

Rasp Mine
Monthly Environmental Monitoring Report
August 2017



Broken Hill Operations Pty Ltd (BHOP) [a wholly owned subsidiary of CBH Resources Limited (CBH)] owns and operates the Rasp Mine (the Mine), which is located centrally within the City of Broken Hill on Consolidated Mine Lease 7 (CML7).

Mining has been undertaken within CML7 since 1885. The existing operations at the Rasp Mine include underground mining operations, a processing plant producing zinc and lead concentrates and a rail siding for concentrate dispatch. These operations are undertaken in accordance with Project Approval 07_0018 granted 31 January 2011, under Part3A of the Environmental Planning and Assessment Act 1979 (EP&A Act).

As the holder of an Environmental Protection Licence, 12559, BHOP is required, under Section 66(6) of the NSW *Protection of the Environment Operations Act 1997*, to publish pollution monitoring data. In addition BHOP is required to publish data in accordance with its Project Approval 07_0018 Schedule 4 Condition 9. These documents can be found on the Rasp Mine web site.

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1 Air Quality

The following criteria as listed in the Project Approval apply to air quality monitoring:

Long Term Criteria for Particulate Matter

Pollutant	Averaging Period	Criterion
Total solid particles (TSP)	Annual	90 µg/m ³
Particulate matter < 10 µm (PM ₁₀)	Annual	30 µg/m ³

Short Term Criterion for Particulate Matter

Pollutant	Averaging Period	Criterion
Particulate matter < 10 µm (PM ₁₀)	24 hour	50 µg/m ³

Long Term Criteria for Deposited Dust

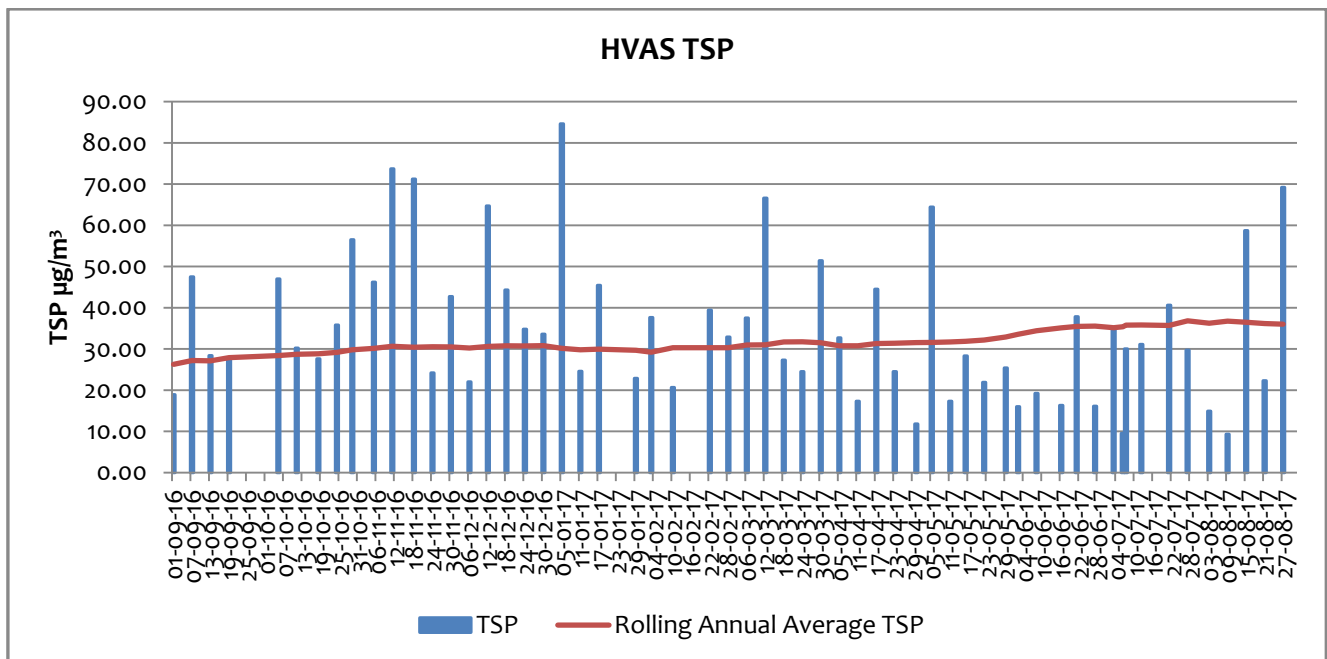
Pollutant	Averaging Period	Maximum Project Contribution	Maximum Total Deposited Dust Level
Deposited dust	Annual	2 g/m ² /month	4 g/m ² /month

1.1 High Volume Air Samplers

There are three high volume air samplers used to measure ambient air quality at the Rasp Mine - HVAS (EPL10) and HVAS1 (EPL11) are located at the Silver Tank, central and to the south of the mine lease, and HVAS2 (EPL12) is located adjacent to and north of Blackwood Pit. A map indicating these locations can be found on the Rasp Mine web site. HVAS samples for total suspended particulates (TSP) and lead dust, HVAS1 and HVAS2 sample for particulate matter less than 10 microns (PM₁₀) and lead dust.

