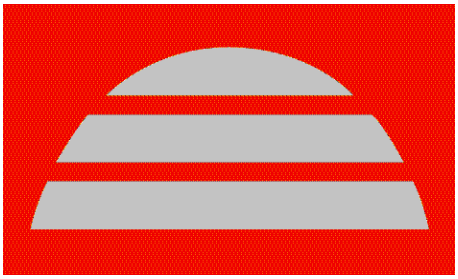

Rasp Mine
Monthly Environmental Monitoring Report
February 2018

INTRODUCTION

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 (MOD4 6 September 2017) 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	25 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

Hot dry conditions in February

February was a hot dry windy month in Broken Hill with little rain. According to the Rasp Mine site weather station, 20 days exceeded 30^{o}C, winds were predominantly from the south and wind speeds exceeded 35 km/h over 17 days with wind gusts up to 62 km/h. The BoM monitor at the airport confirmed these conditions recording 25 days with wind gusts greater than 35 km/h predominantly from a southern direction (also 17 days), and 23 days with temperatures above 30^{o}C. These dry conditions and high winds resulted in regional dust storms impacting February air quality monitoring results.

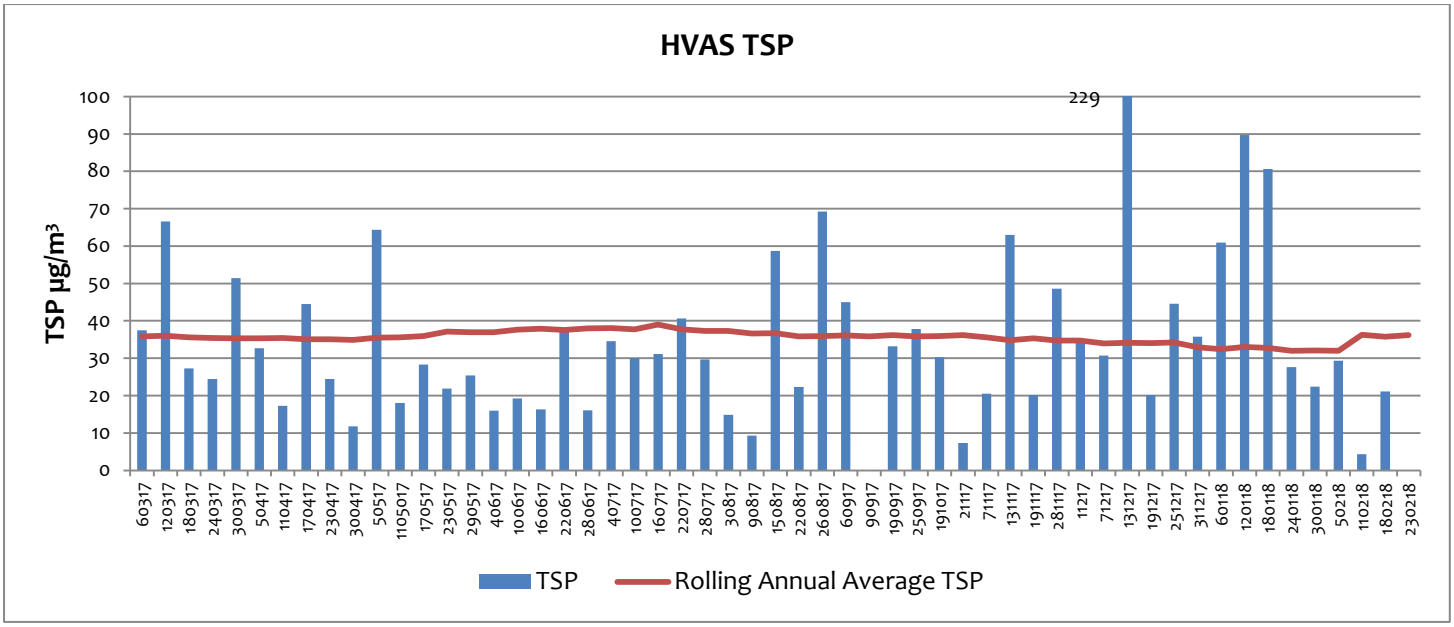
1.1 High Volume Air Samplers

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, and HVAS1 and HVAS2 sample for particulate matter less than 10 microns (PM_{10}) and lead dust.

