

MARINE VESSEL OCEAN FLOWER

ANALYSIS OF AIR QUALITY MONITORING DATA ASSOCIATED WITH BULK NICKEL SULFIDE SHIP-LOADING ON 23-24 MARCH 2011

Revision	Prepared	Reviewed	Approved	Date	Description
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1. INTRODUCTION

1.1 Licence Reporting Conditions

This document reports the air quality monitoring for the loading of the MV Ocean Flower between 0135 hrs on 23rd March 2011 to 1302 hrs on 24th March 2011 at the Esperance Port. This report is compiled and issued in compliance with Condition 17 and includes data analysis consistent with requirements of Condition 14 of the Government of Western Australia Department of Environment and Conservation (DEC) Licence L5099/1974/13 ('the licence'). The licence was issued to Esperance Ports Sea & Land (EPSL) on the 24th February 2011.

1.2 Location of Monitoring Stations

As required by the licence, ambient monitoring is being undertaken at four locations surrounding the Port operations and one community monitor 1.6 km from the Port (**Figure 1**). The monitor locations were chosen in consultation with the DEC and the Government of Western Australia Department of Health (DoH).

The EPSL has an Australian Standards-compliant meteorological station adjacent to E-Sampler 7, located on the Port premises adjacent to Berth 3. This meteorological station records both wind speed and direction. Data from this station has been used for this report.

1.3 Assessment Criteria

The following ambient concentration targets are used in this assessment, as adapted from Table 1 in the licence:

Table 1: Pollution concentration targets from Table 1 in Licence L5099/1974/13

Parameter	Target
Nickel in air	0.14 µg/m ³
Dust as PM ₁₀	50 µg/m ³
Dust as TSP	90 µg/m ³

Map of EPSL monitoring sites:



Figure 1: Location of monitoring sites

2. ANALYSIS OF BULK NICKEL SHIP LOADING

2.1 Port Activities

The 'berthing period' in this report will refer to 1735 hours on 22/03/2011 to 1510 hours on 24/03/2011. The '**loading period**' in this report will refer to **0135 on 23/03/2011 to 1302 hours on 24/03/2011**.

Bulk nickel loading ceased on one occasion due to winds being in the red zone from 1100 to 2039 hours 23/03/2011 for the total of 9 hours and 39 minutes. Approximately 12,324 tonnes of BHP Billiton Nickel West nickel sulphide concentrate bulk was loaded.

The following marine vessels were also in Port during the monitoring period were:

- GCL Argentina was alongside Berth 3 being loaded with iron ore between 1508 hours on 22 March 2011 hours to 0054 hours on 25 March 2011.

Products received/delivered other than by marine vessels, were:

- 35,507 tonnes of iron ore averaged across 6 trains delivered to the Port and
- 327 tonnes of nickel concentrate (Mount Keith) across 5 trucks delivered to the Port in containers.

2.2 Meteorological Conditions

All wind speeds and directions described in this section are limited to the loading period.

- The wind direction was variable and was spread from SW to NNW (23% SW, 14% SSW, 13% S, 11% N, 10% NNE, 9% SE, 8% SSE, 7% ESE, 5% NNW) (**Figure 2**).
- The maximum hourly wind speed recorded was 5.7 m/s (20.5 km/hr) from the SW direction (green zone), which occurred between 1300 hours and 1355 hours on 23/03/2011.
- The average wind speed during the loading periods was 4.3 m/s (15.5 km/h). The 'Beaufort Wind Force Scale' is a measure for understanding wind speeds in descriptive terminology. A wind speed of 4.3 m/s is described as 'light' winds (BOM, 2010).

2.3 Odour and Dust Monitoring

Pre-loading determination of the Nickel West concentrate was undertaken as per the requirement of EPSL “Environmental Considerations for Nickel Ship-loading Procedure’ (PR088) (EsPA 2009). It was determined that the Nickel West concentrate was classified as ‘very weak’ typical of the Mount Keith concentrate, and had a low dust potential indicated by the average moisture of >8%. The nickel concentrate was therefore loaded as per Section 3.1 of the procedure (EsPA 2009). The odour and moisture content record sheet is included in **Appendix A**.