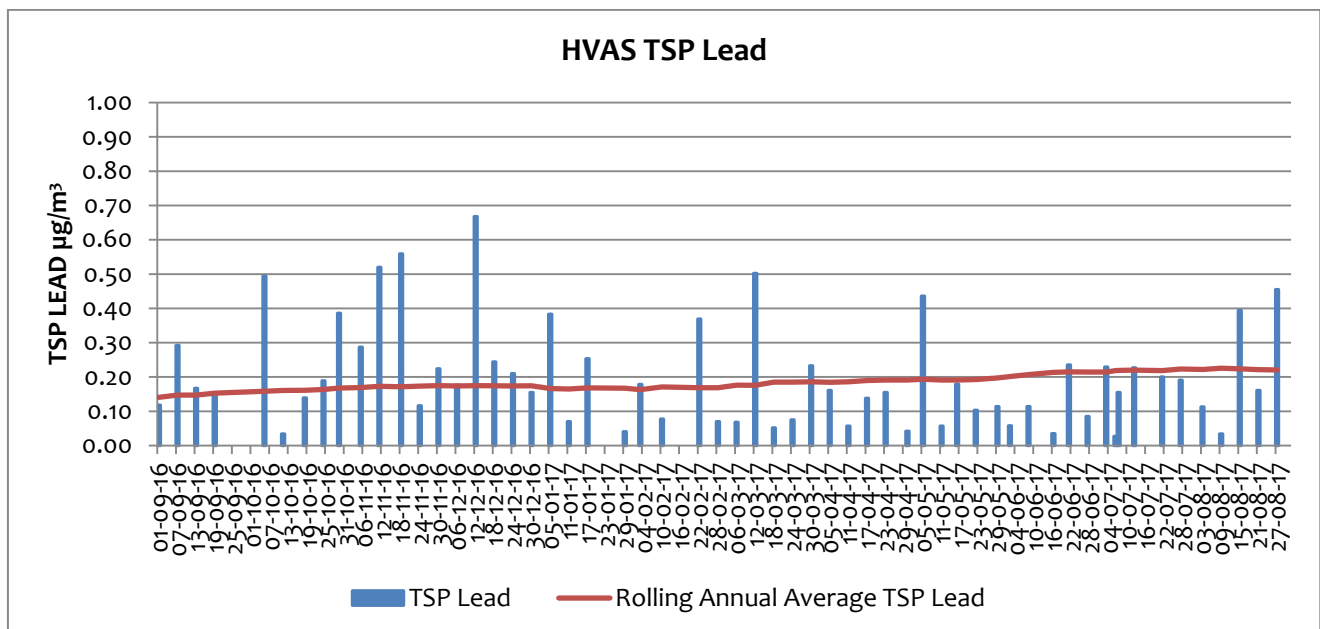
HVAS (EPL10) - SILVER TANK - ON SITE

DATE	TSP (µg/m ³)	Lead (µg/m ³)
03-08-17	14.90	0.11
09-08-17	9.30	0.03
15-08-17	58.70	0.39
21-08-17	22.30	0.16
27-08-17	69.20	0.46



This monitoring unit is located on the mining lease and no criterion applies at this point, criteria apply to the closest residential location. The data indicates that the annual average TSP for August of $35.5 \mu\text{g}/\text{m}^3$ is well below the annual average criterion for TSP of $90 \mu\text{g}/\text{m}^3$.

The Rasp Mine is in compliance with this criterion.



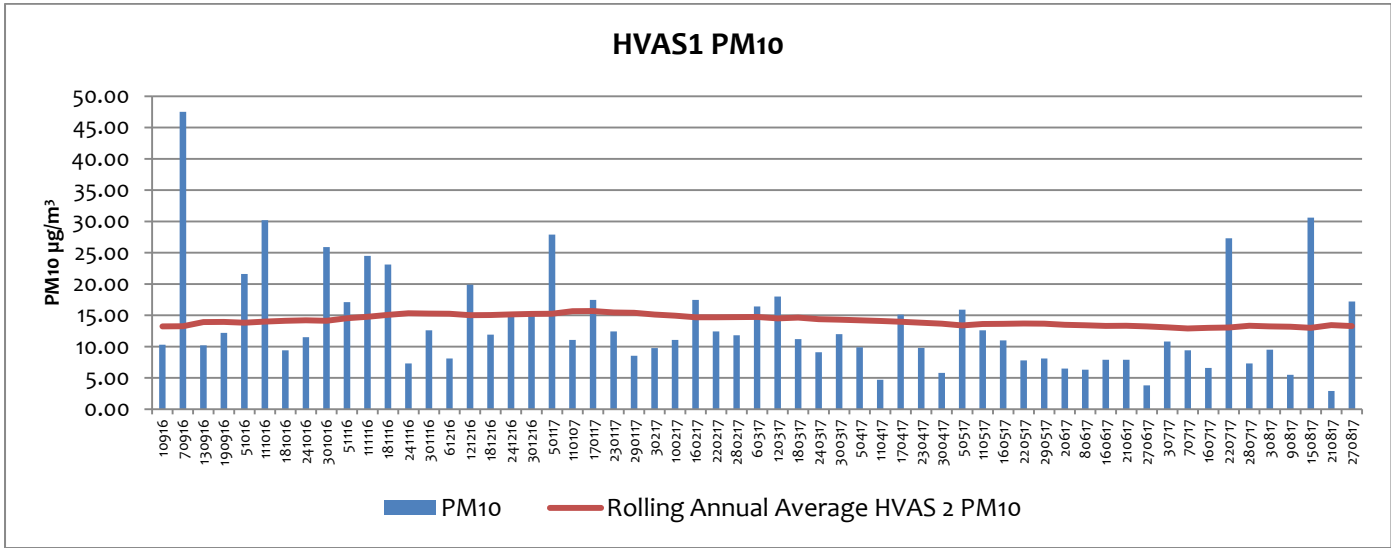
Guidelines for air quality are provided by the DECCW NSW (now EPA), 2005 Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales. In regards to ambient lead dust the Rasp Mine annual averaged for August ($0.22 \mu\text{g}/\text{m}^3$) is below the DECCW guideline of $0.50 \mu\text{g}/\text{m}^3$.

The Rasp Mine is in compliance with this criterion.

