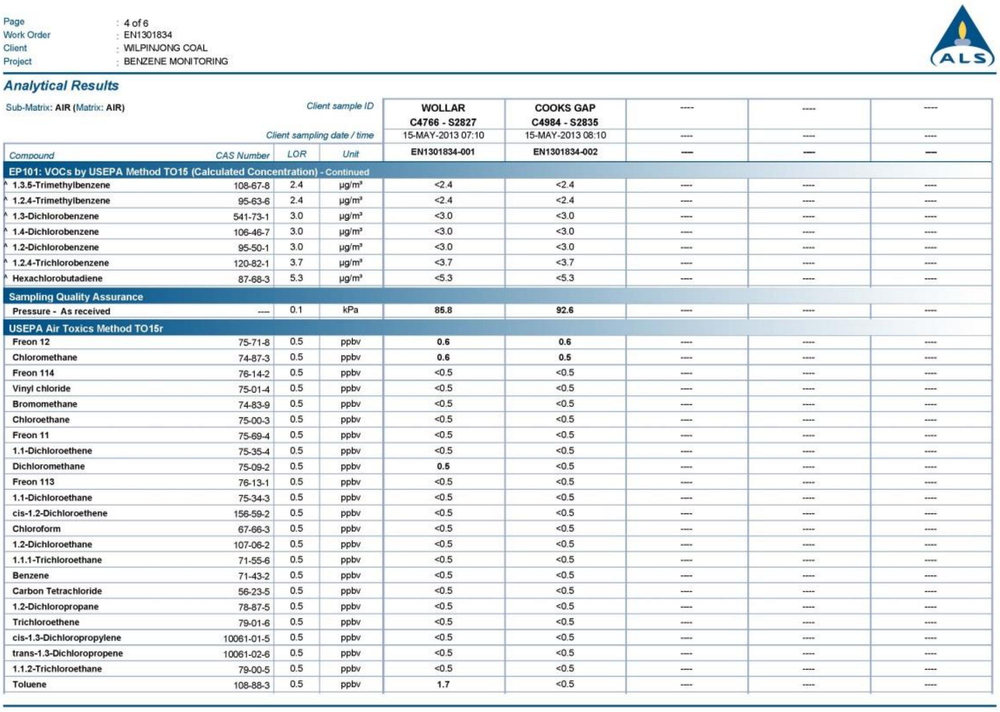
Work Order : EN1301834
Client : WILPINJONG COAL
Project : BENZENE MONITORING

Analytical Results

Sub-Matrix: **AIR** (Matrix: **AIR**)

