



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

MARINE VESSEL HENRY OLDENDORFF

29TH SEPTEMBER – 4TH OCTOBER 2011

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1	C. Field			19/10/2011	1 st Draft
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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) Henry Oldendorff between 0848 hrs on 28th September 2011 to 1342 hrs on 4th October 2011 at the Esperance Ports Sea and Land. This report is compiled and issued in compliance with Condition 18 and includes data analysis consistent with requirements of Condition 15 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 7th 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 Henry Oldendorff was berthed at Esperance Port from 0848 hours on 28/09/2011 to 1342 hours on 04/10/2011. The 'loading period' began at **0940 on 28/09/2011 and went to 1730 on 29/9/11. Loading recommenced at 0800 on the 3/10/11 and finished at 1140 hours on 04/10/2011.**

There were some delays relating to acquisition of sufficient product and wind being in the red zone during bulk loading of the 10,739 tonnes of BHP Billiton Nickel West nickel sulphide concentrate which meant product was loaded until 4/10/2011.

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

- 172,043 tonnes of iron ore was delivered by 23 trains;
- 1,825 tonnes of nickel concentrate (from Mount Keith) was delivered in containers by 7 trucks;and
- 3,340 tonnes of formed sulphur was outloaded on 42 trucks.

Note, no marine vessels were alongside in Berth 3 (due to shutdown) or Berth 1;

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 during the first loading period on 28th to 29th was spread from SSW to NW (45% SW, 20% WNW, 18% WSW and the remainder in the other directions between SSW to NW) (**Figure 2**).
- During the second loading period on the 3rd and 4th of October the wind direction spread was from E to SSW and loading only occurred when the winds moved to a S to SSW direction(**Figure 3**).
- The maximum hourly wind speed recorded was 9.91 m/s (35.7km/hr) from the SW direction (green zone), which occurred between 1200 hours and 1300 hours on 28/09/2011. This wind is described as 'fresh' winds by the 'Beaufort Wind Force Scale' (BOM, 2011).
- The average wind speed during the loading periods was 5.77 m/s (20.8 km/h) described as 'moderate' 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 ‘weak’ to ‘distinct’, and had a low dust potential indicated by the average moisture of 10.87%. 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 EP7 meteorological station from 0940 on 28/09/2011 to 1730 on 29/09/2011.



Figure 3: 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 EP7 meteorological station from 0940 on 03/10/2011 to 1740 on 04/10/2011.

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 arcs are illustrated by *Figure 2* and *Figure 3* and the loading rates (below 1000 tph) are illustrated in *Figure 4*. 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 4* 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 Henry Oldendorff the wind direction was in the green zone for the two consecutive loading periods. Loading did not commence at the beginning of the second loading period on the 3/10/2011 due to winds being in the red zone between 90° to 135° (E to SE direction). Loading commenced on the 4/10/2011 when winds moved into the SSW direction.

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 Henry Oldendorff.