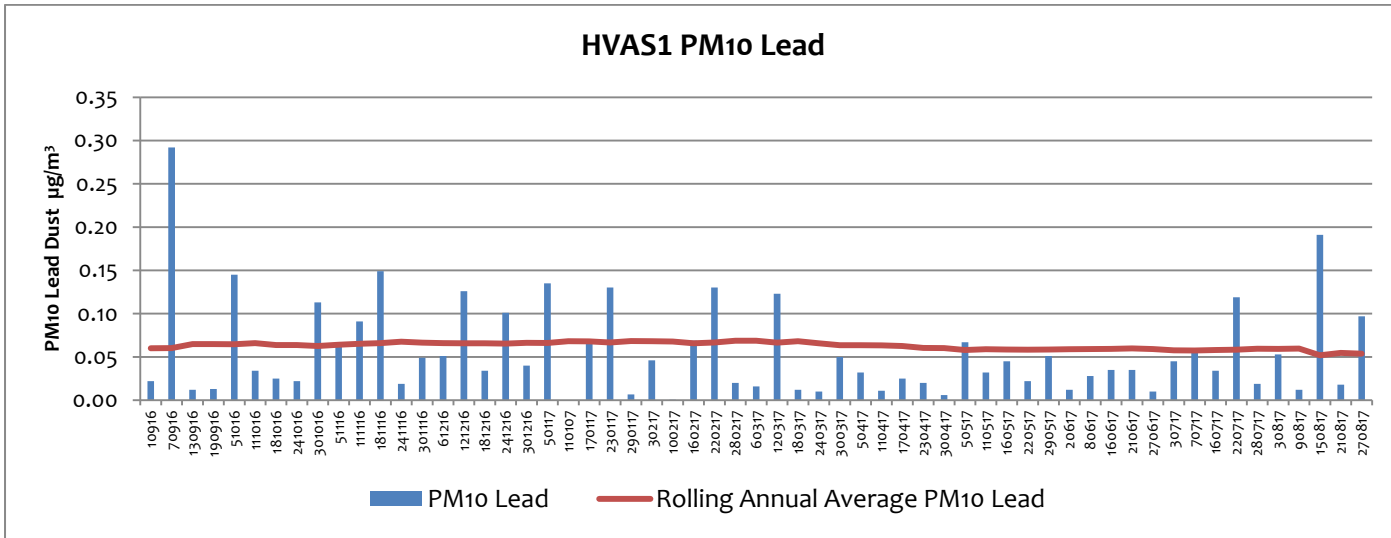


HVAS1 (EPL11) - Silver Tank - On Site

DATE	PM10 ($\mu\text{g}/\text{m}^3$)	Lead ($\mu\text{g}/\text{m}^3$)
03-08-17	9.50	0.05
09-08-17	5.50	0.01
15-08-17	30.60	0.19
21-08-17	2.90	0.02
27-08-17	17.20	0.10



This monitoring unit is located on the Rasp Mine mining lease and thus no criterion applies at this point, criteria apply to the closest residential location. The data indicates that the annual average PM₁₀ of 14 $\mu\text{g}/\text{m}^3$ is below the annual average criterion of 30 $\mu\text{g}/\text{m}^3$. The Rasp Mine is in compliance with this criterion.

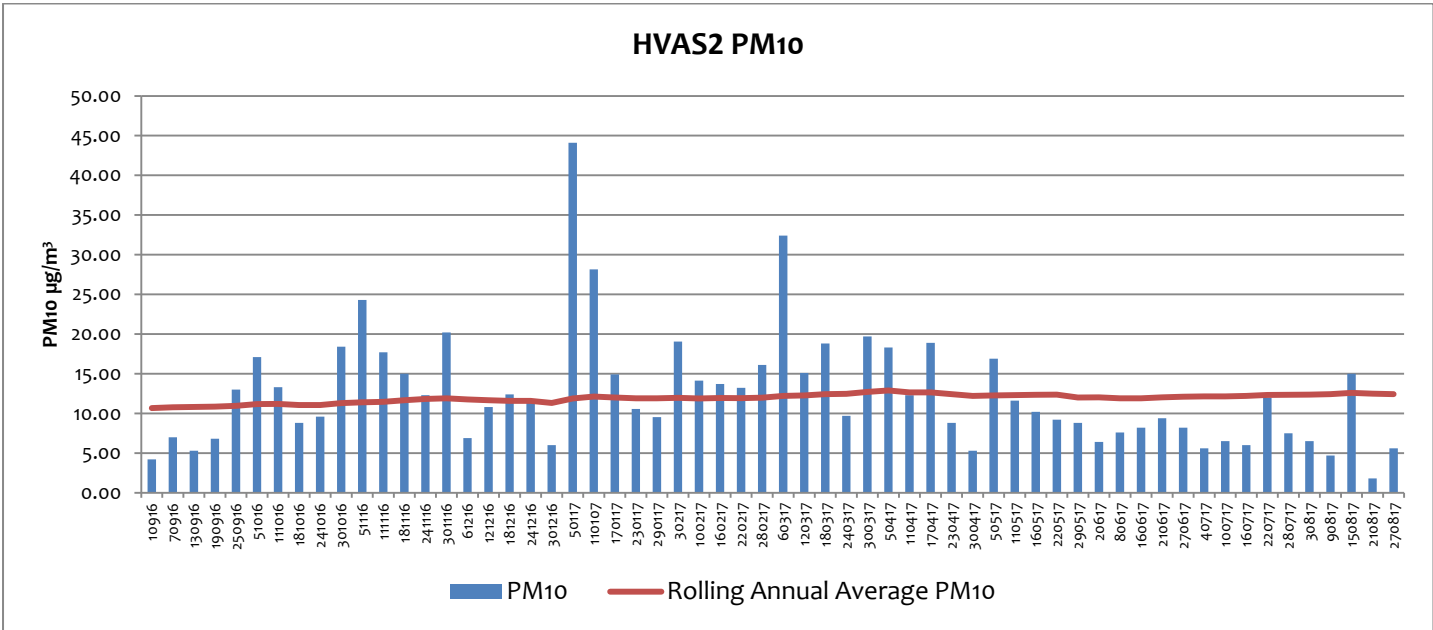


There is no guideline for assessing PM₁₀ lead dust, the overall the trend for lead dust at this location remains consistent with the previous 12 months.



