

## **MARINE VESSEL VOGE RENATE**

# **ANALYSIS OF AIR QUALITY MONITORING DATA ASSOCIATED WITH BULK NICKEL SULPHIDE SHIP LOADING ON 13-14 JUNE 2011**

<b>Revision</b>	<b>Prepared</b>	<b>Reviewed</b>	<b>Approved</b>	<b>Date</b>	<b>Description</b>
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## 1. INTRODUCTION

### 1.1 Licence Reporting Conditions

This document reports the air quality monitoring for the loading of the MV Voge Renate between 0633 hrs on 13<sup>th</sup> June 2011 to 0041 hrs on 14<sup>th</sup> June 2011 at the Esperance Ports Sea and Land. 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 and Land (EPSL) on the 24<sup>th</sup> 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).

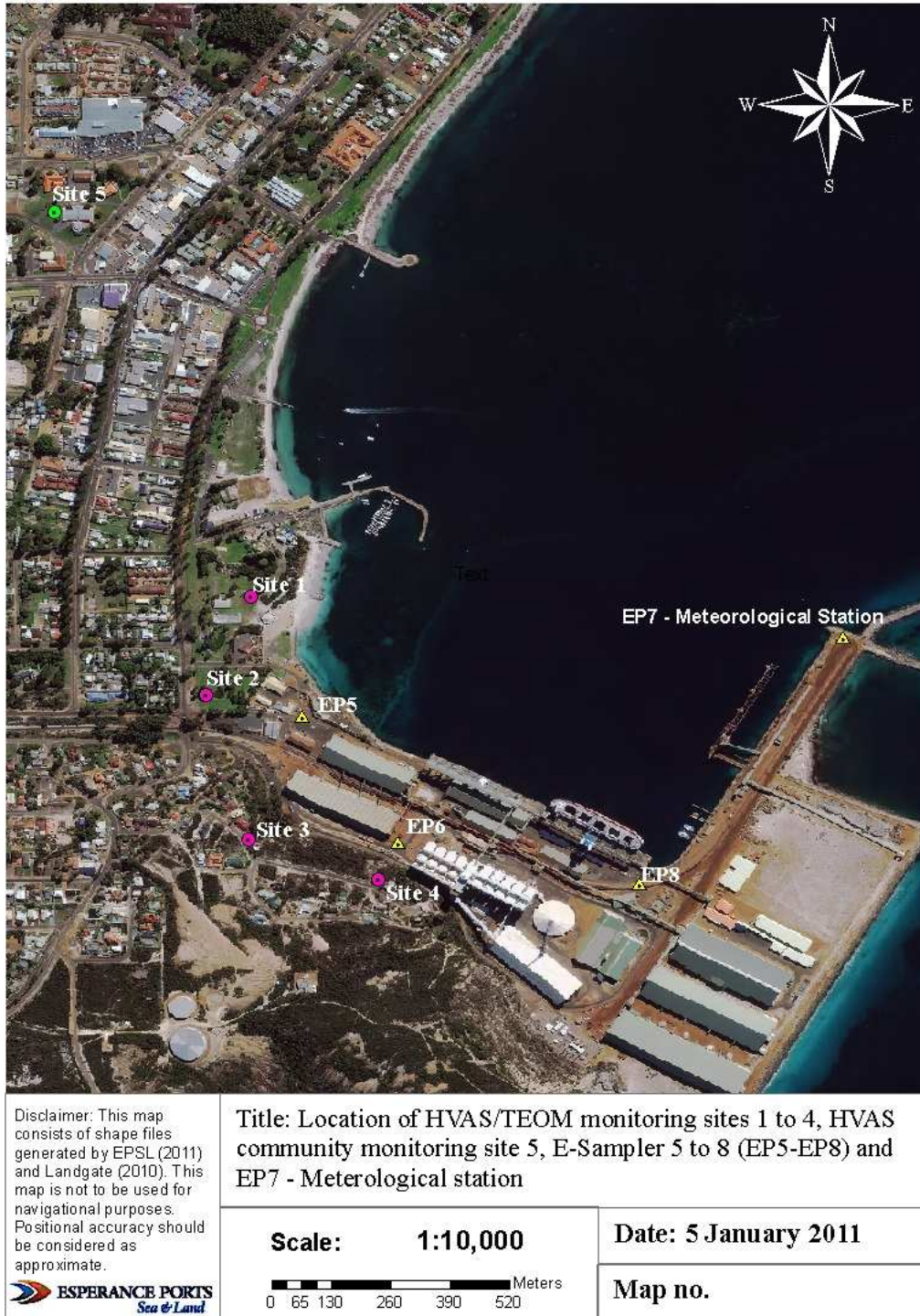
The EPSL has an Australian Standards-compliant meteorological station adjacent to E-Sampler 7, located on the Port premises adjacent to Berth 3. This meteorological station records both wind speed and direction. Data from this station has been used for this report.

