Air Impact Assessment - Resource Recovery and Recycling Facility (Rutherford, NSW)

January 2006

Transpacific Industries Group Ltd

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2118506A
PR_2562Iss3.doc

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Date: .... 16 January 2005

Distribution: .... internal (electronic)

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Executive summary

Parsons Brinckerhoff (PB) was commissioned by Transpacific Industries Group Ltd to undertake an environmental air impact assessment for the proposed construction and operation of the Rutherford Recovery and Recycling Facility.

The proposed plant incorporates waste oil processing and a vehicle servicing workshop. The facility would store, treat, recycle, recover and transport industrial and biodegradable wastes generated within the region.

Assessment of potential air impacts has been made in accordance with the Department of Environment and Conservation Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (2005).

Existing meteorological conditions for the subject site were assessed. A site-representative meteorological file was also compiled using the CSIRO TAPM model for the year 2001. Measured conditions for the local area Lochinvar (1980) were also adopted in this technical paper.

The existing status of the local air shed had not been classified to date. Indicative background levels for the study area were adopted and regional conditions measured by the DEC Air Monitoring Network (the nearest continuous monitoring station) were applied in the assessment of potential cumulative impacts. Reference was also made to measurements previously carried out by external parties for the region.

Predictive air impact modelling was carried out using the DEC recognised AUSPLUME v6 dispersion model. The US EPA Screen3 model was also used in the assessment of potential air quality impacts from flare emissions.

Process specific air emission rates and air release properties were considered. A conservative methodology was applied throughout.

Total suspended particulates (TSP), particulate matter (PM_{10}), sulphur dioxide (SO_2), and nitrogen dioxide (NO_2) off-site impacts were predicted. A number of specific individual toxic compounds were also considered. Where relevant, incremental and cumulative impact levels at the nearest potentially affected receptors have were determined.

The modelling indicated that no adverse off-site air impacts are expected at the nearest potentially affected sensitive receptors.

Maximum boundary impacts of the toxic compounds considered (Ammonia, Hydrogen Chloride and Cyanide) were noted to be slightly above the adopted guidelines. The levels predicted are not considered a major issue given the conservative nature of the assessment. A more detailed assessment, in the form of a health risk assessment, is not considered warranted in this instance.

No major odour generating activities are proposed for the site. Considering similar operations (Narrangba plant) as a case study for the CFS and oily water treatment and waste oil recovery works, no air impact issues, particularly odour are expected.

A number of stringent controls and management practices are proposed as follows:

- *the CFS reverse pulse filter would reduce particulate emissions to less than 0.03 g/m*^{3}*. Emissions of TSP and* PM_{10} *would be maintained to emission rates below those assumed within this technical paper (1.5 g/s and 1 g/s from the CFS curing structure for TSP and* PM_{10} *respectively)*

- NO_X *and* SO_2 *emission rates for key sources would be verified post commissioning*

- *Nitrogen blankets would be incorporated into the design of the oily water treatment and waste oil recovery process tanks.*

- *a vapour recovery system for the storage tanks of the hydrogenation feed stock that comply with the requirements of the Protection of the Environment Operations (Clean Air) Amendment (Industrial and Commercial Activities and Plant) Regulation 2005. A closed capture water trap system with overflow to an enclosed sump will be implemented. Light ends will be recovered back into the light end fuel tank. The vapour recovery system will be designed and implemented by Transpacific Industries. Further details are not available at this stage. The feed stock tanks will be ducted and vented to a single emission point.*

It is proposed that a performance based approach would be applied during the final design and commissioning of the site. Conceptually, with regard to the presented findings and proposed mitigation measures, the proposed Resource Recovery and Recycling Facility is not expected to result in long-term degradation to the existing air sheds or loss of local amenity is expected.

Post-commissioning source validation measurements would be carried out to verify the conclusions provided within this report.

1. Introduction

1.1 Background

This report has been prepared by Parsons Brinckerhoff (PB) on behalf of Transpacific Industries Group Ltd (Transpacific) to assess the potential air quality impacts of the proposed construction and operation of the Rutherford Recovery and Recycling Facility.

The study has been prepared for inclusion within the Environmental Assessment (EA) being prepared by PB.

This assessment has been completed in accordance with the guidelines presented in the *Approved Methods and Guidance for the Modelling of Air Pollutants in New South Wales* (NSW EPA 2001), and other relevant guidelines.

The report presents the potential for off-site air quality impacts from the proposal based on predictive air quality modelling. The air quality assessment focuses on potential dust and ground level contaminant generation during operations.

Meteorological data, modelling assumptions and model outputs are included within the Appendix section of this report.

1.2 Scope

The scope of works for this study was to prepare an air quality impact assessment for the proposed construction and operation of the Rutherford Recovery and Recycling Facility.

This required completion of the following tasks:

- detail relevant meteorological and air quality conditions for the region
- review the proposed construction works and site operations
- assess potential air emission sources
- provide a detailed assessment of anticipated air quality impacts associated with the proposal
- assess potential impacts against relevant legislation and guidelines
- provide a concise statement of potential air quality impacts.

2. Site description and proposal details

2.1 Site location and surrounding environs

The proposed resource recovery and recycling facility is located at Kyle Street, Rutherford. The site is approximately 10 hectares (25 acres) in size and has dimensions of 435 metres by 235 metres.

The proposed facility would be located within the existing industrial area, zoned 4(a) (General Industry) within the Maitland Local Environmental Plan. The township of Rutherford is 1,500 metres to east. A number of existing receivers are located to the north west, north east and east of the proposed site. The New England Highway lies approximately 250 metres to the north of the subject site.

The study area and nearest potentially affected receivers considered for operational air impacts are shown in *Figure 2.1*. Identified catchment areas adopted within this assessment have been outlined in *Table 2.1*.

Table 2.1: Adopted catchment areas

Catchment	Distance	Bearing	Description
1	≈ 1,300 metres	north west	Receivers A and B
			Dent Street. Elevated receivers
2	≈ 1,000 metres	north west	Receivers C and D
			Located adjacent New England Highway
3	≈ 1,000 metres	south	Receivers E and F
			Isolated semi-rural allotments. Elevated receivers
4	≈ 1,000 metres	south east	Receivers G, H, I and J
			Rutherford South
5	≈ 1,100 metres	north east	Receivers K, L and M
			Rutherford South
6	≈ 1,000 metres	north	Receivers N, O and P
			Anambah

Air catchment areas were identified and selected with consideration to existing land use(s) and potential sources influencing existing background air quality levels.

Each potentially affected receiver is located in the far field zone (an area where plume rise and meandering have fully occurred and site plumes would be well mixed in the vertical plane from ground level to the base of the first temperature inversion).

2.2 Description of proposal

2.2.1 Overview

The proposed plant incorporates waste oil processing and a vehicle servicing workshop. The facility would store, treat, recycle, recover and transport industrial and biodegradable wastes generated within the region.

2.2.2 Construction works

Where possible, components of the proposed development would be constructed and operated within existing site buildings and using existing infrastructure. Renovation of existing buildings and infrastructure would be undertaken. Demolition of existing site infrastructure, including a steel tank, existing waste water treatment facilities, stormwater lagoon and an existing dwelling would be carried out.

Components of the proposed facility that would increase the footprint of the development include soil conditioner and compost manufacture, hydrogenation process, oily water treatment, waste water treatment plant, truck parking, fuel bowsers, truck and tanker wash and tank farms for waste treatments.

2.2.3 Operations

The waste resource recovery and recycling facility would incorporate the following treatment processes:

process 1)	oily water treatment and waste oil recovery
process 2)	treatment of non-sewerable aqueous wastes by neutralisation, chemical fixation, stabilisation and solidification (CFS)
process 3)	hydrogenation of re-refined base lube oils.

The proposed site layout, with each process area identified, is provided as *Figure 2.2*.

Figure 2.1: Study area location and surrounding landscapes

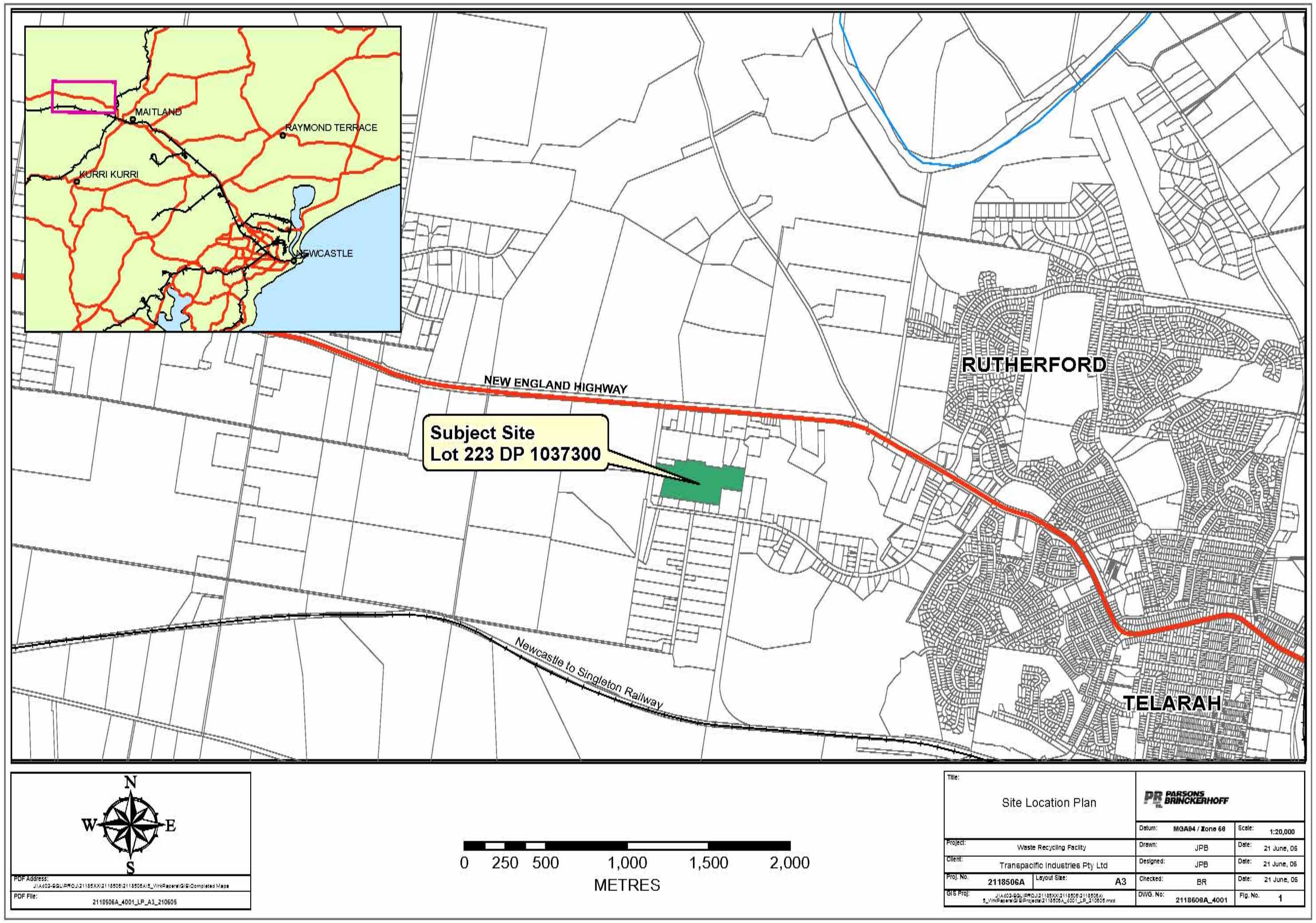
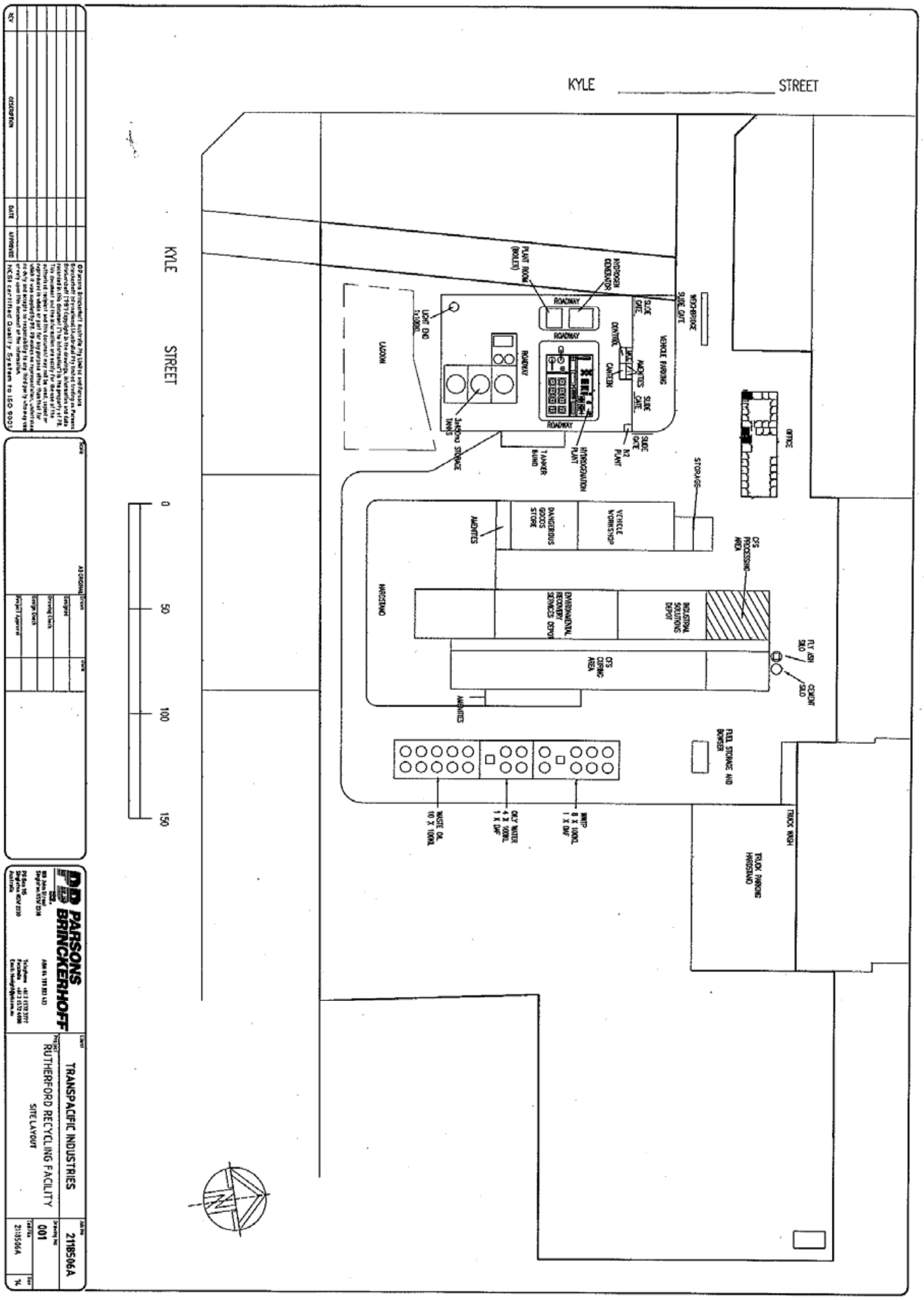


Figure 2.2: Indicative site layout (process areas identified)



3. Existing air quality and dispersion meteorology

3.1 Ambient air quality

3.1.1 Overview

The existing air quality for the Rutherford Region can be characterised as typical of a suburban environment.

The locality includes a combination of rural, residential, commercial and light industrial land uses. No major pollutant generating activities are located within the immediate study area. Local minor sources of air emissions include a combination of general residential activities, light industry, as well as local and arterial roads.

Emissions of motor vehicles would be considered a primary contributor to air pollution for the local setting.

No background air quality monitoring has been undertaken for this technical paper. Monitoring information relating to existing ambient air quality levels is also not available for either the local or regional area.

However, acceptable ranges of particulates, dust, hydrocarbons, oxides of nitrogen and sulphur would be expected throughout the study area for the majority of the time due to the relatively undeveloped nature of the study area and surrounds.

3.1.2 Adopted background levels

Sufficiently detailed background air quality data is not currently available for the local or regional area.

During the site inspections undertaken on the 27 June 2005. Walk over investigations were carried out on a calm day following a cool, clear night. Stable atmospheric conditions were noted. No odours or visible plumes were detected throughout the local area.

No historical information was available or site-specific monitoring undertaken. The data supplied by the DEC Air Monitoring Network has been adopted.

Data measured for the Pacific Highway at Beresfield, near Newcastle (2003) was adopted. The monitoring station is located on the main street (Lawson Street) in a rural residential area. The measured air quality would be influenced by higher traffic flow profiles and increased industrial emissions than expected at Rutherford.

Although the monitoring site is not site specific, it is considered a conservative estimation of typical (or indicative) ambient air environs for the study area. Air quality at Rutherford would be expected to be better than the reported Beresfield data. The data was the best available for use in this technical paper and is considered to be a conservative estimate of baseline conditions.

Monthly averaged data for monitored levels of particulate matter, nitrogen dioxide and sulphur dioxide is provided in *Table 3.1*.

Table 3.1: Adopted background levels (Beresfield, 2003)

Month	**Pollutant**								
	PM_{10} [TEOM] ($\mu g/m^3$) 24-hour average			**NO_2 ($\mu g/m^3$) 1-hour average**			**SO_2 ($\mu g/m^3$) 1-hour average**		
	Avg.	**Max.**	**days > goal**	**Avg.**	**Max.**	**days > goal**	**Avg.**	**Max.**	**days > goal**
January	nd	nd	nd	14.4	55.4	0	2.9	57	0
February	20	39	0	10.3	79.9	0	2.9	119.7	0
March	19	59	1	16.4	51.5	0	2.9	48.5	0
April	16	34	0	20.5	67.7	0	5.7	42.5	0
May	16	30	0	20.5	67.7	0	5.7	199.5	0
June	18	31	0	20.5	67.7	0	5.7	65.6	0
July	17	27	0	22.6	65.6	0	5.7	82.7	0
August	20	35	0	22.6	59.5	0	5.7	65.6	0
September	25	51	1	18.5	82	0	5.7	68.4	0
October	17	88	1	16.4	69.7	0	5.7	59.5	0
November	17	49	0	16.4	67.7	0	5.7	91.2	0
December	20	34	0	10.3	57.4	0	5.7	57	0
NSW GOAL		30			62			60	
Annual Avg.		**18.6**			**18.5**			**5.7**	
NSW GOAL		50			246			570	
Peak		**88**			**82**			**199.5**	

Notes to *Table 3.1*

Source: NSW DEC Air Quality Monitoring Points

PM_{10} = Particulate matter $\leq 10\mu m$ in aerodynamic diameter

NO_2 = nitrogen dioxide

SO_2 =sulfur dioxide

$\mu g/m^3$ = micro grams per cubic metre

TEOM – I hour average

nd – no data

The measured PM_{10} Tapered Element Oscillating Microbalance (TEOM) measurements provide continuous recordings of PM_{10} with 24-averaged measurements reported. The annual average of 18 $\mu g/m^3$ was noted at below the NSW DEC 30 $\mu g/m^3$ long-term reporting goal. A maximum 24 hour average of 88 $\mu g/m^3$ exceeded the 24-hour goal of 50 $\mu g/m^3$. The TEOM measurements indicate that three days on 2003 exceeded the 24-hour PM_{10} goal. Localised sources or regional bushfire conditions are expected to be the cause of this.

A maximum NO_2 level of 85 μg/m^3 was measured during 2003 for the Beresfield monitoring station. The NEPM 1 hour maximum goal of 246 μg/m^3 was achieved. The annual average of 18.5 μg/m^3 readily achieved the goal of 62 μg/m^3.

A maximum SO_2 level of 199.5 μg/m^3 was measured during 2003 for the Beresfield monitoring station. A NEPM 1 hour maximum goal of 570 μg/m^3 was achieved. The annual average of 5.7 μg/m^3 readily achieved the goal of 60 μg/m^3.

Roadside air quality monitoring was collected in 1993 as part of the proposed upgrade of the Pacific Highway (Coolongolook and Possum Brush). The data was collected by Peter Stephenson and Associates, summarised by Holmes Air Sciences and provided in the *Upgrading of the Pacific Highway Environmental Impact Statement (Buladelah), Technical Paper No. 15 – Air Quality Impact Assessment*. While not site specific and is now slightly dated, it provides indicative background levels adjacent to an arterial road with heavy traffic. Measurements were presented at five road side sites along the Pacific Highway and at five backroad locations. Grab samples were taken during peak traffic flows and worst-case dispersion conditions. The results cannot be compared with continuous monitoring data as they do not reflect diurnal changes in traffic flows or varying meteorological conditions. The 1-hour CO levels along the Pacific Highway were measured in the range of 0.4 to 18.4 mg/m^3. Backroad sites were generally lower and all readings were less than half the air quality level of 30 mg/m^3. Congestion and higher fleet CO emissions influence measured levels.

No indicative annual average background TSP data for the Rutherford area is available. Where TSP background data is not available, it is considered good practice to assume a TSP concentration at least double the annual PM10 concentration. An annual TSP background concentration of 40 μg/m^3 was therefore adopted and added to the calculated incremental impacts where applicable.

Similarly, records relating to dust deposition monitoring in vicinity of the proposed works were not available. However, from experience of dust deposition levels in similar receiving environments it is anticipated that existing ambient levels would be less than two grams per square metre per month.

The approach adopted is considered the best available for the purposes of undertaking the contemporaneous assessment.

3.1.3 Industrial sources

Regional

A search of the National Pollution Inventory database (NPI) 2003 – 2004 indicated six industrial sources reporting emissions to the Maintland airshed. Reporting was carried out for a total of 47 substances from 37 industrial sources.

Industrial sources included a vegetable oil manufacturing and bottling plant; bulk petroleum storage site; clay bricks and pavers manufacturer; open cut coal mine; extended aeration / activated sludge process; and biological nutrient removal sewage treatment.

Diffuse data was selected for 32 diffuse sources, such as traffic and agricultural sources, and reported for air emissions.

Indicative key sources for the Maitland air shed included ceramic product manufacturing, motor vehicles and coal mining.

Ambient air quality levels for the regional air sheds are not expected to be adversely influenced by existing industrial sources.

Local

A number of industrial sources are located in the study area that have the potential to influence local air sheds. In particular, a limited number of existing odour sources are located in the Rutherford area.

Correspondence held with the DEC North East Branch (document 273266A1; NEF 18163 dated 23 November 2005) indicated odour sources are present within the locality of the proposed resource recovery and recycling facility site. A summary of premises known to be odour sources which are regulated by the DEC and details regarding odour impact assessment works was provided. Relevant information is provided in *Table 3.2*.

Table 3.2: Summary of Odour Sources in Rutherford Area

Licensee	Activity	Address	Odour assessment information held	DEC Comment
Truegain Pty Ltd	Waste oil refinery	Kyle Street, Rutherford	1. Australian Waste Oil Recyclers - Air Quality Assessment Report - Odour and VOC Modelling - July 2004 2. Advitech - Air Quality Assessment - Source Identification for Australian Waste Oil Recyclers 62 Kyle Street, Rutherford	Documentation held at Newcastle DEC office - application required under Freedom of Information Act to access.
Atlantic Pacific Foods Pty Ltd	Oil Seed processing/margarine manufacture	Gardiner Street, Rutherford	No recent info listed	Known to be a potentially significant odour source
Wax Converters Textiles Pty Ltd	Textile manufacture	Racecourse Road, Rutherford	1. Wax Converters Textiles Pty, Rutherford – Odour Impact Assessment Report 2. Wax Converters Textiles Pty Ltd - NSW EPA Pollution Reduction Program - Stage One - Preliminary Air Quality Assessment - December 2003 3. Wax Converters Textiles P/L - Air Quality Assessment - Reduction Program Stage 2 - July 2004.	Documentation held at Newcastle DEC office - application required under Freedom of Information Act to access. Current and on-going odour issues.
Pioneer Road Services Pty Ltd	Bitumen Hot-mix plant	Gardiners Road, Rutherford	No recent documentation	-
Maitland Saleyards	Livestock Intensive Industry	Kyle Street, Rutherford	No recent documentation	-
Environmental Waste Managers (NSW) Pty Ltd	Waste Activity (HIGAB storage/processing)	Kyle Street, Rutherford	No recent documentation	EIS may be held on file

Table 3.2(ctd): Summary of Odour Sources in Rutherford Area

Licensee	Activity	Address	Odour assessment information held	Comment
National Ceramic Industries Australia Pty Ltd	Ceramic tile manufacture	Racecourse Road, Rutherford	1. HLA-Envirosciences P/L - fax - National Ceramic Industries Australia - Emissions Inventory. Stack emission sources that will be commissioned for Stage 1 operations at the Rutherford facility highlighted in attached figure. 2. National Ceramic Industries - Rutherford Plan - Dispersion Modelling and Validation Report - dated 15 September 2005 3. National Ceramic Industries - Australia P/L – Ceramic Tile Manufacturing Facility at Rutherford - EIS	Documentation held at Newcastle DEC office - application required under Freedom of Information Act to access.

Notes to *Table 3.2*

source DEC document 273266A1; NEF 18163 (dated 23 November 2005)

Of the seven industrial sites listed, four sites do not have recent documentation.

With regard to the Wax Converters Textiles site, the primary author of this technical paper undertook the first two odour assessments for the site. A number of recommendations were implemented on the site as part of a pollution reduction programme.

PB completed the EIS for the National Ceramic Industries Australia site. Review of the Holmes Air Sciences *Air Quality Assessment: Proposed Ceramic Tile Manufacturing Facility at Rutherford* (2002) completed for the EIS indicated the assessment of odour issues (both from the site and cumulative) was not required.

Operations of the proposed Rutherford Waste Resource Recovery and Recycling Facility are noted expected to emit odours beyond the site boundaries. The requirement for quantifying the existing level of odour impact from the industrial sites listed, and undertaking a cumulative odour impact assessment is not required (pers com DEC officers Friday 6 January 2006).

3.2 Existing meteorology

Air quality impacts are influenced by both regional meteorological conditions, primarily in the form of gradient wind flow regimes, and by local conditions, generally driven by topographical features in the form of drainage flows. Topography, wind speed and wind direction all affect the potential dispersion and transport of plumes. An effort to define both the regional and local dispersion meteorology at the project site has been made.

Regional surface wind profiles have been obtained from the observations compiled for Williamtown (Bureau of Meteorology, station #61078). Williamtown is approximately 30 kilometres east of Rutherford. Seasonal and annual wind rose plots have been provided in *Appendix A*.

Review of the wind rose data indicates that wind directions are generally variable throughout each season. Williamtown experiences winds predominately from the southern, north-east and west north-western quadrants on an annual basis. In summer, the winds are predominately from the south-east and north-east. Southerlies predominate in autumn. West north-westerlies are frequent in the winter and spring experiences winds predominately from the north-east.

A site-specific meteorological data file was also configured for Rutherford for the year 2001. The 2001 data was generated through the use of the CSIRO developed TAPM program. Grid spacing nested down to 1,000 metres was applied. This is required to provide a detailed and robust assessment. Annual and seasonal wind rose plots for this file have been included in *Appendix A*. An annual average wind speed of 4.3 m/s was calculated with the primary wind directions from the west and west north-west.

Data measured during 1980 for Lochinvar, and provided by Holmes Air Sciences, indicated winds predominately from the west–north west and north west directions on an annual basis. In the summer, south-south east through east-south east winds flows were dominant. During autumn, an even distribution of winds throughout the north west and south west quadrants were present. North westerly and south easterly winds dominated in spring. North westerly flows were dominate during winter. Wind rose plots for Lochnivar 1980 are provided in *Appendix A*.

The primary seasonal wind flow patterns have similar frequencies to the annual wind rose plot. The site-specific wind rose diagrams are consistent with wind flow regimes for the northern region and generally confirm the reviewed Bureau of Meteorology (BOM) wind rose plots for Williamtown.

A summary of the data used to compile the wind roses and the occurrence of stability classes has been provided in *Appendix A*. and *Appendix B*.

Worse case dispersion conditions from the site (that is, least dispersion) would normally be associated with F-class stability conditions – still / light winds and clear skies during the night time or early morning period (stable conditions). Analysis of the referenced site-specific meteorological data indicates that F-class dispersion conditions were present for approximately 10 percent of the time for the year 2001. E class conditions were present for approximately 22 percent of the time. The high frequency of E and F class stabilities indicates that dispersion conditions would be such that any particulate plumes would disperse slowly for a significant proportion of the time.

3.3 Topography

When assessing the impact potential from a ground level source of air pollutants, it is also important to consider local drainage flows. The movement of cold air down a slope (generally under stable atmospheric conditions) is referred to as katabatic drift and can result in plume entrapment, poor dispersion of air borne pollutants, and the potential to cause greater off-site impacts. Katabatic drift would follow the topography of the site.

The study area generally consists of cleared agricultural land with scattered patches of remnant vegetation and low gently rolling hills (10 - 50 metres in relief).

