City Pacific Limited

TOWNSVILLE OCEAN TERMINAL: SUPPLEMENTARY REPORT - SUSPENDED PARTICULATES

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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.

This supplementary report presents the results of the available suspended particulate monitoring undertaken by the EPA and TPA in the Townsville area.

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 – Deposited Dust
- Townsville Ocean Terminal: Supplementary Report – Gaseous Emissions
- Townsville Ocean Terminal: Supplementary Report – Metals 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 suspended particulates 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
Total Suspended Particulates (TSP)	1 year	90	QLD EPA
PM_{10}	24 hours 24 hours 1 year	50 150 50	NEPM EPP Air EPP Air

1. *This criteria was recommended for the assessment of potential nuisance dust impacts by the EPA in response to the AQA.*

The EPA has also requested that the Project Team determine compliance with a limit of 80 ug/m^3 measured as total suspended particulates at the Project Site. As discussed in *'Townsville Ocean Terminal: Supplementary Report – Responses to EIS Comments'*, this criteria is inconsistent with the requirements currently placed on operations within the Port. Regardless of this, the compliance of air quality in the vicinity of the Project Site with this criteria is discussed in detail in this report.

3 AMBIENT AIR MONITORING

3.1 OVERVIEW

This section of the report provides a summary of all available suspended particulate monitoring data. The data presented includes data collected and reported in the AQA along with additional data collected following submission of the AQA.

3.2 TYPICAL TOWNSVILLE METEOROLOGY

The climatology in the Townsville area is typical of a tropical environment, however, due to its geographical location, rainfall is not as high as elsewhere in the tropics. Winter months are dominated by SE trade winds and mostly fine weather. The summer months are hot and humid with "build-up" thunderstorms starting in late October or November. Bursts of monsoon rains from late December through until early April deliver the highest rainfall.

Figure 1 presents a wind rose for the Townsville Port Authority meteorological station located at Berth 10 of the Port of Townsville (located to the east of the Project Site) for the period January 2004 – December 2006.

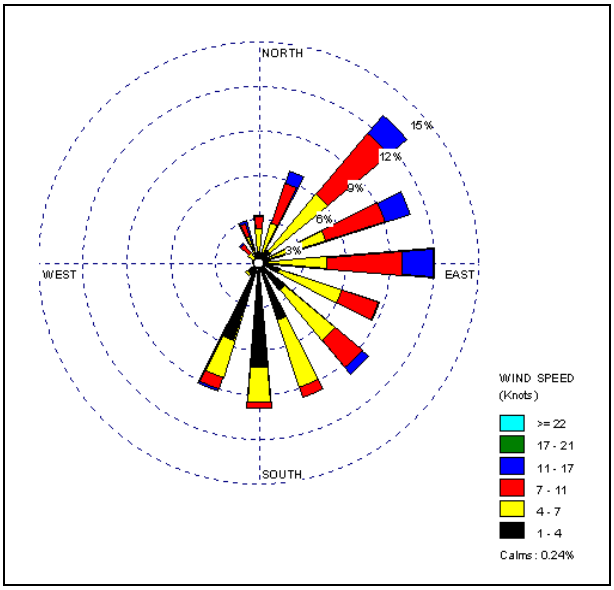

Figure 1: Windrose for Townsville Port Berth 10 Monitoring Station (2004 – 2007)

Winds are noted to be predominantly easterly and north-easterly during the wet season and easterly to south south westerly in the dry season. For all periods the occurrence of calms in the Project Site area is low with less than 1 % calms recorded in any season of available monitoring data.

The average annual rainfall recorded at the Bureau of Meteorology monitoring station located at Townsville Airport is 1143 mm for an average of 91 rain days, most of which falls in the six month "wet season" November to April. Figure 2 presents a summary of average rainfall per month across a typical year.