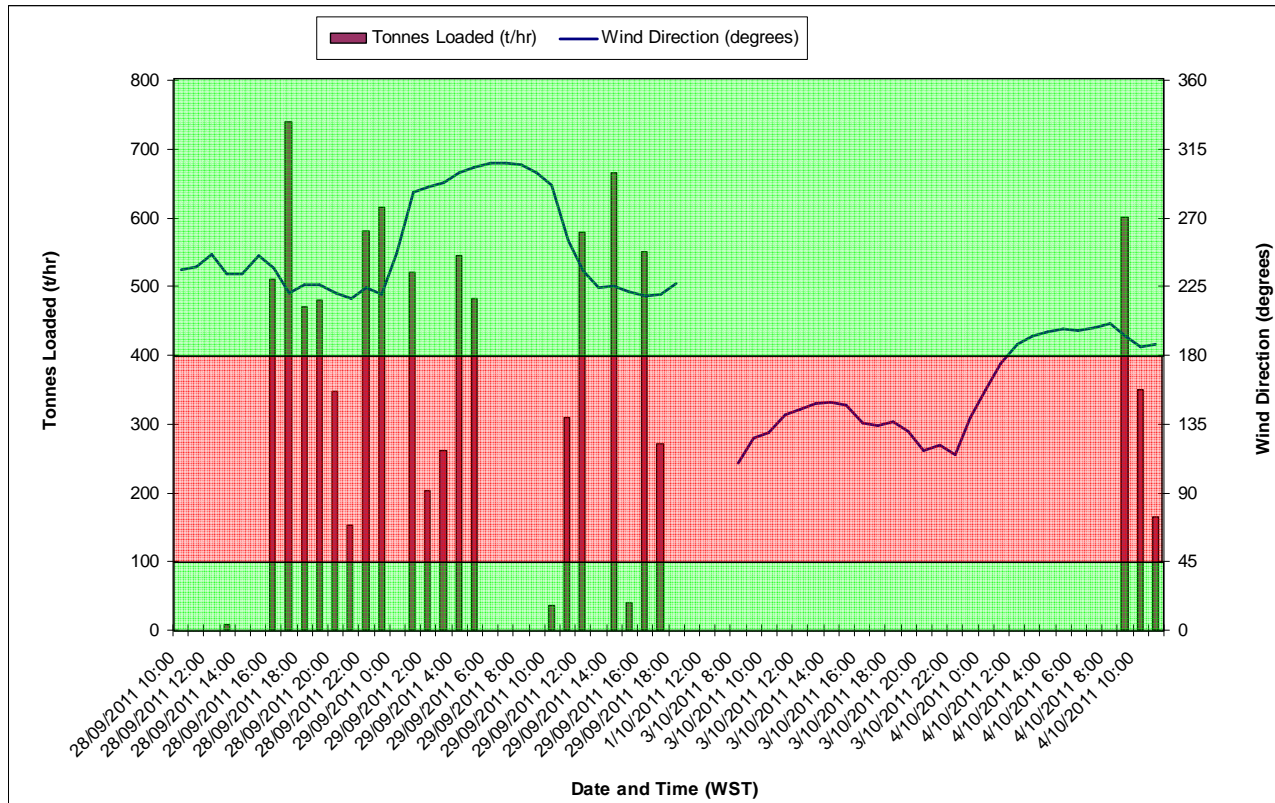


Figure 4: Wind Direction and Loading Rate of MV Henry Oldendorff

Note: loading occurred from 0940 hours 28/09/2011 to 1730 hours on 29/09/2011 and from 0800 hours on 03/10/2011 to 1140 hours 04/10/2011.

2.5 TEOM PM₁₀ Monitoring

The MV Henry Oldendorff loaded in two separate periods. During the first loading period the wind was in the green zone for the entire time and a maximum PM₁₀ of 42 µg/m³ was recorded at Site 2 at 1600 to 1700 hours on 28th September 2011. The wind direction was mostly between a SW to NW direction.

For the second loading period the wind was in the red zone (a SE direction) on the 3rd October 2011 and loading was cancelled and recommenced at 0815 hours on the 4th October when the wind was in a SSW direction. The maximum PM₁₀ recorded during the second period of loading was 23 µg/m³ which was recorded at Site 4 at 0800 to 0900 hours on 4th October 2011. 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 Henry Oldendorff was being loaded (refer to **Figure 5**). 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 50 µg/m³ was not exceeded at any of the sites. The maximum daily average PM₁₀ concentration of 31 µg/m³ was recorded at Site 1 between 1200 hours on 03/10/2011 and 1200 hours on 04/10/2011 and represents 62 % of the assessment criterion (50 µg/m³). Data was missing from Site 2 on the same dates due to a power outage causing the system software to be lost. The software was reinstalled at 1030 hours on 04/10/2011 and therefore the PM₁₀ concentration value for this 24 hour period is not valid (notes below Table 2)

Table 2: Daily 24-hr average TEOM results for PM₁₀ for 28/09/2011 to 04/10/2011

Sampling Start	Sampling Finish	Site 1 (µg/m ³)	Site 2 (µg/m ³)	Site 3 (µg/m ³)	Site 4 (µg/m ³)
28/09/2011 12:00	29/09/2011 12:00	20.92	19.95	19.63	18.48
29/09/2011 12:00	30/09/2011 12:00	16.78	19.27	17.61	5.58
Loading suspended. Recommended at 0815 hours on 4/10/2011					
3/10/2011 12:00	4/10/2011 12:00	30.63	0.12	29.30	29.58
Assessment Criterion (µg/m³)		50			

