



**AIR QUALITY MONITORING REPORT OF
BULK NICKEL SULFIDE SHIP-LOADING ON**

MARINE VESSEL KEN ZUI

23RD-24TH AUGUST 2011

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1	C. Field	A Leonard		8/9/2011	1 st Draft
2					Final

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1. INTRODUCTION

1.1 Licence Reporting Conditions

This document reports the air quality monitoring for the loading of the Marine Vessel (MV) Ken Zui between 2030 hrs on 23rd August 2011 to 1650 hrs on 24th August 2011 at the Esperance Port Sea and Land. This report is compiled and issued in compliance with Condition 18 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 and Land (EPSL) on the 3rd March 2011 (amended on 28th July 2011).

1.2 Location of Monitoring Stations

As required by the licence, ambient monitoring is undertaken at five sites; four in close proximity to the port boundary and one 1.6 km from the port within the town of Esperance (**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 (**Figure 1**). 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: Emission Concentration Targets (taken from Table 1 in Licence L5099/1974/13)

Emission	24hr Ambient Concentration Target
Nickel in air	0.14 µg/m ³
Dust as PM ₁₀	50 µg/m ³
Dust as TSP	90 µg/m ³



Figure 1: Location of EPSL Monitoring Sites

2. ANALYSIS OF BULK NICKEL SHIP LOADING

2.1 Port Activities

The MV Ken Zui was berthed at Esperance Port from 1950 hours on 23/08/2011 to 1845 hours on 24/08/2011. The 'loading period' began at **2030 on 23/08/2011 and finished at 1650 hours on 24/08/2011.**

There were no delays relating to wind being in the red zone during bulk loading of the 8,345 tonnes of BHP Billiton Nickel West nickel sulphide concentrate.

The following activities were also occurring in port during the loading period:

- Marine Vessel F Duckling, was alongside in Berth 3 between 0620 hours on 23rd August 2011 to 0800 hours on 26th August 2011 and was loaded with 168,839 tonnes of iron ore
- Marine Vessel SH Bright was alongside in Berth 1 between 1230 hours on 23rd August 2010 to 1248 hours on 24th August 2011 and was loading with 14,250 tonnes of barley
- 35,977 tonnes of iron ore was delivered by 4 trains; and
- 418 tonnes of nickel concentrate (from Mount Keith) was delivered in containers by 6 trucks.

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 NNE (32% WNW, 22% W, 22% WSW, 7% SW and remainder between NW to NNE (**Figure 2**)).
- The maximum hourly wind speed recorded was 8.75 m/s (31.5km/hr) from the W direction (green zone), which occurred between 1000 hours and 1100 hours on 24/08/2011.
- The average wind speed during the loading periods was 5.10 m/s (18.4 km/h). described as 'light' winds by the 'Beaufort Wind Force Scale' (BOM, 2011).

2.3 Odour and Dust Monitoring

Pre-loading determination of the Nickel West concentrate was undertaken in accordance with the EPSL Procedure '*Environmental Considerations for Nickel Ship-loading: PR088*' (EPSL, 2009a). It was determined that the blended Nickel

West concentrate was classified as 'very weak', and had a low dust potential indicated by the average moisture of 8.81%. The nickel concentrate was therefore loaded as per Section 3 of the procedure (EPSL, 2009b). The odour and moisture content record sheet is included in **Appendix A**.

