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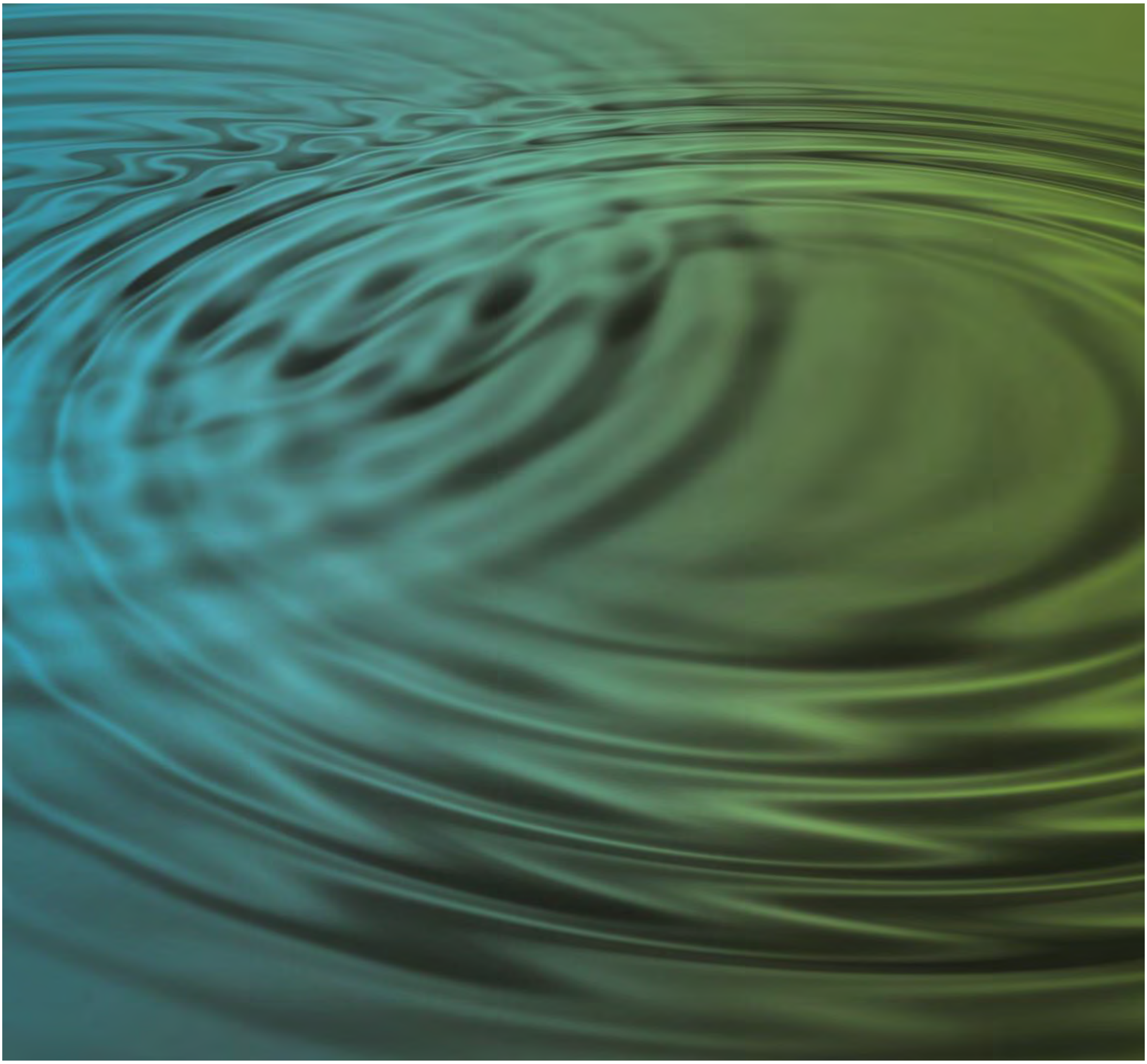
Stolthaven Australia Pty Limited
21-Aug-2015

Air Quality Impact Assessment

Stolthaven Mayfield Fuel Terminal - SSD_6664 MOD1 - Throughput Increase to 1,300ML



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Stolthaven Mayfield Fuel Terminal - SSD_6664 MOD1 - Throughput Increase to 1,300ML

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1.0 Introduction

1.1 Project Overview

This Air Quality Impact Assessment (AQIA) has been prepared by AECOM Australia Pty Ltd (AECOM) on behalf of Stolthaven Australia Pty Ltd (Stolthaven) in support of an application to modify State Significant Development SSD_6664 to increase the approved annual fuel throughput for their fuel terminal (the Facility) at Mayfield, NSW. The existing Facility provides terminal facilities for the storage and distribution of 1,010ML per annum (pa) of combustible bulk liquid fuels, including diesel and biofuels.

The Proposed Modification includes consideration and assessment of the existing Facility and approved modifications as described in **Section 2.3**. In addition to those elements previously assessed and approved, the Proposed Modification also proposes to:

- Increase throughput of diesel and biofuels from 1,010ML per annum up to 1,300ML per annum;
- Increased management of fuels within the Facility (increased pumping); and
- Increased distribution of fuels by road (increased vehicle movements).

The main potential sources of air emissions associated with the modification are vapour emissions from the storage and transfer of fuels (volatile organic compounds, or VOCs). The purpose of this assessment was to assess the air emissions and potential impacts associated with the Proposed Modification. This report provides details of the methodology and results of the dispersion modelling of VOC emissions.

1.2 Scope of Work

The assessment was undertaken in accordance with the NSW Environment Protection Authority (NSW EPA) *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (The Approved Methods) (DEC 2005). The assessment considered the following pertinent information:

- An increase in storage tank emissions from working and standing losses due to an increase in throughput from the currently approved 1,010 MLpa to the proposed 1,300 MLpa; and
- The truck filling station gantry bays operating at both typical and maximum operation, with a gantry vapour collection stack 21 m in height.

VOC emissions associated with diesel and biodiesel storage from operation of the Facility were estimated through dispersion modelling using the CALPUFF model in accordance with the NSW EPA's guidelines for air pollution assessments (DEC 2005). The assessment was also undertaken in accordance with the Port of Newcastle's Mayfield Concept Plan Site Air Quality Model as detailed in **Section 4.1**.

1.3 Secretary's Environmental Assessment Requirements

In preparing this AQIA, consideration has been given to the NSW Planning and Environment (P&E) Secretary's Environmental Assessment Requirements (SEARs) issued for the most recent Environmental Impact Statement prepared for the Facility (SSD-6664) on 19 Sept 2014. Although the modification is not contingent on SEAR's they have been used as a guide for this assessment. The key matters raised by the Secretary, and where this report addresses them are outlined in **Table 1**.

Table 1 Secretary's Environmental Assessment Requirements applicable to the Air Quality impact Assessment

Secretary's Environmental Assessment Requirement		Section Addressed
Air Quality	A quantitative assessment of the air quality and odour impacts of the development on surrounding receivers.	**Section 5.0**
	Potential upgrades to the original approved air quality/odour control measures and management protocols and procedures for the expansion.	**Section 6.0**
	Details of a protocol that has been agreed with the Port of Newcastle for the provision of input into the Mayfield Concept Plan Air Quality Model (MP 09_0096).	**Section 4.1**

1.4 Structure of Report

The remainder of the report has been structured as follows:

- **Section 2** provides a description of the Proposed Modification and its potential construction and operations air quality impact sources.
- **Section 3** described the existing environment including existing air quality details as well as site meteorology.
- **Section 4** provides a detailed description of the air quality assessment methodology. Section 4 also includes how this methodology is consistent with the Mayfield Concept Plan Site Air Quality Model.
- **Section 5** provides an assessment of the potential air quality impacts of the Proposed Modification on the local air shed and provides assessment of relevant criteria against identified sensitive receptors.
- **Section 6** describes the mitigation measures that are currently used at the Facility or that are recommended to be implemented as part of the Proposed Modification.
- **Section 7** provides the study conclusions.

2.0 Proposed Modification Description

2.1 Location

The Facility is located on part of the former BHP Steelworks site, known as the Mayfield Concept Approval Site, as shown in **Figure 1** along with the sensitive receptor locations used in this assessment (refer to **Section 4.5.6**). The site is approximately 5 km northwest of the Newcastle Central Business District and is wholly located within Lot 2 DP 1177466 which is leased to Stolthaven from the Port of Newcastle.

The topography in the area beside the Hunter River is essentially flat. The area surrounding the terminal is characterised by a mixture of port-related activities, industrial uses, and commercial areas. The nearest residential area is located at Mayfield, with the closest receptors approximately 900 m from the approved terminal site. Neighbouring industry includes OneSteel and Koppers Coal Tar Products to the west and Port Waratah Coal Services to the north. Land to the east and south of the site is currently vacant and proposed for future industrial development.

2.2 Infrastructure

Stolthaven currently has approval to operate a bulk fuels terminal to receive, store and dispatch diesel and biodiesel fuel. The Facility is approved for a total annual throughput of fuel of 1,010 MLpa under application number SSD_6664. The fuel is delivered by ship and dispatched by truck. The approved Facility includes nine above-ground storage tanks (seven diesel and two biodiesel). The site layout is shown in **Figure 2**.

The modification would increase the throughput of the site to 1,300 MLpa of diesel/biodiesel without an increase to the number of tanks. The method of delivery and distribution of fuel products would not be affected. As approved, the Facility makes use of an existing ship berthing facility to receive diesel fuel, which is transferred to site using an above-ground, dedicated pipeline approximately 1 km in length. Delivery and dispatch would occur 24 hours per day, 7 days per week.

The dimensions of the main on-site structures and their approval status are summarised in **Table 2**.

Table 2 Main Site Structures

Structure	Approximate Size	No.	Description
Diesel tanks (in construction)	36 m diameter, 17.8m high, 18ML capacity	2	Steel tanks with white exterior
Diesel tanks	36.6 m diameter; 17 m high, 18ML capacity	5	Steel tanks with white exterior
Biodiesel tank	7.6 m diameter; 12 m high, 0.5ML capacity	1	Steel tank with white exterior
Biodiesel tank	18 m diameter; 17 m high, 4.2ML capacity	1	Steel tank with white exterior
Office and amenities	16 m x 9 m; 4 m high	1	Steel wall and roof cladding
Truck-loading gantry	33 m x 16.5 m; 6.5 m high	1	Steel frame with colourbond cladding
Workshop	11 m x 9 m; 5 m high	1	-
Fire water storage tank	11 m diameter; 8.5 m high	1	Steel tank with galvanised finish
Fire pump house	15.5 m x 5 m x 5.5 m high	1	Steel frame with colourbond cladding

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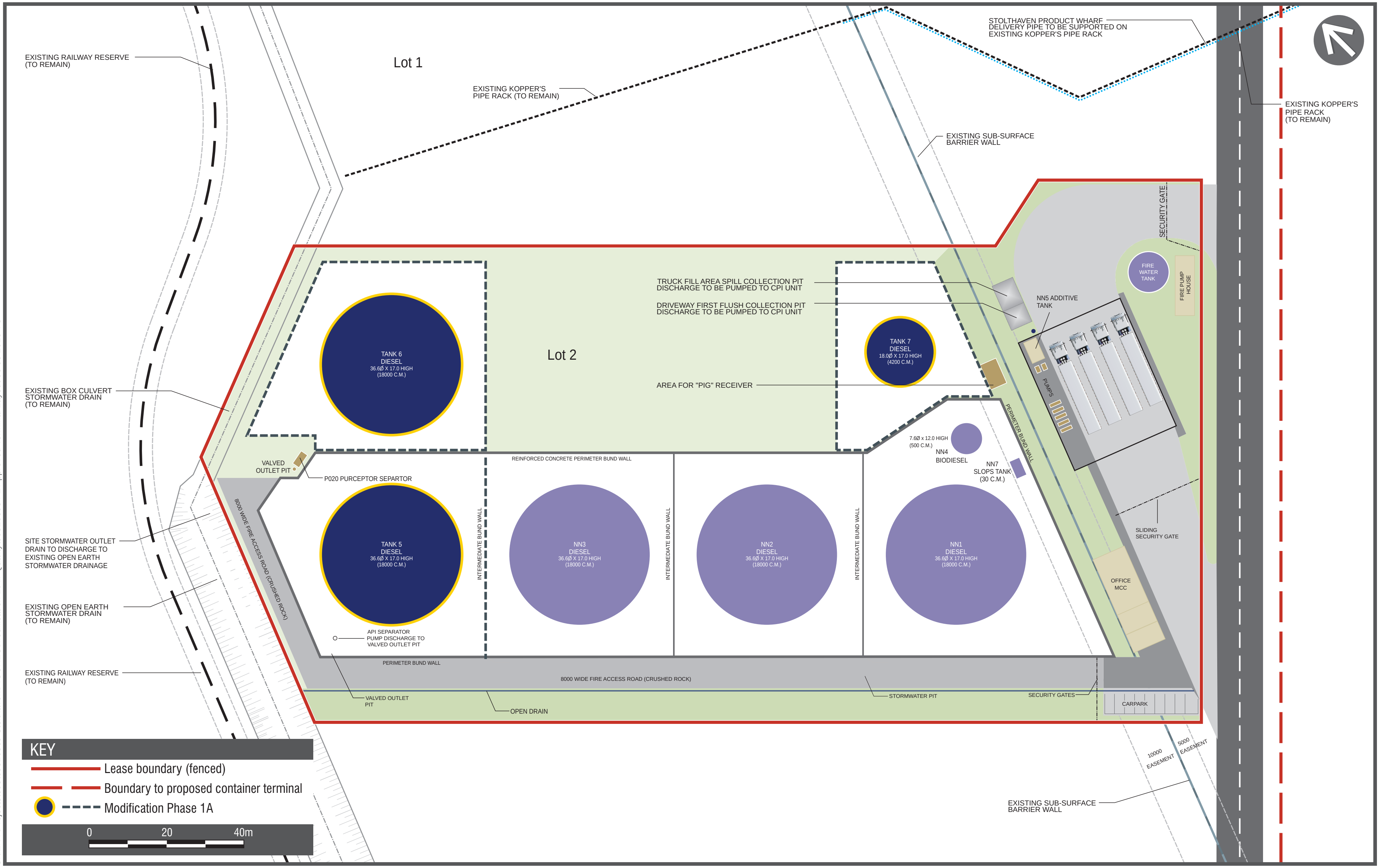
SITE AND SENSITIVE RECEPTOR LOCATIONS

Stolthaven State Significant Development Modification 1

FIGURE 1



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FACILITY LAYOUT

Stolthaven State Significant Development Modification 1

FIGURE 2

2.3 Proposed Modification Operations

2.3.1 Operational Overview

The Proposed Modification seeks approval for the increase of throughput of the Facility from the currently approved 1,010MLpa to 1,300MLpa. This represents an annual increase of 290ML per year. This will require the following main operational changes:

- Increased import of fuels (increased shipping);
- Increased management of fuels within the Facility (increased pumping); and
- Increased distribution of fuels by road (increased vehicle movements).

Diesel is, and would continue to be stored in seven 18 ML atmospheric welded steel storage tanks and biodiesel in the 0.5ML and 4.2ML tanks. All tanks are bunded in accordance with *AS 1940-2004 Storage and handling of flammable and combustible liquids.* Tanks are fitted with:

- Auto-level gauging;
- High/low level alarms;
- Multi-level temperature measurement;
- Multi-level sampling equipment;
- Water draining; and
- Low-level product drains for maintenance purposes.

The Facility includes a 4 bay truck loading gantry which can accommodate B-Double trucks (also referred to as tankers) with approximate capacities of 50,000 litres. The Facility is also serviced by B-Single trucks that have a capacity of 30,000L. Truck loading is controlled by industry standard fuel management software/hardware and a metering system operated by suitably trained personnel.

No additional truck loading /unloading bays or gantries are proposed as part of the Proposed Modification. The loading and unloading of vehicles would continue to be undertaken in accordance with current operational procedures. All loading and unloading activities would be undertaken by the inducted and trained Road Tanker drivers.

2.3.2 Operational Emissions

The main emissions of interest for fuel storage activities are VOCs. VOCs are organic compounds with a vapour pressure exceeding 0.13 kPa at a temperature of 20^{o}C. VOCs have been implicated as a precursor in the production of photochemical smog, which causes atmospheric haze, eye irritation and respiratory problems. VOCs can be emitted from storage tanks, filling stations vents, pipelines and process equipment leaks at plant associated with fuel storage.

Combustion emissions associated with the ships and trucks dispatching fuel from the premises were not quantitatively assessed due to the following:

- Shipping is expected to be a maximum of 52 ships per year (104 ship movement year) with an average time at berth of 36 hours;
- The distance of the road within the Stolthaven site is approximately 160m; and
- Trucks entering the terminal will switch off engines while transferring product to/from tanks. Again, the level of emissions from the trucks within the terminal is not considered likely to be distinguishable from other local transport (road, rail, port operations) or other combustion sources.

3.0 Existing Environment

3.1 Air Quality

The primary pollutants of interest in the Newcastle airshed are particulate matter and photochemical smog/ozone and its precursors (oxides of nitrogen and VOCs)[1]. Significant industrial pollutant sources include the nearby Orica, Aluminium smelting. Other fuel storage facilities in Newcastle include Caltex (Wickham) and BP (Carrington), which are located in proximity to residential areas, and Park Fuels on Kooragang Island which is expected to become operational late 2015.

The pollutants of prime interest in NSW are ozone and particulates, with levels of these pollutants approaching or exceeding the national standards prescribed in the National Environment Protection Measure for Ambient Air Quality (NEPM) on occasion. Pollutant levels in Newcastle, however, are generally acceptable, with limited exceedences noted[1]. The Stolthaven facility is not expected to generate significant levels of ozone or particulates.

No local monitoring of VOCs was identified at the time of preparation of this report. The NSW EPA Approved Methods (DEC 2005), however, does not require the cumulative assessment of VOC impacts (i.e. consideration of background VOC levels is not required).

3.2 Regional Meteorology

The Bureau of Meteorology (BoM) records long-term meteorological data at a number of automatic weather stations around the country (NSW EPA monitoring stations are generally only short-term and do not show long-term data and statistics). The BoM station that best represents the region is located at Williamtown, approximately 13 km northeast of the Site. Selected long-term regional meteorological data were obtained from the BoM Williamtown monitoring station; a summary is provided in the following sections. Average climate parameters recorded at this station are shown in **Appendix A**.

3.2.1 Climate

The warmest temperatures occur between November and March, with the warmest average maximum temperatures occurring in January (28.0ºC). The coldest temperatures are recorded in the winter months, with the lowest average minimum temperature occurring in July (6.4ºC).

The highest average rainfall is recorded in June (121.9mm), while September is the driest month (59.3 mm). Humidity in the area is relatively high, with recorded levels typically between 50 and 80 %. Wind speeds are typically higher at 3 pm compared to 9 am.

3.2.2 Wind Direction

The long-term wind rose diagrams for the Williamtown monitoring station are shown in **Appendix A**. The wind roses show the frequency of occurrence of winds by direction and strength. The bar at the top of each wind rose diagram represents winds blowing from the north (i.e. northerly winds), and so on. The length of the bar represents the frequency of occurrence of winds from that direction, and the widths of the bar sections correspond to wind speed categories, the narrowest representing the lightest winds. Winds recorded at Williamtown at 9 am blow predominantly from the west. In the afternoons, recorded winds blow predominantly from the east and southeast.

[1] Newcastle City Council. (2009). 2008/09 State of the Environment Report – The City of Newcastle.

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4.0 Assessment Methodology

4.1 Port of Newcastle Site Model

The Port of Newcastle (PoN) (formerly Newcastle Port Corporation) gained development approval from the Department of Planning and Infrastructure, now Department of Planning and Environment (DP&E) on 16 July 2012 for the Mayfield Site Port-Related Activities Concept Plan (the Concept Plan). As part of the consent conditions provided in Schedule 3 of the approval document, there is a requirement for the proponent to "*develop and maintain a Site Air Quality Model to facilitate the assessment of air quality impacts of projects and to report on compliance with the site pollutant performance criteria".* The Site Air Quality Model (the Site Model) is intended to be progressively updated with details from project approvals and used to assess the sites performance against the air quality criteria, as well as to support the continual development of site management measures.

