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Report

WERRIS CREEK COAL PRP U1: MONITORING RESULTS – WHEEL GENERATED DUST

WERRIS CREEK COAL PTY LTD

Job ID. 07487c

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CONTENTS

1 INTRODUCTION

Werris Creek Coal Pty Ltd (WCCPL) holds Environmental Protection Licence (EPL) 12290 for Werris Creek Coal (WCC). Condition U1 (*Particulate Matter Control Best Practice Implementation - Wheel Generated Dust)* requires that WCC must achieve and maintain a dust control efficiency of 80% or more on its 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 Werris Creek Coal.

1.1 Licence Requirements

Condition U1.1 (*Particulate Matter Control Best Practice Implementation - Wheel Generated Dust)* requires that WCC 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 = measured emissions (mg/m^3).

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

- Measure uncontrolled and controlled haul road emissions on at least 2 occasions using a mobile dust monitor.
- Continuously measure and record 'additional site data' including:
  - Vehicle kilometres travelled (VKT)
  - Meteorological conditions
  - Water use for dust suppression
- Undertake silt content and soil moisture sampling during sampling events.
- Determine if a site specific relationship can be derived between the measured control efficiency, additional site data, water use, meteorological data and silt content and moisture levels.

The measurement of controlled and uncontrolled haul road dust emissions must be undertaken under varying meteorological conditions, including at times when analysis of meteorological data indicated that elevate levels of dust are most likely at the Premises.

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 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, two rounds of REX monitoring have been completed during February 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 96 %. 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	6 February 2014	5	94 %	85 % - 99 %
2	26 June 2014	4	99 %	98 % - 99 %

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	6 February 2014	0.880	14.390
2	26 June 2014	0.146	

3.3 Additional Site Data

A summary of the meteorological conditions, as recorded by the site meteorological station operating during the sampling day, 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.

The control efficiencies measured on each run correlate with temperature, humidity and solar radiation. These relationships are illustrated in **Section 3.4**.

Table 3.3: Summary statistics for meteorological conditions

Parameter (units)	Round 1	Round 2
Average Wind Speed (m/s)	3.0 m/s	2.8 m/s
Average Temperature (°C)	21.7 °C	9.9 °C
Average Relative Humidity (%)	48.6 %	69.4 %
Average Solar Radiation (W/m^2)	301.3 W/m^2	83.1 W/m^2
Total Rainfall (mm)	0.00 mm	0.00 mm
Average control efficiency (%)	94 %	99 %

Four and a half years of meteorological data (January 2009 – May 2013) from the Werris Creek Coal Mine site meteorological station were analysed to determine the seasonal variation in meteorology at the site. **Figure 3.1** to **Figure 3.4** shows the following:

- Average monthly temperature compared to average temperature on sampling day (**Figure 3.1**)
- Average monthly humidity compared to average humidity on sampling days (**Figure 3.2**)
- Average monthly solar radiation compared to average solar radiation on sampling days (**Figure 3.3**)
- Total monthly rainfall by year (**Figure 3.4**)