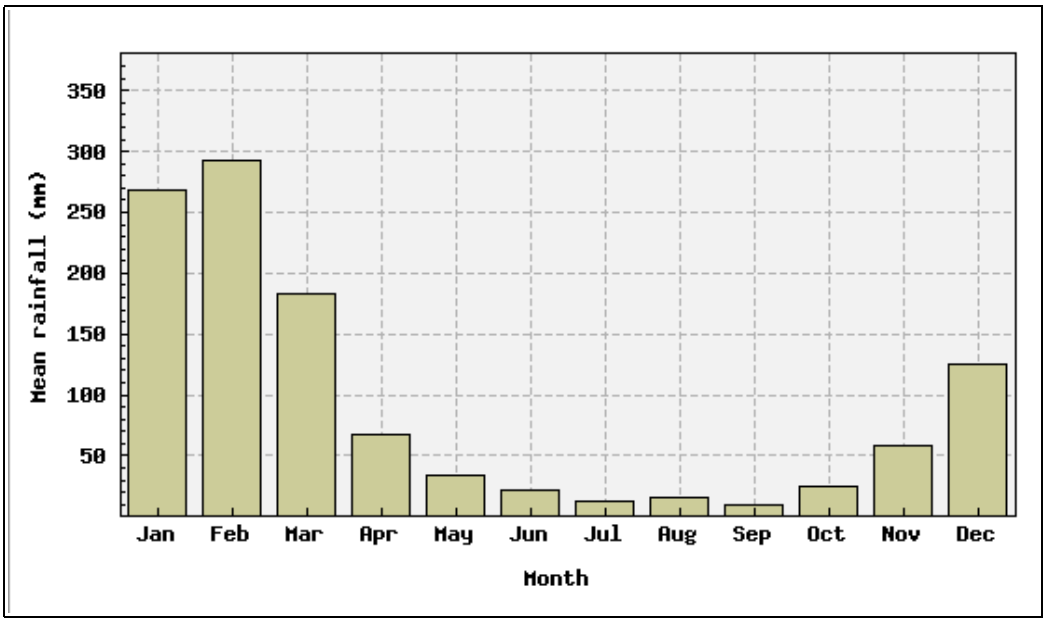

Figure 2: Typical Rainfall Patterns for Townsville Region (average over all years of recorded data)

3.3 SUSPENDED PARTICULATE MONITORING

3.3.1 Scope of the Monitoring

Particulate monitoring has been undertaken in the Townsville Port area by the EPA and the TPA. Table 3.1 provides a summary of monitoring undertaken in the area by these organisations. It is possible that additional monitoring data has also been collected in the area however the Project Team is not aware of this information.

TABLE 3.1: SUMMARY OF SUSPENDED PARTICULATE MONITORING IN TOWNSVILLE AREA

Organisation	Monitoring Undertaken
Qld EPA	▪ Joint (with TPA) monitoring of PM_{10} undertaken at Townsville Port Berth 10 monitoring station (commenced prior to 2000). ▪ Monitoring of continuous total suspended particulate concentrations at the Townsville Coastguard site located to the south of the Project Site adjacent to Ross Creek (commenced August 2007).
TPA	▪ Joint (with EPA) monitoring of PM_{10} undertaken at Townsville Port Berth 10 monitoring station (commenced prior to 2000).

Figure 3 presents the location of these monitoring stations in relation to the Project Site and surrounding landuses. As can be seen from Figure 3, the TPA Berth 10 monitoring station is located at the western boundary of Port activities and is the nearest point of the Port to the Project Site. The

EPA Coastguard station is located to the south of the Project Site. These monitoring stations, while not located within the Project Site area, are expected to provide a good representation of pollutant levels likely to be experienced at the Project Site.

Figure 3: Particulate Monitoring Station Locations

3.3.2 Meteorological Conditions During Monitoring Period

Figure 4 provides a summary of meteorological conditions during the monitoring of TSP at the EPA Coastguard monitoring site. Review of this data confirms that for a considerable portion of the monitoring periods, winds were from easterly sectors. Thus, for much of the monitoring period, winds were blowing from the major sources at the Port to the monitoring station.