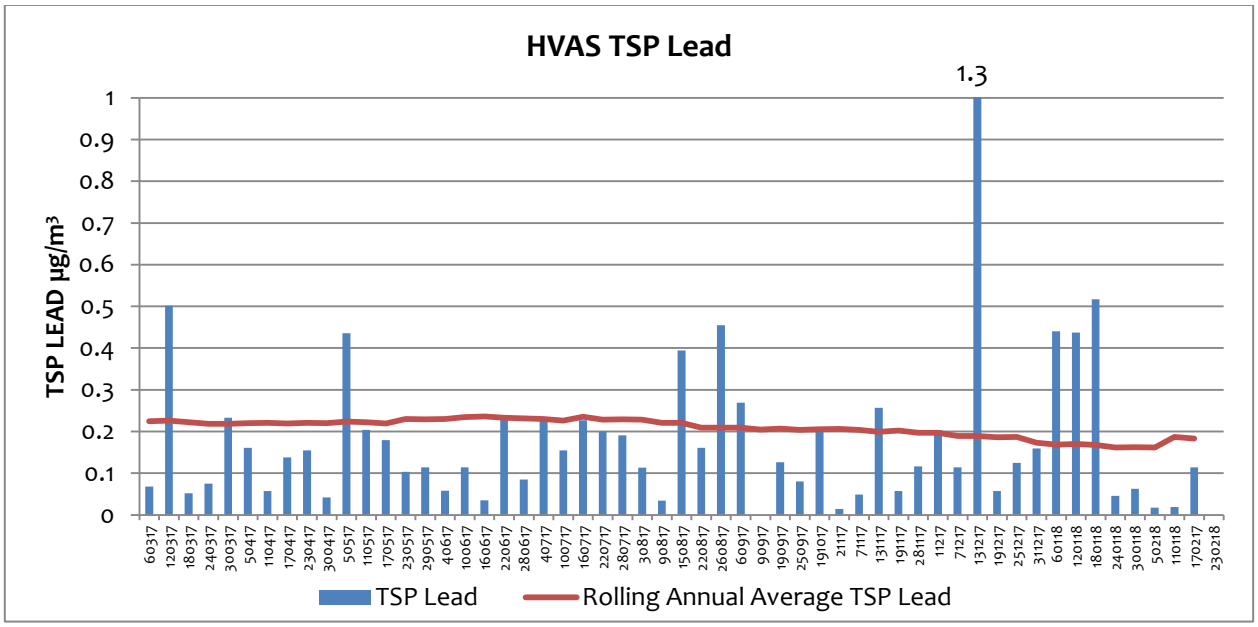
HVAS (EPL10) - SILVER TANK - ON Site Results for February

DATE	TSP (µg/m^3)	Lead (µg/m^3)
05-02-18	29.30	0.02
11-02-18	4.30	0.02
17-02-18	21.10	0.11
23-02-18	SD[1]	SD[1]

Note [1]: SD – Sample discarded. Unit fault identifed and under investigation – EPA notified



This monitoring unit is located on the Rasp Mine and criteria does not apply at this point, criteria apply at the closest residential location. The data indicates that the annual average TSP for February was 35.06 µg/m^3 and was well below the TSP annual average criterion of 90 µg/m^3 required for the nearest residential location.



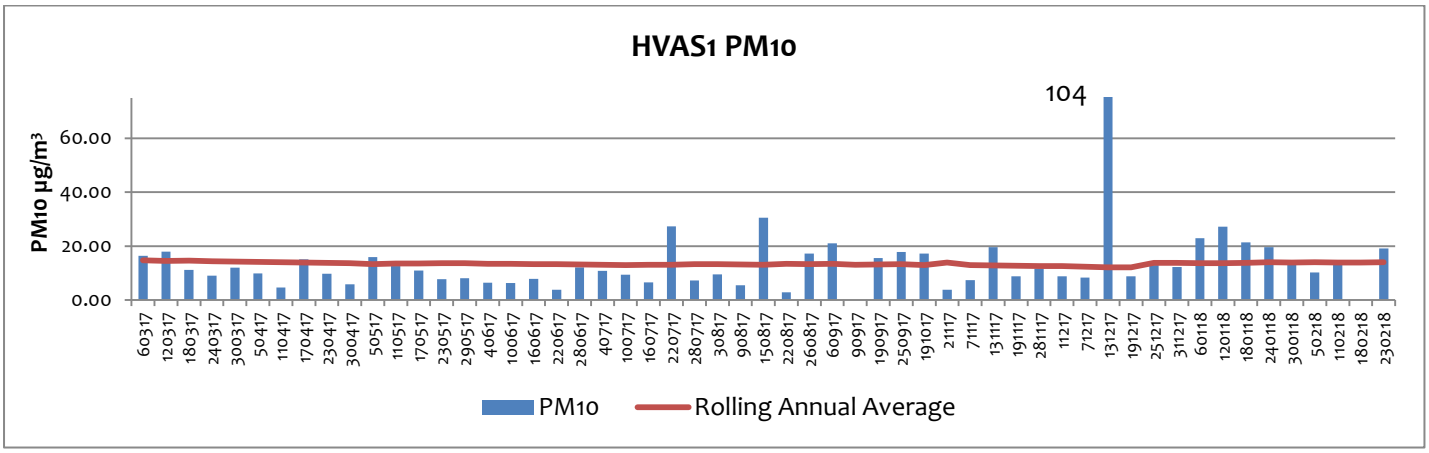
Guidelines for air quality are provided by the EPA, *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales, 2016.* The on-site annual average for TSP lead dust for February was 0.18 µg/m^3 and is below the EPA guideline of 0.50 µg/m^3.

