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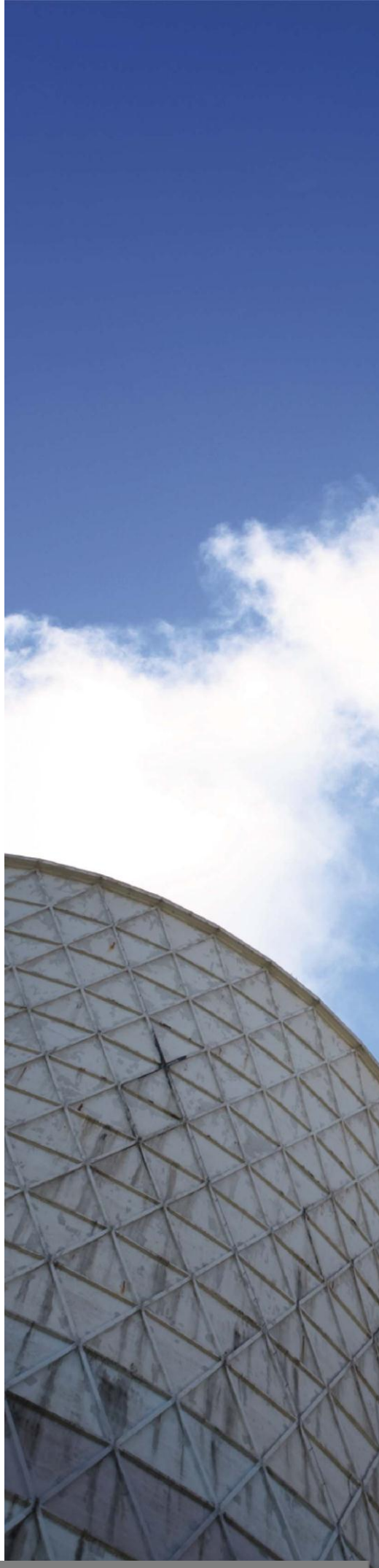

REPORT

STRATFORD COAL MINE EPL 5161 PRP U2 & EPL 11745 PRP U1: MONITORING PROGRAM RESULTS – WHEEL GENERATED DUST

Stratford Coal Pty Ltd

Job No: **7933**

24 July 2014

PROJECT TITLE:	Stratford coal mine EPL 5161 PRP U2 & EPL 11745 PRP U1: Monitoring Program Results – Wheel Generated Dust
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1 INTRODUCTION

Stratford Coal Pty Ltd (SCPL) holds Environmental Protection Licence (EPL) 5161 for the Stratford Coal Mine (SCM) and EPL 11745 for Bowens Road North Coal Project (BRN). EPL 5161 Condition U2 and EPL 11745 Condition U1 (*Particulate Matter Control Best Practice - Wheel Generated Dust)* requires that SCM 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 U2 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 SCM.

1.1 Condition U2 requirements

Condition U2 (*Particulate Matter Control Best Practice - Wheel Generated Dust)* requires that SCM must achieve and maintain a dust control efficiency of 80% or more on its haul roads, defined as follows:

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

Where E = emissions rate of the activity.

The requirements of U2 are outlined in Table 1-1, including how the requirements are addressed.

Table 1-1: PRP Requirements

PRP requirement	How this is addressed
Measure uncontrolled and controlled haul road emissions on at least 3 occasions using a mobile dust monitoring system.	**Section 4**
Continuously measure and record additional site data including: • Vehicle movements, including loaded weight direction. • Vehicle weight and speed • Procedures for watering • Meteorological conditions • Water application time, duration rate and volume	**Section 5**
Determine if a site specific relationship can be derived between the measures control efficiency and the additional site data.	Refer to **Section 5.3**
The measurement of uncontrolled and controlled haul road PM_{10} emissions must be undertaken under varying meteorological conditions, including at those times when analysis of meteorological data indicates that elevated levels of dust are most likely.	Monitoring completed across three different seasons, including summer when elevated dust levels are most likely (high temperature, evaporation, dry). Refer **Section 5.1**, **Appendix A**

2 DEFINITION OF UNCONTROLLED HAUL ROAD

Critical to the determination of haul road dust control efficiency is the definition of what constitutes an 'uncontrolled' section of haul road. In reality, finding a section of active haul road that is completely uncontrolled is challenging. For example, the correct construction and maintenance of a haul road is, in itself, a method of controlling dust.

