Pacific Environment Limited

Consulting • Technologies • Monitoring • Toxicology

Report

WILPINJONG COAL MINE PRP U1: MONITORING RESULTS – WHEEL GENERATED DUST

WILPINJONG COAL PTY LTD

Job ID. 8356

7 August 2014

PROJECT NAME:	Wilpinjong Coal Mine PRP U1: Monitoring Results – Wheel Generated Dust
JOB ID:	8356
DOCUMENT CONTROL NUMBER	AQU-NW-001-08356
PREPARED FOR:	Wilpinjong Coal Pty Ltd
APPROVED FOR RELEASE BY:	Ronan Kellaghan
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DOCUMENT CONTROL			
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1 INTRODUCTION

Wilpinjong Coal Pty Ltd Environmental Protection Licence (EPL) 12425 requires that the site develop and implement Pollution Reduction Programs (PRPs). PRP Condition U1: *Particulate Matter Control Best Practice Implementation - Wheel Generated Dust* requires Wilpinjong Coal to achieve and maintain a dust control efficiency of 80% or more on all active haul roads.

To satisfy the requirements of the EPL, a Monitoring Plan was developed for condition U1 which outlined the proposed monitoring method to determine the site wide haul road control efficiency (**Pacific Environment, 2013a**). This report provides results from the haul road dust control efficiency monitoring for Wilpinjong Coal.

1.1 Licence Requirements

Condition U1.1 (*Particulate Matter Control Best Practice Implementation - Wheel Generated Dust)* requires that Wilpinjong Coal must achieve and maintain a dust control efficiency of 80% or more on its haul roads. Control efficiency is calculated as:

$$CE = \frac{E_{uncontrolled} - E_{controlled}}{E_{uncontrolled}} \times 100$$

Where E = emissions rate of the activity.

Condition U1.2 requires that to assess compliance with U1.1, Wilpinjong Coal must:

- Measure uncontrolled and controlled haul road emissions on at least 3 occasions using a Road Emission Expert (REX) system;
- Measure 'additional site data' including:
  - Vehicle movements
  - Meteorological conditions
  - Water and suppressant application time, duration, rate and volume
- Determine if a site specific relationship can be derived between the measured control efficiency, additional site data; and the soil moisture and silt content levels.

2 SAMPLING METHODOLOGY

2.1 Mobile Monitoring

PM_{10} emissions from haul roads were measured using the mobile system REX (Road Emissions eXpert). REX measures the concentration of PM_{10} generated from the test vehicle and so by comparing data collected from haul roads with and without controls, control efficiencies can be calculated.

The monitoring method is described in the Monitoring Plan (**Pacific Environment, 2013a**) and in greater detail in ACARP Project C20023 (**Cox & Laing, in press**). All monitoring was conducted according to the internal Quality Management Plan for the use of REX (**Pacific Environment, 2013b**).

2.2 Sampling Approach

All active haul routes on the mine were sampled repeatedly over the sampling day. Within the full active circuit of the mine was an uncontrolled section of road, left at least 12 hours without controls (further details in **Section 2.3**).

2.3 Calculating Control Efficiency

Critical to the determination of haul road dust control efficiency is the definition of what constitutes an 'uncontrolled' section of haul road.

Seasonal changes in meteorology play a large role in the efficiency of controls applied to haul roads to manage wheel-generated dust. Conditions such as rainfall, high humidity, fog or damp are natural controls that reduce dust generated from an unsealed road. Conversely, higher ambient temperatures can cause increased evaporation, requiring more watering or suppressant to be used to meet a sufficient level of control. Road management, construction and maintenance also contribute to controlling dust.

For these reasons, it is not appropriate to calculate a control efficiency using baseline data that is heavily impacted by these seasonal conditions and management factors, where the control efficiency calculated does not have any bearing on the dust being generated (i.e. winter control efficiency being much lower than summer control efficiency). Therefore, the maximum uncontrolled data collected over all monitoring campaigns has been used to reflect an uncontrolled baseline and applied across the year to calculate the control efficiency.