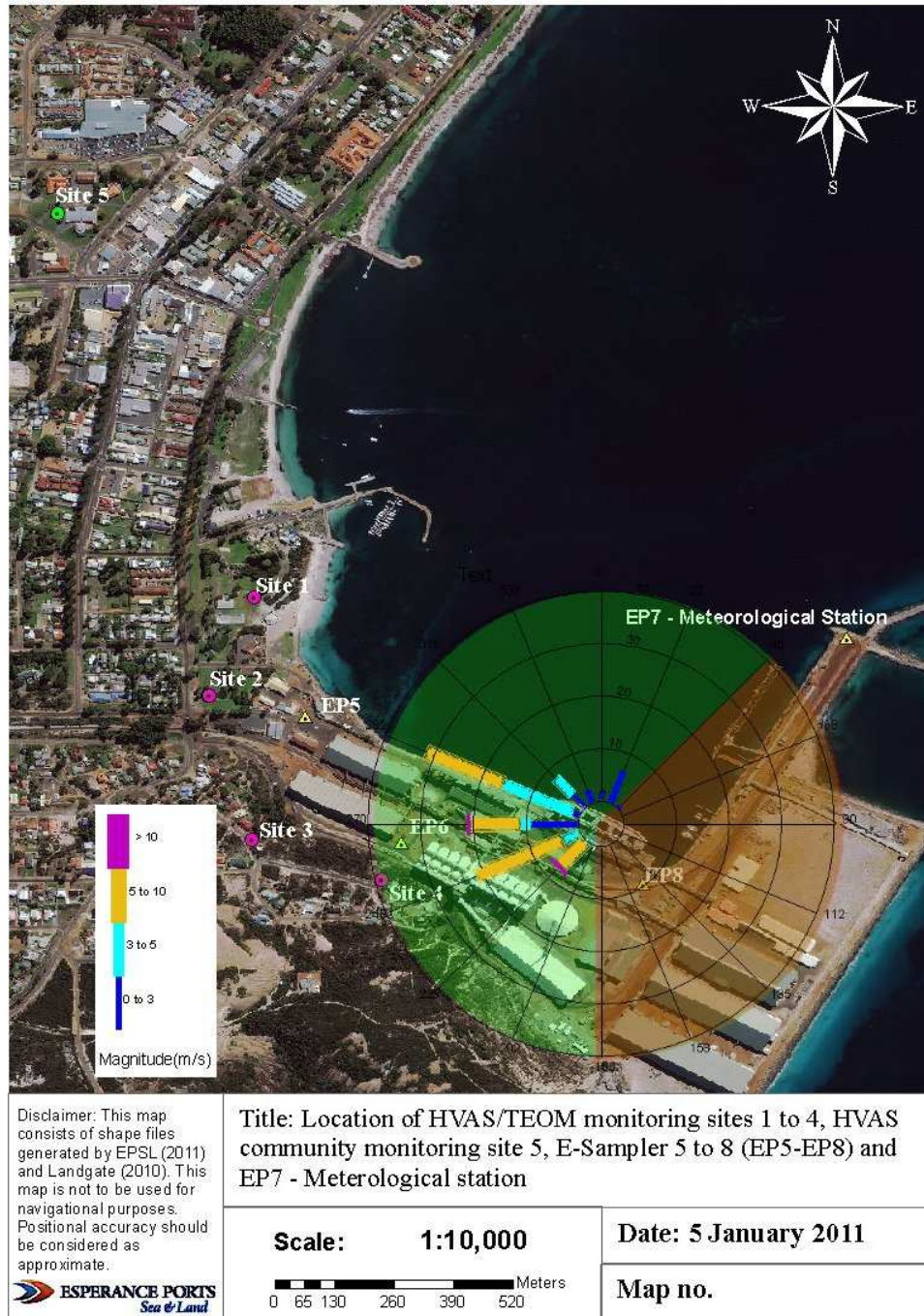


Figure 2: Wind arc zones, where 'red zone' is 45° to 180 ° and 'green zone' is 180 ° to 45° (EPSL, 2009a), showing loading wind rose data measured at the meteorological station adjacent to E-Sampler 7 from 2000 on 23/08/2011 to 1700 on 24/08/2011.

2.4 Compliance to Loading Protocol

The bulk nickel sulphide loading was compliant with the EPSL loading procedure which documents maximum loading rates, percentage moisture of the product and in what wind directions the concentrate may or may not be loaded (green and red respectively) (EPSL, 2009a). The wind direction arc is illustrated *Figure 2* and the loading rates (below 1000tph) are illustrated in *Figure 3*. The effectiveness of these procedures has been demonstrated in the absence of any exceedences since implementation of the wind arc procedure in December 2008.

These conditions are in place to minimise nickel particulate emitted from the Port to the community which is more sensitive than the marine environment. This is due to terrestrial animals including people, having a higher exposure to the nickel particulates which become trapped in lung cavities. Marine animals are less exposed, since only a low proportion (less than 6%), of the nickel sulphide particulates dissolve in seawater based on dilute acid extractions of marine sediments (Oceanica, 2008). Uptake via gills is the primary uptake route in marine biota. Aquatic organisms are likely to actively regulate dissolved nickel at low levels, as nickel is an essential element (Muysen *et al.*, 2004).