More importantly, meteorological conditions also provide a certain level of natural control. Obviously, during rainfall a haul road cannot be 'uncontrolled' but other conditions such as high humidity, fog and mist, low evaporation also afford certain level of dust control to a road surface.

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

> *"A section 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 OVERVIEW OF MONITORING METHOD

PM emissions from haul roads were measured using the mobile system REX (Road Emissions eXpert). REX measures the concentration of PM from vehicles travelling on unpaved roads. By comparing data collected from haul roads with and without controls, control efficiencies can be calculated. In this way, REX can measure the average control efficiency (%) for each haul road section.

All active haul roads are sampled and a number of circuits are completed on the day of sampling. A section of road is left uncontrolled for at least 12 hours prior to sampling and this is also sampled during each circuit.

The monitoring method is described in more detail in the Monitoring Plan prepared for SCM and approved by the EPA (**Pacific Environment, 2013b**). All monitoring was conducted according to the internal Quality Management Plan for the use of REX (**Pacific Environment, 2013c**).

4 RESULTS

In accordance with condition U2, three rounds of REX monitoring have been completed. The variation in ambient conditions has been captured by monitoring during Spring, Summer and Autumn. An analysis of the seasonal variation in meteorology at the site is shown in **Appendix A**.

The average controlled PM_{10} concentrations are presented in **Table 4-1**. The dust emissions from controlled sections of the haul roads are consistent across all monitoring rounds. Once all monitoring rounds were complete, the uncontrolled PM_{10} concentration was determined by taking the maximum measured concentration of each round and circuit. The maximum measured uncontrolled concentration occurred during the summer monitoring round, as expected, corresponding to the ambient conditions which promote the highest levels of dust generation.

The calculated site wide haul road PM control efficiency is presented in **Table 4-2**. The results are presented graphically in **Figure 4-1**, showing performance against the target of 80%.

Table 4-1: Summary of REX measured PM concentration

Monitoring Round	Sampling Date	Number of circuits of the active mine	Controlled PM_{10} concentration (mg/m^3)	Uncontrolled PM_{10} concentration (mg/m^3)
1	7 May 2013 (11am – 3pm)	7	0.06	0.78
2	10 October 2013 (8am – 2pm)	7 (5 valid)	0.06	
3	29 January 2014 (9am – 2pm)	7	0.05	

Table 4-2: Summary of REX control efficiencies

Monitoring Round	Sampling Date	Average Control Efficiency	Range of Control Efficiency by circuit
1	7 May 2013	92 %	86 – 97 %
2	10 October 2013	92 %	88 – 97 %
3	29 January 2014	93 %	91 – 94 %