HVAS1 (EPL11) - SILVER TANK – ON Site Results for February

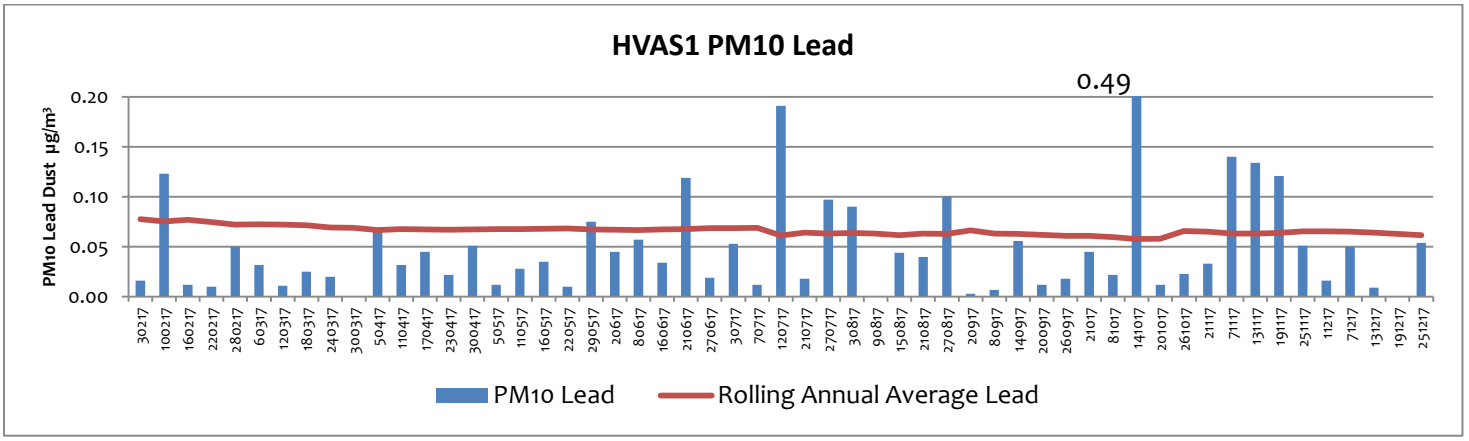
DATE	PM10 (µg/m^3)	PM10 Lead (µg/m^3)
05-02-18	10.20	0.05
11-02-18	14.50	0.01

17-02-18	NR[2]	NR[2]
23-02-18	19.10	0.05

Note 2: NR – Unit failed to record due to power outage.



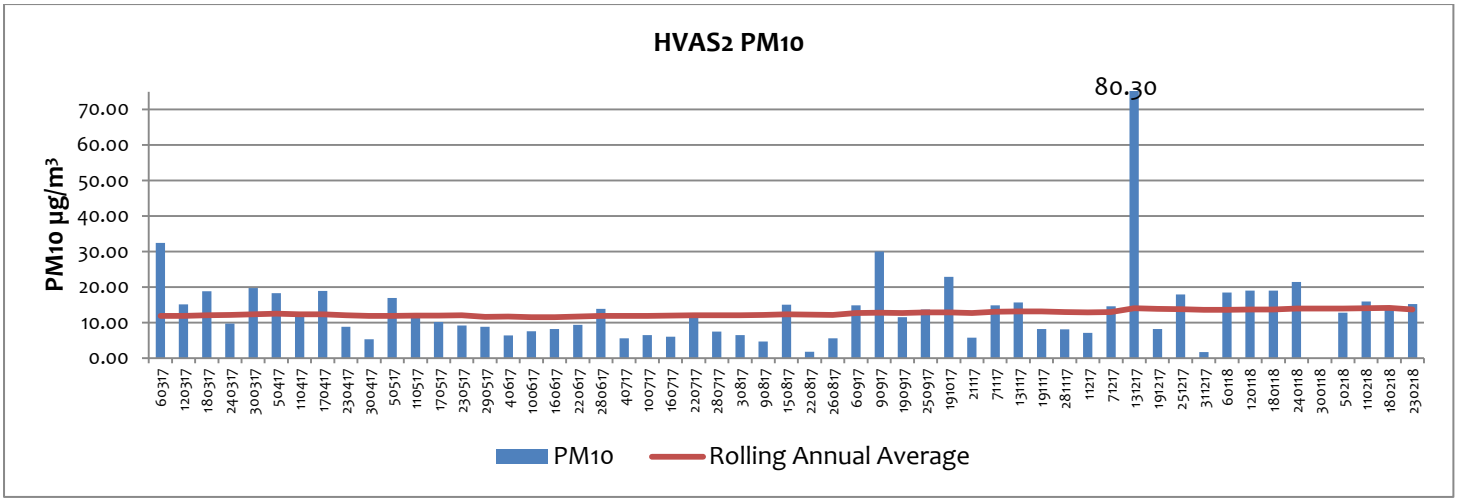
This monitoring unit is located on the Rasp Mine and the criteria does not apply at this point, criteria apply at the closest residential location. The data indicates that the annual average PM_{10} for February of 14 µg/m^3 is below the PM_{10} annual average criterion of 25 µg/m^3 required at the nearest residential location. Overall the trend for PM_{10} at this location remains consistent with the previous 12 months.



There is no guideline for assessing PM_{10} lead dust; the trend for lead dust at this location remains consistent with the previous 12 months.