The bar chart in *Figure 3* shows tonnes of nickel loaded in tonnes per hour (tph) in relation to hourly averages of wind direction (line plot) and the red/green loading zones (background). During the loading of MV Ken Zui the wind direction was in the green zone between 180° to 45° during the entire loading period.

As a further restriction to minimise dust emissions, EPSL has committed to limit loading to less than 1000 t/hr nominal ship-loading rate as part of its 'Heavy Metals Ship Loading Procedure: PR026' in Section 8 (EPSL, 2009b). Loading rates, however, 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 include a telescopic extension. The EPSL ship loading procedure was adhered to during the loading of the MV Ken Zui.

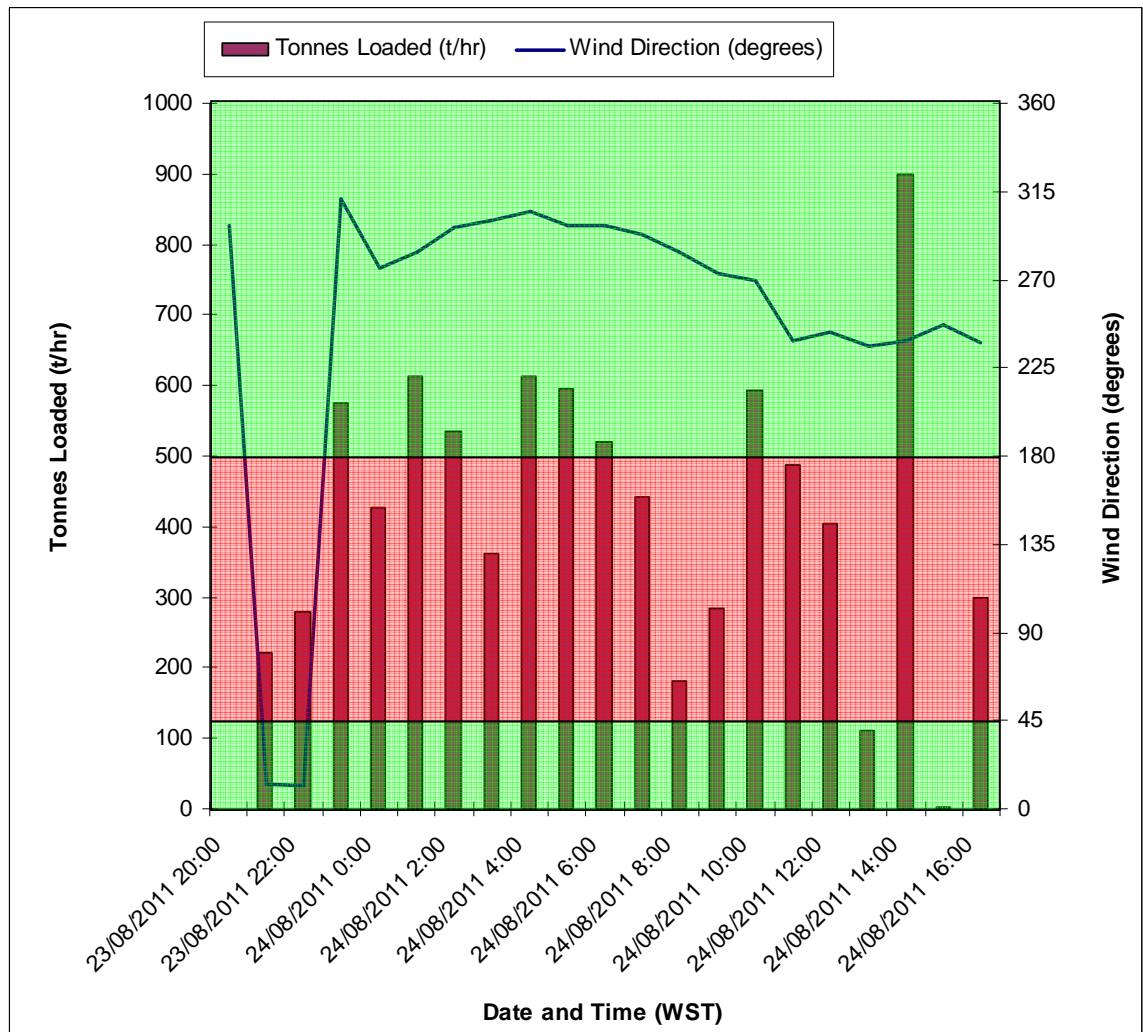


Figure 3: Wind Direction and Loading Rate of MV Ken Zui

Note: loading occurred for 21 hours from 2030 hours 23/08/2011 to 1650 hours on 24/08/2011.