Although general patterns can be determined with confidence, it is difficult to accurately predict the influence of local drainage flows without detailed site-specific meteorological information. Topographic information available for the site of the proposal indicates that a localised catchment is formed within the site towards Stony Creek and the smaller tributary gullies. Based on this information, it would be reasonable to assume that there is the potential for plume entrapment and minimal horizontal or vertical diffusion in this area.

No further assessment of topographical influences in the fate and transport of air emissions has been made as part of this Technical Paper. Given emissions from the site would comprise low level emission sources, topography is not expected to significantly affect site related air emissions, and impact potential.

4. Adopted standards and guidelines

Air quality goals relevant to the site are presented in this section of the technical paper. Relevant National and New South Wales ambient air quality goals have been adopted. Air quality reporting standards and regional goals are established to protect the health of local communities and minimise potential annoyance.

The identified national goals are based on the recommendations of the National Health and Medical Research Council (NHMRC, 1995) and the National Environmental Protection (Ambient Air Quality) Measure (NEPM, 1998) prepared by the National Environment Protection Authority Council (NEPC). The NEPM goals are long-term reporting descriptors. New South Wales (NSW) ambient air quality goals are provided in the NSW DEC document *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW* (2005).

The adopted standards / goals for this technical paper are presented in *Table 4.1*. Pollutants indicated are each expected to be emitted from the site.

No air quality goals are prescribed for reactive hydrocarbons as air quality guidelines are not specific for reactive species. Reactive species are the key elements in the formation of photochemical smog.

These adopted goals apply to sensitive receptors at site boundaries and beyond. Assessment of impacts also requires an understanding that the air quality at any given receptor may be a composite of emissions from a number of sources which all contribute various proportions to the overall pollutant burden (dependent on the location of the receptor with respect to sources and dispersion conditions).

Further, compliance with the NEPM regional goal requires management and control of all sources and is therefore considered beyond the scope of an individual project. However, large air quality sources (such as the proposed Waste Resource Recovery and Recycling Facility) should be assessed with respect to their influence on regional air quality. This has been qualitatively undertaken within this technical paper with the assessment of annual impacts.

A NEPM “advisory” standard has been established for 24-hour and annual $PM_{2.5}$ concentration levels. However, given the existing “advisory” status of the $PM_{2.5}$ criterion, detailed assessment of impact potential has not been presented in this technical paper.

The 2004 NEPC air toxics NEPM provides a framework for monitoring, assessing and reporting ambient levels of a number of DEC managed air toxics (Formaldehyde, Toluene and Xylenes). Similar with the approach applied to the $PM_{2.5}$ standard, the air toxic goals are “investigation levels” only and do necessarily require detailed assessment.

Table 4.1: Adopted ambient air quality criteria

Pollutants	Averaging period	Goal	Source
Nitrogen dioxide	1 hour maximum	245 $\mu g/m^3$	NEPC, NEPM
	1 hour maximum	200 $\mu g/m^3$	NSW DEC long term reporting goal
	annual mean	62 $\mu g/m^3$	NEPC
Carbon Monoxide	15 minutes	100 mg/m^3	WHO
	1 hour	30 mg/m^3	WHO
	8 hours	10 mg/m^3	NEPC
Sulphur dioxide	10 minute maximum	712 $\mu g/m^3$	NHMRC
	1 hour maximum	570 $\mu g/m^3$	NEPC, NEPM
	1 day	228 $\mu g/m^3$	NEPC, NEPM
	annual mean	60 $\mu g/m^3$	NEPC, NEPM
TSP	annual TSP Concentration	90 $\mu g/m^3$	NHMRC
	annual TSP Deposition[1]	2 g/m^2/month	NERDDC
	annual TSP Deposition[2]	4 g/m^2/month	NERDDC
PM_{10}	annual PM_{10} Concentration	30 $\mu g/m^3$	NSW EPA
	24-hour PM_{10} Concentration	50 $\mu g/m^3$	NEPC, NEPM
Ammonia	1 hour maximum	0.33 mg/m^3	NSW DEC
Hydrogen Chloride	1 hour maximum	0.14 mg/m^3	NSW DEC
Cyanide (as CN)	1 hour maximum	0.09 mg/m^3	NSW DEC
INDIVIDUAL TOXIC AIR POLLUTANTS (selected)			
Lead	annual	0.5 $\mu g/m^3$	NSW DEC
Iron oxide fume	1 hour maximum	0.09 mg/m^3	NSW DEC
Copper fume	1 hour maximum	0.0037 mg/m^3	NSW DEC
Zinc oxide fume	1 hour maximum	0.09 mg/m^3	NSW DEC
Magnesium oxide fumes	1 hour maximum	0.18 mg/m^3	NSW DEC
VOLATILE ORGANIC COMPOUNDS (selected)			
Benzene	1 hour maximum	0.029 mg/m^3	NSW DEC
Ethylbenzene	1 hour maximum	8.0 mg/m^3	NSW DEC

Notes to *Table 4.1*

1 - maximum allowable increase

2 - maximum total deposited level

PM_{10} = Particulate matter $\leq 10\mu m$ in aerodynamic diameter

TSP = Total suspended particulates $\leq 30\mu m$ in aerodynamic diameter

NEPM = National Environment Protection (Ambient Air Quality) Measure

NHMRC = National Health and Medical Research Council

The above values are ambient air quality goals. Wherever possible, cumulative assessment of particulate matter impacts is required.

In assessing short-term impact potential, it should be noted that the 24-hour PM_{10} target specified in the NEPM should not be exceeded on more than five days in a single year.

The Air NEPM state that: the 1 hour NO_2 criterion of 245 $\mu g/m^3$ can be exceeded no more than one day in a single year, the SO_X 1 hour criterion of 570 $\mu g/m^3$ can be exceeded no more than one day in a single year; the SO_X 1 day criterion of 225 $\mu g/m^3$ can be exceeded no more than one day in a single year; and the 24 hour PM_{10} pollutant standard of 50 micrograms per cubic metre cannot be exceeded more than five days in a single year.

The goals established for the selected toxic air pollutants have been based on MSDS information outlined within the MSDS for the hydrogenation feed stock product.

The goals established for volatile organic compounds have been recommended as indicator air quality goals only. The selected volatile compounds allow for qualitative assessment of impact potential and assist in establishing boundary air quality goals for future boundary compliance monitoring works.

5. Air emission sources

Air emission sources for the proposed Resource Recovery and Recycling Facility have been provided in this section of the report. Primary sources of air emission have only been considered for each identified process.

A site layout (indicating process areas) is provided as *Figure 2.2*. Process flow diagrams have been included as *Appendix C* to this technical paper. Where relevant, a summary of process inputs and outputs has been included within this section. Additional information in relation to processes is provided in Section 2 of the Environmental Assessment.

5.1 Oily water treatment and waste oil recovery

Treatment of waste oil would involve the following activities:

- collection and initial dewatering of waste oils
- hydrogenation of re-refined oils to lube oil specification.

Oily waters would initially be filtered from road vehicles into upright, above-ground, settling tanks to allow heat and/or gravity separation of the oil from the water phase. Chemical additives would be added where required to assist the separation process by breaking stable emulsions.

The water phase would then be decanted with the separated oil transferred to the oil storage tanks. Clean effluent would be transferred to the water treatment plant prior to discharge to sewer or re-use on site. Sludge residues separated from the waste oil feedstock would be filter pressed and transferred to the CFS process for further treatment.

Initially, it is expected that up to 300 kL of oily water would be collected per month. The site would have the capacity to store up to 800 kL of waste oil (in four 200 kL tanks).

The waste resource and recovery centre would also be used as a transfer station for used cooking oils. Up to 200 kL per month of cooking oils are expected to be delivered, stored and dispatched from the site. Cooking oils would be contained within sealed drums at all times.

Process inputs and outputs from the oily water treatment and waste oil recovery are provided in *Table 5.1*.

Table 5.1: Oily Water Treatment and Waste Oil Recovery Summary Quantities

	Nature of Waste	Per Day (Litres)	Per Week (Litres)	Per Month (Litres)	Per Year (Litres)	Destination
Incoming	Oily water	42,740	300,000	1,300,000	15,600,000	Oily water treatment
	Waste oil	4,274	30,000	130,000	1,560,000	Waste oil storage transfer tank
	Process waters	15,000	105,000	420,000	5,460,000	Oily water treatment
	Chemical additives	14	100	433	5,200	Chemical storage area WWTP
Outgoing	Waste oil	2,351	16,500	71,500	858,000	Offsite for treatment
	Recovered water	42,740	300,000	1,300,000	15,600,000	WWTP
	Sludge residues	2,351	16,500	71,500	858,000	CFS process
	Metal wastes	1,420	10,000	40,000	520,000	Disposal to landfill

VOCs, and to a lesser degree odours, may be emitted from the oily water collection, treatment, and storage systems through volatilisation or organic compounds at the liquid surface. Emissions can occur by diffusive or convective mechanisms, or both. Diffusion occurs when organic concentrations at the water surface are much higher than ambient concentrations. The organics volatilise, or diffuse into the air, in an attempt to reach equilibrium between aqueous and vapour phases. Convection occurs when air flows over a water surface, sweeping organic vapours from the water surface into the air. The rate of volatilisation relates directly to the speed of the air flow over a surface.

Other factors that can affect the rate of volatilisation include surface area, turbulence, retention times, concentration of organic compounds in the waste water and their physical properties such as volatility (VOCs vary in volatility) and diffusivity, the presence of a mechanism that inhibits volatilisation (such as an oil film) or a competing mechanism such as biodegradation.

Storage of product in drums and tanks will result in air emissions from venting. Venting is required to prevent the creation of excessive pressure or vacuum inside fixed roof tanks.

5.1.1 Comment on VOC Emission Potential

Tanks associated with the oily water and waste oil treatment recovery works would contain minor components of VOC compounds only.

Due to the minor quantities of VOC compounds expected, and relatively low vapour pressure of the oils contained in the mix, emissions during discharge and at fill have not been considered further within this document.

The oily water and waste oil treatment recovery process tanks would be designed to meet relevant Australian Standards and Regulations for vent emissions. It is recommended that the requirements of the *Protection of the Environment Operations (Clean Air) Amendment (Industrial and Commercial Activities and Plant) Regulation 2005* be adhered to.

Control options to manage VOC emissions have been provided (Section 7.1.3).

5.2 CFS

Treatment of non-sewerable aqueous wastes by neutralisation, chemical fixation, stabilisation and solidification (CFS) would be carried out on the site for non-sewerable wastes and sludges. The process immobilises the waste by chemical bonding to produce a stable inert medium.

Lime-based and cement based fixation technologies would be adopted to promote precipitation, enhance solidifying curing reactions and increase binding between the waste and solidifying reagents.

The CFS operations would process up to 1,500 kL of industrial wastes per month over a 10 to 12 hour operational day.

The CFS process includes the four stages listed (a process flow diagram is included in *Appendix C*.

- Stage 1 – Pre-screening

  Prior to approval, assessment of waste proposed to be disposed at the facility would be carried out.

- Stage 2 – Receival

  On arrival, quality assurance / quality control procedures are undertaken. Wastes would be then transferred to treatment cells and storage tanks.

- Stage 3 – Fixation

  Soluble metals are precipitated out as insoluble compounds. Supernatant liquid and sludge residue is produced during fixation. The supernatant would be transferred to the Water Treatment Plant for further processing and filtration. The sludge (containing insoluble metal compounds) would be pumped to the filter press for dewatering prior to solidification.

  Transfer of material from the treatment and processing areas would be undertaken in a closed system with the receival tanks including ventilation extraction and neutralising scrubbers where required.

- Stage 4 – Solidification

  Solidification mechanically binds the dewatered insoluble metal solids using chemical additives such as fly ash and cement. Mixing would be carried out with a backhoe or auger system with dry chemical additives feed by hopper through sealed air slides.

Curing would be then carried out for a seven to ten day period. Conveyor belts and front end loaders handle and place the material during curing.

After curing, the solid material is disposed to landfill.

It is proposed that the CFS plant would operate seven days per week from 6am to 9pm.

The proposed maximum throughput of the CFS plant would be 52,000 tonnes per year or approximately 1,000 tonnes per week.

Process inputs and outputs from the CFS process are provided in *Table 5.2*.

Table 5.2: CFS Process Summary Quantities

	Nature of Waste	Per Day (tonnes)	Per Week (tonnes)	Per Month (tonnes)	Per Year (tonnes)	Destination
Incoming	Non sewerable aqueous wastes & sludges from clients & onsite activities	71	500	2,167	26,000	In ground pits or storage tanks
	Phase separating chemicals	36	250	1,083	13,000	Chemical storage area CFS plant
	Cement & lime (chemical fixation & stabilisation)	9	50	217	2,600	Silo & lime storage tank
	Electricity	80 kilowatt hrs	560 kilowatt hrs	2,240 kilowatt hrs	26,880 kilowatt hrs	Pumps, instruments, controls etc
Outgoing	Supernatant liquid	57	400	1,733	20,800	WWTP
	Fixated material	91	500	2,167	26,000	Disposal to landfill
	Emissions	unquantified				Atmosphere

Emissions would occur within the CFS Mixing Area and CFS Processing Area. The emission of air contaminants would be expected to be the greatest during the Stage 3 and Stage 4 processes.

Particulate matter and vapours produced within the mixing cells would be captured by an exhaust system and feed back to the storage silos.

The processing of materials would be carried out within the internal confines of the on-site structures.

The CFS processing area would be ventilated with an extraction system designed and installed by Dustcotech and similar to the extraction system used within Transpacific's

Narangba plant. Captured air from the processing area would be collected by extraction and directed to a reverse pulse air filter with collected dust deposited within the silo beneath.

The CFS curing area would be maintained at static conditions within the building (no forced air flow or induced pressure differentials).

Air quality impacts of most relevance to the proposed CFS process would be particulate matter releases caused by the internal handling and processing of bulk material and a number of chemical contaminant trace compounds.

In calculating the relevant emission factors, typical process conditions (operating times, material handling rates) were set in accordance with anticipated maximum site operations. This allowed for a worse case dispersion model to be established for the proposed operations.

Emissions into the surrounding environment would occur from two categories of sources: process and fugitive. Fugitive sources relate to external sources of the site such as trafficable areas, car parks and external handling of waste materials. Process sources include all those emissions that are vented directly to the atmosphere from a fixed emission point.

In attempting to characterise emissions and evaluate the control alternatives, potential air emission sources can be classified into several groups. The first group includes external emission sources, which are characterised by direct release from the operations to the atmosphere. These emission points are typically outside enclosures or within partial enclosures, and emissions are quickly dispersed by wind currents around the structure. Another group of sources are process emission sources that may or may not be vented to the atmosphere and include material sorting and internal handling operations. These operations are typically located inside the building structure. Dust would be released directly from these operations to the internal environment with associated emission potential minimised as a result.

5.2.1 CFS processing

CFS processing is undertaken internally inside the building structure.

The main generation of emissions would be attributable to the exhaust vent. All associated CFS process emissions would be captured, vented, filtered and collected prior to atmospheric release.

Emissions from the CFS processing operations were assumed to be restricted to a single dedicated emission point located at the CFS processing silo. Emissions would be expected to exhaust plumes with similar characteristics as a wake affected point source.

Emission rates from the CFS processing area were based on information provided by Dustcotech. The Flyash silo would be fitted with a silovent filter to handle tanker filling air discharge. Dust suppression and extraction would be implemented within the mixing pits flyash filling process. A movable cover would be placed in the mixing pits to enclose each pit whilst being filled with flyash via the air slides.

The silo venting and dust extraction from the pit would be handled by a single silo mounted reverse pulsejet Dust Collector mounted on the silo top. This allows collected dust to be immediately returned to the flyash silo beneath. The Dust Collector would be a Model DCTBV72EXSM complete with fan and discharge attenuator. The following parameters have been provided by Dustcotech:

- Discharge emissions from Dust Collector - <30 mg/Nm^3
- Capture velocity at open areas of pit hood (when in position) - 1.7 m/s

Hood size based on 4.1m x 4.1m with 75mm clearance (open area x 4 sides)

Key specifications for the CFS processing dust extraction system are consistent with the following:

Table 5.2: Specifications for CFS Dust Extraction System

Parameter	**Description**
Model	DCTBV72EXSM (Dust Extraction and Silo Venting Unit)
Type	'ICS' Reverse pulsejet.
Capacity	2.1m^3/s
Filtration area and Filter Quantity	72m^2 – 28 off DCT ES1200/150 IV filters.™
Filtration Media	Non-woven spunbond polyester for optimum dust release and performance on fine and hygroscopic dusts.
Filtration Efficiency	40.1% 0.3 - 0.5 µm 52.4% 0.5 - 1 µm 86.0% 1 - 2 µm At 0.05ms-1 superficial velocity 99.0% 2 - 5 µm 100.0% > 5 µm
Superficial Velocity	0.029m/s
Control system	Mecair MCS - differential pressure actuated sequential timer. Sophisticated algorithm provides proportional control of pause time with respect to filter differential pressure. All time digital readout, 4-20mA facility fully interface able with PLC, 2 high differential pressure alarm set points (switching), shut down cleaning and breakdown diagnostics.
Filter Changing	Tool free via hinged lid assembly.
Fan Set	Aerovent BLI530/90 Arrangement 4, direct drive, 11kW, 2P, 415V AC 3 Phase, IP55 Teco Monarch motor, opposing louvre damper & silencer (80dBA at 1 metre). Case hot dipped galvanised complying with AS4680:1999. Fan mounted on side of collector. Duty: 2.1m3/s at -3.35kPa (Fan curve available on request).
Duct work	For extraction from 3 – 4 mixing pits
Type	Spiral lock seam
Dimensions	356 diameter
Moveable Pit hood cover	
Dimensions	Approximately 4.1m x 4.1m

Details of the dust extraction system is provided in *Appendix D*.

The calculation of the particulate matter emission rates was based on the minimum requirements specified by Dustcotech in conjunction with the air flow rates set as part of the filtration system design parameters. The adopted emission rates would be lower than the minimum requirements specified within the amended *Protection of the Environment Operations (Clean Air) Amendment (Industrial and Commercial Activities and Plant) Regulation* 2005.

Worse case emission rates from the CFS Process Area reverse pulse dust collector would be expected to be consistent with the following:

- TSP - Flow Rate of 2.1 m^3/s x Concentration of 0.03 g/m^3

  - indicative emission rate of 0.063 g/s

- PM_{10} - Flow Rate of 2.1 m^3/s x Concentration of 0.03 g/m^3 x 0.75

  (PM_{10} emissions conservatively assumed at a value of 75% total suspended particulate emission rates)

  - indicative emission rate of 0.047 g/s

Post commissioning validation of the above estimates would be undertaken.

An emission height of 8 metres was assumed with a diameter of 450 millimetres and a horizontal emission profile.

Emissions of compounds such as Ammonia, Hydrogen Chloride and Cyanide may also occur. Emissions of these compounds would be short term events only and are considered an occupational health and safety (OHS) issue rather than a key environmental air issue.

Fugitive emissions from the CFS processing area may occur. Release from the open access door have been assumed for the purposes of this assessment. Occupational health and safety time weighted average (TWA) concentrations (in mg/m^3) have been multiplied by an indicative air flow rate from the access door opening of 10 m^3/s to obtain worse case emission rates. TWA values have been adopted from the National Occupational Health and Safety Council (NOHSC).

The following compound specific CFS process area emissions have been adopted:

- Ammonia - NOHSC TWA 17 mg/m^3
  - indicative emission rate of 0.17 g/s (0.017 g/m^3 x 10 m^3/s)
- Hydrogen Chloride - NOHSC TWA 7.5 mg/m^3
  - indicative emission rate of 0.075 g/s (0.0075 g/m^3 x 10 m^3/s)
- Cyanide - NOHSC TWA 5 mg/m^3
  - indicative emission rate of 0.05 g/s (0.005 g/m^3 x 10 m^3/s)

More detailed assessment of the release of the above compounds is not considered warranted.

5.2.2 CFS curing

Emissions from the CFS curing area and fugitive emissions from the CFS processing area have not been measured for this study. A similar operation suitable for obtaining suitable source measurements was not available for sampling at the writing of this report.

Given the limitations in source measurement, a maximum allowable dust emission rate from the CFS curing area has been adopted. Transpacific Industries would implement control options and management practices to achieve the adopted whole of structure dust emission rates.

The CFS curing area was set as a line volume source with a height of 10 metres, initial horizontal spread of 40 metres and an initial vertical spread of 2.5 metres. This was carried out in an effort to determine emission profiles from upper ridge line venting or similar).

Emission rates adopted were consistent with:

- TSP - 1.5 g/s
- PM_{10} - 1 g/s

Constant (24 hours a day, seven days per week) emissions were established.

The assumed emission rates would be reasonably expected from the CFS Curing area. The assessment aims to demonstrate that by limiting emissions to the adopted values, adverse impacts to the local ambient air sheds would not occur.

5.3 Hydrogenation of re-refined base lube oils

An electrolytic hydrogen plant would be established in order to manufacture hydrogen on site. Hydrogen would be produced for the hydrogenation process while oxygen would be vented to atmosphere. The hydrogenation plant would house a boiler with emissions flared off. Hydrogenation is a desulphurisation process where, in the presence of a catalyst, the sulphur is removed to form hydrogen sulphide (H_2S) and hydrogen is attached to the open bonds to saturate and stabilise the material. The process takes place at temperature approaching 400°C and pressures of up to 3,500 kPa. The gases produced, including methane, ethane and propane, along with the hydrogen sulphide, are utilised to provide the heat required for the reaction.

The process consists of a gas fired heater to heat the oil, which is then fed into the reactor along with the re-cycled hydrogen. The oil, excess hydrogen and off-gases are then cooled. The gas is re-cycled via a compressor and a controlled amount of off-gas is purged from the system to maintain the required hydrogen concentration. The desulphurised oil is drained from the high-pressure system and fed through a vacuum stripper to remove all hydrogen, hydrogen sulphide and light-ends. The light-ends, or low-flash material plus the off-gases are used as the energy source in the fired heater. An incinerator is provided as a standby to allow for an alternative disposal route should the fired heater need to be shut down.

The proposed hydrogenation plant would use a range of raw materials in the process. Summary of quantities input and output have provided by Transpacific from the U.S. based Pietermaritzburg plant supplier. Summary of quantities of Hydrogenation and the Hydrogen Plant are provided in *Table 5.6* and *Table 5.7.*

Table 5.6: Input Quantities – Hydrogenation and Hydrogen Plant

Process	Stream	Units	Per Hour	Comments
In HgP	Pre-treated lubes	tonnes	4	To be hydrogenated at 0.6% to 0.4% Sulphur content - $5m^3/h$
Out H2P - In HgP	Hydrogen	kg	18	For hydrogenation - fresh feed 200Nm3/h
In HgP & H2P	Electricity	kW	300	At 400kVA - HGP, H2P and services
In HgP & H2P	Potable Water	m3	4.60	Cooling tower evap&blowdown, boiler, steam gen, dosing
In HgP & H2P	Cooling water	kW	2,000	Closed loop $210m^3/h$ evaporative cooling tower system
In HgP & H2P	Demin water	m3	0.1	HGP water dose for soluble salts (2% of feed)
In HgP	Nat gas (88% Met)	GJ	6	Fired heater burner, boiler and flare pilot.
In HgP	Steam (10barG)	kg	2,000	Vacuum stripper heater and vacuum ejectors
In HgP	Nitrogen (avg)	kg	7	Safety purge (shut & maint) and tank blanket.
In HgP	Catalyst	m3	-	Replenishing deactivated catalyst (1.5 / year each)
In H2P	Nat gas (88% Met)	GJ	5	Reforming gas and reformer burner.
In H2P	Steam (20barG)	kg	300	Reforming steam.
In H2P	Catalyst	m3	-	Reformer,ShiftCon, HydSul deactivated (1 / year each)
In HgP & H2P	Air	kPa	1,200	Instrument air required for actuator and control valves

Notes to *Table 5.6*

HgP - Hydrogenation Plant

H2P - Hydrogen Plant\

The design capacity of the plant would be a nominal 2700 tonnes per month of final product. This would require a feed in-take of 3000 tonnes of pre-processed used lube oils. The process is a continuous operation running 24 hours per day. Storage tanks would consist of 8 x 100 kL feed stock and 4 finished product.

Table 5.7: Output Quantities – Hydrogenation and Hydrogen Plant

Process	Stream	Units	Per Hour	Comments
Out HgP & H2P	Cooling tower vap	m^3	3	Evaporative loss
Out HgP & H2P	Effluent water	m^3	0.9	Cooling water blow-down (30%) - to sewer
Hydrogenation plant				
Final product	Base lube	tonnes	3.87	90% yield - To storage tanks - final product 0.1% Sulphur
By product	Light ends	tonnes	0.301	7% yield - To storage tanks - final product
Emission	TOTAL Sulphur	kg	8.6	TOTAL Sulphur removed from lubes (0.6% to 0.4%) into TOTAL off gas and water
Effluent stream	Sulphur in sour water	kg	0.43	Sulphur removed in sour water 5% soluble (TOTAL 0.6% to 0.1%)
Emission	Sulphur in off gas	kg	8.17	Sulphur removed in off gas 95% (TOTAL 0.6% to 0.1%)
Emission	TOTAL Off gas burnt	kg	51.6	Is 1.2% of TOTAL throughput. Fired heater fuel 100%, flare 0%.
Effluent stream	TOTAL Sour water volume	kg	380	HP & LP seperators - to effluent handling facility.
Fired heater	Air Emission - SO_2	g/Nm^3	11	Process oil heater - Off gas fired - 100% of TOTAL off gas - 2000MJ/hr required
	Air Emission - CO_2	g/Nm^3	140	
	Air Emission - N_2	g/Nm^3	1002	
	Air Emission - H_2O	g/Nm^3	142	
	Air Emission - O_2	g/Nm^3	83	
Plant flare	Air Emission - SO_2	g/Nm^3	0	Plant flare – for emergency, start-up & shut down imbalance. Permanent natural gas pilot
	Air Emission - CO_2	g/Nm^3	102	
	Air Emission - N_2	g/Nm^3	945	
	Air Emission - H_2O	g/Nm^3	75	
	Air Emission - O_2	g/Nm^3	141	
Stripper	Condensate	kg	1000	Recycled from stripper heat exchanger.
Reactor	Catalyst	m^3		Deactivated catalyst as above to catalyst recycling facility
Natural gas and steam reforming hydrogen plant.				
Reformer burner	Air Emission - N_2	g/Nm^3	919	Reformer burner - natural gas fired to atmosphere
	Air Emission - H_2O	g/Nm^3	117	
	Air Emission - O_2	g/Nm^3	55	
Generator	Air Emission - N_2	g/Nm^3	919	Reformer steam gen - natural gas fired burner to atmos
	Air Emission - H_2O	g/Nm^3	117	
	Air Emission - O_2	g/Nm^3	55	
	Effluent water	kg	15	Reformer steam generator blow down (5%) - to sewer
Reformed gas	Water	kg	100	Condensed steam from chemical process
Reactors	Catalyst	m^3		Deactivated catalyst as above to catalyst recycling facility
Plant steam boiler				
Steam boiler	Air Emission - N_2	g/Nm^3	919	Boiler stack - natural gas
	Air Emission - H_2O	g/Nm^3	117	
	Air Emission - O_2	g/Nm^3	55	
	Effluent water	kg	100	Blow-down (5%) - to sewer

Note to *Table 5.7*:

The data provided reflects the South African process that uses waste oil (approximately 3 percent off gas). This does not equate to using refined oils as proposed at the Rutherford site. Emissions from Rutherford would be better than listed above.

5.3.1 Comment on Air Emissions From Hydrogenation Process

Feed stock for the hydrogenation process will be sourced from the Nationwide Oil Pty Ltd Wetherill Park site. The feed stock is pre-processed petroleum hydrocarbon. A Material Safety Data Sheet (MSDS) is provided in *Appendix E*.

The product is a mixture of paraffins and cycloparrafins with carbon numbers predominately in the range of C22 – C26. It may also contain small quantities of sulphur and nitrogen compounds and additive packages such as antioxidants, corrosion inhibitors, and proprietary performance enhancing additives.

Chemical properties, and associated emission rates, of the pre-processed feed stock are provided in *Table 5.8*.

Table 5.8: Hydorgenation Feed Stock Oil Emissions

Substance	Concentration		Flow Rate (m^3/s)	Calculated Emission Rate (g/s)
	ppm	g/m^3		
Vanadium	< 1	< 0.02	Not assessed as no DEC criteria	
Iron	< 10	< 0.24	0.186 m^3/s	0.04
Lead	< 10	< 0.90	0.186 m^3/s	0.17
Sodium	< 10	< 0.10	Not assessed as no DEC criteria	
Silicon	< 100	< 1.22	Not assessed as no DEC criteria	
Copper	< 1	< 0.03	0.186 m^3/s	0.006
Zinc	< 10	< 0.28	0.186 m^3/s	0.05
Calcium	< 100	< 1.73	Not assessed as no DEC criteria	
Potassium	< 10	< 0.17	Not assessed as no DEC criteria	
Magnesium	< 10	< 0.11	0.186 m^3/s	0.02
PCBs	0	0	Not assessed as there are no PCBs in product	

Notes to *Table 5.8*

Upper limiting emission rates based on flow rate of fired heater (approx 671 Nm^3/hr)

5.3.2 Comment on Storage Tank VOC Emissions

Tank venting would occur that includes trace amounts of VOC compounds from the oil feed stock and product. The recovered waste oil, processed by distillation to remove light fractions and water, will contain minor concentrations of VOCs only.