			Client sample ID	**WOLLAR C4766 - S2827**	**COOKS GAP C4984 - S2835**	----	----	----
			Client sampling date / time	15-MAY-2013 07:10	15-MAY-2013 08:10	----	----	----
Compound	CAS Number	LOR	Unit	EN1301834-001	EN1301834-002	----	----	----
EP101: VOCs by USEPA Method TO15 (Calculated Concentration)								
^ Freon 12	75-71-8	2.5	µg/m³	**3.0**	**3.0**	----	----	----
^ Chloromethane	74-87-3	1.0	µg/m³	**1.2**	**1.0**	----	----	----
^ Freon 114	76-14-2	3.5	µg/m³	<3.5	<3.5	----	----	----
^ Vinyl chloride	75-01-4	1.3	µg/m³	<1.3	<1.3	----	----	----
^ Bromomethane	74-83-9	1.9	µg/m³	<1.9	<1.9	----	----	----
^ Chloroethane	75-00-3	1.3	µg/m³	<1.3	<1.3	----	----	----
^ Freon 11	75-69-4	2.8	µg/m³	<2.8	<2.8	----	----	----
^ 1.1-Dichloroethene	75-35-4	2.0	µg/m³	<2.0	<2.0	----	----	----
^ Dichloromethane	75-09-2	1.7	µg/m³	**1.7**	<1.7	----	----	----
^ Freon 113	76-13-1	3.8	µg/m³	<3.8	<3.8	----	----	----
^ 1.1-Dichloroethane	75-34-3	2.0	µg/m³	<2.0	<2.0	----	----	----
^ cis-1.2-Dichloroethene	156-59-2	2.0	µg/m³	<2.0	<2.0	----	----	----
^ Chloroform	67-66-3	2.4	µg/m³	<2.4	<2.4	----	----	----
^ 1.2-Dichloroethane	107-06-2	2.0	µg/m³	<2.0	<2.0	----	----	----
^ 1.1.1-Trichloroethane	71-55-6	2.7	µg/m³	<2.7	<2.7	----	----	----
^ Benzene	71-43-2	1.6	µg/m³	<1.6	<1.6	----	----	----
^ Carbon Tetrachloride	56-23-5	3.1	µg/m³	<3.1	<3.1	----	----	----
^ 1.2-Dichloropropane	78-87-5	2.3	µg/m³	<2.3	<2.3	----	----	----
^ Trichloroethene	79-01-6	2.7	µg/m³	<2.7	<2.7	----	----	----
^ cis-1.3-Dichloropropylene	10061-01-5	2.3	µg/m³	<2.3	<2.3	----	----	----
^ trans-1.3-Dichloropropene	10061-02-6	2.3	µg/m³	<2.3	<2.3	----	----	----
^ 1.1.2-Trichloroethane	79-00-5	2.7	µg/m³	<2.7	<2.7	----	----	----
^ Toluene	108-88-3	1.9	µg/m³	**6.4**	<1.9	----	----	----
^ 1.2-Dibromoethane (EDB)	106-93-4	3.8	µg/m³	<3.8	<3.8	----	----	----
^ Tetrachloroethene	127-18-4	3.4	µg/m³	<3.4	<3.4	----	----	----
^ Chlorobenzene	108-90-7	2.3	µg/m³	<2.3	<2.3	----	----	----
^ Ethylbenzene	100-41-4	2.2	µg/m³	<2.2	<2.2	----	----	----
^ meta- & para-Xylene	108-38-3 106-42-3	4.3	µg/m³	<4.3	<4.3	----	----	----
^ Styrene	100-42-5	2.1	µg/m³	<2.1	<2.1	----	----	----
^ 1.1.2.2-Tetrachloroethane	79-34-5	3.4	µg/m³	<3.4	<3.4	----	----	----
^ ortho-Xylene	95-47-6	2.2	µg/m³	<2.2	<2.2	----	----	----
^ 4-Ethyltoluene	622-96-8	2.4	µg/m³	<2.4	<2.4	----	----	----
^ Total Xylenes	1330-20-7	6.5	µg/m³	<6.5	<6.5	----	----	----



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Work Order : EN1301834
Client : WILPINJONG COAL
Project : BENZENE MONITORING

Analytical Results

Sub-Matrix: **AIR** (Matrix: **AIR**)