For the purposes of determination of control efficiency, we define an uncontrolled haul road as:

> *"A section of at least 150 m of an active haul road where no water has been applied for at least 12 hours prior to monitoring and hasn't been treated with chemical suppressant. Less than 0.3 mm of precipitation has been recorded at the closest meteorological station in the preceding 12 hours and ambient conditions during monitoring do not act to suppress dust (rainfall, fog, mist, high humidity, low evaporation, low wind speeds)."*

3 RESULTS

In accordance with condition U1, three rounds of REX monitoring have been completed during December 2013, April 2014 and June 2014. The results of the monitoring are shown in following sections:

- Dust control efficiency achieved on the sampling days (**Section 3.1**)
- Dust concentrations measured (**Section 3.2**)
- Additional site data, including meteorological conditions, operational factors and the results of silt and moisture sampling (**Section 3.3**)
- Site specific relationships between these data (**Section 3.4**)

3.1 Dust Control Efficiency

The average control efficiency achieved during the monitoring was calculated as 88%. Average control efficiency achieved during each sampling campaign and the range by circuit is shown in **Table 3.1**.

Table 3.1: Summary of REX control efficiencies

Monitoring Round	Sampling Date	Number of circuits of the active mine	Average Control Efficiency	Range of Control Efficiency by circuit
1	18 December 2013	2 (of 3)	80 %	72 % - 88 %
2	8 April 2014	3	87 %	80 % - 96 %
3	6 June 2014	3	95 %	94 % - 95 %

The third circuit of the mine during the first round was excluded from analysis. The data exhibited a baseline shift and the cause has not been identified with certainty.

3.2 Dust Concentrations Measured

The average PM_{10} concentration measured during each sampling campaign is shown in **Table 3.2**.

Table 3.2: Summary of REX measured PM concentration

Monitoring Round	Sampling Date	Average controlled PM_{10} concentration (mg/m^3)	Maximum average uncontrolled PM_{10} concentration (mg/m^3)
1	18 December 2013	0.171	0.861
2	8 April 2014	0.109	
3	6 June 2014	0.045	

3.3 Additional Site Data

A summary of the meteorological conditions, as recorded by the site meteorological station, for the day of each monitoring event is presented in **Table 3.3**. The average control efficiency achieved during each day has been included for comparison. Meteorological data were not recorded between 9am and 2.45pm on 18 December 2013, so the meteorological statistics are not representative of the full sampling day.

Table 3.3: Summary statistics for meteorological conditions

Parameter (units)	18 December 2013	8 April 2014	6 June 2014
Average Wind Speed (m/s)	1.4 m/s	1.6 m/s	1.7 m/s
Average Temperature (°C)	21.3 °C	17.6 °C	12.7 °C
Average Relative Humidity (%)	61.5 %	67.0 %	76.7 %
Average Solar Radiation (W/m^2)	151 W/m^2	145 W/m^2	65 W/m^2
Total Rainfall (mm)	0 mm	0 mm	0 mm
Average control efficiency (%)	80 %	87 %	95 %

Three years of meteorological data (August 2011 – June 2014) from the Wilpinjong Mine site meteorological station were analysed to determine the seasonal variation in meteorology at the site. Monthly variation in temperature, humidity, solar radiation and rainfall are shown in **Figure 3.1** to **Figure 3.2** and compare with conditions on the day of sampling.

The analysis shows that the sampling days are representative of changing seasonal conditions across the year.

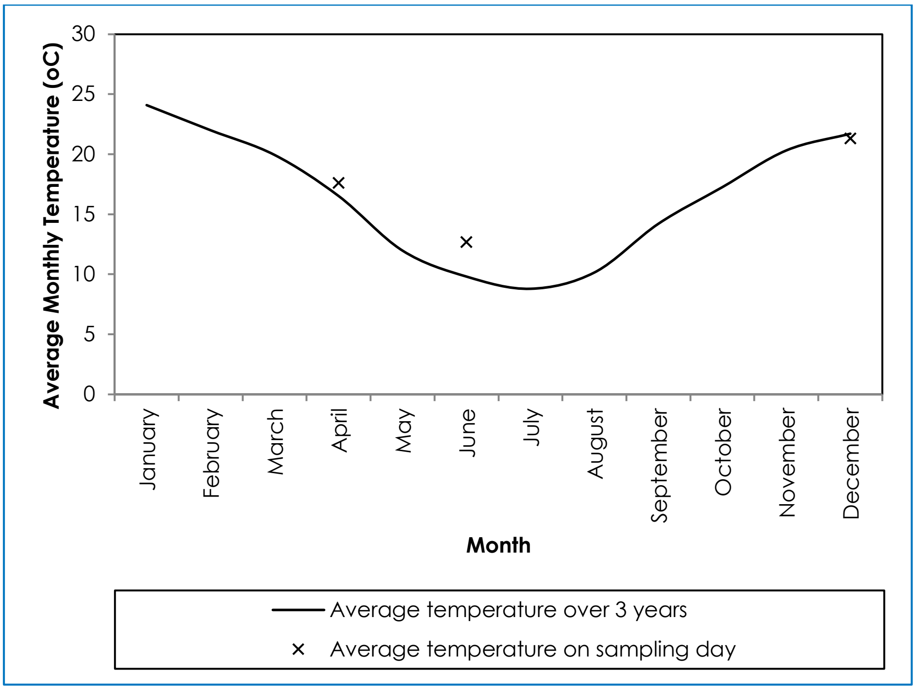

Figure 3.1: Average monthly temperature (°C) from August 2011 – June 2014 compared to average temperature on sampling day