5.3.2.1 Fugitive Emission

Assessment of air emissions of the oily water treatment and waste oil recovery process tanks have not been considered as part of this technical paper. Significant emissions from VOCs are not expected.

US EPA, Document AP42 – Chapter 4.7 *Waste Solvent Reclamation* indicated that VOC emission rates form storage tank venting is in the order of 0.01 kg/Mg from a storage tank of fixed roof design.

A 200 kL tank, with typical liquid specific gravity of 0.8, would equate to a weight of approximately 160 tonnes (80 Mg). VOC emissions in the order of 1.6 kg may occur per tank from venting.

Over a 24 hour period, this would be expected to result in emissions less than 0.019 g/s. The fugitive emissions would be expected to oxidise and volatilise quickly upon release to atmosphere. Boundary impacts, and particularly loss of residential air quality at an approximate distance of 1,000 metres, are not expected.

5.3.2.2 Emissions During Fill

The potential for displacement of air at fill of the hydrogenation feed stock tanks may result in short term impacts of volatile compounds.

Control options which are consistent with the requirements of the *Protection of the Environment Operations (Clean Air) Amendment (Industrial and Commercial Activities and Plant) Regulation 2005* have been proposed to manage VOC emissions (see Section 7.3.2).

5.3.3 Key SO_X emissions

Emissions of SO_X (emissions using lube oil as feed stock) have been considered in detail as part of this air impact assessment. SO_2 would be produced in the hydrogenation plant from the combustion of hydrogen sulphide.

Emissions of CO_2, H_2O and N_2 would also be vented to atmosphere. These have not been considered further within this technical paper given their limited potential for local air quality degradation.

The following SO_2 emission rates have been provided by Transpacific Industries:

Fired Heater:	SO_X emission factor of 11g/Nm^3, flow rate of approx 671 Nm^3/hr
	SO_X emission rate of **2.1 g/s**
	Set at 16 metres high, with a diameter of 0.2 metres, exit air velocity of 12.67 m/s and flare temperature of 250 °C.
Plant Flare:	No SO_X emissions

5.3.4 Flare stack emissions

The flare will operate only during start up and shut down operations (and potentially process imbalances). The start-up and shut-down durations would be expected to be 3 to 6 hours. After the commissioning and testing period, this would be expected to occur at most once per month.

In calculating the potential air emission rates for the operations of the flare stack, the US EPA document *AP42, compilation of air emission factors* was referenced. Chapter 13.5 outlines air emissions associated with industrial flares.

Since flares do not lend themselves to conventional emission testing techniques, only a few attempts have been made to characterise flare emissions. This resulted in an Emission Factor Rating of B being applied by the US EPA to the works undertaken in the compiling of Chapter 13.5.

Emissions from flaring include carbon particles (soot), not considered as part of this assessment due to the minimal potential adverse off-site impact, unburnt hydrocarbons, CO, and other partially burned and altered hydrocarbons (*US EPA, Document AP42 – Chapter 13.5*).

Nitrogen oxides are also produced due to the fixation of atmospheric nitrogen with oxygen, or by the reaction between the hydrocarbon radicals present in the combustion products and atmospheric nitrogen.

The degree of combustion depends largely on the rate and extent of fuel-air mixing and on the flame temperatures achieved and maintained.

AP42 states that properly operated flares achieve at least 98 percent combustion efficiency in the flare plume, meaning that hydrocarbon and CO emissions amount to less than 2 percent of hydrocarbons in the gas stream.

Odour emissions from the flare stack have not been considered as these would be negligible.

A flow value of 0.75 m^3/s (manufacturer's supplied data) has been assumed in the calculation of the emission rates associated with the flare. The burn rate of the flare stack has also been assumed at a value of 30 MJ/m^3.

The flare stack was set at 16 metres high, with a diameter of 0.445 metres, exit air velocity of 9.75 m/s and flare temperature of 400 °C. The flare stack was set as a single wake affected emission point.

Table 5.9: Flare stack emission rates

Substance	Flare Burn Rate	Emission Factor	Emission Rate	Flare Stack Flow Rate	Calculated Emission Rate
Carbon Monoxide	30 MJ/m^3	0.17 g/MJ	5.1 g/m^3	0.75 m^3/s	3.8 g/s
NO_X	30 MJ/m3	0.031 g/MJ	0.93 g/m^3	0.75 m^3/s	0.7 g/s

Notes to *Table 5.9*

sourced from Table 13.5-1, AP42 Chapter 13.5

Emissions of soots from the flare have not been considered further as these would be negligible.

5.3.4.1 Comment on Flare Emissions

The flare will operate only during start up and shut down operations (and potentially process imbalances). The start-up and shut-down durations would be expected to be 3 to 6 hours. After the commissioning and testing period, this would be expected to occur at most once per month.

The product from Wetherill Park is understood to nominally contain 1.2 percent of product that will come off as off gas, with the maximum expected by the equipment suppliers FSS for the pre-refined oil is 1.5 percent.

The waste oil heater is capable of utilising off gas from up to 2 percent of the feed stock.

It is important to note that apart from start up and shut down (and the occasional process imbalance) continuous operation of the flare is not expected.

5.3.5 Boiler emissions

NO_X emissions from the operations of the proposed boiler that services the Hydrogenation Plant have been assessed. These combustion processes would emit gaseous products through a single point source into the atmosphere. Based on estimates provided, a boiler of approximately 2.5 MW is proposed. The boiler in turn would be used to produce steam. Various gaseous emissions can be expected as a result. The use of natural gas is proposed as it is the cleanest burning fuel source available.

The heights of the exhaust from the boiler would be a minimum of 12 metres above ground level. The discharge velocity has been indicated at 17 m/sec and exhaust temperature of 250 °C.

The 2.5 MW boiler would be classified as 'small' (with 'small' defined as consisting of boilers between the size range 0.3 to 100 MW). The emissions of NO_X are proportional to the energy consumption of the boiler. Average daily gas usage has been assumed to be a maximum of 134 GJ per day.

The primary boiler would have an emission rate of approximately 601 m^3/hr (0.17 m^3/s). Adopting the *Protection of the Environment Operations (Clean Air) Amendment (Industrial and Commercial Activities and Plant) Regulation* 2005 maximum allowable emission rate specified in Schedule 4 of 350 mg/m^3, a NO_X emission rate of 0.05 g/s or lower would need to be achieved.

Emissions from the second boiler in the utilities building (300 kW unit) were conservatively established with parameters consistent with those for the primary unit.

NO_X emissions have been considered from two on-site boilers. A worse case NO_X emission value of 0.05 g/s has been adopted for both boilers in this assessment.

Emissions of SO_2 and CO from the boiler have not been assessed. SO_2 and CO emissions would be expected to be negligible due to the combustion of natural gas and relatively small output. The boiler would not be a primary contributor to SO_2 and CO emissions.

Transpacific would ensure the boiler sourced has a NO_X emission rate at or below the value adopted in this study.

5.4 Mobile sources

5.4.1 Gaseous Emissions

Emissions are likely to be associated with diesel fuel and petroleum. The operation of on-site machinery during the construction works and general site operations would generate carbon monoxide, carbon dioxide, oxides of nitrogen, sulphides and trace amounts of non-combustible hydrocarbons.

Emission rates and impact potential depend on the power output of the combustion engines, quality of the fuel and condition of the combustion engines.

The contractors and site management would ensure that all equipment does not release smoke in contravention of the *Protection of the Environment Operations (Clean Air) Amendment (Industrial and Commercial Activities and Plant) Regulation* 2005.

Slight odours may be detectable close to the source(s) and at the site boundaries. Based on the setting of the subject site, relatively minor number of mobile sources, existing ambient air quality characteristics, low population density in the vicinity of the study area, anticipated location of potential sources and short term nature of emissions, the potential for impacts from vehicle emissions is minimal.

Provided that the site (and associated contractors) meet the requirements of relevant legislation and regulations, emissions from vehicles are unlikely to result in air quality impacts, and are not considered further.

Further consideration of exhaust emissions from the on-site mobile sources has not been considered warranted.

5.4.2 Particulate Emissions

Particulate emissions may be associated with the site due to vehicles traveling over the paved yard surface. Particulate emissions from paved roads are due to direct exhaust from vehicles and re-suspension of loose material on the road surface. In general terms, particulate emissions from paved roads originate from the loose material present on the surface. In turn, the surface loading, as it is moved or removed, is continuously replenished by other sources.

Dust emissions from paved roads have been found to vary with what is termed the ‘silt loading’ present on the road surface as well as the average weight of vehicles travelling the road.

Although vehicle movements along the sealed internal roadways were not considered as having the potential to cause elevated particulate matter plumes. Particulate matter emissions, and the associated potential off-site impacts, have been considered further as part of this study.

The modelling undertaken for the proposed upgrade of operations assumed constant emissions.

Table 5.10: Internal Hardstand Emission Factors Adopted

Source	Emission Factor		Units
	TSP	PM_{10}	
Mobile Movements [1]	59.3	11.4	g/VKT †

Notes to *Table 5.10*:

† - Vehicle Kilometres Travelled

1 - sourced from AP 42 Chapter 13.2.1

In calculating the dust generated from the identified source(s), several assumptions were necessary. These include:

- Road Surface Silt Loading ≈ 0.5 g/m^2 (limited access)
- Average Vehicle Weight ≈ 10 tonnes
- Potential for 24 hours of operation each day

However, the relatively infrequent use of internal haul roads by heavy vehicles, the low speeds generated during movement along the access roads, the small distances of the access roads and the construction method and maintenance of the roadways would minimise suspension of particulate matter from the internal haul roads.

The calculated emission rates have been outlined below.

Table 5.11: Internal Hardstand Emission Rates Calculated

Source	Emission Factor		Units
	TSP	PM_{10}	
Mobile Movements [1]	1.29e^{-5}	2.49e-6	g/s-m2

Notes to *Table 5.11*:

- 1800m^2 exposed trafficable surface assumed (12 segments @ 30m x 5m)
- emissions over 86400 seconds (24 hours)
- mobile movements assumed to result in 34 VKT/day
- emission rate ≈ factor x 34 / 86400 / 1800 [g/VKT x VKT/day x day/s/area]

TSP emission rate ≈ 59.3 x 34 / 86400 / 1800 ≈ 1.29e-5 g/s-m^2

PM10 emission rate ≈ 11.4 x 34 / 86400 / 1800 ≈ 2.49e-6 g/s-m^2

6. Air impact modelling

The AUSPLUME modelling program (Version 6) implemented in this assessment utilises consecutive meteorological data records to define the conditions for plume rise, transport, diffusion and deposition. The model was used to estimate the concentration or deposition value for each source and receptor combination for each hour of input meteorology and calculated user selected short-term average predictions. Within the AUSPLUME dispersion model, technical options are available to simulate plume behaviour affected by the presence of buildings and terrain. Atmospheric dispersion curves and surface roughness heights were also selected which specifically represented the industrial conditions present.

The basis of the model used is the straight line, steady state Gaussian plume equation (as consistent with current theory). The model is based on the U.S. developed ISC modelling code and has been the industry standard for predicting plume dispersions since 1986.

To provide a thorough assessment and to account for the additional buoyant plume rise and momentum flux, flare emission impacts were also assessed with the use of the US EPA Screen3 program.

6.1 Meteorological data used in modelling

Meteorological conditions are the primary variable which govern (and drive) the transport and dispersion of pollutants from an emissions source. It is therefore important to use meteorological data that is specifically representative of the site and the surrounding region in general.

Two meteorological data input files were adopted: Rutherford (2001) and Lochinvar (1980).

The meteorological data input file for Rutherford (2001) was used. The file is calculated from CSIRO's TAPM V2 program using synoptic data. Grid points of 25 x 25 x 25 were selected with four grids nested at spacings of 30 km, 10 km, 3 km and 1 km. Co-ordinates of 32°43'30"S (latitude) and 151°30'30"E (longitude) were selected.

The Lochinvar (1980) data file was provided by Holmes Air Sciences. The data was collected by a Woelfe Model 1482 anemometer mounted at 10 metres above local ground-level, approximately 40 metres AHD at the anemometer site.

The data sets adopted are considered site-specific and suitable for the purposes of this assessment. The data file is considered as being representative of the wind climate and wind direction events at the subject site and study regional in general.

Over 8,500 individual temperature, wind speed, wind direction, mixing height and stability class events were obtained for the meteorological input file. The Rutherford (2001) and Lochinvar (1980) meteorological input files contained sufficient data to ensure worse-case conditions were adequately represented in the model predictions.

6.2 Terrain effects used in modelling

Due to the topographical location of the development, and the distances to the nearest potentially affected receivers, the effects of local changes in grade were not assessed.

Experience has shown that the terrain effects (in relation to changes in grade) have minimal influence on the predicted impacts for sites with ground based low level volume and area sources. Essentially, AUSLPUME only accounts for terrain effects from elevated stack emission points, particularly when ground levels within 50 metres of the stack vary by more than a third of the stack release height. The approach adopted by the model is that changes in the plume centreline occur in proportion to the changes in elevation of the underlying terrain.

Due to the topographical location of the proposed site, and the separation distances from source(s) to potentially affected receptor(s) present, the effects of local changes in grade were not assessed.

6.3 Building wake effects

Plumes trapped in building wakes can either be recirculated in the cavity region immediately downwind of a building or subjected to plume downwash and enhanced horizontal or vertical spreading due to the turbulent zone that exists further downwind. Pollutants can be bought to ground within a highly turbulent, generally recirculating cavity region in the immediate lee of the building and/or be subject to plume downwash and enhanced dispersion in a turbulent region which extends further downwind behind the building.

Based on the above, the AUSPLUME utility program BPIP was referenced during model configuration stage.

6.3.1 Building parameter input program (BPIP)

Many short industrial stacks subject to downwash are affected by different buildings and building tiers for different wind directions. Even for relatively simple structures, it is not uncommon for the projected building face to be squat for some wind directions and tall for others. For these cases building downwash may occur for some wind directions and not for others. BPIP was used to calculate the 36 wind-direction-dependent building dimensions.

6.4 Modelled scenarios

A worse-case modelling approach was established in the configuration of the site-specific air quality impact model. The model was configured for air emissions over a constant 24 hour period. Fugitive emissions and impacts from spills have not been considered as these are not typical of site operations. Receptors considered are detailed in *Table 2.1* and shown on *Figure 2.1*. Results are presented in *Table 6.1* through *Table 6.5*.

Table 6.1: Predicted operational air impacts (CFS processing), Rutherord 2001 data

				Catchment			
Parameter Modelled	**1 - NW**	**2 – NW**	**3 - S**	**4 - SE**	**5 - NE**	**6 - NE**	**near field**
				Receiver			
	A, B	**C, D**	**E, F**	**G, H, I, J**	**K, L, M**	**N, O, P**	**boundary**
CFS PROCESSING, CFS CURING, INTERNAL ROADWAYS							
annual TSP incremental concentration	0.412 μg/m^3	0.733 μg/m^3	0.294 μg/m^3	0.638 μg/m^3	0.609 μg/m^3	0.504 μg/m^3	39.6 μg/m^3
adopted annual background TSP concentration of 40 μg/m^3							
worse case residential annual TSP concentration impact of <41 μg/m^3. 90 μg/m^3 cumulative criterion satisfied							
annual (monthly average) TSP incremental deposition	<0.05 g/m^2/mth	<0.05 g/m^2/mth	<0.05 g/m^2/mth	<0.05 g/m^2/mth	<0.05 g/m^2/mth	<0.05 g/m^2/mth	3.2 g/m^2/mth
adopted annual (monthly average) background TSP deposition n of 2 g/m^2/month							
worse case residential annual TSP concentration impact of <2.5 g/m^2/month. 4 g/m^2/month cumulative criterion satisfied							
annual PM$_{10}$ incremental concentration	0.296 μg/m^3	0.459 μg/m^3	0.184 μg/m^3	0.403 μg/m^3	0.380 μg/m^3	0.316 μg/m^3	20.4 μg/m^3
adopted annual background PM$_{10}$ concentration of 18.6 μg/m^3							
worse case residential annual PM$_{10}$ concentration impact of <19 μg/m3. 30 μg/m^3 cumulative criterion satisfied							
peak 24 hour PM$_{10}$ incremental concentration	4.39 μg/m^3	6.64 μg/m^3	4.01 μg/m^3	4.43 μg/m^3	6.97 μg/m^3	5.83 μg/m^3	128 μg/m^3
comparing incremental PM$_{10}$ concentration impacts to the adopted 2003 data indicates that for 2003, the 50 μg/m^3 cumulative criterion would have been exceeded on four occasions only. NEPM requirements are expected to be achieved throughout.							
peak 1 hour Ammonia concentration	0.012 mg/m^3	0.015 mg/m^3	0.011 mg/m^3	0.014 mg/m^3	0.013 mg/m^3	0.018 mg/m^3	0.484 mg/m^3
99.9th % 1 hour Ammonia concentration	-	-	-	-	-	-	0.21 mg/m^3
0.33 mg/m^3 criterion satisfied for all receptors. 99.9th percentile impacts satisfied at the boundary.							
peak 1 hour Hydrogen Chloride concentration	0.005 mg/m^3	0.007 mg/m^3	0.005 mg/m^3	0.006 mg/m^3	0.006 mg/m^3	0.008 mg/m^3	0.210 mg/m^3
99.9th % 1 hour Ammonia concentration	-	-	-	-	-	-	0.10 mg/m^3
0.14 mg/m^3 criterion satisfied for all receptors. 99.9th percentile impacts satisfied at the boundary.							
peak 1 hour Cyanide concentration	0.003 mg/m^3	0.004 mg/m^3	0.003 mg/m^3	0.004 mg/m^3	0.004 mg/m^3	0.005 mg/m^3	0.142 mg/m^3
99.9th % 1 hour Ammonia concentration	-	-	-	-	-	-	0.06 mg/m^3
0.09 mg/m^3 criterion satisfied for all receptors. 99.9th percentile impacts satisfied at the boundary.							

Table 6.2: Predicted operational air impacts (CFS processing), Lochinvar 1980 data

				Catchment			
Parameter Modelled	**1 - NW**	**2 – NW**	**3 - S**	**4 - SE**	**5 - NE**	**6 - NE**	**near field**
				Receiver			
	A, B	**C, D**	**E, F**	**G, H, I, J**	**K, L, M**	**N, O, P**	**boundary**
CFS PROCESSING, CFS CURING, INTERNAL ROADWAYS							
annual TSP incremental concentration	1.340 µg/m^3	0.977 µg/m^3	0.532 µg/m^3	3.240 µg/m^3	0.785 µg/m^3	1.230 µg/m^3	54.0 µg/m^3
adopted annual background TSP concentration of 40 µg/m^3							
worse case residential annual TSP concentration impact of <45 µg/m^3. 90 µg/m^3 cumulative criterion satisfied							
annual (monthly average) TSP incremental deposition	<0.05 g/m^2/mth	<0.05 g/m^2/mth	<0.05 g/m^2/mth	<0.05 g/m^2/mth	<0.05 g/m^2/mth	<0.05 g/m^2/mth	2.6 g/m^2/mth
adopted annual (monthly average) background TSP deposition n of 2 g/m^2/month							
worse case residential annual TSP concentration impact of <2.5 g/m^2/month. 4 g/m^2/month cumulative criterion satisfied							
annual PM$_{10}$ incremental concentration	0.844 µg/m^3	0.614 µg/m^3	0.334 µg/m^3	2.04 µg/m^3	0.492 µg/m^3	0.769µg/m^3	26.9 µg/m^3
adopted annual background PM$_{10}$ concentration of 18.6 µg/m^3							
worse case residential annual PM$_{10}$ concentration impact of <25 µg/m3. 30 µg/m^3 cumulative criterion satisfied							
peak 24 hour PM$_{10}$ incremental concentration	11.4 µg/m^3	7.6 µg/m^3	4.2 µg/m^3	13.6 µg/m^3	9.7 µg/m^3	10.8µg/m^3	87.7 µg/m^3
comparing incremental PM$_{10}$ concentration impacts to the adopted 2003 data indicates that for 2003, the 50 µg/m^3 cumulative criterion would have been exceeded on four occasions only. NEPM requirements are expected to be achieved throughout.							
peak 1 hour Ammonia concentration	0.027 mg/m^3	0.036 mg/m^3	0.018 mg/m^3	0.045 mg/m^3	0.037 mg/m^3	0.041 mg/m^3	0.380 mg/m^3
99.9th % 1 hour Ammonia concentration	-	-	-	-	-	-	0.29 mg/m^3
0.33 mg/m^3 criterion satisfied for all receptors. 99.9th percentile impacts satisfied at the boundary.							
peak 1 hour Hydrogen Chloride concentration	0.012 mg/m^3	0.016 mg/m^3	0.008 mg/m^3	0.019 mg/m^3	0.016 mg/m^3	0.018 mg/m^3	0.167 mg/m^3
99.9th % 1 hour Ammonia concentration	-	-	-	-	-	-	0.128 mg/m^3
0.14 mg/m^3 criterion satisfied for all receptors. 99.9th percentile impacts satisfied at the boundary.							
peak 1 hour Cyanide concentration	0.008 mg/m^3	0.011 mg/m^3	0.005 mg/m^3	0.013 mg/m^3	0.011 mg/m^3	0.012 mg/m^3	0.112 mg/m^3
99.9th % 1 hour Ammonia concentration	-	-	-	-	-	-	0.08 mg/m^3
0.09 mg/m^3 criterion satisfied for all receptors. 99.9th percentile impacts satisfied at the boundary.							

Table 6.3: Predicted operational air impacts (Hydrogernation of re-refined base lube oils – Hydrogenation emissions), Rutherford 2001 data

				Catchment			
Parameter Modelled	**1 - NW**	**2 – NW**	**3 - S**	**4 - SE**	**5 - NE**	**6 - NE**	**near field**
				Receiver			
	A, B	**C, D**	**E, F**	**G, H, I, J**	**K, L, M**	**N, O, P**	**boundary**
Hydrogenation Emissions							
peak 10 minute incremental SO$_2$ concentration	56.7 µg/m^3	58.0 µg/m^3	50.9 µg/m^3	77.6 µg/m^3	72.0 µg/m^3	113 µg/m^3	202 µg/m^3
no background 10 minute SO$_2$ concentration data adopted							
712 µg/m^3 cumulative criterion expected to be satisfied							
peak 1 hour incremental SO$_2$ concentration	47.0 µg/m^3	40.8 µg/m^3	40.2 µg/m^3	58.1 µg/m^3	61.2 µg/m^3	78.9 µg/m^3	145 µg/m^3
adopted 1 hour background SO$_2$ concentration of 199.5 µg/m^3							
worse case 1 hour SO$_2$ concentration impact of <150 µg/m^3. 570 µg/m^3 cumulative criterion satisfied							
peak 24 hour incremental SO$_2$ concentration	5.0 µg/m^3	7.7 µg/m^3	2.9 µg/m^3	4.4 µg/m^3	4.7 µg/m^3	4.9 µg/m^3	54 µg/m^3
no background 24 hour SO$_2$ concentration data adopted							
228 µg/m^3 cumulative criterion expected to be satisfied							
Annual incremental SO$_2$ concentration	0.4 µg/m^3	0.6 µg/m^3	0.2 µg/m^3	0.8 µg/m^3	0.6 µg/m^3	0.4 µg/m^3	5.2 µg/m^3
adopted annual background SO$_2$ concentration of 5.7 µg/m^3							
worse case annual SO$_2$ concentration impact of <10 µg/m^3. 60 µg/m^3 cumulative criterion satisfied							
Annual incremental Lead concentration	0.034 µg/m^3	0.051 µg/m^3	0.017 µg/m^3	0.068 µg/m^3	0.051 µg/m^3	0.034 µg/m^3	0.44 µg/m^3
0.5 µg/m^3 criterion satisfied							
peak 1 hour incremental iron concentration	< 0.001 mg/m^3	< 0.001 mg/m^3	< 0.001 mg/m^3	0.001 mg/m^3	0.001 mg/m^3	0.002 mg/m^3	0.003 mg/m^3
0.09 mg/m^3 criterion satisfied							
peak 1 hour incremental copper concentration	< 0.001 mg/m^3	< 0.001 mg/m^3	< 0.001 mg/m^3	< 0.001 mg/m^3	< 0.001 mg/m^3	< 0.001 mg/m^3	< 0.001 mg/m^3
0.0037 mg/m^3 criterion satisfied							
peak 1 hour incremental zinc concentration	0.001 mg/m^3	0.001 mg/m^3	0.001 mg/m^3	0.001 mg/m^3	0.002 mg/m^3	0.002 mg/m^3	0.004 mg/m^3
0.09 mg/m^3 cumulative criterion satisfied							
peak 1 hour incremental magnesium concentration	< 0.001 mg/m^3	< 0.001 mg/m^3	< 0.001 mg/m^3	< 0.001 mg/m^3	< 0.001 mg/m^3	< 0.001 mg/m^3	0.001 mg/m^3
0.18 mg/m^3 criterion satisfied							

Table 6.4: Predicted operational air impacts (Hydrogernation of re-refined base lube oils – Hydrogenation emissions), Lochinvar 1980 data

Parameter Modelled	Catchment 1 - NW Receiver A, B	2 – NW C, D	3 - S E, F	4 - SE G, H, I, J	5 - NE K, L, M	6 - NE N, O, P	near field boundary
Hydrogenation Emissions							
peak 10 minute incremental SO_2 concentration	77.4 $\mu g/m^3$	93.5 $\mu g/m^3$	76.1 $\mu g/m^3$	83.7 $\mu g/m^3$	82.8 $\mu g/m^3$	97.3 $\mu g/m^3$	213 $\mu g/m^3$
no background 10 minute SO_2 concentration data adopted							
712 $\mu g/m^3$ cumulative criterion expected to be satisfied							
peak 1 hour incremental SO_2 concentration	54.7 $\mu g/m^3$	65.5 $\mu g/m^3$	59.4 $\mu g/m^3$	58.5 $\mu g/m^3$	58.0 $\mu g/m^3$	69.1 $\mu g/m^3$	149 $\mu g/m^3$
adopted 1 hour background SO_2 concentration of 199.5 $\mu g/m^3$							
worse case 1 hour SO_2 concentration impact of <150 $\mu g/m^3$. 570 $\mu g/m^3$ cumulative criterion satisfied							
peak 24 hour incremental SO_2 concentration	5.8 $\mu g/m^3$	7.4 $\mu g/m^3$	3.7 $\mu g/m^3$	7.6 $\mu g/m^3$	3.5 $\mu g/m^3$	7.2 $\mu g/m^3$	29.4 $\mu g/m^3$
no background 24 hour SO_2 concentration data adopted							
228 $\mu g/m^3$ cumulative criterion expected to be satisfied							
Annual incremental SO_2 concentration	1.0 $\mu g/m^3$	0.9 $\mu g/m^3$	0.5 $\mu g/m^3$	2.1 $\mu g/m^3$	0.5 $\mu g/m^3$	0.7 $\mu g/m^3$	2.1 $\mu g/m^3$
adopted annual background SO_2 concentration of 5.7 $\mu g/m^3$							
worse case annual SO_2 concentration impact of <5 $\mu g/m^3$. 60 $\mu g/m^3$ cumulative criterion satisfied							
Annual incremental Lead concentration	0.085 $\mu g/m^3$	0.077 $\mu g/m^3$	0.043 $\mu g/m^3$	0.179 $\mu g/m^3$	0.043 $\mu g/m^3$	0.059 $\mu g/m^3$	0.179 $\mu g/m^3$
0.5 $\mu g/m^3$ criterion satisfied							
peak 1 hour incremental iron concentration	0.001 mg/m^3	0.001 mg/m^3	0.001 mg/m^3	0.001 mg/m^3	0.001 mg/m^3	0.002 mg/m^3	0.003 mg/m^3
0.09 mg/m^3 criterion satisfied							
peak 1 hour incremental copper concentration	< 0.001 mg/m^3	< 0.001 mg/m^3	< 0.001 mg/m^3	< 0.001 mg/m^3	< 0.001 mg/m^3	< 0.001 mg/m^3	< 0.001 mg/m^3
0.0037 mg/m^3 criterion satisfied							
peak 1 hour incremental zinc concentration	0.001 mg/m^3	0.001 mg/m^3	0.001 mg/m^3	0.001 mg/m^3	0.002 mg/m^3	0.002 mg/m^3	0.004 mg/m^3
0.09 mg/m^3 cumulative criterion satisfied							
peak 1 hour incremental magnesium concentration	< 0.001 mg/m^3	< 0.001 mg/m^3	< 0.001 mg/m^3	< 0.001 mg/m^3	< 0.001 mg/m^3	< 0.001 mg/m^3	0.001 mg/m^3
0.18 mg/m^3 criterion satisfied							