During the creation of the Site Model, a meeting was held with the NSW EPA to discuss the models inputs and settings to ensure consistency with regulatory requirements. Discussions were had relating to model selection, meteorological data, sensitive receptors, background evaluation and more. The NSW EPA indicated that they were in general agreement with the proposed methods, however as per industry practice, future planning documentation relating to the Site Model should discuss and justify all modelling details.

The following sections provide the settings selected in the Site Model and applied in the Stolthaven AQIA. These settings were selected based on the following documents, as well as current industry standards:

- DEC. (2005). Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales; and
- Barclay, J. and Scire, J. (2011). Generic Guidance and Optimum Model Settings for the CALPUFF Modelling System for Inclusion into the 'Approved Methods for the Modelling and Assessments of Air Pollutants in NSW, Australia'.

The CALMET model and subsequent settings were selected in accordance with the 'hybrid' mode discussed in Barclay and Scire (2011). The hybrid mode can be considered an 'advanced model simulation', or 'refined model run' since it combines the numerical prognostic model data in a 3D.DAT file along with surface data.

The Stolthaven application is the first development to fall under the Site Model requirement.

4.2 Dispersion Model

Various air dispersion models are required for the successful modelling of air quality impacts from the Site. These are: The Air Pollution Model (TAPM), which is used to generate prognostic meteorological data; CALTAPM, which is used to process the TAPM output into a format suitable for input into the CALMET model; CALMET, which generates three-dimensional wind fields used in the dispersion modelling; CALPUFF, which predicts the movement and concentration of pollutants; and CALPOST, which is used to process the CALPUFF output files. The programs are briefly described in the following sections.

The flow diagram in **Figure 3** shows the general flow of programs and data required for the dispersion model.

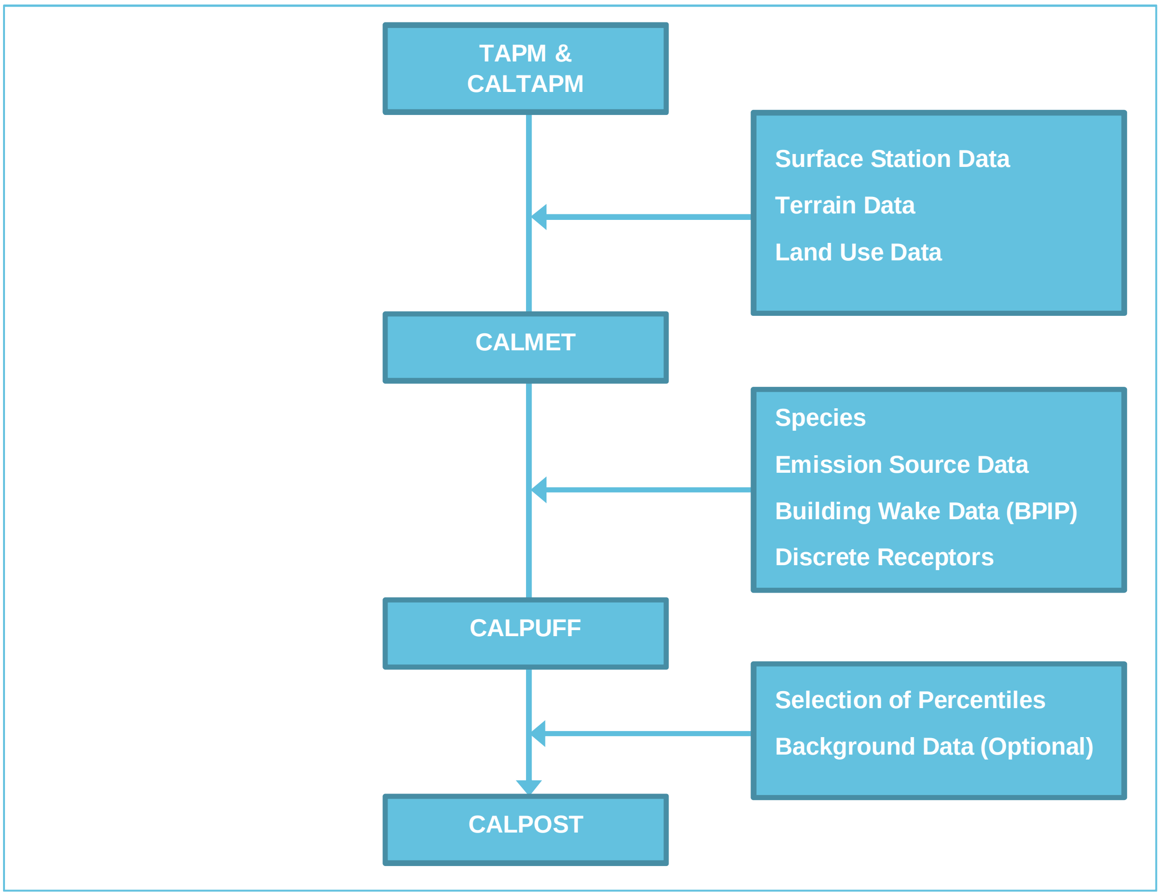

Figure 3 Site Model Program and Input Flow Chart

The selection of the dispersion modelling for this assessment was undertaken in accordance with the guidelines published by the NSW EPA[2]. Details of the modelling inputs and assumptions are provided in the following sections.

4.2.1 TAPM

TAPM predicts three-dimensional meteorology, including terrain-induced circulations. TAPM is a PC-based interface that is connected to databases of terrain, vegetation and soil type, leaf area index, sea-surface temperature, and synoptic-scale meteorological analyses for various regions around the world. TAPM is used to predict meteorological parameters at both ground level and at heights of up to 8,000 m above the surface; these data are required by the CALPUFF model. The TAPM output file requires processing through a program such as CALTAPM to generate a file that is used within CALMET to generate the three-dimensional wind fields required by the CALPUFF dispersion model.

The settings used for the TAPM program are provided in **Table 3**. The settings are in accordance with the Site Model.

[2] DEC (2005). Approved Methods for the Modelling and Assessment of Air Pollutants in NSW.

Table 3 TAPM Settings

Parameter	Setting
TAPM Version	4.0.5
Grid centre coordinates	-32 deg -53.5 min E
	151 deg 45 min S
Date parameters	2013 full calendar year
Number of grid points	nx = 40
	ny = 40
Outer grid spacing	dx1 = 36000 m
	dy1 = 36000 m
Number of grid domains	4
Grid spacing for CALTAPM	Inner most grid (t010a)
Number of vertical grid levels	nz = 25
Observation file	Not used

4.2.1.1 CALTAPM

The NSW EPA has released guidance documentation (Barclay and Scire, 2011) on the optimum settings for the use of the CALPUFF modelling system. One modelling approach provided in the document is the use of a 'Hybrid Mode' whereby numerical prognostic three-dimensional meteorological model data, in a 3D.DAT file, along with surface observation data gained from a representative nearby surface monitoring station, are combined. The CALTAPM program converts the TAPM data into a 3D.DAT file, which can be input directly into the CALMET meteorological processer.

4.2.2 CALPUFF Model Package

CALPUFF is the NSW EPA model of choice for areas that are affected by coastal breezes, coastal fumigation or complex terrain. The Stolthaven site is located in a coastal area and, hence, the CALPUFF model was chosen for use in the AQIA and is in accordance with the Site Model.

The CALPUFF modelling system consists of three main components and a set of pre-processing and post-processing programs. The main components of the modelling system are CALMET (a diagnostic three-dimensional meteorological model), CALPUFF (an air quality dispersion model), and CALPOST (a post-processing package). The three main CALPUFF software package programs are described in the following sections.

4.2.2.1 CALMET

CALMET is a meteorological model that develops hourly wind and temperature fields on a three-dimensional gridded modelling domain. Associated two-dimensional fields such as mixing height, surface characteristics and dispersion properties are also included in the file produced by CALMET. CALMET produces a meteorological file that is used within the CALPUFF model to predict the movement of pollution.

The settings in **Table 4** were specifically selected in order to run CALMET in the 'hybrid' mode discussed in Barclay and Scire (2011). Only those parameters that deviate from the program default values or are significant to the AQIA are provided. The settings are in accordance with the Site Model.

Table 4 CALMET Settings

Parameter	Setting
CALMET version	6.334
Grid Spacing	0.200 km
Grid Size	30km x 30km
# Cells NX	150
# Cells NY	150
Source of Land Use Data	Site-specific creation based on USGS data system
Geo Processer Used	Used external data in the Geophysical Processer program
Surface and Overwater	Surface stations - Mayfield Berth 4 meteorological station - NSW EPA Newcastle meteorological station Overwater - Prognostic Data.
Upper Air	Prognostic Data
Convective mixing height method	Maul-Carson for land and water
Overwater surface flux method	COARSE with no wave parameterisation
Use 3D temperature from	1: Surface and upper air
Surface temperature	Compute internally from 2-D spatially varying
Surface wind vertical extrapolation	Extrapolate using similarity theory and exclude upper air observations from level 1
Wind field guess	Compute externally
Cloud cover data options	Generate from prognostic RH (unless cloud.dat available)

4.2.2.2 CALPUFF

CALPUFF is a non-steady-state three-dimensional Gaussian puff model developed for the US Environmental Protection Agency (US EPA) and approved by the NSW EPA for use in situations where basic Gaussian plume models are not effective, such as areas with complex meteorological or topographical conditions, including coastal areas with re-circulating sea breezes. The CALPUFF model substantially overcomes the basic limitations of the steady-state Gaussian plume models, and as such, was chosen as the most suitable dispersion model for the AQIA and Site Model. Some examples of applications for which CALPUFF may be suitable include:

- Near-field impacts in complex flow or dispersion situations:
  - complex terrain;
  - stagnation, inversion, recirculation, and fumigation conditions;
  - overwater transport and coastal conditions;
  - light wind speed and calm wind conditions;
- Long range transport;
- Visibility assessments and Class I area impact studies;
- Criteria pollutant modelling, including application to development applications;
- Secondary pollutant formation and particulate matter modelling; and
- Buoyant area and line sources (e.g. forest fires and aluminium reduction facilities).

Those parameters that deviate from the program default values or are significant to the AQIA are provided in **Table 5**. The settings are in accordance with the Site Model.

Table 5 CALPUFF Settings

Parameter	Setting
CALPUFF version	6.42
Calculation type	Concentration and deposition
Chemical transformation method	Not modelled
Dispersion Option	Dispersion coefficient. use turbulence computed from micrometeorology
Use PDF method for Sigma-z in the convective BL	On
Puff splitting	No puff splitting
Plume rise method	Briggs
Transitional plume rise	On
Stack tip downwash	On
Partial plume penetration	On
Partial plume penetration (buoyant)	On
Terrain adjustment method	Partial plume path adjustment
Building wake calculation	PRIME algorithm

4.2.2.3 CALPOST

The CALPOST program is used to process the outputs of the CALPUFF program into a format defined by the user. Results can be tabulated for selected options including percentiles, selected days, gridded results or discrete locations, and can be adjusted to account for chemical transformation and background values.

The program default settings were used for the CALPOST program, ensuring that the correct averaging periods, percentiles and receptors were selected to meet the NSW EPA ambient pollutant criteria assessed (DEC, 2005). CALPOST version 6.292 was used in the assessment.

4.3 Modelling Scenario

The dispersion modelling was undertaken for two scenarios as discussed in **Table 6**. The scenarios have been created by selecting a representative number of fuel loading arms for the tankers per hour, together with the expected loading time of a b-double tanker and the selection of representative residual tanker fuels (resulting in remnant vapours in the empty tankers). The details of the operational parameters adopted for the modelling scenarios are provided in the table; both scenarios assume continuous operation of the facility (24 hours per day, 7 days per week, 365 days per year). Combustible refers to diesel while flammable refers to unleaded petrol.

Table 6 Assessment Scenarios

#	Title	Description
1	Typical Operations	One hourly gantry emission rate applied to all hours of the year based on: - Three 50,000L capacity tankers filled per bay per hour i.e. 12 tankers per hour serviced by the facility. - A combustible to flammable fuel ratio of 60:40 of residual fuel in tankers. Emissions from TANKS using the design throughput were used to account for non-gantry VOC emissions.
2	Maximum Operations	One hourly gantry emission rate applied to all hours of the year based on: - Four 50,000L capacity tankers filled per bay per hour i.e. 16 tankers per hour serviced by the facility. - All tankers contain residual flammable fuel.

Advice from Stolthaven suggests that three tankers per bay per hour is the normal operating maximum, and that at any time it is likely that only three of the four bays would have residual flammable tankers as a maximum. The use of four flammable tankers in the modelling maximum scenario is therefore considered to be a significant overestimation of VOC emissions.

Further details of the calculation method are provided in **Section 4.5.5.2**. The above scenarios have been expressly designed to allow an assessment of both typical and worst case emissions from the gantry stack. It is envisaged that by looking at hourly tanker loading information that the best hourly emissions assessment would be achieved, avoiding the possible removal of peak emissions if an annual averaged mass calculation was applied.

4.4 Assessment Criteria

The NSW EPA assessment criteria (DEC, 2005) and averaging period for the pollutants of interest are shown in **Table 7**.

Table 7 NSW EPA Assessment Criteria

Pollutant	Assessment Criterion (µg/m^3)	Averaging Period	Percentile	Applicable Location
Benzene	29	1 hour	99.9th	At and beyond the boundary of the facility
Cumene	21	1 hour	99.9th	At the nearest sensitive receptor
Trimethylbenzene (mixed isomers)	2,200	1 hour	99.9th	At and beyond the boundary of the facility
Toluene	360	1 hour	99.9th	At the nearest sensitive receptor
Ethylbenzene	8,000	1 hour	99.9th	At and beyond the boundary of the facility
Xylenes	190	1 hour	99.9th	At the nearest sensitive receptor

4.5 Model Inputs

CALPUFF requires six main categories of data to determine the dispersion of pollutants:

- Meteorology;
- Terrain;
- Building wake effects;
- Source characteristics;
- Emissions inventory; and
- Sensitive receptor locations.

The above inputs are addressed separately in the following sections.

4.5.1 Meteorology

The meteorological data are used by the model in different ways to estimate the dispersion of air pollutants:

- Ambient temperature is used to incorporate thermal buoyancy effects when calculating the rise and dispersion of pollutant plumes;
- Wind direction determines the direction in which pollutants will be carried;
- Wind speed influences the dilution and entrainment of the plume into the air continuum;
- Atmospheric stability class is a measure of atmospheric turbulence and the dispersive properties of the atmosphere. Most dispersion models utilise six stability classes, ranging from A (very unstable) to F (stable/very stable); and
- Vertical mixing height is the height at which vertical mixing occurs in the atmosphere.

The AQIA used meteorological data from the PoN Mayfield Berth 4 meteorological monitoring station for the 2013 calendar year. The station is located at the facility gatehouse at a height of 10 m and is approximately 1.1km from the Stolthaven site. The station monitors wind speed, wind direction, precipitation, pressure, relative humidity and temperature in five minute increments. The station meets the relevant Australian Standards and is located within the boundary of the PoN Concept Plan site.

A review of the 2013 Mayfield Berth 4 data against long-term BoM Williamtown RAAF base data is provided in **Appendix B** in order to validate that the data are representative of the area and appropriate for use in the assessment. The review concluded that the Mayfield Berth 4 data from this site are considered to be representative of meteorological conditions around the Newcastle Harbour area.

4.5.2 Terrain

Terrain elevations of the modelling domain were gained from the Shuttle Radar Topography Mission (SRTM) 90m digital elevation database. The Geophysical Processer program was used to process the data gained externally so the heading, weighting of land use, assumptions and other settings are consistent with CALMET's interpretations.

4.5.3 Building Wake Effects

The dispersion of pollutants around the terminal is likely to be affected by aerodynamic wakes generated by winds having to flow around the storage tanks and the gantry building. Building wakes generally decrease the distance downwind at which the stack plumes comes into contact with the ground. This may result in higher ground level pollutant concentrations closer to the emission source.

CALPUFF includes the PRIME building wake algorithm and the Building Profile Input Program (BPIP) for entering the location and dimension of buildings where building wakes may be important for dispersion. The storage tanks and gantry building were inputted into the BPIP to estimate the building wakes required for the CALPUFF model.

4.5.4 Source Characteristics

VOCs are expected to be emitted from the storage tanks (fugitive emissions vented to atmosphere) and the truck filling stack (point source vented to atmosphere). The storage tanks would be designed to AP1650 and operated in accordance with the requirements of *AS 1940; The storage and handling of flammable and combustible liquids*. In complying with these standards, the following safety features would be installed:

- Tank level instruments (high and low) with independent high/low alarms;
- Tank vents with anti-flash gauze to prevent potential for sparking and ignition from external sources;
- Multi-level temperature measurements; and
- Water draining facilities to prevent water build up in the tank and potential corrosion in the tank base.

The site operations also encompass the use of an additives tank and a slopes tank. Both these sources are small in size and have an extremely low turnover when compared to the diesel storage tanks. The composition of the liquid held in these tanks is variable and cannot be adequately identified. The emissions from these sources are considered to be minor and have not been quantitatively reviewed in this assessment.

The TANKS emissions estimation model was used to calculate the predicted total VOC emissions from the storage tanks using the parameters provided in **Table 8**. The distribution of the throughput for each tank was provided by Stolthaven. Input and output data from the TANKS model is provided in **Appendix C**. The total VOCs were used to calculate the emissions of individual pollutants as discussed later in this document.

Table 8 TANKS Input Parameters

Fuel Stored	Tank Type	Approximate Size	Number
Diesel (in construction)	Vertical Fixed Roof	Diameter: 36 m	2
		Height: 17.8 m	
		Capacity: 18 ML	
		Throughput: 174 ML (per tank; total diesel throughput of 348 ML)	
Diesel	Vertical Fixed Roof	Diameter: 36.6 m	5
		Height: 17 m	
		Capacity: 18 ML	
		Throughput: 174 ML (per tank; total diesel throughput of 870 ML)	
Biodiesel	Vertical Fixed Roof	Diameter: 7.6 m	1
		Height: 12 m	
		Capacity: 0.5 ML	
		Throughput: 13 ML	
Biodiesel	Vertical Fixed Roof	Diameter: 18 m	1
		Height: 17 m	
		Capacity: 4.2 ML	
		Throughput: 71 ML	

During tanker filling, the vapour within the empty tanker is displaced and redirected to the tanker vent air outlet point from where it is discharged via a stack. The system does not treat the air or re-circulate the vapour back into the tankers or to another process for further use. No additional truck loading /unloading bays or gantries are proposed as part of the Proposed Modification. The loading and unloading of vehicles would continue to be undertaken in accordance with current operational procedures. The assumed physical parameters of the gantry stack are shown in **Table 9**. The volumetric flow rate of the gantry is dependent on the filling activities. Note that the stack diameter is different from previous assessments as these were based on initial design values; the current assessment included the actual measurement of the as-built stack dimensions.

Table 9 Truck Filling Physical Stack Parameters

Parameter	Value
Temperature	25°C
Height	21 m above ground level
Internal diameter	0.118 m

4.5.5 Emissions Inventory

The emissions inventory for the Proposed Modification was prepared using site-specific measured data for storage tank liquid composition and gantry vapour composition for all pollutants of concern. Previous development applications relied heavily on default composition values provided in the NPI and other regulatory documents. The use of site-specific data is considered to be best practice and likely to reflect a more accurate representation of the facilities impacts than previous work.