### 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 <sup>3</sup>
Dust as PM <sub>10</sub>	50 µg/m <sup>3</sup>
Dust as TSP	90 µg/m <sup>3</sup>



**Figure 1. Location of air quality monitoring sites.**

## **2. ANALYSIS OF BULK NICKEL SHIP LOADING**

### **2.1 Port Activities**

The 'berthing period' in this report will refer to 0224 hours on 13/06/2011 to 0200 hours on 14/06/2011. The '**loading period**' in this report will refer to **0633 on 13/06/2011 to 0041 hours on 14/06/2011.**

Bulk nickel loading ceased on two occasions due to winds being in the red zone from 1357 on 13/06/2011 to 1415 on 13/06/2011 and 1735 13/06/2011 to 1805 hours 13/06/2011 and for the total of 48 minutes. Approximately 9934 tonnes of BHP Billiton Nickel West nickel sulphide concentrate bulk was loaded.

There were no other marine vessels in Port during the monitoring period.

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

- 26, 866 tonnes of iron ore averaged across 3 trains delivered to the Port.

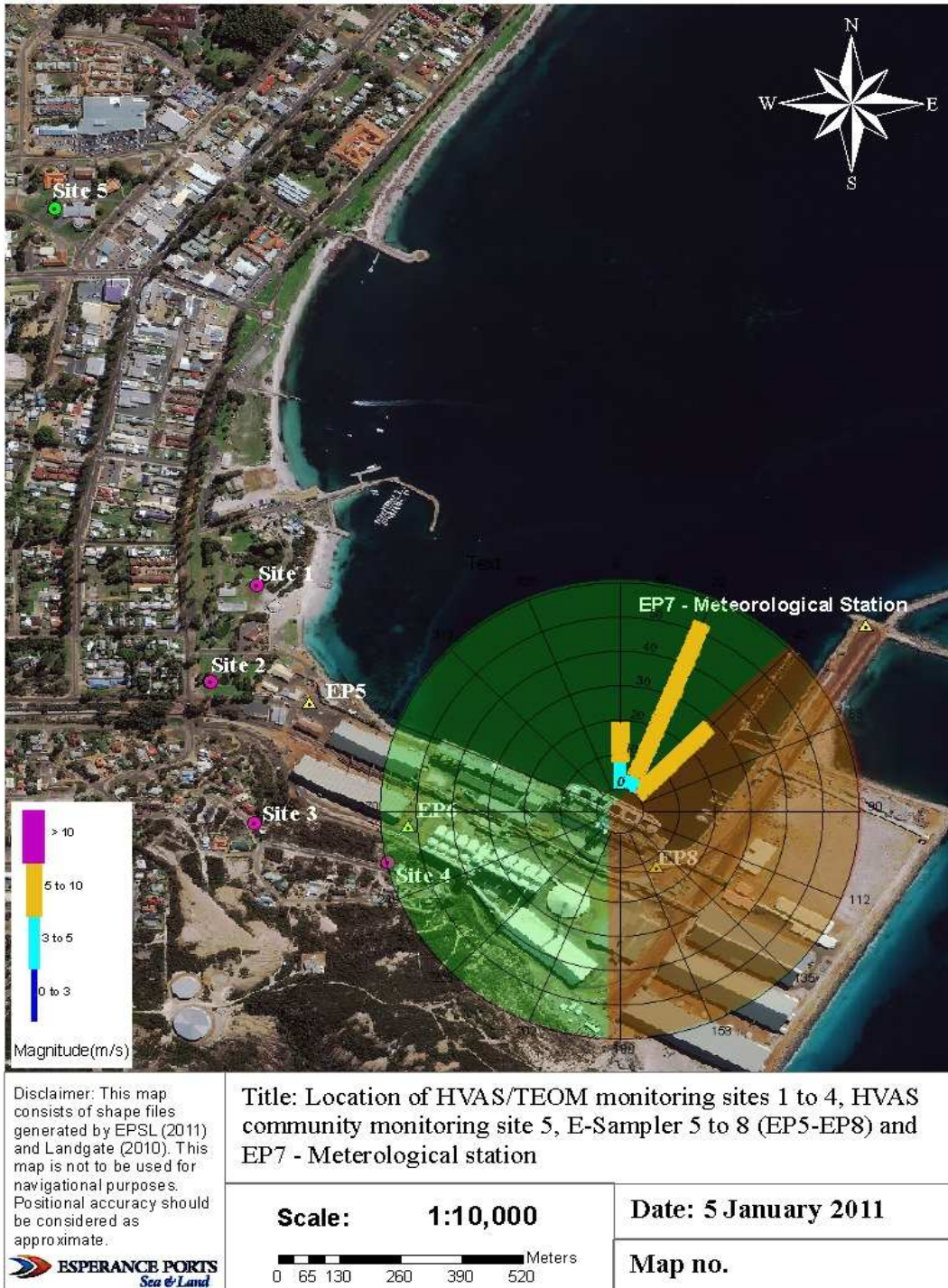
### **2.2 Meteorological Conditions**

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

- The wind direction was only slightly variable and was spread from N to NE (20% N, 52% NNE and 28% NE) (Figure 2).
- The maximum hourly wind speed recorded was 8.4 m/s (30 km/hr) from the NNE direction (green zone), which occurred between 1400 hours and 1455 hours on 13/06/2011.
- The average wind speed during the loading periods was 6.4 m/s (23 km/h). The 'Beaufort Wind Force Scale' is a measure for understanding wind speeds in descriptive terminology. A wind speed of 6.4 m/s is described as 'moderate' 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 0633 13/06/2011 to 0041 14/06/2011.

## **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 exceedances 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 Voge Renate the wind direction was in the green zone between 0 to 40 degrees during the majority of the loading period. The wind direction moved to the red zone between 1357 hours on 13/06/2011 to 1415 hours on 13/06/2011 and also between 1735 on 13/06/2011 to 1805 on 13/06/2011.

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 Voge Renate (Figure 3). However, loading rates do not appear to be critical in controlling dust emissions from the Berth 2 shiploader based on recent ship loading events since the ship loader upgrades including a telescopic extension.