Note: Site 2 data is not complete between 3rd to 4th October due to software loss caused by a power outage. Rectified at 1030 hours on 4/10/2011

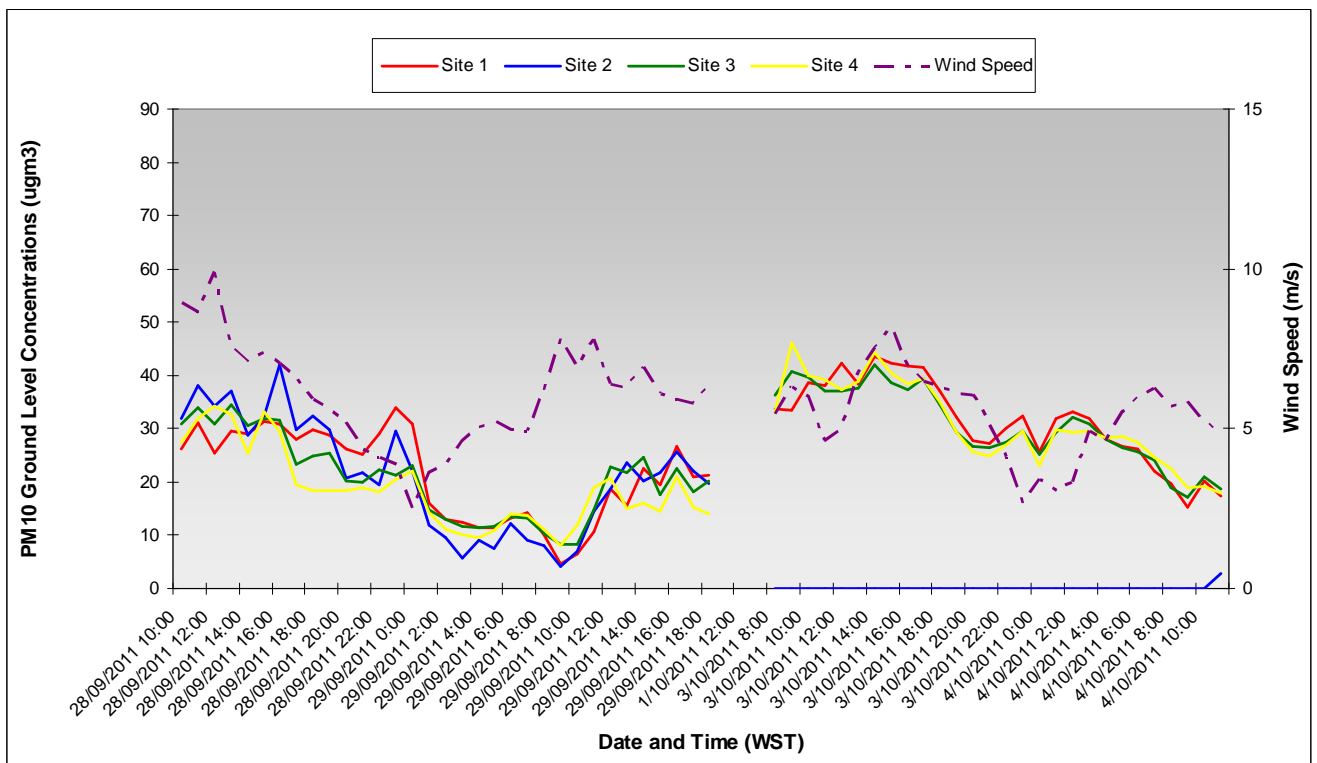


Figure 5: Hourly PM₁₀ concentrations and wind speed between 1000 hours on 28/09/2011 to 1200 hours on 04/10/2011

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 two consecutive loading periods at any of the five sites. The maximum recorded daily average TSP concentration that occurred during loading was 86 µg/m³ recorded at Site 1 between 1200 hours on 03/10/2011 and 1200 hours on 4/10/2011 and was close to the assessment criterion (90 µg/m³) but did not exceed it.

The 24-hour average licence target of 0.14 µg/m³ for nickel was not exceeded during the shiploading period. The highest 24-hour average nickel concentrations recorded during the loading period was 0.007 µg/m³ at Site 2 between 1200 hours 29/09/2011 to 1200 hours 30/09/2011, representing only 5% of the assessment criterion (0.14 µg/m³).

