Rasp Mine
Monthly Environmental Monitoring Report
February 2019

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

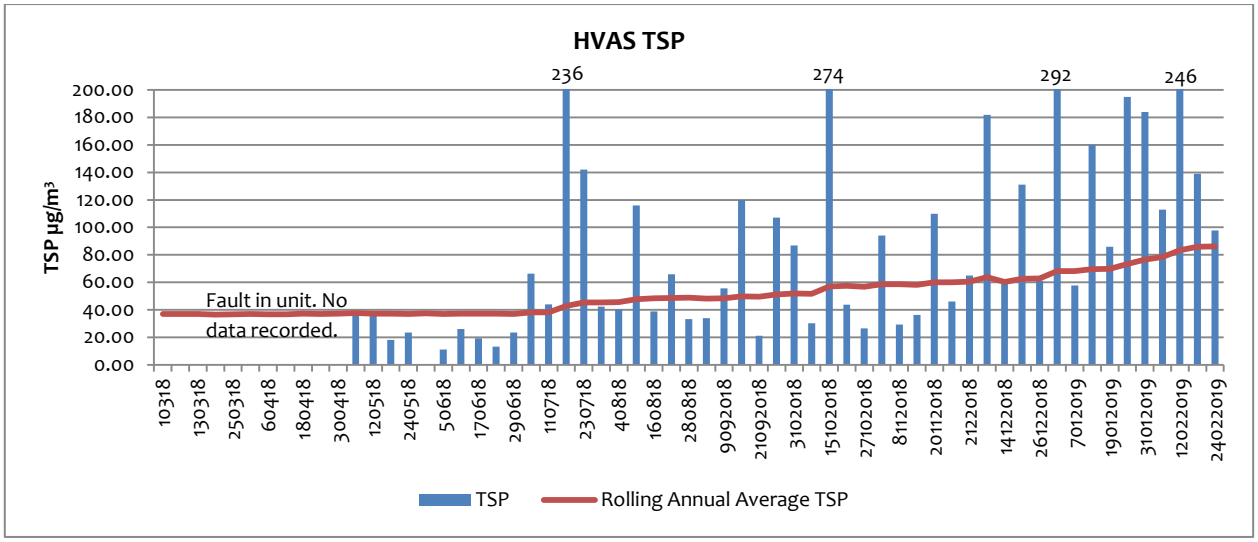
Pollutant	Averaging Period	Maximum Project Contribution	Maximum Total Deposited Dust Level
Deposited dust	Annual	2 g/m^2/month	4 g/m^2/month

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

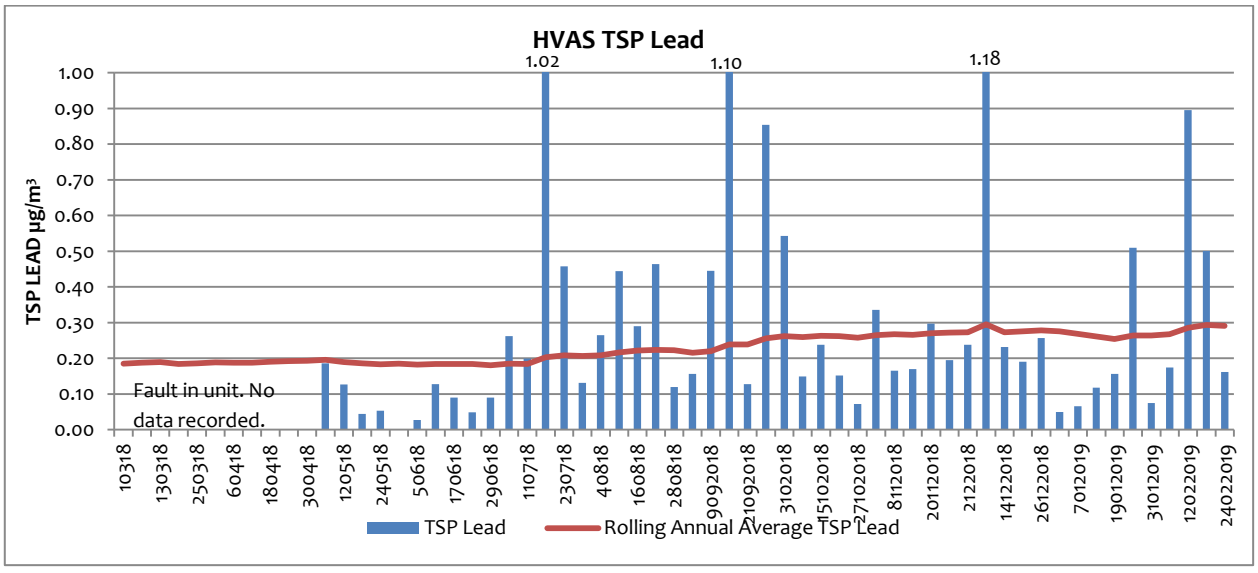
DATE	TSP (µg/m^3)	Lead (µg/m^3)
6-02-2019	113.00	0.17
12-02-2019	246.00	0.90
18-02-2019	139.00	0.50
24-02-2019	97.80	0.16