4.5.5.1 Storage Tank Emissions

Sampling of the typical diesel stored and transferred by the facility was conducted in March 2015 by AECOM to identify the concentration of VOCs within the diesel. Two samples were collected to represent product from the two suppliers of diesel for the facility. Analysis of the liquid samples was undertaken by SGS laboratories in accordance with analysis method ASTM D-2887 and USEPA Method TO17. The results as a percentage of the total liquid are provided in **Table 10** for all assessed pollutants; the laboratory analysis certificates are provided in **Appendix D**. These values were included into the TANKS model as a speciation profile. The maximum of the two samples were used in the assessment. Where a value was less than the limit of reporting (LoR) for the analysis, half the LoR was applied. The typical diesel composition values provided in the NPI *Fuel and organic liquid storage*, Version 3.3 (May 2012) and used in previous development applications are also provided for comparative purposes.

Table 10 Diesel Liquid Composition from Site-Specific Sampling

Diesel Liquid Composition (%)						
Pollutant	Benzene	Cumene	Trimethyl-benzene	Toluene	Ethyl-benzene	Xylenes
Sampling Data	0.0037%	0.0220%	0.4870%	0.0659%	0.0524%	0.3120%
NPI Default	0.03%	0.975%	NA	0.1%	0.11%	0.345%

The reported analysis values are shown to be lower for all pollutants than that provided in the NPI; the site-specific sample data were used in this assessment. All other TANKS inputs remained the same as those used for the AQIA with the exception of the increase in throughput. The resultant TANKS outputs are summarised in **Table 11** which presents the total combined emissions from the seven diesel tanks and two biodiesel tanks in kilograms per year and grams per second; the full TANKS outputs (in pounds per year) are provided in **Appendix C**.

Table 11 Predicted Fuel Storage Tank Emissions

Pollutant	Estimated Emissions from Storage Tanks									
	NN1	NN2	NN3	NN5	NN6	TK011	TK012	NN4	NN7	Total
	Emission Rate kg/yr									
Benzene	11.5	11.5	11.5	11.5	11.5	11.5	11.5	0.5	3.4	84.3
Cumene	3.0	3.0	3.0	3.0	3.0	3.1	3.1	0.1	0.9	22.4
Trimethylbenzene	29.2	29.2	29.2	29.2	29.2	29.3	29.3	1.3	8.6	214.5
Toluene	59.8	59.8	59.8	59.8	59.8	60.0	60.0	2.7	17.7	439.6
Ethylbenzene	16.1	16.1	16.1	16.1	16.1	16.1	16.1	0.7	4.8	118.0
Xylenes	79.8	79.8	79.8	79.8	79.8	80.1	80.1	3.7	23.6	586.6
Remaining VOC	1,254.1	1,254.1	1,254.1	1,254.1	1,254.1	1,258.0	1,258.0	57.6	371.3	9,215.4
TOTAL	1,453.5	1,453.5	1,453.5	1,453.5	1,453.5	1,458.1	1,458.1	66.8	430.3	10,680.9
	Emission Rate g/s									
Benzene	0.000364	0.000364	0.000364	0.000364	0.000364	0.000365	0.000365	0.000017	0.000108	0.00267
Cumene	0.000097	0.000097	0.000097	0.0000966	0.0000966	0.0000969	0.0000969	0.0000044	0.0000286	0.000710
Trimethylbenzene	0.000926	0.000926	0.000926	0.000926	0.000926	0.000929	0.000929	0.000043	0.000274	0.00680
Toluene	0.00190	0.00190	0.00190	0.00190	0.00190	0.00190	0.00190	0.000087	0.00056	0.0139
Ethylbenzene	0.000509	0.000509	0.000509	0.000509	0.000509	0.000511	0.000511	0.000023	0.000151	0.00374
Xylenes	0.00253	0.00253	0.00253	0.00253	0.00253	0.00254	0.00254	0.000116	0.00075	0.0186
Remaining VOC	0.0398	0.0398	0.0398	0.0398	0.0398	0.0399	0.0399	0.00183	0.0118	0.292
TOTAL	0.0461	0.0461	0.0461	0.0461	0.0461	0.0462	0.0462	0.00212	0.0136	0.339

4.5.5.2 Gantry Vapour Emissions

Emissions from the truck filling gantry are generated when tankers are filled with diesel fuel on site; as the tankers are loaded with diesel, residual vapours from the empty tankers are expelled and captured by the gantry. The composition of the expelled vapours is dependent on the previous contents of the tanker. The tanker being filled at the Facility may have previously contained either combustibles (i.e. diesel) or flammables (i.e. unleaded petrol), resulting in residual vapours from either of these fuels. Flammable fuels generally have higher concentrations of VOCs than combustible fuels.

In order to capture potential differences in residual vapour between tankers carrying combustibles and flammables, sampling was undertaken to estimate the likely composition of vapour emissions from the tankers (i.e. the vapour in the tanker headspace) during filling operations. Samples were taken directly from the tanker vapour outlet lines on June 24, 2015. Two samples were collected from combustible tankers and four from flammable tankers using Summa Canisters and sent to the NATA-certified ALS laboratories (accreditation number 825) for analysis of VOC composition in accordance with USEPA method TO-15; the laboratory analysis certificates are provided in **Appendix D**.

The sampling results are summarised in **Table 12**. The total VOCs represent the sum of all the volatile compounds measured in the samples. Where data were reported as less than the LoR for a particular species, the concentration of that species was assumed to be half the LoR for the purpose of the total VOC estimation in the sample. The upper quartile value from each fuel type was used in the assessment and presented in the table.

Table 12 Gantry Sample Concentration Summary

Fuel Type*	Concentration (mg/m^3)						
	Benzene	Cumene	Trimethyl-benzene	Toluene	Ethyl-benzene	Xylenes	TVOC
Combustible	26	4	18	114	27	90	777
Flammable	613	44	776	7,440	473	2,060	19,580

**denotes the fuel type that was previously carried by the road tanker prior to entering the Stolthaven Terminal*

The concentrations shown in **Table 12** were used with the source parameters provided in this AQIA to estimate emissions of individual VOCs from the gantry for a throughput of 1,300 ML per year. The estimated pollutant emission rates from the truck filling gantry are presented in **Table 13**. To avoid confusion no flammable fuels are stored or dispatched from the Facility.

As provided in **Section 4.3**, two scenarios were assessed; typical operations and maximum operations. The typical operations scenario assumed three tankers per bay per hour (12 tankers per hour) and a combustible to flammable residual fuel split of 60/40. The maximum operations scenario assumed four tankers per bay per hour (16 tankers per hour), all of which contained residual flammable fuel. The 60/40 split was based on advice from Stolthaven and is expected to be a reasonable estimate of the normal residual fuel split in the tankers being loaded.

The modelled scenarios assess the total hourly emissions on a mass basis using the volume of liquid pumped into the tankers, and the subsequent vapour, displaced by the loading operations. Pertinent information used in the calculations is as follows:

- Volume of vapour released: A standard B-Double tanker volume is 50,000L, or 50m^3. The total vapour released in an hour is calculated by the number of tankers loaded multiplied by 50m^3. This equates to 600m^3/hour for Scenario 1 and 800m^3/hour for Scenario 2.
- Mass of VOC released: The volume of vapour released in an hour is multiplied by each individual VOC species concentration in g/m^3 for a specific residual fuel type to gain a mass per hour. This value is divided by the seconds in an hour to gain an emission rate in g/s.

The above scenarios and calculations have been designed to ensure the assessment of both typical and worst case emissions from the gantry stack. It is envisaged that by looking at hourly tanker loading information that the best hourly emissions assessment would be achieved, avoiding the possible exclusion of peak emissions if an annual averaged mass calculation was applied.

Table 13 Predicted Gantry Emissions

Pollutant	Estimated Emissions from Gantry Stack - g/s	
	Scenario 1 - Typical Operations	Scenario 2 - Maximum Operations
Benzene	0.136	0.0451
Cumene	0.00967	0.00340
Trimethylbenzene	0.172	0.0556
Toluene	1.653	0.528
Ethylbenzene	0.105	0.0355
Xylenes	0.458	0.152

The operations of the facility were reviewed in consideration of the Protection of the Environment Operations (Clean Air) Regulation 2010 (POEO). The POEO regulation provides operational restrictions / limits based on the type of activity being undertaken. The activities at Stolthaven's Mayfield terminal relate to the transfer of liquid and hence fall under Part 6 of the regulation (control of volatile organic liquids); this is consistent with advice provided to AECOM specific to the facility by the NSW EPA Air Quality Technical Team. Clause 64 of the regulation provides requirements for the control of large loading plant in the Sydney Metropolitan area, of which Newcastle is not part of. The clause therefore does not apply to the Facility.

4.5.6 Sensitive Receptors

The NSW EPA considers sensitive receptors to be areas where people are likely to either live or work, or engage in recreational activities. The nearest residential area is located at Mayfield, with the closest receptors approximately 800 m from the site boundary. Other residential areas in proximity to the Facility include the suburbs of Carrington, Wickham and Tighes Hill.

Discrete sensitive receptor locations have been selected to represent the residential and commercial areas surrounding the Site. The selected receptors are listed in **Appendix E** with the locations also indicated on **Figure 1**. In addition to the sensitive receptors, boundary receptors were also selected for assessment of principle and individual air toxics in accordance with the NSW EPA Approved Methods. The boundary was defined as the land encompassed by the Stolthaven land lease, including lots1, 2, 36 and 37.

4.6 Limitations and Conservatism of Dispersion Modelling

The atmosphere is a complex, physical system, and the movement of air in a given location is dependent on a number of variables, including temperature, topography and land use, as well as larger-scale synoptic processes. Dispersion modelling is a method of simulating the movement of air pollutants in the atmosphere using mathematical equations. The model equations necessarily involve the current understanding of the complex environmental interactions and chemical reaction processes involved, available input data, processing time and data storage limitations. The model configuration particularly affects model predictions during certain meteorological conditions and source emission types. For example, the prediction of pollutant dispersion under low wind speed conditions (typically defined as those less than 1 m/s) or for low-level, non-buoyant sources, is problematic for most dispersion models. To accommodate these effects, the model is configured to provide conservative estimates of pollutant concentrations at particular locations.

The results of dispersion modelling, therefore, provide an overly conservative indication of the worst likely level of pollutants within the modelling domain. While the models, when used appropriately and with high quality input data, can provide very good indications of the scale of pollutant concentrations and the likely locations of the maximum concentrations occurring, their outputs should not be considered to be representative of exact pollutant concentrations at any given location or point in time.

Specific to this assessment, it should be noted that the assessment was conservative in that the modelling assumed constant emissions from the gantry vapour collection system and tanks; in reality, substantial emissions will likely only occur during tank and truck filling activities.

5.0 Impact Assessment

5.1 Predicted Ground Level Concentrations

The predicted ground level concentrations resulting from the dispersion modelling are presented in the following sections for the typical and maximum operations (Scenarios 1 and 2 respectively). The data is presented for principle and individual air toxics assessable at the site boundary and individual odorous air pollutants assessable at the nearest sensitive receptor. The NSW EPA's assessment criteria for the assessed pollutants apply to the 99.9th percentile for site-specific assessments, such as this AQIA.

5.1.1 Scenario 1 (Typical Operations) Assessment

The predicted ground level concentrations for Scenario 1 (typical operations) resulting from the dispersion model are summarised in **Table 14** for principle and individual air toxics assessable at the site boundary and in **Table 15** for individual odorous air pollutants assessable at the nearest sensitive receptor.

Table 14 Scenario 1 (Typical Operations) Predicted Maximum Ground Level Concentrations 99.9th Percentile for Principle and Individual Air Toxics Assessable at the Site Boundary (μg/m^3)

Pollutant	NSW EPA Criteria (μg/m^3)	Predicted Maximum Concentration 99.9th Percentile (μg/m^3)			
		Boundary	% of EPA Criterion	Residential / Industrial / Commercial	% of EPA Criterion
Benzene	29	8.66	29.9%	3.17	10.9%
Trimethylbenzene (mixed isomers)	2,200	10.69	0.5%	3.94	0.2%
Ethylbenzene	8,000	6.82	0.09%	2.50	0.03%

Table 15 Scenario 1 (Typical Operations) Predicted Maximum Ground Level Concentrations 99.9th Percentile for Individual Odorous Air Pollutants Assessable at the Nearest Sensitive Receptor (μg/m^3)

Pollutant	NSW EPA Criteria (μg/m^3)	Predicted Maximum Concentration 99.9th Percentile (μg/m^3)			
		Residential	% of EPA Criterion	Industrial / Commercial	% of EPA Criterion
Cumene	21	0.12	0.6%	0.25	1.2%
Toluene	360	15.82	4.4%	36.97	10.3%
Xylenes	190	5.07	2.7%	10.75	5.7%

As shown in the tables, the results of the modelling assessment predicted that all assessed VOC concentrations would comply with the NSW EPA guideline criterion at all sensitive receptor and boundary locations assessed. The predicted value with the highest proportion of the NSW EPA criteria was for benzene at 29.9%; this receptor was a boundary receptor located on the east of the site. The predicted value with the highest proportion of the criteria for a residential / commercial location was also for benzene with a predicted impact of 10.9% of the NSW EPA criterion. Concentration contour Plots showing the predicted 1hour 99.9th percentile impacts from the assessed pollutants are provided in **Appendix F**.

The assessment predicts that no adverse impacts are likely to occur as a result of the Stolthaven bulk liquids facilities typical operations at and beyond the site boundary or at residential receptors.

5.1.2 Scenario 2 (Maximum Operations) Assessment

The predicted ground level concentrations for Scenario 2 (maximum operations) resulting from the dispersion model are summarised in **Table 16** for principle and individual air toxics assessable at the site boundary and in **Table 17** for individual odorous air pollutants assessable at the nearest sensitive receptor.

Table 16 Scenario 2 (Maximum Operations) Predicted Maximum Ground Level Concentrations 99.9th Percentile for Principle and Individual Air Toxics Assessable at the Site Boundary (µg/m³)

Pollutant	NSW EPA Criteria (µg/m³)	Predicted Maximum Concentration 99.9th Percentile (µg/m³)			
		Boundary	% of EPA Criterion	Residential / Industrial / Commercial	% of EPA Criterion
Benzene	29	24.73	85.3%	9.02	31.1%
Trimethylbenzene (mixed isomers)	2,200	31.31	1.4%	11.44	0.5%
Ethylbenzene	8,000	19.09	0.2%	6.97	0.09%

Table 17 Scenario 2 (Maximum Operations) Predicted Maximum Ground Level Concentrations 99.9th Percentile for Individual Odorous Air Pollutants Assessable at the Nearest Sensitive Receptor (µg/m³)

Pollutant	NSW EPA Criteria (µg/m³)	Predicted Maximum Concentration 99.9th Percentile (µg/m³)			
		Residential	% of EPA Criterion	Industrial / Commercial	% of EPA Criterion
Cumene	21	0.30	1.4%	0.65	3.1%
Toluene	360	47.97	13.3%	109.43	30.4%
Xylenes	190	13.82	7.3%	30.38	16.0%

As shown in the tables, the results of the modelling assessment predicted that all assessed VOC concentrations would comply with the NSW EPA guideline criterion at all sensitive receptor locations assessed.

Advice from Stolthaven suggests that three tankers per bay per hour is the normal operating maximum, and that at any time it is likely that only three of the four bays would have residual flammable tankers maximum. The use of four flammable tankers in the maximum scenario is therefore considered to be a significant overestimation and subsequently the maximum scenario is likely to present a significant overestimation of impacts.

The assessment predicts that no adverse impacts are likely to occur as a result of the Stolthaven bulk liquids facilities maximum operations at and beyond the site boundary or at residential receptors.

5.2 Assessable Pollutant Load for Inclusion in EPL

The governing legislation for load based licensing in NSW is the Protection of the Environment Operations (General) Regulation 2009 (POEO General Regulation). Under Schedule 1 of the POEO General Regulation, the statutory activity at the Mayfield facility is classified as petroleum products storage. The assessable pollutants for this activity are benzene and VOCs.

The assessable loads for these pollutants are calculated in accordance with the EPA's Load Calculation Protocol (June, 2009). For petroleum products storage, the acceptable load calculation methods and emission factors are specified as shown in **Table 18**.

Table 18 Acceptable Load Calculation Methods - Petroleum Products Storage

Component/Activity	Acceptable Calculation Methods	
	Benzene	VOCs
Transfer of liquid	Site-specific emission factors Mass balance TANKS	
Storage of liquids		
Vapour disposal or recovery systems	N/A	Periodic source monitoring Emission factors - predictive emission monitoring system or site-specific

As previously discussed, site-specific sampling was undertaken at the site for both the transfer and storage of liquid and the gantry emissions for VOC composition. The site-specific sampling together with the TANKS model, both methods listed by the EPA's Load Calculation Protocol, were used to estimate the emissions for the 1,300 MLpa modification. The sum of the emissions from the tanks and truck filling gantry represent the total estimated assessable loads for the site with a throughput of 1,300 ML.

The total VOC and benzene load from the tanks emissions are provided in **Table 11**.

The assessable load from the gantry stack has been calculated using the volume of liquid throughput of the facility, and subsequently vapour release, together with the concentrations gained from the site specific sampling. An estimated combustible to flammable residual tanker fuel ratio of 60:40 has been applied to the total throughput, resulting in 780,000m3 (780ML) of combustible vapour released and 520,000m3 (520ML) of flammable vapour released. These values were applied to the concentrations provided in **Table 12** to gain the mass emission in kg/year of TVOC and benzene from the gantry.

The total assessable load for total VOC and benzene is provided in **Table 19.** In summary, the assessable load for total VOC is estimated to be 21,469 kilograms per year, while the benzene assessable load is estimated to be 423 kilograms per year.

Table 19 Revised Assessable Load Limits

Pollutants	Revised Assessable Loads Limits (kg/year)
Storage Tank Emissions	
Benzene	84
Total VOCs	10,681
Gantry Emissions	
Benzene	339
Total VOCs	10,788
TOTAL	
Benzene	423
Total VOCs	21,469

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6.0 Mitigation Measures

6.1 Operational Mitigation Measures

Operational mitigation measures are those that are implemented after the facility has been modified and operations commenced in accordance with its consent approval. Operational mitigation measures focus on the undertaking of specific activities in a manner designed to minimise environmental impacts.

An Air Quality Management Plan (AQMP) was previously prepared for the site in consultation with the PoN and the NSW EPA. The AQMP was prepared in accordance with the requirements set out in the site's consent conditions and Environment Protection Licence (EPL 20193) and provides the following:

- Identifies the sensitive receptors in proximity to the site;
- Outlines the legislative framework and standards applicable to the operation;
- Details the potential contributors to off-site pollutant impacts, including the pollutants that are of concern;
- Proposes mitigation measures required to minimise the operation's impacts on the local air quality;
- Outlines the contingency plans for complaints and pollution incidents; and
- Details the review and reporting protocols.

The AQMP would be reviewed and updated where appropriate to reflect the Proposed Modification. The mitigation measures provided in the AQMP are summarised as follows:

- All vehicles and plant/equipment should be fitted with appropriate emission control equipment and be serviced and maintained in accordance with the manufacturers' specifications. Smoke from vehicles/plant should not be visible for more than ten seconds;
- Trucks entering and leaving the premises that are carrying loads of dust-generating materials must have their loads covered at all times, except during loading and unloading (as per EPL condition O3.3);
- Hard surfaces or paving should be used where possible, as unpaved routes can account for a significant proportion of fugitive dust emissions, particularly during dry/windy conditions. Routes should be inspected regularly and repaired when necessary, and roads should be swept and watered as required to limit dirt/dust build up and potential dust generation during windy conditions;
- Any areas on site that are not covered with hard surfaces should be vegetated wherever possible to minimise wind erosion and associated dust generation; and
- All vehicles should be switched off when not in use for extended periods.