## **2.5 TEOM PM<sub>10</sub> Monitoring**

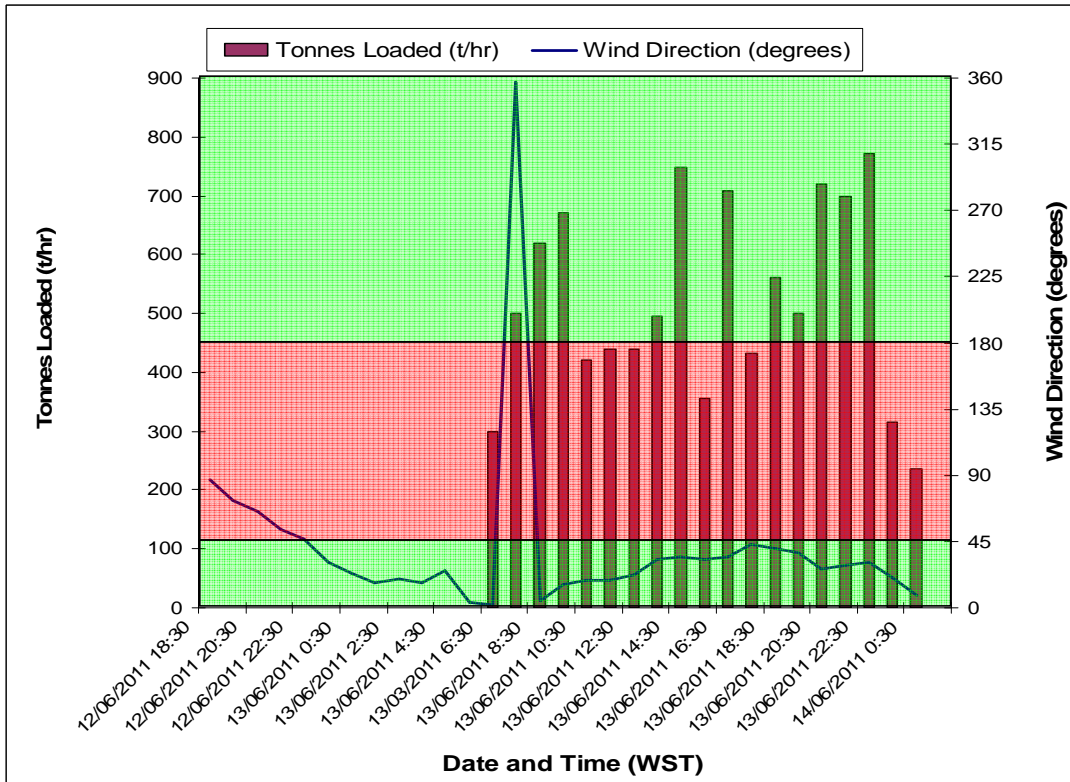
During the berthing period and prior to loading, the wind was in the green zone. During loading, a maximum PM<sub>10</sub> of 23.1 µg/m<sup>3</sup> was recorded at Site 2 at 1400 hours on 13/06/2011. Figure 4 graphs the hourly PM<sub>10</sub> concentration (µg/m<sup>3</sup>) and wind speed (m/s) against date. Throughout the loading of MV Voge Renate the winds moved into the red zone between 1357 hours on 13/06/2011 to 1415 hours on 13/06/2011. Loading resumed when the wind direction changed to the green

zone at 1415 hours on 13/06/2011. The winds moved into the red zone for a second time between 1735 hours on 13/06/2011 to 1805 hours on 13/06/2011, and loading of nickel was halted during this period. Loading resumed when the wind direction