HVAS (EPL10) is located on the Rasp Mine and while limit criteria do not apply at this point, they do apply at the closest residential location. There was elevated dust levels recorded at HVAS throughout February . Overall the trend for TSP at this location has risen over the past 12 months which is likely due to the severe drought conditions and numerous dust storms over this period.

The rolling annual average for TSP February is 86.07µg/m^3 which is below the long term annual average criteria of 90 µg/m^3.

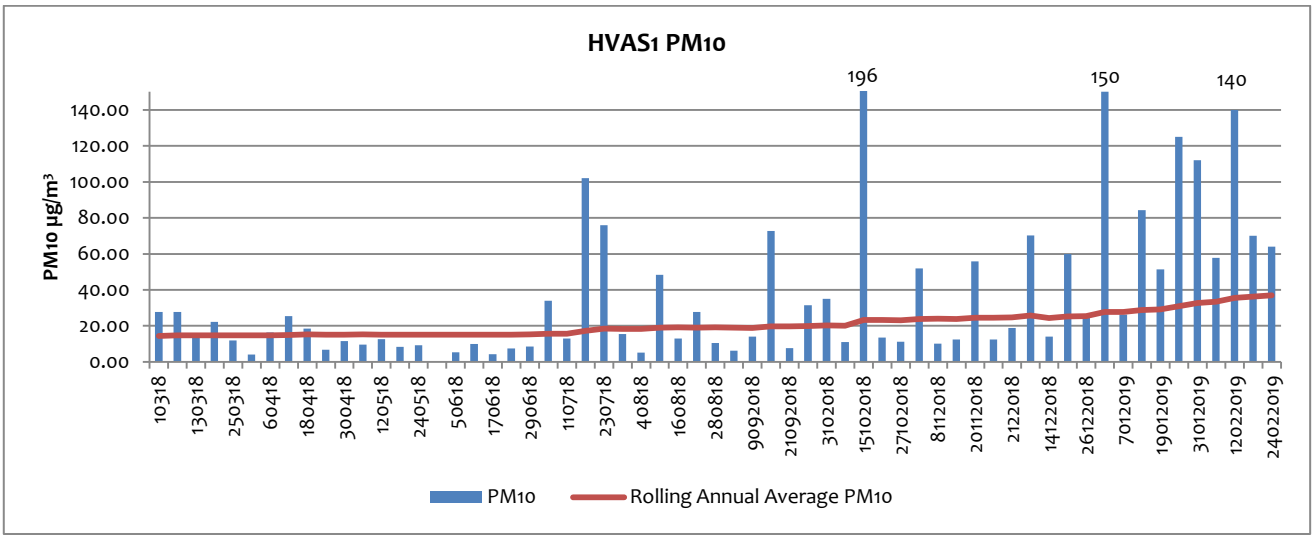
Dust is controlled on site using the application of dust suppressant and the watering of haul roads.



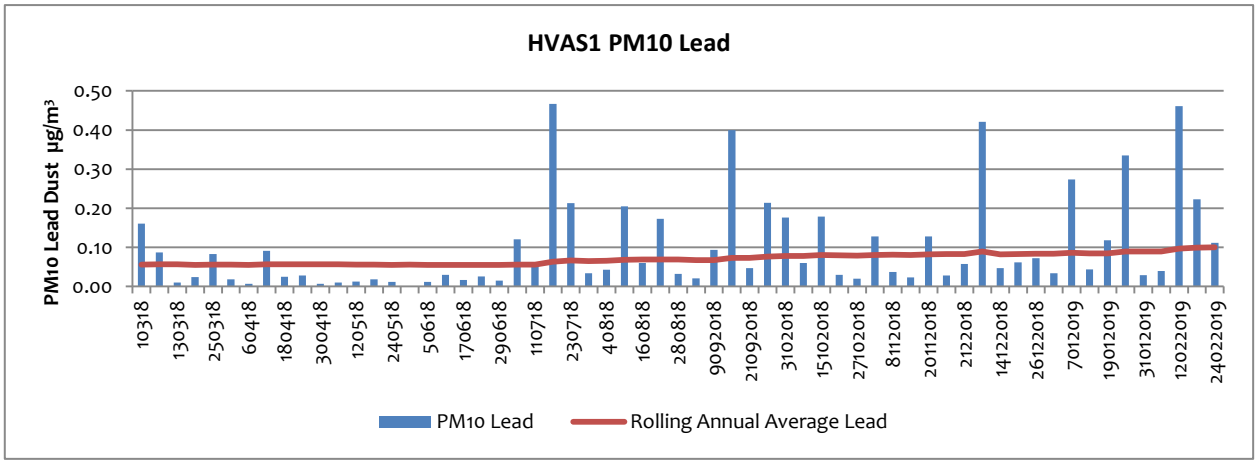
The rolling annual average for TSP Lead to February has risen slightly to 0.29 µg/m^3 however this well below the criterion of 0.5 µg/m^3.