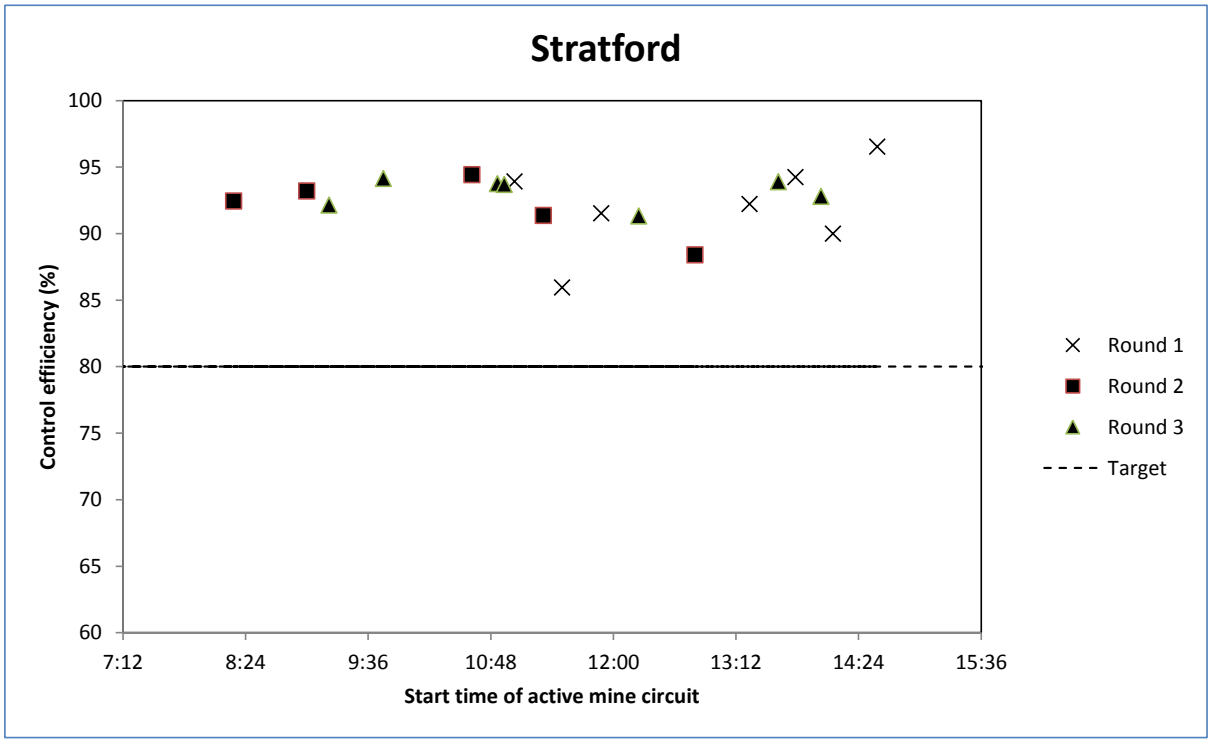


Figure 4-1: Overview of control efficiency for Stratford Coal Mine

5 ADDITIONAL SITE DATA

5.1 Meteorological conditions

In accordance with condition U2, meteorological conditions are continuously measured at the onsite weather station during the monitoring periods. A summary of the meteorological conditions for the period of each monitoring event (generally between 8am and 3pm) is presented in **Table 5-1**. A graphical summary of seasonal variation is shown in **Appendix A**.

Table 5-1: Summary statistics for meteorological conditions

Parameter (units)	7 May 2013	10 Oct 2013	29 Jan 2014
Average Wind Speed (m/s)	3.2	2.1	2.6
Average Temperature (°C)	17.2	30.7	28.1
Average Relative Humidity (%)	79%	17%	37%
Total Rainfall (mm)	0.0	0.0	0.0

5.2 Additional site data

In accordance with condition U2, additional operational data is collected for the periods of monitoring. The additional site data captured during the monitoring is summarised in **Table 5-2**.

Table 5-2: Additional site data

Site Data	7 May 2013	10 Oct 2013	29 Jan 2014
Vehicle movements and loaded weight direction	644 truck movements for the day running from pit to ROM pad and waste dump	311 truck movements for the day running from pit to ROM pad and dump	175 truck movements for the day running from BRN pit to ROM pad only
Vehicle weight (gross) and speed	CAT 775 - 110 tonnes CAT 740 – 71 tonnes Speed limit is 40 km/hr but lower on ramps (14 km/hr on BRN ramp, 18km/hr on RVL ramp)	CAT 775 - 110 tonnes CAT 740 – 71 tonnes Speed limit is 40 km/hr but lower on ramps (14 km/hr on BRN ramp, 18km/hr on RVL ramp)	CAT 775 - 110 tonnes CAT 740 – 71 tonnes Speed limit is 40 km/hr but lower on ramps (14 km/hr on BRN ramp, 18km/hr on RVL ramp)
Procedures for watering	2 water carts used on haul routes. 1 used at all times. Additional water truck used when dusty		
Water application time, duration, volume	One 55 kL water truck running continuously.	Two water carts running during the day. 13 loads of 75 kL and 9 loads of 45 kL	One 55 kL water truck running continuously

5.3 Site specific relationships

It has been determined through the completion of the Australian Coal Association Research Program (ACARP) Project C20023 '*Improvement of Haul Road Dust Emission Estimation and Controls at Coal Mines*' (**Cox & Laing, in press**) that whilst on average the open-cut mines are meeting (and often exceeding) the PRP requirement of 80% control efficiency, the variability in the mobile sampling data across the site renders it unfeasible to determine a relationship between measured concentrations and water/suppressant application rate.