			Client sample ID	**WOLLAR C4766 - S2827**	**COOKS GAP C4984 - S2835**	----	----	----
			Client sampling date / time	15-MAY-2013 07:10	15-MAY-2013 08:10	----	----	----
Compound	CAS Number	LOR	Unit	EN1301834-001	EN1301834-002	----	----	----
EP101: VOCs by USEPA Method TO15 (Calculated Concentration) - Continued								
^ 1.3.5-Trimethylbenzene	108-67-8	2.4	µg/m³	<2.4	<2.4	----	----	----
^ 1.2.4-Trimethylbenzene	95-63-6	2.4	µg/m³	<2.4	<2.4	----	----	----
^ 1.3-Dichlorobenzene	541-73-1	3.0	µg/m³	<3.0	<3.0	----	----	----
^ 1.4-Dichlorobenzene	106-46-7	3.0	µg/m³	<3.0	<3.0	----	----	----
^ 1.2-Dichlorobenzene	95-50-1	3.0	µg/m³	<3.0	<3.0	----	----	----
^ 1.2.4-Trichlorobenzene	120-82-1	3.7	µg/m³	<3.7	<3.7	----	----	----
^ Hexachlorobutadiene	87-68-3	5.3	µg/m³	<5.3	<5.3	----	----	----
Sampling Quality Assurance								
Pressure - As received	----	0.1	kPa	**85.8**	**92.6**	----	----	----
USEPA Air Toxics Method TO15r								
Freon 12	75-71-8	0.5	ppbv	**0.6**	**0.6**	----	----	----
Chloromethane	74-87-3	0.5	ppbv	**0.6**	**0.5**	----	----	----
Freon 114	76-14-2	0.5	ppbv	<0.5	<0.5	----	----	----
Vinyl chloride	75-01-4	0.5	ppbv	<0.5	<0.5	----	----	----
Bromomethane	74-83-9	0.5	ppbv	<0.5	<0.5	----	----	----
Chloroethane	75-00-3	0.5	ppbv	<0.5	<0.5	----	----	----
Freon 11	75-69-4	0.5	ppbv	<0.5	<0.5	----	----	----
1.1-Dichloroethene	75-35-4	0.5	ppbv	<0.5	<0.5	----	----	----
Dichloromethane	75-09-2	0.5	ppbv	**0.5**	<0.5	----	----	----
Freon 113	76-13-1	0.5	ppbv	<0.5	<0.5	----	----	----
1.1-Dichloroethane	75-34-3	0.5	ppbv	<0.5	<0.5	----	----	----
cis-1.2-Dichloroethene	156-59-2	0.5	ppbv	<0.5	<0.5	----	----	----
Chloroform	67-66-3	0.5	ppbv	<0.5	<0.5	----	----	----
1.2-Dichloroethane	107-06-2	0.5	ppbv	<0.5	<0.5	----	----	----
1.1.1-Trichloroethane	71-55-6	0.5	ppbv	<0.5	<0.5	----	----	----
Benzene	71-43-2	0.5	ppbv	<0.5	<0.5	----	----	----
Carbon Tetrachloride	56-23-5	0.5	ppbv	<0.5	<0.5	----	----	----
1.2-Dichloropropane	78-87-5	0.5	ppbv	<0.5	<0.5	----	----	----
Trichloroethene	79-01-6	0.5	ppbv	<0.5	<0.5	----	----	----
cis-1.3-Dichloropropylene	10061-01-5	0.5	ppbv	<0.5	<0.5	----	----	----
trans-1.3-Dichloropropene	10061-02-6	0.5	ppbv	<0.5	<0.5	----	----	----
1.1.2-Trichloroethane	79-00-5	0.5	ppbv	<0.5	<0.5	----	----	----
Toluene	108-88-3	0.5	ppbv	**1.7**	<0.5	----	----	----

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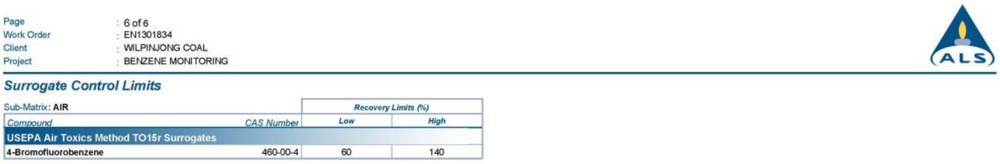
Work Order : EN1301834
Client : WILPINJONG COAL
Project : BENZENE MONITORING

Analytical Results

Sub-Matrix: **AIR** (Matrix: **AIR**)