HVAS1 (EPL11) - Silver Tank (On Site) Results for February

DATE	PM10 (µg/m^3)	PM10 Lead (µg/m^3)
6-02-2019	57.70	0.04
12-02-2019	140.00	0.46
18-02-2019	70.00	0.22
24-02-2019	64.00	0.11



HVAS1 (EPL11) is located on the Rasp Mine and while limit criteria do not apply at this point, they do apply at the closest residential location. There were elevated dust levels above the daily criteria of 50 µg/m^3 on all of the 4 monitoring events in February. On these days the wind were from a southerly direction, between SSW and ESE, so it was unlikely that site operations contributed significantly to the high recordings. Overall the trend for PM10 at this location has risen over the previous 12 month. The results show that the PM_{10} rolling annual average for HVAS 1 has risen to 36.9 µg/m^3 which is above the PM_{10} annual average criterion of 25 µg/m^3 required at the nearest residential location. The increase in PM_{10} annual average would be a result of severe drought conditions over this period.

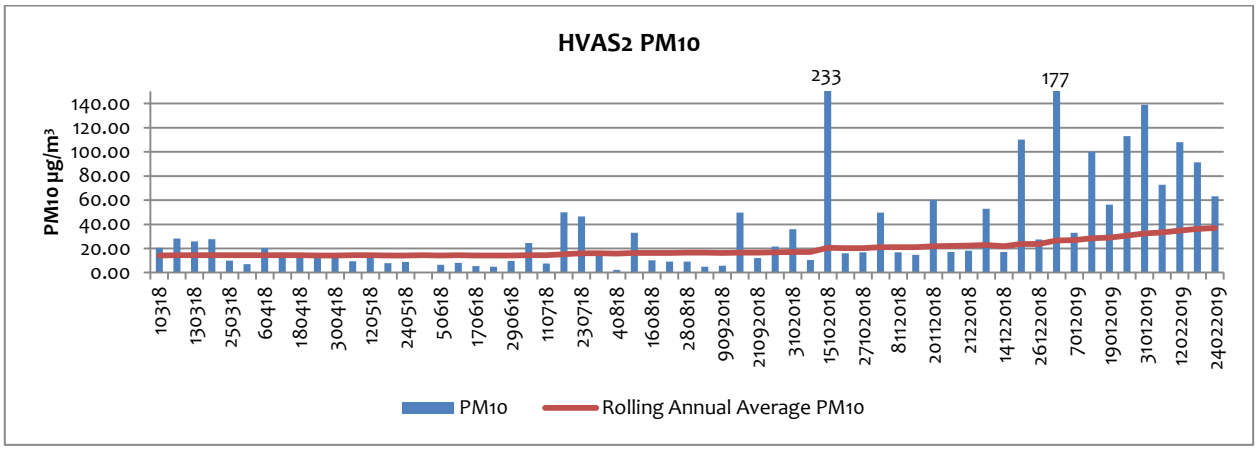


Lead levels were elevated on 12 and 18 February when winds were predominantly from the South.

There is no guideline for assessing PM_{10} lead dust; the trend for PM10 lead dust at this location has risen slightly over the previous 12 months from 0.06 µg/m^3 to 0.10 µg/m^3 and is likely the result of drought conditions and windy weather transporting lead contaminated dust from the Broken Hill environs.