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

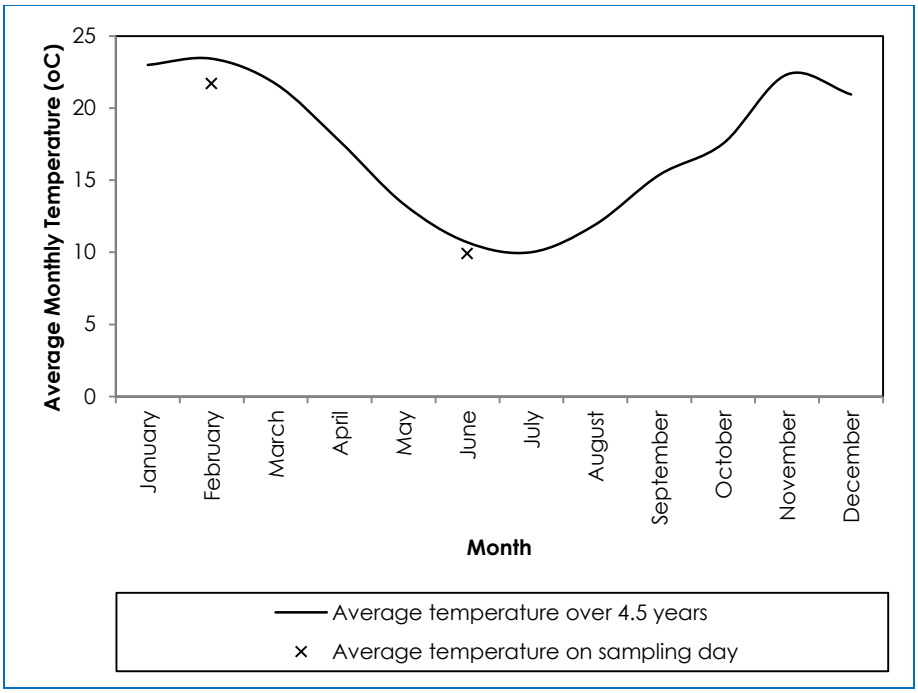

Figure 3.1: Average monthly temperature (°C) from January 2009 – May 2013 compared to average temperature on sampling day

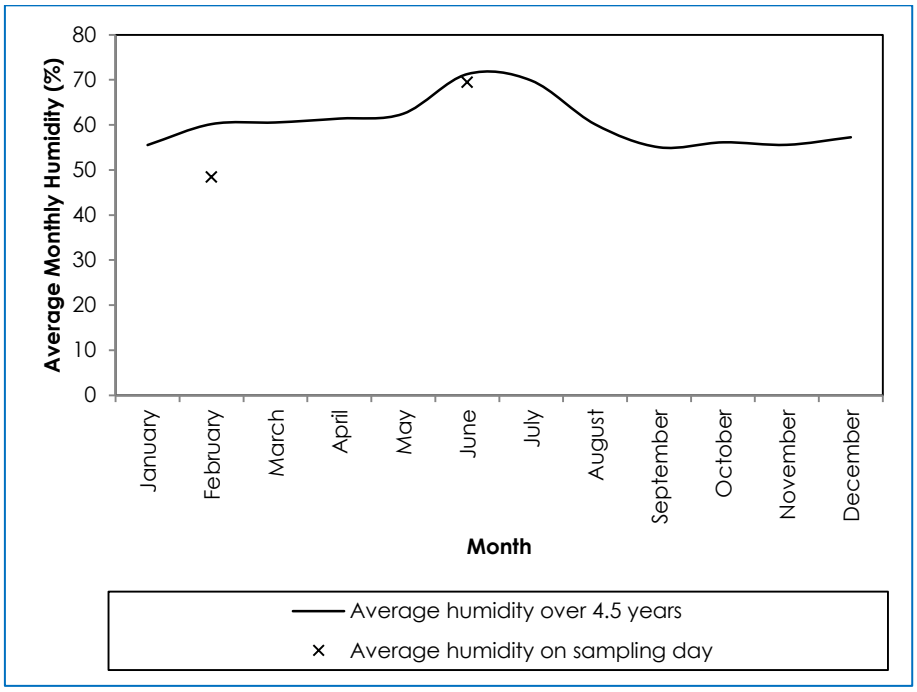

Figure 3.2: Average monthly humidity (%) from January 2009 – May 2013 compared to average humidity on sampling day

