City Pacific Limited

TOWNSVILLE OCEAN TERMINAL: SUPPLEMENTARY REPORT – METALS EMISSIONS

August 2008

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Project Reference: 1496

Document Title: Townsville Ocean Terminal: Supplementary Report – Metals Emissions

Client: City Pacific Limited

Document Reference: /Network/Projects/1496/Supplementary EIS/Report/1496MetalsEmissions07.odt

Version:	Description:	Date:	Author:	Checked by:	Approved by:	Signature:
00	Draft for internal review	13/6/08	Craig Beyers	CMR	-	
01	Draft for client review	13/6/08	Craig Beyers	CMR	CMR	
02	Final including client comments	16/6/08	Craig Beyers	CMR	CMR	
03	Revised final with additional client comments	29/07/08	Craig Beyers	CMR	CMR	
04	Further revised final	30/07/08	Craig Beyers	CMR	CMR	
05	Further revised final	31/07/08	Craig Beyers	CMR	CMR	
06	Further revised final	01/08/08	Craig Beyers	CMR	CMR	
07	Further revised final	01/08/08	Craig Beyers	CMR	CMR	

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1 INTRODUCTION

1.1 OVERVIEW

Air Noise Environment Pty Ltd (ANE) were commissioned by City Pacific Limited to undertake an air quality assessment for the Townsville Ocean Terminal (TOT) development proposed to be constructed in Townsville.

The proposal will provide Townsville with:

- a dedicated cruise terminal and wharf for cruise ships and military vessels, located on the Port Western Breakwater, adjacent to the Port of Townsville;
- an integrated residential and tourism development providing residential land parcels of mixed density for development;
- extended public access to the Breakwaters and provide future open space areas to land to be reclaimed to the north of the existing Townsville Hotel and Casino Complex and the Townsville Entertainment Centre; and
- increased marina berths for the marine industry, general recreational vessels, and provide berthing facilities for superyachts.

The Air Quality Assessment (AQA) undertaken by ANE[1] and included in the Environmental Impact Statement (EIS) for the Project incorporated modelling of future emissions from the Port of Townsville. In addition, monitoring of existing air quality at (or near) the Project Site was undertaken for a range of determinants including oxides of nitrogen, sulphur dioxide, organic hydrocarbons and deposited dust. Monitoring data collected by the Queensland Environmental Protection Agency (EPA) and the Townsville Port Authority (TPA) was also considered in the assessment. In response to the EIS, a number of stakeholders have raised metals being emitted from activities at the Port as an area requiring further information to allow a considered assessment to be completed.

This supplementary report presents the results of an assessment of the potential impacts of metals emissions from the Port on the TOT based on currently available information.

1.2 THIS REPORT

This report provides a summary of the results of deposited dust monitoring undertaken in the area and forms part of the following series of supplementary air quality assessment reports prepared for the project:

- Townsville Ocean Terminal: Supplementary Report - Responses to EIS Comments
- Townsville Ocean Terminal: Supplementary Report – Suspended Particulates
- Townsville Ocean Terminal: Supplementary Report – Deposited Dust
- Townsville Ocean Terminal: Supplementary Report – Gaseous Emissions

[1] *Townsville Ocean Terminal – Air Quality Assessment (October 2007) prepared by Air Noise Environment Pty Ltd on behalf of City Pacific Limited*

2 ASSESSMENT CRITERIA

The Terms of Reference for the project EIS nominated the following air quality criteria:

- The National Health and Medical Research Council (NHMRC) national guidelines (1985) for control of emissions from stationary sources.
- Environmental Protection Air Policy (1997) (EPP Air) and the Environmental Protection Act (1994).
- National Environmental Protection Measure (NEPM) for Ambient Air Quality (1998).

The Project does not include stationary sources (e.g. industrial stacks), hence application of the NHMRC criteria is not relevant.

For the assessment of the impacts of gaseous emissions on the proposed development, Table 2.1 provides a summary of the criteria and sources of the criteria utilised in the assessment. Where different air quality goals are nominated in the State legislation and the National Environmental Protection Measure (NEPM), both are referenced.