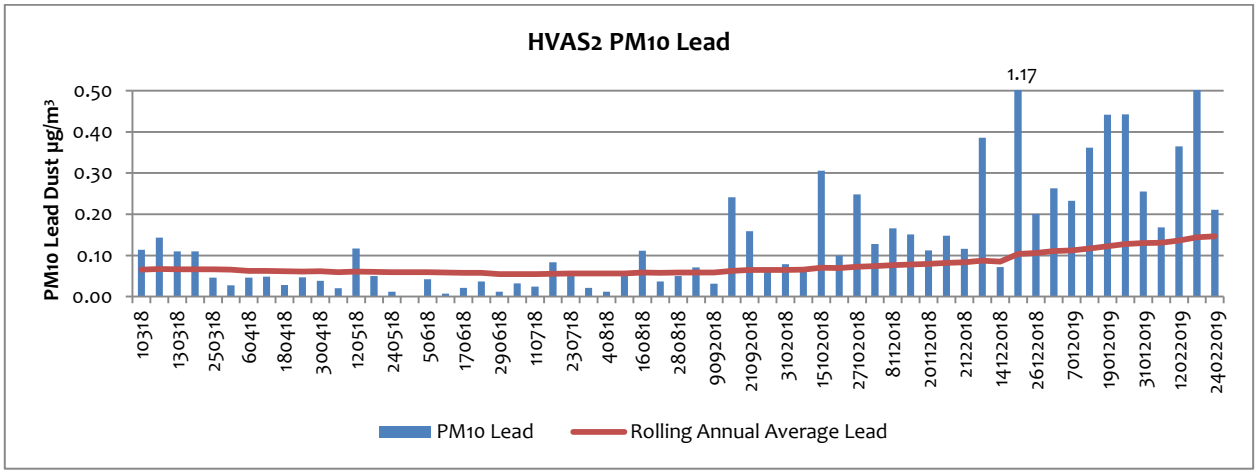
HVAS 2 (EPL12) - Blackwood Pit (On Site) Results for February

DATE	PM10 (µg/m^3)	Lead (µg/m^3)
6-02-2019	72.60	0.17
12-02-2019	108.00	0.37
18-02-2019	91.20	0.51
24-02-2019	63.20	0.21



HVAS2 (EPL12) is located on the Rasp Mine and while limit criteria do not apply at this point, they do apply at the closest residential location. There were elevated dust levels above the daily criteria of 50 µg/m^3 on all of the 4 monitoring events in February. As the wind was predominantly from the South on these days, it is unlikely the site operations contributed significantly to the high recordings as elevated dust levels were also recorded in the HVAS1 PM10 monitor on the southern boundary of the operations.

The rolling annual average PM_{10} to February is 36.98 µg/m^3 which is above the PM_{10} annual average criterion 25 µg/m^3 required at the nearest residential location.



There is no guideline for assessing PM10 lead dust; the Annual Rolling Average for lead dust at this location has increased over the previous 12 months from 0.07 µg/m^3 to 0.15 µg/m^3 at the end of February 2019.

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}) in size.

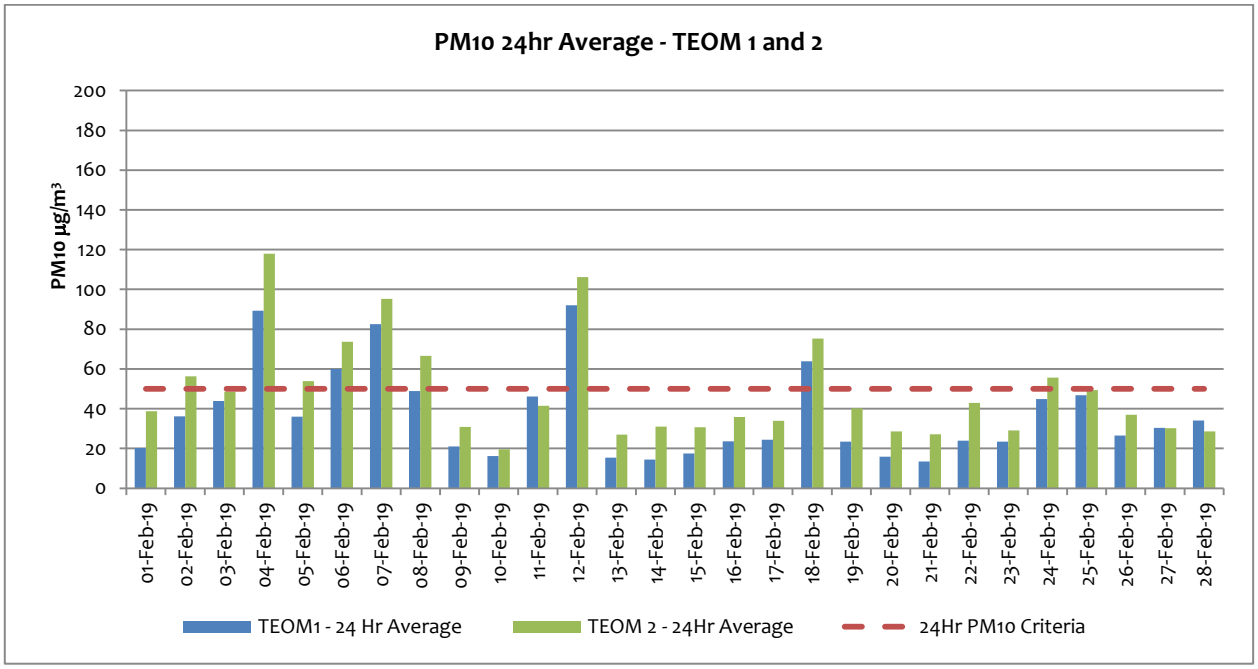
TEOM1 (EPL13) (Off Site) and TEOM2 (EPL14) (On Site) Results for February