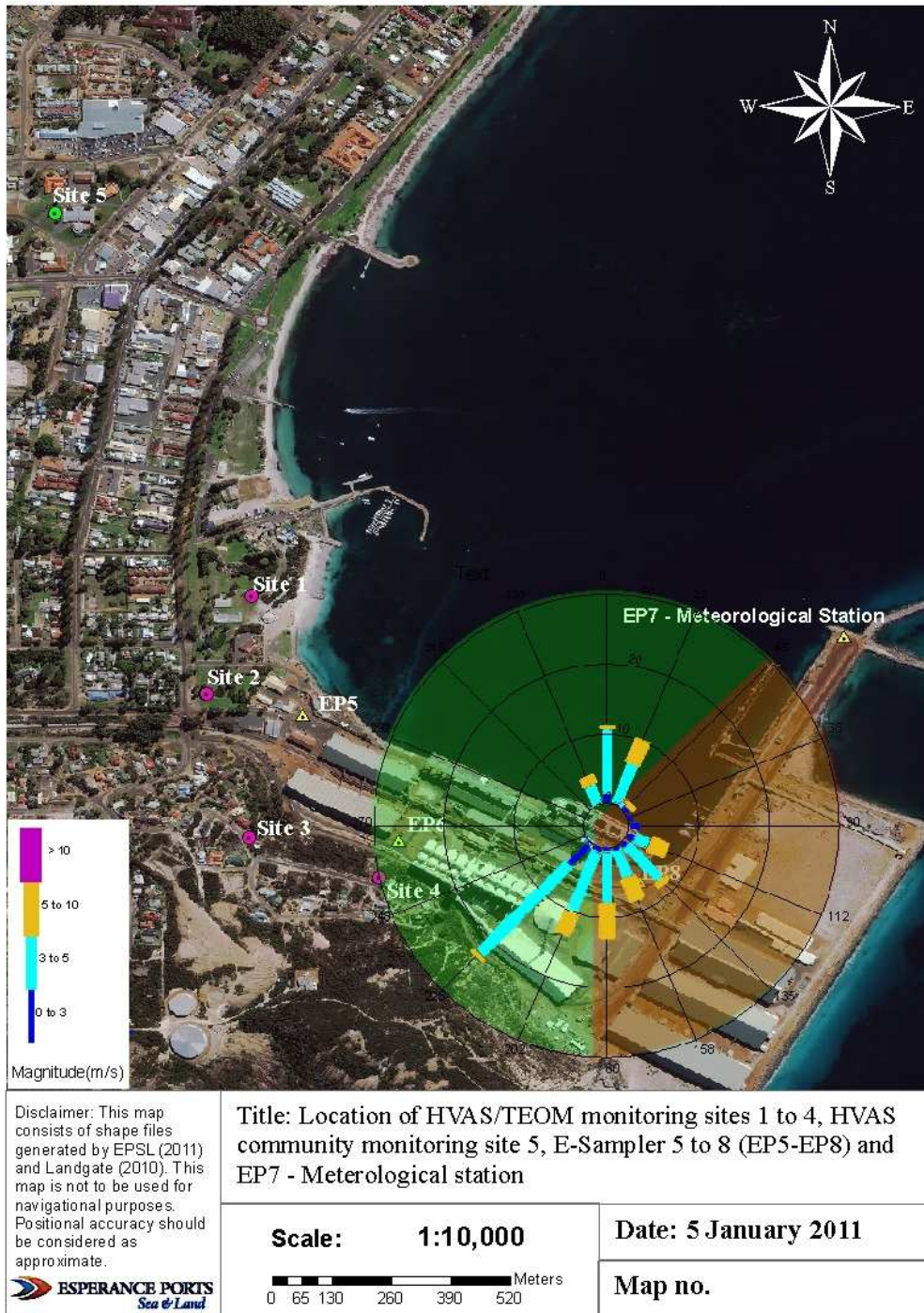


Figure 2: Wind arc zones defined in EPSL (2008), where 'red zone' is 45° to 180° and 'green zone' is 180° to 45°, showing loading wind rose data measured at the meteorological station adjacent to E-Sampler 7 from 0135 on 23/03/2011 to 1302 on 24/03/2011.

2.4 Compliance to loading protocol

The loading was compliant with the loading protocol (**Figures 2 and 3**). The wind arc zones in which EPSL may or may not load bulk nickel sulphide concentrate (green and red respectively) are illustrated in **Figure 2** and are documented within EPSL's internal procedures. These conditions are in place to minimise nickel particulate emitted from the Port to the community which is more sensitive than the marine environment. The effectiveness of these procedures has been demonstrated in the absence of any exceedences since implementation of the wind arc procedure in December 2008.

The bar chart in **Figure 3** shows tonnes of nickel loaded (tonnes/hour) in relation to hourly averages of wind direction (line plot) and the red/green loading zones (background). During the loading of MV Ocean Flower the wind direction was in the green zone between 180 to 360 degrees during the majority of the loading period. The wind direction moved to the red zone between 1105 hours on 23/3/2011 to 2145 hours on 23/3/2011.

As a further restriction to minimise ship-loading emissions, EPSL has to maintain less than 1000 tonnes per hour (tph) nominal ship-loading rate as part of its protocol. This ship loading protocol (PR026) was not exceeded during the loading of the MV Ocean Flower (**Figure 3**). However, loading rates do not appear to be critical in controlling dust emissions from the Berth 2 ship loader based on recent ship loading events since the ship loader upgrades including a telescopic extension.