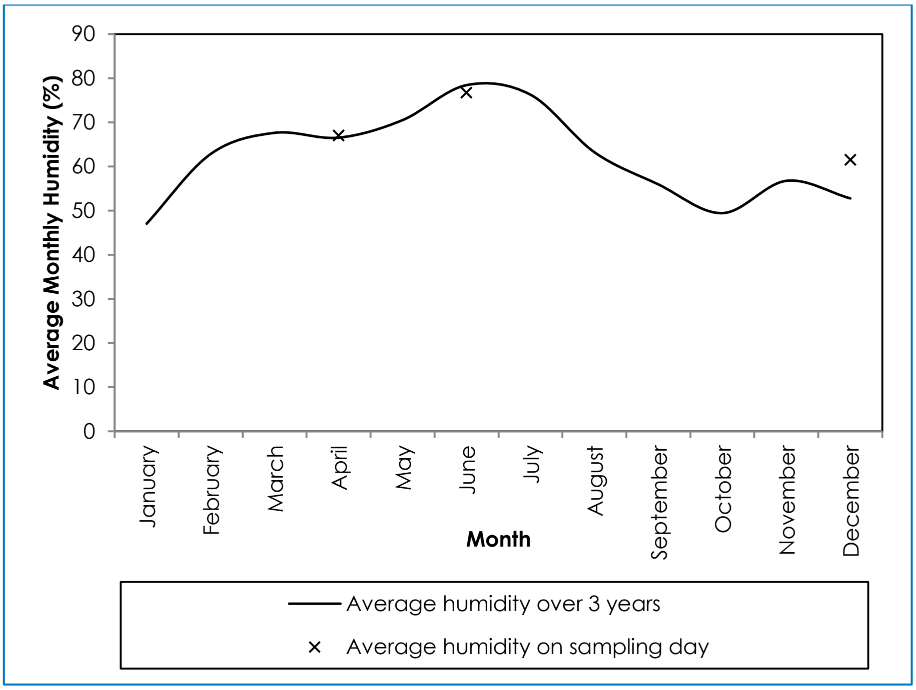

Figure 3.2: Average monthly humidity (%) from August 2011 – June 2014 compared to average humidity on sampling day

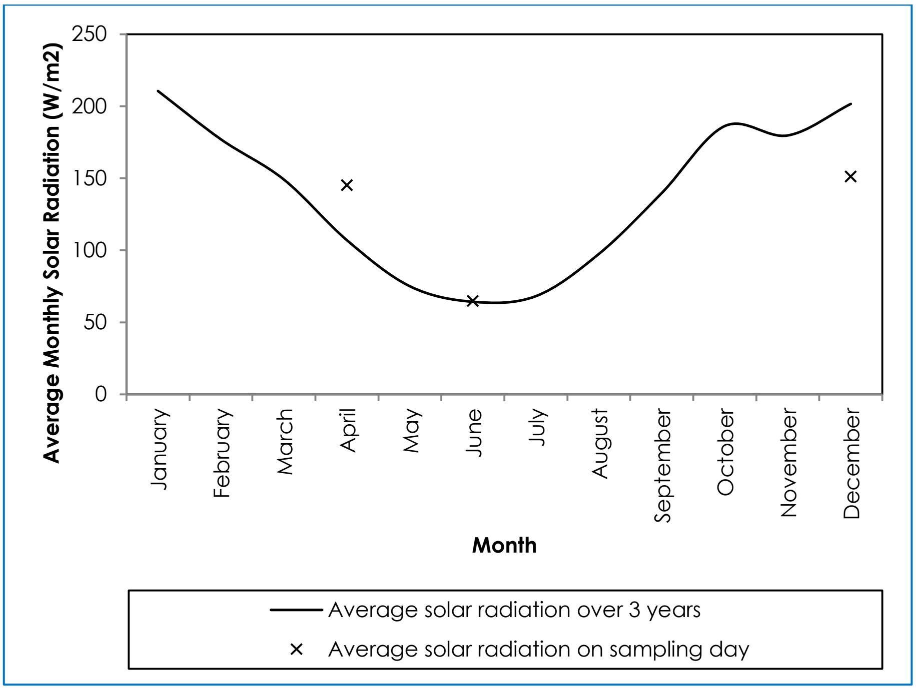

Figure 3.3: Average monthly solar radiation from August 2011 – June 2014 compared to average solar radiation on sampling day