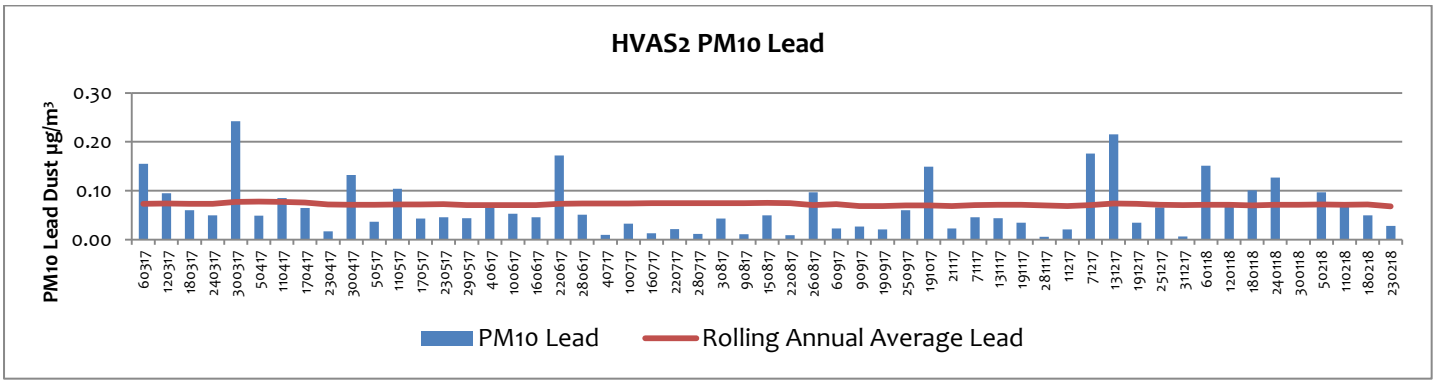
HVAS 2 (EPL12) - Blackwood Pit – On Site Results for February

DATE	PM10 (µg/m^3)	Lead (µg/m^3)
05-02-18	12.80	0.10
11-02-18	15.90	0.08
17-02-18	14.10	0.05
23-02-18	15.20	0.03



This monitoring unit is located on the Rasp Mine and criteria does not apply at this point, criteria apply to the closest residential location. The data indicates that the annual average PM_{10} for February of 14 µg/m^3 is below the PM_{10} annual average criterion 25 µg/m^3 required at the nearest residential location.

Overall the trend for PM_{10} at this location remains consistent with the previous 12 months.



There is no guideline for assessing PM10 lead dust; 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 (PM_{10}).

TEOM1 (EPL13) – Off Site and TEOM2 (EPL14) – On Site Results for February

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?
01-02-18	12.33	Y	-18.35	Y[3]
02-02-18	14.26	Y	-42.35	Y[3]

03-02-18	12.7	Y	Not recorded[1]	
04-02-18	14.78	Y	Not recorded[1]	
05-02-18	21.87	Y	11.55	Y
06-02-18	13.26	Y	20.98	Y
07-02-18	20.12	Y	17.52	Y
08-02-18	17.97	Y	19.18	Y
09-02-18	19.74	Y	19.39	Y
10-02-18	30.28	Y	36.92	Y
11-02-18	17.28	Y	24.15	Y
12-02-18	18.34	Y	25.62	Y
13-02-18	17.13	Y	14.9	Y
14-02-18	24.07	Y	26.57	Y
15-02-18	26.51	Y	28.83	Y
16-02-18	18.66	Y	30.28	Y
17-02-18	13.57	Y	19.53	Y
18-02-18	68.4	Y	60.8	Y[2]
19-02-18	12.11	Y	17.95	Y
20-02-18	24.45	Y	28.19	Y
21-02-18	42.7	Y	24.84	Y
22-02-18	30.83	Y	21.86	Y
23-02-18	27.83	Y	23.7	Y
24-02-18	15.56	Y	18.54	Y
25-02-18	10.88	Y	14.02	Y
26-02-18	19.62	Y	32.65	Y
27-02-18	24.09	Y	18.13	Y
28-02-18	25.26	Y	28.73	Y