2.5 TEOM PM₁₀ Monitoring

During the berthing period and prior to loading, the wind was in the red zone and a maximum PM₁₀ of 33.0 µg/m³ was recorded at Site 1 at 1400 hours on 22/03/2011. As the wind direction shifted from the red zone to the green zone, levels of PM10 generally declined, and vice versa.

Figure 4 graphs the hourly PM₁₀ concentration (µg/m³) and wind speed (m/s) against date. Throughout the loading of MV Ocean Flower the winds moved into the red zone between 1105 hours 23/03/2011 to 2145 hours 23/03/2011. Loading of nickel was halted during this period. Loading resumed when the wind direction changed to the green zone at 2145 hours 23/3/2011. Therefore the recorded PM₁₀ concentrations are likely to be from sources other than nickel loading operations. There is no correlation between wind speed and PM₁₀ during the loading period (refer to **Appendix B** for raw data).

The 24-hour average PM₁₀ concentrations for the monitoring period are presented in **Table 2** as calculated at 1200 hours each date to coincide with the approximate time when TSP filter papers are changed. The 24-hour average licence target concentration of 50µg/m³ was not exceeded at any of the sites. The maximum

daily average PM₁₀ concentration of 25.2 µg/m³ was recorded at Site 2 between 1200 hours on 23/03/2011 and 1200 hours on 24/03/2011 and represents 50.4% of the assessment criterion (50 µg/m³).

Table 2: Daily 24-hr average TEOM results for PM₁₀ for 22/03/2011 to 25/03/2011

Sampling Start	Sampling Finish	Site 1 (µg/m ³)	Site 2 (µg/m ³)	Site 3 (µg/m ³)	Site 4 (µg/m ³)
1200 22/03/2011	1200 23/02/2011	14.5	15.6	15.3	15.2
1200 23/03/2011	1200 24/03/2011	23.9	25.2	22.5	20.5
1200 24/03/2011	1200 25/03/2011	17.2	15.5	16.9	17.2
Assessment Criterion (µg/m³)		50			

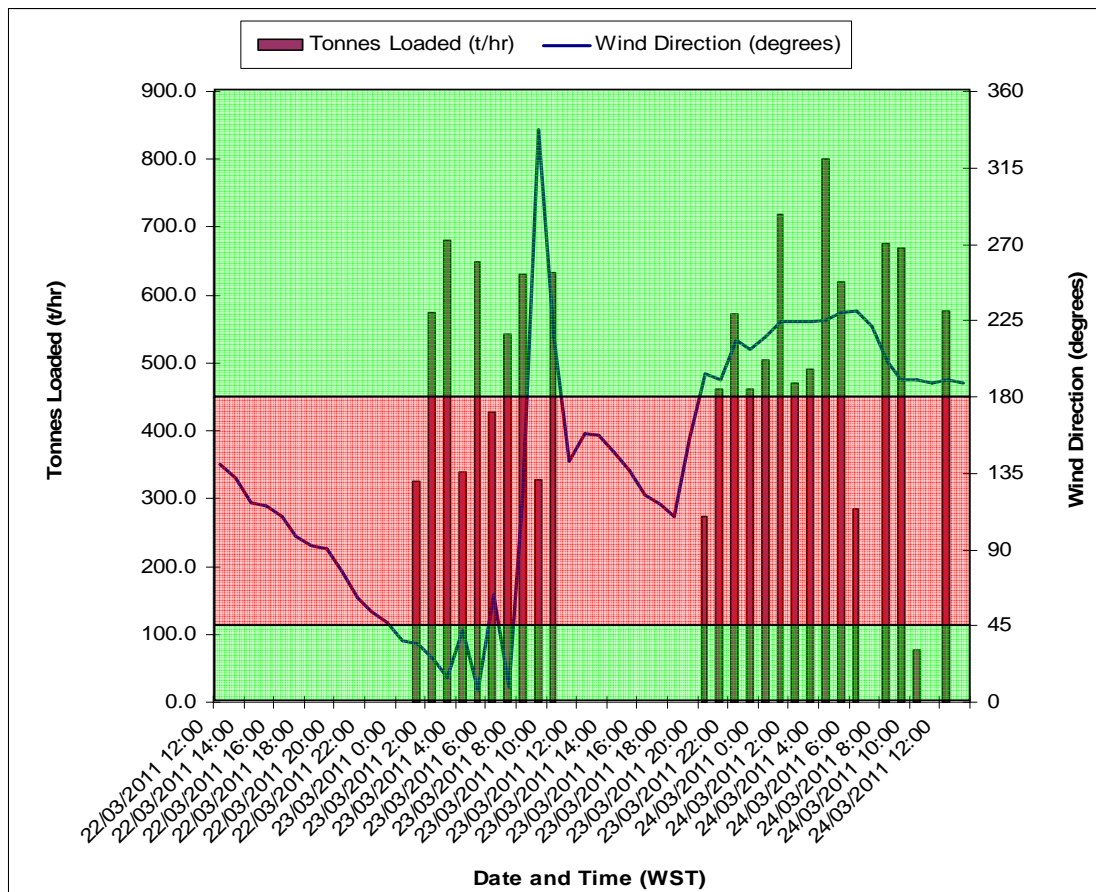


Figure 3: Wind direction preceding and during loading of MV Ocean Flower.