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.

The data collected at SCM generally supports some of the conclusions drawn in from the ACARP study in relation to meteorological conditions. Namely that particular attention should be paid to haul road management measures when any of the following meteorological conditions are present or predicted:

- Temperatures are above 25 ^{o}C.
- Relative humidity is 40% or below.
- Solar radiation is 600 W/m2 or above.

The strongest relationship between average control efficiency achieved on each sampling day was with average temperature. These relationships are illustrated in **Figure 5-1** to **Figure 5-2**.

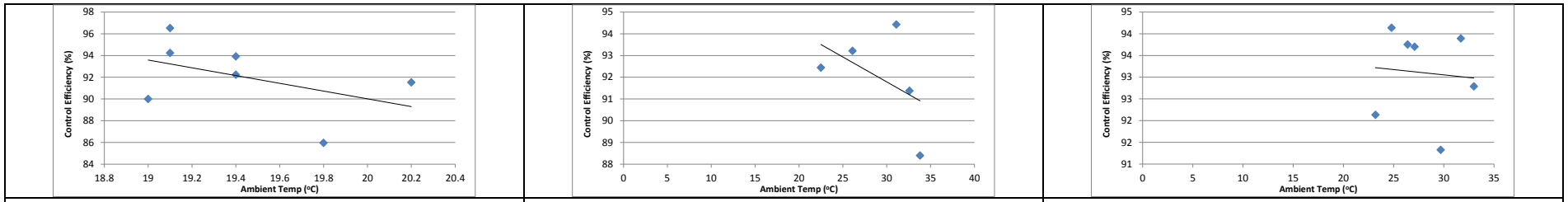


Figure 5-1: Average measured control efficiency (%) against average air temperature (°C)

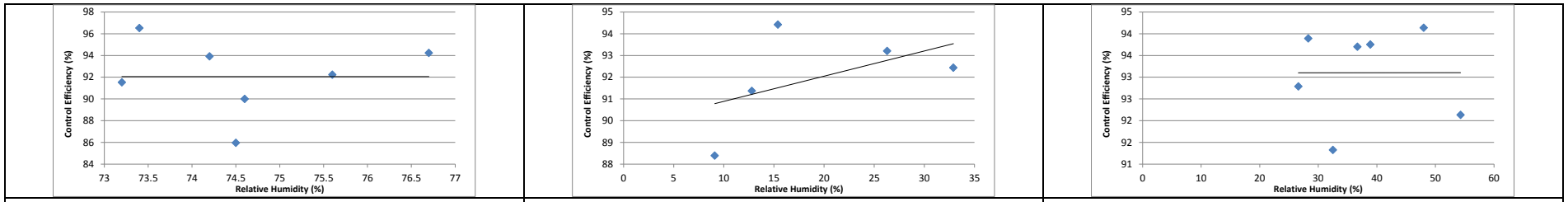


Figure 5-2: Average measured control efficiency (%) against average relative humidity (%)

6 CONCLUSION

In accordance with the Monitoring Plan developed for EPL 5161 Condition U2 and EPL 11745 Condition U1, direct measurements of haul road control efficiency have been completed over three seasons, Spring, Summer and Autumn.

The Monitoring Plan proposed Key Performance Indicators (KPI) used to demonstrate compliance with haul road control efficiency targets. **Table 6.1** summarises the compliance against the KPIs.

Table 6.1: KPIs for U2

KPI	Result
Primary KPI – to achieve PM control efficiency of 80%	Monitoring on three different occasions with varying ambient conditions demonstrates control efficiency of greater than 80%
Secondary KPI - Watering application rate to maintain efficiency of 80% on non-rain days	The regular water application rate (1 water truck running constantly) is sufficient to achieve greater than 80% control during normal conditions – refer to watering rates for 7 May 2013 and 29 January 2014 in **Table 5-2**. When conditions are dusty, SCM increase the watering rate. This is demonstrated in the 10 October 2013 monitoring when an additional water truck was employed (**Table 5-2**). The ambient conditions on this day showed elevated temperatures and reduced relative humidity which contributed to dusty conditions.