6.1.1 Environmental Management Strategy

In accordance with the Project Approval requirements for the existing Facility, Stolthaven has in operation an Environmental Management Strategy (EMS) which includes a range of management plans for the control of various operational systems and environmental aspects. This suite of documents includes:

- Health, Safety and Environmental Management (EMS);
- Safety, health, environment and quality polices;
- Accident and incident reporting system; and
- Operational Environmental Management Plan (OEMP), incorporating the following sub plans:
    - Soils, contamination and acid sulphate soils;
    - Surface water;
    - Groundwater;
    - Noise and vibrations;
    - Air quality;
    - Traffic; and
    - Dangerous goods

The EMS was prepared in consultation with key agency stakeholders including the NSW EPA, Hunter development corporation (HDC), Newcastle City Council (NCC) and PoN with evidence of consultation provided to DP&E.

The air quality portion of the OEMP details prevention and management measures for air quality issues associated with the operations of the facility. It defines mitigation measures to be implemented during operations and contingency measures that may be implemented if complaints are received. The primary goal of the OEMP is to effectively manage operational activities to prevent potential air quality issues and ensure that operational activities are managed to meet air quality objectives as set out in environmental assessments and the EPL issued by the NSW EPA.

7.0 Conclusion

AECOM conducted an assessment of the potential effects on air quality associated with the operation of the Stolthaven bulk liquid fuel storage terminal at Mayfield, NSW. Stolthaven is seeking approval to increase the annual throughout of its existing terminal from 1,010 MLpa to 1,300 MLpa.

This assessment investigated the air quality impacts of the Proposed Modification on the surrounding environment. The assessment of air emissions was limited to VOCs during operation of the Facility. VOC concentrations at sensitive receptor locations were estimated through dispersion modelling using the CALPUFF program.

The emissions inventory for the Proposed Modification was prepared using site-specific measured data for storage tank liquid composition and gantry vapour composition for all pollutants of concern. Previous development applications relied heavily on default composition values provided in the NPI and other regulatory documents. The use of site-specific data is considered to be best practice and likely to reflect a more accurate representation of the facilities impacts than previous work.

The impact assessment reviewed both typical and maximum operations and confirmed that both scenarios resulted in compliance with the NSW EPA criteria at all sensitive receptor locations assessed. The proposed throughput increase to 1,300MLpa is therefore not expected to adversely affect the environment or amenity of receptors.

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Appendix A

Regional Climate Data - Williamtown BoM

Appendix A Regional Climate Data - Williamtown BoM

The long-term climate averages recorded at the BOM Williamtown station between 1942 and 2014 for temperature and rainfall and 1942 to 2010 for 9am and 3pm conditions are shown in **Table A1**. The 9am and 3pm windroses for 1942 to 2010 are presented in **Figure A1**.

Table A.1 – Long Term Climate Averages, BOM Williamtown (1942-2014)

Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Temperature													
Mean maximum temperature (°C)	28.0	27.6	26.2	23.7	20.3	17.7	17.0	18.6	21.3	23.6	25.5	27.2	23.1
Mean minimum temperature (°C)	18.0	18.1	16.3	13.2	10.0	7.9	6.4	6.8	9.1	11.9	14.4	16.5	12.4
Rainfall													
Mean rainfall (mm)	96.6	121.4	120.2	107.5	112.9	121.9	73.8	74.2	59.3	73.4	84.1	78.7	1122.9
Mean number of days of rain ≥ 1 mm	7.1	7.4	8.1	7.4	7.9	8.2	6.4	6.1	5.5	7.3	7.4	7.0	85.8
9 am Conditions													
Mean 9am temperature (°C)	23.0	22.5	21.2	18.2	14.3	11.6	10.5	12.2	15.7	18.8	20.5	22.2	17.6
Mean 9am relative humidity (%)	72	76	77	76	79	80	77	71	66	64	66	68	73
Mean 9am wind speed (km/h)	11.9	10.6	10.2	11.4	13.7	15.9	16.4	16.8	15.3	14.4	14.4	12.9	13.7
3 pm Conditions													
Mean 3pm temperature (°C)	26.5	26.1	24.9	22.5	19.3	16.8	16.2	17.6	20.0	21.9	23.8	25.6	21.8
Mean 3pm relative humidity (%)	59	62	61	59	60	60	55	50	50	54	55	56	57
Mean 3pm wind speed (km/h)	21.9	20.6	18.9	17.2	15.8	17.5	18.7	20.9	22.0	22.5	23.5	23.5	20.2

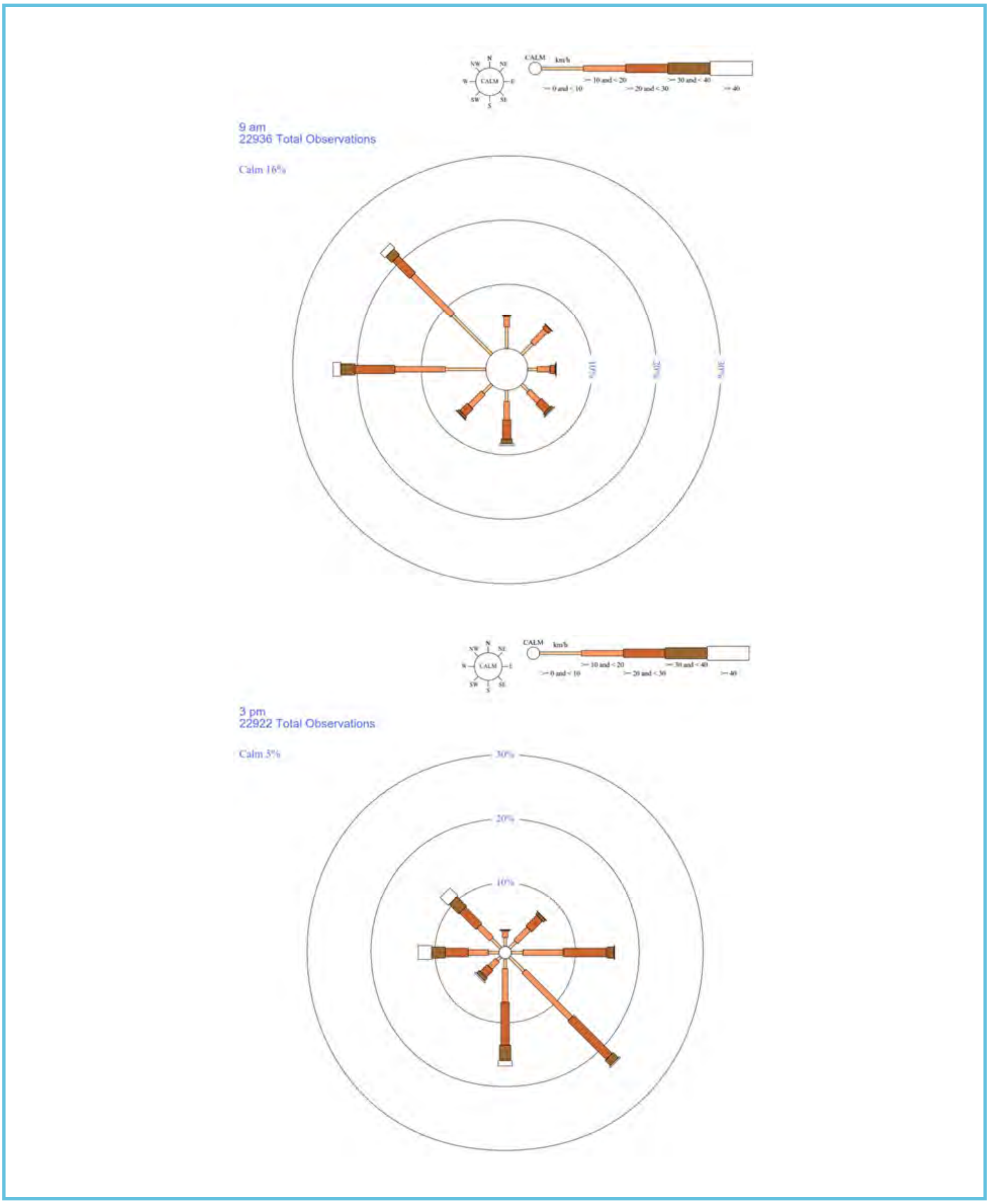

Figure A1 BoM Williamtown Windroses 1942 - 2010

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Appendix B

2013 Mayfield Berth 4 Meteorological Data Review

Appendix B 2013 Mayfield Berth 4 Meteorological Data Review

The following appendix discusses the meteorological data from the PoN operated Mayfield Berth 4 monitoring station for the year 2013 in terms of wind speed, wind direction and temperature.

The Bureau of Meteorology (BoM) operates a network of meteorological monitoring stations around the country. The closest station to the site that measures long-term parameters is located at the Williamtown RAAF base, approximately 13 km northeast of the Site. The BoM station is located approximately 5 km from the ocean, while the Mayfield Berth 4 station is adjacent to a river and located approximately 2 km from the ocean.

Wind Speed

The frequency distribution of hourly averaged wind speed values from the Mayfield Berth 4 data generated for the assessment is shown in **Figure B1**. As shown, wind speeds in the area are medium to high strength, with speeds greater than 3.6 m/s occurring for nearly 70 percent of the time. The average wind speed is 3.3 m/s and the maximum wind speed is 13.2 m/s. Given the coastal location of the station, the high percentage of strong winds is expected.

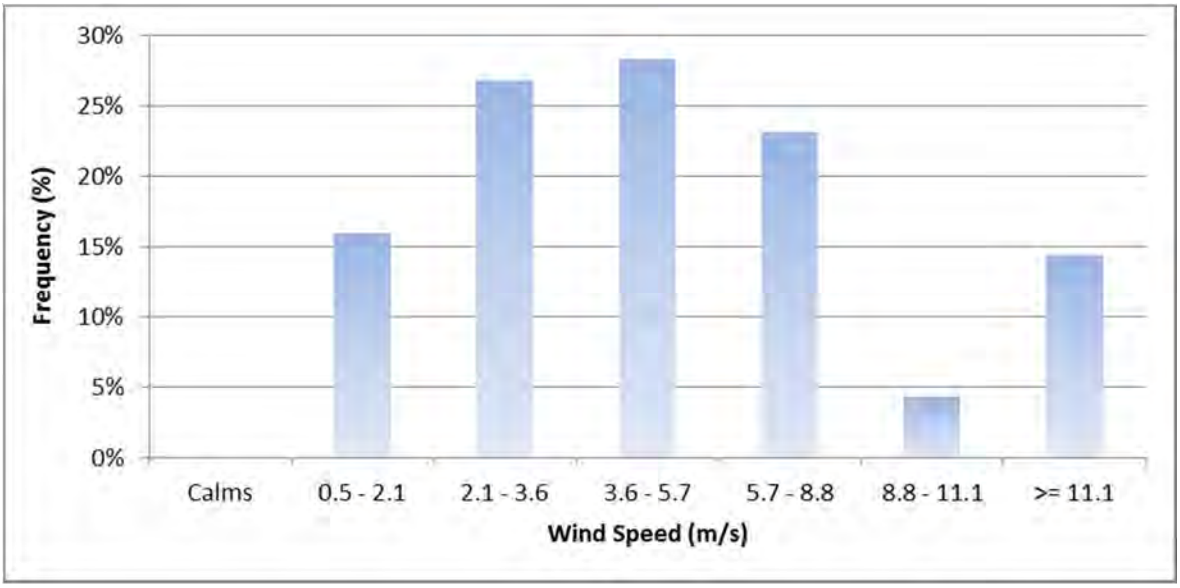


Figure B1 Frequency Distribution of Wind Speed Mayfield Berth 4, 2013

Figure B2 shows the distribution of wind speeds by hour of day. Higher wind speeds tend to occur during the daytime between 10 am and 5 pm, with a peak around 3 pm.

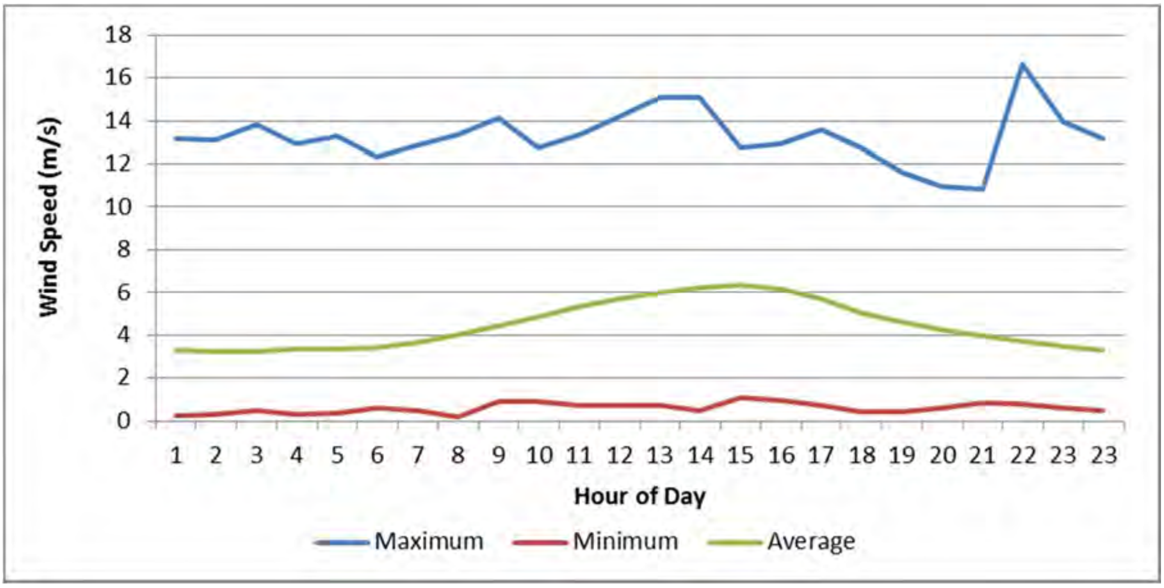
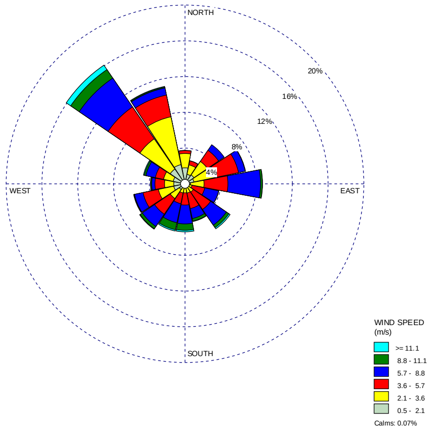


Figure B2 Wind Speed by Hour of Day Mayfield Berth 4, 2013

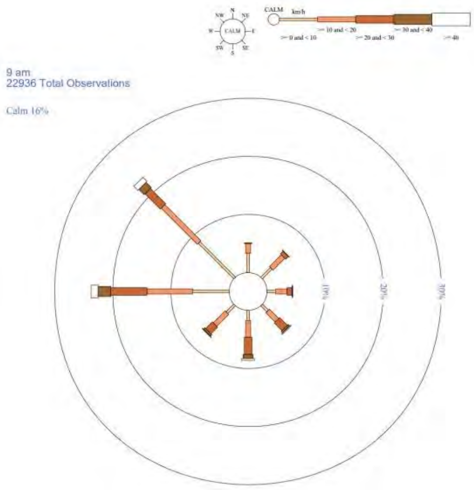
Wind Rose

Wind speed and direction are important variables in dispersion modelling, as they dictate the direction and distance pollutant plumes travel. A comparison of the wind roses from the BoM Williamtown monitoring station, which are indicative of long-term climatic wind patterns, and the Mayfield Berth 4 data is shown below and summarised in the following paragraphs.

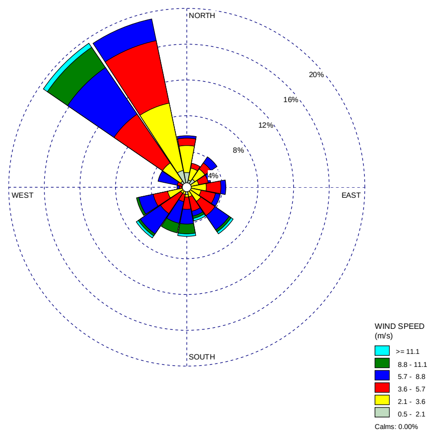
The BoM data indicate that the predominant wind directions in the morning are from the northwest and west. Similarly, morning north westerly winds are a common occurrence in the Mayfield data; the BoM data, however, predict a greater frequency of winds from the western quadrant. The wind roses from the afternoon BoM and Mayfield data sets correlate well, with winds most commonly occurring from east to south with noticeable winds also from the North West.



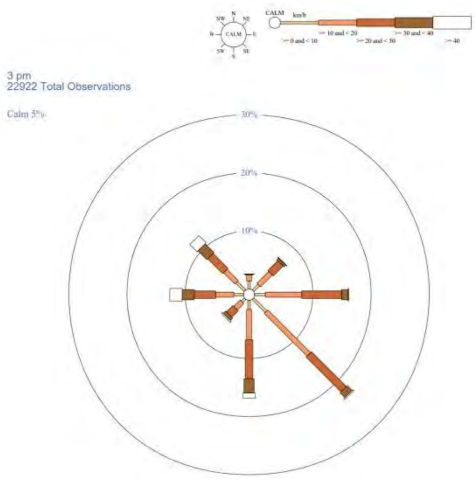
Mayfield Berth 4 Annual - 2013



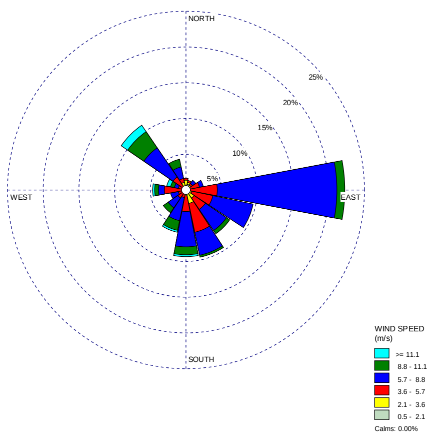
BoM Williamtown RAAF 9am – 1942 - 2010



Mayfield Berth 4 9am - 2013



BoM Williamtown RAAF 3pm – 1942 - 2010



Mayfield Berth 4 3pm - 2013

Figure B3 **Comparison of BoM Williamtown RAAF1942 - 2010 and Mayfield Berth 4 2013 Wind Roses**

Temperature

The temperature data show a reasonable comparison between data sets, with the Mayfield data generally showing lower minimum temperatures and higher maximum temperatures. The maximum difference between results is 37 %, with an average difference of -15 % for the minimum value and 24 % for the maximum data set.

Table B1 Temperature Comparison of BoM Williamtown Long-term to Mayfield Berth 4 2013

Parameter	Monitoring Site	Jan	Feb	Mar	Apr	May	Jun
Minimum Temperature (ºC)	BoM Williamtown	18.0	18.1	16.3	13.2	10.0	7.9
	Mayfield Berth 4	18.0	14.9	14.4	11.7	8.4	6.9
	% Difference	0%	-22%	-14%	-13%	-20%	-14%
Maximum Temperature (ºC)	BoM Williamtown	28.0	27.6	26.2	23.6	20.3	17.7
	Mayfield Berth 4	42.0	29.6	31.3	27.7	28.0	21.6
	% Difference	33%	7%	16%	15%	27%	18%
Parameter	**Monitoring Site**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Minimum Temperature (ºC)	BoM Williamtown	6.4	6.8	9.1	11.9	14.4	16.5
	Mayfield Berth 4	5.9	6.0	9.7	9.4	12.9	11.5
	% Difference	-9%	-13%	6%	-27%	-11%	-44%
Maximum Temperature (ºC)	BoM Williamtown	17.0	18.6	21.3	23.6	25.5	27.2
	Mayfield Berth 4	22.2	27.4	33.9	34.6	34.5	34.1
	% Difference	23%	32%	37%	32%	26%	20%

Conclusion

The review undertaken suggests that the wind speed and direction for the BoM and the Mayfield Berth 4 show similar trends. The Mayfield Berth 4 data tends to have lower minimum temperatures and higher maximum temperatures. The relatively higher wind spread and the noted diurnal cycle are expected of the coastal site. The Mayfield Berth 4 data is therefore considered fit for use in the Proposed Modification.