Compound	CAS Number	LOR	Unit	WOLLAR C4766 - S2827	COOKS GAP C4984 - S2835	----	----	----
			Client sampling date / time	15-MAY-2013 07:10	15-MAY-2013 08:10	----	----	----
				EN1301834-001	**EN1301834-002**	----	----	----
USEPA Air Toxics Method TO15r - Continued								
1.2-Dibromoethane (EDB)	106-93-4	0.5	ppbv	<0.5	<0.5	----	----	----
Tetrachloroethene	127-18-4	0.5	ppbv	<0.5	<0.5	----	----	----
Chlorobenzene	108-90-7	0.5	ppbv	<0.5	<0.5	----	----	----
Ethylbenzene	100-41-4	0.5	ppbv	<0.5	<0.5	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	1.0	ppbv	<1.0	<1.0	----	----	----
Styrene	100-42-5	0.5	ppbv	<0.5	<0.5	----	----	----
1.1.2.2-Tetrachloroethane	79-34-5	0.5	ppbv	<0.5	<0.5	----	----	----
ortho-Xylene	95-47-6	0.5	ppbv	<0.5	<0.5	----	----	----
4-Ethyltoluene	622-96-8	0.5	ppbv	<0.5	<0.5	----	----	----
1.3.5-Trimethylbenzene	108-67-8	0.5	ppbv	<0.5	<0.5	----	----	----
1.2.4-Trimethylbenzene	95-63-6	0.5	ppbv	<0.5	<0.5	----	----	----
1.3-Dichlorobenzene	541-73-1	0.5	ppbv	<0.5	<0.5	----	----	----
1.4-Dichlorobenzene	106-46-7	0.5	ppbv	<0.5	<0.5	----	----	----
1.2-Dichlorobenzene	95-50-1	0.5	ppbv	<0.5	<0.5	----	----	----
1.2.4-Trichlorobenzene	120-82-1	0.5	ppbv	<0.5	<0.5	----	----	----
Hexachlorobutadiene	87-68-3	0.5	ppbv	<0.5	<0.5	----	----	----
USEPA Air Toxics Method TO15r Surrogates								
4-Bromofluorobenzene	460-00-4	0.1	%	**101**	**100**	----	----	----



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Work Order : EN1301834
Client : WILPINJONG COAL
Project : BENZENE MONITORING

Surrogate Control Limits

Sub-Matrix: **AIR**

Compound	CAS Number	Recovery Limits (%)	
		Low	High
USEPA Air Toxics Method TO15r Surrogates			
4-Bromofluorobenzene	460-00-4	60	140

Appendix E: ALS PAH Monitoring Report

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order : ME1300719
Client : WILPINJONG COAL
Contact : Kieren Bennetts
Address : Peabody Energy
Locked Bag 2005
MUDGEE NSW 2850
E-mail : kbennetts@peabodyenergy.com
Telephone : ----
Facsimile : ----
Project : HVAS - HV1_WOLLAR
Order number : 300200027
C-O-C number : ----
Sampler : ALS
Site : 15/05/2013
Quote number : Book Price

Page : 1 of 4
Laboratory : Environmental Division Mudgee
Contact : Mary Monds
Address : 1/29 Sydney Road Mudgee NSW AUSTRALIA 2850
E-mail : mary.monds@alsglobal.com
Telephone : 02 6372 6735
Facsimile : 02 6372 7597
QC Level : NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Date Samples Received : 20-MAY-2013
Issue Date : 28-MAY-2013
No. of samples received : 1
No. of samples analysed : 1

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

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NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

WORLD RECOGNISED ACCREDITATION

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Karinne Gelderman	Analyst	Newcastle - Organics
Mary Monds	Environmental Services Representative	Laboratory - Mudgee
Raymond Commodor	Instrument Chemist	Sydney Inorganics

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Environmental Division Mudgee ABN 84 009 936 029 Part of the ALS Group An ALS Limited Company

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Page : 2 of 4
Work Order : ME1300719
Client : WILPINJONG COAL
Project : HVAS - HV1_WOLLAR