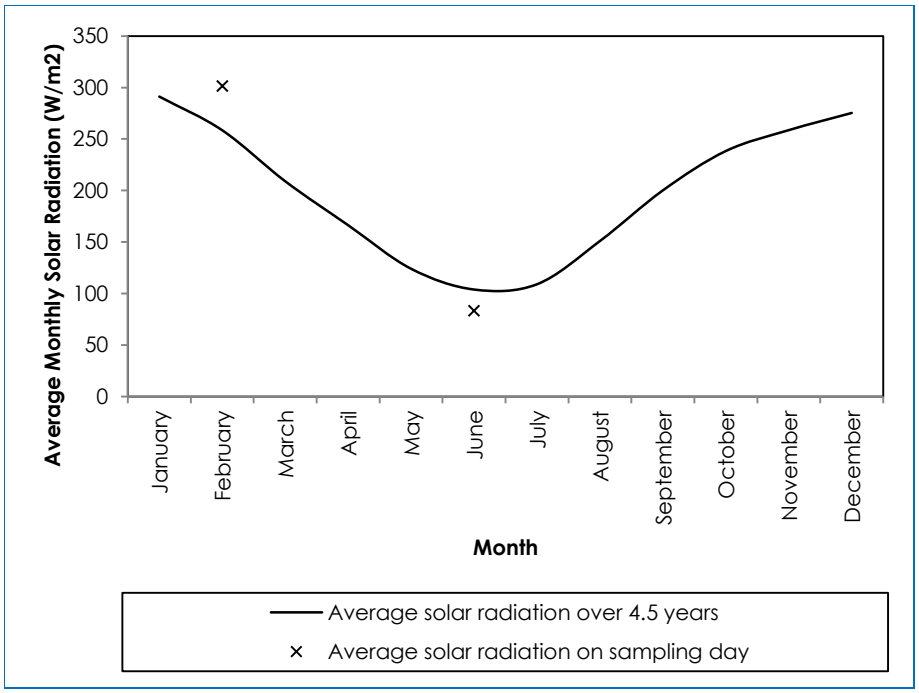

Figure 3.3: Average monthly solar radiation from January 2009 – May 2013 compared to average solar radiation on sampling day