2.5 TEOM PM₁₀ Monitoring

For the entire loading period of MV Ken Zui, the wind was in the green zone and a maximum PM₁₀ of 47.8 µg/m³ was recorded at Site 4 at 1200 hours on 24th August 2011. The wind direction was mostly between a WSW to WNW direction but started in a N direction between 2100 hours and 2200 hours on 23rd April 2011 before swinging west. Wind direction did not appear to influence levels of PM₁₀ based on inspection of the raw data (refer to **Appendix B**). The recorded PM₁₀ concentrations, are therefore likely to be from sources other than nickel loading operations.

The hourly PM₁₀ concentration (µg/m³) and average wind speed (m/s) has been plotted against the date and hour that the MV Ken Zui was being loaded (refer to

Figure 4). As wind speed increased, levels of PM10 increased, but there were no measurements that exceeded the 24 hour PM10 criteria.

The 24-hour average PM₁₀ concentrations for the monitoring period are presented in **Table 2** as calculated at 1200 hours each day 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 16.7 µg/m³ was recorded at Site 2 between 1200 hours on 24/08/2011 and 1200 hours on 25/08/2011 and represents 33.4% of the assessment criterion (50 µg/m³). Data was missing from Site 2 and Site 3 on the 23rd due to power failure and instrument faults (notes below Table 2)

Table 2: Daily 24-hr average TEOM results for PM₁₀ for 23/08/2011 to 25/08/2011

Sampling Start	Sampling Finish	Site 1 (µg/m ³)	Site 2 (µg/m ³)	Site 3 (µg/m ³)	Site 4 (µg/m ³)
23/08/2011 12:00	24/08/2011 12:00	12.3			16.2
24/08/2011 12:00	25/08/2011 12:00	13.9	16.7	15.4	15.5
Assessment Criterion (µg/m³)		50			

Note: Site 2 power outage causing software issues. Software reinstalled on 24/8

Site 3: Intermittent instrument faults. High level of noise due to faulty filters. Filters changed 29/8