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Appendix C

TANKS Files

Appendix C TANKS Files

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification		
User Identification:	Stolt_0.5ML_1300ML	
City:	Newcastle	
State:	NSW	
Company:	Stolt	
Type of Tank:	Vertical Fixed Roof Tank	
Description:	Stolthaven 0.5ML Tank	
Tank Dimensions		
Shell Height (ft):		39.40
Diameter (ft):		24.90
Liquid Height (ft) :		36.70
Avg. Liquid Height (ft):		20.00
Volume (gallons):		132,086.00
Turnovers:		25.74
Net Throughput(gal/yr):		3,400,234.00
Is Tank Heated (y/n):	N	
Paint Characteristics		
Shell Color/Shade:	White/White	
Shell Condition	Good	
Roof Color/Shade:	White/White	
Roof Condition:	Good	
Roof Characteristics		
Type:	Dome	
Height (ft)		0.00
Radius (ft) (Dome Roof)		24.90
Breather Vent Settings		
Vacuum Settings (psig):		-0.03
Pressure Settings (psig)		0.03

Meterological Data used in Emissions Calculations: Newcastle, NSW (Avg Atmospheric Pressure = 14.7 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

Stolt_0.5ML_1300ML - Vertical Fixed Roof Tank
Newcastle, NSW

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	67.40	59.30	75.50	65.32	0.0099	0.0075	0.0127	125.1470			186.80	Option 1: VP60 = .0065 VP70 = .009
1,2,4-Trimethylbenzene						0.0273	0.0199	0.0372	120.1900	0.0049	0.0201	120.19	Option 2: A=7.04383, B=1573.267, C=208.56
Benzene						1.4289	1.1455	1.7681	78.1100	0.0000	0.0079	78.11	Option 2: A=6.905, B=1211.033, C=220.79
Distillate fuel oil no. 2						0.0084	0.0064	0.0106	130.0000	0.9906	0.8628	188.00	Option 1: VP60 = .0065 VP70 = .009
Ethylbenzene						0.1398	0.1059	0.1826	106.1700	0.0005	0.0110	106.17	Option 2: A=6.975, B=1424.255, C=213.21
Isopropyl benzene						0.0632	0.0469	0.0842	120.2000	0.0002	0.0021	120.20	Option 2: A=6.93666, B=1460.793, C=207.78
Toluene						0.4141	0.3230	0.5259	92.1300	0.0007	0.0412	92.13	Option 2: A=6.954, B=1344.8, C=219.48
Xylenes (mixed isomers)						0.1167	0.0882	0.1528	106.1700	0.0031	0.0549	106.17	Option 2: A=7.009, B=1462.266, C=215.11

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

Stolt_0.5ML_1300ML - Vertical Fixed Roof Tank
Newcastle, NSW

Annual Emission Calcaulations	
Standing Losses (lb):	46.8907
Vapor Space Volume (cu ft):	10,278.5926
Vapor Density (lb/cu ft):	0.0002
Vapor Space Expansion Factor:	0.0577
Vented Vapor Saturation Factor:	0.9891
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	10,278.5926
Tank Diameter (ft):	24.9000
Vapor Space Outage (ft):	21.1079
Tank Shell Height (ft):	39.4000
Average Liquid Height (ft):	20.0000
Roof Outage (ft):	1.7079
Roof Outage (Dome Roof)	
Roof Outage (ft):	1.7079
Dome Radius (ft):	24.9000
Shell Radius (ft):	12.4500
Vapor Density	
Vapor Density (lb/cu ft):	0.0002
Vapor Molecular Weight (lb/lb-mole):	125.1470
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0099
Daily Avg. Liquid Surface Temp. (deg. R):	527.0709
Daily Average Ambient Temp. (deg. F):	65.3000
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	524.9900
Tank Paint Solar Absorptance (Shell):	0.1700
Tank Paint Solar Absorptance (Roof):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,556.0000
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0577
Daily Vapor Temperature Range (deg. R):	32.3906
Daily Vapor Pressure Range (psia):	0.0051
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0099
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0075
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0127
Daily Avg. Liquid Surface Temp. (deg R):	527.0709
Daily Min. Liquid Surface Temp. (deg R):	518.9733
Daily Max. Liquid Surface Temp. (deg R):	535.1685
Daily Ambient Temp. Range (deg. R):	34.7000
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9891
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0099
Vapor Space Outage (ft):	21.1079
Working Losses (lb):	100.2538

Vapor Molecular Weight (lb/lb-mole):	125.1470
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0099
Annual Net Throughput (gal/yr.):	3,400,234.0000
Annual Turnovers:	25.7426
Turnover Factor:	1.0000
Maximum Liquid Volume (gal):	132,086.0003
Maximum Liquid Height (ft):	36.7000
Tank Diameter (ft):	24.9000
Working Loss Product Factor:	1.0000
Total Losses (lb):	147.1445

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

Stolt_0.5ML_1300ML - Vertical Fixed Roof Tank
Newcastle, NSW

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	100.25	46.89	147.14
Benzene	0.79	0.37	1.16
Toluene	4.13	1.93	6.06
Ethylbenzene	1.11	0.52	1.63
Xylenes (mixed isomers)	5.51	2.58	8.08
Isopropyl benzene	0.21	0.10	0.31
1,2,4-Trimethylbenzene	2.01	0.94	2.96
Distillate fuel oil no. 2	86.50	40.46	126.96

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification	
User Identification:	Stolt_4.2ML_1300ML
City:	Newcastle
State:	NSW
Company:	Stolt
Type of Tank:	Vertical Fixed Roof Tank
Description:	Stolthaven 4.2ML Tank
Tank Dimensions	
Shell Height (ft):	55.80
Diameter (ft):	59.10
Liquid Height (ft) :	52.00
Avg. Liquid Height (ft):	28.00
Volume (gallons):	1,109,523.00
Turnovers:	16.86
Net Throughput(gal/yr):	18,701,289.00
Is Tank Heated (y/n):	N
Paint Characteristics	
Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good
Roof Characteristics	
Type:	Dome
Height (ft)	0.00
Radius (ft) (Dome Roof)	59.10
Breather Vent Settings	
Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Newcastle, NSW (Avg Atmospheric Pressure = 14.7 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

Stolt_4.2ML_1300ML - Vertical Fixed Roof Tank
Newcastle, NSW

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	67.40	59.30	75.50	65.32	0.0099	0.0075	0.0127	125.1470			186.80	Option 1: VP60 = .0065 VP70 = .009
1,2,4-Trimethylbenzene						0.0273	0.0199	0.0372	120.1900	0.0049	0.0201	120.19	Option 2: A=7.04383, B=1573.267, C=208.56
Benzene						1.4289	1.1455	1.7681	78.1100	0.0000	0.0079	78.11	Option 2: A=6.905, B=1211.033, C=220.79
Distillate fuel oil no. 2						0.0084	0.0064	0.0106	130.0000	0.9906	0.8628	188.00	Option 1: VP60 = .0065 VP70 = .009
Ethylbenzene						0.1398	0.1059	0.1826	106.1700	0.0005	0.0110	106.17	Option 2: A=6.975, B=1424.255, C=213.21
Isopropyl benzene						0.0632	0.0469	0.0842	120.2000	0.0002	0.0021	120.20	Option 2: A=6.93666, B=1460.793, C=207.78
Toluene						0.4141	0.3230	0.5259	92.1300	0.0007	0.0412	92.13	Option 2: A=6.954, B=1344.8, C=219.48
Xylenes (mixed isomers)						0.1167	0.0882	0.1528	106.1700	0.0031	0.0549	106.17	Option 2: A=7.009, B=1462.266, C=215.11

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

Stolt_4.2ML_1300ML - Vertical Fixed Roof Tank
Newcastle, NSW

Annual Emission Calcaulations	
Standing Losses (lb):	396.4278
Vapor Space Volume (cu ft):	87,382.5416
Vapor Density (lb/cu ft):	0.0002
Vapor Space Expansion Factor:	0.0577
Vented Vapor Saturation Factor:	0.9836
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	87,382.5416
Tank Diameter (ft):	59.1000
Vapor Space Outage (ft):	31.8537
Tank Shell Height (ft):	55.8000
Average Liquid Height (ft):	28.0000
Roof Outage (ft):	4.0537
Roof Outage (Dome Roof)	
Roof Outage (ft):	4.0537
Dome Radius (ft):	59.1000
Shell Radius (ft):	29.5500
Vapor Density	
Vapor Density (lb/cu ft):	0.0002
Vapor Molecular Weight (lb/lb-mole):	125.1470
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0099
Daily Avg. Liquid Surface Temp. (deg. R):	527.0709
Daily Average Ambient Temp. (deg. F):	65.3000
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	524.9900
Tank Paint Solar Absorptance (Shell):	0.1700
Tank Paint Solar Absorptance (Roof):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,556.0000
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0577
Daily Vapor Temperature Range (deg. R):	32.3906
Daily Vapor Pressure Range (psia):	0.0051
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0099
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0075
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0127
Daily Avg. Liquid Surface Temp. (deg R):	527.0709
Daily Min. Liquid Surface Temp. (deg R):	518.9733
Daily Max. Liquid Surface Temp. (deg R):	535.1685
Daily Ambient Temp. Range (deg. R):	34.7000
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9836
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0099
Vapor Space Outage (ft):	31.8537
Working Losses (lb):	551.3960

Vapor Molecular Weight (lb/lb-mole):	125.1470
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0099
Annual Net Throughput (gal/yr.):	18,701,289.0000
Annual Turnovers:	16.8553
Turnover Factor:	1.0000
Maximum Liquid Volume (gal):	1,109,523.0000
Maximum Liquid Height (ft):	52.0000
Tank Diameter (ft):	59.1000
Working Loss Product Factor:	1.0000
Total Losses (lb):	947.8238

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

Stolt_4.2ML_1300ML - Vertical Fixed Roof Tank
Newcastle, NSW

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	551.40	396.43	947.82
Benzene	4.35	3.13	7.48
Toluene	22.70	16.32	39.01
Ethylbenzene	6.09	4.38	10.47
Xylenes (mixed isomers)	30.29	21.77	52.06
Isopropyl benzene	1.16	0.83	1.99
1,2,4-Trimethylbenzene	11.07	7.96	19.04
Distillate fuel oil no. 2	475.74	342.04	817.78

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification	
User Identification:	Stolt_18ML_New_1300ML
City:	Newcastle
State:	NSW
Company:	Stolt
Type of Tank:	Vertical Fixed Roof Tank
Description:	Stolthaven 18ML New Tanks
Tank Dimensions	
Shell Height (ft):	58.40
Diameter (ft):	118.10
Liquid Height (ft) :	54.50
Avg. Liquid Height (ft):	29.00
Volume (gallons):	4,755,097.00
Turnovers:	9.65
Net Throughput(gal/yr):	45,903,163.00
Is Tank Heated (y/n):	N
Paint Characteristics	
Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good
Roof Characteristics	
Type:	Dome
Height (ft)	0.00
Radius (ft) (Dome Roof)	118.10
Breather Vent Settings	
Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Newcastle, NSW (Avg Atmospheric Pressure = 14.7 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

Stolt_18ML_New_1300ML - Vertical Fixed Roof Tank
Newcastle, NSW

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	67.40	59.30	75.50	65.32	0.0099	0.0075	0.0127	125.1470			186.80	Option 1: VP60 = .0065 VP70 = .009
1,2,4-Trimethylbenzene						0.0273	0.0199	0.0372	120.1900	0.0049	0.0201	120.19	Option 2: A=7.04383, B=1573.267, C=208.56
Benzene						1.4289	1.1455	1.7681	78.1100	0.0000	0.0079	78.11	Option 2: A=6.905, B=1211.033, C=220.79
Distillate fuel oil no. 2						0.0084	0.0064	0.0106	130.0000	0.9906	0.8628	188.00	Option 1: VP60 = .0065 VP70 = .009
Ethylbenzene						0.1398	0.1059	0.1826	106.1700	0.0005	0.0110	106.17	Option 2: A=6.975, B=1424.255, C=213.21
Isopropyl benzene						0.0632	0.0469	0.0842	120.2000	0.0002	0.0021	120.20	Option 2: A=6.93666, B=1460.793, C=207.78
Toluene						0.4141	0.3230	0.5259	92.1300	0.0007	0.0412	92.13	Option 2: A=6.954, B=1344.8, C=219.48
Xylenes (mixed isomers)						0.1167	0.0882	0.1528	106.1700	0.0031	0.0549	106.17	Option 2: A=7.009, B=1462.266, C=215.11

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

Stolt_18ML_New_1300ML - Vertical Fixed Roof Tank
Newcastle, NSW

Annual Emission Calcaulations	
Standing Losses (lb):	1,858.2466
Vapor Space Volume (cu ft):	410,796.8587
Vapor Density (lb/cu ft):	0.0002
Vapor Space Expansion Factor:	0.0577
Vented Vapor Saturation Factor:	0.9807
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	410,796.8587
Tank Diameter (ft):	118.1000
Vapor Space Outage (ft):	37.5005
Tank Shell Height (ft):	58.4000
Average Liquid Height (ft):	29.0000
Roof Outage (ft):	8.1005
Roof Outage (Dome Roof)	
Roof Outage (ft):	8.1005
Dome Radius (ft):	118.1000
Shell Radius (ft):	59.0500
Vapor Density	
Vapor Density (lb/cu ft):	0.0002
Vapor Molecular Weight (lb/lb-mole):	125.1470
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0099
Daily Avg. Liquid Surface Temp. (deg. R):	527.0709
Daily Average Ambient Temp. (deg. F):	65.3000
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	524.9900
Tank Paint Solar Absorptance (Shell):	0.1700
Tank Paint Solar Absorptance (Roof):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,556.0000
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0577
Daily Vapor Temperature Range (deg. R):	32.3906
Daily Vapor Pressure Range (psia):	0.0051
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0099
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0075
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0127
Daily Avg. Liquid Surface Temp. (deg R):	527.0709
Daily Min. Liquid Surface Temp. (deg R):	518.9733
Daily Max. Liquid Surface Temp. (deg R):	535.1685
Daily Ambient Temp. Range (deg. R):	34.7000
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9807
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0099
Vapor Space Outage (ft):	37.5005
Working Losses (lb):	1,353.4265

Vapor Molecular Weight (lb/lb-mole):	125.1470
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0099
Annual Net Throughput (gal/yr.):	45,903,163.0000
Annual Turnovers:	9.6535
Turnover Factor:	1.0000
Maximum Liquid Volume (gal):	4,755,097.0000
Maximum Liquid Height (ft):	54.5000
Tank Diameter (ft):	118.1000
Working Loss Product Factor:	1.0000
Total Losses (lb):	3,211.6731

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

Stolt_18ML_New_1300ML - Vertical Fixed Roof Tank
Newcastle, NSW

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	1,353.43	1,858.25	3,211.67
Benzene	10.68	14.66	25.34
Toluene	55.71	76.49	132.20
Ethylbenzene	14.95	20.53	35.49
Xylenes (mixed isomers)	74.34	102.06	176.40
Isopropyl benzene	2.84	3.90	6.73
1,2,4-Trimethylbenzene	27.18	37.32	64.50
Distillate fuel oil no. 2	1,167.73	1,603.29	2,771.01

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification	
User Identification:	Stolt_18ML_Original_1300ML
City:	Newcastle
State:	NSW
Company:	Stolt
Type of Tank:	Vertical Fixed Roof Tank
Description:	Stolthaven 18ML Original Tanks
Tank Dimensions	
Shell Height (ft):	55.80
Diameter (ft):	120.10
Liquid Height (ft) :	52.00
Avg. Liquid Height (ft):	28.00
Volume (gallons):	4,755,097.00
Turnovers:	9.65
Net Throughput(gal/yr):	45,903,163.00
Is Tank Heated (y/n):	N
Paint Characteristics	
Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good
Roof Characteristics	
Type:	Dome
Height (ft)	0.00
Radius (ft) (Dome Roof)	120.10
Breather Vent Settings	
Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Newcastle, NSW (Avg Atmospheric Pressure = 14.7 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

Stolt_18ML_Original_1300ML - Vertical Fixed Roof Tank
Newcastle, NSW

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	67.40	59.30	75.50	65.32	0.0099	0.0075	0.0127	125.1470			186.80	Option 1: VP60 = .0065 VP70 = .009
1,2,4-Trimethylbenzene						0.0273	0.0199	0.0372	120.1900	0.0049	0.0201	120.19	Option 2: A=7.04383, B=1573.267, C=208.56
Benzene						1.4289	1.1455	1.7681	78.1100	0.0000	0.0079	78.11	Option 2: A=6.905, B=1211.033, C=220.79
Distillate fuel oil no. 2						0.0084	0.0064	0.0106	130.0000	0.9906	0.8628	188.00	Option 1: VP60 = .0065 VP70 = .009
Ethylbenzene						0.1398	0.1059	0.1826	106.1700	0.0005	0.0110	106.17	Option 2: A=6.975, B=1424.255, C=213.21
Isopropyl benzene						0.0632	0.0469	0.0842	120.2000	0.0002	0.0021	120.20	Option 2: A=6.93666, B=1460.793, C=207.78
Toluene						0.4141	0.3230	0.5259	92.1300	0.0007	0.0412	92.13	Option 2: A=6.954, B=1344.8, C=219.48
Xylenes (mixed isomers)						0.1167	0.0882	0.1528	106.1700	0.0031	0.0549	106.17	Option 2: A=7.009, B=1462.266, C=215.11

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

Stolt_18ML_Original_1300ML - Vertical Fixed Roof Tank
Newcastle, NSW

Annual Emission Calcaulations	
Standing Losses (lb):	1,848.1458
Vapor Space Volume (cu ft):	408,256.5171
Vapor Density (lb/cu ft):	0.0002
Vapor Space Expansion Factor:	0.0577
Vented Vapor Saturation Factor:	0.9815
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	408,256.5171
Tank Diameter (ft):	120.1000
Vapor Space Outage (ft):	36.0377
Tank Shell Height (ft):	55.8000
Average Liquid Height (ft):	28.0000
Roof Outage (ft):	8.2377
Roof Outage (Dome Roof)	
Roof Outage (ft):	8.2377
Dome Radius (ft):	120.1000
Shell Radius (ft):	60.0500
Vapor Density	
Vapor Density (lb/cu ft):	0.0002
Vapor Molecular Weight (lb/lb-mole):	125.1470
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0099
Daily Avg. Liquid Surface Temp. (deg. R):	527.0709
Daily Average Ambient Temp. (deg. F):	65.3000
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	524.9900
Tank Paint Solar Absorptance (Shell):	0.1700
Tank Paint Solar Absorptance (Roof):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,556.0000
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0577
Daily Vapor Temperature Range (deg. R):	32.3906
Daily Vapor Pressure Range (psia):	0.0051
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0099
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0075
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0127
Daily Avg. Liquid Surface Temp. (deg R):	527.0709
Daily Min. Liquid Surface Temp. (deg R):	518.9733
Daily Max. Liquid Surface Temp. (deg R):	535.1685
Daily Ambient Temp. Range (deg. R):	34.7000
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9815
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0099
Vapor Space Outage (ft):	36.0377
Working Losses (lb):	1,353.4265

Vapor Molecular Weight (lb/lb-mole):	125.1470
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0099
Annual Net Throughput (gal/yr.):	45,903,163.0000
Annual Turnovers:	9.6535
Turnover Factor:	1.0000
Maximum Liquid Volume (gal):	4,755,097.0000
Maximum Liquid Height (ft):	52.0000
Tank Diameter (ft):	120.1000
Working Loss Product Factor:	1.0000
Total Losses (lb):	3,201.5723

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

Stolt_18ML_Original_1300ML - Vertical Fixed Roof Tank
Newcastle, NSW

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	1,353.43	1,848.15	3,201.57
Benzene	10.68	14.58	25.26
Toluene	55.71	76.07	131.78
Ethylbenzene	14.95	20.42	35.38
Xylenes (mixed isomers)	74.34	101.51	175.84
Isopropyl benzene	2.84	3.87	6.71
1,2,4-Trimethylbenzene	27.18	37.12	64.30
Distillate fuel oil no. 2	1,167.73	1,594.57	2,762.30

Appendix D

Laboratory Certificates of Analysis

Appendix D Laboratory Certificates of Analysis

ANALYTICAL REPORT

Contact:	Simon Murphy, Adam Plant
Customer:	AECOM Sydney.
Your Reference:	ASTM D-2887 and TO-17 analysis; BTEXN
SGS Report Number:	ENV21760; LIMS 137204
Date of Receipt of Samples:	12/03/2015
Sample Description:	Two samples of Diesel fuel.
Analysis performed:	ASTM D-2887 (GC-MS); US-EPA method TO-17; (Thermal Desorption Gas Chromatography-Mass Spectrometry).