Table 6.5: Predicted operational air impacts (Hydrogernation of re-refined base lube oils – flare stack emissions), Rutherford 2001 data

Parameter Modelled				Catchment			
	1 - NW	2 – NW	3 - S	4 - SE	5 - NE	6 - NE	near field
				Receiver			
	A, B	C, D	E, F	G, H, I, J	K, L, M	N, O, P	boundary
Flare Stack Emissions							
peak 15 minute incremental CO concentration	0.06 mg/m^3	0.05 mg/m^3	0.05 mg/m^3	0.05 mg/m^3	0.07 mg/m^3	0.09 mg/m^3	0.13 mg/m^3
no background 15 minute CO concentration data adopted							
100 mg/m^3 cumulative criterion expected to be satisfied							
peak 1 hour incremental CO concentration	0.09 mg/m^3	0.16 mg/m^3	0.11 mg/m^3	0.12 mg/m^3	0.13 mg/m^3	0.09 mg/m^3	0.29 mg/m^3
adopted 1 hour background CO concentration of 18.4 mg/m^3							
worse case 1 hour CO concentration impact of <20 mg/m^3. 30 mg/m^3 cumulative criterion satisfied							
peak 8 hour incremental CO concentration	0.03 mg/m^3	0.07 mg/m^3	0.02 mg/m^3	0.02 mg/m^3	0.03 mg/m^3	0.03 mg/m^3	0.13 mg/m^3
no background 8 hour CO concentration data adopted							
10 mg/m^3 cumulative criterion expected to be satisfied							
peak 1 hour incremental NO_X concentration	16.0 $\mu g/m^3$	29.8 $\mu g/m^3$	20.6 $\mu g/m^3$	22.2 $\mu g/m^3$	23.3 $\mu g/m^3$	14.2 $\mu g/m^3$	52.9 $\mu g/m^3$
adopted 1 hour background NO_2 concentration of 82 $\mu g/m^3$							
worse case 1 hour NO_2 concentration impact of <120 $\mu g/m^3$. 245 $\mu g/m^3$.cumulative criterion satisfied							
Annual incremental NO_X concentrations	0.13 $\mu g/m^3$	0.20 $\mu g/m^3$	0.06 $\mu g/m^3$	0.17 $\mu g/m^3$	0.15 $\mu g/m^3$	0.12 $\mu g/m^3$	0.96 $\mu g/m^3$
adopted annual background NO_2 concentration of 18.5 $\mu g/m^3$							
worse case residential 1 hour NO_2 concentration impact of <20 $\mu g/m^3$. 62 $\mu g/m^3$.cumulative criterion satisfied							

Table 6.6: Predicted operational air impacts (Hydrogernation of re-refined base lube oils – flare stack emissions), Lochinvar 1980 data

				Catchment			
Parameter Modelled	**1 - NW**	**2 – NW**	**3 - S**	**4 - SE**	**5 - NE**	**6 - NE**	**near field**
				Receiver			
	A, B	**C, D**	**E, F**	**G, H, I, J**	**K, L, M**	**N, O, P**	**boundary**
Flare Stack Emissions							
peak 15 minute incremental CO concentration	0.07 mg/m^3	0.08 mg/m^3	0.06 mg/m^3	0.08 mg/m^3	0.08 mg/m^3	0.08 mg/m^3	0.12 mg/m^3
no background 15 minute CO concentration data adopted							
100 mg/m^3 cumulative criterion expected to be satisfied							
peak 1 hour incremental CO concentration	0.42mg/m^3	0.15 mg/m^3	0.22 mg/m^3	0.34 mg/m^3	0.43 mg/m^3	0.50 mg/m^3	0.19 mg/m^3
adopted 1 hour background CO concentration of 18.4 mg/m^3							
worse case 1 hour CO concentration impact of <20 mg/m^3. 30 mg/m^3 cumulative criterion satisfied							
peak 8 hour incremental CO concentration	0.06 mg/m^3	0.02 mg/m^3	0.03 mg/m^3	0.11 mg/m^3	0.05 mg/m^3	0.03 mg/m^3	0.05 mg/m^3
no background 8 hour CO concentration data adopted							
10 mg/m^3 cumulative criterion expected to be satisfied							
peak 1 hour incremental NO_X concentration	77.0 $\mu g/m^3$	27.0 $\mu g/m^3$	40.4 $\mu g/m^3$	62.5 $\mu g/m^3$	79.3 $\mu g/m^3$	37.1 $\mu g/m^3$	32.8 $\mu g/m^3$
adopted 1 hour background NO_2 concentration of 82 $\mu g/m^3$							
worse case 1 hour NO_2 concentration impact of <160 $\mu g/m^3$. 245 $\mu g/m^3$.cumulative criterion satisfied							
Annual incremental NO_X concentrations	0.33 $\mu g/m^3$	0.24 $\mu g/m^3$	0.13 $\mu g/m^3$	0.75 $\mu g/m^3$	0.13 $\mu g/m^3$	0.17 $\mu g/m^3$	0.25 $\mu g/m^3$
adopted annual background NO_2 concentration of 18.5 $\mu g/m^3$							
worse case residential 1 hour NO_2 concentration impact of <20 $\mu g/m^3$. 62 $\mu g/m^3$.cumulative criterion satisfied							

Table 6.7: Predicted operational air impacts (Hydrogernation of re-refined base lube oils – boiler emissions), Rutherford 2001 data

Parameter Modelled	1 - NW	2 – NW	3 - S	4 - SE	5 - NE	6 - NE	near field
				Catchment			
				Receiver			
	A, B	C, D	E, F	G, H, I, J	K, L, M	N, O, P	boundary
Boiler Emissions							
peak 1 hour incremental NO_X concentrations	6.3 $\mu g/m^3$	9.51 $\mu g/m^3$	8.45 $\mu g/m^3$	5.34 $\mu g/m^3$	4.69 $\mu g/m^3$	5.68 $\mu g/m^3$	72 $\mu g/m^3$
adopted 1 hour background NO_2 concentration of 82 $\mu g/m^3$							
worse case residential 1 hour NO_2 concentration impact of <160 $\mu g/m^3$. 245 $\mu g/m^3$.cumulative criterion satisfied							
Annual incremental NO_X concentrations	0.02 $\mu g/m^3$	0.05 $\mu g/m^3$	0.02 $\mu g/m^3$	0.04 $\mu g/m^3$	0.03 $\mu g/m^3$	0.02 $\mu g/m^3$	0.54 $\mu g/m^3$
adopted annual background NO_2 concentration of 18.5 $\mu g/m^3$							
worse case residential 1 hour NO_2 concentration impact of <20 $\mu g/m^3$. 62 $\mu g/m^3$.cumulative criterion satisfied							

Table 6.8: Predicted operational air impacts (Hydrogernation of re-refined base lube oils – boiler emissions), Lochinvar1980 data

Parameter Modelled				Catchment			
	1 - NW	2 – NW	3 - S	4 - SE	5 - NE	6 - NE	near field
				Receiver			
	A, B	C, D	E, F	G, H, I, J	K, L, M	N, O, P	boundary
Boiler Emissions							
peak 1 hour incremental NO_X concentrations	31.5 $\mu g/m^3$	12.6 $\mu g/m^3$	8.3 $\mu g/m^3$	34.7 $\mu g/m^3$	40.6 $\mu g/m^3$	14.6 $\mu g/m^3$	69 $\mu g/m^3$
adopted 1 hour background NO_2 concentration of 82 $\mu g/m^3$							
worse case residential 1 hour NO_2 concentration impact of <160 $\mu g/m^3$. 245 $\mu g/m^3$.cumulative criterion satisfied							
Annual incremental NO_X concentrations	0.08 $\mu g/m^3$	0.06 $\mu g/m^3$	0.03 $\mu g/m^3$	0.18 $\mu g/m^3$	0.04 $\mu g/m^3$	0.05 $\mu g/m^3$	0.3 $\mu g/m^3$
adopted annual background NO_2 concentration of 18.5 $\mu g/m^3$							
worse case residential 1 hour NO_2 concentration impact of <20 $\mu g/m^3$. 62 $\mu g/m^3$.cumulative criterion satisfied							

Potential short term NO_X impacts from the operation of the flare have been qualitatively assessed with the use of the US EPA Screen3 program,

The following parameters were assumed:

NO_X Emission Rate	- 0.7 g/s
Flare Stack Height	- 16 metres
Assumed Heat Release	- 0.5374e+7 CAL/s
Receptor Height	- 1.2 metres
Land Use Option	- Rural

Simple terrain was applied and potential impacts for all stability classes and wind speed categories assessed. Building downwash was considered.

An effective release height of 23.5 m was calculated for the flare. A buoyancy flux of 89 m^4/s^3 and momentum flux of 54 m^4/s^2 were calculated within the Screen3 model.

Maximum 1 hour concentration impacts of less than 5 $\mu g/m^3$ were predicted at a distance of approximately 800 metres from the flare. An inversion break-up fumigation calculation also provided maximum NO_X impacts of less than 5 $\mu g/m^3$.

The AUSPLUME model provided more conservative incremental impacts. No further consideration is deemed necessary.

6.4.1 Comments

General limitations and assumptions made in the predictive modelling have been included in *Appendix F*. A sample AUSPLUME configuration file has been included as *Appendix G* for reference.

7. Statement of potential air impact

Concise statements of potential impact and recommendations are presented in this section. Where relevant, reference has been made to the presented incremental impacts.

Although minor off-site impacts are predicted, a number of mitigation measures and safeguards are proposed to provide further confidence in maintaining the local air quality environs.

7.1 Oily water treatment and waste oil recovery

7.1.1 Potential Impacts

Assessment of air emissions of the oily water treatment and waste oil recovery have not been considered as part of this technical paper.

Tanks associated with the oily water and waste oil treatment recovery works would contain minor components of VOC compounds only.

Due to the minor quantities of VOC compounds expected, and relatively low vapour pressure of the oils contained in the mix, significant emissions from VOCs are not expected.

The oily water and waste oil treatment recovery process tanks would be designed to meet relevant Australian Standards and Regulations for vent emissions. It is recommended that the requirements of the *Protection of the Environment Operations (Clean Air) Amendment (Industrial and Commercial Activities and Plant) Regulation 2005* be adhered to.

Adverse off site air impacts are not anticipated.

7.1.2 Case Study

Given the semi-quantitative assessment prepared for air emissions from the oily water treatment and waste oil recovery works, a review of operations and complaint history for the oily water treatment and waste oil recovery works at the Narangba (Queensland) plant was carried out.

Transpacific Industries have indicated that the oily water treatment and waste oil recovery works at Narangba run at approximately 12 million litres per annum. A maximum of 15.6 million litres per annum is expected to be output at the Rutherford site. Although a higher throughput is expected for Rutherford, the separation distance of greater than 1,000 metres is expected to provide a suitable buffer to minimise any loss of local air quality

The nearest resident to the Narangba operations is approximately 750 metres to the north of the site.

Air emissions from the oily water treatment and waste oil recovery works are not an issue for the Narangba facility. Operations of the oily water treatment and waste oil recovery works at Rutherford are similarly not expected to result in potential adverse off-site impacts.

7.1.3 Mitigation measures and safeguards

The oily water and waste oil treatment recovery process tanks would be designed to meet relevant Australian Standards and Regulations for vent emissions. It is recommended that the requirements of the *Protection of the Environment Operations (Clean Air) Amendment (Industrial and Commercial Activities and Plant) Regulation 2005* be adhered to.

Nitrogen blankets will be utilised on all oily water and waste oil treatment recovery process tanks. Volatile organic emissions from storage tanks can be reduced by as much as 98 percent by converting from fixed to floating roof tanks. Emission reduction is, however, dependant on solvent evaporation rates, ambient temperatures, loading rates and tank capacities.

Post commissioning monitoring would verify the findings of this technical paper.

The site-specific air quality management plan will itemise further mitigation measures and safeguards in the event of adopted site-specific air quality trigger levels being exceeded.

7.2 CFS

7.2.1 Potential impacts

The results of the assessment indicate that adverse off-site impacts would not be likely. Comparing incremental PM_{10} concentration impacts to the adopted 2003 data indicates that for 2003, the 50 $\mu g/m^3$ cumulative criterion would be expected to be achieved throughout.

Maximum boundary impacts of the toxic compounds considered (Ammonia, Hydrogen Chloride and Cyanide) were noted to be slightly above the adopted guidelines. 99.9th percentile values at the boundary satisfied the adopted criterion. The levels predicted are not considered a major issue given the conservative nature of the assessment. A more detailed assessment, in the form of a health risk assessment, is not considered warranted in this instance.

It should be noted that emissions from the CFS curing area, in particular dust, have not been considered in detail. Although the material will be housed within an enclosed structure, with significant internal entrainment expected, release of particulates from vents and openings may occur.

7.2.2 Case Study

Similar to the approach taken for the oily water treatment and waste oil recovery works, comparison to existing operations at Narangba has been made.

Transpacific Industries have indicated that the CFS works at Narangba run at approximately 20,000 tonnnes per annum of fixated material. A maximum of 26,000 tonnes per annum of fixated material is expected to be output at the Rutherford site. Throughput values are equivalent.

The Narangba CFS operations are undertaken within an enclosed structure with one open side to the building. The nearest resident to the Narangba operations is approximately 750 metres to the north of the site.

Air emissions from the CFS works are not an issue for the Narangba facility. Operations of the CFS works at Rutherford are similarly not expected to result in potential adverse off-site impacts.

7.2.3 Mitigation measures and safeguards

The extraction system implemented within the subject site would be designed to have design flow rates that correspond to values adopted within this assessment. The exhaust hoods would be designed to allow entrainment and capture of particulates and compounds released from the mixing pits.

The reverse pulse filter would reduce particulate emissions to less than 0.03 g/m^3. Emissions of TSP and PM$_{10}$ would be maintained to emission rates below those assumed within this technical paper (1.5 g/s and 1 g/s from the CFS curing structure for TSP and PM$_{10}$ respectively).

It is proposed that a misting system be installed in both the CFS Processing Area and CFS Curing area. Internal watering within the CFS Curing Area would also be undertaken as required. These measures would reduce dust emissions from the CFS works significantly.

The use of chemical deodorants (generally strong oxidising agents) that chemically oxidise compounds that lead to a given undesirable odour mixture would be utilised as required within the CFS mixing and curing areas. Oxidising agents such as hydrogen peroxide, potassium permanganate and ozone chemically oxidise odour-causing compounds.

A number of products are available that are injected into a building climate through high-pressure mister systems. The function of a periodic mist injection is to neutralise odour compounds that accumulate in a building prior to being exhausted. At the writing of this technical paper, no published results have been found on this form of system.

Post commissioning validation monitoring and compliance works would determine the requirement for further controls and management practices. Consideration would also be given to implementing fast shutting roller doors at the CFS Processing Area access point.

7.3 Hydrogenation of re-refined base lube oils

7.3.1 Potential impacts

No adverse impacts from the hydrogenation works are anticipated.

NO_X boundary levels are predicted to comply with the adopted air quality goals. It was assumed that a 100% conversion of site NO_X emissions would be converted to NO_2. As the distance of separation increase, impact potential decreased significantly.

Combined emissions of NO_X from the boiler and flare operating simultaneously were not assessed.

Predicted SO_2 impacts were below the adopted air quality goals. However, the potential for elevated off site levels may occur where assumed emission rates are not achieved.

Detailed assessment of VOC emissions from feed stock tanks has not been carried out. Although the feed stock oil is pre-treated at Wetherill Park, potential emissions during fill should adhere to the requirements *Protection of the Environment Operations (Clean Air) Amendment (Industrial and Commercial Activities and Plant) Regulation* 2005.

US EPA, Document AP42 – Chapter 4.7 *Waste Solvent Reclamation* indicated that VOC emission rates form storage tank venting is in the order of 0.01 kg/Mg from a storage tank of fixed roof design. A 200 kL tank, with typical liquid specific gravity of 0.8, would equate to a weight of approximately 160 tonnes (160 Mg). VOC emissions in the order of 1.6 kg may occur per tank from venting. Over a 24 hour period, this would be expected to result in emissions less than 0.019 g/s. The fugitive emissions would be expected to oxidise and volatilise quickly upon release to atmosphere. Assuming the tank comprises 10 percent of Benzene, associated boundary impacts would be below the NSW DEC guideline value of 0.029 mg/m^3 (1 hour average).

Air displaced during tank load, assuming a maximum allowable emission rate of 1.5 g/m^3 and a nominal flow rate of 750 m^3/hr (consistent with flow conditions at the Wetherill Park plant), a maximum VOC emission rate of 0.3 g/s could be expected to result in a maximum indicative boundary impact of 0.02 mg/m^3 (with the impact level interpolated based on the results of impact profiles presented in *Table 6.3* and *Table 6.4*) . Again assuming this entirely comprises the VOC indicator Benzene, the DEC 1 hour criterion of 0.029 mg/m^3 would be expected to be satisfied

7.3.2 Mitigation measures and safeguards

Validation of the assumptions made within this technical paper for the hydrogenation plant, flare and boiler would be undertaken. Manufacturers performance specifications (after equipment is selected) and post-commissioning source monitoring would be undertaken.

A number of control options would be implemented for the storage tanks for hydrogenation feed stock. Transpacific Industries' have indicated that a vapour control system would be constructed based on a recovery system that limits the total concentration of unrecovered vapour to the atmosphere during any period of 4 hours does not exceed 100 milligrams per litre of volatile organic liquid passing into the tank during that period.

A close capture water trap system with overflow to an enclosed sump will be implemented. Light ends will be recovered back into the light end fuel tank. The vapour recovery system will be designed and implemented by Transpacific Industries. Further details are not available at this stage.

The feed stock tanks will ducted and vented to a single emission point.

7.4 General air quality management recommendations

Based on the results of the predictive air emission modelling presented, there is a potential for off-site air emissions to become elevated if not managed satisfactorily. It is essential for industrial sites to actively manage air emissions and to minimise any potential problems.

The following management practices and air release mitigation techniques would be implemented during the standard operational phases of the site. Each point detailed should be outlined in detail within the site-specific operational environmental management plan.

7.4.1 Best management practices

The adoption of Best Management Practice (BMP) is encouraged by the NSW DEC. BMP includes the encouragement of a general staff attitude to reducing air (especially odorous) emissions. All staff would be made aware of the problems associated with off-site air impacts and the proximity of residences to the site. Transpacific would ensure the established BMP attitudes are continued by all site personnel.

Measures to ensure general cleanliness and avoiding spills would be implemented with the primary benefit being in the general reduction in all site-related environmental issues under BMP principles.

7.4.2 Complaints procedure

Site management would initiate and maintain a suitable complaints register. All complaints would be taken seriously with their verification followed up. All complaints would be recorded, with all appropriate details logged (such as time of the complaint, reason for complaint, operations and meteorological conditions during the complaint event).

A complaint telephone number and procedure to log any complaints and provide management follow up would be established.

7.4.3 Compliance monitoring

It is proposed that detailed rounds of air emission compliance monitoring be undertaken on an annual basis during the first two years of site operation. Details of the proposed monitoring would be provided in an air quality management plan to be developed for operation of the facility.

The installation of proposed control equipment is expected to result in minimal emissions of all other products.

Longer term actions for the recording and managing of potential air emissions from the site would be carried out. These works would form the basis of the site-specific air quality management plan.

The monitoring program would be extended to include potential compound-specific emissions (through the use of a gas chromatograph). Applicable NSW DEC and Australian Standards would be adhered to. Each compound identified within this technical paper should be addressed as part of stack sample analysis program.

Any measured exceedances of the site-specific air emission limits would be addressed where appropriate.

During the first year's implementation of the air quality management plan, the odour management practices and effectiveness gauged by observations would be recorded. Corrective action taken as a result of this experience would be built into the environmental management plan / manual (EMP) for the site. It is anticipated that the requirements for the monitoring program would vary after detailed review and assessment of the results from the initial assessment.

7.4.4 Summary of management practices to be considered

For the adequate management of all site-specific air emissions, the following items are proposed:

- an incineration or vapour recovery system for the storage tanks of the hydrogenation feed stock that comply with the requirements of the Protection of the Environment Operations (Clean Air) Amendment (Industrial and Commercial Activities and Plant) Regulation 2005. The feed stock tanks will need to be ducted and vented to a single emission point.
- completion of adequate Air Quality Management plan for the site – as part of an Environmental Management Plan
- undertake a post commissioning compliance study (odour and compound specific measurements), followed by annual surveys thereafter
- formulate a suitable complaints procedure

8. Conclusion

An air quality impact assessment was conducted for the proposed operations of the Waste Resource Recovery and Recycling Facility located at Rutherford.

Air emissions resulting from the site operations were assessed with reference being made to NSW DEC approved methods. Conservative factors were adopted throughout. Where applicable, ambient air quality goals and assessment methodologies were based on current guidelines.

Although no cumulative air impact are expected, a number of site-specific control mitigation measures and safeguards are proposed.

The CFS reverse pulse filter would reduce particulate emissions to less than 0.03 g/m^3. Emissions of TSP and PM_{10} would be maintained to emission rates below those assumed within this technical paper (1.5 g/s and 1 g/s from the CFS curing structure for TSP and PM_{10} respectively).

Nitrogen blankets would be incorporated into the design of the oily water treatment and waste oil recovery process tanks.

A vapour recovery system for the storage tanks of the hydrogenation feed stock that comply with the requirements of the Protection of the Environment Operations (Clean Air) Amendment (Industrial and Commercial Activities and Plant) Regulation 2005. A closed capture water trap system with overflow to an enclosed sump will be implemented. Light ends will be recovered back into the light end fuel tank. The vapour recovery system will be designed and implemented by Transpacific Industries. Further details are not available at this stage. The feed stock tanks will be ducted and vented to a single emission point.

The findings of this report would be incorporated into a site-specific air quality management plan. It is proposed that post-commissioning source validation measurements be carried out to verify the conclusions provided within this report. The results of the air compliance study would be used to determine the necessity of detailed safeguards or controls. Once the compliance study has been presented, the environmental management plan for the site would be updated to include any recommendations for additional air quality control or procedures.

It is also proposed that as part of the site's best-practice environmental management policy, any complaints received by management from the local community would be logged in detail. If, at any point during the site's operations, air issues arise, management would review operations and investigate the need for additional of additional control practices.

With the implementation of the recommended control options and management practices, the operation of the proposed site is expected to comply with current NSW DEC guidelines, with minimal potential for annoyance throughout the local community.

The proposed Waste Resource Recovery and Recycling Plant is unlikely to result in significant off-site air quality impacts. No long-term loss or degradation to the existing local amenity is expected.

9. References

Protection of the Environment Operations (Clean Air) Amendment (Industrial and Commercial Activities and Plant) Regulation 2005

Holmes Air Sciences *Air Quality Assessment: Proposed Ceramic Tile Manufacturing Facility at Rutherford* (2002)

Holmes Air Sciences *Upgrading of the Pacific Highway Environmental Impact Statement (Buladelah), Technical Paper No. 15 – Air Quality Impact Assessment (2004)*

Katestone Scientific *Report from Katestone Scientific to Environment Protection Authority of NSW, Peak-to-Mean Ratios for Odour Assessments* (1998)

Katestone Scientific *The Evaluation of Peak-to-Mean Ratios for Odour Assessments* (1995)

NPI *Emission Estimation Technique Manual for Combustion in Boilers* (1999)

NSW EPA *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in New South Wales* (2002)

NSW EPA *Draft Policy: Assessment and Management of Odour from Stationary Sources in NSW* (2001)

NSW EPA Technical Notes - *Draft Policy: Assessment and Management of Odour from Stationary Sources in NSW* (2001)

NSW DEC Composting and Related Organics Processing Facilities (2004).

Protection of the Environment Operations Act (1997)

US EPA, Document AP42 – Chapter 13.5 *Industrial Flares*

US EPA, Document AP42 – Chapter 4.3 *Waste Water Collection, Treatment and Storage*

US EPA, Document AP42 – Chapter 4.7 *Waste Solvent Reclamation*

VIC EPA *The Ausplume Gaussian Plume Dispersion Model* (1986)

Virotec Wastewater and Solid Waste Emission Control: *Case Studies in Advanced Odour Abatement and Site Management* (2004)

WSP Walmsey *Proposed Hydrogenation Plant, Pietermaritzburg Environmental Scoping Report* (prepared of the Department of Agriculture and Environmental Affairs, reference EIA / 4068)

10. Limitations

Scope of Services and Reliance of Data

This environmental impact study ("the study") has been prepared in accordance with the scope of work/services set out in the contract, or as otherwise agreed, between Parsons Brinckerhoff (PB) and the Client. In preparing this environmental impact study, PB has relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the environmental impact study ("the data"). Except as otherwise stated in the environmental impact study, PB has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in this environmental impact study ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. PB will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to PB.

Study for Benefit of Client

This environmental impact study has been prepared for the exclusive benefit of the Client and no other party. PB assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with in this environmental impact study, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in this environmental impact study (including without limitation matters arising from any negligent act or omission of PB or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in this environmental impact study). Other parties should not rely upon the environmental impact study or the accuracy or completeness of any conclusions and should make their own inquiries and obtain independent advice in relation to such matters.

Other Limitations

To the best of PBs knowledge, the proposal presented and the facts and matters described in this environmental impact study reasonably represent the Client's intentions at the time of printing of the environmental impact study. However, the passage of time, the manifestation of latent conditions or the impact of future events (including a change in applicable law) may have resulted in a variation of the Proposal and of its possible environmental impact.

PB will not be liable to update or revise the environmental impact study to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the environmental impact study.