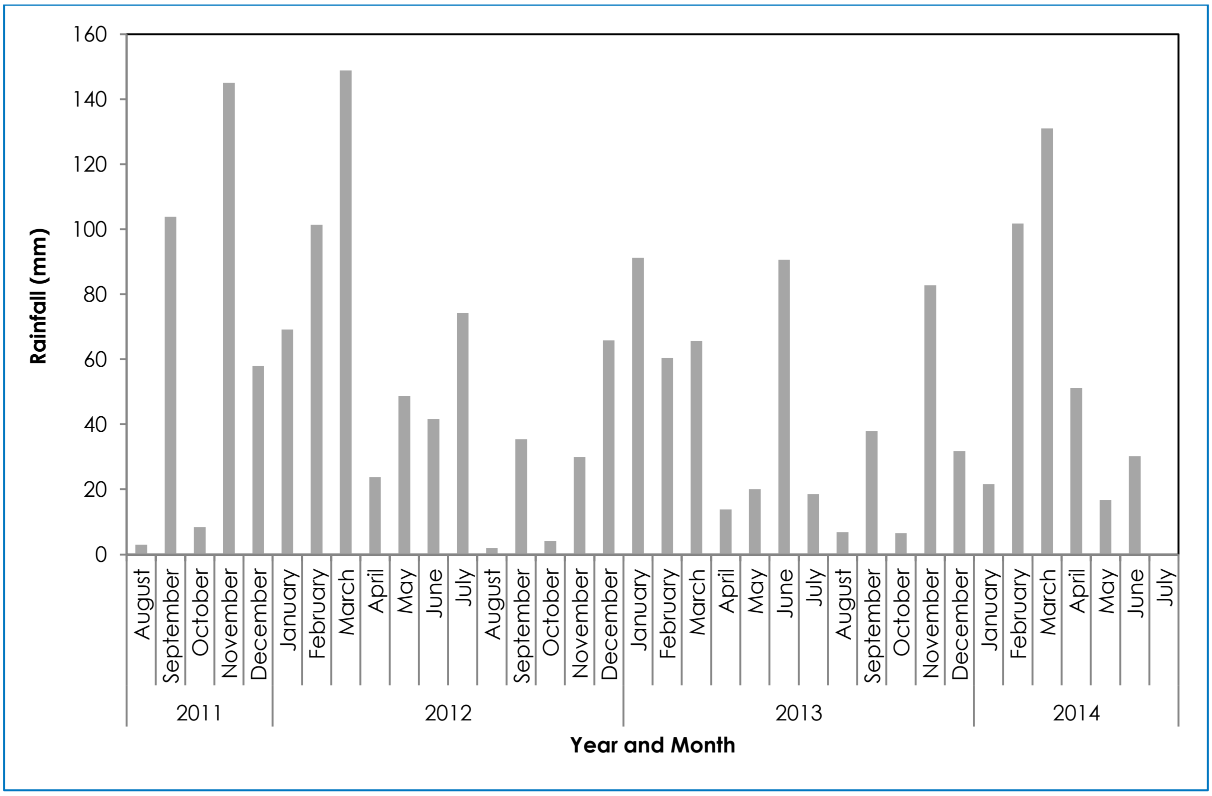

Figure 3.4: Total monthly rainfall (mm) from August 2011 – June 2014

In accordance with condition U1.2, additional operational data were collected for the periods of monitoring and are summarised **Table 3.4**. The majority of operational parameters do not change between monitoring periods.

Table 3.4: Additional site data

Site Data	Monitoring Round 1	Monitoring Round 2	Monitoring Round 3
Vehicle movement routes	Pit 5 to dump, Pit 7 to dump, Pit 3 to ROM stockpile	Pit 5 to dump, Pit 7 to dump, Pit 3 to dump	Pit 5 to dump, Pit 7 to dump, Pit 3 to ROM stockpile
Loaded haul truck weight	CAT789 122 tonne empty, 317 tonne loaded; CAT 785 96 tonne empty, 249 tonne loaded	CAT789 122 tonne empty, 317 tonne loaded; CAT 785 96 tonne empty, 249 tonne loaded	CAT789 122 tonne empty, 317 tonne loaded; CAT 785 96 tonne empty, 249 tonne loaded
Vehicle speed	Maximum 60 km/h	Maximum 60 km/h	Maximum 60 km/h
Method of watering	Water	Water	Water
Water application time	Not recorded	Not recorded	Not recorded
Water application volume	3 large water carts running (70,000L each): WT3007; WT3008 and WT9303	2 large water carts running (70,000L each): WT3007 and WT3008	1 large water cart running (70,000L), WT3005
Water application rate	Continuous or as required	Continuous or as required	Continuous or as required