Table 3: Daily HVAS monitoring results for TSP and Nickel for 28/09/2011 to 04/10/2011

Sampling Start ¹	Sampling Finish ¹	Site 1 (µg/m ³)		Site 2 (µg/m ³)		Site 3 (µg/m ³)		Site 4 (µg/m ³)		Site 5 (µg/m ³)	
		TSP	Ni	TSP	Ni	TSP	Ni	TSP	Ni	TSP	Ni
1200 28/09/2011	1200 29/09/2011	32	0.002	47	0.006	30	0.002	32	<0.002	28	0.002
1200 29/09/2011	1200 30/09/2011	33	0.003	45	0.007	31	0.002	30	<0.002	30	0.003
Loading suspended. Awaiting additional product and wind in "red zone" on 3/10/2011. Recommended at 0815 hours on 4/10/2011											
1200 03/10/2011	1200 04/10/2011	86	0.002	76	0.004	74	<0.002	77	<0.002	65	<0.002
Assessment Criterion (µg/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 90µg/m³ 24-hour average concentration target for TSP
0.002 µg/m³ is the limit of detection for the analysis of nickel.

3. CONCLUSIONS

Loading of the MV Henry Oldendorff 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 two consecutive loading periods. Loading did not commence on 3/10/2011 due to winds being in the 'red zone' but was delayed until 4/10/2011 when winds were in the 'green zone'. 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 'weak' to 'distinct' 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 PM₁₀, TSP and nickel were not exceeded at any of the five monitoring sites during the two consecutive loading periods of the MV Henry Oldendorff. None of these parameters significantly increased during the loading period.

These results warranted no further emission reduction measures.

4. REFERENCES

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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: *Henry Oldendorff* Sampled by: *Michael G. Cullen*

Odour Assessor(s)	Date	Time	Sample#	Location	Temperature (°C)	pH	%moisture	Odour intensity (Rate 1 to 6)
<i>H. Harer</i>	<i>27/9</i>	<i>09:00</i> <i>air</i>	<i>1</i>	<i>Batch 2</i> <i>sample room</i>		<i>6.76</i>	<i>9.8</i>	<i>3</i>
<i>u</i>	<i>u</i>	<i>u</i>	<i>2</i>	<i>u</i>		<i>7.57</i>	<i>9.7</i>	<i>2</i>
<i>u</i>	<i>u</i>	<i>u</i>	<i>3</i>	<i>u</i>		<i>6.26</i>	<i>8.9</i>	<i>2</i>
<i>u</i>	<i>u</i>	<i>u</i>	<i>4</i>	<i>u</i>		<i>7.84</i>	<i>8.6</i>	<i>3</i>
<i>u</i>	<i>u</i>	<i>u</i>	<i>5</i>	<i>u</i>		<i>6.74</i>	<i>8.4</i>	<i>2</i>
<i>u</i>	<i>u</i>	<i>u</i>	<i>6</i>	<i>u</i>		<i>6.47</i>	<i>9.3</i>	<i>2</i>