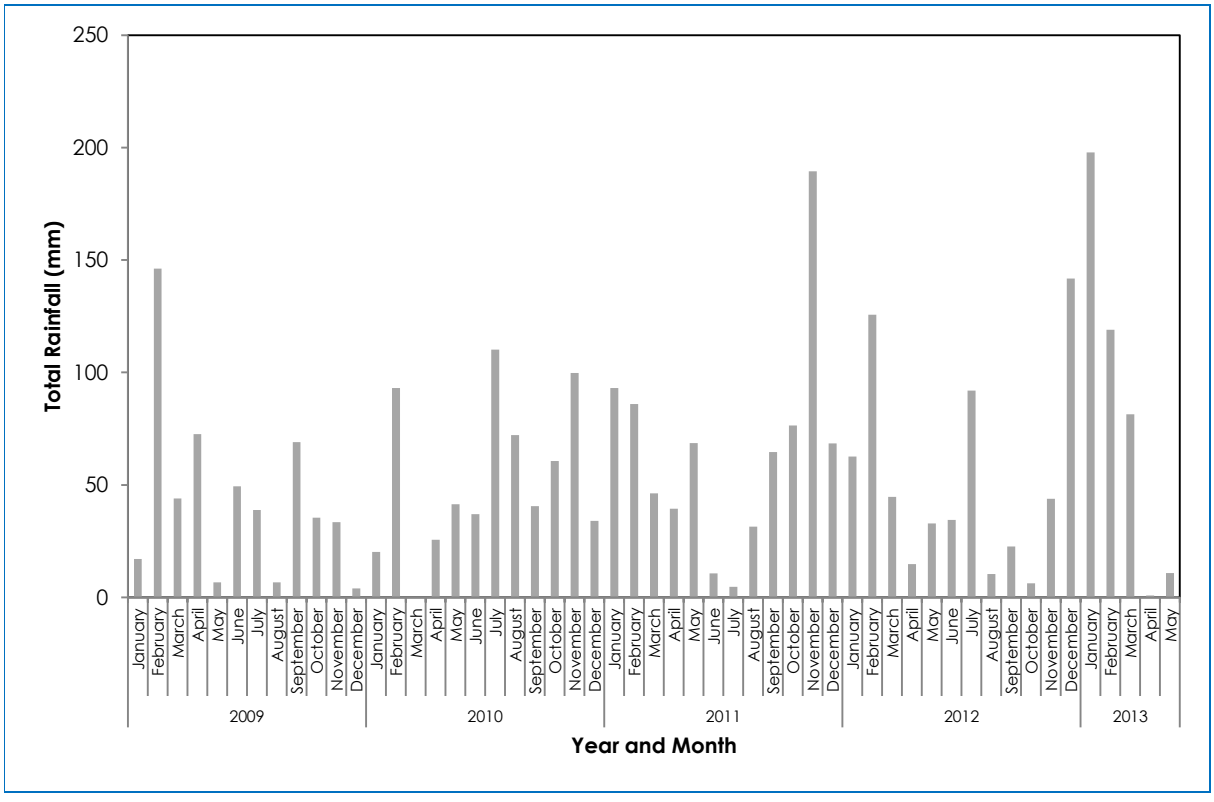

Figure 3.4: Total monthly rainfall (mm) from January 2009 – May 2013

In accordance with condition U2, additional operational data were collected for the periods of monitoring and are summarised in **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
Vehicle movement routes	Pit to upper west dump, pit to ROM	Pit to ROM, pit to upper west dump
Loaded haul truck weight	CAT793 112 tonne empty, 226 tonne payload, CAT785 95 tonne empty, 151 tonne overburden load / 116 tonne coal load	CAT793 112 tonne empty, 226 tonne payload, CAT785 95 tonne empty, 151 tonne overburden load / 116 tonne coal load
Vehicle speed	Speed limit 60 km/h	Speed limit 60 km/h
Method of watering	Water	Water
Water application time	Not measured directly	Not measured directly
Water application volume	WAT867 (32,000L) running for 8 hours, WAT869 (50,000L) running for 9.5 hours	WAT863 (32,000L) running for 3 hours, WAT869 (50,000L) running for 8.6 hours
Water application rate	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 (%)
1	Permanent	Uncontrolled	4.6	0.7
	Permanent	Controlled	4.8	3.9
	Permanent	Controlled	0.6	2.1
2	Permanent	Controlled	4.6	4.5
	Permanent	Controlled	1.2	2.7
	Permanent	Uncontrolled	4.0	2.2

3.4 Site Specific Relationships

The strongest relationship between average control efficiency achieved on the sampling day and additional site specific data were with average temperature, average humidity and average solar radiation. These relationships are illustrated in **Figure 3.5** to **Figure 3.7**.

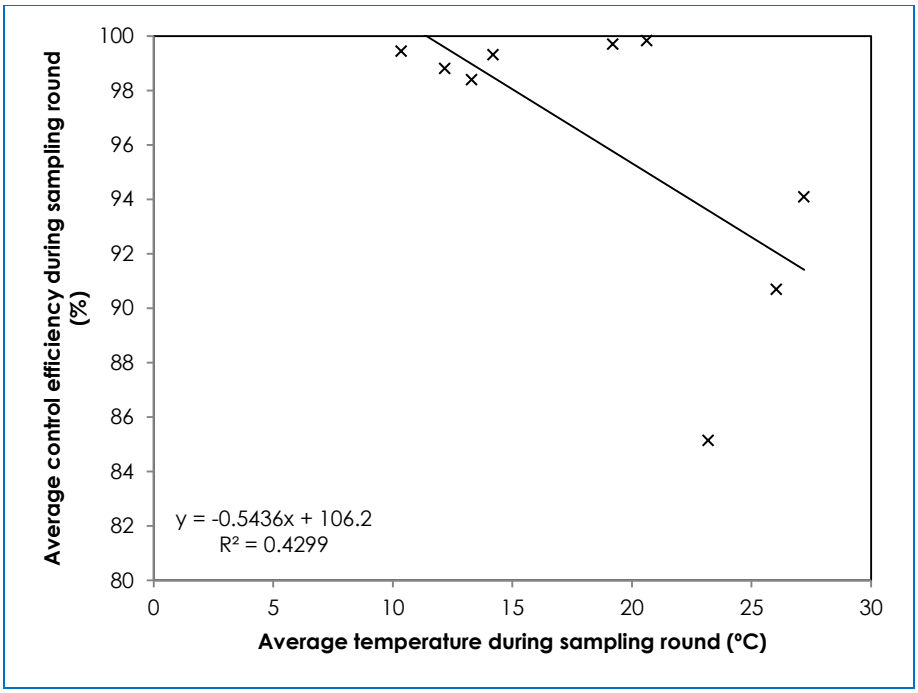

Figure 3.5: Average measured control efficiency (%) against average air temperature (°C)