Note: loading occurred from 0135 hours on 23/03/2011 to 1302 hours on 24/03/2011.

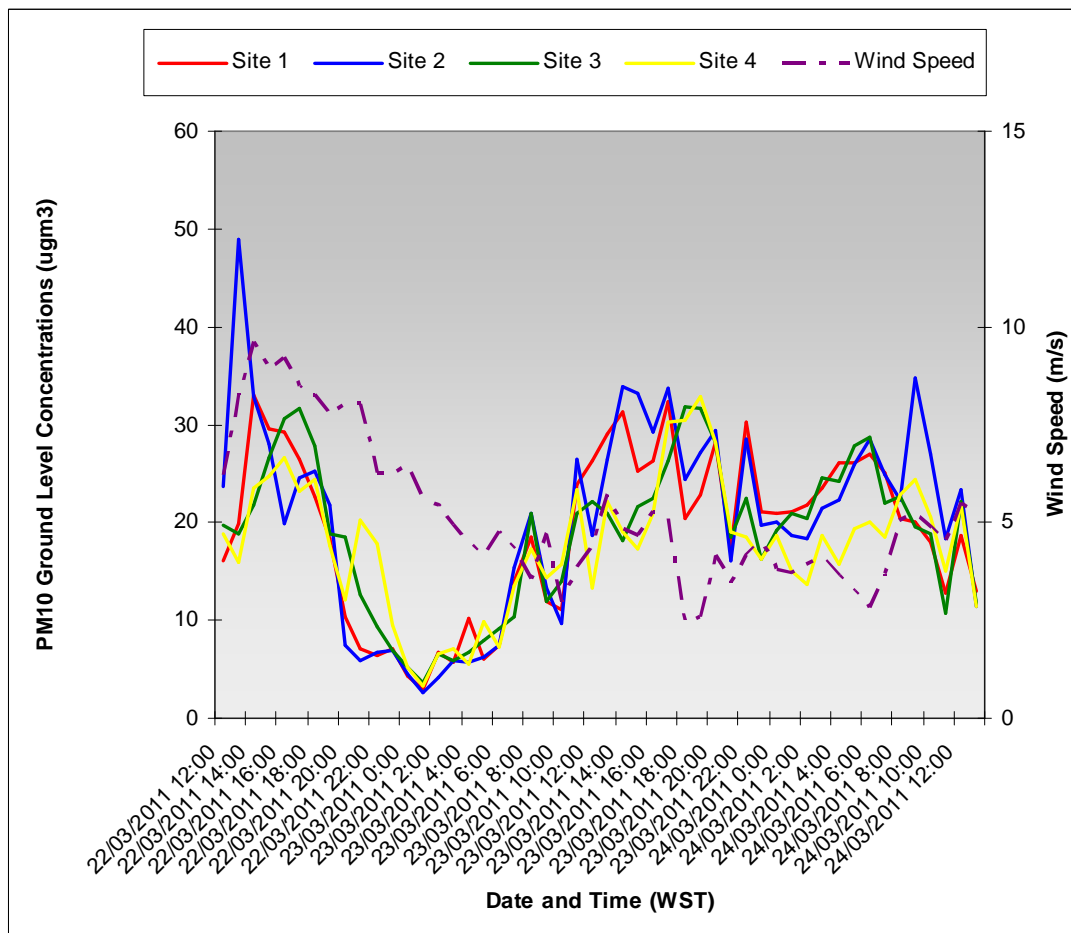


Figure 4: Hourly PM10 concentrations and wind speed between 0135 hours on 23/03/2011 to 1302 hours on 24/03/2011.

2.6 TSP HVAS Data

The results from the laboratory analysis of the TSP filter papers are presented in **Table 3** and the laboratory reports are provided in **Appendix C**. There were no exceedences of the $90 \mu\text{g}/\text{m}^3$ 24-hour average concentration target for TSP during the monitoring period. The maximum recorded daily average TSP concentration of $56 \mu\text{g}/\text{m}^3$ recorded at Site 2 between 1200 hours on 23/03/2011 and 1200 hours on 24/03/2011 represents 62.2% of the assessment criterion ($90 \mu\text{g}/\text{m}^3$). This is a typical value for background dust levels, and is within the TSP concentration criteria.