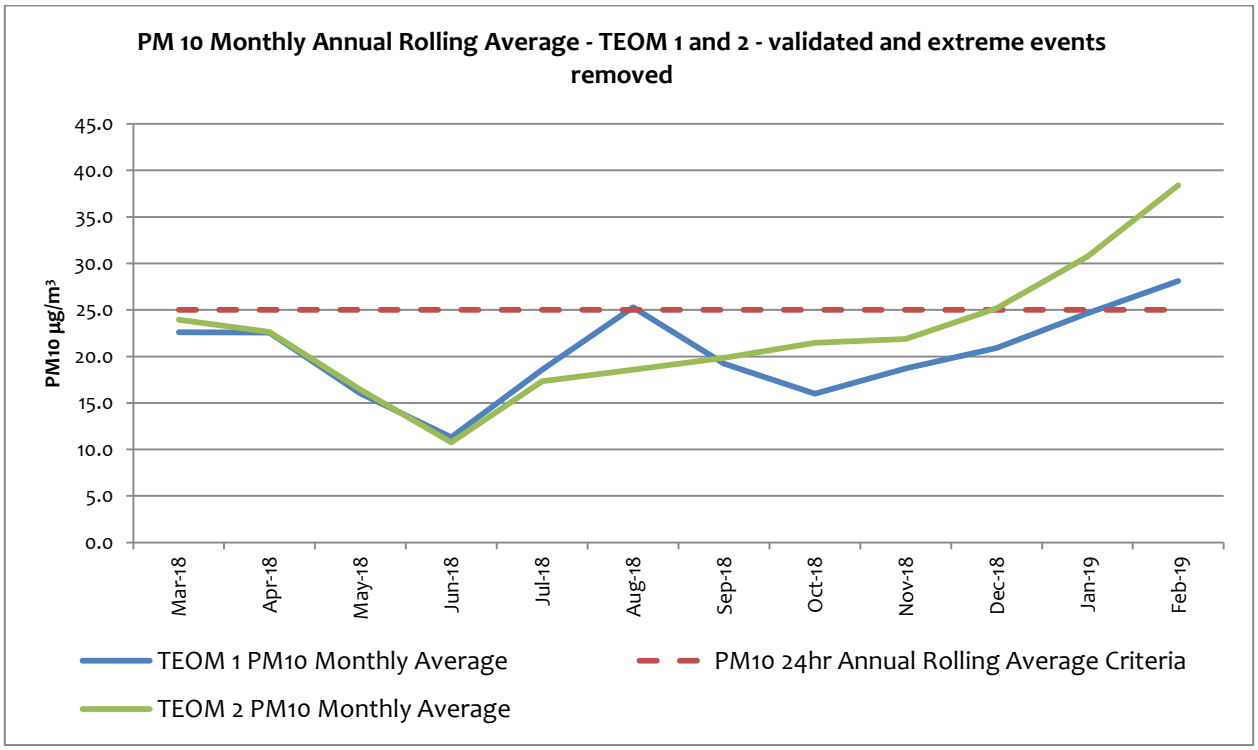
Particulate Matter <10 Microns 24Hr Average				
Date	TEOM 1 (µg/m^3)	Compliant with 50µg/m^3 24hr average?	TEOM 2 (µg/m^3)	Compliant with 50µg/m^3 24hr average?
01-Feb-19	20.2	Y	38.7	Y
02-Feb-19	36.2	Y	56.2	Y[1]
03-Feb-19	43.9	Y	48.6	Y
04-Feb-19	89.3	Y[1]	118.0	Y[1]
05-Feb-19	36.0	Y	53.8	Y[1]
06-Feb-19	60.0	Y[1]	73.7	Y[1]
07-Feb-19	82.5	Y[1]	95.2	Y[1]
08-Feb-19	48.8	Y	66.7	Y[1]
09-Feb-19	21.0	Y	30.8	Y
10-Feb-19	16.1	Y	19.5	Y
11-Feb-19	46.1	Y	41.5	Y
12-Feb-19	92.0	Y[1]	106.1	Y[1]
13-Feb-19	15.5	Y	26.9	Y
14-Feb-19	14.5	Y	31.0	Y
15-Feb-19	17.5	Y	30.6	Y
16-Feb19	23.6	Y	35.9	Y
17-Feb-19	24.4	Y	33.8	Y
18-Feb-19	63.8	Y[1]	75.2	Y[1]
19-Feb-19	23.5	Y	40.2	Y
20-Feb-19	15.8	Y	28.6	Y
21-Feb-19	13.5	Y	27.2	Y
22-Feb-19	23.9	Y	42.9	Y
23-Feb-19	23.5	Y	29.1	Y
24-Feb-19	44.8	Y	55.6	Y[1]
25-Feb-19	46.8	Y	49.3	Y
26-Feb-19	26.5	Y	37.0	Y
27-Feb-19	30.4	Y	30.2	Y
28-Feb-19	34.0	Y	28.5	Y