changed to the green zone at 1805 hours on 13/06/2011. Therefore the recorded PM<sub>10</sub> concentrations are likely to be from sources other than nickel loading operations. There is no correlation between wind speed and PM<sub>10</sub> during the loading period (refer to **Appendix B** for raw data).

The 24-hour average PM<sub>10</sub> 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 50 µg/m<sup>3</sup> was not exceeded at any of the sites. The maximum daily average PM<sub>10</sub> concentration of 11.1 µg/m<sup>3</sup> was recorded at Site 4 between 1200 hours on 13/06/2011 and 1200 hours on 14/06/2011 and represents 22.2% of the assessment criterion (50 µg/m<sup>3</sup>).

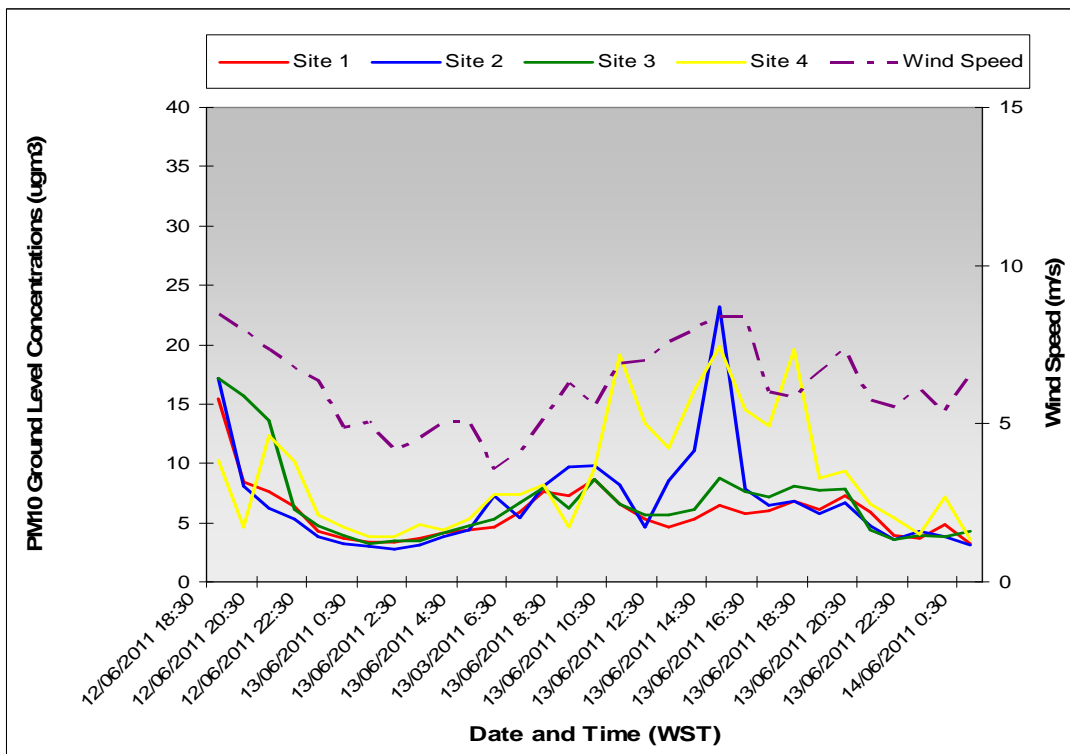
**Table 2. Daily 24-hr average TEOM results for PM<sub>10</sub> for 12/06/2011 to 14/06/2011**