By increasing the watering rate on 10 October 2013, when elevated temperatures resulted in dustier conditions, SCM have maintained a high level of haul road control efficiency. Existing standard operating practices at SCM are therefore sufficient to achieve haul road control efficiency targets outlined in EPL 5161 Condition U2 and EPL 11745 Condition U1.

7 REFERENCES

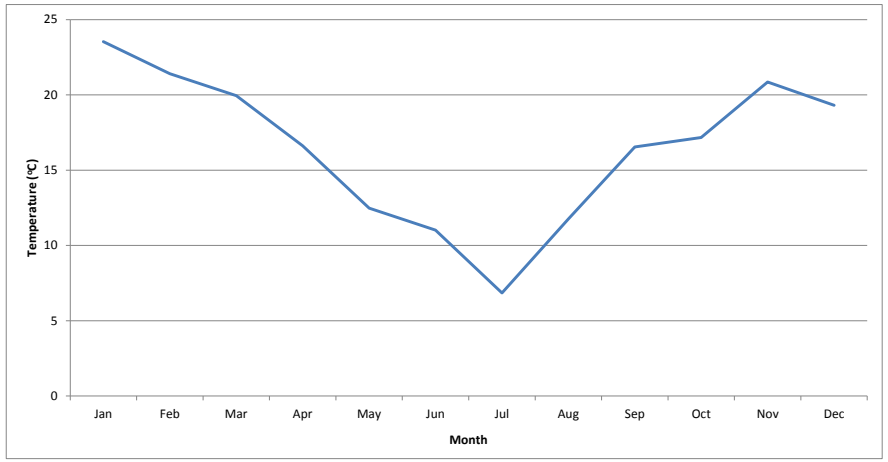
Cox J and Laing G (in press). Mobile Sampling of Dust Emissions from Unsealed Roads. ACARP Project C20023. Stage 2 Final Report.

Pacific Environment (2013a). Stratford Coal Mine PRP U2 Monitoring Plan – Wheel Generated Dust. 26 July 2013.

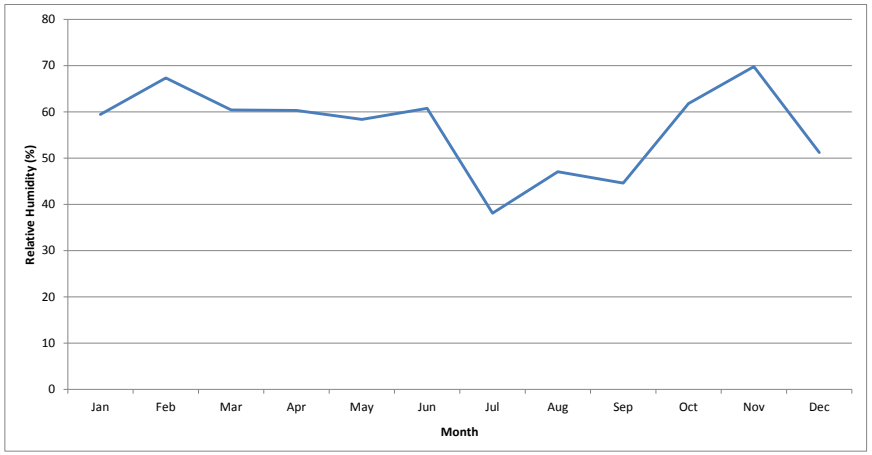
Pacific Environment (2013b). Duralie Coal Mine PRP U2 Monitoring Plan – Wheel Generated Dust. 26 July 2013.