Table 2.1: SUMMARY OF ADOPTED AIR QUALITY CRITERIA

Pollutant	Averaging Period	Criteria (µg/m^3)	Source
Lead	1 year 90 days	0.5 1.5	NEPM EPP Air
Cadmium	1 year	0.020	EPP Air
Manganese	1 year	1	EPP Air
Vanadium	24 hours	8	EPP Air

3 METALS EMISSIONS FROM TOWNSVILLE PORT

The Townsville Port currently has a total of 9 berths in operation servicing a range of industries including transport of mineral and metal ore and concentrates, sugar, livestock, molasses, fuel products and general freight. In terms of emissions from operations at the Townsville Port, there is only one operation with an ERA including emission limits for metals.

BHP Billiton's Cannington mine is the world's largest single mine producer of both silver and lead. BHP Billiton export lead and zinc concentrates through the Port of Townsville to Korea, Europe, and Japan under Environmental Authority NR162. This authority provides conditions limiting emissions from the site.

The authority requires that *'contaminants must only be released to the atmosphere from a release point at a height not less than 4 metres above the roof ridge of any adjacent building or structure but in any case not less than 6 metres above ground level'.* It is understood, however, that emissions from the site are likely to be released at heights significantly more than 6 m above ground level. The authority places limits on emissions from the site. Tables 3.1 and 3.2 provide a summary of the release limits specified in Schedule B Table 1 and 2 of the environmental authority respectively.

TABLE 3.1: SCHEDULE B TABLE 1 RELEASE LIMITS

Release Point Number	Source Description	Minimum Efflux Velocity (metres/second)
A1	Rail wagon tipper – dust collector	8
A2, A3, A4	Conveyor transfer points – dust collectors	8

TABLE 3.2: SCHEDULE B TABLE 2 RELEASE LIMITS

Release Point Number	Contaminant release	Maximum release concentration at maximum continuous rating
A1, A2, A3, A4	Particulate	250 mg/Nm^3
A1, A2, A3, A4	Total of antimony, arsenic, cadmium, lead, mercury and vanadium and their respective compounds	10 mg/Nm^3

These release limits have been utilised to estimate the maximum allowable emissions of lead from the BHP operations at the Port of Townsville as presented in Table 3.3 below assuming, all metals emitted from the site are lead (i.e. no antimony, arsenic, cadmium, mercury or vanadium are emitted).

TABLE 3.3: SUMMARY OF MAXIMUM ALLOWABLELEAD EMISSIONS (g/s)

Source	Maximum Release Limit
A1 – rail wagon tippler dust collector	0.14
A2 – conveyor dust collector	0.14
A3 – conveyor dust collector	0.14
A4 – conveyor dust collector	0.14

It is understood through discussions with BHP that the site currently operates at approximately 17 % of full capacity. Based on recent export data, this equates to approximately 10 ship movements per annum with an average load of approximately 20,000 tonnes of concentrate and average time in berth of 24 hours. Given this, it is possible that at full capacity, ships may be in berth and being loaded up to 59 days per year (or 5 per month) relating to an export of approximately 1.2 mega tonnes per annum.

4 MONITORING DATA

4.1 PREVIOUS STUDIES

The Townsville Port Authority have previously undertaken an assessment of the potential impacts of dust emissions from the Port on the nearby Castle Hill[2]. The study was commissioned by the Townsville Port Authority in response to dust complaints received by the Port. In particular the study measured levels of deposited dust including elemental metals analysis at a total of four stations (Berth 1, Berth 2, Sugar Terminal and Curtain Brothers Compound) and PM_{10} monitoring at a single station located at Castle Hill. Table 4.1 presents a summary of the results of five samples (14 day sample periods) collected over the period March to May 1998.

TABLE 4.1: SUMMARY OF METALS CONTENT OF DEPOSITED DUST (1998) (mg/m²/day)

Station	Lead			Zinc			Nickel		
	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max
Berth 2	1.67	0.11	3.61	1.74	0.39	4.38	0.05	- [1]	0.12
Sugar Terminal	0.30	0.10	0.48	2.63	0.03	9.55	- [1]	- [1]	- [1]
Curtain Brothers	0.24	0.05	0.57	0.61	0.08	1.23	- [1]	- [1]	- [1]
Berth 1	4.02	0.04	6.25	2.32	0.03	9.55	0.06	- [1]	0.25

[1] *Results below method detection limit*

The results of the metals analysis of deposited dust monitoring presented in Table 4.1 show similar levels of lead and zinc at all monitoring positions with higher levels of lead measured at Berth 1 than other stations. For zinc, measured levels of deposition are similar for both Berths 1 and the Sugar Terminal. Deposited nickel levels for the majority of monitoring positions are negligible with all positions showing levels below the method detection limits for at least one month of monitoring.