Sampling Start	Sampling Finish	Site 1 (µg/m <sup>3</sup> )	Site 2 (µg/m <sup>3</sup> )	Site 3 (µg/m <sup>3</sup> )	Site 4 (µg/m <sup>3</sup> )
1200 12/06/2011	1200 13/06/2011	6.1	6.6	8.9	8.9
1200 13/06/2011	1200 14/06/2011	7.2	8.3	7.5	11.1
<b>Assessment Criterion (µg/m<sup>3</sup>)</b>		<b>50</b>			



**Figure 3. Wind direction preceding and during loading of MV Voge Renate.**

Note: loading occurred from 0633 hours on 13/06/2011 to 0041 hours on 14/06/2011.



**Figure 4. Hourly PM<sub>10</sub> concentrations and wind speed between 0633 hours 13/06/2011 to 0041 hours 14/06/2011.**

## 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 exceedances of the 90 µg/m<sup>3</sup> 24-hour average concentration target for TSP during the monitoring period. The maximum recorded daily average TSP concentration of 26 µg/m<sup>3</sup> recorded at Site 4 between 1200 hours on 12/06/2011 and 1200 hours on 13/06/2011 represents 28.9% of the assessment criterion (90 µg/m<sup>3</sup>). 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/m<sup>3</sup> for nickel was not exceeded during the monitoring period. The highest 24-hour average nickel concentration recorded during the monitoring period was 0.022 µg/m<sup>3</sup> which occurred at Site 4 between 1200 hours 13/06/2011 to 1200 hours 14/06/2011 representing 15.7% of the assessment criterion (0.14 µg/m<sup>3</sup>). Site 4 is the site closest to the Port boundary and more importantly the site most downwind from the nickel shiploading of MV Vogue Renate.

**Table 3. Daily HVAS monitoring results for TSP for 12/06/2011 to 14/06/2011**

Sampling Start <sup>1</sup>	Sampling Finish <sup>1</sup>	Site 1 (µg/m <sup>3</sup> )		Site 2 (µg/m <sup>3</sup> )		Site 3 (µg/m <sup>3</sup> )		Site 4 (µg/m <sup>3</sup> )		Site 5 (µg/m <sup>3</sup> )	
		TSP	Ni	TSP	Ni	TSP	Ni	TSP	Ni	TSP	Ni
1200 12/06/2011	1200 13/06/2011	8.3	<0.002	12	0.005	20	0.011	26	0.012	9.2	<0.002
1200 13/06/2011	1200 14/06/2011	21	0.002	23	<0.002	24	0.005	24	0.022	25	0.003
<b>Assessment Criterion (µg/m<sup>3</sup>)</b>		<b>90</b>	<b>0.14</b>	<b>90</b>	<b>0.14</b>	<b>90</b>	<b>0.14</b>	<b>90</b>	<b>0.14</b>	<b>90</b>	<b>0.14</b>

<sup>1</sup> These times are approximate for all five monitoring sites.

**Bold** - exceedance of the 90µg/m<sup>3</sup> 24-hour average concentration target for TSP  
 0.001 µg/m<sup>3</sup> is the limit of detection for the analysis of nickel.