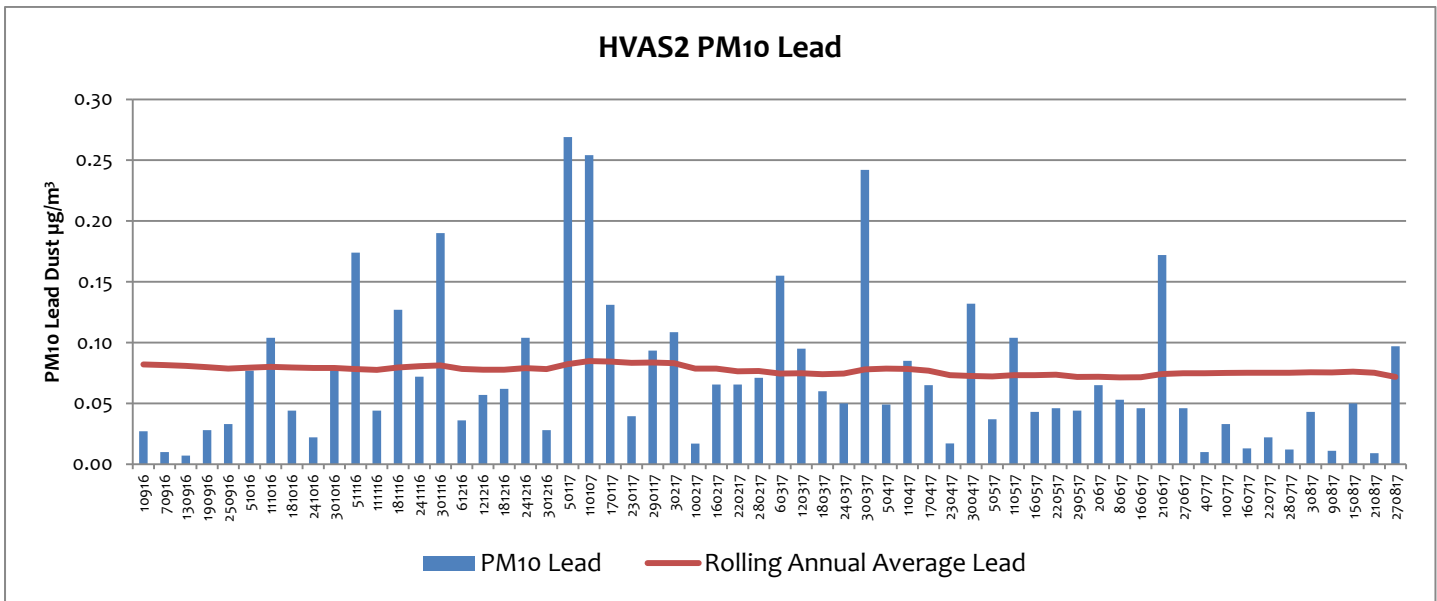
HVAS 2 (EPL12) - Blackwood Pit – On Site

DATE	PM10 ($\mu\text{g}/\text{m}^3$)	Lead ($\mu\text{g}/\text{m}^3$)
03-08-17	6.50	0.04
09-08-17	4.70	0.01
15-08-17	15.00	0.05
21-08-17	1.80	0.01
27-08-17	5.60	0.10



This monitoring unit is located on the Rasp Mine mining lease and no criterion applies at this point, criteria apply to the closest residential location. The data indicates that the annual average PM₁₀ of 12 $\mu\text{g}/\text{m}^3$ is below the PM₁₀ annual average criterion of 30 $\mu\text{g}/\text{m}^3$.

The Rasp Mine is in compliance with this criterion.



There is no guideline for assessing PM₁₀ Lead dust, however the overall the trend for lead dust at this location remains consistent with the previous 12 months.

1.2 Tapered Element Oscillating Microbalance Sampling (TEOM)

There are two tapered element oscillating microbalance (TEOM) sampling units used to measure ambient air quality at the Rasp Mine – TEOM1 (EPL13) is located off-site within the perimeter fence of Essential Water south of the mine lease, and TEOM2 (EPL14) is located on-site adjacent to Blackwood Pit to the north of the mine lease. A map indicating these locations can be found on the Rasp Mine web site. TEOM1 and TEOM2 operate continuously and sample for particulate matter less than 10 microns (PM₁₀).

TEOM1 (EPL13) – Off-site and TEOM2 (EPL14) – On Site

Particulate Matter <10 Microns 24Hr Average				
Date	TEOM 1 (µg/m ³)	Compliant with 50µg/m ³ 24hr average?	TEOM 2 (µg/m ³)	Compliant with 50µg/m ³ 24hr average?
01-08-17	2.1	Y	6.75	Y
02-08-17	11.83	Y	9.42	Y
03-08-17	4.43	Y	-1.40	Y
04-08-17	6.48	Y	5.80	Y
05-08-17	10.46	Y	9.92	Y
06-08-17	8.88	Y	8.08	Y
07-08-17	8.91	Y	8.78	Y
08-08-17	11.99	Y	16.27	Y
09-08-17	20.56	Y	8.70	Y
10-08-17	21.25	Y	20.79	Y
11-08-17	13.26	Y	15.40	Y