The results of the metals analysis presented in Table 4.1 are not comparable to any health or nuisance criteria although the World Health Organisation has previously identified that *'some data indicate that lead fallout in excess of 250 µg/m²/day* [0.25 mg/m²/day] *will increase blood levels'*[3,4]. Average lead deposition monitoring results for the 1998 study presented in Table 4.1 indicate that deposited lead at all four stations may have resulted in an increase in blood lead levels. Furthermore, the elevated levels of lead deposition were identified at significant distances from the lead concentrate load berth with exceedences of the indicator level observed as far south as the Sugar Terminal and the Curtain Brothers compound in 1998. The 1998 data indicate that, if the same levels of emissions occur today, similar elevated levels of lead deposition could be expected both at the Project Site and at other existing residential areas near to the Port. It is important to note that since completion of this study in 1998 it is understood that mitigation measures intended to reduce the potential of lead emissions from the BHP concentrate exports have been implemented[5].

[2] *Coffey Partners International (October 1998) 'Assessment of Impact of Dust on Castle Hill, Townsville'.*
[3] *World Health Organisation (2001), 'Air Quality Guidelines – Second Edition'*
[4] *Western Australian Education and Health Standing Committee (2007), 'Inquiry into the cause and extent of lead pollution in the Esperance area'*
[5] *North Queensland Conservation Council (2000) 'Broadening Our Horizons, An appraisal by the North Queensland Conservation Council of the environmental performance of BHP Cannington'*

4.2 RECENT MONITORING DATA

Deposition samples collected by ANE during August 2007 were also analysed for a suite of metal compounds. Table 4.2 presents a summary of the results of this analysis for each of the samples collected. It should be noted that the sample collected for Breakwater Wall 1 and Breakwater Wall 2 were unable to be analysed due to vandalism. The sample collected for Mariner's Peninsular was noted by the laboratory to not have enough material collected to allow for metals analysis.

TABLE 4.2: SUMMARY OF RESULTS OF METALS ANALYSIS (mg/m^2/day)[1]

Metal	Breakwater Wall 1	Breakwater Wall 2	Casino Carpark	Mariner's Peninsular	Jezzine Army Barracks
Arsenic	-	-	0.007	-	< 0.002
Barium	-	-	0.008	-	0.023
Beryllium	-	-	< 0.001	-	< 0.002
Cadmium	-	-	0.002	-	< 0.002
Chromium	-	-	0.004	-	< 0.002
Cobalt	-	-	0.002	-	< 0.002
Iron	-	-	1.384	-	0.793
Lead	-	-	0.104	-	0.038
Manganese	-	-	0.022	-	0.005
Molybdenum	-	-	< 0.001	-	< 0.002
Nickel	-	-	0.008	-	0.007
Selenium	-	-	< 0.001	-	< 0.002
Titanium	-	-	0.031	-	0.013
Vanadium	-	-	0.002	-	< 0.002
Zinc	-	-	0.712	-	0.163

Note: '<' indicates the results of the monitoring were less than the detection limit for the analytical method.

Review of the results indicates that some metals are present in both samples collected near to the Project Site (Casino Carpark) and at locations expected to be more typical of ambient concentrations in the waterfront area (Jezzine Army Barracks). Further, for all metals analysed, with the exception of barium, deposition rates measured at the background position (Jezzine Army Barracks) were less than those measured at the Casino Carpark monitoring position indicating a possible influence from emissions from the Port.

As previously discussed, the results of the metals analysis presented in Table 4.2 are not comparable to any health or nuisance criteria although the World Health Organisation has previously identified that *'some data indicate that lead fallout in excess of 250 µg/m^2/day* [0.25 mg/m^2/day] *will increase blood levels'*[6,7]. As can be seen, lead levels measured in both the background (Jezzine Army Barracks) and the Project Site (Casino Carpark) monitoring locations were below this indicator level.