### **3. CONCLUSIONS**

Loading of the MV Voge Renate 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<sub>10</sub>, TSP and nickel were not exceeded at any of the four monitoring sites during the berthing or loading periods of the MV Voge Renate. None of these parameters significantly increased during the loading period, with the exception of site 4 where it is possible that higher nickel levels may have been due to the ship loading. However, the levels at site 4 were still five fold below the licence criteria. These results warranted no further emission reduction measures.

#### **4. REFERENCES**

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

 Title: Odour Record Sheet	Form No : FM239 Revision: 2 Issue Date: 8/12/02009 Page: 1 of 1 Reference: PR089
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ODOUR INTENSITY	
Extremely Strong	6
Very Strong	5
Strong	4
Distinct	3
Weak	2
Very Weak	1
Not Perceptible	0

Ship Name: Voges Renate Sampled by: Alex Leonard

Odour Assessor(s)	Date	Time	Sample#	Location	Temperature (°C)	pH	%moisture	Odour intensity (Rate 1 to 6)
AL	7/11/11	11:15	1	Black Swan Shed		9.57	9.2	1
↓	↓	↓	2	↓		7.54	9.0	2
↓	↓	↓	3	↓		8.12	8.3	1
↓	↓	↓	4	↓		8.47	8.9	1
↓	↓	↓	5	↓		7.42	7.8	1
↓	↓	11:20	6	↓		8.82	8.7	1

### Appendix B Hourly Average PM10 Concentration

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			
12/06/2011 18:30	15.50	17.12	17.14	10.30	8.46	87	-
12/06/2011 19:30	8.46	8.11	15.69	4.63	7.97	73	-
12/06/2011 20:30	7.61	6.26	13.65	12.34	7.33	65	-
12/06/2011 21:30	6.34	5.29	6.07	10.11	6.73	53	-
12/06/2011 22:30	4.31	3.81	4.70	5.61	6.35	47	-
12/06/2011 23:30	3.68	3.18	3.94	4.56	4.89	31	-
13/06/2011 0:30	3.38	2.95	3.19	3.86	5.06	23	-
13/06/2011 1:30	3.37	2.71	3.44	3.81	4.14	17	-
13/06/2011 2:30	3.72	3.09	3.48	4.87	4.54	20	-
13/06/2011 3:30	4.19	3.83	4.17	4.37	5.02	17	-
13/06/2011 4:30	4.43	4.39	4.78	5.36	5.08	25	-
13/06/2011 5:30	4.66	7.26	5.32	7.40	3.56	4	-
13/06/2011 6:30	5.85	5.43	6.71	7.39	4.10	2	299
13/06/2011 7:30	7.61	8.13	7.91	8.24	5.18	357	501
13/06/2011 8:30	7.22	9.72	6.19	4.63	6.29	5	620
13/06/2011 9:30	8.68	9.82	8.69	9.60	5.54	16	670
13/06/2011 10:30	6.57	8.18	6.56	19.15	6.92	19	420
13/06/2011 11:30	5.36	4.58	5.67	13.34	6.99	19	440
13/06/2011 12:30	4.65	8.52	5.65	11.24	7.55	22	440
13/06/2011 13:30	5.31	11.04	6.10	16.11	8.00	33	496
13/06/2011 14:30	6.51	23.11	8.71	19.87	8.40	35	748
13/06/2011 15:30	5.77	7.83	7.58	14.51	8.37	33	356
13/06/2011 16:30	5.98	6.43	7.09	13.09	5.99	35	708
13/06/2011 17:30	6.81	6.82	8.04	19.55	5.83	43	432
13/06/2011 18:30	6.12	5.76	7.67	8.75	6.62	40	560
13/06/2011 19:30	7.27	6.70	7.86	9.39	7.33	37	501
13/06/2011 20:30	5.86	4.78	4.37	6.54	5.76	26	719
13/06/2011 21:30	3.98	3.61	3.63	5.47	5.54	29	700
13/06/2011 22:30	3.68	4.26	3.98	4.05	6.11	31	772
13/06/2011 23:30	4.84	3.85	3.79	7.19	5.34	21	316
14/06/2011 0:30	3.27	3.13	4.21	3.53	6.58	8	236

**Appendix C      MPL Laboratory reports**

## **CERTIFICATE OF ANALYSIS 112247**

**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

20/06/11

20/06/11

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:

27/06/11

Date of Preliminary Report:

Not issued

Issue Date:

24/06/11

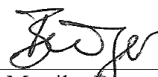
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**Tests not covered by NATA are denoted with \*.**

**Results Approved By:**



Dr Monika Buerger

Supervisor – Micro, Asbestos, Dust

**Client Reference: Dust Analysis**

Metals in High Volume Filters	UNITS	PQL	112247-1	112247-2	112247-3	112247-4	112247-5
Our Reference:	--	--	PAE299	PAE300	PAE301	PAE302	PAE303
Your Reference	--	--	Site 4	Site 3	Site 2	Site 1	Site 5
Location	--	--	10/06/11	10/06/11	10/06/11	10/06/11	10/06/11
Date Sampled							
Dust	mg/filter	0.1	42	41	14	10	13
Dust in Air	µg/m <sup>3</sup>	0.1	26	25	8.7	6.1	8.3
Iron	µg/filter	5	990	740	360	180	210
Iron in Air	µg/m <sup>3</sup>	0.005	0.61	0.46	0.22	0.11	0.13
Nickel	µg/filter	2	21	18	7	4	3
Nickel in Air	µg/m <sup>3</sup>	0.002	0.013	0.011	0.005	0.002	<0.002
Lead	µg/filter	5	<5	<5	<5	<5	<5
Lead in Air	µg/m <sup>3</sup>	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 <sup>3</sup>	0.001	0.001	0.001	0.001	<0.001	<0.001
Sulfur	µg/filter	50	3,800	5,100	1,500	970	720
Sulfur in Air	µg/m <sup>3</sup>	0.02	2.3	3.1	0.89	0.59	0.44
Zinc	µg/filter	5	2,497	2,591	2,500	2,468	2,043
Zinc in Air	µg/m <sup>3</sup>	0.002	1.5	1.6	1.5	1.5	1.3

Metals in High Volume Filters	UNITS	PQL	112247-6	112247-7	112247-8	112247-9	112247-10
Our Reference:	--	--	PAE304	PAE311	PAE312	PAE313	PAE314
Your Reference	--	--	Blank	Site 4	Site 3	Site 2	Site 1
Location	--	--		12/06/11	12/06/11	12/06/11	12/06/11
Date Sampled							
Dust	mg/filter	0.1	0.10	42	33	19	13
Dust in Air	µg/m <sup>3</sup>	0.1	[NA]	26	20	12	8.3
Iron	µg/filter	5	120	1,100	830	460	140
Iron in Air	µg/m <sup>3</sup>	0.005	[NA]	0.68	0.51	0.28	0.090
Nickel	µg/filter	2	3	19	18	8	<2
Nickel in Air	µg/m <sup>3</sup>	0.002	[NA]	0.012	0.011	0.005	<0.002
Lead	µg/filter	5	<5	<5	<5	<5	<5
Lead in Air	µg/m <sup>3</sup>	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 <sup>3</sup>	0.001	[NA]	0.001	0.001	<0.001	<0.001
Sulfur	µg/filter	50	710	4,200	4,500	1,000	730
Sulfur in Air	µg/m <sup>3</sup>	0.02	[NA]	2.5	2.7	0.63	0.45
Zinc	µg/filter	5	2,406	2,406	2,551	2,155	1,739
Zinc in Air	µg/m <sup>3</sup>	0.002	[NA]	1.5	1.6	1.3	1.1