The sample was analysed in accordance with your instructions. The results and associated information are contained in the following pages of the report. Should you have any queries regarding this report please contact the undersigned.

Reported by: Dr David Stone
Date: 20 March 2015

Report authorised by: Paul Pui
Date: 24 March 2015

SGS Australia Pty Ltd ABN 44 000 964 278 | Environmental Services Sydney Unit 16, 33 Maddox St Alexandria 2015 NSW Australia
t +61 (0)2 8594 0400 f +61 (0)2 8594 0499 www.au.sgs.com

Sample description:

Diesel fuel was analysed by direct injection to a GC-MS, and headspace vapour samples at several temperatures were collected using pre-conditioned VOC analysis tubes supplied by Markes International (UK), utilising two-stage Carboxen adsorbent.

Methods Used:
ASTM D-2887 (GC-MS) was performed on the liquids as received. US-EPA method TO-17, was performed on vapours produced from the liquids at 20C and 25C.
Each thermal desorption tube was thermally desorbed at 250C using a Markes International UNITY TD-1 thermal desorber interfaced to a Hewlett Packard 5973 Gas Chromatograph-Mass Spectrometer.

Analytical Results:

The full suite of 65 analytes described in the US EPA method TO-15 were targeted.
The analytes requested are described in Table 1:

Analyte in liquid fuel	Diesel Concentration (mg/litre)	
Project; Stolhaven Australia	NN2@20C	NN6@20C
Benzene	30	21
Toluene	540	280
Ethylbenzene	430	220
m,p-Xylenes	1700	1200
o-Xylene	860	490
Styrene	<50	<50
i-Propylbenzene	180	110
α-Methyl styrene	<50	<50
2-Ethyl toluene	1400	800
3-Ethyl toluene	790	370
1,3,5-Trimethyl benzene	730	560
1,2,4-Trimethyl benzene	860	370
1,2,3-Trimethyl benzene	2400	1600
Naphthalene	91	27
Cyclohexane	140	89
TOTAL (gram per litre)	**10.15**	**6.94**
Hexane	57	23
Heptanes	210	130
Octane	1200	560
Decane	5300	3600
Dodecane	6900	4400

Analyte in headspace	Vapour Concentration (ppm)			
Project; Stolhaven Australia	NN2@20C	NN6@20C	NN2@25C	NN6@25C
Benzene	3.013	5.43	31.9	33.6
Toluene	17.22	19.16	68.0	73.0
Ethylbenzene	10.08	9.49	27.3	29.9
m,p-Xylenes	14.14	18.09	45.8	50.3
o-Xylene	17.21	17.53	48.8	51.8
Styrene	0.0056	0.009	0.012	0.019
i-Propylbenzene	12.78	14.67	14.5	15.2
α-Methyl styrene	<0.01	<0.01	<0.01	<0.01
2-Methyl toluene	8.07	8.29	15.9	18.0
3-Methyl toluene	15.54	15.81	37.2	40.1
1,3,5-Trimethyl benzene	9.31	10.9	24.2	24.3
1,2,4-Trimethyl benzene	11.82	13.48	27.9	34.2
1,2,3-Trimethyl benzene	21.58	25.84	47.6	59.3
Naphthalene	1.244	0.764	2.09	1.72
Cyclohexane	7.69	12.39	47.5	64.5

Analyte in headspace	Vapour Concentration (mg per cubic metre)			
Project; Stolhaven Australia	NN2@20C	NN6@20C	NN2@25C	NN6@25C
Benzene	9.79	17.6	50	74
Toluene	66.0	73.4	126	189
Ethylbenzene	44.5	41.9	58	89
m,p-Xylenes	62.5	79.9	97	150
o-Xylene	76.0	77.4	104	154
Styrene	0.024	0.039	0.024	0.055
i-Propylbenzene	63.9	73.4	34.9	51.2
α-Methyl styrene	<0.01	<0.01	<0.01	<0.01
2-Methyl toluene	40.4	41.5	38.3	60.6
3-Methyl toluene	77.7	79.1	90	135
1,3,5-Trimethyl benzene	46.6	54.5	58	82
1,2,4-Trimethyl benzene	59.1	67.4	67	115
1,2,3-Trimethyl benzene	108	129	115	200
Naphthalene	6.63	4.07	5.4	6.2
Cyclohexane	26.9	43.4	80	152

CERTIFICATE OF ANALYSIS

Work Order	: **EN1512111**	Page	: 1 of 12
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Newcastle
Contact	: MR SIMON MURPHY	Contact	: Peter Keyte
Address	: 17 WARABROOK BOULEVARDE WARABROOK NSW 2304	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
E-mail	: Simon.Murphy@aecom.com	E-mail	: peter.keyte@alsglobal.com
Telephone	: +61 02 4911 4900	Telephone	: +61 2 4014 2500
Facsimile	: +61 02 4911 4999	Facsimile	: +61 2 4967 7382
Project	: 60326869 - Stolthaven	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: 60326869 Task 1.1	Date Samples Received	: 24-Jun-2015 14:35
C-O-C number	: ----	Date Analysis Commenced	: 26-Jun-2015
Sampler	: ADAM PLANT	Issue Date	: 29-Jun-2015 12:21
Site	: ----		
		No. of samples received	: 6
Quote number	: ----	No. of samples analysed	: 6

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Daniel Junek	Senior Air Analyst	Newcastle
Daniel Junek	Senior Air Analyst	Newcastle - Organics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.

- EP101: Samples required dilution due to the presence of high level hydrocarbons. Where applicable, LOR values have been adjusted accordingly.
- EP101: Results reported in mg/m^3 are calculated from PPMV results based on a temperature of 25°C and atmospheric pressure of 101.3 kPa.
- CAN-001: Results for Pressure - As Received are measured under controlled conditions using calibrated laboratory gauges. These results are expressed as an Absolute Pressure. Equivalent gauge pressures may be calculated by subtracting the Pressure - Laboratory Atmosphere taken at the time of measurement.
- CAN-001: Results for Pressure - Gauge as Received are obtained from uncalibrated field gauges and are indicative only. These results may not precisely match calibrated gauge readings and may vary from field measurements due to changes in temperature and pressure

Analytical Results

Sub-Matrix: AIR (Matrix: AIR)			Client sample ID	Diesel C0832	Diesel C1092	ULP 91 C1020	ULP 91 C0741	Hi-Oct 98 C1285
			Client sampling date / time	24-Jun-2015 09:55	24-Jun-2015 10:45	24-Jun-2015 12:00	24-Jun-2015 13:07	24-Jun-2015 12:20
Compound	CAS Number	LOR	Unit	EN1512111-001	EN1512111-002	EN1512111-003	EN1512111-004	EN1512111-005
				Result	Result	Result	Result	Result
EP101: VOCs by USEPA Method TO15 (Calculated Concentration)								
^ **Freon 12**	75-71-8	0.25	mg/m³	<0.250	<0.250	<2.50	<2.50	<5.00
^ **Chloromethane**	74-87-3	0.1	mg/m³	<0.100	<0.100	<1.00	<1.00	<2.00
^ **Freon 114**	76-14-2	0.35	mg/m³	<0.350	<0.350	<3.50	<3.50	<7.00
^ **Vinyl chloride**	75-01-4	0.0051	mg/m³	<0.128	<0.128	<1.28	<1.28	<2.55
^ **Bromomethane**	74-83-9	0.19	mg/m³	<0.190	<0.190	<1.90	<1.90	<3.80
^ **Chloroethane**	75-00-3	0.13	mg/m³	<0.130	<0.130	<1.30	<1.30	<2.60
^ **Freon 11**	75-69-4	0.28	mg/m³	<0.280	<0.280	<2.80	<2.80	<5.60
^ **1.1-Dichloroethene**	75-35-4	0.2	mg/m³	<0.200	<0.200	<2.00	<2.00	<4.00
^ **Dichloromethane**	75-09-2	0.17	mg/m³	**0.646**	<0.170	<1.70	<1.70	<3.40
^ **Freon 113**	76-13-1	0.38	mg/m³	<0.380	<0.380	<3.80	<3.80	<7.60
^ **1.1-Dichloroethane**	75-34-3	0.2	mg/m³	<0.200	<0.200	<2.00	<2.00	<4.00
^ **cis-1.2-Dichloroethene**	156-59-2	0.02	mg/m³	<0.200	<0.200	<2.00	<2.00	<4.00
^ **Chloroform**	67-66-3	0.24	mg/m³	<0.240	<0.240	<2.40	<2.40	<4.80
^ **1.2-Dichloroethane**	107-06-2	0.2	mg/m³	<0.200	<0.200	<2.00	<2.00	<4.00
^ **1.1.1-Trichloroethane**	71-55-6	0.27	mg/m³	<0.270	<0.270	<2.70	<2.70	<5.40
^ **Benzene**	71-43-2	0.1	mg/m³	**24.9**	**26.0**	**399**	**517**	**709**
^ **Carbon Tetrachloride**	56-23-5	0.31	mg/m³	<0.310	<0.310	<3.10	<3.10	<6.20
^ **1.2-Dichloropropane**	78-87-5	0.23	mg/m³	<0.230	<0.230	<2.30	<2.30	<4.60
^ **Trichloroethene**	79-01-6	0.0054	mg/m³	<0.270	<0.270	<2.70	<2.70	<5.40
^ **cis-1.3-Dichloropropylene**	10061-01-5	0.23	mg/m³	<0.230	<0.230	<2.30	<2.30	<4.60
^ **trans-1.3-Dichloropropene**	10061-02-6	0.23	mg/m³	<0.230	<0.230	<2.30	<2.30	<4.60
^ **1.1.2-Trichloroethane**	79-00-5	0.27	mg/m³	<0.270	<0.270	<2.70	<2.70	<5.40
^ **Toluene**	108-88-3	0.19	mg/m³	**87.4**	**114**	**4290**	**4780**	**10100**
^ **1.2-Dibromoethane (EDB)**	106-93-4	0.38	mg/m³	<0.380	<0.380	<3.80	<3.80	<7.60
^ **Tetrachloroethene**	127-18-4	0.34	mg/m³	<0.340	<0.340	<3.40	<3.40	<6.80
^ **Chlorobenzene**	108-90-7	0.23	mg/m³	<0.230	<0.230	<2.30	<2.30	<4.60
^ **Ethylbenzene**	100-41-4	0.22	mg/m³	**27.2**	**26.0**	**356**	**141**	**590**
^ **meta- & para-Xylene**	108-38-3 106-42-3	0.43	mg/m³	**61.6**	**63.4**	**1250**	**469**	**1780**
^ **Styrene**	100-42-5	0.21	mg/m³	<0.210	<0.210	<2.10	<2.10	<4.20
^ **1.1.2.2-Tetrachloroethane**	79-34-5	0.34	mg/m³	<0.340	<0.340	<3.40	<3.40	<6.80
^ **ortho-Xylene**	95-47-6	0.22	mg/m³	**26.3**	**26.6**	**460**	**184**	**629**
^ **4-Ethyltoluene**	622-96-8	0.24	mg/m³	**7.37**	**7.81**	**138**	**115**	**202**
^ **Total Xylenes**	1330-20-7	0.65	mg/m³	**88.0**	**90.0**	**1710**	**653**	**2410**
^ **1.3.5-Trimethylbenzene**	108-67-8	0.24	mg/m³	**3.87**	**4.64**	**132**	**107**	**177**
^ **1.2.4-Trimethylbenzene**	95-63-6	0.24	mg/m³	**15.3**	**17.6**	**469**	**384**	**599**

Analytical Results

Sub-Matrix: AIR (Matrix: AIR)			Client sample ID	Diesel C0832	Diesel C1092	ULP 91 C1020	ULP 91 C0741	Hi-Oct 98 C1285
			Client sampling date / time	24-Jun-2015 09:55	24-Jun-2015 10:45	24-Jun-2015 12:00	24-Jun-2015 13:07	24-Jun-2015 12:20
Compound	CAS Number	LOR	Unit	EN1512111-001	EN1512111-002	EN1512111-003	EN1512111-004	EN1512111-005
				Result	Result	Result	Result	Result
EP101: VOCs by USEPA Method TO15 (Calculated Concentration) - Continued								
^ **1.3-Dichlorobenzene**	541-73-1	0.3	mg/m³	<0.300	<0.300	<3.00	<3.00	<6.00
^ **Benzylchloride**	100-44-7	0.26	mg/m³	<0.260	<0.260	<2.60	<2.60	<5.20
^ **1.4-Dichlorobenzene**	106-46-7	0.3	mg/m³	<0.300	<0.300	<3.00	<3.00	<6.00
^ **1.2-Dichlorobenzene**	95-50-1	0.3	mg/m³	<0.300	<0.300	<3.00	<3.00	<6.00
^ **1.2.4-Trichlorobenzene**	120-82-1	0.37	mg/m³	<0.370	<0.370	<3.70	<3.70	<7.40
^ **Hexachlorobutadiene**	87-68-3	0.53	mg/m³	<0.530	<0.530	<5.30	<5.30	<10.6
^ **Acetone**	67-64-1	0.12	mg/m³	<0.120	<0.120	<1.20	<1.20	<2.40
^ **Bromodichloromethane**	75-27-4	0.34	mg/m³	<0.340	<0.340	<3.40	<3.40	<6.80
^ **1.3-Butadiene**	106-99-0	0.11	mg/m³	<0.110	<0.110	<1.10	<1.10	<2.20
^ **Carbon disulfide**	75-15-0	0.16	mg/m³	<0.160	<0.160	<1.60	<1.60	<3.20
^ **2-Chlorotoluene**	95-49-8	0.26	mg/m³	<0.260	<0.260	<2.60	<2.60	<5.20
^ **1-Chloro-2-propene (Allyl chloride)**	107-05-1	0.16	mg/m³	<0.160	<0.160	<1.60	<1.60	<3.20
^ **Cyclohexane**	110-82-7	0.17	mg/m³	**78.1**	**76.0**	**447**	**667**	**633**
^ **Dibromochloromethane**	124-48-1	0.43	mg/m³	<0.430	<0.430	<4.30	<4.30	<8.60
^ **1.4-Dioxane**	123-91-1	0.18	mg/m³	<0.180	<0.180	<1.80	<1.80	<3.60
^ **Ethylacetate**	9002-89-5	0.18	mg/m³	<0.180	<0.180	<1.80	<1.80	<3.60
^ **trans-1.2-Dichloroethene**	156-60-5	0.2	mg/m³	<0.200	<0.200	<2.00	<2.00	<4.00
^ **Heptane**	142-82-5	0.2	mg/m³	**179**	**142**	**475**	**392**	**467**
^ **Hexane**	110-54-3	0.18	mg/m³	**143**	**130**	**2600**	**2650**	**1190**
^ **Isooctane**	540-84-1	0.23	mg/m³	**1.80**	**7.94**	**565**	**375**	**3800**
^ **Isopropyl Alcohol**	67-63-0	0.12	mg/m³	**0.948**	**0.558**	<1.20	<1.20	<2.40
^ **2-Butanone (MEK)**	78-93-3	0.15	mg/m³	<0.150	<0.150	<1.50	<1.50	<3.00
^ **Methyl iso-Butyl ketone**	108-10-1	0.2	mg/m³	<0.200	<0.200	<2.00	<2.00	<4.00
^ **2-Hexanone (MBK)**	591-78-6	0.2	mg/m³	<0.200	<0.200	<2.00	<2.00	<4.00
^ **Propene**	115-07-1	0.09	mg/m³	**5.47**	**5.49**	<0.900	<0.900	<1.80
^ **Methyl tert-Butyl Ether (MTBE)**	1634-04-4	0.18	mg/m³	<0.180	**6.20**	**88.3**	**155**	**54.0**
^ **Tetrahydrofuran**	109-99-9	0.15	mg/m³	<0.150	<0.150	<1.50	<1.50	<3.00
^ **Bromoform**	75-25-2	0.52	mg/m³	<0.520	<0.520	<5.20	<5.20	<10.4
^ **Vinyl Acetate**	108-05-4	0.18	mg/m³	<0.180	<0.180	<1.80	<1.80	<3.60
^ **Vinyl bromide**	593-60-2	0.22	mg/m³	<0.220	<0.220	<2.20	<2.20	<4.40
^ **Ethanol**	64-17-5	0.09	mg/m³	**0.174**	**3.73**	**1750**	**28.6**	**11.2**
^ **Acetonitrile**	75-05-8	0.08	mg/m³	<0.0800	<0.0800	<0.800	<0.800	<1.60
^ **Acrolein**	107-02-8	0.11	mg/m³	<0.110	<0.110	<1.10	<1.10	<2.20
^ **Acrylonitrile**	107-13-1	0.11	mg/m³	<0.110	<0.110	<1.10	<1.10	<2.20

Analytical Results

Sub-Matrix: AIR (Matrix: AIR)			Client sample ID	Diesel C0832	Diesel C1092	ULP 91 C1020	ULP 91 C0741	Hi-Oct 98 C1285
			Client sampling date / time	24-Jun-2015 09:55	24-Jun-2015 10:45	24-Jun-2015 12:00	24-Jun-2015 13:07	24-Jun-2015 12:20
Compound	*CAS Number*	*LOR*	*Unit*	EN1512111-001	EN1512111-002	EN1512111-003	EN1512111-004	EN1512111-005
				Result	Result	Result	Result	Result
EP101: VOCs by USEPA Method TO15 (Calculated Concentration) - Continued								
^ tert-Butyl alcohol	75-65-0	0.15	mg/m³	<0.150	<0.150	<1.50	<1.50	<3.00
^ 2-Chloro-1.3-butadiene	126-99-8	0.18	mg/m³	<0.180	<0.180	<1.80	<1.80	<3.60
^ Di-isopropyl Ether	108-20-3	0.21	mg/m³	<0.210	<0.210	<2.10	<2.10	<4.20
^ Ethyl tert-Butyl Ether (ETBE)	637-92-3	0.21	mg/m³	<0.210	<0.210	<2.10	<2.10	<4.20
^ tert-Amyl Methyl Ether (TAME)	994-05-8	0.21	mg/m³	<0.210	<0.210	<2.10	<2.10	<4.20
^ Methyl Methacrylate	80-62-6	0.21	mg/m³	<0.210	<0.210	<2.10	<2.10	<4.20
^ 1.1.1.2-Tetrachloroethane	630-20-6	0.34	mg/m³	<0.340	<0.340	<3.40	<3.40	<6.80
^ Isopropylbenzene	98-82-8	0.25	mg/m³	**3.86**	**3.69**	**32.5**	**18.2**	**54.5**
^ n-Propylbenzene	103-65-1	0.25	mg/m³	**7.56**	**7.71**	**107**	**73.2**	**156**
^ tert-Butylbenzene	98-06-6	0.27	mg/m³	<0.270	<0.270	<2.70	<2.70	<5.40
^ sec-Butylbenzene	135-98-8	0.27	mg/m³	**4.54**	<0.270	**6.20**	<2.70	**6.31**
^ 2-isopropyltoluene	527-84-4	0.27	mg/m³	**0.354**	<0.270	<2.70	<2.70	<5.40
^ n-Butylbenzene	104-51-8	0.27	mg/m³	**2.18**	**2.14**	**18.4**	**12.4**	**14.8**
^ Naphthalene	91-20-3	0.1	mg/m³	**0.796**	**1.01**	**32.3**	**41.1**	**30.7**
Sampling Quality Assurance								
Pressure - As received	PRESSURE	0.1	kPa	**109**	**113**	**108**	**108**	**106**
Pressure - Laboratory Atmosphere	----	0.1	kPa	**102**	**102**	**102**	**102**	**102**
Temperature as Received	----	0.1	°C	**21.0**	**21.0**	**21.0**	**21.0**	**21.0**
USEPA Air Toxics Method TO15r								
Freon 12	75-71-8	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Chloromethane	74-87-3	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Freon 114	76-14-2	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Vinyl chloride	75-01-4	0.002	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Bromomethane	74-83-9	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Chloroethane	75-00-3	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Freon 11	75-69-4	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
1.1-Dichloroethene	75-35-4	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Dichloromethane	75-09-2	0.05	ppmv	**0.186**	<0.0500	<0.500	<0.500	<1.00
Freon 113	76-13-1	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
1.1-Dichloroethane	75-34-3	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
cis-1.2-Dichloroethene	156-59-2	0.005	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Chloroform	67-66-3	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
1.2-Dichloroethane	107-06-2	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
1.1.1-Trichloroethane	71-55-6	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Benzene	71-43-2	0.03	ppmv	**7.80**	**8.14**	**125**	**162**	**222**