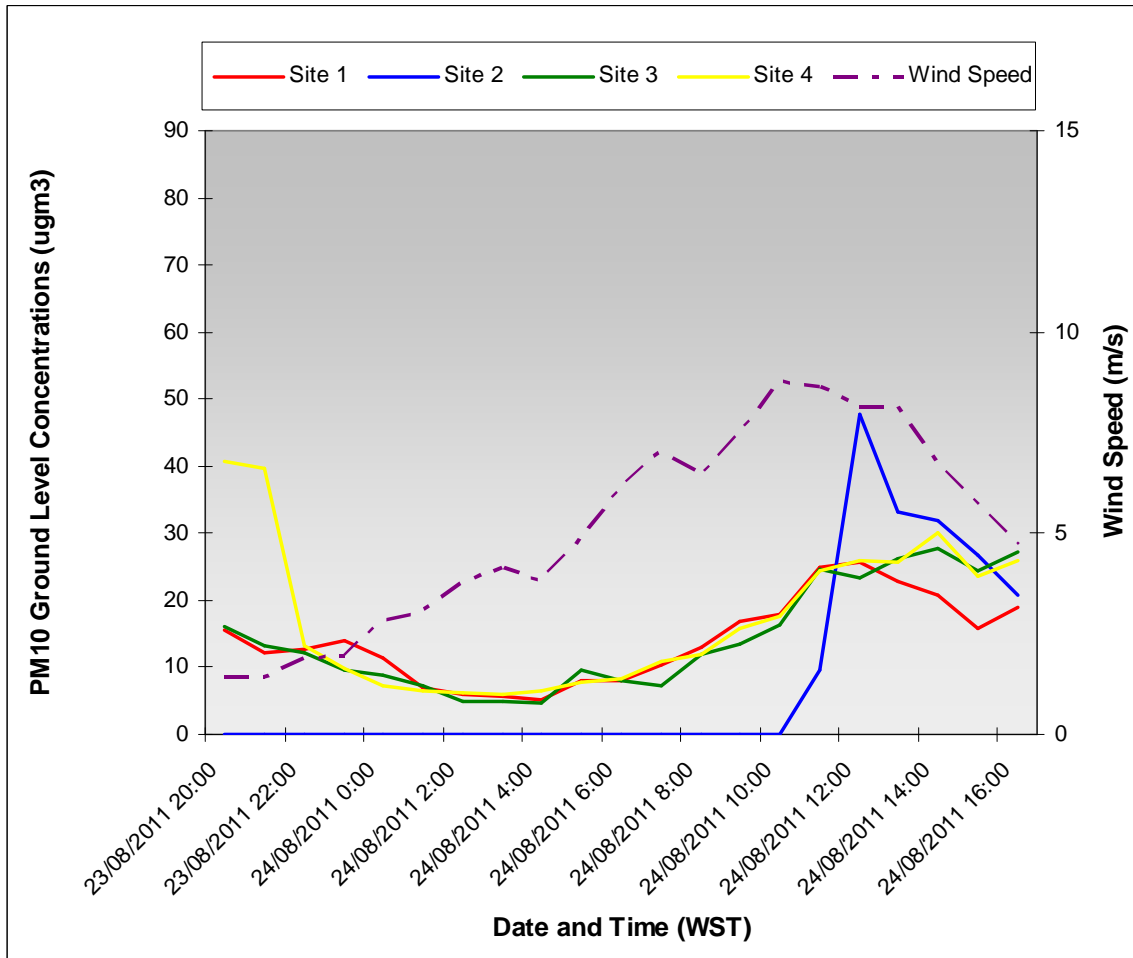


Figure 4: Hourly PM₁₀ concentrations and wind speed between 2000 hours on 23/08/2011 to 1700 hours on 24/08/2011

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 µg/m³ 24-hour average concentration target for TSP during the monitoring period at sites 1, 3, 4 and 5. Data from site 2 was missing due to the flow rate ranging uncontrollably due to a faulty motherboard in the HVAS that has since been replaced. This loss of data was reported to the DEC. The maximum recorded daily average TSP concentration at the remaining four sites was 37 µg/m³ recorded at Site 3 between 1200 hours on 23/08/2011 and 1200 hours on 24/08/2011 represents 41% of the assessment criterion (90 µg/m³). 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 µg/m³ for nickel was not exceeded during the monitoring period. The highest 24-hour average nickel concentrations recorded during the monitoring period were 0.003 µg/m³ which occurred at Sites 3 and 4 between 1200 hours 23/8/2011 to 1200 hours 24/8/2011 representing 2% of the assessment criterion (0.14 µg/m³).

Table 3: Daily HVAS monitoring results for TSP and Nickel for 23/08/2011 to 25/08/2011

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 23/08/2011	1200 24/08/2011	25	<0.002	-	-	37	0.003	43	0.003	26	<0.002
1200 24/08/2011	1200 25/08/2011	17	<0.002	-	-	23	<0.002	26	<0.002	17	<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

Note: Missing data from HVAS Site 2 was due to flow issues caused by a faulty motherboard. This was replaced on 25/8/2011

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
 $0.002\mu\text{g}/\text{m}^3$ is the limit of detection for the analysis of nickel.

3. CONCLUSIONS

Loading of the MV Ken Zui was consistent with EPSL operational procedures (PR088 and PR026). Ship-loading only occurred when the wind was blowing from within the green zone over the 21 hour loading period. The loading rates were less than 1,000 tph 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 operational activities.

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 MV Ken Zui. None of these parameters significantly increased during the loading period.

These results warranted no further emission reduction measures.

4. REFERENCES

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Department of Environment and Conservation (DEC), (2009). *Licence for Prescribed Premises, Licence number L5099/1074/13*, Department of Environment and Conservation, Western Australia, www.dec.wa.gov.au

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Oceanica (2008). *Port of Esperance Survey of Lead and Nickel in Marine Sediments Level (Stage) 2 – Bioavailability Investigation Report* January

B.T.A. Muysen, K.V. Brix, D.K. DeForest, and C.R. Janssen, (2004). Nickel Essentiality and Homeostasis in Aquatic Organisms In: *Environmental Reviews* 2004, Volume 12: 113–131, NRC Research Press.