APPENDIX B HOURLY AVERAGE PM₁₀ CONCENTRATION

Date and Time	Hourly Average PM ₁₀ 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			
28/09/2011 10:00	26.28	31.85	30.83	27.53	8.94	236	0
28/09/2011 11:00	31.09	38.10	34.05	31.98	8.62	238	0
28/09/2011 12:00	25.40	34.20	30.84	34.22	9.91	246	0
28/09/2011 13:00	29.45	37.09	34.48	32.64	7.52	233	8
28/09/2011 14:00	28.97	28.69	30.72	25.34	7.10	233	0
28/09/2011 15:00	31.41	32.52	31.92	33.21	7.39	245	0
28/09/2011 16:00	30.78	41.89	31.69	29.64	7.04	237	510
28/09/2011 17:00	28.07	29.89	23.28	19.41	6.59	221	740
28/09/2011 18:00	29.84	32.34	25.03	18.52	5.90	226	470
28/09/2011 19:00	28.81	29.94	25.34	18.36	5.60	226	480
28/09/2011 20:00	26.30	20.84	20.17	18.46	5.19	221	347
28/09/2011 21:00	25.23	21.89	20.06	18.94	4.38	217	153
28/09/2011 22:00	29.02	19.50	22.24	18.19	4.09	224	580
28/09/2011 23:00	34.06	29.69	21.37	20.59	3.89	220	616
29/09/2011 0:00	30.83	22.11	23.06	22.02	2.52	247	0
29/09/2011 1:00	16.01	11.86	14.74	14.39	3.63	287	520
29/09/2011 2:00	13.05	9.52	12.84	11.07	3.88	290	204
29/09/2011 3:00	12.38	5.80	11.76	10.19	4.64	293	261
29/09/2011 4:00	11.53	9.04	11.43	9.70	5.04	299	545
29/09/2011 5:00	11.52	7.46	11.55	10.87	5.22	303	482
29/09/2011 6:00	13.18	12.22	13.46	13.99	4.99	306	0
29/09/2011 7:00	14.14	9.06	13.20	13.63	4.91	306	0
29/09/2011 8:00	10.21	7.94	10.48	11.16	6.21	305	0
29/09/2011 9:00	4.77	4.10	8.26	8.09	7.83	299	0
29/09/2011 10:00	6.53	6.90	8.32	11.87	6.90	291	37
29/09/2011 11:00	10.55	14.44	14.75	18.92	7.76	255	310
29/09/2011 12:00	18.72	18.70	22.86	20.76	6.40	235	579
29/09/2011 13:00	15.69	23.69	21.74	15.17	6.33	224	0
29/09/2011 14:00	22.59	20.23	24.58	15.97	6.90	225	665
29/09/2011 15:00	19.50	21.74	17.55	14.43	6.09	222	40
29/09/2011 16:00	26.73	25.68	22.47	20.91	5.93	219	551
29/09/2011 17:00	21.03	22.01	18.22	15.18	5.80	220	271
29/09/2011 18:00	21.14	19.63	20.24	14.08	6.32	227	0
30/09/2011 12:00							0
1/10/2011 12:00							0
2/10/2011 12:00							0
3/10/2011 8:00	33.79	0.00	36.31	33.14	5.45	109.00	0
3/10/2011 9:00	33.52	0.00	40.71	46.24	6.32	126.00	0
3/10/2011 10:00	38.53	0.00	39.63	40.03	5.99	129.00	0
3/10/2011 11:00	38.10	0.00	36.99	39.08	4.63	141.00	0
3/10/2011 12:00	42.23	0.00	37.18	37.39	5.01	145.00	0
3/10/2011 13:00	38.46	0.00	37.62	38.91	6.74	148.00	0
3/10/2011 14:00	43.67	0.00	42.10	44.38	7.52	149.00	0
3/10/2011 15:00	42.15	0.00	38.65	40.54	8.19	147.00	0
3/10/2011 16:00	41.73	0.00	37.38	38.44	6.91	136.00	0
3/10/2011 17:00	41.57	0.00	39.40	39.48	6.47	134.00	0
3/10/2011 18:00	37.02	0.00	34.47	35.00	6.32	137.00	0
3/10/2011 19:00	32.28	0.00	29.36	29.42	6.15	130.00	0
3/10/2011 20:00	27.68	0.00	26.77	25.65	6.05	118.00	0
3/10/2011 21:00	27.36	0.00	26.46	24.85	5.15	121.00	0
3/10/2011 22:00	30.14	0.00	27.45	27.04	4.10	115.00	0
3/10/2011 23:00	32.55	0.00	29.61	29.52	2.68	139.00	0
4/10/2011 0:00	25.68	0.00	25.08	23.07	3.43	157.00	0
4/10/2011 1:00	31.81	0.00	29.22	29.72	3.08	175.00	0
4/10/2011 2:00	33.25	0.00	32.18	29.36	3.31	187.00	0
4/10/2011 3:00	31.86	0.00	30.75	29.46	4.93	193.00	0
4/10/2011 4:00	28.11	0.00	28.12	28.27	4.64	195.00	0
4/10/2011 5:00	26.71	0.00	26.42	28.62	5.53	197.00	0
4/10/2011 6:00	26.26	0.00	25.61	27.52	5.97	196.00	0
4/10/2011 7:00	22.12	0.00	24.03	24.60	6.29	198.00	0
4/10/2011 8:00	19.74	0.00	18.86	22.61	5.72	201.00	0
4/10/2011 9:00	15.21	0.00	17.11	18.81	5.86	193.00	602
4/10/2011 10:00	20.14	0.00	20.90	19.26	5.24	185.00	350
4/10/2011 11:00	17.36	2.94	18.55	17.90	4.84	187.00	165