[6] *World Health Organisation (2001), 'Air Quality Guidelines – Second Edition'*
[7] *Western Australian Education and Health Standing Committee (2007), 'Inquiry into the cause and extent of lead pollution in the Esperance area'*

In addition to the analysis of the single round of deposition samples collected by ANE, both the TPA and the EPA have recently commissioned monitoring programs focussing on dust monitoring (including metals content) in and around the Port area.

It is understood through discussions with the Port that up to 6 months of monitoring data including metals analysis may have been collected. To date the Project Team has not been able to gain access to this monitoring data hence it cannot be included in the assessment. The EPA commenced monitoring of total suspended particulate lead in August 2007 at the Townsville Coastguard Station. Dust material collected by the instrument is stored on filters on a six day cycle (i.e. a new filter cartridge is loaded every six days). Analysis of these samples for metal content commenced with samples collected during November / December 2007. Discussions with the EPA have confirmed that no lead was detected in these samples (i.e. the lead concentration was below the method detection limit). Additional monitoring at this site has also been undertaken using a high volume air sampler. While the results of this additional monitoring are yet to be released, discussions with the EPA indicate that no exceedences of the annual average criteria are expected based on the currently available results.

4.3 OTHER AREAS IN AUSTRALIA

A review of available literature relating to lead deposition in residential areas of Australia has identified that most studies undertaken to date have focussed on residential areas located in close proximity to significant lead sources (e.g. smelters and mines). Table 4.3 presents a summary of published lead deposition rates at a range of locations around Australia. Comparison of the available monitoring data for Townsville with that collected at other areas in Australia indicates that in general the levels measured at the Project Site (August 2007 deposition monitoring) are comparable with average levels measured in residential areas near to a former smelter site (once the smelter had ceased operations).

TABLE 4.3: COMPARISON OF LEAD DEPOSITION MONITORING DATA WITH OTHER AREAS OF AUSTRALIA

Location	Type	Year(s)	Lead (mg/m^2/day)	Reference
Broken Hill, NSW	Mining town	1992	1.9-940	Gulson et al., 1995
McArthur River, NT	Mining area	1995-1997	0.1-151	Munksgaard and Parry, 1998
Port Pirie, SA	Indoor (closed buildings)	1993-1994	14	Kutlaca, 1998
	Indoor (opened buildings)	1993-1994	137	
Cockle Creek, NSW	21 monitoring stations at various locations (including residential, schools) near to smelter site	1996-2003 (smelter operating)	0.08-10.59 (average 1.17)	Holmes Air Sciences, 2006
		2004 (smelter not operating)	0.04 – 1.13 (average 0.22)	

Location	Type	Year(s)	Lead (mg/m^2/day)	Reference
Port Pirie, SA	Mining town	1997-1998	18800	van Alphen, 1999
Townsville	***TPA Monitoring (Table 4.1)***	***1998***	***0.04 – 6.25 (average 0.24 – 4.02)***	***Coffey Partners, 1998***
	Project Monitoring (Table 4.2)	***August 2007***	***0.038 – 0.104***	***Air Noise Environment, 2007***

4.4 CONCLUSIONS

Limited information is currently available regarding the potential for exposure to residents at the Project Site to elevated levels of lead. While not directly comparable to criteria, the most recently available monitoring data indicate levels of lead deposition within the World Health Organisation indicator level. Historic data from 1998 suggests that significantly higher lead deposition rates have been experienced in the past. Some changes to operation which may result in lower emissions of lead have been implemented since the 1998 measurements were completed.

Comparison of available lead deposition monitoring data with levels measured in other areas of Australia indicate that the existing levels are likely to be similar to those in residential areas in proximity to a former smelter site.

Given that limited data is available to confirm current exposure levels, modelling of estimated emissions from licensed lead export activities has been undertaken.

5 MODELLING

Modelling of licensed lead emissions from BHP operations at the Port of Townsville has been undertaken using the meteorological dataset developed for the AQA. Emissions have been modelled using the Calpuff dispersion model based on the source parameters discussed in Section 3 of this report. As noted in Section 3, the maximum number of export shipments of lead concentrate per year is expected to be approximately 5 per month (with loading for approximately 24 hours per shipment) with current export rates at less than 1 per month. To provide a conservative assessment, the modelling has considered emissions based on 5 export shipments per month (the maximum possible) rather than the current level of less than one per month.