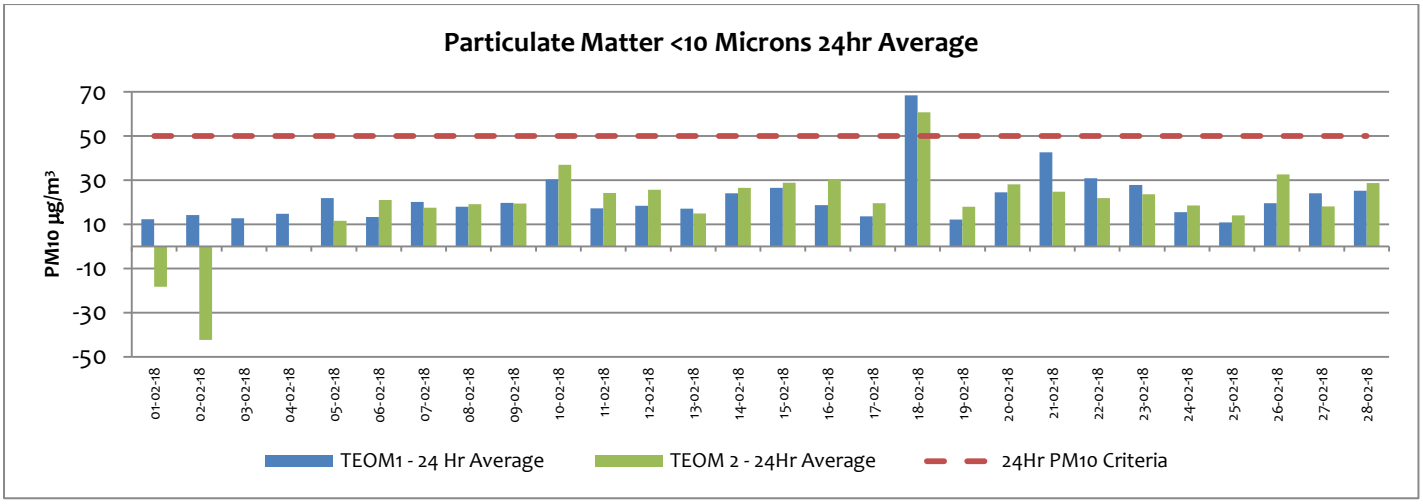
Note: 1 = Power outage by supplier affected TEOM2 Note: 2 = Predominant wind direction from the south/south-east not affected by site.
Note: 3 = Results may be negative or positive depending on water exposure and humidity.

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 PM_{10} - 24 hour average and an annual average. The highest 24-hour average recorded at TEOM1 was 68.4 $\mu g/m^3$ on 18 February. Although the site weather station recorded winds from the SSW of 23 km/h, the Broken Hill BOM data indicated wind gusts of up to 76 km/h with a temperature of almost 40^{o}C resulting in dust storms across Broken Hill. The PM_{10} annual average at the end of February was 22.0 $\mu g/m^3$. The Project Approval excludes extraordinary events such as dust storms and therefore the criteria does not apply.

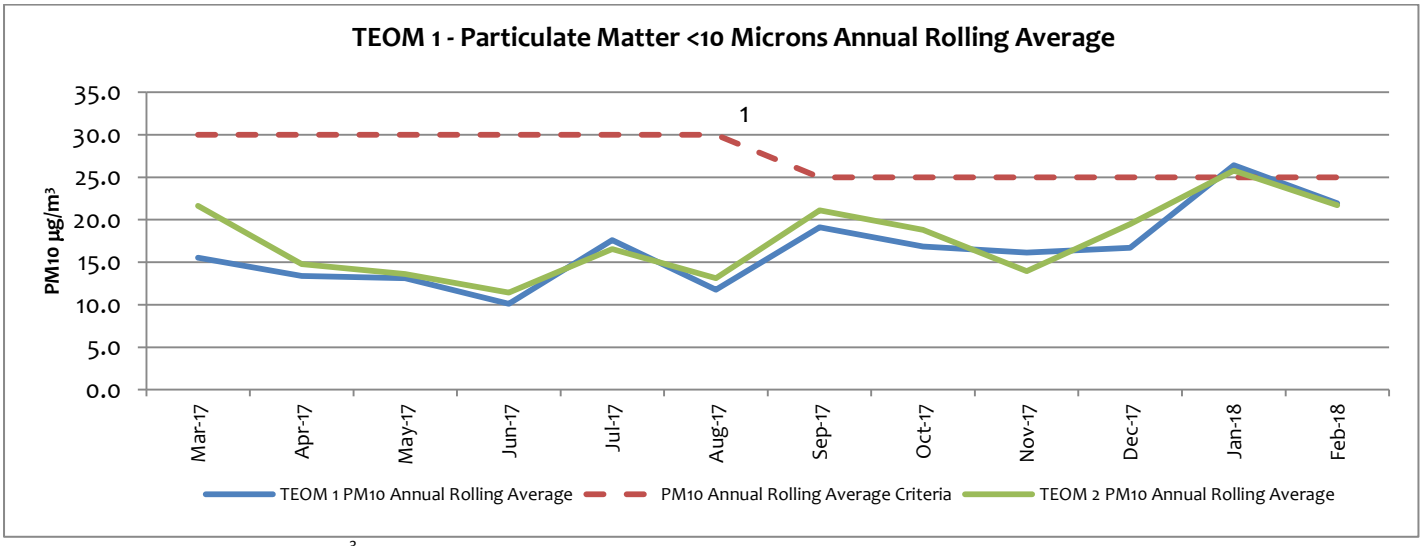
The TEOM2 monitoring unit is located on the Rasp Mine and criteria does not apply at this point, criteria apply to the closest residential location. TEOM 2 was not operational for the first three days in February. This was due to a transformer being replaced in Broken Hill by the energy supplier, resulting in the circuit breaker having to be reset manually twice. The incident was reported to the EPA and investigated. The outcome of the investigation was the replacement of the circuit breaker.