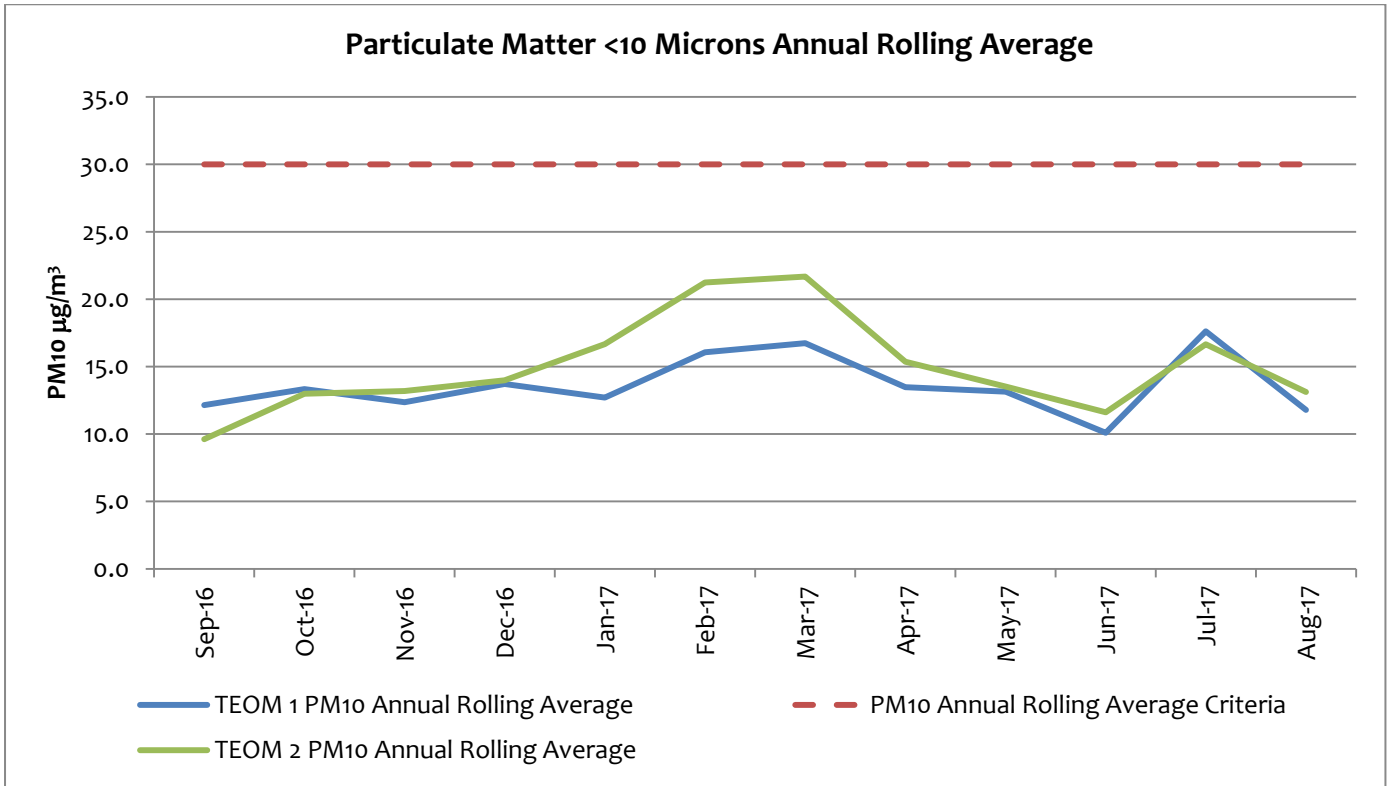
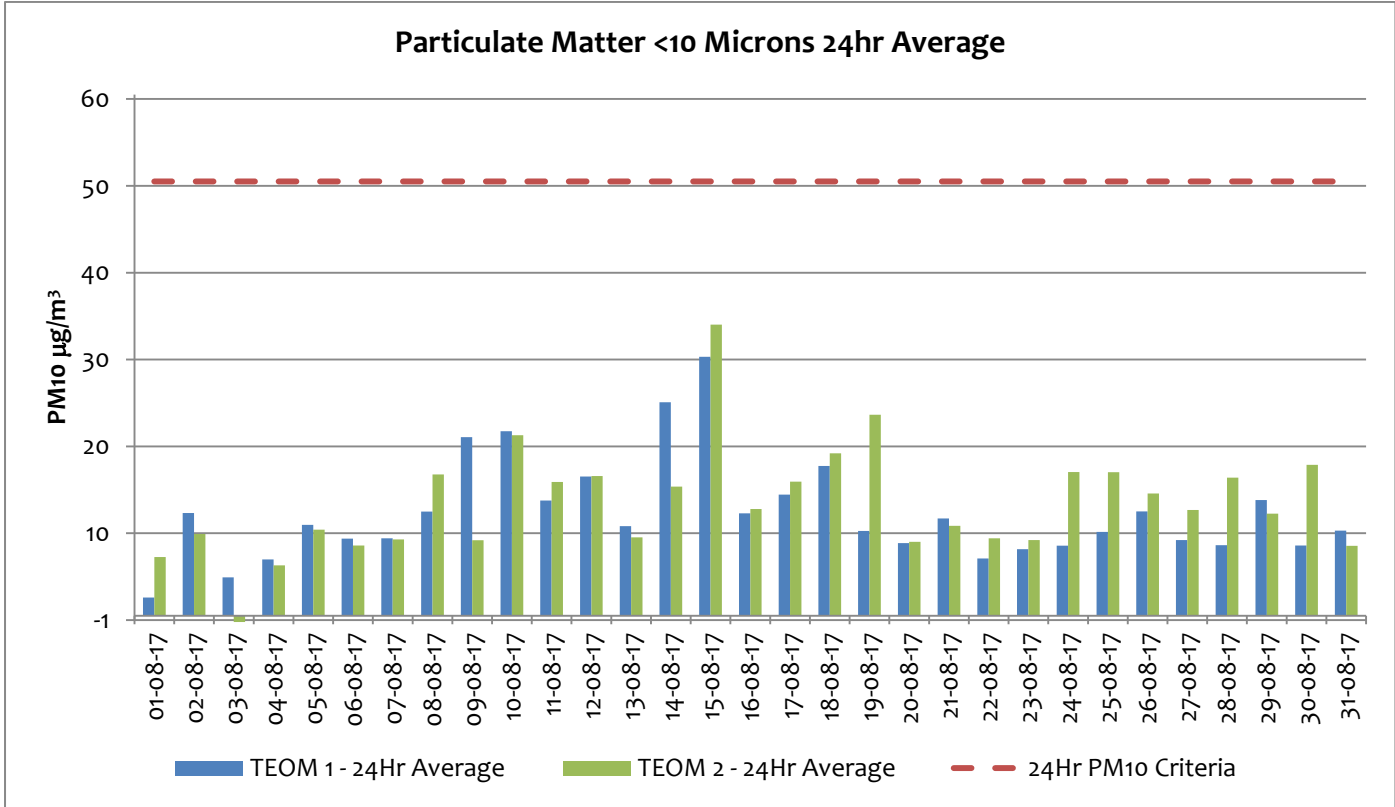
12-08-17	16.03	Y	16.09	Y
13-08-17	10.32	Y	9.03	Y
14-08-17	24.58	Y	14.87	Y
15-08-17	29.83	Y	33.51	Y
16-08-17	11.79	Y	12.28	Y
17-08-17	13.96	Y	15.44	Y
18-08-17	17.24	Y	18.70	Y
19-08-17	9.76	Y	23.15	Y
20-08-17	8.36	Y	8.52	Y
21-08-17	11.21	Y	10.35	Y
22-08-17	6.60	Y	8.91	Y
23-08-17	7.66	Y	8.72	Y
24-08-17	8.08	Y	16.54	Y
25-08-17	9.66	Y	16.52	Y
26-08-17	12.01	Y	14.07	Y
27-08-17	8.72	Y	12.17	Y
28-08-17	8.12	Y	15.90	Y
29-08-17	13.32	Y	11.76	Y
30-08-17	8.08	Y	17.37	Y
31-08-17	9.80	Y	8.04	Y

The TEOM1 monitoring unit is located off-site from the Rasp Mine and the criteria as listed in the Project Approval 07_0018 applies at this point. There are two criterion listed for PM₁₀ - 24 hour average and an annual average. The highest 24-hour average recorded at TEOM1 was 29.83 µg/m³ on 15 August, this is below the criteria of 50 µg/m³. The annual average for PM₁₀ at the end of August 2017 was 11.8 µg/m³ and well below the listed criteria of 30 µg/m³.

The TEOM2 monitoring unit is located on the Rasp Mine lease and no criteria applies at this point, criteria apply to the closest residential location. The data indicates that the highest 24-hour average recorded at TEOM2 of 33.51 µg/m³ was also on the 15 August and is below the criteria of 50 µg/m³. The annual average for PM₁₀ at the end of August was 13.1 µg/m³ and is below the listed PM₁₀ criteria of 30 µg/m³ at the nearest residential location.