Note: Site 2 data was missing due to software loss caused by a power outage. Rectified at 1030 hours on 4/10/2011

APPENDIX C

MPL LABORATORY REPORTS

CERTIFICATE OF ANALYSIS 115416

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

47 Hi Volume Filters

05/10/11

5/10/11

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:

12/10/11


Date of Preliminary Report:

Not issued

Issue Date:

12/10/11

Results Approved By:



Joshua Lim
Operations Supervisor

MPL Reference: 115416

Revision No: R 00

Client Reference: Dust Analysis

Metals in High Volume Filters							
Our Reference:	UNITS	PQL	115416-1	115416-2	115416-3	115416-4	115416-5
Your Reference	--	--	EPL29	EPL30	EPL31	EPL32	EPL34
Location	--	--	Site 4	Site 3	Site 2	Site 1	Blank
Date Sampled			23/09/2011	23/09/2011	23/09/2011	23/09/2011	
Dust	mg/filter	0.1	60	38	56	61	4.2
Dust in Air	µg/m ³	0.1	36	23	31	37	[NA]
Iron	µg/filter	5	3,700	1,500	990	790	310
Iron in Air	µg/m ³	0.005	2.2	0.88	0.54	0.47	[NA]
Nickel	µg/filter	2	29	10	9	7	2
Nickel in Air	µg/m ³	0.002	0.017	0.006	0.005	0.004	[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	<2	<2	<2	<2	<2
Lithium in Air	µg/m ³	0.001	<0.001	<0.001	<0.001	<0.001	[NA]
Sulfur	µg/filter	50	4,000	3,200	2,600	2,000	1,100
Sulfur in Air	µg/m ³	0.02	2.4	1.9	1.4	1.2	[NA]
Zinc	µg/filter	5	153	141	154	142	130
Zinc in Air	µg/m ³	0.002	0.090	0.080	0.090	0.080	[NA]

Metals in High Volume Filters							
Our Reference:	UNITS	PQL	115416-6	115416-7	115416-8	115416-9	115416-10
Your Reference	--	--	EPL47	EPL48	EPL49	EPL50	EPL51
Location	--	--	Site 4	Site 3	Site 2	Site 1	Site 5
Date Sampled			26/09/2011	26/09/2011	26/09/2011	26/09/2011	26/09/2011
Dust	mg/filter	0.1	26	26	30	23	22
Dust in Air	µg/m ³	0.1	16	16	17	14	14
Iron	µg/filter	5	470	420	590	360	390
Iron in Air	µg/m ³	0.005	0.29	0.26	0.34	0.22	0.24
Nickel	µg/filter	2	3	3	4	4	4
Nickel in Air	µg/m ³	0.002	0.002	<0.002	0.002	0.002	0.003
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	1,500	1,600	2,000	1,400	1,400
Sulfur in Air	µg/m ³	0.02	0.94	0.98	1.2	0.87	0.89
Zinc	µg/filter	5	137	147	147	132	142
Zinc in Air	µg/m ³	0.002	0.080	0.090	0.080	0.080	0.090

Client Reference: Dust Analysis

Metals in High Volume Filters	UNITS	PQL	115416-11	115416-12	115416-13	115416-14	115416-15
Our Reference:	--	--	EPL52	EPL59	EPL60	EPL61	EPL62
Your Reference	--	--	Blank	Site 4	Site 3	Site 2	Site 1
Location	--	--		28/09/2011	28/09/2011	28/09/2011	28/09/2011
Date Sampled							
Dust	mg/filter	0.1	4.5	53	50	84	53
Dust in Air	µg/m ³	0.1	[NA]	32	30	47	32
Iron	µg/filter	5	370	590	430	1,800	530
Iron in Air	µg/m ³	0.005	[NA]	0.36	0.26	1.0	0.33
Nickel	µg/filter	2	5	3	4	10	4
Nickel in Air	µg/m ³	0.002	[NA]	<0.002	0.002	0.006	0.002
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	1,200	2,100	2,100	2,100	1,900
Sulfur in Air	µg/m ³	0.02	[NA]	1.2	1.3	1.2	1.1
Zinc	µg/filter	5	149	137	144	160	141
Zinc in Air	µg/m ³	0.002	[NA]	0.080	0.090	0.090	0.090