Analytical Results

Sub-Matrix: AIR
(Matrix: AIR)

Compound	CAS Number	LOR	Unit	Diesel C0832	Diesel C1092	ULP 91 C1020	ULP 91 C0741	Hi-Oct 98 C1285
Client sampling date / time				24-Jun-2015 09:55	24-Jun-2015 10:45	24-Jun-2015 12:00	24-Jun-2015 13:07	24-Jun-2015 12:20
				EN1512111-001	EN1512111-002	EN1512111-003	EN1512111-004	EN1512111-005
				Result	Result	Result	Result	Result
USEPA Air Toxics Method TO15r - Continued								
Carbon Tetrachloride	56-23-5	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
1.2-Dichloropropane	78-87-5	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Trichloroethene	79-01-6	0.001	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
cis-1.3-Dichloropropylene	10061-01-5	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
trans-1.3-Dichloropropene	10061-02-6	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
1.1.2-Trichloroethane	79-00-5	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Toluene	108-88-3	0.05	ppmv	**23.2**	**30.2**	**1140**	**1270**	**2690**
1.2-Dibromoethane (EDB)	106-93-4	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Tetrachloroethene	127-18-4	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Chlorobenzene	108-90-7	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Ethylbenzene	100-41-4	0.05	ppmv	**6.28**	**6.00**	**82.0**	**32.6**	**136**
meta- & para-Xylene	108-38-3 106-42-3	0.1	ppmv	**14.2**	**14.6**	**289**	**108**	**410**
Styrene	100-42-5	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
1.1.2.2-Tetrachloroethane	79-34-5	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
ortho-Xylene	95-47-6	0.05	ppmv	**6.07**	**6.13**	**106**	**42.4**	**145**
4-Ethyltoluene	622-96-8	0.05	ppmv	**1.50**	**1.59**	**28.1**	**23.4**	**41.2**
1.3.5-Trimethylbenzene	108-67-8	0.05	ppmv	**0.788**	**0.944**	**26.8**	**21.7**	**36.1**
1.2.4-Trimethylbenzene	95-63-6	0.05	ppmv	**3.12**	**3.59**	**95.5**	**78.2**	**122**
1.3-Dichlorobenzene	541-73-1	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Benzylchloride	100-44-7	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
1.4-Dichlorobenzene	106-46-7	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
1.2-Dichlorobenzene	95-50-1	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
1.2.4-Trichlorobenzene	120-82-1	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Hexachlorobutadiene	87-68-3	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Acetone	67-64-1	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Bromodichloromethane	75-27-4	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
1.3-Butadiene	106-99-0	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Carbon disulfide	75-15-0	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
2-Chlorotoluene	95-49-8	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
1-Chloro-2-propene (Allyl chloride)	107-05-1	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Cyclohexane	110-82-7	0.05	ppmv	**22.7**	**22.1**	**130**	**194**	**184**
Dibromochloromethane	124-48-1	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
1.4-Dioxane	123-91-1	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Ethylacetate	9002-89-5	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00

Analytical Results

Sub-Matrix: AIR
(Matrix: AIR)

Compound	CAS Number	LOR	Unit	Diesel C0832	Diesel C1092	ULP 91 C1020	ULP 91 C0741	Hi-Oct 98 C1285
			Client sampling date / time	24-Jun-2015 09:55	24-Jun-2015 10:45	24-Jun-2015 12:00	24-Jun-2015 13:07	24-Jun-2015 12:20
				EN1512111-001	EN1512111-002	EN1512111-003	EN1512111-004	EN1512111-005
				Result	Result	Result	Result	Result
USEPA Air Toxics Method TO15r - Continued								
trans-1.2-Dichloroethene	156-60-5	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Heptane	142-82-5	0.05	ppmv	**43.7**	**34.6**	**116**	**95.7**	**114**
Hexane	110-54-3	0.05	ppmv	**40.6**	**36.9**	**738**	**752**	**338**
Isooctane	540-84-1	0.05	ppmv	**0.386**	**1.70**	**121**	**80.3**	**813**
Isopropyl Alcohol	67-63-0	0.05	ppmv	**0.386**	**0.227**	<0.500	<0.500	<1.00
2-Butanone (MEK)	78-93-3	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Methyl iso-Butyl ketone	108-10-1	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
2-Hexanone (MBK)	591-78-6	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Propene	115-07-1	0.05	ppmv	**3.18**	**3.19**	<0.500	<0.500	<1.00
Methyl tert-Butyl Ether (MTBE)	1634-04-4	0.05	ppmv	<0.0500	**1.72**	**24.5**	**43.0**	**15.0**
Tetrahydrofuran	109-99-9	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Bromoform	75-25-2	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Vinyl Acetate	108-05-4	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Vinyl bromide	593-60-2	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Ethanol	64-17-5	0.05	ppmv	**0.0924**	**1.98**	**930**	**15.2**	**5.96**
Acetonitrile	75-05-8	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Acrolein	107-02-8	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Acrylonitrile	107-13-1	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
tert-Butyl alcohol	75-65-0	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
2-Chloro-1.3-butadiene	126-99-8	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Di-isopropyl Ether	108-20-3	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Ethyl tert-Butyl Ether (ETBE)	637-92-3	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
tert-Amyl Methyl Ether (TAME)	994-05-8	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Methyl Methacrylate	80-62-6	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
1.1.1.2-Tetrachloroethane	630-20-6	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
Isopropylbenzene	98-82-8	0.05	ppmv	**0.785**	**0.752**	**6.62**	**3.70**	**11.1**
n-Propylbenzene	103-65-1	0.05	ppmv	**1.54**	**1.57**	**21.7**	**14.9**	**31.8**
tert-Butylbenzene	98-06-6	0.05	ppmv	<0.0500	<0.0500	<0.500	<0.500	<1.00
sec-Butylbenzene	135-98-8	0.05	ppmv	**0.828**	<0.0500	**1.13**	<0.500	**1.15**
2-isopropyltoluene	527-84-4	0.05	ppmv	**0.0646**	<0.0500	<0.500	<0.500	<1.00
n-Butylbenzene	104-51-8	0.05	ppmv	**0.398**	**0.391**	**3.36**	**2.26**	**2.70**
Naphthalene	91-20-3	0.019	ppmv	**0.152**	**0.193**	**6.16**	**7.84**	**5.87**
USEPA Air Toxics Method TO15r Surrogates								
4-Bromofluorobenzene	460-00-4	0.5	%	**112**	**112**	**102**	**103**	**121**

Analytical Results

Sub-Matrix: AIR
(Matrix: AIR)

Compound	CAS Number	LOR	Unit	Hi-Oct 98 C1294	----	----	----	----
Client sampling date / time				24-Jun-2015 13:00	----	----	----	----
				EN1512111-006	--------	--------	--------	--------
				Result	Result	Result	Result	Result
EP101: VOCs by USEPA Method TO15 (Calculated Concentration)								
^ Freon 12	75-71-8	0.25	mg/m³	<1.00	----	----	----	----
^ Chloromethane	74-87-3	0.1	mg/m³	<0.400	----	----	----	----
^ Freon 114	76-14-2	0.35	mg/m³	<1.40	----	----	----	----
^ Vinyl chloride	75-01-4	0.0051	mg/m³	<0.510	----	----	----	----
^ Bromomethane	74-83-9	0.19	mg/m³	<0.760	----	----	----	----
^ Chloroethane	75-00-3	0.13	mg/m³	<0.520	----	----	----	----
^ Freon 11	75-69-4	0.28	mg/m³	<1.12	----	----	----	----
^ 1.1-Dichloroethene	75-35-4	0.2	mg/m³	<0.800	----	----	----	----
^ Dichloromethane	75-09-2	0.17	mg/m³	<0.680	----	----	----	----
^ Freon 113	76-13-1	0.38	mg/m³	<1.52	----	----	----	----
^ 1.1-Dichloroethane	75-34-3	0.2	mg/m³	<0.800	----	----	----	----
^ cis-1.2-Dichloroethene	156-59-2	0.02	mg/m³	<0.800	----	----	----	----
^ Chloroform	67-66-3	0.24	mg/m³	<0.960	----	----	----	----
^ 1.2-Dichloroethane	107-06-2	0.2	mg/m³	<0.800	----	----	----	----
^ 1.1.1-Trichloroethane	71-55-6	0.27	mg/m³	<1.08	----	----	----	----
^ Benzene	71-43-2	0.1	mg/m³	**495**	----	----	----	----
^ Carbon Tetrachloride	56-23-5	0.31	mg/m³	<1.24	----	----	----	----
^ 1.2-Dichloropropane	78-87-5	0.23	mg/m³	<0.920	----	----	----	----
^ Trichloroethene	79-01-6	0.0054	mg/m³	<1.08	----	----	----	----
^ cis-1.3-Dichloropropylene	10061-01-5	0.23	mg/m³	<0.920	----	----	----	----
^ trans-1.3-Dichloropropene	10061-02-6	0.23	mg/m³	<0.920	----	----	----	----
^ 1.1.2-Trichloroethane	79-00-5	0.27	mg/m³	<1.08	----	----	----	----
^ Toluene	108-88-3	0.19	mg/m³	**1900**	----	----	----	----
^ 1.2-Dibromoethane (EDB)	106-93-4	0.38	mg/m³	<1.52	----	----	----	----
^ Tetrachloroethene	127-18-4	0.34	mg/m³	<1.36	----	----	----	----
^ Chlorobenzene	108-90-7	0.23	mg/m³	<0.920	----	----	----	----
^ Ethylbenzene	100-41-4	0.22	mg/m³	**153**	----	----	----	----
^ meta- & para-Xylene	108-38-3 106-42-3	0.43	mg/m³	**495**	----	----	----	----
^ Styrene	100-42-5	0.21	mg/m³	<0.840	----	----	----	----
^ 1.1.2.2-Tetrachloroethane	79-34-5	0.34	mg/m³	<1.36	----	----	----	----
^ ortho-Xylene	95-47-6	0.22	mg/m³	**221**	----	----	----	----
^ 4-Ethyltoluene	622-96-8	0.24	mg/m³	**196**	----	----	----	----
^ Total Xylenes	1330-20-7	0.65	mg/m³	**716**	----	----	----	----
^ 1.3.5-Trimethylbenzene	108-67-8	0.24	mg/m³	**173**	----	----	----	----
^ 1.2.4-Trimethylbenzene	95-63-6	0.24	mg/m³	**953**	----	----	----	----

Analytical Results

Sub-Matrix: AIR (Matrix: AIR)			Client sample ID	Hi-Oct 98 C1294	----	----	----	----
			Client sampling date / time	24-Jun-2015 13:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EN1512111-006	--------	--------	--------	--------
				Result	Result	Result	Result	Result
EP101: VOCs by USEPA Method TO15 (Calculated Concentration) - Continued								
^ **1.3-Dichlorobenzene**	541-73-1	0.3	mg/m³	<1.20	----	----	----	----
^ **Benzylchloride**	100-44-7	0.26	mg/m³	<1.04	----	----	----	----
^ **1.4-Dichlorobenzene**	106-46-7	0.3	mg/m³	<1.20	----	----	----	----
^ **1.2-Dichlorobenzene**	95-50-1	0.3	mg/m³	<1.20	----	----	----	----
^ **1.2.4-Trichlorobenzene**	120-82-1	0.37	mg/m³	<1.48	----	----	----	----
^ **Hexachlorobutadiene**	87-68-3	0.53	mg/m³	<2.12	----	----	----	----
^ **Acetone**	67-64-1	0.12	mg/m³	<0.480	----	----	----	----
^ **Bromodichloromethane**	75-27-4	0.34	mg/m³	<1.36	----	----	----	----
^ **1.3-Butadiene**	106-99-0	0.11	mg/m³	<0.440	----	----	----	----
^ **Carbon disulfide**	75-15-0	0.16	mg/m³	<0.640	----	----	----	----
^ **2-Chlorotoluene**	95-49-8	0.26	mg/m³	<1.04	----	----	----	----
^ **1-Chloro-2-propene (Allyl chloride)**	107-05-1	0.16	mg/m³	<0.640	----	----	----	----
^ **Cyclohexane**	110-82-7	0.17	mg/m³	**199**	----	----	----	----
^ **Dibromochloromethane**	124-48-1	0.43	mg/m³	<1.72	----	----	----	----
^ **1.4-Dioxane**	123-91-1	0.18	mg/m³	<0.720	----	----	----	----
^ **Ethylacetate**	9002-89-5	0.18	mg/m³	<0.720	----	----	----	----
^ **trans-1.2-Dichloroethene**	156-60-5	0.2	mg/m³	<0.800	----	----	----	----
^ **Heptane**	142-82-5	0.2	mg/m³	**266**	----	----	----	----
^ **Hexane**	110-54-3	0.18	mg/m³	**1320**	----	----	----	----
^ **Isooctane**	540-84-1	0.23	mg/m³	**1020**	----	----	----	----
^ **Isopropyl Alcohol**	67-63-0	0.12	mg/m³	<0.480	----	----	----	----
^ **2-Butanone (MEK)**	78-93-3	0.15	mg/m³	<0.600	----	----	----	----
^ **Methyl iso-Butyl ketone**	108-10-1	0.2	mg/m³	<0.800	----	----	----	----
^ **2-Hexanone (MBK)**	591-78-6	0.2	mg/m³	<0.800	----	----	----	----
^ **Propene**	115-07-1	0.09	mg/m³	<0.360	----	----	----	----
^ **Methyl tert-Butyl Ether (MTBE)**	1634-04-4	0.18	mg/m³	**79.6**	----	----	----	----
^ **Tetrahydrofuran**	109-99-9	0.15	mg/m³	<0.600	----	----	----	----
^ **Bromoform**	75-25-2	0.52	mg/m³	<2.08	----	----	----	----
^ **Vinyl Acetate**	108-05-4	0.18	mg/m³	<0.720	----	----	----	----
^ **Vinyl bromide**	593-60-2	0.22	mg/m³	<0.880	----	----	----	----
^ **Ethanol**	64-17-5	0.09	mg/m³	**42.4**	----	----	----	----
^ **Acetonitrile**	75-05-8	0.08	mg/m³	<0.320	----	----	----	----
^ **Acrolein**	107-02-8	0.11	mg/m³	<0.440	----	----	----	----
^ **Acrylonitrile**	107-13-1	0.11	mg/m³	<0.440	----	----	----	----

Analytical Results

Sub-Matrix: AIR (Matrix: AIR)			Client sample ID	Hi-Oct 98 C1294	----	----	----	----
			Client sampling date / time	24-Jun-2015 13:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EN1512111-006	--------	--------	--------	--------
				Result	Result	Result	Result	Result
EP101: VOCs by USEPA Method TO15 (Calculated Concentration) - Continued								
^ tert-Butyl alcohol	75-65-0	0.15	mg/m³	<0.600	----	----	----	----
^ 2-Chloro-1.3-butadiene	126-99-8	0.18	mg/m³	<0.720	----	----	----	----
^ Di-isopropyl Ether	108-20-3	0.21	mg/m³	<0.840	----	----	----	----
^ Ethyl tert-Butyl Ether (ETBE)	637-92-3	0.21	mg/m³	<0.840	----	----	----	----
^ tert-Amyl Methyl Ether (TAME)	994-05-8	0.21	mg/m³	<0.840	----	----	----	----
^ Methyl Methacrylate	80-62-6	0.21	mg/m³	<0.840	----	----	----	----
^ 1.1.1.2-Tetrachloroethane	630-20-6	0.34	mg/m³	<1.36	----	----	----	----
^ Isopropylbenzene	98-82-8	0.25	mg/m³	**30.6**	----	----	----	----
^ n-Propylbenzene	103-65-1	0.25	mg/m³	**103**	----	----	----	----
^ tert-Butylbenzene	98-06-6	0.27	mg/m³	<1.08	----	----	----	----
^ sec-Butylbenzene	135-98-8	0.27	mg/m³	**3.59**	----	----	----	----
^ 2-isopropyltoluene	527-84-4	0.27	mg/m³	<1.08	----	----	----	----
^ n-Butylbenzene	104-51-8	0.27	mg/m³	**13.6**	----	----	----	----
^ Naphthalene	91-20-3	0.1	mg/m³	**24.7**	----	----	----	----
Sampling Quality Assurance								
Pressure - As received	PRESSURE	0.1	kPa	**105**	----	----	----	----
Pressure - Laboratory Atmosphere	----	0.1	kPa	**102**	----	----	----	----
Temperature as Received	----	0.1	°C	**21.0**	----	----	----	----
USEPA Air Toxics Method TO15r								
Freon 12	75-71-8	0.05	ppmv	<0.200	----	----	----	----
Chloromethane	74-87-3	0.05	ppmv	<0.200	----	----	----	----
Freon 114	76-14-2	0.05	ppmv	<0.200	----	----	----	----
Vinyl chloride	75-01-4	0.002	ppmv	<0.200	----	----	----	----
Bromomethane	74-83-9	0.05	ppmv	<0.200	----	----	----	----
Chloroethane	75-00-3	0.05	ppmv	<0.200	----	----	----	----
Freon 11	75-69-4	0.05	ppmv	<0.200	----	----	----	----
1.1-Dichloroethene	75-35-4	0.05	ppmv	<0.200	----	----	----	----
Dichloromethane	75-09-2	0.05	ppmv	<0.200	----	----	----	----
Freon 113	76-13-1	0.05	ppmv	<0.200	----	----	----	----
1.1-Dichloroethane	75-34-3	0.05	ppmv	<0.200	----	----	----	----
cis-1.2-Dichloroethene	156-59-2	0.005	ppmv	<0.200	----	----	----	----
Chloroform	67-66-3	0.05	ppmv	<0.200	----	----	----	----
1.2-Dichloroethane	107-06-2	0.05	ppmv	<0.200	----	----	----	----
1.1.1-Trichloroethane	71-55-6	0.05	ppmv	<0.200	----	----	----	----
Benzene	71-43-2	0.03	ppmv	**155**	----	----	----	----