Rasp Mine is in compliance with all listed criteria.

PM10 (µg/m³) 12 Month Rolling Average												
	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17
TEOM 1 (EPL13)	12.1	13.3	12.4	13.7	12.7	16.1	16.6	13.5	13.1	10.1	17.6	11.8
Compliant with 30µg/m³ annual average?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
TEOM 2 EPL14	9.6	13.0	13.2	14.0	16.7	21.2	21.7	15.4	13.5	11.4	16.6	13.1
Compliant with 30µg/m³ annual average?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y



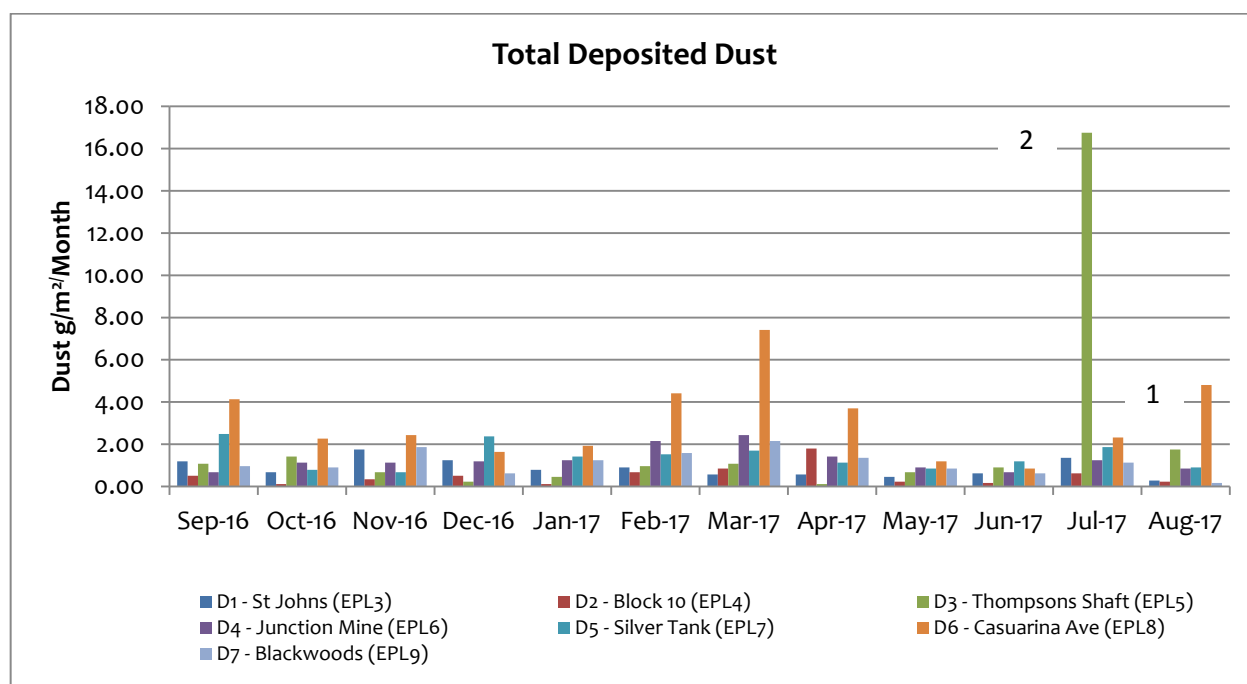
Overall the trend for PM₁₀ remains consistent with the previous 12 months.



1.3 Dust Deposition Sampling

There are seven dust deposition gauges to measure ambient air quality at the Rasp Mine – D1 to D7. D1 and D6 are located off-site, D1 near the St Johns training facility north of the Rasp Mine and D6 in Casuarina Avenue south of the Rasp Mine. D2 to D5 and D7 are located on the mine lease in various locations. A map indicating these locations can be found on the Rasp Mine web site. Dust samples are collected monthly and analysed for total deposited dust and deposited lead dust.

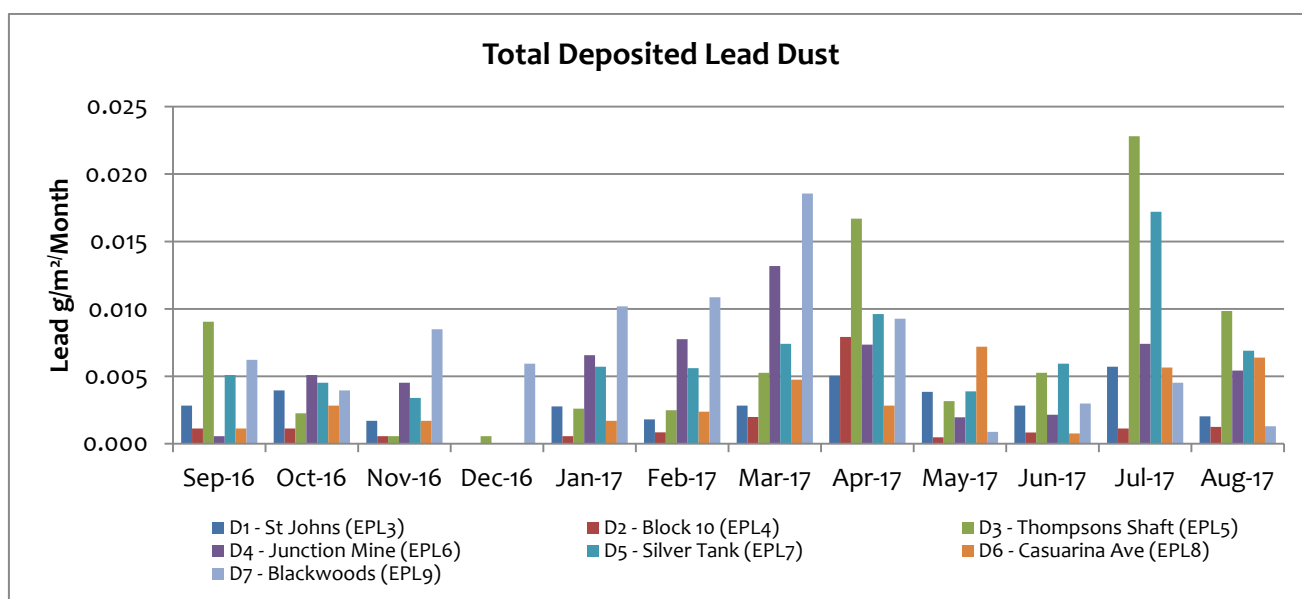
Total Deposited Dust (g/m ² /Month)							
Date	D1 (off site)	D2	D3	D4	D5	D6 (off site)	D7
August 2017	0.28	0.23	1.75	0.85	0.91	4.81	0.17
Background (2010)	4.0	3.1	4.3	5.7	N/A	5.8	N/A
Maximum Mine contribution	2.0					2.0	
Maximum deposition level	4.0					4.0	
Compliant?	Y					Y	



Note 1: Elevated total dust recorded at the offsite monitor at Casuarina Avenue continues to be affected by motor bikes accessing the vacant lot at the rear of the property.