Metals in High Volume Filters	UNITS	PQL	115416-16	115416-17	115416-18	115416-19	115416-20
Our Reference:	--	--	EPL63	EPL64	EPL65	EPL66	EPL67
Your Reference	--	--	Site 5	Blank	Site 4	Site 3	Site 2
Location	--	--			29/09/2011	29/09/2011	29/09/2011
Date Sampled			28/09/2011				
Dust	mg/filter	0.1	45	5.0	46	47	74
Dust in Air	µg/m ³	0.1	28	[NA]	30	31	45
Iron	µg/filter	5	410	290	530	610	2,000
Iron in Air	µg/m ³	0.005	0.25	[NA]	0.34	0.40	1.2
Nickel	µg/filter	2	3	3	3	4	11
Nickel in Air	µg/m ³	0.002	0.002	[NA]	<0.002	0.002	0.007
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	1,900	1,000	1,800	2,700	2,100
Sulfur in Air	µg/m ³	0.02	1.2	[NA]	1.2	1.8	1.3
Zinc	µg/filter	5	144	132	140	151	168
Zinc in Air	µg/m ³	0.002	0.090	[NA]	0.090	0.10	0.10

Client Reference: Dust Analysis

Metals in High Volume Filters	UNITS	PQL	115416-21	115416-22	115416-23	115416-24	115416-25
Our Reference:	--	--	EPL68	EPL69	EPL70	EPL71	EPL72
Your Reference	--	--	Site 1	Site 5	Blank	Site 4	Site 3
Location	--	--	29/09/2011	29/09/2011		30/09/2011	30/09/2011
Date Sampled							
Dust	mg/filter	0.1	51	46	3.7	82	71
Dust in Air	µg/m ³	0.1	33	30	[NA]	49	42
Iron	µg/filter	5	530	510	330	3,300	3,100
Iron in Air	µg/m ³	0.005	0.34	0.33	[NA]	2.0	1.8
Nickel	µg/filter	2	4	5	3	13	16
Nickel in Air	µg/m ³	0.002	0.003	0.003	[NA]	0.008	0.009
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	2,000	1,800	6,300	5,300
Sulfur in Air	µg/m ³	0.02	2.7	1.3	[NA]	3.7	3.1
Zinc	µg/filter	5	107	142	140	151	137
Zinc in Air	µg/m ³	0.002	0.070	0.090	[NA]	0.090	0.080

Metals in High Volume Filters	UNITS	PQL	115416-27	115416-28	115416-29	115416-30	115416-31
Our Reference:	--	--	EPL74	EPL75	EPL76	EPL77	EPL78
Your Reference	--	--	Site 1	Site 5	Blank	Site 4	Site 3
Location	--	--	30/09/2011	30/09/2011		1/10/2011	1/10/2011
Date Sampled							
Dust	mg/filter	0.1	61	43	<0.1	84	60
Dust in Air	µg/m ³	0.1	36	26	[NA]	54	39
Iron	µg/filter	5	1,400	670	280	3,000	2,900
Iron in Air	µg/m ³	0.005	0.85	0.40	[NA]	1.9	1.9
Nickel	µg/filter	2	10	4	2	15	14
Nickel in Air	µg/m ³	0.002	0.006	0.002	[NA]	0.009	0.009
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	3,800	3,500	790	13,455	5,900
Sulfur in Air	µg/m ³	0.02	2.2	2.1	[NA]	8.7	3.8
Zinc	µg/filter	5	150	139	88	147	143
Zinc in Air	µg/m ³	0.002	0.090	0.080	[NA]	0.10	0.090