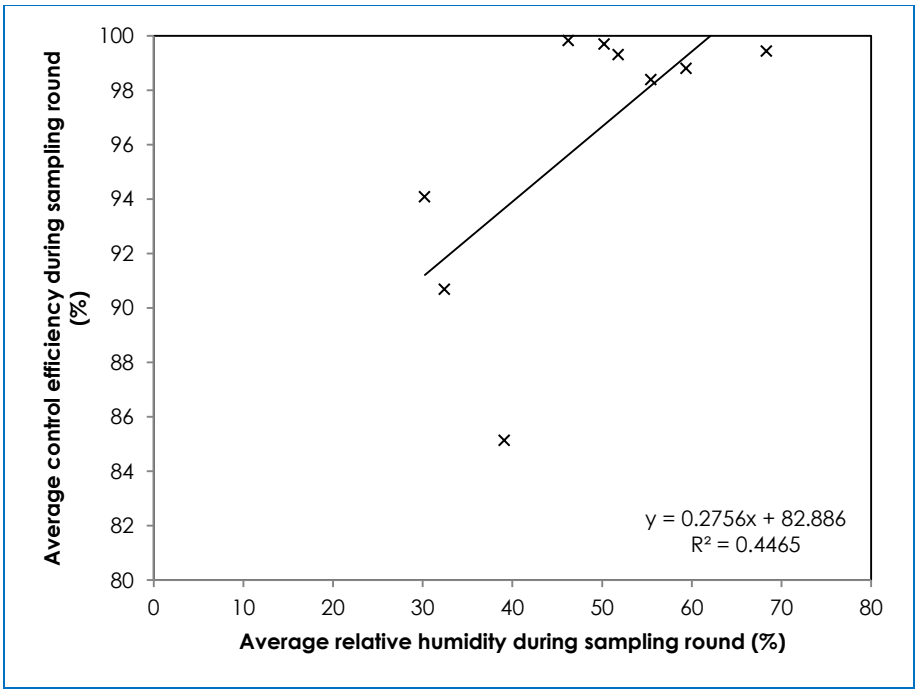

Figure 3.6: Average measured control efficiency (%) against average relative humidity (%)

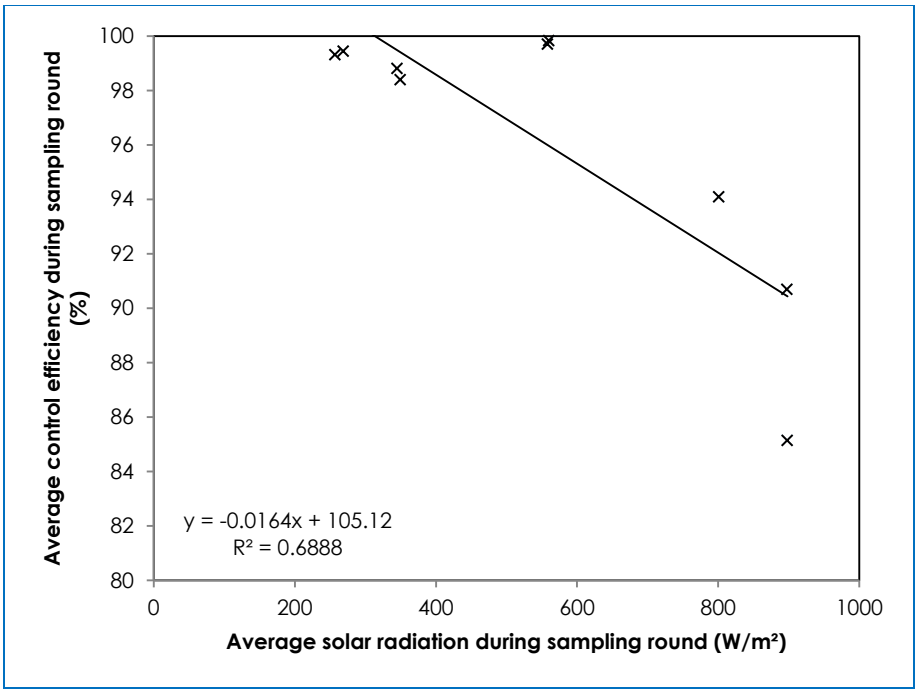

Figure 3.7: Average measured control efficiency (%) against solar radiation (W/m²)