TEOM2 results indicate that the highest PM_{10} 24 hour average of 60.8 $\mu g/m^3$ on 18 February was the result of the windy conditions discussed above. The annual average PM_{10} for February of 21.7 $\mu g/m^3$. The Project Approval and air quality guidelines exclude extraordinary events such as dust storms and therefore the criteria does not apply.

Rasp Mine is in compliance with all listed criteria.



Note 1: Wind speeds for day up to 48km an hour from ESE created dust storms across monitors.
Note 2: Equipment malfunction for TEOM 2 resulted in no data recorded from 1 Jan to 3 Dec, refer above discussion.



Note 1: Criteria change to 25µg/m^3 in September as per PA MOD4.

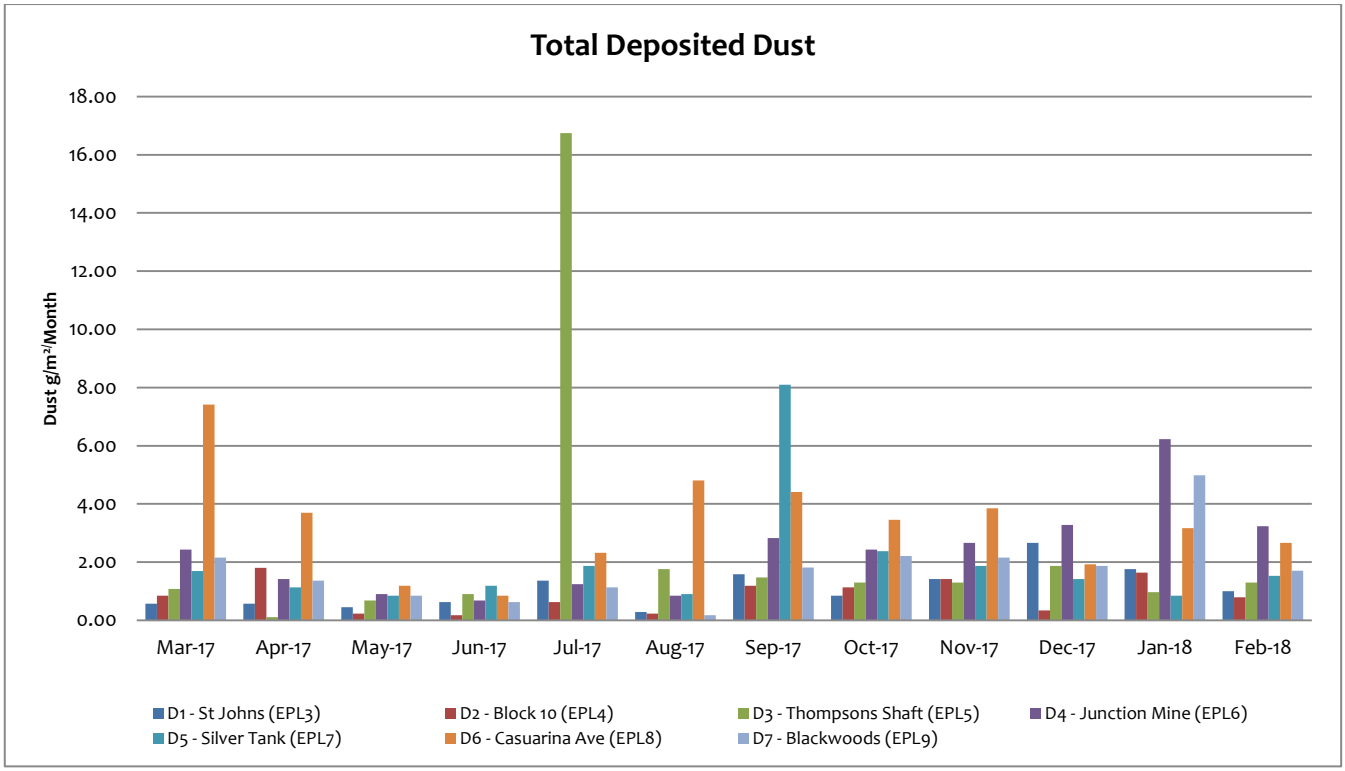
1.3 Dust Deposition Sampling

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.