During each sampling campaign a bulk sample of the road surface was collected in accordance with the surface sampling methodology (**US EPA, 1993**). The samples were analysed at the laboratory for silt and moisture content, these reports are included in **Appendix A**.

Table 3.5: Results of silt and moisture sampling

Monitoring Round	Road Type	Control Level	Silt (%)	Moisture (%)
3	Permanent	Controlled	11.3	10.7
	Permanent	Uncontrolled	11.0	4.0
	Permanent	Controlled	3.7	7.3

3.4 Site Specific Relationships

No site specific relationships were evident when the average dust concentrations measured were compared against the other site specific parameters. All causal relationships were systematically explored but no correlating parameters were evident for meteorological data, operational parameters or silt and moisture content. The relationships were explored for each round and for each circuit of the mine. There was no meteorological data available for the hours when the sampling was completed during December 2013.

Typically the dust concentrations measured are found to correlate with average temperature, relative humidity and solar radiation. These factors should be considered when managing haul road control measures.

4 CONCLUSION

Wheel-generated dust control efficiency was assessed at Wilpinjong Coal Mine on three occasions using a mobile dust monitoring system (REX). The dust control effectiveness was calculated as 80 % on 18th December 2013, 87 % on 8th April 2014 and 95% on 6th of June 2014. On all three occasions the site was maintaining a dust control efficiency of greater than 80%.

A number of factors contribute to dust generation from haul roads. No site specific relationships were evident from the data collected at Wilpinjong Coal, when the data was compared to silt and moisture data, meteorological data and operational parameters.

However, the ACARP study has shown that consideration of site-specific operational factors is critical to minimising the level of dust generated from unsealed roads, including:

- Roads under construction.
- Roads recently graded.
- Coal operation areas.
- Roads adjacent to stockpiles.
- Highly trafficked areas.

These management measures, along with ambient temperature, relative humidity and solar radiation, should be the focus for best practice management of haul road controls.

5 REFERENCES

Cox J and Laing G (in press). *Mobile Sampling of Dust Emissions from Unsealed Roads*. ACARP Project C20023. Stage 2 Final Report.

Pacific Environment (2013a). *Wilpinjong Coal Pollution Reduction Monitoring Plan – U1 Wheel Generated Dust*. Wilpinjong Coal Pty Ltd, 29 July 2013.

Pacific Environment (2013b). *Quality Management Plan – Mobile Haul Road Monitoring*. 03 January 2013.

US EPA (1993). *Procedures for Sampling Surface/Bulk Dust Loading*. Appendix C.1. AP-42.

Appendix A SILT AND MOISTURE SAMPLING RESULTS

JUNE 2014 SILT AND MOISTURE SAMPLING RESULTS

Job Number : L108579
Client : Pacific Environment Limited
Reference/Order : 8356
Project : SILT

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Analyte		Lab No / Sample ID / DL	001 / 1-PIT 5	002 / 2-PIT 5	003 / 3-PIT 7
NQ968 - Moisture Determination of Bulk Samples					
Total Moisture (@ 105o C)	%	0.1	10.7	4.0	7.3
NQ899 - Size Analysis of Misc.Material					
+ 31.5 mm	%	0.1	nd	nd	nd
-31.5 + 16.0 mm	%	0.1	nd	1.9	nd
-16.0 + 8.0 mm	%	0.1	9.1	6.9	12.4
-8.0 + 4.0 mm	%	0.1	12.0	9.2	26.2
-4.0 + 0.85 mm	%	0.1	28.4	27.6	35.0
-0.85 + 0.425 mm	%	0.1	12.7	13.3	10.1
-0.425 + 0.150 mm	%	0.1	19.4	20.6	9.4
-0.150 + 0.075 mm	%	0.1	7.0	9.5	3.2
-0.075 mm	%	0.1	11.3	11.0	3.7

DL = Detection Limit
LNR = Samples Listed not Received
-- = Not Applicable
nd = < DL
db = Dry basis

Sample Description Key (if req'd)

001 .
002
003