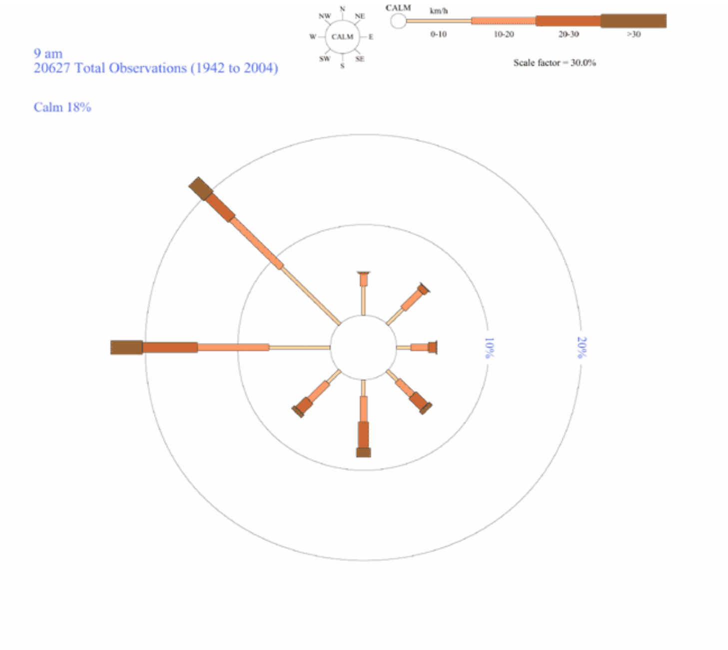
Appendix A

Regional Wind Rose Plots Referenced (Williamtown, Rutherford, Lochinvar)

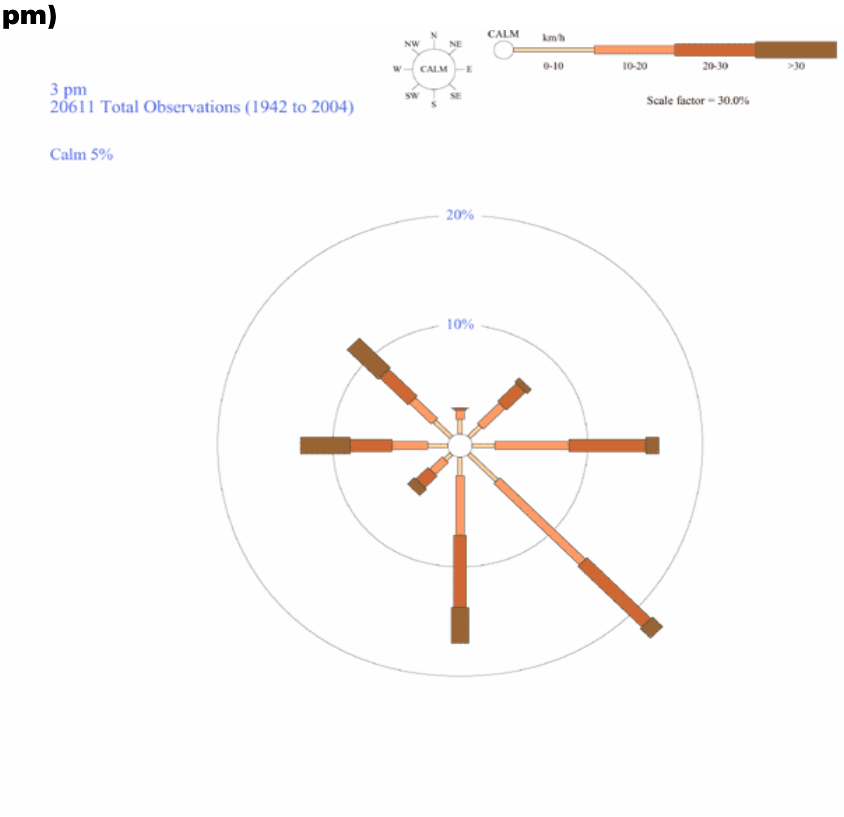
Mean 9am and 3 pm Wind Speeds (Williamtown)

Annual (9 am)

Location: Williamtown **Site Number:** 61078
Lattitude: -32.80 **Longitude:** 151.83 **Elevation:** 9 metres (above sea level)



Annual (3 pm)

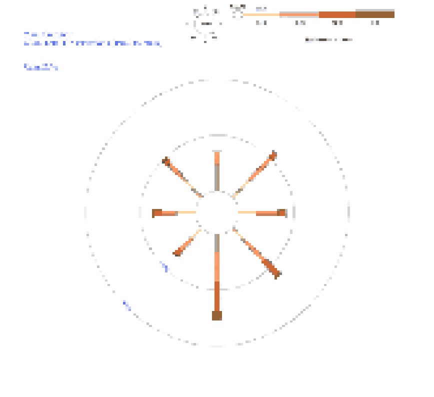


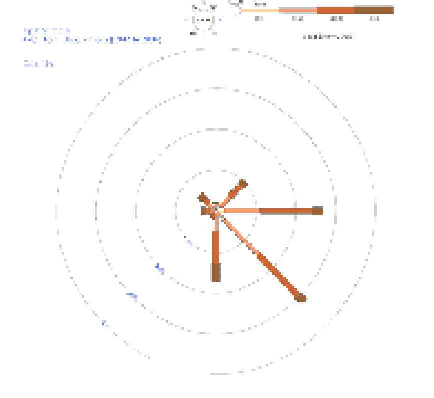
Source: Bureau of Meteorology

Mean 9am and 3 pm Wind Speeds (Williamtown)

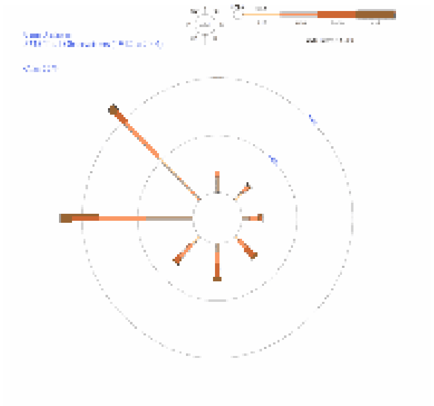
Summer

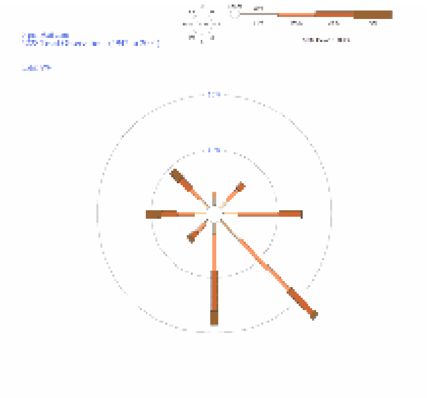
Location: Williamtown **Site Number:** 61078
Lattitude: -32.80 **Longitude:** 151.83 **Elevation:** 9 metres (above sea level)



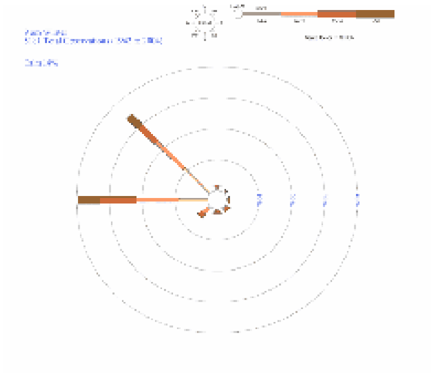


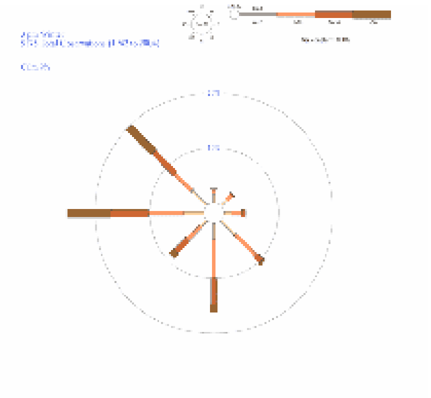
Autumn



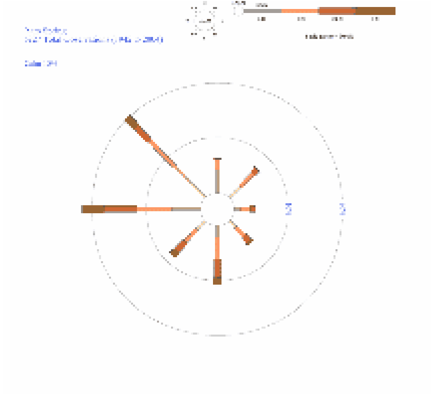


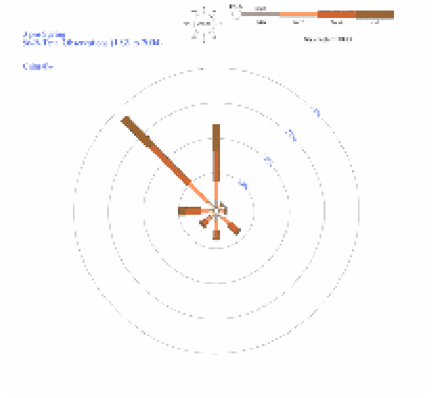
Winter





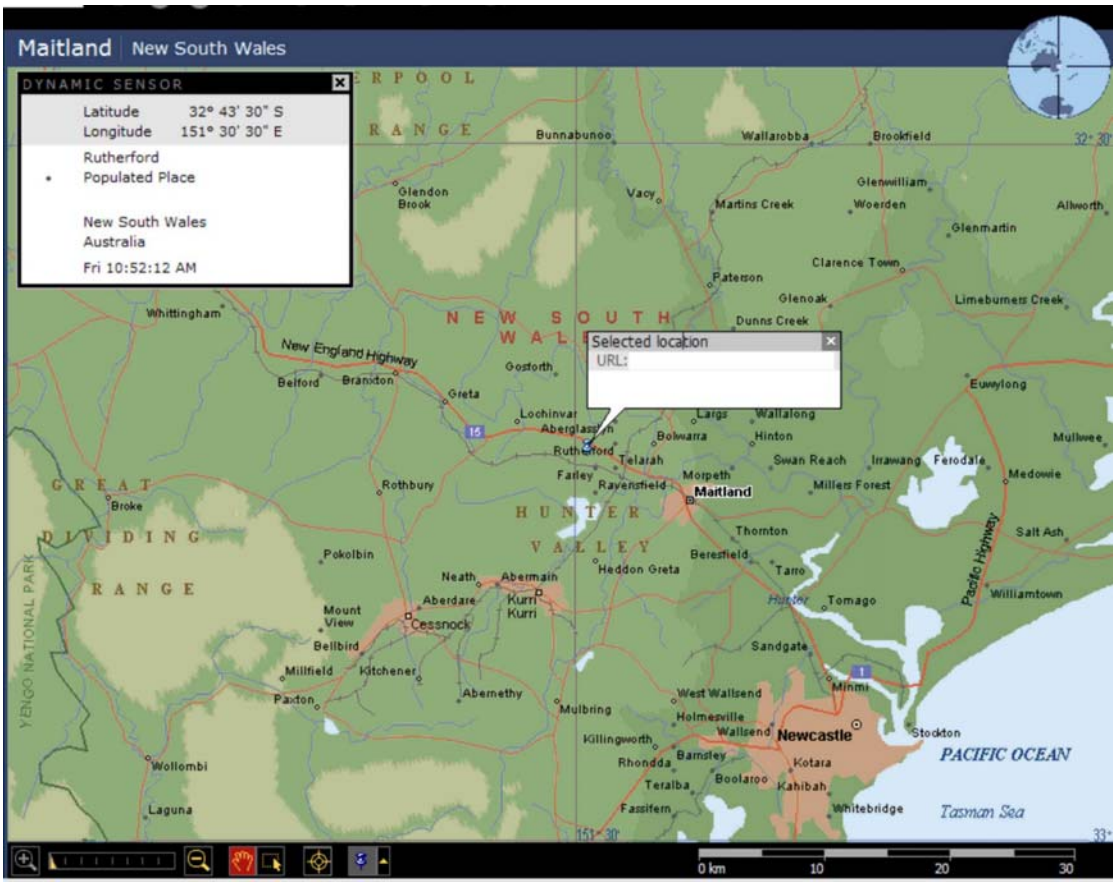
Spring





Source: Bureau of Meteorology

TAPM simulation for Rutherford NSW
Year of simulation: 2001



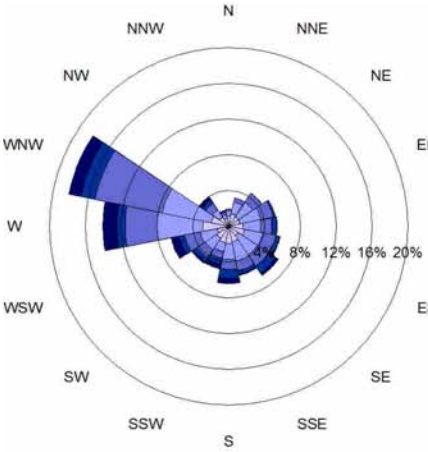
Latitude 32° 43' 30" S
Longitude 151° 30' 30" E

Rutherford
• Populated Place

New South Wales
Australia

Fri 10:52:12 AM

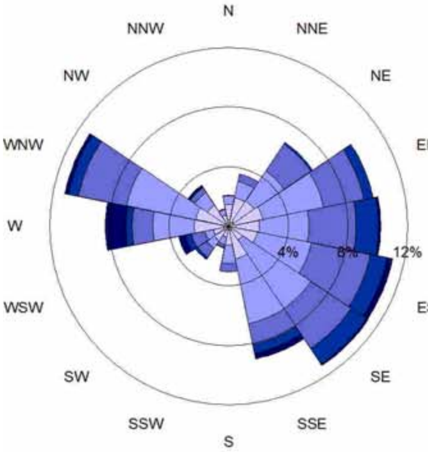
Annual and seasonal windroses for Rutherford (2001 by TAPM)



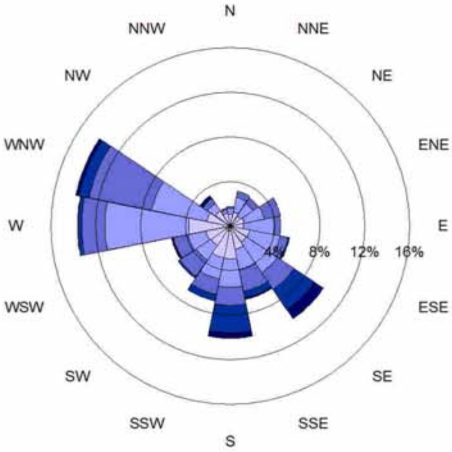
Annual
Calms = 0.7%

Wind speed (m/s)

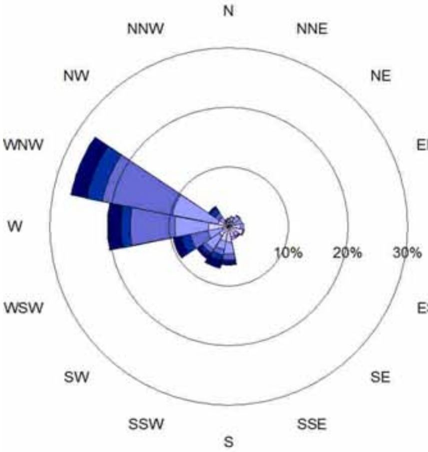
□ >0.5 - 1.5
▨ >1.5 - 3
▨ >3 - 4.5
▨ >4.5 - 6
■ >6 - 7.5
■ >7.5



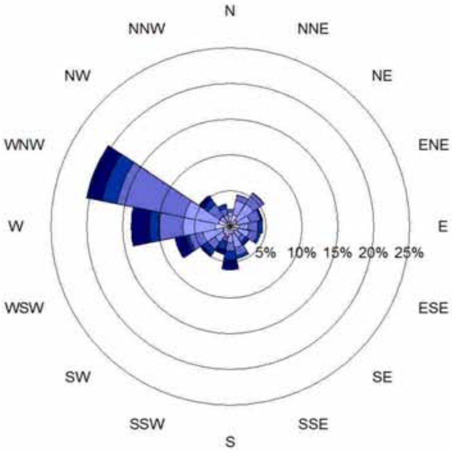
Summer
Calms = 1.4%



Autumn
Calms = 0.5%

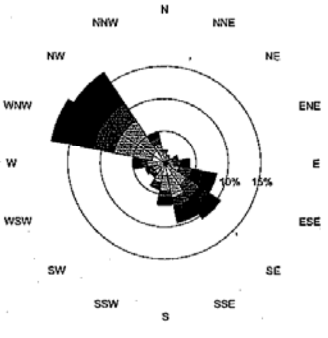


Winter
Calms = 0.3%



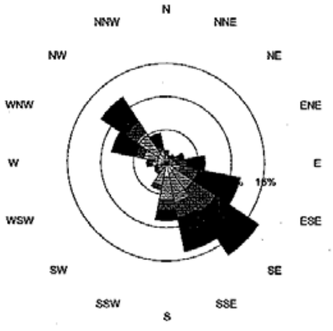
Spring
Calms = 0.5%

Annual and Seasonal Windroses for LOCHINVAR - 1980

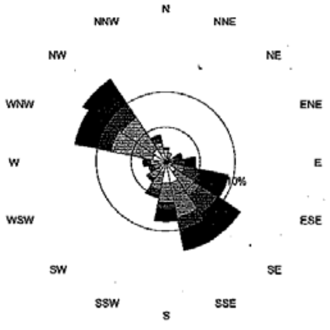


Annual

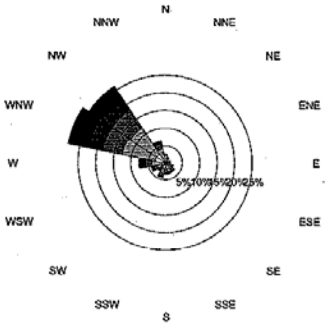
☐ 0.5 to 1.5 m/s
▨ 1.5 to 3.0 m/s
▨ 3.0 to 4.5 m/s
■ 4.5 to 6.0 m/s
■ 6.0 to 7.5 m/s
■ >7.5 m/s



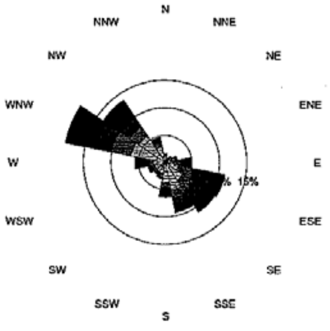
Summer



Autumn



Winter



Spring

Appendix B

TAPM Wind Frequency Distribution and Stability Class Tables (Rutherford 2001)

```
STATISTICS FOR FILE:  C:\Jobs\RthrFord\Ruth2001.met
MONTHS: All
HOURS : All
OPTION: Frequency

                     PASQUILL STABILITY CLASS 'A'

                        Wind Speed Class (m/s)

             0.50     1.50     3.00     4.50     6.00     7.50     9.00  GREATER
 WIND         TO       TO       TO       TO       TO       TO       TO     THAN
SECTOR       1.50     3.00     4.50     6.00     7.50     9.00    10.50    10.50    TOTAL
-----------------------------------------------------------------------------------------

   NNE   0.000457 0.003767 0.001370 0.000000 0.000000 0.000000 0.000000 0.000000 0.005594
    NE   0.000457 0.002397 0.001142 0.000000 0.000000 0.000000 0.000000 0.000000 0.003995
   ENE   0.000228 0.001598 0.000685 0.000000 0.000000 0.000000 0.000000 0.000000 0.002511
     E   0.000457 0.001142 0.000114 0.000000 0.000000 0.000000 0.000000 0.000000 0.001712
   ESE   0.000114 0.000457 0.000228 0.000000 0.000000 0.000000 0.000000 0.000000 0.000799
    SE   0.000114 0.001598 0.000342 0.000000 0.000000 0.000000 0.000000 0.000000 0.002055
   SSE   0.000913 0.001142 0.000228 0.000000 0.000000 0.000000 0.000000 0.000000 0.002283
     S   0.001370 0.001712 0.000342 0.000000 0.000000 0.000000 0.000000 0.000000 0.003425
   SSW   0.001598 0.002283 0.000228 0.000000 0.000000 0.000000 0.000000 0.000000 0.004110
    SW   0.002169 0.003311 0.000799 0.000000 0.000000 0.000000 0.000000 0.000000 0.006279
   WSW   0.002169 0.002626 0.000685 0.000000 0.000000 0.000000 0.000000 0.000000 0.005479
     W   0.001256 0.002626 0.001142 0.000000 0.000000 0.000000 0.000000 0.000000 0.005023
   WNW   0.001484 0.002169 0.000913 0.000000 0.000000 0.000000 0.000000 0.000000 0.004566
    NW   0.000799 0.001256 0.000685 0.000000 0.000000 0.000000 0.000000 0.000000 0.002740
   NNW   0.000228 0.001256 0.000342 0.000000 0.000000 0.000000 0.000000 0.000000 0.001826
     N   0.000685 0.002968 0.000114 0.000000 0.000000 0.000000 0.000000 0.000000 0.003767

  CALM                                                                           0.002055
-----------------------------------------------------------------------------------------
  TOTAL  0.014498 0.032306 0.009361 0.000000 0.000000 0.000000 0.000000 0.000000 0.058219

   MEAN WIND SPEED (m/s) = 2.08
  NUMBER OF OBSERVATIONS = 510


                     PASQUILL STABILITY CLASS 'B'

                        Wind Speed Class (m/s)

             0.50     1.50     3.00     4.50     6.00     7.50     9.00  GREATER
 WIND         TO       TO       TO       TO       TO       TO       TO     THAN
SECTOR       1.50     3.00     4.50     6.00     7.50     9.00    10.50    10.50    TOTAL
-----------------------------------------------------------------------------------------

   NNE   0.000000 0.001712 0.001712 0.000000 0.000000 0.000000 0.000000 0.000000 0.003425
    NE   0.000342 0.000685 0.004224 0.000457 0.000000 0.000000 0.000000 0.000000 0.005708
   ENE   0.000114 0.001370 0.002169 0.000685 0.000000 0.000000 0.000000 0.000000 0.004338
     E   0.000114 0.000571 0.001826 0.000457 0.000000 0.000000 0.000000 0.000000 0.002968
   ESE   0.000228 0.000571 0.001712 0.000457 0.000000 0.000000 0.000000 0.000000 0.002968
    SE   0.000114 0.000913 0.003995 0.000571 0.000000 0.000000 0.000000 0.000000 0.005594
   SSE   0.000114 0.000685 0.003311 0.000228 0.000000 0.000000 0.000000 0.000000 0.004338
     S   0.000114 0.000799 0.001598 0.000228 0.000000 0.000000 0.000000 0.000000 0.002740
   SSW   0.000114 0.001598 0.001712 0.000913 0.000000 0.000000 0.000000 0.000000 0.004338
    SW   0.000342 0.001027 0.002055 0.001142 0.000000 0.000000 0.000000 0.000000 0.004566
   WSW   0.000342 0.001370 0.005251 0.001370 0.000000 0.000000 0.000000 0.000000 0.008333
     W   0.000799 0.004909 0.008562 0.001256 0.000000 0.000000 0.000000 0.000000 0.015525
   WNW   0.000228 0.001598 0.007306 0.002169 0.000000 0.000000 0.000000 0.000000 0.011301
    NW   0.000342 0.000342 0.001826 0.000913 0.000000 0.000000 0.000000 0.000000 0.003425
   NNW   0.000114 0.000228 0.000457 0.000342 0.000000 0.000000 0.000000 0.000000 0.001142
     N   0.000571 0.000571 0.000228 0.000114 0.000000 0.000000 0.000000 0.000000 0.001484

  CALM                                                                           0.000342
-----------------------------------------------------------------------------------------
  TOTAL  0.003995 0.018950 0.047945 0.011301 0.000000 0.000000 0.000000 0.000000 0.082534

   MEAN WIND SPEED (m/s) = 3.52
  NUMBER OF OBSERVATIONS = 723
```

```
                    PASQUILL STABILITY CLASS 'C'

                       Wind Speed Class (m/s)

             0.50     1.50     3.00     4.50     6.00     7.50     9.00  GREATER
 WIND         TO       TO       TO       TO       TO       TO       TO     THAN
SECTOR       1.50     3.00     4.50     6.00     7.50     9.00    10.50    10.50    TOTAL
-----------------------------------------------------------------------------------------

   NNE   0.000571 0.000457 0.000342 0.000000 0.000000 0.000000 0.000000 0.000000 0.001370
    NE   0.000228 0.001256 0.001598 0.001370 0.000000 0.000000 0.000000 0.000000 0.004452
   ENE   0.000228 0.001370 0.002283 0.003196 0.000228 0.000000 0.000000 0.000000 0.007306
     E   0.000457 0.000913 0.002740 0.003995 0.002055 0.000114 0.000000 0.000000 0.010274
   ESE   0.000571 0.002511 0.003311 0.005936 0.002511 0.000000 0.000000 0.000000 0.014840
    SE   0.000114 0.001142 0.007306 0.005365 0.002397 0.000571 0.000000 0.000000 0.016895
   SSE   0.000228 0.002283 0.002968 0.002511 0.000913 0.000114 0.000000 0.000000 0.009018
     S   0.000000 0.001027 0.004338 0.002511 0.000685 0.000000 0.000000 0.000000 0.008562
   SSW   0.000342 0.002055 0.001826 0.001712 0.000913 0.000114 0.000000 0.000000 0.006963
    SW   0.000114 0.000457 0.001826 0.002626 0.001598 0.000457 0.000000 0.000000 0.007078
   WSW   0.000228 0.001370 0.001370 0.004338 0.001826 0.000685 0.000000 0.000000 0.009817
     W   0.001027 0.003995 0.006279 0.006621 0.004110 0.001027 0.000000 0.000000 0.023059
   WNW   0.000571 0.002397 0.005137 0.010388 0.003767 0.000571 0.000000 0.000000 0.022831
    NW   0.000342 0.000571 0.001256 0.001712 0.001484 0.000913 0.000000 0.000000 0.006279
   NNW   0.000342 0.000228 0.000114 0.000228 0.000685 0.000000 0.000000 0.000000 0.001598
     N   0.000114 0.000571 0.000457 0.000342 0.000000 0.000000 0.000000 0.000000 0.001484

  CALM                                                                          0.000685
-----------------------------------------------------------------------------------------
  TOTAL  0.005479 0.022603 0.043151 0.052854 0.023174 0.004566 0.000000 0.000000 0.152511

   MEAN WIND SPEED (m/s) = 4.58
  NUMBER OF OBSERVATIONS = 1336


                    PASQUILL STABILITY CLASS 'D'

                       Wind Speed Class (m/s)

             0.50     1.50     3.00     4.50     6.00     7.50     9.00  GREATER
 WIND         TO       TO       TO       TO       TO       TO       TO     THAN
SECTOR       1.50     3.00     4.50     6.00     7.50     9.00    10.50    10.50    TOTAL
-----------------------------------------------------------------------------------------

   NNE   0.000114 0.001941 0.000457 0.003311 0.000114 0.000000 0.000000 0.000000 0.005936
    NE   0.000114 0.001826 0.001712 0.004909 0.000571 0.000000 0.000000 0.000000 0.009132
   ENE   0.000114 0.001941 0.003425 0.006963 0.001826 0.000342 0.000000 0.000000 0.014612
     E   0.000913 0.004795 0.004909 0.006164 0.003311 0.000342 0.000000 0.000000 0.020434
   ESE   0.000913 0.007648 0.008904 0.006393 0.001712 0.000799 0.000114 0.000000 0.026484
    SE   0.000457 0.004338 0.006849 0.008447 0.007420 0.002055 0.000571 0.000000 0.030137
   SSE   0.000913 0.006849 0.006279 0.007192 0.003082 0.000913 0.000342 0.000000 0.025571
     S   0.001027 0.007192 0.004566 0.007306 0.009361 0.002397 0.002055 0.001598 0.035502
   SSW   0.000342 0.006735 0.002283 0.003425 0.006050 0.002055 0.000457 0.002511 0.023858
    SW   0.000114 0.005594 0.002283 0.004566 0.002968 0.001256 0.000457 0.000342 0.017580
   WSW   0.000342 0.001941 0.002626 0.005137 0.004338 0.003196 0.003653 0.001598 0.022831
     W   0.000913 0.004452 0.009018 0.011758 0.005137 0.004566 0.006849 0.003196 0.045890
   WNW   0.000228 0.003653 0.009132 0.038699 0.012443 0.007306 0.004795 0.000799 0.077055
    NW   0.000457 0.002055 0.001712 0.004795 0.003311 0.001712 0.000799 0.000228 0.015068
   NNW   0.000342 0.001370 0.000571 0.001027 0.000913 0.000000 0.000000 0.000000 0.004224
     N   0.000799 0.001370 0.000799 0.000571 0.000000 0.000000 0.000000 0.000000 0.003539

  CALM                                                                          0.000799
-----------------------------------------------------------------------------------------
  TOTAL  0.008105 0.063699 0.065525 0.120662 0.062557 0.026941 0.020091 0.010274 0.378653

   MEAN WIND SPEED (m/s) = 5.33
  NUMBER OF OBSERVATIONS = 3317
```

```
                     PASQUILL STABILITY CLASS 'E'

                        Wind Speed Class (m/s)

             0.50     1.50     3.00     4.50     6.00     7.50     9.00  GREATER
 WIND         TO       TO       TO       TO       TO       TO       TO     THAN
SECTOR       1.50     3.00     4.50     6.00     7.50     9.00    10.50    10.50    TOTAL
-----------------------------------------------------------------------------------------

   NNE   0.000228 0.000571 0.006735 0.001370 0.000000 0.000000 0.000000 0.000000 0.008904
    NE   0.000571 0.001370 0.007991 0.004680 0.000000 0.000000 0.000000 0.000000 0.014612
   ENE   0.000457 0.000913 0.011301 0.003311 0.000000 0.000000 0.000000 0.000000 0.015982
     E   0.000457 0.000799 0.007991 0.002055 0.000000 0.000000 0.000000 0.000000 0.011301
   ESE   0.000114 0.001142 0.004566 0.001941 0.000000 0.000000 0.000000 0.000000 0.007763
    SE   0.000228 0.000685 0.005137 0.000342 0.000000 0.000000 0.000000 0.000000 0.006393
   SSE   0.000114 0.000913 0.006735 0.001256 0.000000 0.000000 0.000000 0.000000 0.009018
     S   0.000114 0.001027 0.005594 0.001027 0.000000 0.000000 0.000000 0.000000 0.007763
   SSW   0.000228 0.000685 0.002740 0.001598 0.000000 0.000000 0.000000 0.000000 0.005251
    SW   0.000228 0.000571 0.006279 0.002626 0.000000 0.000000 0.000000 0.000000 0.009703
   WSW   0.000228 0.000000 0.008105 0.007078 0.000000 0.000000 0.000000 0.000000 0.015411
     W   0.000228 0.001256 0.018950 0.016096 0.000000 0.000000 0.000000 0.000000 0.036530
   WNW   0.000114 0.000913 0.029566 0.025457 0.000000 0.000000 0.000000 0.000000 0.056050
    NW   0.000228 0.000457 0.003653 0.001712 0.000000 0.000000 0.000000 0.000000 0.006050
   NNW   0.000114 0.000228 0.002283 0.001598 0.000000 0.000000 0.000000 0.000000 0.004224
     N   0.000000 0.000342 0.002854 0.000913 0.000000 0.000000 0.000000 0.000000 0.004110

  CALM                                                                           0.001826
-----------------------------------------------------------------------------------------
  TOTAL  0.003653 0.011872 0.130479 0.073059 0.000000 0.000000 0.000000 0.000000 0.220890

   MEAN WIND SPEED (m/s) = 4.11
  NUMBER OF OBSERVATIONS = 1935


                     PASQUILL STABILITY CLASS 'F'

                        Wind Speed Class (m/s)

             0.50     1.50     3.00     4.50     6.00     7.50     9.00  GREATER
 WIND         TO       TO       TO       TO       TO       TO       TO     THAN
SECTOR       1.50     3.00     4.50     6.00     7.50     9.00    10.50    10.50    TOTAL
-----------------------------------------------------------------------------------------

   NNE   0.000342 0.004110 0.002740 0.000000 0.000000 0.000000 0.000000 0.000000 0.007192
    NE   0.000342 0.003425 0.002626 0.000000 0.000000 0.000000 0.000000 0.000000 0.006393
   ENE   0.000342 0.003995 0.003881 0.000000 0.000000 0.000000 0.000000 0.000000 0.008219
     E   0.000571 0.004909 0.001826 0.000000 0.000000 0.000000 0.000000 0.000000 0.007306
   ESE   0.000228 0.003539 0.001941 0.000000 0.000000 0.000000 0.000000 0.000000 0.005708
    SE   0.000457 0.002169 0.002740 0.000000 0.000000 0.000000 0.000000 0.000000 0.005365
   SSE   0.000000 0.003767 0.002283 0.000000 0.000000 0.000000 0.000000 0.000000 0.006050
     S   0.000457 0.004680 0.001142 0.000000 0.000000 0.000000 0.000000 0.000000 0.006279
   SSW   0.000457 0.002397 0.001484 0.000000 0.000000 0.000000 0.000000 0.000000 0.004338
    SW   0.000342 0.001941 0.002283 0.000000 0.000000 0.000000 0.000000 0.000000 0.004566
   WSW   0.000114 0.002626 0.001027 0.000000 0.000000 0.000000 0.000000 0.000000 0.003767
     W   0.000571 0.006963 0.007078 0.000000 0.000000 0.000000 0.000000 0.000000 0.014612
   WNW   0.000114 0.006393 0.003881 0.000000 0.000000 0.000000 0.000000 0.000000 0.010388
    NW   0.000228 0.005251 0.000685 0.000000 0.000000 0.000000 0.000000 0.000000 0.006164
   NNW   0.000114 0.004110 0.000913 0.000000 0.000000 0.000000 0.000000 0.000000 0.005137
     N   0.000000 0.003311 0.001484 0.000000 0.000000 0.000000 0.000000 0.000000 0.004795

  CALM                                                                           0.000913
-----------------------------------------------------------------------------------------
  TOTAL  0.004680 0.063584 0.038014 0.000000 0.000000 0.000000 0.000000 0.000000 0.107192

   MEAN WIND SPEED (m/s) = 2.69
  NUMBER OF OBSERVATIONS = 939
```