**Client Reference: Dust Analysis**

Metals in High Volume Filters	UNITS	PQL	112247-11	112247-12	112247-13	112247-14	112247-15
Our Reference:	--	--	112247-11	112247-12	112247-13	112247-14	112247-15
Your Reference	--	--	PAE315	PAE316	PAE317	PAE318	PAE319
Location	--	--	Site 5	Blank	Site 4	Site 3	Site 2
Date Sampled			12/06/11		13/06/11	13/06/11	13/06/11
Dust	mg/filter	0.1	15	0.30	39	38	36
Dust in Air	µg/m <sup>3</sup>	0.1	9.2	[NA]	24	24	23
Iron	µg/filter	5	240	140	1,200	840	460
Iron in Air	µg/m <sup>3</sup>	0.005	0.15	[NA]	0.73	0.53	0.29
Nickel	µg/filter	2	3	3	34	8	<2
Nickel in Air	µg/m <sup>3</sup>	0.002	<0.002	[NA]	0.022	0.005	<0.002
Lead	µg/filter	5	<5	<5	<5	<5	<5
Lead in Air	µg/m <sup>3</sup>	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 <sup>3</sup>	0.001	<0.001	[NA]	0.001	<0.001	<0.001
Sulfur	µg/filter	50	840	800	1,100	720	650
Sulfur in Air	µg/m <sup>3</sup>	0.02	0.52	[NA]	0.68	0.45	0.41
Zinc	µg/filter	5	2,261	2,597	2,404	1,890	1,728
Zinc in Air	µg/m <sup>3</sup>	0.002	1.4	[NA]	1.5	1.2	1.1

Metals in High Volume Filters	UNITS	PQL	112247-16	112247-17	112247-18	112247-19	112247-20
Our Reference:	--	--	112247-16	112247-17	112247-18	112247-19	112247-20
Your Reference	--	--	PAE320	PAE321	PAE322	PAE335	PAE336
Location	--	--	Site 1	Site 5	Blank	Site 4	Site 3
Date Sampled			13/06/11	13/06/11		16/06/11	16/06/11
Dust	mg/filter	0.1	34	40	4.3	51	54
Dust in Air	µg/m <sup>3</sup>	0.1	21	25	[NA]	33	35
Iron	µg/filter	5	550	610	130	190	170
Iron in Air	µg/m <sup>3</sup>	0.005	0.35	0.38	[NA]	0.13	0.11
Nickel	µg/filter	2	4	4	3	4	3
Nickel in Air	µg/m <sup>3</sup>	0.002	0.002	0.003	[NA]	0.003	<0.002
Lead	µg/filter	5	<5	<5	<5	<5	<5
Lead in Air	µg/m <sup>3</sup>	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 <sup>3</sup>	0.001	<0.001	<0.001	[NA]	<0.001	<0.001
Sulfur	µg/filter	50	750	730	730	1,100	1,200
Sulfur in Air	µg/m <sup>3</sup>	0.02	0.47	0.46	[NA]	0.73	0.80
Zinc	µg/filter	5	2,087	1,968	2,378	1,950	2,011
Zinc in Air	µg/m <sup>3</sup>	0.002	1.3	1.2	[NA]	1.3	1.3

**Client Reference: Dust Analysis**

Metals in High Volume Filters	UNITS	PQL	112247-21	112247-22	112247-23	112247-24	112247-25
Our Reference:	--	--	PAE337	PAE338	PAE339	PAE340	Lab Blank
Your Reference	--	--	Site 2	Site 1	Site 5	Blank	
Location							
Date Sampled			16/06/11	16/06/11	16/06/11		
Dust	mg/filter	0.1	50	46	48	3.9	[NA]
Dust in Air	µg/m <sup>3</sup>	0.1	32	30	31	[NA]	[NA]
Iron	µg/filter	5	250	190	130	100	130
Iron in Air	µg/m <sup>3</sup>	0.005	0.16	0.12	0.080	[NA]	[NA]
Nickel	µg/filter	2	<2	4	<2	3	<2
Nickel in Air	µg/m <sup>3</sup>	0.002	<0.002	0.003	<0.002	[NA]	[NA]
Lead	µg/filter	5	<5	<5	<5	<5	<5
Lead in Air	µg/m <sup>3</sup>	0.005	<0.005	<0.005	<0.005	[NA]	[NA]
Lithium	µg/filter	2	<2	<2	<2	<2	<2
Lithium in Air	µg/m <sup>3</sup>	0.001	<0.001	<0.001	<0.001	[NA]	[NA]
Sulfur	µg/filter	50	900	1,100	840	650	750
Sulfur in Air	µg/m <sup>3</sup>	0.02	0.58	0.75	0.55	[NA]	[NA]
Zinc	µg/filter	5	1,728	2,231	1,581	1,971	191
Zinc in Air	µg/m <sup>3</sup>	0.002	1.1	1.4	1.0	[NA]	[NA]

**Client Reference: Dust Analysis**

Method ID	Methodology Summary
<b>DUST-004</b>	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.
<b>METALS-020</b>	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.