Analytical Results

Sub-Matrix: AIR (Matrix: AIR)			Client sample ID	Hi-Oct 98 C1294	----	----	----	----
			Client sampling date / time	24-Jun-2015 13:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EN1512111-006	--------	--------	--------	--------
				Result	Result	Result	Result	Result
USEPA Air Toxics Method TO15r - Continued								
Carbon Tetrachloride	56-23-5	0.05	ppmv	<0.200	----	----	----	----
1.2-Dichloropropane	78-87-5	0.05	ppmv	<0.200	----	----	----	----
Trichloroethene	79-01-6	0.001	ppmv	<0.200	----	----	----	----
cis-1.3-Dichloropropylene	10061-01-5	0.05	ppmv	<0.200	----	----	----	----
trans-1.3-Dichloropropene	10061-02-6	0.05	ppmv	<0.200	----	----	----	----
1.1.2-Trichloroethane	79-00-5	0.05	ppmv	<0.200	----	----	----	----
Toluene	108-88-3	0.05	ppmv	**505**	----	----	----	----
1.2-Dibromoethane (EDB)	106-93-4	0.05	ppmv	<0.200	----	----	----	----
Tetrachloroethene	127-18-4	0.05	ppmv	<0.200	----	----	----	----
Chlorobenzene	108-90-7	0.05	ppmv	<0.200	----	----	----	----
Ethylbenzene	100-41-4	0.05	ppmv	**35.3**	----	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.1	ppmv	**114**	----	----	----	----
Styrene	100-42-5	0.05	ppmv	<0.200	----	----	----	----
1.1.2.2-Tetrachloroethane	79-34-5	0.05	ppmv	<0.200	----	----	----	----
ortho-Xylene	95-47-6	0.05	ppmv	**50.9**	----	----	----	----
4-Ethyltoluene	622-96-8	0.05	ppmv	**40.0**	----	----	----	----
1.3.5-Trimethylbenzene	108-67-8	0.05	ppmv	**35.2**	----	----	----	----
1.2.4-Trimethylbenzene	95-63-6	0.05	ppmv	**194**	----	----	----	----
1.3-Dichlorobenzene	541-73-1	0.05	ppmv	<0.200	----	----	----	----
Benzylchloride	100-44-7	0.05	ppmv	<0.200	----	----	----	----
1.4-Dichlorobenzene	106-46-7	0.05	ppmv	<0.200	----	----	----	----
1.2-Dichlorobenzene	95-50-1	0.05	ppmv	<0.200	----	----	----	----
1.2.4-Trichlorobenzene	120-82-1	0.05	ppmv	<0.200	----	----	----	----
Hexachlorobutadiene	87-68-3	0.05	ppmv	<0.200	----	----	----	----
Acetone	67-64-1	0.05	ppmv	<0.200	----	----	----	----
Bromodichloromethane	75-27-4	0.05	ppmv	<0.200	----	----	----	----
1.3-Butadiene	106-99-0	0.05	ppmv	<0.200	----	----	----	----
Carbon disulfide	75-15-0	0.05	ppmv	<0.200	----	----	----	----
2-Chlorotoluene	95-49-8	0.05	ppmv	<0.200	----	----	----	----
1-Chloro-2-propene (Allyl chloride)	107-05-1	0.05	ppmv	<0.200	----	----	----	----
Cyclohexane	110-82-7	0.05	ppmv	**57.8**	----	----	----	----
Dibromochloromethane	124-48-1	0.05	ppmv	<0.200	----	----	----	----
1.4-Dioxane	123-91-1	0.05	ppmv	<0.200	----	----	----	----
Ethylacetate	9002-89-5	0.05	ppmv	<0.200	----	----	----	----

Analytical Results

Sub-Matrix: AIR (Matrix: AIR)			Client sample ID	Hi-Oct 98 C1294	----	----	----	----
			Client sampling date / time	24-Jun-2015 13:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EN1512111-006	--------	--------	--------	--------
				Result	Result	Result	Result	Result
USEPA Air Toxics Method TO15r - Continued								
trans-1.2-Dichloroethene	156-60-5	0.05	ppmv	<0.200	----	----	----	----
Heptane	142-82-5	0.05	ppmv	**64.9**	----	----	----	----
Hexane	110-54-3	0.05	ppmv	**374**	----	----	----	----
Isooctane	540-84-1	0.05	ppmv	**218**	----	----	----	----
Isopropyl Alcohol	67-63-0	0.05	ppmv	<0.200	----	----	----	----
2-Butanone (MEK)	78-93-3	0.05	ppmv	<0.200	----	----	----	----
Methyl iso-Butyl ketone	108-10-1	0.05	ppmv	<0.200	----	----	----	----
2-Hexanone (MBK)	591-78-6	0.05	ppmv	<0.200	----	----	----	----
Propene	115-07-1	0.05	ppmv	<0.200	----	----	----	----
Methyl tert-Butyl Ether (MTBE)	1634-04-4	0.05	ppmv	**22.1**	----	----	----	----
Tetrahydrofuran	109-99-9	0.05	ppmv	<0.200	----	----	----	----
Bromoform	75-25-2	0.05	ppmv	<0.200	----	----	----	----
Vinyl Acetate	108-05-4	0.05	ppmv	<0.200	----	----	----	----
Vinyl bromide	593-60-2	0.05	ppmv	<0.200	----	----	----	----
Ethanol	64-17-5	0.05	ppmv	**22.5**	----	----	----	----
Acetonitrile	75-05-8	0.05	ppmv	<0.200	----	----	----	----
Acrolein	107-02-8	0.05	ppmv	<0.200	----	----	----	----
Acrylonitrile	107-13-1	0.05	ppmv	<0.200	----	----	----	----
tert-Butyl alcohol	75-65-0	0.05	ppmv	<0.200	----	----	----	----
2-Chloro-1.3-butadiene	126-99-8	0.05	ppmv	<0.200	----	----	----	----
Di-isopropyl Ether	108-20-3	0.05	ppmv	<0.200	----	----	----	----
Ethyl tert-Butyl Ether (ETBE)	637-92-3	0.05	ppmv	<0.200	----	----	----	----
tert-Amyl Methyl Ether (TAME)	994-05-8	0.05	ppmv	<0.200	----	----	----	----
Methyl Methacrylate	80-62-6	0.05	ppmv	<0.200	----	----	----	----
1.1.1.2-Tetrachloroethane	630-20-6	0.05	ppmv	<0.200	----	----	----	----
Isopropylbenzene	98-82-8	0.05	ppmv	**6.23**	----	----	----	----
n-Propylbenzene	103-65-1	0.05	ppmv	**21.0**	----	----	----	----
tert-Butylbenzene	98-06-6	0.05	ppmv	<0.200	----	----	----	----
sec-Butylbenzene	135-98-8	0.05	ppmv	**0.654**	----	----	----	----
2-isopropyltoluene	527-84-4	0.05	ppmv	<0.200	----	----	----	----
n-Butylbenzene	104-51-8	0.05	ppmv	**2.47**	----	----	----	----
Naphthalene	91-20-3	0.019	ppmv	**4.72**	----	----	----	----
USEPA Air Toxics Method TO15r Surrogates								
4-Bromofluorobenzene	460-00-4	0.5	%	**102**	----	----	----	----

Appendix E

Discrete Receptor List

Appendix E Discrete Receptor List

The discrete receptor list for the AQIA, in accordance with the PoN Site Model, is provided in **Table E1**. The list also includes the location of the boundary receptors assessed.

Table E1 Discrete Receptor List

ID	X [m]	Y [m]	Receptor Type	Approximate Description
R_1	383463	6359379	Industrial	Intertrade Industrial Park, Industrial Drive, Mayfield East
R_2	383122	6359676	Residential	26 Crebert St, Mayfield East
R_3	382896	6359734	Residential	Corner of Ingall St and Industrial Drive, Mayfield
R_4	382693	6359982	Residential	60 Arthur St, Mayfield
R_5	383246	6359069	Residential	Corner of Greaves St and George St, Mayfield East
R_6	383005	6359120	Residential	Corner of Margaret St and George St, Mayfield East
R_7	382888	6359545	Residential	Corner of Crebert St and Ingall St, Mayfield
R_8	382100	6360170	Residential	Hunter Christian School
R_9	382638	6359611	Residential	Corner of Crebert St and Arthur St, Mayfield (Acoustic)
R_10	383222	6359548	Residential	Corner of Crebert St and Industrial Dr, Mayfield (Acoustic)
R_11	384714	6358309	Residential	38 Elizabeth St, Carrington (Acoustic)
R_12	386373	6358966	Commercial	Stockton Air Monitoring Station, Fullerton St, (Acoustic)
R_13	383898	6360914	Industrial - KI	Cormorant St, Kooragang
R_14	384678	6360594	Industrial - KI	Cormorant St, Kooragang
R_15	385356	6360082	Industrial - KI	Heron Rd, Kooragang
R_16	385323	6359730	Industrial - KI	Heron Rd, Kooragang
R_17	385424	6359169	Industrial - KI	Heron Rd, Kooragang
R_18	383764	6359312	Industrial	Intertrade Industrial Park, Industrial Drive, Mayfield East
R_19	384655	6359159	Industrial	NCIG, Industrial Drive, Mayfield East
R_20	384427	6358709	Industrial	8 Everett St, Carrington
R_21	383212	6359903	Industrial	OneSteel, Mayfield North
R_22	383432	6360104	Industrial	OneSteel, Mayfield North
R_23	383486	6360416	Industrial	OneSteel, Mayfield North
R_24	383037	6360070	Industrial	OneSteel, Mayfield North
R_25	383033	6360354	Industrial	OneSteel, Mayfield North
R_26	383078	6360595	Industrial	OneSteel, Mayfield North
R_27	383506	6360604	Industrial	OneSteel, Mayfield North
R_28	382747	6360894	Industrial	OneSteel, Mayfield North
R_29	383344	6358877	Industrial	32 Greaves St, Mayfield East
R_30	383757	6358609	Residential	54 Kings Rd, Tighes Hill
R_31	383328	6359203	Industrial	52 Industrial Drive, Mayfield East
R_32	383528	6360424	Boundary	Boundary

ID	X	Y	Receptor Type	Approximate Description
	[m]	[m]		
R_33	383518	6360407	Boundary	Boundary
R_34	383511	6360378	Boundary	Boundary
R_35	383502	6360348	Boundary	Boundary
R_36	383495	6360314	Boundary	Boundary
R_37	383491	6360279	Boundary	Boundary
R_38	383485	6360242	Boundary	Boundary
R_39	383476	6360209	Boundary	Boundary
R_40	383473	6360183	Boundary	Boundary
R_41	383464	6360142	Boundary	Boundary
R_42	383455	6360097	Boundary	Boundary
R_43	383462	6360037	Boundary	Boundary
R_44	383487	6359981	Boundary	Boundary
R_45	383528	6359951	Boundary	Boundary
R_46	383573	6360007	Boundary	Boundary
R_47	383616	6360067	Boundary	Boundary
R_48	383648	6360117	Boundary	Boundary
R_49	383678	6360156	Boundary	Boundary
R_50	383706	6360197	Boundary	Boundary
R_51	383724	6360223	Boundary	Boundary
R_52	383740	6360246	Boundary	Boundary
R_53	383759	6360273	Boundary	Boundary
R_54	383775	6360297	Boundary	Boundary
R_55	383792	6360321	Boundary	Boundary
R_56	383805	6360340	Boundary	Boundary
R_57	383814	6360370	Boundary	Boundary
R_58	383830	6360393	Boundary	Boundary
R_59	383837	6360408	Boundary	Boundary
R_60	383774	6360447	Boundary	Boundary
R_61	383729	6360467	Boundary	Boundary
R_62	383691	6360486	Boundary	Boundary
R_63	383651	6360505	Boundary	Boundary
R_64	383610	6360526	Boundary	Boundary
R_65	383600	6360500	Boundary	Boundary
R_66	383577	6360472	Boundary	Boundary
R_67	383558	6360453	Boundary	Boundary
R_68	383539	6360442	Boundary	Boundary

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Appendix F

Scenario 1 (Typical Operations) Predicted Concentration Contour Plots

Figure 4 Predicted 1 Hour Benzene Concentrations 99.9th Percentile

Figure 5 **Predicted 1 Hour Cumene Concentrations 99.9th Percentile**

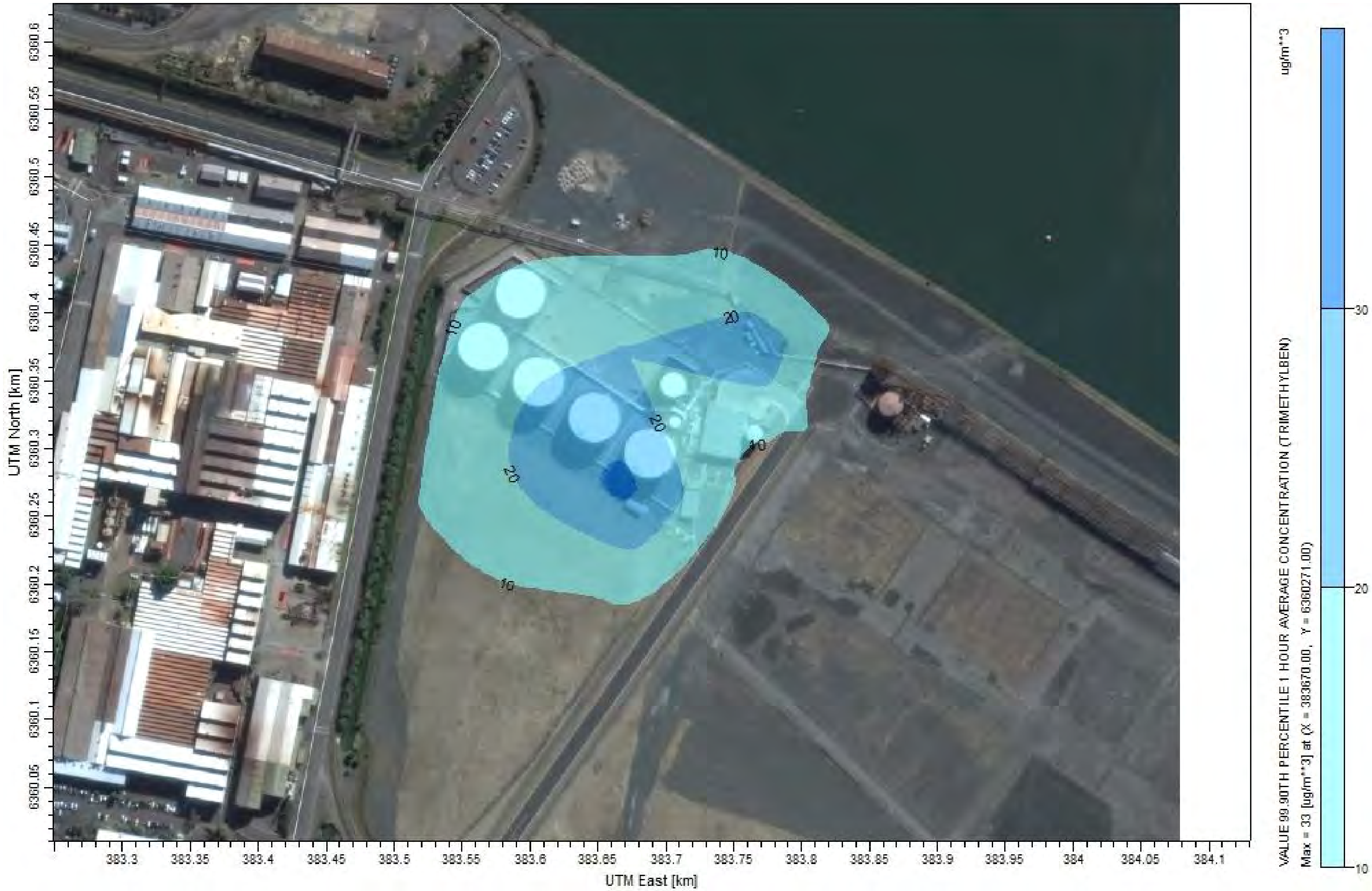

Figure 6 **Predicted 1 Hour Trimethylbenzene Concentrations 99.9th Percentile**

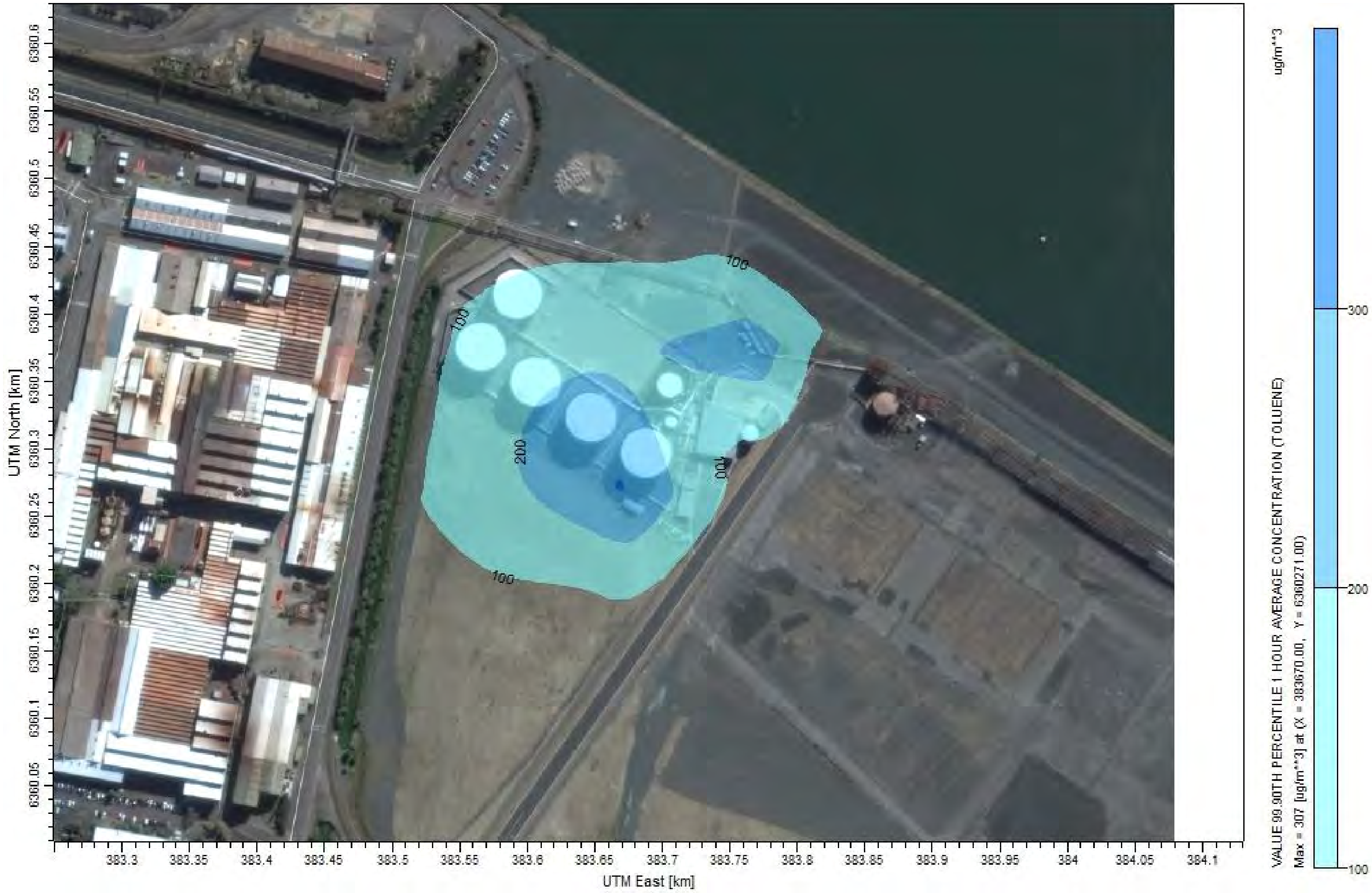

Figure 7 Predicted 1 Hour Toluene Concentrations 99.9th Percentile

Figure 8 **Predicted 1 Hour Ethylbenzene Concentrations 99.9th Percentile**

Figure 9 **Predicted 1 Hour** Xylenes Concentrations 99.9th Percentile

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