Client Reference: Dust Analysis

Metals in High Volume Filters	UNITS	PQL	115416-32	115416-33	115416-34	115416-35	115416-36
Our Reference:	--	--	EPL79	EPL80	EPL81	EPL82	EPL83
Your Reference	--	--	Site 2	Site 1	Site 5	Blank	Site 4
Location	--	--	1/10/2011	1/10/2011	1/10/2011		2/10/2011
Date Sampled							
Dust	mg/filter	0.1	49	54	28	5.6	110
Dust in Air	µg/m ³	0.1	29	35	18	[NA]	74
Iron	µg/filter	5	1,900	910	460	320	1,600
Iron in Air	µg/m ³	0.005	1.1	0.59	0.30	[NA]	1.0
Nickel	µg/filter	2	9	5	4	<2	7
Nickel in Air	µg/m ³	0.002	0.006	0.003	0.002	[NA]	0.004
Lead	µg/filter	5	<5	<5	<5	<5	<5
Lead in Air	µg/m ³	0.005	<0.005	<0.005	<0.005	[NA]	<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	[NA]	<0.001
Sulfur	µg/filter	50	3,900	5,000	5,800	4,800	5,200
Sulfur in Air	µg/m ³	0.02	2.3	3.3	3.8	[NA]	3.4
Zinc	µg/filter	5	130	134	142	144	161
Zinc in Air	µg/m ³	0.002	0.080	0.090	0.090	[NA]	0.10

Metals in High Volume Filters	UNITS	PQL	115416-37	115416-38	115416-39	115416-40	115416-41
Our Reference:	--	--	EPL84	EPL85	EPL86	EPL87	EPL88
Your Reference	--	--	Site 3	Site 2	Site 1	Site 5	Blank
Location	--	--	2/10/2011	2/10/2011	2/10/2011	2/10/2011	
Date Sampled							
Dust	mg/filter	0.1	190	210	220	180	6.5
Dust in Air	µg/m ³	0.1	120	120	140	120	[NA]
Iron	µg/filter	5	1,900	2,400	1,700	480	200
Iron in Air	µg/m ³	0.005	1.3	1.5	1.1	0.31	[NA]
Nickel	µg/filter	2	6	14	9	4	3
Nickel in Air	µg/m ³	0.002	0.004	0.008	0.006	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	<2	<2	<2	<2	<2
Lithium in Air	µg/m ³	0.001	<0.001	<0.001	<0.001	<0.001	[NA]
Sulfur	µg/filter	50	3,100	4,400	3,900	2,500	590
Sulfur in Air	µg/m ³	0.02	2.0	2.7	2.6	1.6	[NA]
Zinc	µg/filter	5	162	193	151	142	72
Zinc in Air	µg/m ³	0.002	0.11	0.12	0.10	0.090	[NA]

Client Reference: Dust Analysis

Metals in High Volume Filters	UNITS	PQL	115416-42	115416-43	115416-44	115416-45	115416-46
Our Reference:	--	--	EPL89	EPL90	EPL91	EPL92	EPL93
Your Reference	--	--	Site 4	Site 3	Site 2	Site 1	Site 5
Location	--	--	3/10/2011	3/10/2011	3/10/2011	3/10/2011	3/10/2011
Date Sampled							
Dust	mg/filter	0.1	120	120	130	140	100
Dust in Air	µg/m ³	0.1	77	74	76	86	65
Iron	µg/filter	5	480	420	1,700	770	480
Iron in Air	µg/m ³	0.005	0.31	0.26	1.0	0.49	0.30
Nickel	µg/filter	2	3	2	7	4	3
Nickel in Air	µg/m ³	0.002	<0.002	<0.002	0.004	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	2,700	2,400	3,200	4,300	3,000
Sulfur in Air	µg/m ³	0.02	1.7	1.5	1.9	2.7	1.9
Zinc	µg/filter	5	152	132	98	95	153
Zinc in Air	µg/m ³	0.002	0.10	0.080	0.060	0.060	0.10

Metals in High Volume Filters	UNITS	PQL	115416-47	115416-48
Our Reference:	--	--	EPL94	Blank Lot
Your Reference	--	--	Blank	T03776
Location	--	--		
Date Sampled				
Dust	mg/filter	0.1	5.1	[NA]
Iron	µg/filter	5	280	290
Nickel	µg/filter	2	2	2
Lead	µg/filter	5	<5	<5
Lithium	µg/filter	2	<2	<2
Sulfur	µg/filter	50	1,400	1,400
Zinc	µg/filter	5	124	140

Client Reference: Dust Analysis

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.

Report Comments:

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.