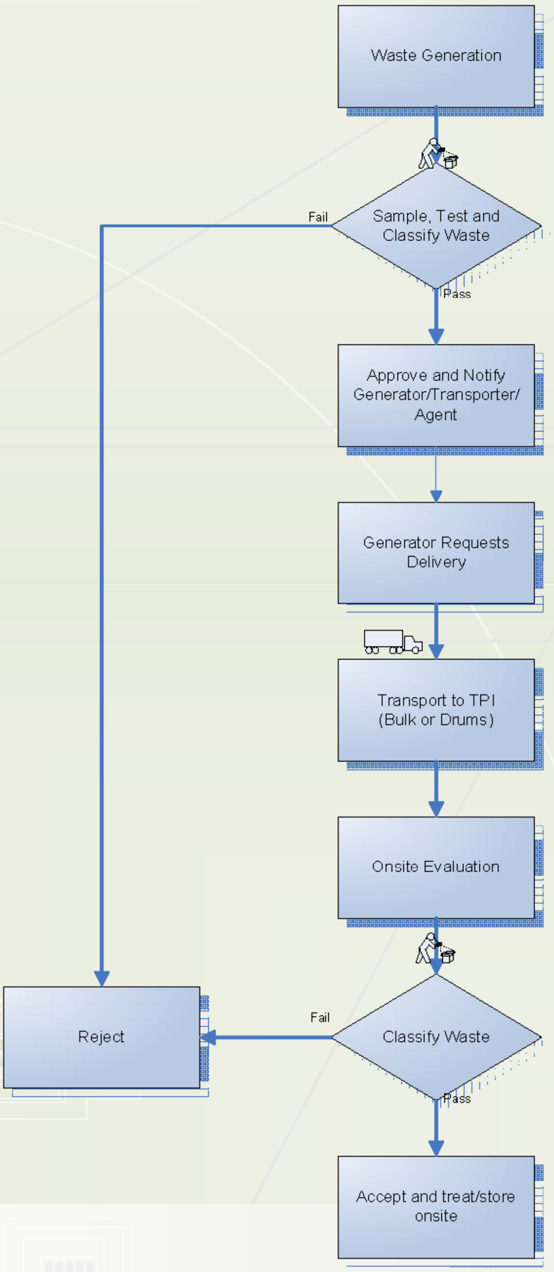
```
                   ALL PASQUILL STABILITY CLASSES

                        Wind Speed Class (m/s)

              0.50     1.50     3.00     4.50     6.00     7.50     9.00  GREATER
 WIND          TO       TO       TO       TO       TO       TO       TO     THAN
SECTOR        1.50     3.00     4.50     6.00     7.50     9.00    10.50    10.50    TOTAL
-----------------------------------------------------------------------------------------

   NNE   0.001712 0.012557 0.013356 0.004680 0.000114 0.000000 0.000000 0.000000 0.032420
    NE   0.002055 0.010959 0.019292 0.011416 0.000571 0.000000 0.000000 0.000000 0.044292
   ENE   0.001484 0.011187 0.023744 0.014155 0.002055 0.000342 0.000000 0.000000 0.052968
     E   0.002968 0.013128 0.019406 0.012671 0.005365 0.000457 0.000000 0.000000 0.053995
   ESE   0.002169 0.015868 0.020662 0.014726 0.004224 0.000799 0.000114 0.000000 0.058562
    SE   0.001484 0.010845 0.026370 0.014726 0.009817 0.002626 0.000571 0.000000 0.066438
   SSE   0.002283 0.015639 0.021804 0.011187 0.003995 0.001027 0.000342 0.000000 0.056279
     S   0.003082 0.016438 0.017580 0.011073 0.010046 0.002397 0.002055 0.001598 0.064269
   SSW   0.003082 0.015753 0.010274 0.007648 0.006963 0.002169 0.000457 0.002511 0.048858
    SW   0.003311 0.012900 0.015525 0.010959 0.004566 0.001712 0.000457 0.000342 0.049772
   WSW   0.003425 0.009932 0.019064 0.017922 0.006164 0.003881 0.003653 0.001598 0.065639
     W   0.004795 0.024201 0.051027 0.035731 0.009247 0.005594 0.006849 0.003196 0.140639
   WNW   0.002740 0.017123 0.055936 0.076712 0.016210 0.007877 0.004795 0.000799 0.182192
    NW   0.002397 0.009932 0.009817 0.009132 0.004795 0.002626 0.000799 0.000228 0.039726
   NNW   0.001256 0.007420 0.004680 0.003196 0.001598 0.000000 0.000000 0.000000 0.018151
     N   0.002169 0.009132 0.005936 0.001941 0.000000 0.000000 0.000000 0.000000 0.019178

  CALM                                                                           0.006621
-----------------------------------------------------------------------------------------
  TOTAL  0.040411 0.213014 0.334475 0.257877 0.085731 0.031507 0.020091 0.010274 1.000000

   MEAN WIND SPEED (m/s) = 4.32
  NUMBER OF OBSERVATIONS = 8760



  -------------------------------------------
  FREQUENCY OF OCCURENCE OF STABILITY CLASSES
  -------------------------------------------
    A : 5.8%
    B : 8.3%
    C : 15.3%
    D : 37.9%
    E : 22.1%
    F : 10.7%
```

Appendix C

Process Flow Diagrams

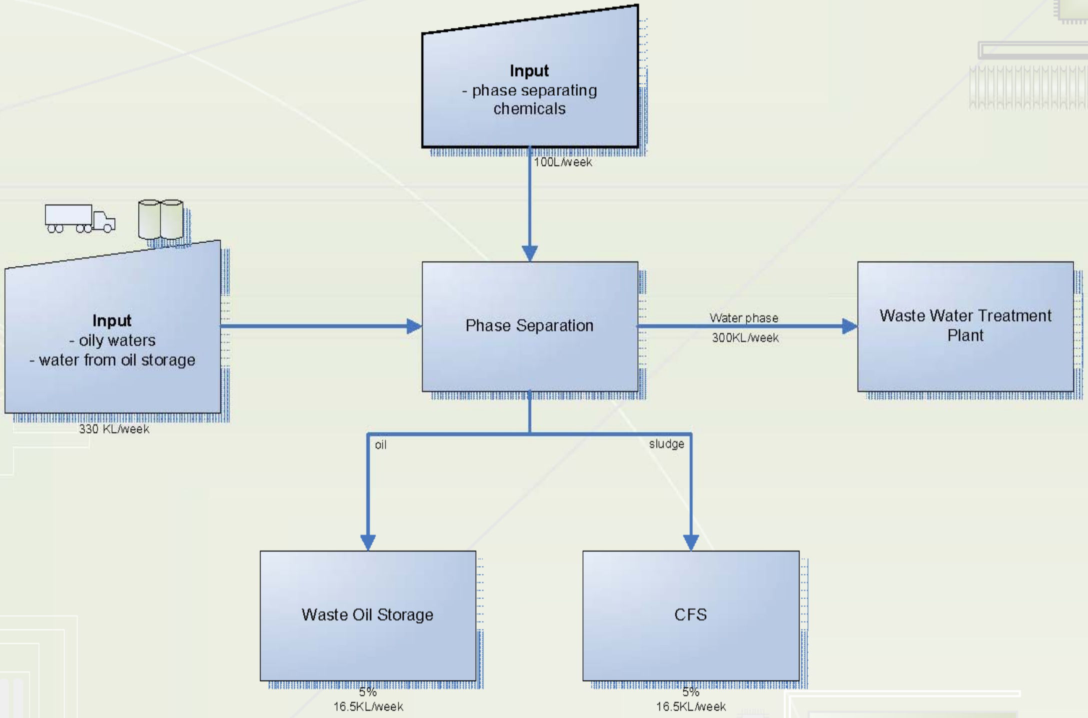
Process Flow Diagram 1

Incoming Waste Quality Control Process Flow Diagram



Process Flow Diagram 2

Oily Water Treatment Process Flow Diagram



Input
- phase separating chemicals

100L/week

Input
- oily waters
- water from oil storage

330 KL/week

Phase Separation

Water phase
300KL/week

Waste Water Treatment Plant

oil

sludge

Waste Oil Storage

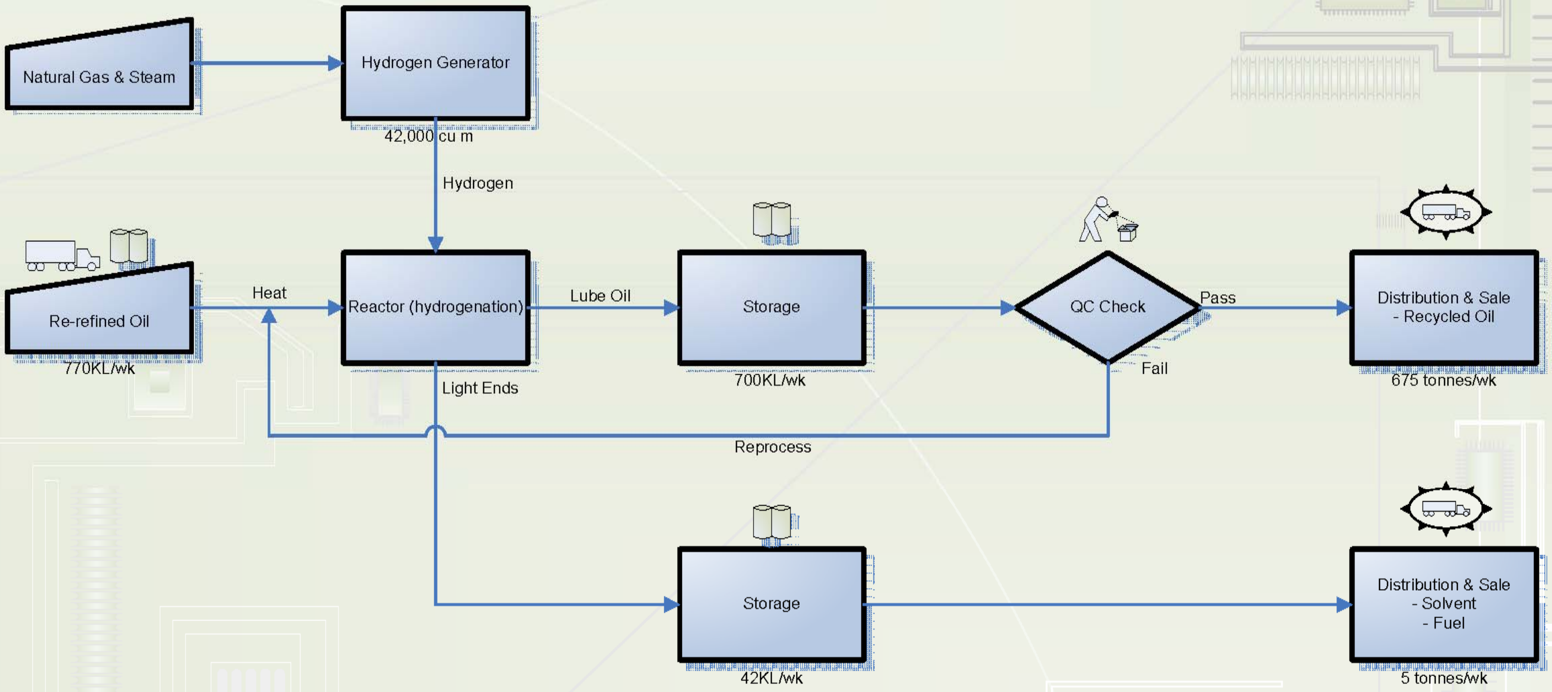
5%
16.5KL/week

CFS

5%
16.5KL/week

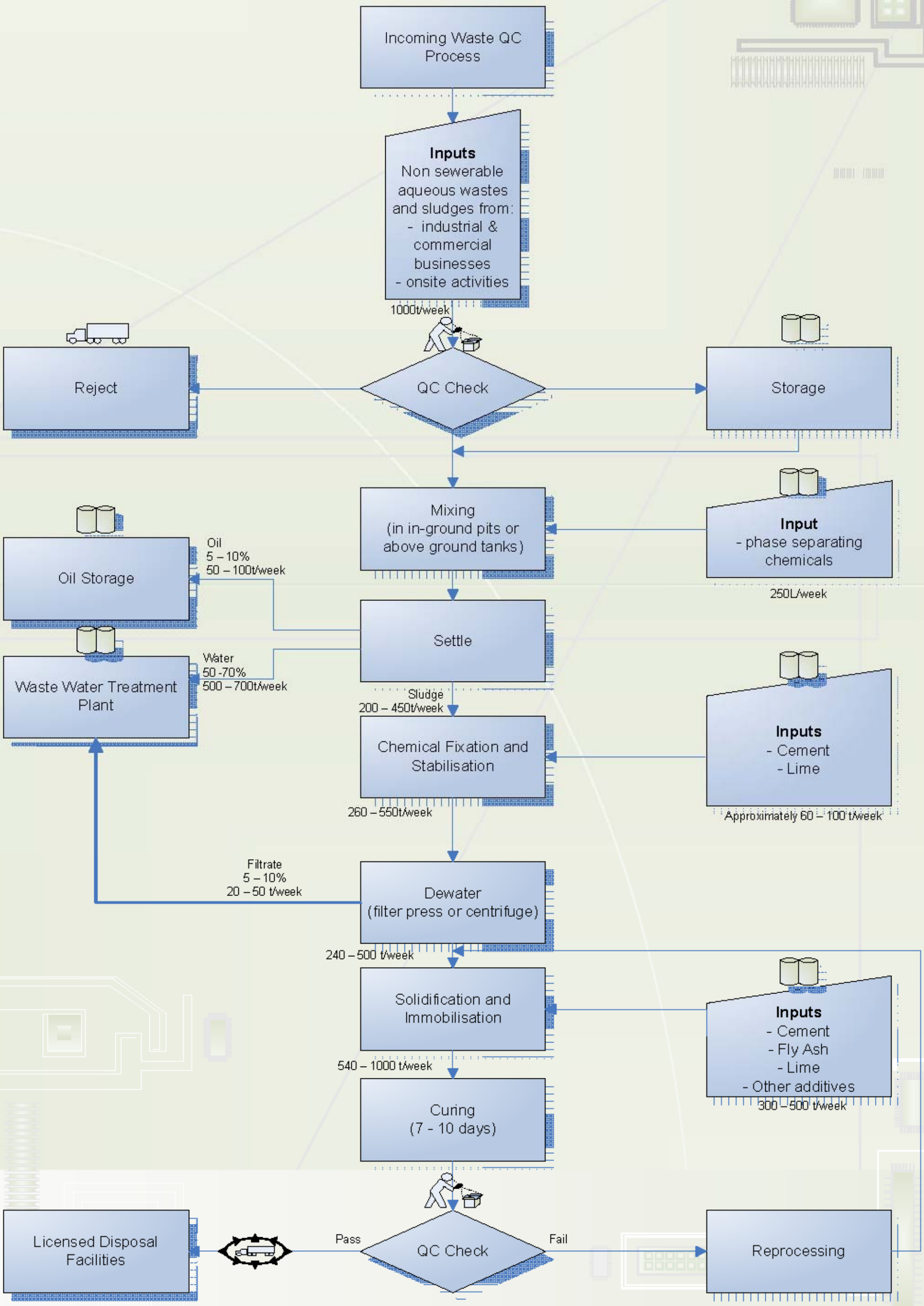
Process Flow Diagram 3

Lube Oil Hydrogenation Process Flow Diagram



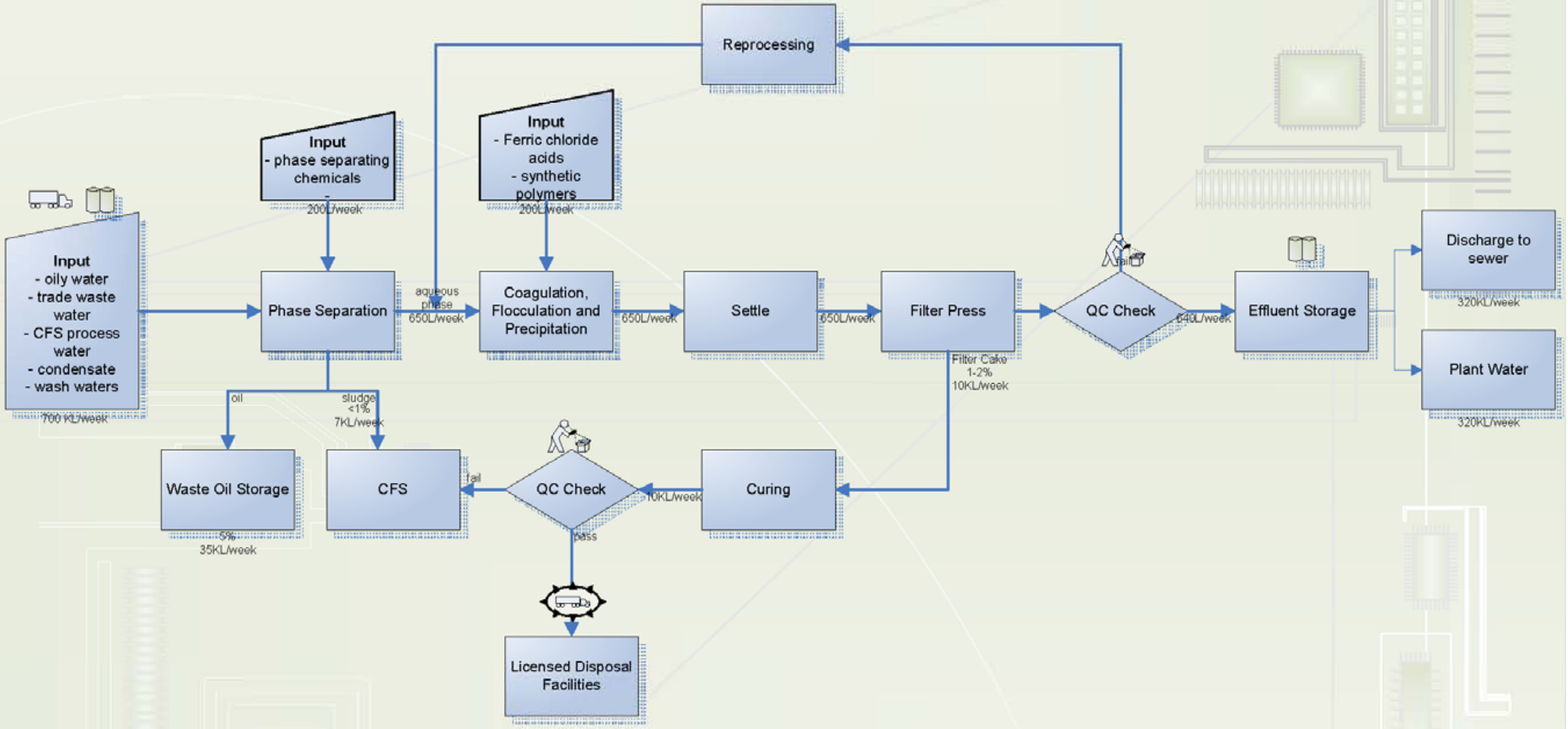
Process Flow Diagram 4

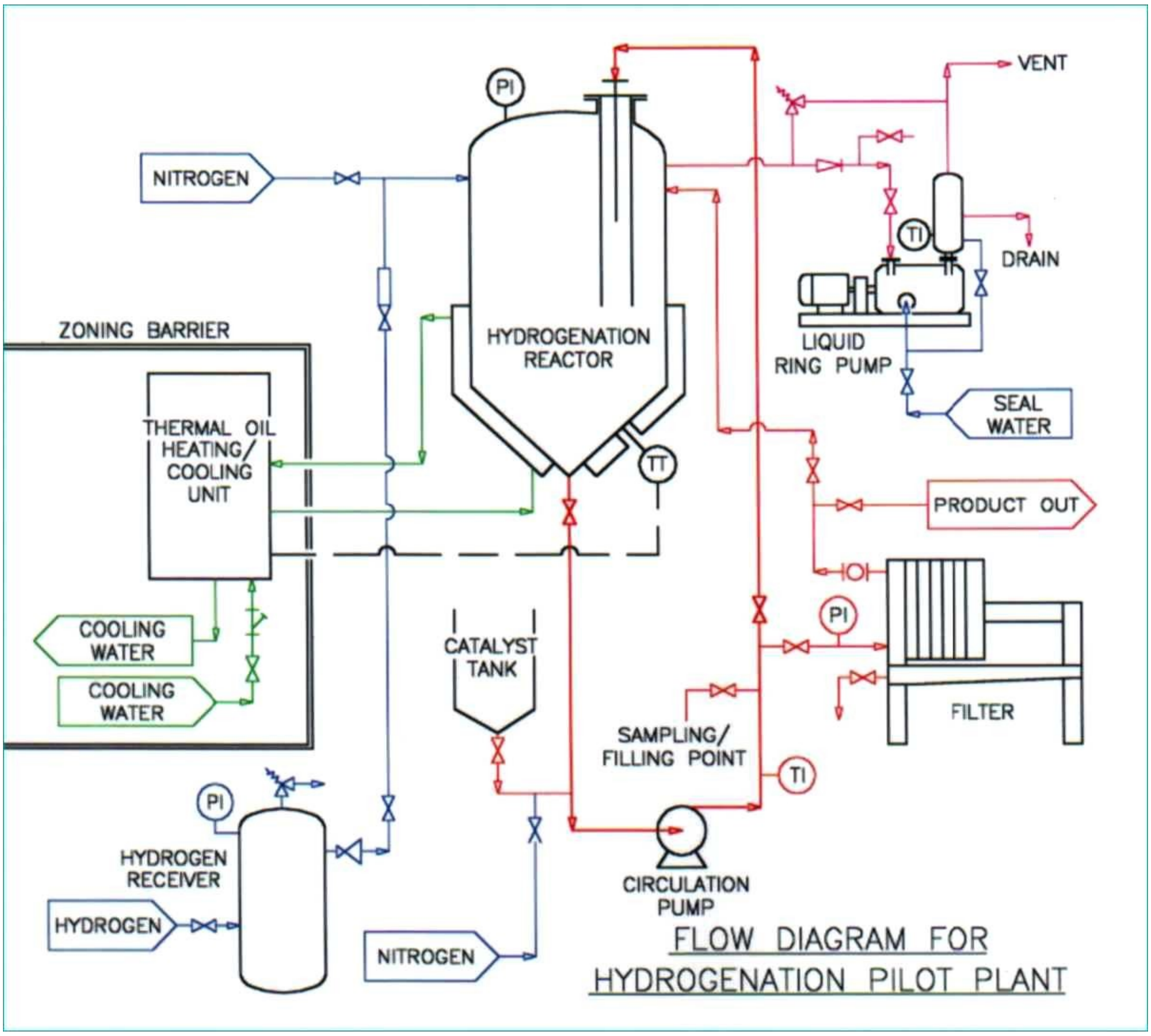
Chemical Fixation, Stabilisation and Solidification Process Flow Diagram

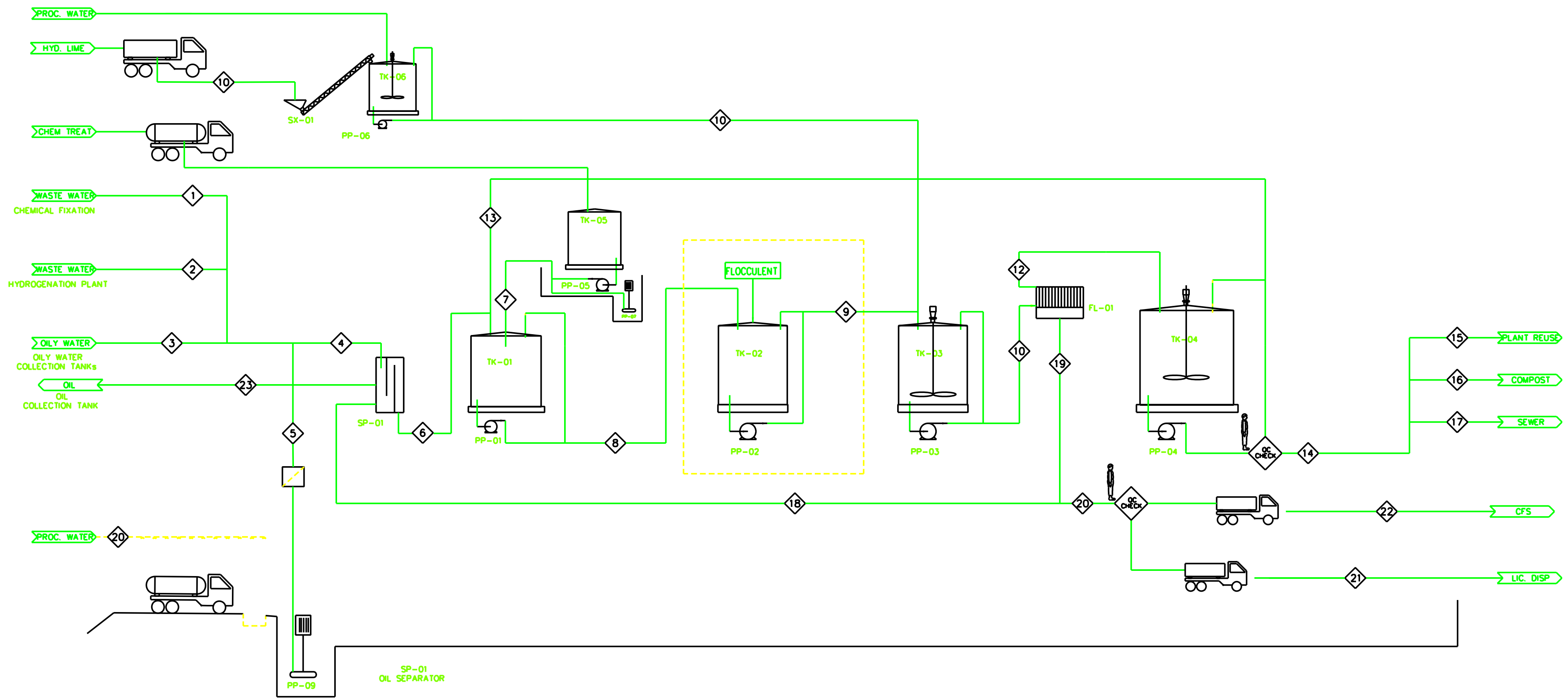


Process Flow Diagram 6

Waste Water Treatment Plant Process Flow Diagram




PI
NITROGEN
VENT
TI
DRAIN
ZONING BARRIER
HYDROGENATION REACTOR
LIQUID RING PUMP
SEAL WATER
THERMAL OIL HEATING/ COOLING UNIT
TT
PRODUCT OUT
PI
COOLING WATER
COOLING WATER
CATALYST TANK
FILTER
SAMPLING/ FILLING POINT
TI
PI
HYDROGEN RECEIVER
HYDROGEN
NITROGEN
CIRCULATION PUMP
FLOW DIAGRAM FOR HYDROGENATION PILOT PLANT



BUND-01
WASHDOWN AREA

TK-05
CHEMICAL TREATMENTS STORAGE TANKS

TK-06
IIME SLURRY TANK

TK-01
MAIN COLLECTION TANK

TK-02
COAG/FLOCC/PRECIP TANK

TK-03
Ph ADJUSTMENT TANK

FL-01
FILTER PRESS

TK-04
EFFLUENT STORAGE TANK

PP-09
BUND SUMP PUMP

PP-05
TK-05 DISCHARGE PUMP

PP-06
LIME SLURRY PUMP

PP-01
TK-01 DISCHARGE PUMP

PP-02
TK-02 DISCHARGE PUMP

PP-03
TK-03 DISCHARGE PUMP

PP-04
TK-04 DISCHARGE PUMP

Stream	WASTE WATER					SEPARATED WATER	SEPARATION CHEMICAL	SEPARATED WATER	SEPARATED WATER	LIME ADDIT.	MILKY WATER	FILTERED WATER			DISCHARGE WATER			SLUDGE					OIL		
Stream Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
Source	CFS	OILY COLLECT.	HgP & H2P	W/WATER BUND	COMB. FLOW	SP-01	TK-05	TK-01	TK-02	TK-06	TK-03	FL-22	QC	QC	DISCHARGE	DISCHARGE	DISCHARGE	SP-01	FL-01	COMB. FLOW	QC	QC	SP-01		
Destination	SP-01	SP-01	SP-01	SP-01	SP-01	TK-01	TK-01	TK-02	TK-03	TK-03	FL-22	QC	TK-01	DISCHARGE	PLANT RE-USE	SEWER	COMPOST	QC	QC	QC	LIC'D LANDFILL	CFS	OIL STORAGE		
Concentration Oil (%)	<5%	<5%	<5%	< 5%	<0.1%	< 0.1%	0	<0.1%	<0.1%	N/A	<0.1%	0	0	0	0	0	0						> 95%		
Flow	700 KL/WK	330 KL/WK	206 KL/WK	9 KL/WK	1218 KL/WK	1158 KL/WK	0.3 KL/WK	1158.3 KL/WK	1158.6 KL/WK	28150 kg/WK	1186.6KL/WK	1158KL/WK	115 KL/WK	1043 KL/WK	1043 KL/WK			1.2 KL/WK	28.6 KL/WK	29.8 KL/WK			58.5 KL/WK		
Pressure (kPag)	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	N/A	<800	<800	<500	<500	<500	<500	N/A	N/A	<500		
Temperature (^ C)	AMB.	AMB.	AMB.	AMB.	AMB.	AMB.	AMB.	AMB.	AMB	AMB	AMB.	AMB.	AMB.	AMB.	AMB.	AMB.	AMB.	AMB.	AMB.	AMB.	AMB.	AMB.	AMB.		