Note 2: The high result recorded in July for Thompson Shaft has not continued into August and would appear to be an anomaly.

Total Deposited Lead (g/m ² /Month)							
Date	D1 (Off Site)	D2	D3	D4	D5	D6 (Off Site)	D7
August 2017	0.002	0.001	0.010	0.005	0.007	0.006	0.004
Background (2010)	0.0034	0.005	0.005	0.006	N/A	0.004	N/A



There is no guideline or criterion for deposited lead dust. Total deposited lead dust results remain lower than the initial measurements taken prior to commencement of operations.

1.4 Ventilation Outlets and Bag House Monitoring

There are three locations to measure pollutants from exhausts or stacks, these include the Primary Ventilation Shaft and Shaft 6, both measuring pollutants from underground firings, and the Baghouse Stack at the crusher measuring dust. All are located on-site. The Primary Ventilation Shaft is located centrally and to the north of the lease and Shaft 6 is located centrally within the lease. The Primary Crusher Baghouse Stack is located within the area of the processing plant to the east of the lease. A map indicating these locations can be found on the Rasp Mine web site. Samples are collected quarterly and analysed for a number of parameters listed in below. Quarterly sampling is undertaken in January, April, July and October.

The following criteria apply:

Primary Ventilation Shaft (EPL1) and Shaft 6 (EPL56)

	Unit	Criteria
Nitrogen Oxides	mg/m ³	350
Volatile Organic Compounds	mg/m ³	40

Primary Ventilation Shaft (EPL1), Shaft 6 (EPL56) and Crusher Baghouse (EPL2)

	Unit	Criteria
Total Suspended particles	mg/m ³	20
Type 1 and Type 2	mg/m ³	1

Type 1 substance Means the elements antimony, arsenic, cadmium, lead or mercury or any compound containing one or more of those elements.

Type 2 substance Means the elements beryllium, chromium, cobalt, manganese, nickel, selenium, tin or vanadium or any compound containing one or more of those elements.

Sampling was not scheduled for August.



2 Noise

2.1 Blasting (Vibration and Overpressure)

There are 6 vibration monitors at various locations to measure for vibration and overpressure from blast firings. These include V1 to V5 which are located off-site and V6 which is located on-site near Shaft 4. A map indicating these locations can be found on the Rasp Mine web site. In addition there are 2 roving monitors which may be used to monitor vibration and overpressure at particular locations as required. Monitors operate continuously and are automatically triggered when a blast occurs. The following conditions apply as listed in the Project Approval and Environment Protection License.

Blasting Criteria (excluding Block 7)

Location	Airblast Overpressure (dB(Lin Peak))	Ground Vibration (mm/s)	Allowable Exceedance
Residence on privately owned land (7am-7pm)	115	5	5% of the total number of blasts over a 12-month period
(7am-7pm)	120	10	0%
(7pm-10pm)	105	-	-
(10pm-7am)	95	-	-
Public Infrastructure	-	100	0%

Blasting Criteria (Block 7)

Location	Airblast Overpressure (dB(Lin Peak))	Ground Vibration (mm/s)	Allowable Exceedance
Residence on privately owned land (7am-7pm)	115	3 (interim)	5% of the total number of blasts over a 12-month period
(7am-7pm)	120	10	0%
(7pm-10pm)	105	-	-
(10pm-7am)	95	-	-
Broken Hill Bowling Club, Italio (Bocce) Club, Heritage Items within CML7	-	50	0%
Perilya Southern Operations	-	100	0%
Public Infrastructure	-	100	0%

In addition the following conditions apply:-

- Production blasts may occur between 6.45 am and 7.15 pm on any day
- 1 production blast per day, with 6 per week averaged over a calendar year
- 6 development blasts per day, with 42 per week averaged over a calendar year



Blasting Data Summary for August

Total number of blasts:

- no production blasts have occurred before 6:45 am or after 7:15 pm
- production blasts averaged 4 per week over the previous calendar year
- development blasts, averaging 34 per week over the previous calendar year

Rest of Mine - Western Mineralisation and Main Lodes:

- 1 Blast recorded a ppv >5mm/s
- 0 Blasts recorded a ppv of >10mm/s
- 0 Blasts recorded a ppv >100mm/s
- 0 development blasts recorded an over pressure level over 95 dBL (10pm to 7am)
- 0 development blasts recorded an over pressure level over 105 dBL (7pm to 10pm)
- 0 Blasts recorded an over pressure level over 115dBL or 120 dBL (7am to 7pm)
- % of all blasts over 5mm/sec = 0.3% calculated from 1 September 2016 until 31 August, 2017;
- % of production blasts over 5mm/sec = 3.7% calculated from 1 September 2016 until 31 August, 2017

Block 7:

- 0 Blasts recorded a ppv of >3mm/s
- 0 Blasts recorded a ppv of >10mm/s
- 0 Blasts (V6) recorded a ppv of >50mm/s
- 0 development blasts recorded an over pressure level over 95 dBL (10pm to 7am)
- 0 development blasts recorded an over pressure level over 105 dBL (7pm to 10pm)
- 0 Blasts recorded an over pressure level over 115dBL or 120 dBL (7am to 7pm)
- % of all blasts over 3mm/sec = 0% calculated from 1 September 2016 until 31 August, 2017;
- % of production blasts over 3mm/sec = 0% calculated from 1 September 2016 until 31 August, 2017

Rasp Mine is in compliance with all listed criteria.

2.2 Noise

Noise monitoring is undertaken as per the NSW Industrial Noise Policy at a frequency of once per annum. A noise assessment was conducted in 2016, and is next due in Q4 2017.