The 24-hour average licence target of $0.14 \mu\text{g}/\text{m}^3$ for nickel was not exceeded during the monitoring period. The highest 24-hour average nickel concentration recorded during the monitoring period was $0.012 \mu\text{g}/\text{m}^3$ which occurred at Site 5 between 1200 hours 22/3/2011 to 1200 hours 23/3/2011 representing 9% of the assessment criterion ($0.14 \mu\text{g}/\text{m}^3$).

Table 3: Daily HVAS monitoring results for TSP for 22/03/2011 to 25/03/2011

Sampling Start ¹	Sampling Finish ¹	Site 1 ($\mu\text{g}/\text{m}^3$)		Site 2 ($\mu\text{g}/\text{m}^3$)		Site 3 ($\mu\text{g}/\text{m}^3$)		Site 4 ($\mu\text{g}/\text{m}^3$)		Site 5 ($\mu\text{g}/\text{m}^3$)	
		TSP	Ni	TSP	Ni	TSP	Ni	TSP	Ni	TSP	Ni
1200 22/03/2011	1200 23/03/2011	29	0.006	33	<0.002	36	0.005	47	0.007	23	0.012
1200 23/03/2011	1200 24/03/2011	37	0.005	56	0.009	32	<0.002	36	<0.002	35	0.002
1200 24/03/2011	1200 25/03/2011	32	0.003	25	0.004	26	0.002	36	0.003	24	<0.002
Assessment Criterion ($\mu\text{g}/\text{m}^3$)		90	0.14	90	0.14	90	0.14	90	0.14	90	0.14

¹ These times are approximate for all five monitoring sites.

Bold - exceedance of the $90\mu\text{g}/\text{m}^3$ 24-hour average concentration target for TSP
 $0.001\mu\text{g}/\text{m}^3$ is the limit of detection for the analysis of nickel.

3. CONCLUSIONS

Loading of the MV Ocean Flower was consistent with EPSL operational procedures, ship-loading only occurred when the wind was blowing from within the green zone and loading rates were less than 1,000 tonnes/hour. Therefore, the potential for dust and odour impacts were significantly reduced.

No odour complaints were reported to EPSL during this period consistent with the 'No perceptible' product odour assessment result. There have been no odour complaints reported to EPSL since December 2008 that are attributable to the activities of the Port.

The licence targets for PM_{10} , TSP and nickel were not exceeded at any of the four monitoring sites during the berthing or loading periods of the Ocean Flower. None of these parameters significantly increased during the loading period.

These results warranted no further emission reduction measures.

4. REFERENCES

Bureau of Meteorology (BOM), 2009. Beaufort Wind Scale. Access online 1 April 2011, <http://www.bom.gov.au/lam/glossary/beaufort.shtml>

DEC 2009, Licence for prescribed premises, licence number L5099/1074/13, Western Australian Department of Environment and Conservation, Australia, www.dec.wa.gov.au


Esperance Port Authority 2009, PR088: Environmental conditions for nickel ship loading, document number PR088, issued May 2009, Esperance Port Authority.

Esperance Port Authority 2010, Marine Vessel Ratu Tembaga – Analysis of Air Quality Monitoring Data Associated with Bulk Nickel Sulphide Ship-Loading on 3-5 July 2010.

NATA 2009, Facilities and labs: MP Laboratories a division of Coffey Environments Pty Ltd, Accessed online 5 April 2011, <http://mpl.com.au/>

Standards Australia 2008, Methods for sampling and analysis of ambient air, method 9.8: determination of suspended particulate matter – PM10 continuous direct mass method using a tapered element oscillating microbalance analyser, AS 3580.9.8-2008, Accessed online 6 February 2009, <http://www.saiglobal.com/online/autologin.asp?br=true&userid=7439352104>.

Appendix A Odour Record Sheet

 <p>ESPERANCE PORTS Sea & Land</p> <p>Title: Odour Record Sheet</p>	Form No : FM239
	Revision: 2
	Issue Date: 8/12/02009
	Page: 1 of 1
	Reference: PR089

ODOUR INTENSITY	
Extremely Strong	6
Very Strong	5
Strong	4
Distinct	3
Weak	2
Very Weak	1
Not Perceptible	0

Ship Name: Ocean Flower Sampled by: Alex Leonard

Odour Assessor(s)	Date	Time	Sample#	Location	Temperature (°C)	pH	%moisture	Odour intensity (Rate 1 to 6)	
AL	21/3/11	10:15	1	BSS		8.95	95	511	1
↓	↓	↓	2	↓	↑	7.17	76	414	0
↓	↓	↓	3	↓		6.49	82	362	1
↓	↓	↓	4	↓		7.77	80	454	1
↓	↓	↓	5	↓		7.1	77	487	0
↓	↓	↓	6	↓		5.92	63	403	0