DRAWING No.
REFERENCE DRAWINGS

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TICOR CHEMICAL Co. P/L
Landing Rd. Yarwun
Gladstone 4680
Telephone (07) 49761777

No.	BY	DATE	REVISION	CHECKED	APPROV.
A	RNM	11/05	DS SUBMISSION		

	BY	DATE
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CHECKED		
DRAWN	RNM	25/11/05

CLIENT
TICOR CHEMICAL Co. Pty. Ltd.

TITLE
WASTE WATER TREATMENT-RUTHERFORD

SIZE A1
SCALE NTS
CAD FILE No. 10F8004
REV. No. A
DRAWING No. TPI-10-F-8004

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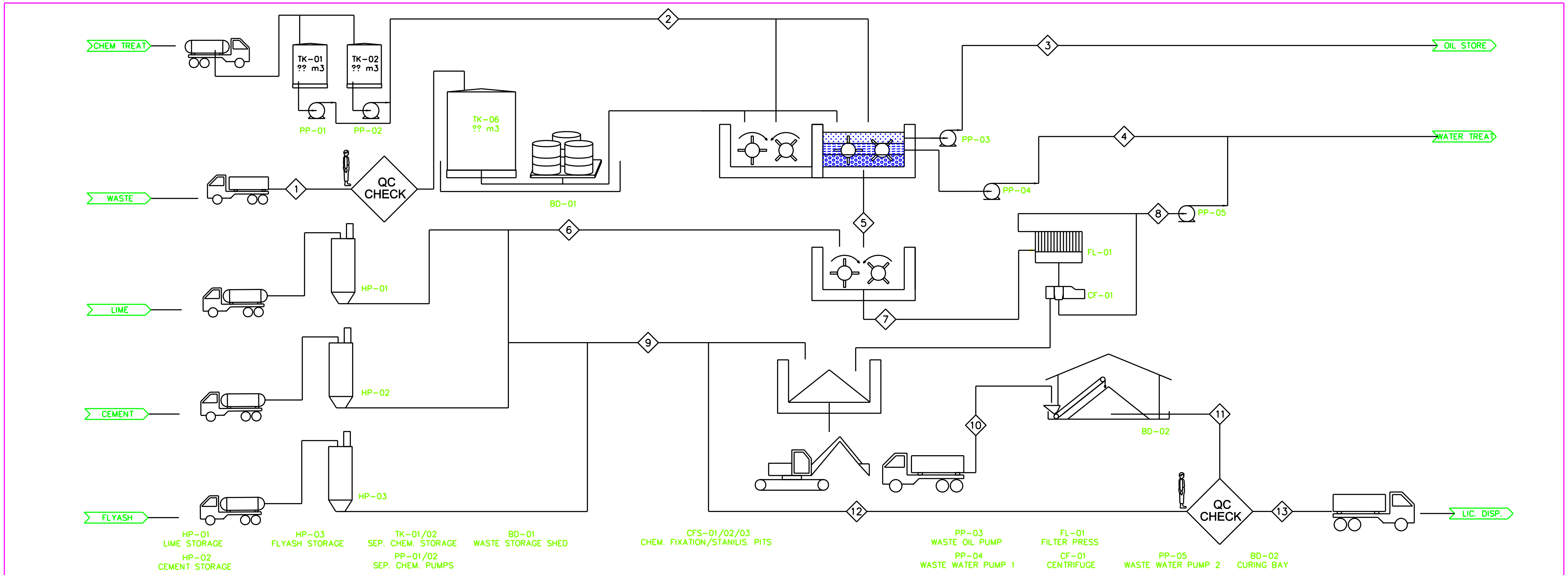

Stream	INCOMING WASTE	SEP CHEM.'S	WASTE OIL	WASTE WATER	SLUDGE	LIME/ CEMENT	CFS SLURRY	FLYASH/ CEMENT	FIXATED SOLID			
Stream Number	1	2	3	4	5	7	8	9	10	11	12	13
Source	EXT CUST.	STORAGE	CFS PITS	CFS PITS	CFS PITS	STORAGE	CFS PITS	STORAGE	SOLIDIF./ IMMOB.	CURING	QA REJECT	QA OK
Destination	STORAGE	CFS PITS	OIL STORAGE	WATER TREAT.	CFS PITS	CFS PITS	FL-01/ CF-01	SOLIDIF./ IMMOB.	CURING	QA	SOLIDIF./ IMMOB.	LIC'D. DISPOSAL
Total Volume (UNITS AS SHOWN)	1000t/WK	0.3KL/WK	100t/WK	700t/WK	450t/WK	100t/WK	550t/WK	500t/WK	1000t/WK	1000t/WK	??	1000t/WK
Pressure (kPag)	N/A	<500	<500	<500	N/A	N/A	<500	N/A	N/A	N/A	N/A	N/A
Temperature (^ C)	AMBIENT	AMB.	AMB.	AMB.	AMB.	AMB.	AMB	AMB.	AMB.	AMB.	AMB.	AMB.
Acid/Alkali Soltn. (Low Contaminant.)	21.5 t/WK										<5 or >11	5-11
pH	1 - 14											
Metals	VARIES											
Acid/Alkaline Strength	VARIES											
Cyanide	< 1000 ppm											
Acid/Alkali/Paint & Other Sludges	188 t/WK											
pH	1 - 14										<5 or >11	5-11
Metals	VARIES											
Acid/Alkaline Strength	VARIES											
Cyanide	< 1000 ppm											
Metal Contam. Waste (Mod Contam.)	13.4 t/WK											
pH	1 - 14										<5 or >11	5-11
Metals	VARIES											
Cyanide	< 1000 ppm											
Cyanide Waste	1.6 t/WK											
pH	> 8										<5 or >11	5-11
Cyanide	< 1000 ppm											
CCA/ Metal Contam Sludges (high)	1.1 t/WK											
Copper	VARIES										0	< 200 mg/kg
Chrome	VARIES										0.9%	< 5 mg/kg
Arsenic	VARIES										0.2%	< 5 mg/kg

Stream	INCOMING WASTE	SEP CHEM.'S	WASTE OIL	WASTE WATER	SLUDGE	LIME/ CEMENT	CFS SLURRY	FLYASH/ CEMENT	FIXATED SOLID			
Stream Number	1	2	3	4	5	7	8	9	10	11	12	13
Source	EXT CUST.	STORAGE	CFS PITS	CFS PITS	CFS PITS	STORAGE	CFS PITS	STORAGE	SOLIDIF./ IMMOB.	CURING	QA REJECT	QA OK
Destination	STORAGE	CFS PITS	OIL STORAGE	WATER TREAT.	CFS PITS	CFS PITS	FL-01/ CF-01	SOLIDIF./ IMMOB.	CURING	QA	SOLIDIF./ IMMOB.	LIC'D. DISPOSAL
Total Volume (UNITS AS SHOWN)	1000t/WK	0.3KL/WK	100t/WK	700t/WK	450t/WK	100t/WK	550t/WK	500t/WK	1000t/WK	1000t/WK	??	1000t/WK
Pressure (kPag)	N/A	<500	<500	<500	N/A	N/A	<500	N/A	N/A	N/A	N/A	N/A
Temperature (^ C)	AMB.	AMB.	AMB.	AMB.	AMB.	AMB.	AMB	AMB.	AMB.	AMB.	AMB.	AMB.
Acid Wastes	72.2 t/WK											
pH	< 5										<5 or >11	5-11
Metals	VARIES											
Acid Strength	VARIES											
Phenolic Waste	4.2 t/WK											
pH	1 - 14										<5 or >11	5-11
Phenols	VARIES											
Oily Wastes/Sludges	470 t/WK											
pH	1 - 14										<5 or >11	5-11
Metals	VARIES											
Cyanide	469 t/WK											
Phenols	VARIES											
Contaminated Soil	35.4 t/WK											
Catalyst	193.6 t/WK											
Cadmium	VARIES										0.2%	<0.5 mg/kg
Lead	VARIES										0.2%	< 5 mg/kg
Zinc	VARIES										0	< 500 mg/kg
Total TPH	VARIES										3%	< 50 mg/kg

DRAWING No. | REFERENCE DRAWINGS

TRANSPACIFIC INDUSTRIES PTY LTD
Coronation Drive
Milton, Qld
Telephone (07) 33677800

No.	BY	DATE	REVISION	CHECKED	APPROV.
B	RNM	01/06	ADDITIONAL ANALYSIS DATA ADDED		
A	RNM	8/05	EIS SUBMISSION		

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PROJ. APP.		
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DRAWN	RNM	17/08/05

CLIENT
TRANSPACIFIC INDUSTRIES PTY LTD

TITLE
CHEMICAL FIXATION & STABILISATION
RUTHERFORD

SIZE A1
SCALE NTS
CAD FILE No. 10F8005
REV. No. A B
DRAWING No. TPI-10-F-8005

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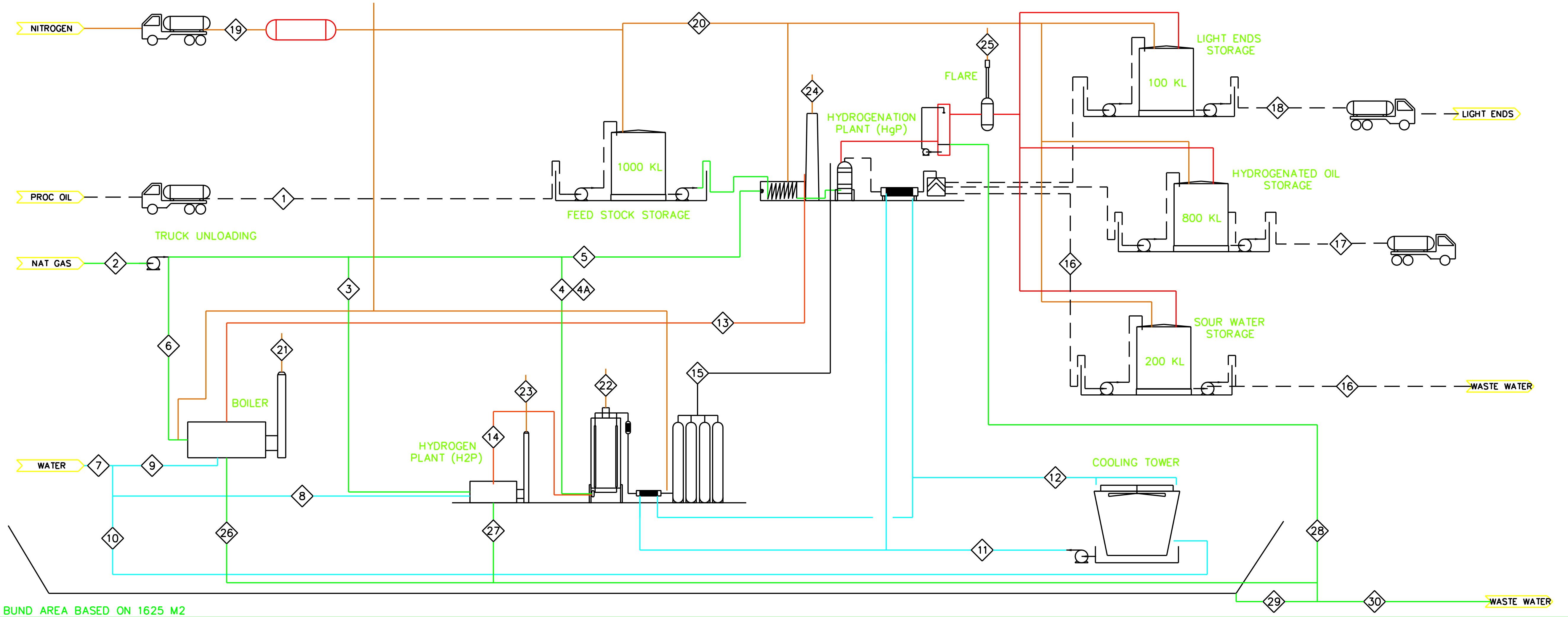

** BUND AREA BASED ON 1625 M2

Stream	PRE-TREATED OIL		NATURAL GAS (88% Methone)						RAW WATER				COOLING WATER		STEAM		H2	SOUR WATER	BASE OIL	LIGHT ENDS	NITROG.	NITROG.	AIR EMISSIONS				
Stream Number	1	1	2	3	4	4A	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Source	TRUCK UNLOAD	TRUCK UNLOAD	MAIN SUPPLY	GAS COMPR.	GAS COMPR.	GAS COMPR.	GAS COMPR.		RAW SUPPLY	WATER SUPPLY	WATER SUPPLY	WATER SUPPLY	COOLING TOWER	H2P HgP	BOILER	H2P STM GENER.	H2P STM GENER.	TK-10	TK-5/6/7 TK-8/9	TK-11	SUPPLIER	STORAGE	BOILER	H2P REFORMER	H2P STM GENER.	HgP HEATER	FLARE
Destination	TK-1/2/3 TK-4/5/6	TK-1/2/3/ TK-4/5/6	GAS COMPR	H2P STM GENER.	H2P BURNER	H2 PRODUCT	HgP, FLARE PILOT BURNER, BOILER		COMB. FLOW	H2 STM GENER.	BOILER	COOLING TOWER	H2P HgP	COOLING TOWER	HYDROG. PLANT	H2 PROD.	HYDROG. PLANT	WATER TREAT.	TRUCK LOAD	HYDROG. PLANT	STORAGE	PURGES	ATMOSPH.	ATMOSPH.	ATMOSPH.	ATMOSPH.	ATMOSPH.
Concentration Oil (%)	99	99 C	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Flow	4 T/Hr	36000 T/Y	12 GJ/Hr	0.9 GJ/Hr	1.2 GJ/Hr	2.9 GJ/Hr	6 GJ/Hr		4500 L/Hr	250 L/Hr	1250 L/Hr	3000 L/Hr	210 M3/Hr	210 M3/Hr	2000 KG/H	250 KG/H	250 NCMH	3283 T/Y	33436 T/Y	2000 T/Y	60.48 T/Y	60.48 T/Y	1233 AM3/Hr	732 AM3/h	586 AM3/h	1915 AM3/Hr	51 AM3/Hr
Pressure (kPag)	<500	< 500	250	150	150	1800	150		600	600	600	600	<700	< 500	1000	1800	1379	<500	<500	<500	1500	0.6	ATMOSPH	ATMOSPH	ATMOSPH	ATMOSPH	ATMOSPH
Temperature (^ C)	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT	AMBIENT		AMBIENT	<100	100	AMB.					38	<40	<40	<40	<0	25					
KW	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	2000	2000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
S02	N/A	N/A	N/A	N/A	0	0	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	11 G/Nm3	0
C02	N/A	N/A	N/A	N/A	158 g/Nm3	158 g/Nm3	158 g/Nm3		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	158 G/Nm3	158 G/Nm3	158 G/Nm3	140 G/Nm3	102 G/Nm3
N2	N/A	N/A	N/A	N/A	919 g/Nm3	919 g/Nm3	919 g/Nm3		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	919 G/Nm3	919 G/Nm3	919 G/Nm3	1000 G/Nm3	945 G/Nm3
H20	N/A	N/A	N/A	N/A	117 g/Nm3	117 g/Nm3	117 g/Nm3		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	117 G/Nm3	117 G/Nm3	117 G/Nm3	140 G/Nm3	75 G/Nm3
02	N/A	N/A	N/A	N/A	55 g/Nm3	55 g/Nm3	55 g/Nm3		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	55 G/Nm3	55 G/Nm3	55 G/Nm3	85 G/Nm3	141 G/Nm3
Sulphur			N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.43 kg/Hr	N/A	N/A	N/A	N/A					

Stream	EFFLUENT WATER				
Stream Number	26	27	28	29	30
Source	BOILER	H2P GENER.	STRIPPER COND.	BUNDS**	COMB FLOW
Destination	W/WATER	W/WATER	W/WATER	W/WATER	W/WATER
Concentration Oil (%)	0	0	<1%	<1%	<1%
Flow	100 L/Hr	15 L/Hr	1 kL/Hr	185 L/Hr	1.3 kL/Hr
Pressure (kPag)	<500	< 500	< 500	<650	<650

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TRANSPACIFIC INDUSTRIES PTY LTD
CORONATION DRIVE
MILTON, QLD
Telephone (07) 33677800

No.	BY	DATE	REVISION	CHECKED	APPROV.
D	RNM	1/06	FLOW 4 NAT GAS SUPPLY TO H2P SPLIT- BURNER/PRODUCT		
C	RNM	1/06	AIR EMISSION FLOWS ADDED, NAT GAS FLOW CORRECTED		
B	RNM	8/05	EIS DRAFT- N2 ADDED		
A	RNM	8/05	EIS DRAFT		

	BY	DATE
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DESIGN APP.		
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DRAWN	RNM	08/05

CLIENT
TRANSPACIFIC INDUSTRIES PTY LTD

TITLE
RUTHERFORD PROJECT
HYDROGENATION FLOW SHEET

SIZE A1
SCALE NTS
CAD FILE No. 10F8003
REV. No. A B C
DRAWING No. TPI-10-F-8003

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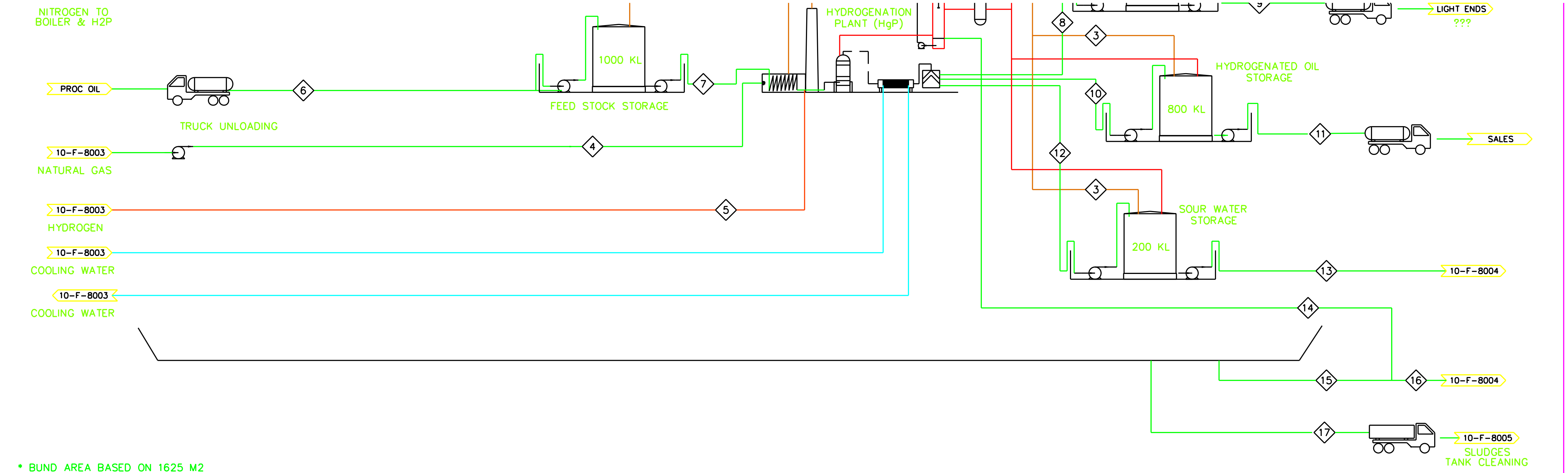

* BUND AREA BASED ON 1625 M2
** ESTIMATED PUMPING PRESSURES, NOT STORAGE. (N2 BLANKET AT APPROX 6 kPag)

Stream	NITROGEN			NAT GAS	HYDROGEN	PRE TREATED OIL		LIGHT ENDS		BASE OIL		SOUR WATER		WASTE WATER			WASTE SOLIDS	AIR EMISSIONS								
Stream Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Source	TRUCK DELIVERY	ISOTAINER	PLANT SUPPLY	GAS COMPRESSOR	H2P PLANT	TRUCK DELIVERY	STORAGE	HGP SEPARATOR	TK-11 STORAGE	HGP SEPARATOR	TK-11 STORAGE	HGP SEPARATOR	TK-11 STORAGE	STRIPPER CONDENS.	BUNDS * STORMWATER	COMBINED FLOW	SLUDGE CLEANING	HGP HEATER	FLARE							
Destination	ISOTAINER	PLANT SUPPLY	STORAGE TANKS	HGP BURNER	HGP INJECTOR	TK-1/2/3/4/5/6 STORAGE	HGP PROCESS	TK-11 STORAGE	TRUCK TRANSPORT	TK-5/6/7/8/9 STORAGE	TRUCK TRANSPORT	TK-10 STORAGE	WASTE WATER	WASTE WATER	WASTE WATER	WASTE WATER	CHEMICAL FIXATION	ATMOSPHERE	ATMOSPHERE							
Flow	60.48 T/Y	60.48 T/Y	60.48 T/Y	6 GJ/Hr	250 NCMH	36000 T/Y	4 T/Hr	0.23 T/Hr	2000 T/Y	3.82 T/Hr	33436 T/Y	0.375 T/Hr	3283 T/Y	1 kL/Hr	185 L/Hr	1.185 kL/Hr	10 T/Yr	1915 Am3/Hr	51 Am3/Hr							
Pressure (kPag)	1500	1500	0.6	1800	1379	<500 **	<500 **	<500 **	<500 **	<500 **	<500 **	<500 **	<500 **	<500 **	<500 **	<500 **	N/A	ATMOSPH.	ATMOSPH.							
Temperature (^ C)	<0	<0	25	AMBIENT	38	AMBIENT	AMBIENT	< 40	< 40	< 40	< 40	< 40	< 40	<40	AMBIENT	AMBIENT	AMBIENT	–	–							
pH	–	–	–	–	–	7-8	7-8	–	–	–	–	–	–	–	–	–	–	–	–							
Moisture Content	–	–	–	–	–	< 0.01%v/v	< 0.01%v/v	–	–	–	–	–	–	–	–	–	–	–	–							
Sulphur	–	–	–	–	–	< 1%w/w	< 1%w/w	–	–	–	–	5%	–	–	–	–	–	–	–							
Ash Content	–	–	–	–	–	< 0.05%w/w	< 0.05%w/w	–	–	–	–	–	–	–	–	–	–	–	–							
Vanadium	–	–	–	–	–	< 1 ppm	< 1 ppm	–	–	–	–	–	–	–	–	–	–	–	–							
Iron	–	–	–	–	–	< 10 ppm	< 10 ppm	–	–	–	–	–	–	–	–	–	–	–	–							
Lead	–	–	–	–	–	< 10 ppm	< 10 ppm	–	–	–	–	–	–	–	–	–	–	–	–							
Sodium	–	–	–	–	–	< 10 ppm	< 10 ppm	–	–	–	–	–	–	–	–	–	–	–	–							
Silicon	–	–	–	–	–	< 100 ppm	< 100 ppm	–	–	–	–	–	–	–	–	–	–	–	–							
Copper	–	–	–	–	–	< 1 ppm	< 1 ppm	–	–	–	–	–	–	–	–	–	–	–	–							
Zinc	–	–	–	–	–	< 10 ppm	< 10 ppm	–	–	–	–	–	–	–	–	–	–	–	–							
Calcium	–	–	–	–	–	< 100 ppm	< 100 ppm	–	–	–	–	–	–	–	–	–	–	–	–							
Potassium	–	–	–	–	–	< 10 ppm	< 10 ppm	–	–	–	–	–	–	–	–	–	–	–	–							
Magnesium	–	–	–	–	–	< 10 ppm	< 10 ppm	–	–	–	–	–	–	–	–	–	–	–	–							
S02	–	–	–	–	–	–	–											11 G/Nm3	0 G/Nm3							
C02	–	–	–	–	–	–	–											140 G/Nm3	102 G/Nm3							
N2	100%	100%	100%	–	–	–	–											1000 G/Nm3	943 G/Nm3							
02	–	–	–	–	–	–	–											83 G/Nm3	141 G/Nm3							

DRAWING No. REFERENCE DRAWINGS

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CORONATION DRIVE
MILTON, QLD
Telephone (07) 33677800

No.	BY	DATE	REVISION	CHECKED	APPROV.
B	RNM	1/06	AIR EMISSIONS FLARE AND BURNER ADDED		
A	RNM	1/06	EIS DRAFT		

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DRAWN	RNM	4/1/06

CLIENT
TRANSPACIFIC INDUSTRIES PTY LTD

TITLE
RUTHERFORD PROJECT
HYDROGENATION OIL PROCESSING
FLOW SHEET

SIZE A1
SCALE NTS
CAD FILE No. 10F8003
REV. No. A B
DRAWING No. TPI-10-F-8008

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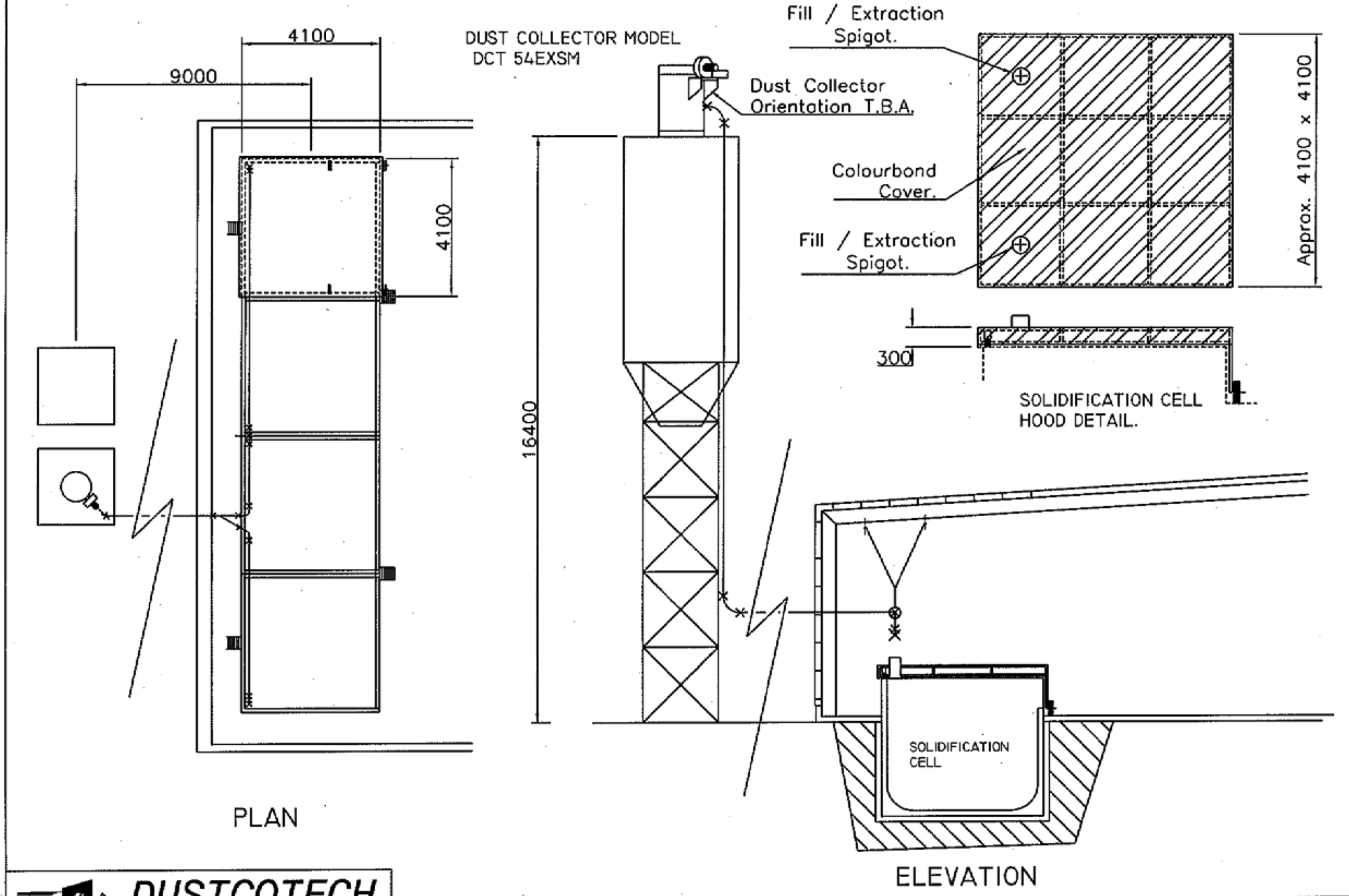
Appendix D

Dustcotech Extraction System

TRANSPACIFIC INDUSTRIES DUST EXTRACTION SYSTEM G.A.