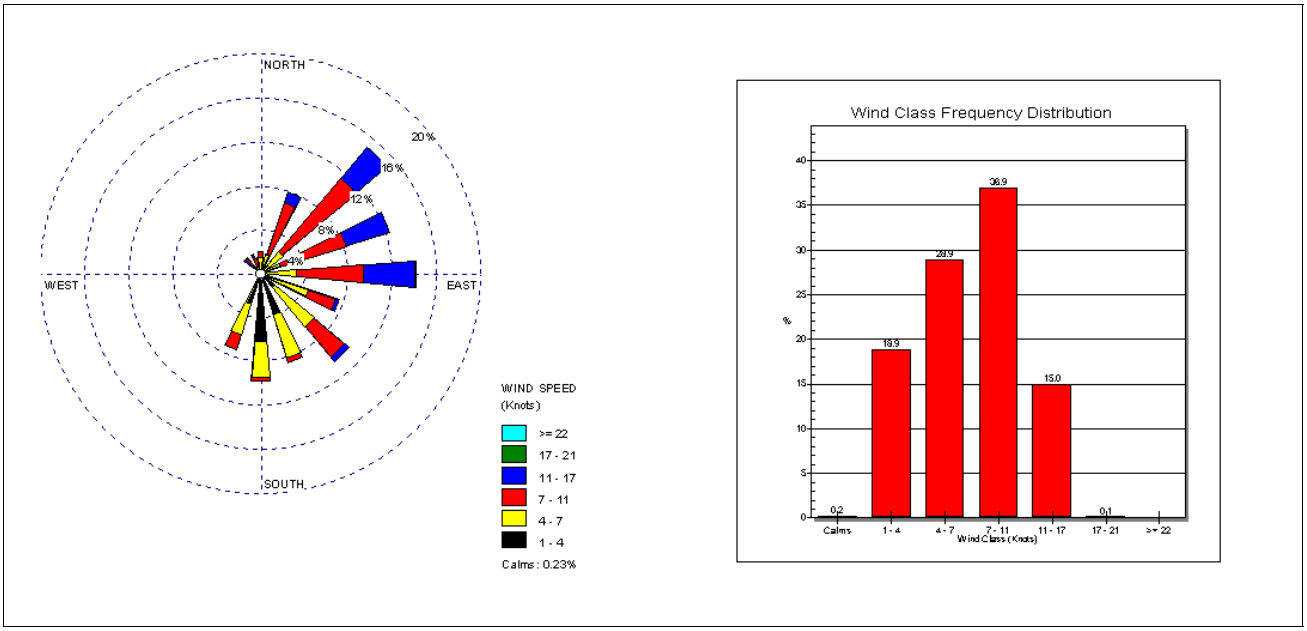

Figure 4: Wind rose and Frequency Distribution for TSP Monitoring Period (08/07 - 02/08)

Review of the rainfall intensity data presented in Figure 5 identifies that rain periods during the monitoring period were typical of average rainfall patterns in Townsville with the exception of January and February. For these months, Townsville experienced higher rainfalls than are typical for that time of year based on historical monitoring data. Monitoring undertaken during the period August to October 2007 however is likely to provide a reasonable representation of typical suspended particulate levels during the drier months in Townsville.