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: KEN ZUI Sampled by: Alex Leung

Odour Assessor(s)	Date	Time	Sample#	Location	Temperature (°C)	pH	%moisture	Odour intensity (Rate 1 to 6)
Alex Leung	23/8/11	1:16	1	B55	52.4	7.05	8.9	0
↓	↓	↓	2	↓	31.8	7.01	7.3	1
↓	↓	↓	3	↓	32.6	8.55	7.8	0
↓	↓	↓	4	↓	38.4	5.83	7.5	0
↓	↓	↓	5	↓	29.7	6.51	8.8	0
↓	↓	↓	6	↓	28.7	8.10	9.3	0

APPENDIX B HOURLY AVERAGE PM₁₀ CONCENTRATION

Date and Time	Hourly Average PM10 in µg/m ³				Hourly Averaged Wind Speed (m/s)	Hourly Averaged Wind Vector (°)	Hourly Averaged Product Loaded (tonnes)
	Site 1	Site 2	Site 3	Site 4			
23/08/2011 20:00	15.48472	0	16.00889	40.78472	1.442409	298	0
23/08/2011 21:00	12.26416	0	13.15833	39.70223	1.425392	13	220
23/08/2011 22:00	12.6	0	12.06056	13.29805	1.886604	12	280
23/08/2011 23:00	14.10806	0	9.524723	9.746667	1.946708	311	575
24/08/2011 0:00	11.29806	0	8.85139	7.271944	2.824434	276	427
24/08/2011 1:00	6.991666	0	7.343889	6.446389	3.062166	284	613
24/08/2011 2:00	5.936389	0	4.965001	6.168334	3.790928	297	535
24/08/2011 3:00	5.729445	0	4.907222	5.894722	4.155203	300	362
24/08/2011 4:00	5.299999	0	4.6625	6.455	3.814106	305	613
24/08/2011 5:00	8.130833	0	9.495556	7.845278	4.889789	298	595
24/08/2011 6:00	7.986944	0	7.943888	8.234445	6.131102	298	520
24/08/2011 7:00	10.41028	0	7.239167	10.98528	7.036055	293	441
24/08/2011 8:00	12.955	0	11.85278	12.05861	6.419956	284	181
24/08/2011 9:00	16.84833	0	13.45472	15.70139	7.488413	273	284
24/08/2011 10:00	18.01417	0	16.34417	17.75056	8.754972	270	593
24/08/2011 11:00	25.00083	9.613611	24.74833	24.46778	8.655337	239	487
24/08/2011 12:00	25.62083	47.77417	23.46222	25.90972	8.124635	243	405
24/08/2011 13:00	22.895	33.25361	26.13416	25.69083	8.116415	236	111
24/08/2011 14:00	20.82333	31.88722	27.7825	30.14916	6.694922	239	899
24/08/2011 15:00	15.87861	26.72306	24.37	23.64722	5.727655	247	2
24/08/2011 16:00	18.87416	20.81	27.32389	25.91167	4.702937	238	299

Note: TEOM Site 2 data was missing due software issues. Software was reinstalled on 24/8

APPENDIX C

MPL LABORATORY REPORTS

CERTIFICATE OF ANALYSIS 114246

Client:

Esperance Ports - Sea and Land

PO Box 35
Esperance
WA 6450

Attention: N Norrish

Sample log in details:

Your Reference:
No. of samples:
Date samples received:
Date completed instructions received:
Location:

Dust Analysis

24 High Volume Filters
29/08/11
29/08/11
NA

Analysis Details:

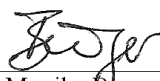
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.

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

Report Details:

Date results requested by: 5/09/11
Date of Preliminary Report: Not issued
Issue Date: 2/09/11

Results Approved By:



Dr Monika Buerger
Supervisor – Micro, Asbestos, Dust

Client Reference: Dust Analysis

Metals in High Volume Filters							
Our Reference:	UNITS	PQL	114246-1	114246-2	114246-4	114246-5	114246-6
Your Reference	--	--	PAE731	PAE732	PAE734	PAE735	PAE736
Location	--	--	Site 4	Site 3	Site 1	Site 5	Blank
Date Sampled			21/08/11	21/08/11	21/08/11	21/08/11	
Dust	mg/filter	0.1	58	73	52	61	3.8
Dust in Air	µg/m ³	0.1	35.56	44.01	32.17	37.17	[NA]
Iron	µg/filter	5	1,200	1,100	1,000	460	160
Iron in Air	µg/m ³	0.005	0.74	0.65	0.65	0.28	[NA]
Nickel	µg/filter	2	5	4	4	2	<2
Nickel in Air	µg/m ³	0.002	0.003	0.002	0.002	<0.002	[NA]
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	[NA]
Lithium	µg/filter	2	3	3	3	<2	2
Lithium in Air	µg/m ³	0.001	0.002	0.002	0.002	<0.001	[NA]
Sulfur	µg/filter	50	2,100	1,500	1,700	700	990
Sulfur in Air	µg/m ³	0.02	1.3	0.91	1.1	0.43	[NA]
Zinc	µg/filter	5	621	459	545	237	561
Zinc in Air	µg/m ³	0.002	0.38	0.28	0.34	0.14	[NA]

Metals in High Volume Filters							
Our Reference:	UNITS	PQL	114246-7	114246-8	114246-10	114246-11	114246-12
Your Reference	--	--	PAE743	PAE744	PAE746	PAE747	PAE748
Location	--	--	Site 4	Site 3	Site 1	Site 5	Blank
Date Sampled			23/08/11	23/08/11	23/08/11	23/08/11	
Dust	mg/filter	0.1	73	63	43	44	3.5
Dust in Air	µg/m ³	0.1	42.85	37.14	25.17	26.10	[NA]
Iron	µg/filter	5	760	830	690	470	150
Iron in Air	µg/m ³	0.005	0.45	0.49	0.41	0.28	[NA]
Nickel	µg/filter	2	5	5	3	<2	<2
Nickel in Air	µg/m ³	0.002	0.003	0.003	<0.002	<0.002	[NA]
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	[NA]
Lithium	µg/filter	2	3	3	3	3	2
Lithium in Air	µg/m ³	0.001	0.002	0.002	0.002	0.001	[NA]
Sulfur	µg/filter	50	2,900	3,500	1,400	1,300	910
Sulfur in Air	µg/m ³	0.02	1.7	2.0	0.82	0.75	[NA]
Zinc	µg/filter	5	571	585	578	493	457
Zinc in Air	µg/m ³	0.002	0.34	0.34	0.34	0.29	[NA]

Client Reference: Dust Analysis

Metals in High Volume Filters							
Our Reference:	UNITS	PQL	114246-13	114246-14	114246-16	114246-17	114246-18
Your Reference	--	--	PAE749	PAE750	PAE752	PAE753	PAE754
Location	--	--	Site 4	Site 3	Site 1	Site 5	Blank
Date Sampled			24/08/11	24/08/11	24/08/11	24/08/11	
Dust	mg/filter	0.1	40	36	27	27	4.0
Dust in Air	µg/m ³	0.1	25.53	23.18	17.36	17.24	[NA]
Iron	µg/filter	5	360	280	230	280	220
Iron in Air	µg/m ³	0.005	0.23	0.18	0.15	0.18	[NA]
Nickel	µg/filter	2	2	<2	<2	<2	<2
Nickel in Air	µg/m ³	0.002	<0.002	<0.002	<0.002	<0.002	[NA]
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	[NA]
Lithium	µg/filter	2	3	3	3	3	3
Lithium in Air	µg/m ³	0.001	0.002	0.002	0.002	0.002	[NA]
Sulfur	µg/filter	50	1,500	1,500	1,500	1,600	1,100
Sulfur in Air	µg/m ³	0.02	0.96	0.92	0.93	1.0	[NA]
Zinc	µg/filter	5	546	516	533	79	552
Zinc in Air	µg/m ³	0.002	0.35	0.33	0.34	0.050	[NA]