[1] = Monitoring results affected by general dust storms and high winds, particularly from the South and SSE.

Project Approval 07_0018 apply at TEOM1 and 2, with two criteria listed for PM10, a 24 hour average criteria of 50 ug/m^3 and an annual average criteria of 25 ug/m^3.

The average monthly PM_{10} inclusive of dust storms during February was 36.9 µg/m^3 at TEOM1 and 48.2 µg/m^3 at TEOM2. Both Project Approval and Environment Protection Licence criteria exclude dust storms and other extraordinary events. Results for 24-hour periods have not been used to calculate the rolling average if there were dust storms on the day or readings were elevated at both TEOM units. TEOM2 can also be impacted from dust generated at other activities to the South of the site.





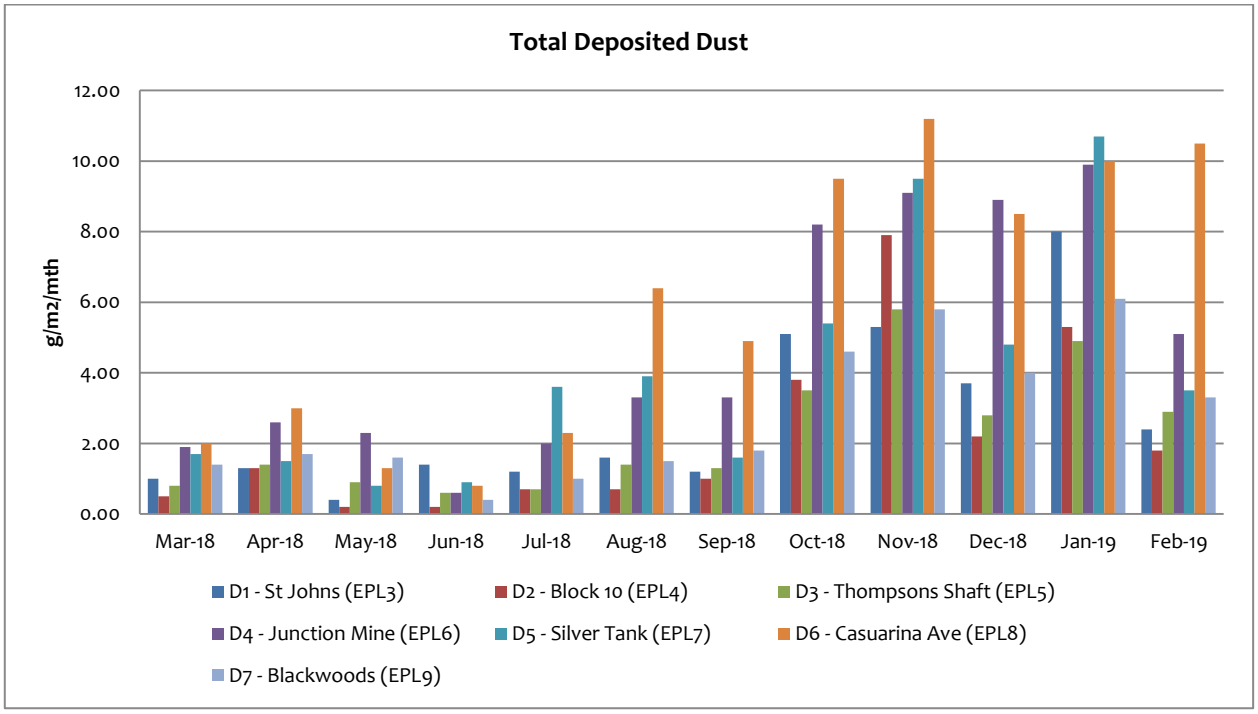
1.3 Dust Deposition Sampling

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 2019	2.40	1.80	2.90	5.10	3.50	10.50	3.30
Background (2010)	4.0	3.1	4.3	5.7	-1	5.8	-1
Compliant?	Y	N/A	N/A	N/A	N/A	Y	N/A