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

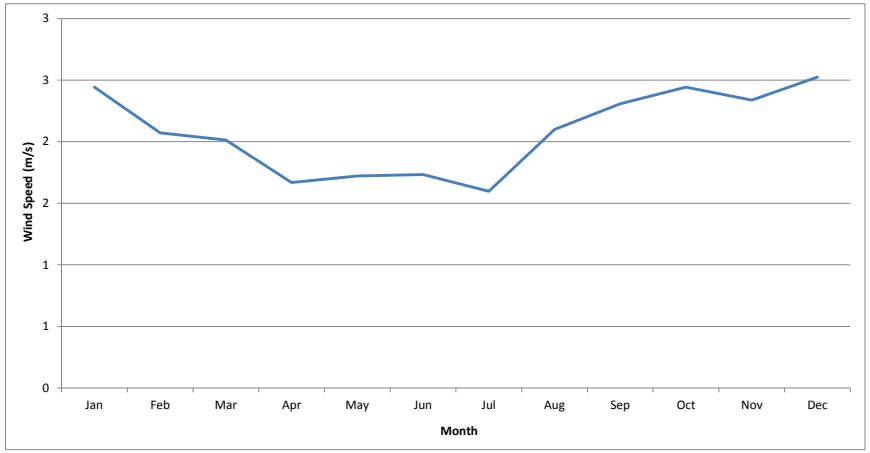
Appendix A SEASONAL VARIATION IN METEOROLOGY



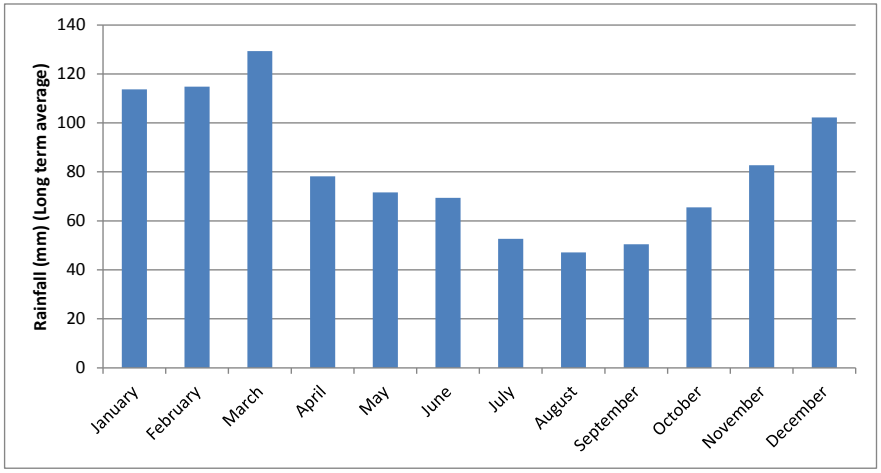
Monthly average temperature (°C)



Monthly average relative humidity (%)



Monthly average wind speed (m/s)



Long term average monthly rainfall (mm)

Appendix B MONITORING RESULTS

				Dust Concentration (mg/m^3)		
Monitoring Round	Date	Start Time	Circuit	Average controlled	Average uncontrolled	CE % (max uncontrolled)
Round 1	7-May-13	11:02	1	0.05	0.09	94
Round 1	7-May-13	11:30	2	0.11	0.19	86
Round 1	7-May-13	11:53	3	0.07	0.10	92
Round 1	7-May-13	13:20	4	0.06	0.04	92
Round 1	7-May-13	13:47	5	0.04	0.05	94
Round 1	7-May-13	14:09	6	0.08	0.11	90
Round 1	7-May-13	14:35	7	0.03	0.10	97
Round 2	10-Oct-13	8:17	1	0.06	0.10	92
Round 2	10-Oct-13	9:00	2	0.05	0.05	93
Round 2	10-Oct-13	10:37	3	0.04	0.08	94
Round 2	10-Oct-13	11:19	4	0.07	0.11	91
Round 2	10-Oct-13	12:48	5	0.09	0.11	88
Round 2	10-Oct-13	1:30	6	Invalid - temp effect in data		N/A
Round 2	10-Oct-13	2:03	7	Invalid - temp effect in data		N/A
Round 3	29-Jan-14	9:13	1	0.06	0.20	92
Round 3	29-Jan-14	9:45	2	0.05	0.67	94
Round 3	29-Jan-14	10:52	3	0.05	0.75	94
Round 3	29-Jan-14	10:56	4	0.05	0.78	94
Round 3	29-Jan-14	12:15	5	0.07	0.74	91
Round 3	29-Jan-14	13:37	6	0.05	0.75	94
Round 3	29-Jan-14	14:02	7	0.06	0.62	93
				Max uncontrolled	**0.78**	