APPENDIX B HOURLY AVERAGE PM10 CONCENTRATIO

Date and Time	Hourly Average PM10 in $\mu\text{g}/\text{m}^3$				Hourly Averaged Wind Speed (m/s)	Hourly Averaged Wind Vector ($^{\circ}$)	Hourly Averaged Product Loaded (tonnes)
	Site 1	Site 2	Site 3	Site 4			
22/03/2011 12:00	16.0	23.7	19.7	18.9	6.2	140.1	-
22/03/2011 13:00	19.9	48.9	18.8	15.9	8.2	132.5	-
22/03/2011 14:00	33.0	32.8	21.8	23.6	9.6	118.0	-
22/03/2011 15:00	29.6	28.1	26.7	24.8	8.9	115.9	-
22/03/2011 16:00	29.1	20.0	30.5	26.7	9.2	109.7	-
22/03/2011 17:00	26.5	24.5	31.7	23.2	8.5	98.0	-
22/03/2011 18:00	22.6	25.3	27.8	24.4	8.3	91.8	-
22/03/2011 19:00	18.3	21.7	18.8	17.7	7.7	90.8	-
22/03/2011 20:00	10.3	7.5	18.4	12.2	8.1	76.7	-
22/03/2011 21:00	7.1	5.9	12.6	20.2	8.0	61.7	-
22/03/2011 22:00	6.4	6.8	9.3	17.8	6.3	53.6	-
22/03/2011 23:00	7.0	6.9	6.9	9.5	6.2	46.7	0
23/03/2011 0:00	4.4	4.6	5.2	5.1	6.5	36.5	0
23/03/2011 1:00	2.9	2.6	3.6	3.3	5.6	33.9	325
23/03/2011 2:00	6.7	4.1	6.6	6.6	5.5	25.5	575
23/03/2011 3:00	5.7	5.8	5.9	7.0	4.9	14.3	680
23/03/2011 4:00	10.3	5.7	6.7	5.5	4.5	42.1	340
23/03/2011 5:00	6.1	6.2	8.0	9.9	4.1	7.4	650
23/03/2011 6:00	7.5	7.4	9.1	7.2	4.7	62.9	427
23/03/2011 7:00	13.9	15.3	10.4	13.5	4.3	9.2	543
23/03/2011 8:00	18.5	20.9	21.0	17.4	3.5	122.6	630
23/03/2011 9:00	12.0	13.2	11.9	14.3	4.7	337.6	328
23/03/2011 10:00	11.0	9.6	14.1	15.7	3.0	215.6	634
23/03/2011 11:00	23.8	26.4	20.9	23.4	3.9	141.8	0
23/03/2011 12:00	26.2	18.6	22.1	13.4	4.4	157.9	0
23/03/2011 13:00	29.1	26.4	20.8	22.1	5.7	157.2	0
23/03/2011 14:00	31.3	33.8	18.2	19.1	4.8	147.2	0
23/03/2011 15:00	25.3	33.2	21.5	17.3	4.7	137.0	0
23/03/2011 16:00	26.3	29.2	22.5	21.0	5.3	122.2	0
23/03/2011 17:00	32.3	33.7	26.3	30.3	5.1	116.7	0
23/03/2011 18:00	20.4	24.3	31.9	30.4	2.5	109.4	0
23/03/2011 19:00	22.8	27.2	31.6	32.9	2.6	155.4	0
23/03/2011 20:00	28.2	29.4	28.2	28.2	4.1	193.3	273
23/03/2011 21:00	17.2	16.2	18.6	19.1	3.5	190.2	461
23/03/2011 22:00	30.2	28.6	22.6	18.5	4.2	213.7	571
23/03/2011 23:00	21.1	19.8	16.3	16.2	4.5	207.7	461
24/03/2011 0:00	21.0	20.0	19.1	18.8	3.8	214.9	504
24/03/2011 1:00	21.1	18.7	20.9	15.0	3.7	224.6	719
24/03/2011 2:00	21.8	18.4	20.5	13.6	3.9	224.2	470
24/03/2011 3:00	23.5	21.5	24.6	18.6	4.1	224.2	490
24/03/2011 4:00	26.1	22.4	24.1	15.8	3.6	225.3	800
24/03/2011 5:00	26.1	25.9	27.8	19.4	3.2	229.4	620
24/03/2011 6:00	27.0	28.4	28.8	20.1	2.8	230.9	284
24/03/2011 7:00	25.0	25.0	21.9	18.5	3.7	221.8	0
24/03/2011 8:00	20.5	22.2	22.7	22.8	5.1	200.4	676
24/03/2011 9:00	20.1	34.7	19.5	24.3	5.2	190.3	670
24/03/2011 10:00	17.9	27.0	18.9	20.5	4.9	189.7	78
24/03/2011 11:00	12.7	18.3	10.8	15.0	4.5	187.9	0
24/03/2011 12:00	18.6	23.3	22.1	21.7	5.5	190.3	576
24/03/2011 13:00	13.0	11.4	11.8	11.3	5.3	188.2	-