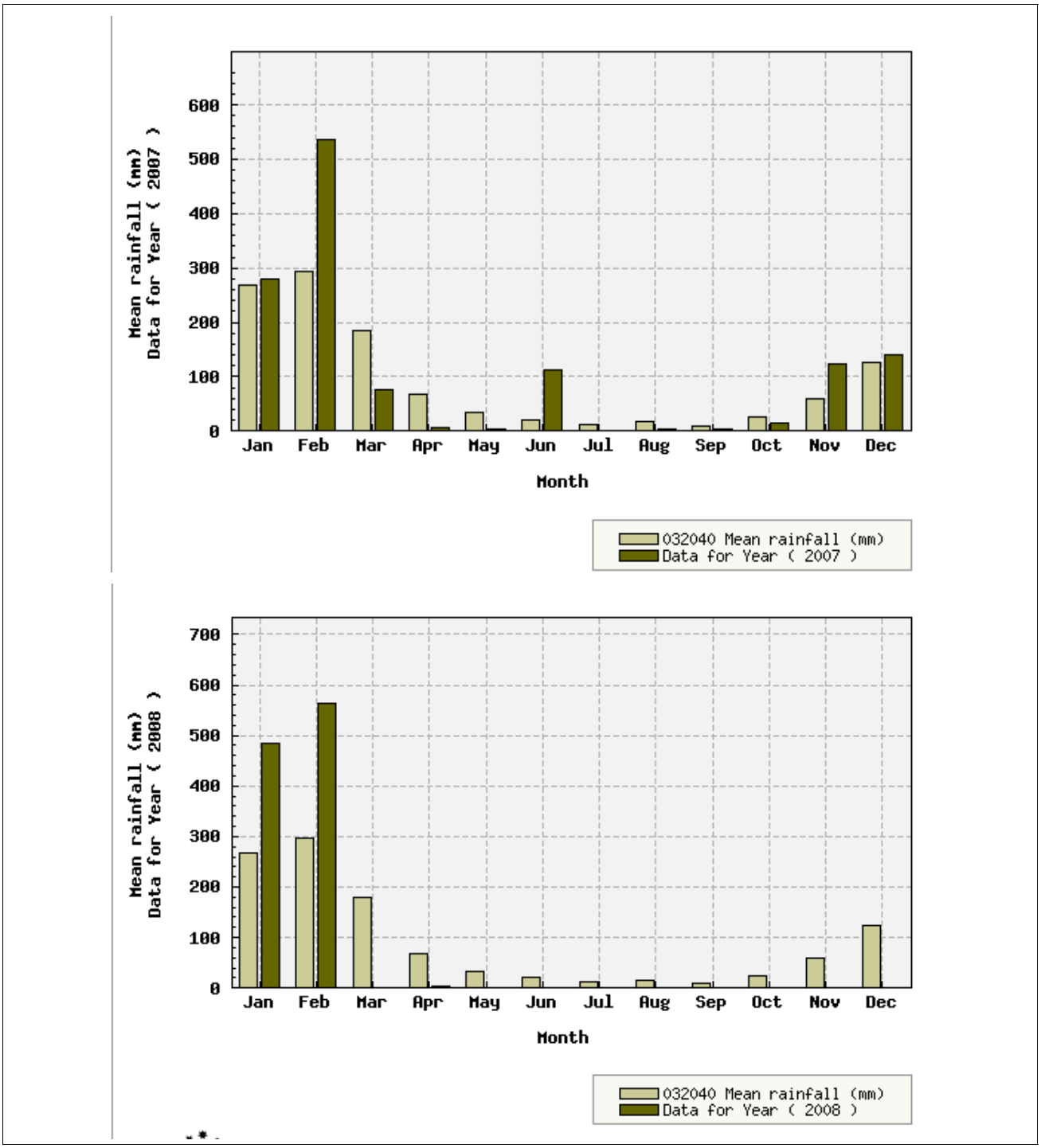

Figure 5: Rainfall Distribution for TSP Monitoring Period (08/07 - 02/08)

Given the comparability of meteorological conditions throughout most of the monitoring period, monitoring results for TSP are expected to provide a reasonable representation of typical conditions at the Project Site.

3.3.3 Monitoring Results

Monitoring of PM_{10} concentrations at the Berth 10 monitoring station has been underway for a number of years. A summary of data collected at this station was presented in Section 5.3 of the AQA for the period 2000 – June 2007. Monitoring of total suspended particulates at the EPA Coastguard station commenced in August 2007 with no data collected during October due to equipment malfunctions.

Table 3.2 and Figure 6 provide a summary of measured particulate concentrations for the period July 2007 – February 2008 for both the EPA and TPA monitoring stations.

TABLE 3.2: SUMMARY OF PARTICULATE MONITORING RESULTS (PM_{10} AND TSP) – JULY 2007 – FEBRUARY 2008 (ug/m^3)

Month	Berth 10 24-Hour Average PM_{10} Concentrations			Coastguard 24-Hour Average TSP Concentrations		
	Average	90th Percentile	Maximum	Average	90th Percentile	Maximum
July	22.1	26.5	50.5	-	-	-
August	23.2	32.2	36.8	27.7	38.9	44.0
September	19.0	29.1	30.9	23.4	33.0	33.9
October	23.6	44.0	53.6	-	-	-
November	22.9	31.2	35.1	18.8	24.8	28.6
December	18.5	24.9	33.6	17.5	24.5	26.0
January	17.5	29.0	40.3	15.7	24.0	30.6
February	14.2	20.4	23.8	13.5	17.4	20.9
Criteria	50 (NEPM) 150 (EPP Air)			90[a] (EPP Air) 80[b]		

[a] *criteria is defined as an annual average.*
[b] *criteria is not legislated however was suggested for the assessment of nuisance dust impacts in the EPA response to the AQA.*

Review of the data presented in Table 3.2 confirms compliance with the nuisance dust criteria of 80 ug/m^3 referenced in the EPA response to the EIS was achieved for the period August 2007 – February 2008 based on the available monitoring data. For PM_{10} three measurements recorded concentrations greater than the NEPM criteria. It is noted, however, that the NEPM allows for exceedences of the 50 ug/m^3 criteria for 5 days per year at a performance station hence these concentrations do not represent an exceedence of the NEPM criteria. It should also be noted that this criteria is not intended to assess measured ambient concentrations at peak monitoring stations (i.e. those at or near to a source of emissions). Rather, the NEPM standards were established to assess the levels of pollution to which the general population is exposed[2].

[2] *National Environmental Protection (Ambient Air Quality) Measure (2003), Section 13(2)*