4 CONCLUSION

Wheel-generated dust control efficiency was assessed at Werris Creek Coal Mine on two occasions using a mobile dust monitoring system (REX). The dust control effectiveness was calculated as 94% on 6 February 2014 and 99 % on 26 June 2014. On both occasions the site was maintaining an average dust control efficiency of greater than 80%.

A number of factors contribute to dust generation from haul roads. The strongest relationship between control effectiveness and additional site data was shown with temperature, humidity and solar radiation. High temperatures, low humidity and high solar radiation generate conditions when controlling haul road dust should be a priority.

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). *Werris Creek Coal Pollution Reduction Monitoring Plan – U1 Wheel Generated Dust*. Werris Creek Coal Pty Ltd, 25 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

A.1 FEBRUARY 2014 SILT AND MOISTURE SAMPLING

AMDEL

Job Number : L107253
Client : Pacific Environment Limited
Reference/Order : 7487c
Project : Werris Creek

Analyte		Lab No / Sample ID / DL	001	002	003
NQ968 - Moisture Determination of Bulk Samples					
Total Moisture (@ 105o C)	%	0.1	0.70	3.9	2.1
NQ899 - Size Analysis of Misc.Material					
+ 31.5 mm	%	0.1	nd	nd	13.4
-31.5 + 16.0 mm	%	0.1	7.5	2.1	27.1
-16.0 + 8.0 mm	%	0.1	13.8	19.7	21.1
-8.0 + 4.0 mm	%	0.1	13.0	16.9	15.9
-4.0 + 0.85 mm	%	0.1	28.8	30.6	16.2
-0.85 + 0.425 mm	%	0.1	13.3	10.0	2.8
-0.425 + 0.150 mm	%	0.1	13.3	11.3	2.1
-0.150 + 0.075 mm	%	0.1	5.7	4.6	0.8
-0.075 mm	%	0.1	4.6	4.8	0.6

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

Sample Description Key (if req'd)

001	1. RAMP 6 UNCONTROLLED HAUL RD - HAUL RD
002	2. RAMP 6 DUMP RD CONTROLLED - HAUL RD
003	3. WEST DUMP RD CONTROLLED - HAUL RD

A.2 JUNE 2014 SILT AND MOISTURE SAMPLING

Job Number : L108835
Client : Pacific Environment Limited
Reference/Order : 7487
Project : WERRIS CREEK

Analyte	Lab No / Sample ID	DL	001	002	003
NQ968 - Moisture Determination of Bulk Samples					
Total Moisture (@ 105o C)	%	0.1	4.5	2.7	2.2
NQ899 - Size Analysis of Misc.Material					
+ 31.5 mm	%	0.1	6.7	14.2	nd
-31.5 + 16.0 mm	%	0.1	9.9	10.7	1.2
-16.0 + 8.0 mm	%	0.1	26.0	23.0	8.7
-8.0 + 4.0 mm	%	0.1	19.3	17.0	26.0
-4.0 + 0.85 mm	%	0.1	18.4	19.9	30.5
-0.85 + 0.425 mm	%	0.1	5.2	6.8	11.2
-0.425 + 0.150 mm	%	0.1	6.6	5.8	14.1
-0.150 + 0.075 mm	%	0.1	3.2	1.4	4.3
-0.075 mm	%	0.1	4.6	1.2	4.0

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

Sample Description Key (if req'd)

001	1-RAMP 6
002	2-DUMP RD
003	3-MAIN WESTERN