APPENDIX C

MPL LABORATORY REPORTS

CERTIFICATE OF ANALYSIS 110074

Client:

Esperance Ports - Sea and Land

PO Box 35

Esperance

WA 6450

Attention: A Leonard

Sample log in details:

Your Reference:

No. of samples:

Date samples received:

Date completed instructions received:

Location:

Dust Analysis

24 High Volume Filters

28/03/11

28/03/11

NA

Analysis Details:

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by:

4/04/11

Date of Preliminary Report:

Not issued

Issue Date:

12/04/11

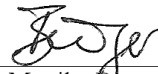
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Results Approved By:



Dr Monika Buerger

Supervisor – Micro, Asbestos, Dust

Client Reference: Dust Analysis

Metals in High Volume Filters	UNITS	PQL	110074-1	110074-2	110074-3	110074-4	110074-5
Our Reference:	--	--	EAP823	EAP824	EAP825	EAP826	EAP827
Your Reference	--	--	Site 4	Site 3	Site 2	Site 1	Site 5
Location	--	--	21/03/11	21/03/11	21/03/11	21/03/11	21/03/11
Date Sampled							
Dust	mg/filter	0.1	52	52	150	39	30
Dust in Air	µg/m ³	0.1	33	33	97	25	19
Iron	µg/filter	5	1,100	840	950	630	270
Iron in Air	µg/m ³	0.005	0.73	0.53	0.61	0.40	0.17
Nickel	µg/filter	2	7	5	9	3	<2
Nickel in Air	µg/m ³	0.002	0.004	0.003	0.006	<0.002	<0.002
Lead	µg/filter	5	<5	<5	<5	<5	<5
Lead in Air	µg/m ³	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Lithium	µg/filter	2	<2	<2	<2	<2	<2
Lithium in Air	µg/m ³	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Sulfur	µg/filter	50	1,900	3,000	3,200	1,600	1,100
Sulfur in Air	µg/m ³	0.02	1.2	1.9	2.1	1.0	0.72
Zinc	µg/filter	5	345	349	244	252	257
Zinc in Air	µg/m ³	0.002	0.22	0.22	0.16	0.16	0.16

Metals in High Volume Filters	UNITS	PQL	110074-6	110074-7	110074-8	110074-9	110074-10
Our Reference:	--	--	EAP828	EAP829	EAP830	EAP831	EAP832
Your Reference	--	--	Blank	Site 4	Site 3	Site 2	Site 1
Location	--	--		22/03/11	22/03/11	22/03/11	22/03/11
Date Sampled							
Dust	mg/filter	0.1	4.8	70	54	49	44
Dust in Air	µg/m ³	0.1	[NA]	47	36	33	29
Iron	µg/filter	5	160	1,900	1,500	320	770
Iron in Air	µg/m ³	0.005	[NA]	1.3	1.0	0.22	0.51
Nickel	µg/filter	2	<2	10	7	2	10
Nickel in Air	µg/m ³	0.002	[NA]	0.007	0.005	<0.002	0.006
Lead	µg/filter	5	<5	<5	<5	<5	<5
Lead in Air	µg/m ³	0.005	[NA]	<0.005	<0.005	<0.005	<0.005
Lithium	µg/filter	2	<2	<2	<2	<2	<2
Lithium in Air	µg/m ³	0.001	[NA]	<0.001	<0.001	<0.001	<0.001
Sulfur	µg/filter	50	690	3,900	3,000	510	2,200
Sulfur in Air	µg/m ³	0.02	[NA]	2.6	2.0	0.34	1.5
Zinc	µg/filter	5	243	255	292	64	260
Zinc in Air	µg/m ³	0.002	[NA]	0.17	0.20	0.043	0.17

Client Reference: Dust Analysis

Metals in High Volume Filters	UNITS	PQL	110074-11	110074-12	110074-13	110074-14	110074-15
Our Reference:	--	--	EAP833	EAP834	EAP835	EAP836	EAP837
Your Reference	--	--	Site 5	Blank	Site 4	Site 3	Site 2
Location	--	--	22/03/11		23/03/11	23/03/11	23/03/11
Date Sampled							
Dust	mg/filter	0.1	35	1.0	55	49	84
Dust in Air	µg/m ³	0.1	23	[NA]	36	32	56
Iron	µg/filter	5	940	160	690	640	1,800
Iron in Air	µg/m ³	0.005	0.63	[NA]	0.46	0.42	1.2
Nickel	µg/filter	2	18	<2	<2	3	14
Nickel in Air	µg/m ³	0.002	0.012	[NA]	<0.002	<0.002	0.009
Lead	µg/filter	5	<5	<5	<5	<5	<5
Lead in Air	µg/m ³	0.005	<0.005	[NA]	<0.005	<0.005	<0.005
Lithium	µg/filter	2	2	<2	<2	<2	2
Lithium in Air	µg/m ³	0.001	0.001	[NA]	<0.001	<0.001	0.001
Sulfur	µg/filter	50	2,300	710	1,700	2,400	3,100
Sulfur in Air	µg/m ³	0.02	1.6	[NA]	1.2	1.6	2.0
Zinc	µg/filter	5	318	241	251	284	303
Zinc in Air	µg/m ³	0.002	0.21	[NA]	0.17	0.19	0.20