General Comments

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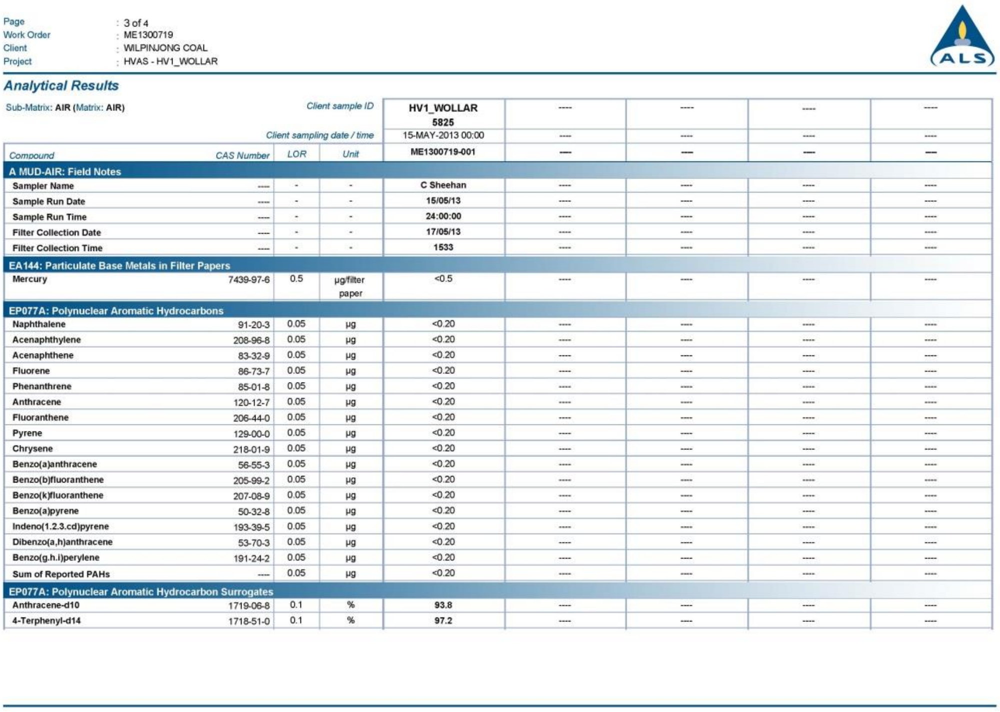
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **EA144: The metal concentration in the filter is reported in µg/filter on a total filter basis calculated up from the proportion of the filter paper provided by the client.**
- **EP077HV: LOR values for PAHs have been raised due to sub-sampling of the HVAS filter at the request of the client.**



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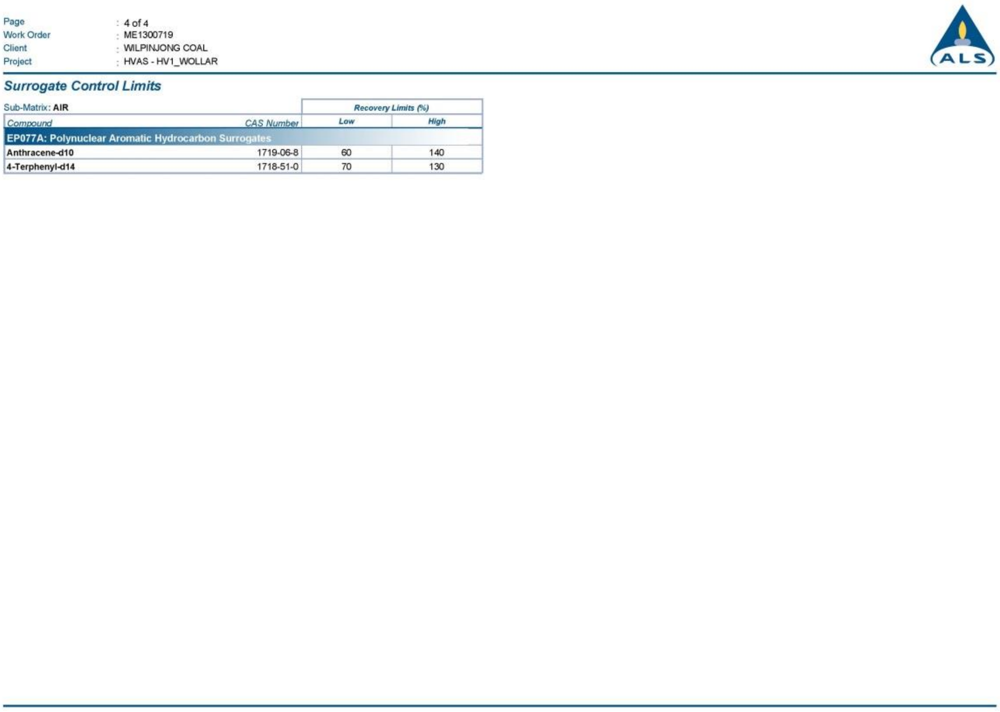
Work Order : ME1300719
Client : WILPINJONG COAL
Project : HVAS - HV1_WOLLAR