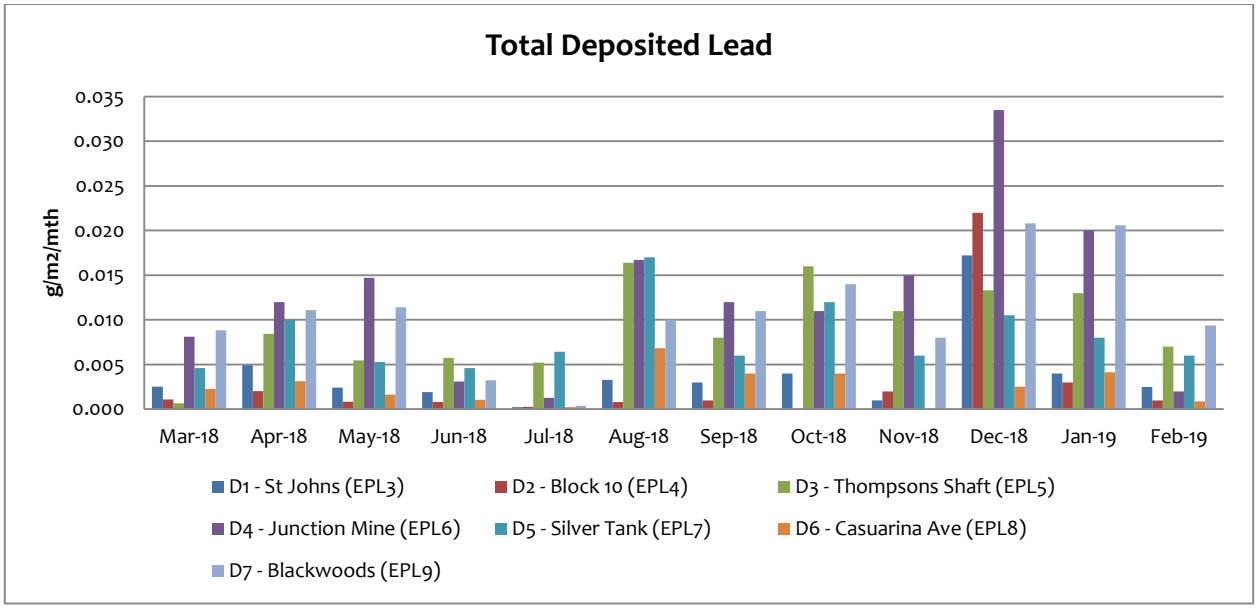
Note: "1"= background not available N/A = not applicable as dust deposition unit is located on site



Results for all dust gauges were elevated in February and were impacted by dusty conditions and dust storms in February. Results were highest at Casuarina Avenue. The Casuarina Avenue location frequently returns high dust readings which are likely due to it being situated adjacent to a bare block.

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 2019	0.002	0.001	0.007	0.002	0.006	0.001	0.009
Background (2010)	0.0034	0.005	0.005	0.006	-1	0.004	-1

Note: "1"= background not available



There are no guidelines for deposited lead dust. Lead results in February were highest at Blackwoods. The Blackwoods gauge is sited adjacent to unsurfaced areas subject to vehicular traffic. Dust suppressant is applied to unsealed areas of the site.

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 is 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 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.

Primary Vent Shaft (EPL1), Crusher Baghouse (EPL2) and Vent Shaft 6 (EPL56) Results for February 2019

Not due in 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
- The number of Production blasts averaged 4.3 per week over the previous calendar year
- The number of Development blasts averaged 29.94 per week over the previous calendar year

Western Mineralisation and Main Lodes (excluding Block 7):

- 4 Blasts recorded >5 mm/s
- 0 Blasts recorded >10 mm/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 (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 2018 until 28 February 2019)
- Percentage of production blasts over 5 mm/sec = 2.5% (1 March 2018 until 28 February 2019)

Block 7:

- 0 Blasts recorded >3 mm/s
- 0 Blasts recorded >10 mm/s
- 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)
- 0 Blasts recorded an over pressure level over or 120 dBL at any time
- Percentage of development blasts over 3mm/sec = 0% (1 March 2018 until 28 February 20192019)
- Percentage of production blasts over 3mm/sec = 0% (1 March 2018 until 28 February 2019) (criteria does not apply in this period as not a regulator reporting period)

There was no blasting in Block 7 during February. The last blasts to have been conducted in Block 7 were in July 2018.