DUSTCOTECH
DUST COLLECTION TECHNOLOGY PTY. LTD.
A.C.N. 057 114 799

Drawn by: M.M
Checked by:
Filename: Transpacific 72EXSM GA.dwg
Date: 18.11.05
Scale: NTS
Client: TRANSPACIFIC INDUSTRIES

RevNo
Revision note
Date
Drawing No. 05.1048.001
Signature
Checked

DUST COLLECTION TECHNOLOGY PTY. LTD.
(DUSTCOTECH)
179-183 Dillon Rd., Banyo, QLD. 4014
Australia
Phone (07) 3267 0429
Fax (07) 3267 0432
International Ph. 61 (07) 3267 0429
International Fax 61 (07) 3267 0432

Appendix E

MSDS for Hydrogenation Feed Stock Oil

Nationwide Oil Pty Ltd

RB40

MATERIAL SAFETY DATA BULLETIN

---

1. PRODUCT AND COMPANY IDENTIFICATION

BASED ON SUPPLIER INFORMATION
PRODUCT NAME : RB40
SUPPLIER : NATIONWIDE OIL PTY LTD A.C.N. 066 383 364
LEVEL 10 TOOWONG TOWERS
9 SHERWOOD ROAD
TOOWONG

Telephone (07) 38707511
Fax (07) 38707460

Product Information : Nationwide Oil (02) 9604 2611

2. COMPOSITION / INFORMATION ON INGREDIENTS

GENERIC COMPOSITION : PETROLEUM HYDROCARBON

The product is a complex mixture of paraffins and cycloparaffins with carbon numbers predominantly in the range C22 - C26. It may contain small quantities of sulphur and nitrogen compounds and additive packages such as antioxidants, corrosion inhibitors, and proprietary performance enhancing additives.

Appearance & Odour : Dark amber liquid. Very slight odour.
Chemical Reactivity : Stable. Avoid Oxidising agents and naked flames

Hazardous according to the criteria of NOHSC – May Cause Cancer.

3. HAZARDS IDENTIFICATION

EFFECTS OF OVEREXPOSURE :

Dizziness, nausea, loss of consciousness

4. FIRST AID MEASURES

EYE CONTACT : Flush thoroughly with water. Seek medical attention if irritation persists.

SKIN CONTACT : Wash contact area with soap and water.

INHALATION : Not expected to be a problem under normal conditions of use.

INGESTION : Not expected to be a problem under normal conditions of use. However, if greater than ½ litre is ingested, or if feeling unwell, give 1-2 glasses of water and seek medical attention. DO NOT INDUCE VOMITING or give anything by mouth to an unconscious patient.

Note to physicians : Treat symptoms with reference to specific health effects identified above.

5. FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA : Foam, dry chemical, CO_2, water fog.

SPECIAL FIRE FIGHTING PROCEDURES :

Use water to cool fire-exposed containers. If a leak or spill has not ignited, use water spray to disperse the spill and to protect personnel attempting to stop the leak. Water spray may be used to flush spills away from exposures. Prevent runoff from fire control or dilution from entering waterways, sewers or drinking water supply.

SPECIAL PROTECTIVE EQUIPMENT :

For fires in enclosed areas, firefighters must use self-contained breathing apparatus.

UNUSUAL FIRE & EXPLOSION HAZARDS :

.

Flash Point	> 150C.
LEL	n/a
UEL	n/a
Autoignition	> 250 °C

HAZARDOUS DECOMPOSITION PRODUCTS :

Carbon monoxide

6. ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES :

Report spills as required to appropriate authorities such as local Environmental Health Officer, EPA or Fire Brigade. If spills are likely to enter any drain, waterway or groundwater, contact the Area Water Authority. In case of accident or road spill, contact the Police and Fire Brigade and, if appropriate, EPA or Area Water Authority.

PROCEDURES IF MATERIAL IS RELEASED OR SPILLED :

Contain and absorb on suitable chemical absorbent material. Shovel up and remove to appropriate waste disposal facility in accordance with current applicable laws and regulations. Remove leaking containers to detached area for decanting or overpacking in appropriate containers.

ENVIRONMENTAL PRECAUTIONS :

Prevent spills from entering storm sewers, drains, watercourses or contact with soil.

7. HANDLING & STORAGE

HANDLING	:Avoid inhalation of mists.
STORAGE	:Store in a cool, dry, well ventilated area away from ignition sources. Section 15 for regulatory information when storing this product.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

VENTILATION :

Use in well ventilated area.

RESPIRATORY PROTECTION :

Approved respiratory protective equipment MUST be used when mist concentrations exceed applicable standards.

EYE PROTECTION :

Normal industrial eye protection practices should be employed.

SKIN PROTECTION :

Wear PVC gloves when handling Light Neutral, good personal hygiene practices should always be followed.

EXPOSURE LIMITS :

Worksafe exposure standard :- TWA 5mg/m^3 (oil mist) STEL 10mg/m^3 (oil mist)

Note : Limits shown for guidance only. Follow applicable regulations.

PERSONAL PROTECTION PRECAUTIONS :

Avoid contact with skin and eyes and avoid breathing mists. When exposure is likely, personal protective equipment in a combination appropriate to the degree and nature of exposure, should be selected from the following list :-

(1) Eye protection
(2) PVC Gloves
(3) PVC apron and sleeves or full PVC covering
(4) PVC or rubber boots

9. PHYSICAL & CHEMICAL PROPERTIES

RB40 SPECIFICATION

Typical physical properties are given below.

PHYSICAL STATE		Dark Amber Liquid
ODOUR		Very Slight
BOILING POINT	degC	> 250
POUR POINT	degC	> -15
FLASH POINT	degC	> 150
DENSITY @ 15 degC	kg/l	0.87 - 0.88
SPECIFIC ENERGY	MJ/kg	> 45
SOLUBILITY IN WATER		Negligible
pH		7 - 8
MOISTURE CONTENT	%v/v	< 0.01
SULPHUR	%w/w	< 1
ASH CONTENT	%w/w	< 0.05
KINEMATIC VISCOSITY @ 40°C	cSt	38 - 42
KINEMATIC VISCOSITY @ 100°C	cSt	5.8 - 6.5
VANADIUM	ppm	< 1
IRON	ppm	< 10
LEAD	ppm	< 10
SODIUM	ppm	< 10
SILICON	ppm	< 100
COPPER	ppm	< 1
ZINC	ppm	< 10
CALCIUM	ppm	< 100
POTASSIUM	ppm	< 10
MAGNESIUM	ppm	< 10

Note: PCB’s will not be present in product due to monitoring of feedstock to eliminate its presence.

10. STABILITY & REACTIVITY

STABILITY (Thermal, Light, etc) : Stable
CONDITIONS TO AVOID : Heat, sparks, flames
INCOMPATIBLE WITH : Strong oxidizers, nitrating agents
DECOMPOSITION PRODUCTS : Carbon monoxide, carbon dioxide
SELF-POLYMERISATION : Will not occur.

11. TOXICOLOGICAL DATA

ACUTE TOXICOLOGY

ORAL : Slightly toxic, may cause gastric irritation
DERMAL : Slightly irritating.
INHALATION : Inhalation of vapours generated at elevated temperatures may be irritating to nose and throat.
EYE IRRITATION : Slightly irritating

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL FATE AND EFFECTS : Not established

13. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL :

Product is suitable for burning in an enclosed controlled burner for fuel value or disposal by supervised incineration. Such burning may be limited by the local authority. In addition, the product is suitable for processing by an approved recycling facility or can be disposed of at an appropriate licensed waste disposal site. Use of these methods is subject to user compliance with applicable laws and regulations and consideration of product characteristics at the time of disposal.

14. TRANSPORT INFORMATION

Classified as a class C2 combustible liquid for storage and handling purposes. Store away from ignition sources, oxidising agents, foodstuffs and clothing. Keep containers closed when not in use.

S 26 Avoid contact with skin
S 36 Wear suitable protective clothing

In case of fire use foam, dry chemical, CO2 or water fog.

15. REGULATORY INFORMATION

GOVERNMENTAL INVENTORY STATUS :

All components comply with European EINECS/ELINCS, US TSCA and Australian AICS.

AUSTRALIAN CLASSIFICATION :

UN Number : n/a
HAZCHEM : n/a
DG Class : n/a
Pack Grp : n/a
AS 1940 Class : C2
Poisons Sched : n/a

REGULATORY LISTS SEARCHED

16. OTHER INFORMATION

USE : HYDROCARBON BASE STOCK

NOTE : NWO PRODUCTS ARE **NOT** FORMULATED TO CONTAIN PCBS

This MSDS meets Worksafe Australia accepted format requirements.

Prepared by : Nationwide Oil Pty Ltd
6 Davis Road
Wetherill Park NSW 2164

For further information : Nationwide Oil Pty Ltd
6 Davis Road
Wetherill Park NSW 2164

Ph 02 9604 2611
Fax 02 9609 2219

Appendix F

Key Assumptions and Limitations of AUSPLUME Modelling

LIMITATIONS OF MODELLING

A number of general assumptions were made during the modelling process based on the inherent limitations in current dispersion modelling theory and program functionality. These assumptions can be divided into those that are specific to the site or process that is modelled and those that are inherently part of the model's algorithms and programming.

Assessment Specific Assumptions

Coupled with the assumptions made upon calculating the emission rates as applied to this assessment, the following assumptions were made in configuration of the AUSPLUME dispersion model:

- emission rates as outlined in *Section 5*
- constant emissions considered throughout each hourly interval

  (consistent with steady state format of model)
- source selection / mode of release as outlined in *Section 5*
- predominantly rural area – rural defaults selected throughout modelling
- surface Roughness = 0.4 metre (no vegetative screening) – 'rolling rural land'
- adopted particle size distributions as follows

μm									
0.45-0.75	0.75-1.2	1.2 – 2	2 – 3.8	3.8 – 6	6 – 15	15 – 30	30 – 50	50 – 80	> 80
5%	6%	10%	15%	14%	17%	14%	12%	4%	3%

Model Specific Assumptions

The following regulatory default options are identified within the parameters utilised as part of the AUSPLUME Gaussian Plume Dispersion Model, and include the following:

- averaging period of 1 hour;
- Pasquill-Gifford horizontal and vertical dispersion curves for sources<100m;
- Briggs-Rural horizontal and vertical dispersion curves for sources>100m;
- no adjustment for wind directional shear;
- Pasquill-Gifford formula adjusted for roughness height;
- plume rise enhanced for buoyancy;
- gradual plume rise;
- entrainment co-efficient of 0.6 for lapse rates (both Adiabatic and Stable conditions);

- 60 minute sampling time for sigma-theta values;
- use default wind speed profile exponents;
- use default potential temperature gradients; and,
- use default upper bound wind speed categories.

The default wind profile exponents follow.

AUSPLUME Default Wind Speed Profile Exponents ("Irwin Rural")

Pasquill Stability Class					
A	**B**	**C**	**D**	**E**	**F**
0.07	0.07	0.10	0.15	0.35	0.50

The default vertical temperature gradients follow.

AUSPLUME Default Potential Temperature Gradients

Pasquill Stability Class					
A	**B**	**C**	**D**	**E**	**F**
0	0	0	0	0.02	0.035

The default wind speed categories follow.

AUSPLUME Default Upper Bounds Wind Speed Categories

Pasquill Stability Class					
1	**2**	**3**	**4**	**5**	**6**
1.54	3.39	5.14	8.23	10.8	>10.8

Furthermore, the VIC EPA *AUSPPLUME Gaussian plume dispersion model – Publication 264*, lists the following limitations are inherent in all Gaussian Plume dispersion models:

- they ignore or only partly account for horizontal and vertical variation in turbulence, wind speed and wind direction within the boundary layer;
- they can predict ensemble-average concentrations but not the transient peaks caused by downdrafts in thermal convection eddies;
- the assumption of quasi-steady conditions precludes simulation of events such as inversion breakup fumigation;
- they ignore longitudinal diffusion (parallel to the plume axis), which restricts applications to wind speeds above about 0.5m/s or so;
- the empirical dispersion parameters σ_y and σ_z are difficult to determine experimentally beyond about 10km from a source, and become meaningless at distances sufficiently large for advection affects to dominate over diffusion (which may be only a kilometre or so in complex terrain); and

- the complex flow in the wakes of buildings or other obstacles cannot be precisely parameterised.

Despite the limitations of general modelling approaches used in this assessment, these limitations are well understood by industry and the AUSPLUME model is widely used by environmental regulators throughout Australia. It is generally understood that the AUSPLUME model is suited to a wider range of applications than most other Gaussian Plume models.

The repeatable and sufficiently accurate results have been demonstrated in numerous scientific studies conducted in the validation of the AUSPLUME modelling package.

Appendix G

Sample AUSPLUME Output File

```
1        _________________________________________________________________

           Transpacific (Rutherford 01) - hydrogenation 10 min SO2 conc.

         _________________________________________________________________

 Concentration or deposition                          Concentration
 Emission rate units                                  grams/second
 Concentration units                                  microgram/m3
 Units conversion factor                              1.00E+06
 Constant background concentration                             0.00E+00
 Terrain effects                                      None
 Smooth stability class changes?                      No
 Other stability class adjustments ("urban modes")    None
 Ignore building wake effects?                        No
 Decay coefficient (unless overridden by met. file)   0.000
 Anemometer height                                    10 m
 Roughness height at the wind vane site               0.400 m
 Use the convective PDF algorithm?                    No

                   DISPERSION CURVES
 Horizontal dispersion curves for sources <100m high  Pasquill-Gifford
 Vertical  dispersion  curves for sources <100m high  Pasquill-Gifford
 Horizontal dispersion curves for sources >100m high  Briggs Rural
 Vertical  dispersion  curves for sources >100m high  Briggs Rural
 Enhance horizontal plume spreads for buoyancy?       Yes
 Enhance  vertical  plume spreads for buoyancy?       Yes
 Adjust horizontal P-G formulae for roughness height? Yes
 Adjust  vertical  P-G formulae for roughness height? Yes
 Roughness height                                     0.400m
 Adjustment for wind directional shear                None

                    PLUME RISE OPTIONS
 Gradual plume rise?                                  Yes
 Stack-tip downwash included?                         Yes
 Building downwash algorithm:                        PRIME method.
 Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
 Partial penetration of elevated inversions?          No
 Disregard temp. gradients in the hourly met. file?   No

 and in the absence of boundary-layer potential temperature gradients
 given by the hourly met. file, a value from the following table
 (in K/m) is used:

    Wind Speed                 Stability Class
     Category       A      B      C      D      E      F
  ________________________________________________________
        1         0.000  0.000  0.000  0.000  0.020  0.035
        2         0.000  0.000  0.000  0.000  0.020  0.035
        3         0.000  0.000  0.000  0.000  0.020  0.035
        4         0.000  0.000  0.000  0.000  0.020  0.035
        5         0.000  0.000  0.000  0.000  0.020  0.035
        6         0.000  0.000  0.000  0.000  0.020  0.035

 WIND SPEED CATEGORIES
 Boundaries between categories (in m/s) are:  1.54,  3.09,  5.14,  8.23, 10.80

 WIND PROFILE EXPONENTS: "Irwin Rural" values (unless overridden by met. file)

 AVERAGING TIME: 10 minutes.

 _____________________________________________________________________________

1        _________________________________________________________________

           Transpacific (Rutherford 01) - hydrogenation 10 min SO2 conc.

                              SOURCE CHARACTERISTICS

         _________________________________________________________________


                   STACK SOURCE: HEATER

    X(m)     Y(m)   Ground Elev.  Stack Height  Diameter Temperature  Speed
    2093     2400        0m           16m        0.20m      250C    12.7m/s

            ______ Effective building dimensions (in metres) ______
 Flow direction                  10°  20°  30°  40°  50°  60°  70°  80°  90° 100°
110° 120°
```

```
 Effective building width          18   20   21   22   22   21   20    0    0   22
25   26
 Effective building height          5    5    5    5    5    5    5    0    0    5
5    5
 Along-flow building length        22   25   26   27   28   27   25    0    0   18
20   21
 Along-flow distance from stack     2    2    1    0    0   -1   -2    0    0   -5
-9  -12
 Across-flow distance from stack   -4   -1    2    5    7   10   12    0    0   14
14   14

 Flow direction                  130° 140° 150° 160° 170° 180° 190° 200° 210° 220°
230° 240°
 Effective building width          27   28   27   25   23   20   18   20   21   22
22   21
 Effective building height          5    5    5    5    5    5    5    5    5    5
5    5
 Along-flow building length        22   22   21   20   19   20   22   25   26   27
28   27
 Along-flow distance from stack   -16  -18  -20  -22  -23  -23  -25  -26  -28  -28
-27  -26
 Across-flow distance from stack   14   13   12   11    9    7    4    1   -2   -5
-7  -10

 Flow direction                  250° 260° 270° 280° 290° 300° 310° 320° 330° 340°
350° 360°
 Effective building width          20    0    0   22   25   26   27   28   27   25
23   20
 Effective building height          5    0    0    5    5    5    5    5    5    5
5    5
 Along-flow building length        25    0    0   18   20   21   22   22   21   20
19   20
 Along-flow distance from stack   -23    0    0  -13  -11   -9   -6   -4   -1    2
3    3
 Across-flow distance from stack  -12    0    0  -14  -14  -14  -14  -13  -12  -11
-9   -7

               (Constant) emission rate = 2.00E+00 grams/second
                   No gravitational settling or scavenging.

 _____________________________________________________________________________

1      _________________________________________________________________

         Transpacific (Rutherford 01) - hydrogenation 10 min SO2 conc.

                              RECEPTOR LOCATIONS

       _________________________________________________________________


 DISCRETE RECEPTOR LOCATIONS (in metres)

 No.     X       Y    ELEVN  HEIGHT       No.     X       Y    ELEVN  HEIGHT
  1     647    3483     0.0    0.0         5    3985    2886     0.0    0.0
  2     661    2957     0.0    0.0         6    2719    3953     0.0    0.0
  3    2568     556     0.0    0.0         7    2217    2551     0.0    0.0
  4    3712    1349     0.0    0.0

 _____________________________________________________________________________

 METEOROLOGICAL DATA : Rutherford (32.725S 151.508E) by TAPM for 2001 - AUS
P
 ___________________________________________________________________________


1       HIGHEST RECORDINGS FOR EACH RECEPTOR  (in microgram/m3)
       AVERAGING TIME = 10 MINUTES


 At the discrete receptors:

  1: 5.67E+01 @Hr01,26/01/01     5: 7.20E+01 @Hr22,13/09/01
  2: 5.80E+01 @Hr07,23/12/01     6: 1.13E+02 @Hr22,01/11/01
  3: 5.09E+01 @Hr06,25/02/01     7: 2.02E+02 @Hr14,23/05/01
  4: 7.76E+01 @Hr07,09/12/01
 ___________________________________________________________________________


1       SECOND-HIGHEST RECORDINGS FOR EACH RECEPTOR  (in microgram/m3)
```

```
          AVERAGING TIME = 10 MINUTES


 At the discrete receptors:

  1: 4.17E+01 @Hr19,31/05/01     5: 4.47E+01 @Hr08,25/02/01
  2: 5.24E+01 @Hr19,28/06/01     6: 4.45E+01 @Hr07,21/09/01
  3: 4.47E+01 @Hr21,13/05/01     7: 1.71E+02 @Hr11,05/06/01
  4: 7.15E+01 @Hr07,25/02/01
```

```
1           Peak values for the 100 worst cases  (in microgram/m3)
                 Averaging time = 10 minutes

  Rank     Value   Time Recorded        Coordinates
                     hour,date       (* denotes polar)

     1   2.02E+02   14,23/05/01   (  2217,    2551,    0.0)
     2   1.71E+02   11,05/06/01   (  2217,    2551,    0.0)
     3   1.66E+02   15,09/02/01   (  2217,    2551,    0.0)
     4   1.63E+02   15,15/04/01   (  2217,    2551,    0.0)
     5   1.61E+02   08,21/09/01   (  2217,    2551,    0.0)
     6   1.49E+02   09,14/04/01   (  2217,    2551,    0.0)
     7   1.49E+02   08,23/02/01   (  2217,    2551,    0.0)
     8   1.47E+02   19,04/07/01   (  2217,    2551,    0.0)
     9   1.46E+02   04,03/05/01   (  2217,    2551,    0.0)
    10   1.45E+02   10,22/09/01   (  2217,    2551,    0.0)
    11   1.44E+02   05,03/05/01   (  2217,    2551,    0.0)
    12   1.44E+02   10,28/12/01   (  2217,    2551,    0.0)
    13   1.43E+02   05,21/05/01   (  2217,    2551,    0.0)
    14   1.42E+02   03,03/05/01   (  2217,    2551,    0.0)
    15   1.40E+02   13,15/12/01   (  2217,    2551,    0.0)
    16   1.40E+02   08,14/04/01   (  2217,    2551,    0.0)
    17   1.38E+02   09,30/04/01   (  2217,    2551,    0.0)
    18   1.38E+02   05,01/07/01   (  2217,    2551,    0.0)
    19   1.38E+02   21,30/05/01   (  2217,    2551,    0.0)
    20   1.37E+02   04,01/07/01   (  2217,    2551,    0.0)
    21   1.37E+02   06,21/05/01   (  2217,    2551,    0.0)
    22   1.35E+02   01,06/09/01   (  2217,    2551,    0.0)
    23   1.34E+02   07,14/04/01   (  2217,    2551,    0.0)
    24   1.34E+02   02,06/09/01   (  2217,    2551,    0.0)
    25   1.33E+02   07,21/05/01   (  2217,    2551,    0.0)
    26   1.32E+02   18,14/09/01   (  2217,    2551,    0.0)
    27   1.30E+02   19,10/05/01   (  2217,    2551,    0.0)
    28   1.30E+02   05,04/07/01   (  2217,    2551,    0.0)
    29   1.29E+02   08,29/03/01   (  2217,    2551,    0.0)
    30   1.27E+02   24,11/11/01   (  2217,    2551,    0.0)
    31   1.26E+02   03,04/07/01   (  2217,    2551,    0.0)
    32   1.26E+02   10,31/08/01   (  2217,    2551,    0.0)
    33   1.26E+02   08,01/05/01   (  2217,    2551,    0.0)
    34   1.25E+02   03,15/02/01   (  2217,    2551,    0.0)
    35   1.25E+02   12,15/12/01   (  2217,    2551,    0.0)
    36   1.25E+02   02,03/05/01   (  2217,    2551,    0.0)
    37   1.25E+02   10,30/04/01   (  2217,    2551,    0.0)
    38   1.23E+02   07,01/01/01   (  2217,    2551,    0.0)
    39   1.22E+02   12,05/05/01   (  2217,    2551,    0.0)
    40   1.22E+02   08,21/05/01   (  2217,    2551,    0.0)
    41   1.22E+02   11,01/07/01   (  2217,    2551,    0.0)
    42   1.20E+02   11,15/12/01   (  2217,    2551,    0.0)
    43   1.19E+02   17,19/03/01   (  2217,    2551,    0.0)
    44   1.19E+02   08,30/04/01   (  2217,    2551,    0.0)
    45   1.18E+02   04,04/07/01   (  2217,    2551,    0.0)
    46   1.17E+02   17,28/02/01   (  2217,    2551,    0.0)
    47   1.17E+02   07,01/05/01   (  2217,    2551,    0.0)
    48   1.17E+02   16,12/05/01   (  2217,    2551,    0.0)
    49   1.17E+02   05,31/07/01   (  2217,    2551,    0.0)
    50   1.15E+02   07,29/03/01   (  2217,    2551,    0.0)
    51   1.14E+02   18,15/01/01   (  2217,    2551,    0.0)
    52   1.14E+02   20,10/05/01   (  2217,    2551,    0.0)
    53   1.14E+02   18,10/05/01   (  2217,    2551,    0.0)
    54   1.13E+02   22,01/11/01   (  2719,    3953,    0.0)
    55   1.12E+02   06,04/07/01   (  2217,    2551,    0.0)
    56   1.12E+02   07,20/01/01   (  2217,    2551,    0.0)
    57   1.12E+02   05,13/04/01   (  2217,    2551,    0.0)
    58   1.11E+02   07,30/04/01   (  2217,    2551,    0.0)
    59   1.10E+02   06,01/05/01   (  2217,    2551,    0.0)
    60   1.09E+02   09,21/05/01   (  2217,    2551,    0.0)
    61   1.09E+02   24,05/09/01   (  2217,    2551,    0.0)
    62   1.09E+02   15,28/12/01   (  2217,    2551,    0.0)
    63   1.08E+02   14,15/04/01   (  2217,    2551,    0.0)
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 64   1.07E+02   15,05/10/01   (  2217,    2551,    0.0)
 65   1.07E+02   11,31/08/01   (  2217,    2551,    0.0)
 66   1.06E+02   23,03/07/01   (  2217,    2551,    0.0)
 67   1.06E+02   09,31/03/01   (  2217,    2551,    0.0)
 68   1.06E+02   18,11/05/01   (  2217,    2551,    0.0)
 69   1.05E+02   10,04/07/01   (  2217,    2551,    0.0)
 70   1.05E+02   15,10/02/01   (  2217,    2551,    0.0)
 71   1.04E+02   02,21/07/01   (  2217,    2551,    0.0)
 72   1.04E+02   09,28/12/01   (  2217,    2551,    0.0)
 73   1.03E+02   09,12/02/01   (  2217,    2551,    0.0)
 74   1.03E+02   14,04/07/01   (  2217,    2551,    0.0)
 75   1.02E+02   13,12/08/01   (  2217,    2551,    0.0)
 76   1.02E+02   15,29/06/01   (  2217,    2551,    0.0)
 77   1.01E+02   17,26/06/01   (  2217,    2551,    0.0)
 78   1.01E+02   11,01/06/01   (  2217,    2551,    0.0)
 79   1.01E+02   09,01/05/01   (  2217,    2551,    0.0)
 80   1.01E+02   10,27/02/01   (  2217,    2551,    0.0)
 81   9.96E+01   14,28/12/01   (  2217,    2551,    0.0)
 82   9.92E+01   07,13/04/01   (  2217,    2551,    0.0)
 83   9.91E+01   13,04/07/01   (  2217,    2551,    0.0)
 84   9.89E+01   06,10/01/01   (  2217,    2551,    0.0)
 85   9.86E+01   16,04/07/01   (  2217,    2551,    0.0)
 86   9.85E+01   01,03/05/01   (  2217,    2551,    0.0)
 87   9.74E+01   17,11/05/01   (  2217,    2551,    0.0)
 88   9.73E+01   10,14/12/01   (  2217,    2551,    0.0)
 89   9.72E+01   16,28/12/01   (  2217,    2551,    0.0)
 90   9.70E+01   08,29/05/01   (  2217,    2551,    0.0)
 91   9.69E+01   04,21/05/01   (  2217,    2551,    0.0)
 92   9.67E+01   22,30/05/01   (  2217,    2551,    0.0)
 93   9.65E+01   15,15/10/01   (  2217,    2551,    0.0)
 94   9.64E+01   08,14/11/01   (  2217,    2551,    0.0)
 95   9.59E+01   03,27/04/01   (  2217,    2551,    0.0)
 96   9.54E+01   10,12/02/01   (  2217,    2551,    0.0)
 97   9.51E+01   07,21/10/01   (  2217,    2551,    0.0)
 98   9.44E+01   14,17/10/01   (  2217,    2551,    0.0)
 99   9.38E+01   10,18/05/01   (  2217,    2551,    0.0)
100   9.37E+01   09,02/08/01   (  2217,    2551,    0.0)
```