3 Water

3.1 Groundwater

There are eighteen sampling locations for groundwater, GW01 (EPL37) to GW16 (EPL52) are installed piezometers at various locations around the mine site and are sampled quarterly. There are also two sampling locations for water pumped from underground mining, Shaft 7 (EPL53) and Kintore Pit (EPL54), sampled monthly. A map indicating these locations can be found on the Rasp Mine web site. Groundwater monitoring is scheduled for completion in March, June, September and December.



Groundwater Monitoring Requirements

EPA Identification Number	Frequency	Parameters to be analysed
Shaft 7 EPL53	Monthly	alkalinity (calcium carbonate (CaCO ₃)), cadmium (Cd), calcium (Ca), chloride (Cl), electrical conductivity (EC), iron (Fe), lead Pb), magnesium (Mg), manganese (Mn), pH, sodium (Na), sulphate (SO ₄), total dissolved solids (TDS) and zinc (Zn)
Kintore Pit (U/G dewatering) EPL54	Monthly	
Piezometers EPL37 (GW01) to EPL52 (GW16)	Quarterly	

Shaft 7 (EPL53) and Kintore Pit (EPL54) August Results

Sample Point	Alkalinity (CaCO ₃) (mg/l)	Cd (mg/l)	Ca (mg/l)	Cl (mg/l)	EC (µS/cm ²)	Fe (mg/l)	Pb (mg/l)	Mg (mg/l)	Mn (mg/l)	pH	Na (mg/l)	SO ₄ (mg/l)	TDS (mg/l)	Zn (mg/l)
Shaft 7 (EPL53)	11	1.79	463	1400	10800	<0.05	0.759	265	298	6.41	1390	4050	11500	839
*Kintore Pit (EPL54)	Not undertaken													

* Sampling not undertaken for underground mine water extraction - error by operator.

3.2 Surface Water

There are seven sampling locations for surface water, these include surface water basins located on the mine lease to capture and retain rainfall and two locations up and down stream of an ephemeral creek located south of the mine lease boundary. A map indicating these locations can be found on the Rasp Mine web site. Sampling is undertaken in October (highest rainfall month as recorded by Bureau of Meteorology) and April.

Surface Water Monitoring Requirements

Description	Frequency	Parameters to be Analysed
Federation Way Culvert EPL29/S31-1	2 x per year , six months apart	cadmium (Cd), chloride (Cl), electrical conductivity (EC), lead Pb), manganese (Mn), pH, sodium (Na), sulphate (SO ₄), total dissolved solids (TDS) and zinc (Zn)
Ryan Street Dam EPL31/S49	2 x per year , six months apart	
Adjacent Olive Grove EPL32/S1A	2 x per year , six months apart	
Adjacent Bowls Club EPL33 /S9-B2	2 x per year , six months apart	
Horwood Dam EPL34/Horwood Dam	2 x per year , six months apart	
Upstream Bonanza St EPL35	2 x per year , six months apart	
Downstream Sydney Rd EPL36	2 x per year , six months apart	

Surface water was not scheduled for monitoring in August.



4 Weather Data

The weather station continuously monitors the following parameters as per point 55 of the Environmental Protection Licence.

The following parameters are required to be recorded each month as listed in the EPL 12559:-

Rasp Mine Weather Station (EPL55)

Parameter	Sampling method	Units of measure	Averaging period	Frequency
Temperature at 10 metres	AM-4	degrees Celsius	15 minutes	Continuous
Wind Direction at 10 metres	AM-4	degrees in a clockwise direction from True North	15 minutes	Continuous
Wind Speed at 10 metres	AM-4	metres per second	15 minutes	Continuous
Rainfall	AM-4	millimetres	1 hour	Continuous
Sigma theta	AM-2 & AM-4	degrees	15 minutes	Continuous

Weather Data Summary

Date	Min Temp @ 10m (°C)	Max Temp @ 10m	Min Wind Speed @ 10m (m/s)	Max Wind Speed @ 10m (m/s)	Predominant wind dir @ 10m (deg)
01-08-17	5.7	16.9	0.1	5.3	ENE
02-08-17	6.7	15.5	0.2	7.3	ENE
03-08-17	6.5	12.2	0.5	8	ENE
04-08-17	4.5	13.9	0.2	11.2	NW
05-08-17	6.0	13.4	0.3	9.7	WNW
06-08-17	9.4	15.3	0.5	12.4	NW
07-08-17	5.1	14.3	0.4	8.7	WSW
08-08-17	6.6	16	0.1	3.9	SSW
09-08-17	7.4	18.4	0.2	8.8	North
10-08-17	13.2	25.1	0.7	15.9	North
11-08-17	8.6	16.2	0.2	7	SW
12-08-17	8.7	19.4	0.1	5.2	North
13-08-17	12.1	22	0.2	8.1	North
14-08-17	17.4	22.3	0.2	6.5	NNE
15-08-17	17.8	29.7	0.4	16.8	NW
16-08-17	10.7	17.7	0.8	11.4	West
17-08-17	10.1	18.1	0.8	11.3	West
18-08-17	7.1	14.8	0.9	12.8	SSW
19-08-17	4.9	12.9	0.6	7.3	SSW
20-08-17	5.0	14.7	0.5	8.1	NNE
21-08-17	8.2	17.9	1	13.2	NNE



Date	Min Temp @ 10m (°C)	Max Temp @ 10m	Min Wind Speed @ 10m (m/s)	Max Wind Speed @ 10m (m/s)	Predominant wind dir @ 10m (deg)
22-08-17	6.9	16.3	1	9.3	SSW
23-08-17	8.1	17.1	0.7	9.1	SSW
24-08-17	5.3	13.9	1.3	9.8	South
25-08-17	4.7	14.5	0.2	7.6	SSE
26-08-17	6.3	14.5	0.4	6.7	ENE
27-08-17	5.3	12.4	0.6	10.1	South
28-08-17	2.1	11.5	0.9	7.8	South
29-08-17	5.0	12.8	0.5	5.9	South/SSE
30-08-17	5.9	14.4	0.1	6.6	SE
31-08-17	6.9	17.2	0.5	6.4	ENE

5 Data Log

Sample	Result Received
Hi Volume Samples	05-Oct-17
TEOM	01-Aug-17
Dust Deposition	07-Sep-17
Water	24-Aug-17
Blast Vibration and overpressure	01-Aug-17
Weather	01-Aug-17

6 Correction Log

There are no corrections to the previous reports.