2.2 Noise

Noise monitoring is undertaken as per the NSW Noise Policy for Industry at a frequency of once per annum. Annual noise monitoring was conducted in December 2018.

3 Water

3.1 Groundwater

There are eighteen sampling locations for groundwater. GW01 (EPL37) to GW16 (EPL52) are piezometers installed 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), which are sampled monthly. A map indicating these locations can be found on the Rasp Mine web site. Groundwater monitoring is scheduled for completion in May, June, September and January. No limits are applied in the EPL to the results from groundwater monitoring.

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 (SO4), 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) Results for February 2019

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)	Cd (mg/l)	Pb (mg/l)	Mn (mg/l)	Zn (mg/l)	Fe (mg/l)
Shaft 7 (EPL53)	6.37	13400	13400	10	5740	1970	530	312	1760	2.46	1.7	347	883	0.05
Kintore Pit (EPL54)	6.38	12200	12500	10	5480	1680	510	280	1580	2.26	0.516	290	892	0.05

Groundwater Bores (EPL37 - EPL52) Results for February 2019

Samples not required in February 2019.

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/S34	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

Samples not required in February 2019.

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

Weather Data Summary for February

Date	Temperature @ 10m (°C)		Wind Speed @ 10m (m/s)		Predominant Wind Direction @ 10m		Rainfall (mm)
	Min	Max	Min	Max	Cardinal	Degree	Total
01-Feb-19	18.1	29.1	6.3	31.1	SSE	154	0.00
02-Feb-19	22.2	36.6	3.5	20.4	SSE	158	0.00
03-Feb-19	28.3	38.0	3.6	32.2	East	91	0.00
04-Feb-19	23.7	33.9	10.6	37.0	South	181	0.80
05-Feb-19	23.6	34.4	7.9	35.1	SSE	161	0.00
06-Feb-19	23.5	34.6	3.4	39.3	SSE	158	0.00
07-Feb-19	22.1	35.6	3.2	24.1	SSE	159	0.10
08-Feb-19	17.0	27.4	6.5	39.6	South	184	0.00
09-Feb-19	14.4	26.6	8.9	29.9	SSW	203	0.00
10-Feb-19	12.9	24.9	3.7	21.4	South	176	0.00
11-Feb-19	19.4	31.1	3.3	33.1	WNW	294	0.00
12-Feb-19	14.2	30.4	3.3	39.2	SSW	203	0.00
13-Feb-19	11.3	20.9	8.0	30.7	South	178	0.00
14-Feb-19	12.7	24.8	10.3	27.2	SSE	160	0.00
15-Feb-19	16.8	29.3	4.9	22.9	SSE	156	0.00
16-Feb-19	19.3	33.6	3.6	20.6	South	180	0.00
17-Feb-19	23.1	36.2	3.4	16.2	South	179	0.00
18-Feb-19	17.5	38.4	4.0	41.4	South	183	0.00
19-Feb-19	13.2	25.3	9.1	38.6	South	178	0.00
20-Feb-19	14.0	27.5	9.2	28.4	South	179	0.00
21-Feb-19	14.9	27.0	10.3	34.4	South	177	0.00
22-Feb-19	16.0	30.3	9.4	33.6	SSE	159	0.00
23-Feb-19	20.4	31.9	4.1	24.2	SSE	157	0.00
24-Feb-19	23.0	31.4	2.9	30.9	ESE	110	0.00
25-Feb-19	22.9	31.1	1.8	21.1	ENE	65	0.00
26-Feb-19	23.9	32.4	2.3	15.0	East	90	0.00
27-Feb-19	25.2	34.5	4.0	20.8	East	90	0.00
28-Feb-19	25.1	35.0	3.5	24.0	ENE	67	0.00

5 Data Log

Sample	Result Received
Hi Volume Samples	11-03-2019
TEOM	28-03-2019
Dust Deposition	15-03-2019
Vents & Bag House	N/A
Water	12-03-2019
Blast vibration and overpressure	11-03-2019
Weather	11-03-2019
Date posted to web site	17-04-2019

6 Correction Log

Nil corrections.