In addition, a second hypothetical scenario has been considered that assumes continuous emissions from the site (i.e. continuous export activities). This is because the current Environmental Licence does not restrict hours of operation hence, in theory, continuous exports (and associated emissions) could occur. In reality the current operational procedures preclude continuous operations, hence this scenario represents a theoretical operational case only.

Table 5.1 presents maximum predicted ground level concentration contours for licensed lead emissions from the BHP facility for the actual maximum export capacity (5 per month).

TABLE 5.1: SUMMARY OF MAXIMUM PREDICTED GROUND LEVEL LEAD CONCENTRATIONS – MAXIMUM EXPORT CAPACITY

Averaging Period	Maximum Predicted Ground Level Lead Concentration (TOT Project Site)	Criteria / Goal	Source of Criteria / Goal
3 month	0.24 ug/m^3	1.5 ug/m^3	EPP (Air)
Annual Average	0.14 ug/m^3	0.5 ug/m^3	NEPM (Ambient Air)

The results presented in Table 5.1 confirm that, even at maximum current export capacity, the appropriate criteria are predicted to be met by a significant margin. It is noted that the current operations represent one export per month, as opposed to the five days per month export included in the modelling. Hence, the current operations are expected to result in lead concentrations that are 20 % of the predicted values for the current maximum export capacity.

The results of the hypothetical continuous operations scenario for emissions of lead from the Port of Townsville are presented in Appendix B.

APPENDIX A

GLOSSARY OF TERMS

APPENDIX A: GLOSSARY OF AIR QUALITY TERMINOLOGY

Term	Definition
Conversion of ppm to mg/m^3	Where R is the ideal gas constant; T, the temperature in kelvin (273.16 + T°C); and P, the pressure in mm Hg, the conversion is as follows: $\mu g\ m^{-3}$ = (P/RT) x Molecular weight x (concentration in ppm) $= \frac{P \times \text{Molecular weight} \times (\text{concentration in ppm})}{62.4 \times (273.2 + T°C)}$ For the purposes of the air quality assessment all conversions were made at 25°C.
g/s	grams per second
mg/m^3	milligrams (10^{-3}) per cubic metre. Conversions from mg/m^3 to parts per volume concentrations (ie, ppm) are calculated at 25 degrees Celsius as required by the SEPP(AQM).
$\mu g/m^3$	micrograms (10^{-6}) per cubic metre. Conversions from $\mu g/m^3$ to parts per volume concentrations (ie, ppb) are calculated at 25 degrees Celsius.
ppb	parts per billion.
ppm	parts per million.
VOC	Volatile Organic Compounds. These compounds can be both toxic and odorous.
PM_{10}, $PM_{2.5}$, PM_1	Fine particulate matter with an equivalent aerodynamic diameter of less than 10, 2.5 or 1 micrometres respectively. Fine particulates are predominantly sourced from combustion processes. Vehicle emissions are a key source in urban environments.
50th percentile	The value exceeded for 50 % of the time.
NO_x	Oxides of nitrogen – a suite of gaseous contaminants that are emitted from road vehicles and other sources. Some of the compounds can react in the atmosphere and, in the presence of other contaminants, convert to different compounds (eg, NO to NO_2).
NO_2	Nitrogen dioxide – one of the group of NO_x compounds that can form through chemical interactions in the atmosphere following emission from the source.

APPENDIX B

MODELLING RESULTS FOR MAXIMUM LICENSED EMISSIONS CASE

TABLE B1: SUMMARY OF MAXIMUM PREDICTED GROUND LEVEL LEAD CONCENTRATIONS – CONTINUOUS OPERATIONS

Averaging Period	Maximum Predicted Ground Level Lead Concentration (TOT Project Site)	Criteria / Goal	Source of Criteria / Goal
3 month	1.5 ug/m^3	1.5 ug/m^3	EPP (Air)
Annual Average	0.9 ug/m^3	0.5 ug/m^3	NEPM (Ambient Air)

The data shows that emissions of lead from the Port of Townsville for continuous loading operations are not predicted to exceed the 3 month average EPP (air) goal. Exceedences of the NEPM (ambient air) annual average goal are however predicted for the majority of the Project Site with concentrations of up to 0.9 ug/m^3 predicted.