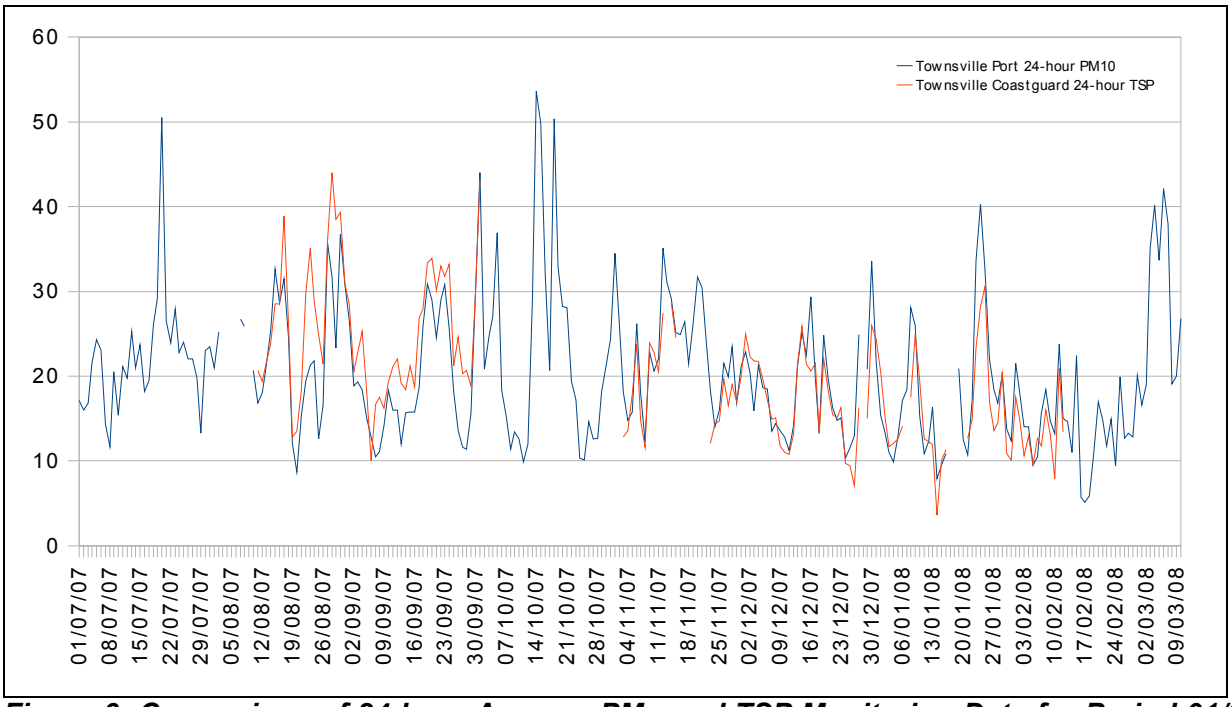

Figure 6: Comparison of 24-hour Average PM_{10} and TSP Monitoring Data for Period 01/07/07 - 09/03/08

Comparison of the daily variation in measured PM_{10} and TSP concentrations at the two monitoring stations as presented in Figure 11 provides a useful analysis. The available monitoring data confirms that for the majority of the time there is only small variation in the concentrations of fine particulates (PM_{10}) and total suspended particulate (TSP) levels at the two monitoring stations. This pattern indicates that the majority of particulate matter being measured by the monitoring stations is being generated by combustion sources rather than bulk material handling sources. For particulates emitted from material handling it could be expected that a significantly larger portion of the sample would be represented in the size fractions larger than 10 µm (i.e. larger than PM_{10})[3]. For combustion processes, particulate emissions are generally much finer with the majority of particulate in the size fractions less than 10 µm (i.e. measured as PM_{10}).

This finding is significant as it indicates that the suspended particulate impact of bulk loading activities at the Port of Townsville on surrounding landuses is limited. Further, it is likely that measured dust levels in the area are comprised of fine particulate from combustion sources including those in operation at the Port (e.g. marine vessels, rail locomotives, road vehicles and industrial heaters) along with other transport sources operating in the Townsville area.

[3] *Richardson, C (April 2000) presented in the Australian Coal Review, p45 – 47.*

4 CONCLUSIONS AND RECOMMENDATIONS

The Townsville Ocean Terminal (TOT) project site (the Project Site) is located on and adjacent to the existing Townsville foreshore and incorporates the existing Port Western Breakwater and the Northern (Offshore) Breakwater, the existing perimeter of the land around the Townsville Hotel and Casino Complex and the Townsville Entertainment Centre.

In response to the EIS prepared for the TOT Project a number of key stakeholders have raised issues regarding the Air Quality Assessment (AQA) undertaken. The focus of these comments is varied although most respondents have identified that the meteorological conditions and activities considered by the air quality monitoring undertaken for the project is not considered to be adequate. The AQA provided a summary of available monitoring data at the time of submission. Since that time further monitoring data has been collected with a summary of the results of the monitoring presented in this report.

The results of the monitoring of suspended particulate levels indicates that the levels of both fine (PM_{10}) and total (TSP) particulate concentrations likely to be experienced at the Project Site are within both the national and state goals and criteria.

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℃.
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.