Analytical Results

Sub-Matrix: AIR (Matrix: AIR)			Client sample ID	HV1_WOLLAR 5825	----	----	----	----
			Client sampling date / time	15-MAY-2013 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ME1300719-001**	----	----	----	----
A MUD-AIR: Field Notes								
Sampler Name	----	-	-	**C Sheehan**	----	----	----	----
Sample Run Date	----	-	-	**15/05/13**	----	----	----	----
Sample Run Time	----	-	-	**24:00:00**	----	----	----	----
Filter Collection Date	----	-	-	**17/05/13**	----	----	----	----
Filter Collection Time	----	-	-	**1533**	----	----	----	----
EA144: Particulate Base Metals in Filter Papers								
Mercury	7439-97-6	0.5	µg/filter paper	<0.5	----	----	----	----
EP077A: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.05	µg	<0.20	----	----	----	----
Acenaphthylene	208-96-8	0.05	µg	<0.20	----	----	----	----
Acenaphthene	83-32-9	0.05	µg	<0.20	----	----	----	----
Fluorene	86-73-7	0.05	µg	<0.20	----	----	----	----
Phenanthrene	85-01-8	0.05	µg	<0.20	----	----	----	----
Anthracene	120-12-7	0.05	µg	<0.20	----	----	----	----
Fluoranthene	206-44-0	0.05	µg	<0.20	----	----	----	----
Pyrene	129-00-0	0.05	µg	<0.20	----	----	----	----
Chrysene	218-01-9	0.05	µg	<0.20	----	----	----	----
Benzo(a)anthracene	56-55-3	0.05	µg	<0.20	----	----	----	----
Benzo(b)fluoranthene	205-99-2	0.05	µg	<0.20	----	----	----	----
Benzo(k)fluoranthene	207-08-9	0.05	µg	<0.20	----	----	----	----
Benzo(a)pyrene	50-32-8	0.05	µg	<0.20	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.05	µg	<0.20	----	----	----	----
Dibenzo(a,h)anthracene	53-70-3	0.05	µg	<0.20	----	----	----	----
Benzo(g.h.i)perylene	191-24-2	0.05	µg	<0.20	----	----	----	----
Sum of Reported PAHs	----	0.05	µg	<0.20	----	----	----	----
EP077A: Polynuclear Aromatic Hydrocarbon Surrogates								
Anthracene-d10	1719-06-8	0.1	%	**93.8**	----	----	----	----
4-Terphenyl-d14	1718-51-0	0.1	%	**97.2**	----	----	----	----



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Work Order : ME1300719
Client : WILPINJONG COAL
Project : HVAS - HV1_WOLLAR

Surrogate Control Limits

Sub-Matrix: AIR		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP077A: Polynuclear Aromatic Hydrocarbon Surrogates			
Anthracene-d10	1719-06-8	60	140
4-Terphenyl-d14	1718-51-0	70	130