Metals in High Volume Filters	UNITS	PQL	110074-16	110074-17	110074-18	110074-19	110074-20
Our Reference:	--	--	EAP838	EAP839	EAP840	EAP841	EAP842
Your Reference	--	--	Site 1	Site 5	Blank	Site 4	Site 3
Location	--	--	23/03/11	23/03/11		24/03/11	24/03/11
Date Sampled							
Dust	mg/filter	0.1	56	53	0.40	57	41
Dust in Air	µg/m ³	0.1	37	35	[NA]	36	26
Iron	µg/filter	5	870	750	170	750	520
Iron in Air	µg/m ³	0.005	0.58	0.50	[NA]	0.47	0.32
Nickel	µg/filter	2	8	3	<2	5	4
Nickel in Air	µg/m ³	0.002	0.005	0.002	[NA]	0.003	0.002
Lead	µg/filter	5	<5	<5	<5	<5	<5
Lead in Air	µg/m ³	0.005	<0.005	<0.005	[NA]	<0.005	<0.005
Lithium	µg/filter	2	2	<2	<2	<2	<2
Lithium in Air	µg/m ³	0.001	0.001	<0.001	[NA]	<0.001	<0.001
Sulfur	µg/filter	50	4,200	3,000	690	1,800	2,200
Sulfur in Air	µg/m ³	0.02	2.8	2.0	[NA]	1.1	1.3
Zinc	µg/filter	5	303	283	255	283	605
Zinc in Air	µg/m ³	0.002	0.20	0.19	[NA]	0.18	0.37

Client Reference: Dust Analysis

Metals in High Volume Filters	UNITS	PQL	110074-21	110074-22	110074-23	110074-24	110074-25
Our Reference:	--	--	EAP843	EAP844	EAP845	EAP846	Lab Blank
Your Reference	--	--	Site 2	Site 1	Site 5	Blank	
Location							
Date Sampled			24/03/11	24/03/11	24/03/11		
Dust	mg/filter	0.1	36	52	39	3.1	[NA]
Dust in Air	µg/m ³	0.1	25	32	24	[NA]	[NA]
Iron	µg/filter	5	860	730	560	150	170
Iron in Air	µg/m ³	0.005	0.60	0.45	0.34	[NA]	[NA]
Nickel	µg/filter	2	5	6	3	<2	<2
Nickel in Air	µg/m ³	0.002	0.004	0.003	<0.002	[NA]	[NA]
Lead	µg/filter	5	<5	<5	<5	<5	<5
Lead in Air	µg/m ³	0.005	<0.005	<0.005	<0.005	[NA]	[NA]
Lithium	µg/filter	2	<2	<2	<2	<2	<2
Lithium in Air	µg/m ³	0.001	<0.001	<0.001	<0.001	[NA]	[NA]
Sulfur	µg/filter	50	2,000	2,200	2,100	780	830
Sulfur in Air	µg/m ³	0.02	1.4	1.4	1.3	[NA]	[NA]
Zinc	µg/filter	5	607	503	274	259	308
Zinc in Air	µg/m ³	0.002	0.42	0.31	0.17	[NA]	[NA]

Client Reference: Dust Analysis

Method ID	Methodology Summary
DUST-004	Airborne samples analysed according to AS 2985 for Respirable Dust or AS 3640 for Inhalable Dust . Sample results based on volume data supplied by client. Samples tested as received, *accreditation does not cover sampling.
METALS-020	Metals in soil and water by ICP-OES.

Report Comments:

This report replaces the one dated 05/04/11 due to changes in precision

INS: Insufficient sample for this test; NT: Not tested; PQL: Practical Quantitation Limit; <: Less than; >: Greater than
RPD: Relative Percent Difference; NA: Test not required; LCS: Laboratory Control Sample; NR: Not requested
NS: Not specified; NEPM: National Environmental Protection Measure
DOL: Sample rejected due to particulate overload

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike: A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample): This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD a matrix spike recoveries for the sample batch were within laboratory acceptance criteria.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.

Matrix Spike and LCS: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and Speciated Phenols is acceptable.

Surrogates: 60-140% is acceptable for general organics and 10-140% for SVOC and Speciated Phenols.