Dust Deposition Gauges (D1 (EPL3) to D7(EPL9)) – Results for February

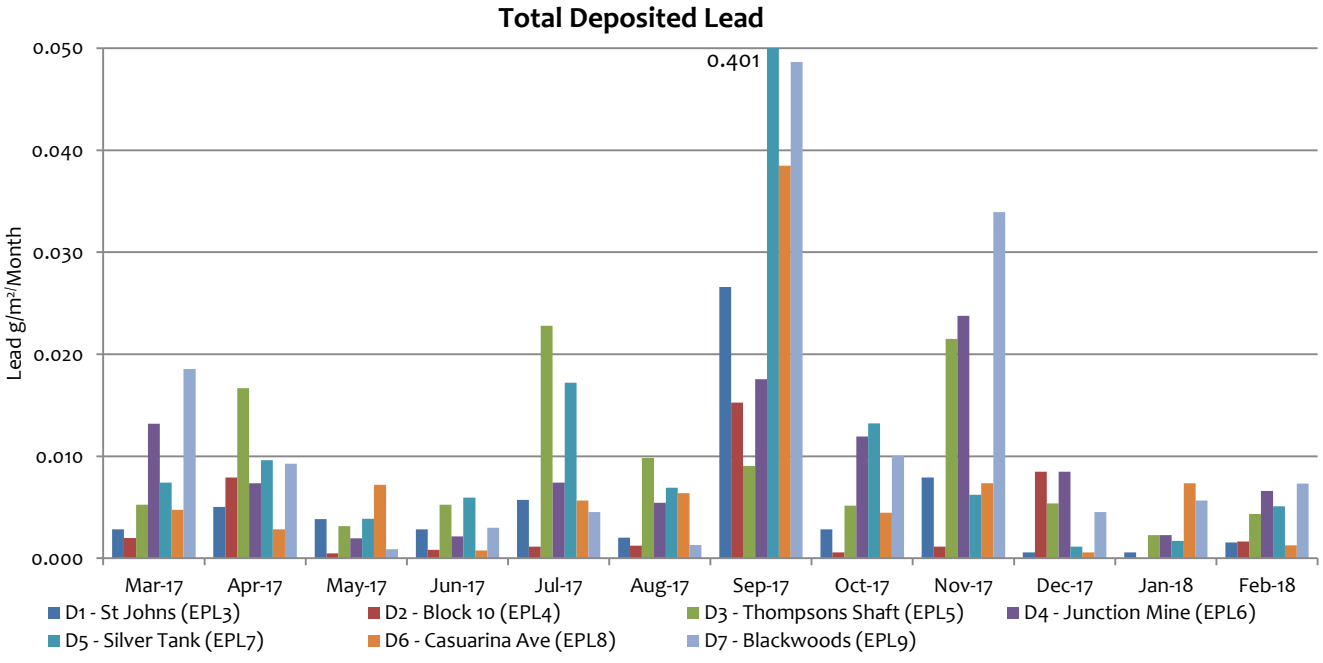
Total Deposited Dust (g/m$^{2/}$Month)							
Date	D1 (off site)	D2 (on site)	D3 (on site)	D4 (on site)	D5 (on site)	D6 (off site)	D7 (on site)
February 2018	1.0	0.79	1.30	3.23	1.53	2.66	1.70
Background (2010)	4.0	3.1	4.3	5.7	-[1]	5.8	N/A
Compliant?	Y	N/A	N/A	N/A	N/A	Y	N/A

Note: "-1" = background not available N/A = not applicable as dust deposition unit is located on site



Monitored results are all below background levels. The Rasp Mine is in compliance with criteria.

Total Deposited Lead (g/m^{2}/Month)							
Date	D1 (off Site)	D2 (on site)	D3 (on site)	D4 (on site)	D5 (on site)	D6 (off Site)	D7 (on site)
February 2018	0.002	0.002	0.004	0.007	0.005	0.001	0.007
Background (2010)	0.0034	0.005	0.005	0.006	-	0.004	-



There are no guidelines for deposited lead dust. The results are consistent with previous months.

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 mine 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 parameters listed in below. Reference to the item required in the Rasp Mine Environment Protection Licence (EPL) is provided below.

Quarterly sampling undertaken in March, June, September and December.

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[1]	mg/m^3	1

Note: 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.

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

Sampling was not scheduled for February.

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 PA 07_0018 and EPL 12559:-

Blasting Criteria (Western Mineralisation and Main Lodes excluding Block 7)

Location	Airblast Overpressure (dB(Lin Peak))	Ground Vibration (mm/s)	Allowable Exceedance (for production and development blasts)
Residence on privately owned land (7am-7pm)	115	5	5% of the total number of blasts over a 12-month period[1]
(7am-7pm)	120	10	0%
(7pm-10pm)	105	-	-
(10pm-7am)	95	-	-
Public Infrastructure	-	100	0%

Note 1: Does not apply until completion of Pollution Reduction Program on the EPL at the end of 2018. Applies to EPL criteria in the period for the Annual Return 3 Nov to 2 Nov the following year and to DPE criteria in the reporting period 1 Jul to 30 Jun each year.

Blasting Criteria (Block 7)

Location	Airblast Overpressure (dB(Lin Peak)	Ground Vibration (mm/s)	Allowable Exceedance (for production and development blasts)
Residence on privately owned land (7am-7pm)	115	3 (interim)	5% of the total number of blasts over a 12-month period[1]
(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%

Note 1: Applies to EPL criteria in the period for the Annual Return 3 Nov to 2 Nov the following year and to DPE criteria in the reporting period 1 Jul to 30 Jun each year.

In addition the following conditions also 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 Results for February

Total Blasts:

- 0 production blasts occurred before 6.45 am or after 7.15 pm
- Production blasts averaged 4.8 per week over the previous calendar year
- Development blasts, averaged 33.8 per week over the previous calendar year

Western Mineralisation and Main Lodes (excluding Block 7):

- 0 Blast recorded >5 mm/s (at V1, V2 and V3)
- 0 Blasts recorded >10 mm/s (at V1, V2 and V3)
- 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 (7am to 7pm)
- 0 Blasts recorded an over pressure level over or 120 dBL at any time
- Percentage of development blasts over 5 mm/sec = 0% (1 March 2017 until 28 February 2018)
- Percentage of production blasts over 5 mm/sec = 4.6% (1 March 2017 until 28 February 2018)

Rasp Mine is in compliance with all listed criteria.