Metals in High Volume Filters							
Our Reference:	UNITS	PQL	114246-19	114246-20	114246-22	114246-23	114246-24
Your Reference	--	--	PAE755	PAE756	PAE758	PAE759	PAE760
Location	--	--	Site 4	Site 3	Site 1	Site 5	Blank
Date Sampled			25/08/11	25/08/11	25/08/11	25/08/11	
Dust	mg/filter	0.1	27	31	35	46	3.1
Dust in Air	µg/m ³	0.1	17.59	20.01	22.36	30.00	[NA]
Iron	µg/filter	5	470	470	400	370	180
Iron in Air	µg/m ³	0.005	0.30	0.31	0.26	0.24	[NA]
Nickel	µg/filter	2	3	2	<2	2	<2
Nickel in Air	µg/m ³	0.002	<0.002	<0.002	<0.002	<0.002	[NA]
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	[NA]
Lithium	µg/filter	2	3	3	2	2	3
Lithium in Air	µg/m ³	0.001	0.002	0.002	0.001	0.001	[NA]
Sulfur	µg/filter	50	1,300	1,600	930	1,300	1,100
Sulfur in Air	µg/m ³	0.02	0.82	1.0	0.60	0.87	[NA]
Zinc	µg/filter	5	457	523	371	466	534
Zinc in Air	µg/m ³	0.002	0.30	0.34	0.24	0.30	[NA]

Client Reference: Dust Analysis

Metals in High Volume Filters			
Our Reference:	UNITS	PQL	114246-25
Your Reference	--	--	Lab Blank
Location	--	--	
Date Sampled			
Iron	µg/filter	5	170
Nickel	µg/filter	2	<2
Lead	µg/filter	5	<5
Lithium	µg/filter	2	<2
Sulfur	µg/filter	50	930
Zinc	µg/filter	5	491

MethodID	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.

QUALITYCONTROL Metals in High Volume Filters	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base Duplicate %RPD
Dust Type				[NT]	[NT]	[NT]
Air Volume	m ³			[NT]	114246-1	1645 1652 RPD: 0
Weight of Filter (initial)	mg	0.02	DUST-004	[NT]	114246-1	3525.30 3525.30 RPD: 0
Weight of Filter (final)	mg	0.02	DUST-004	[NT]	114246-1	3583.80 3583.80 RPD: 0
Dust	mg/filter	0.1	DUST-004	[NT]	114246-1	58 58 RPD: 0
Dust in Air	µg/m ³	0.1		[NT]	114246-1	35.56 35.41 RPD: 0
Iron	µg/filter	5	DUST-004	[NT]	114246-1	1200 1400 RPD: 15
Iron in Air	µg/m ³	0.005		[NT]	114246-1	0.74 0.83 RPD: 11
Nickel	µg/filter	2	METALS-02 0	[NT]	114246-1	5 5 RPD: 0
Nickel in Air	µg/m ³	0.002		[NT]	114246-1	0.003 0.003 RPD: 0
Lead	µg/filter	5	METALS-02 0	[NT]	114246-1	<5 <5
Lead in Air	µg/m ³	0.005		[NT]	114246-1	<0.005 <0.005
Lithium	µg/filter	2	METALS-02 0	[NT]	114246-1	3 3 RPD: 0
Lithium in Air	µg/m ³	0.001		[NT]	114246-1	0.002 0.002 RPD: 0
Sulfur	µg/filter	50	DUST-004	[NT]	114246-1	2100 1800 RPD: 15
Sulfur in Air	µg/m ³	0.02		[NT]	114246-1	1.3 1.1 RPD: 17
Zinc	µg/filter	5	DUST-004	[NT]	114246-1	621 503 RPD: 21
Zinc in Air	µg/m ³	0.002		[NT]	114246-1	0.38 0.30 RPD: 24

Client Reference: Dust Analysis

QUALITYCONTROL Metals in High Volume Filters	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Dust Type		[NT]	[NT]
Air Volume	m ³	[NT]	[NT]
Weight of Filter (initial)	mg	[NT]	[NT]
Weight of Filter (final)	mg	[NT]	[NT]
Dust	mg/filter	[NT]	[NT]
Dust in Air	µg/m ³	[NT]	[NT]
Iron	µg/filter	[NT]	[NT]
Iron in Air	µg/m ³	[NT]	[NT]
Nickel	µg/filter	[NT]	[NT]
Nickel in Air	µg/m ³	[NT]	[NT]
Lead	µg/filter	[NT]	[NT]
Lead in Air	µg/m ³	[NT]	[NT]
Lithium	µg/filter	[NT]	[NT]
Lithium in Air	µg/m ³	[NT]	[NT]
Sulfur	µg/filter	[NT]	[NT]
Sulfur in Air	µg/m ³	[NT]	[NT]
Zinc	µg/filter	[NT]	[NT]
Zinc in Air	µg/m ³	[NT]	[NT]

Report Comments:

This report replaces the one issued previously due to omitting results for site no 2

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.