Block 7:

- 0 Blasts recorded >3 mm/s (at V4 and V5)
- 0 Blasts recorded >10 mm/s (at V4 and V5)
- 0 Blasts recorded >50 mm/s at V6
- 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 115 dBL (7am to 7pm)
- Percentage of development blasts over 3mm/sec = 0% (1 March 2017 to 28 February 2018)
- Percentage of production blasts over 3mm/sec = 6.7% (1 March 2017 to 28 February 2018) (criteria does not apply in this period as not a regulator reporting period)

Mining activities in Block 7 have now reduced and the rolling average will continue to increase until the end of the year. No blasts in Block 7 exceeded 3 mm/s and all measures are taken to reduce the size of the production blasts.

2.2 Noise

Noise monitoring is undertaken as per the NSW Noise Policy for Industry at a frequency of once per annum. A noise assessment was conducted in November 2017, and is next due in Q4 2018.

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 January.

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),
Kintore Pit (U/G dewatering) EPL54	Monthly	

Piezometers EPL37 (GW01) to EPL52 (GW16)	Quarterly	sulphate (SO4), total dissolved solids (TDS) and zinc (Zn)

Shaft 7 (EPL53) and Kintore Pit (EPL54) Results for February

Sample Point	pH	EC ($\mu S/cm^2$)	TDS (mg/l)	Alkalinity ($CaCO_3$) (mg/l)	SO4 (mg/l)	Cl (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K (mg/l)	Cd (mg/l)	Pb (mg/l)	Mn (mg/l)	Zn (mg/l)	Fe (mg/l)
Shaft 7 (EPL53)	5.96	13300	13600	2	6420	1670	513	344	1800	134	3.16	1.32	456	1350	2.41
Kintore Pit (EPL54)	6.05	12200	7040	2	6080	1530	475	301	1650	124	2.68	2.25	356	1130	6.42

Piezometer sampling was not scheduled for February.

3.2 Surface Water Sample Record

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 (SO4), 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 Monitoring Results

Surface water sampling was not scheduled for February.

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) Monitoring Requirements

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

Note: The onsite weather station current does not report Sigma theta.

Weather Data Summary for February

Date	Temperature @ 10m (°C)		Wind Speed @ 10m (m/s)		Predominant wind dir @ 10m (deg)		Rainfall
	Min	Max	Min	Max	Cardinal	Degree	
01-02-18	18.8	21	1.4	13.4	SE	135	0.03
02-02-18	17.5	18.9	1	10.6	SE	135	0.00
03-02-18	21.8	24.8	0.4	8.8	ESE	113	0.00
04-02-18	24.9	29.6	0.3	11.9	ENE	68	0.00
05-02-18	26.7	31.3	0.4	9.4	ENE	68	0.00
06-02-18	29.8	33.4	0.1	6.4	N	360	0.00
07-02-18	31.1	36.3	0.1	7.6	N	360	0.00
08-02-18	33.1	37.6	0.2	6.3	NW	315	0.05
09-02-18	34.5	39	0.3	9.9	NW	315	0.00
10-02-18	34.4	39.7	0.2	7.7	N	12	0.00
11-02-18	31.1	40.7	0.4	13.1	S	180	0.00
12-02-18	24.5	30.9	0.4	9.5	S	180	0.00
13-02-18	20.8	24.3	0.3	7	SSE	158	0.00
14-02-18	27.7	31.2	0.5	6.7	SSW	203	0.01
15-02-18	24.2	31.6	0.2	9.3	SSE	158	0.00
16-02-18	24.8	31.7	0.3	7.4	S	180	0.00
17-02-18	23.6	29.1	0.2	6.1	SSE	158	0.00
18-02-18	26.9	32.8	0.3	6.5	SSW	203	0.00
19-02-18	21	37	0.4	17.2	SSE	158	0.00
20-02-18	26.5	31.2	1.4	8.1	ESE	113	0.00
21-02-18	28.7	33.3	0.3	10.5	NE	45	0.00
22-02-18	29.3	33.1	1.2	6.3	NE	45	0.00
23-02-18	30.3	33.8	1.2	9.9	NNE	24	0.00
24-02-18	27.1	35.7	0.3	9.3	SSW	203	0.00
25-02-18	22.4	32.2	2	13.2	SSE	158	0.00
26-02-18	20.8	25.1	1.6	11.6	S	180	0.00
27-02-18	22.8	27	0.3	10.1	NE	45	0.00
28-02-18	28	33.4	0.5	5.3	SE	180	0.00

5 Data Log

Sample	Result Received
Hi Volume Samples	30-04-2018
TEOM	05-03-2018
Dust Deposition	19-04-2018
Vents & Bag House	
Water	14-02-2018
Blast vibration and overpressure	05-03-2018
Weather	05-03-2018
Date posted to web site	15-05-2018

6 Correction Log

There are no corrections to the previous reports.