NULON MOTOR OILS FACILITY

Air Quality Impact Assessment

Prepared for:

Commercial and Industrial Property
Suite 59, Jones Bay Wharf
26-32 Pirrama Road
Pyrmont NSW 2009

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Commercial and Industrial Property (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
610.17717-R02-v1.1	16 May 2018	Varun Marwaha	Kirsten Lawrence	Graeme Starke
610.17717-R02-v1.0	15 May 2018	Varun Marwaha	Kirsten Lawrence	Graeme Starke

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1 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by Commercial and Industrial Property (CIP) and Charter Hall (CH), on behalf of Nulon Products Australia Pty Ltd (Nulon), to prepare an Air Quality Impact Assessment (AQIA) for the operation of a proposed motor oils blending and packaging facility to be located on proposed Lot 8 within the Bringelly Road Business Park (Development Site). The operations at the Development Site will replace an existing factory located in Moorebank (existing Nulon factory). Blending and packaging equipment currently in use at the existing Nulon factory will be relocated to the Development Site, in addition to the installation of new equipment to facilitate the potential future increased throughput proposed at the new site.

1.1 Background

SLR completed a qualitative AQIA for the Development Site in December 2017 (610.17717-R01-v1.0, hereafter 'the 2017 AQIA') as part of the as part of the Environmental Impact Statement (EIS) for the development proposal. The air quality impacts during construction and operation were assessed using a qualitative (risk-based) approach.

The 2017 AQIA concluded that during construction, there is a low risk for dust emissions to cause nuisance impacts at the off-site receptor locations. For the operational phase, the 2017 AQIA concluded that the potential impact significance of operations at the Development Site on local sensitive receptors is expected to be *neutral*.

Following a review of the AQIA, the NSW Environmental Protection Authority (EPA) requested additional information regarding the expected air emissions from the Development Site and potential off-site impacts (EPA 2018). The additional information requested is listed in **Table 1** below, with the relevant section of this report where the request has been addressed also identified.

Table 1 Information Requested by NSW EPA

Information Requested by NSW EPA	Relevant Section of this Report
Describe the constituent components of the raw materials. It is not sufficient to describe the constituent components as 'aromatics'	**Section 3.2**
Ensure the impact assessment criteria associated with any components listed within the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (NSW EPA 2016) ("Approved Methods") including, but not limited to hydrogen chloride and glycols, have been considered.	**Section 5**
Describe processes that could result in air emissions, such as working or operating losses. It is noted that the AQIA has neither: - nominated operating hours; nor - upper process temperature limits; or - material volumetric flows.	**Section 3.1** **Section 3.2** **Section 3.2** **Section 2.7**
Assess and characterise the level and intensity of any odour emissions in accordance with Section 7.4 of the Approved Methods.	**Section 7.1.2**
Be presented in accordance with Section 7.6 of the Approved Methods	**Section 1.2**
Consider the 'worst case' emission scenario and describe the expected impacts on surrounding receptors.	**Section 4** and **Section 7**

Information Requested by NSW EPA	Relevant Section of this Report
Demonstrate the proponent's ability to comply with the relevant regulatory framework noting: Part 5.4 Air Pollution within the Protection of the Environment Operations Act 1997; and Part 5 definition of Volatile Organic Compounds (VOCs) and the section 66 definition of large tank vehicles within the Protection of the Environment Operations (Clean Air) Regulation 2010.	**Section 5.1** **Section 5.2**
Account for cumulative impacts associated with expansion of the facility in addition to the proposed emission sources.	**Section 4.3**
Detail emission control techniques/practices that will be employed by the proposal.	**Section 3.3**

Source: EPA 2018

1.2 Assessment Approach

To address the information request from NSW EPA, SLR has performed air quality monitoring at the existing Nulon factory to obtain data on the anticipated emissions from the proposed operations at the Development Site. The data collected from the monitoring program was then used, in conjunction with engineering information currently available on the ventilation and emissions control systems proposed at the Development Site, to quantify potential pollutant emission rates and source characteristics. This data was used in an atmospheric dispersion modelling study to predict maximum off-site pollutant concentrations for comparison against regulatory ambient air quality assessment criteria.

Air quality impacts associated with fugitive dust emissions during the construction phase were addressed in the 2017 AQIA, and as no additional information was requested by NSW EPA regarding construction phase impacts, no further assessment of these activities is presented in this report.

The current production rate at the existing Nulon factory is approximately 8 million litres per annum (ML/annum) and the proposed future maximum production rate at the Development Site is 12 ML/annum. The emissions have therefore been scaled up to provide a conservative emissions profile for the proposed Development Site, based on the emissions measured at the existing Nulon factory.

The *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (NSW EPA 2016), hereafter the Approved Methods, outlines the requirements for conducting an AQIA as follows (with identification of where each requirement has been met):

- Description of local topographic features and sensitive receptor locations (**Section 2.2** and **Section 2.3** respectively).
- Description of the activities carried out on the site including a detailed discussion of all unit operations and operational variability, and a description of all aspects of air emission control systems (**Section 3**).
- Compilation of a comprehensive emissions inventory for proposed operations (**Section 4**).
- Establishment of air quality assessment criteria (**Section 5**).
- Analysis of climate and dispersion meteorology for the region (**Section 6.2**).
- Preparation of an air quality impact assessment report comprising the above.

2 Project Overview

2.1 Regional Setting

The Bringelly Road Business Park is located approximately 35 kilometres (km) southwest of Sydney Central Business District (CBD), and at the corner of Cowpasture Road and Bringelly Road. The regional setting of the Bringelly Road Business Park is shown in **Figure 1**. The Development Site is surrounded by residential areas to the southeast, east and north.

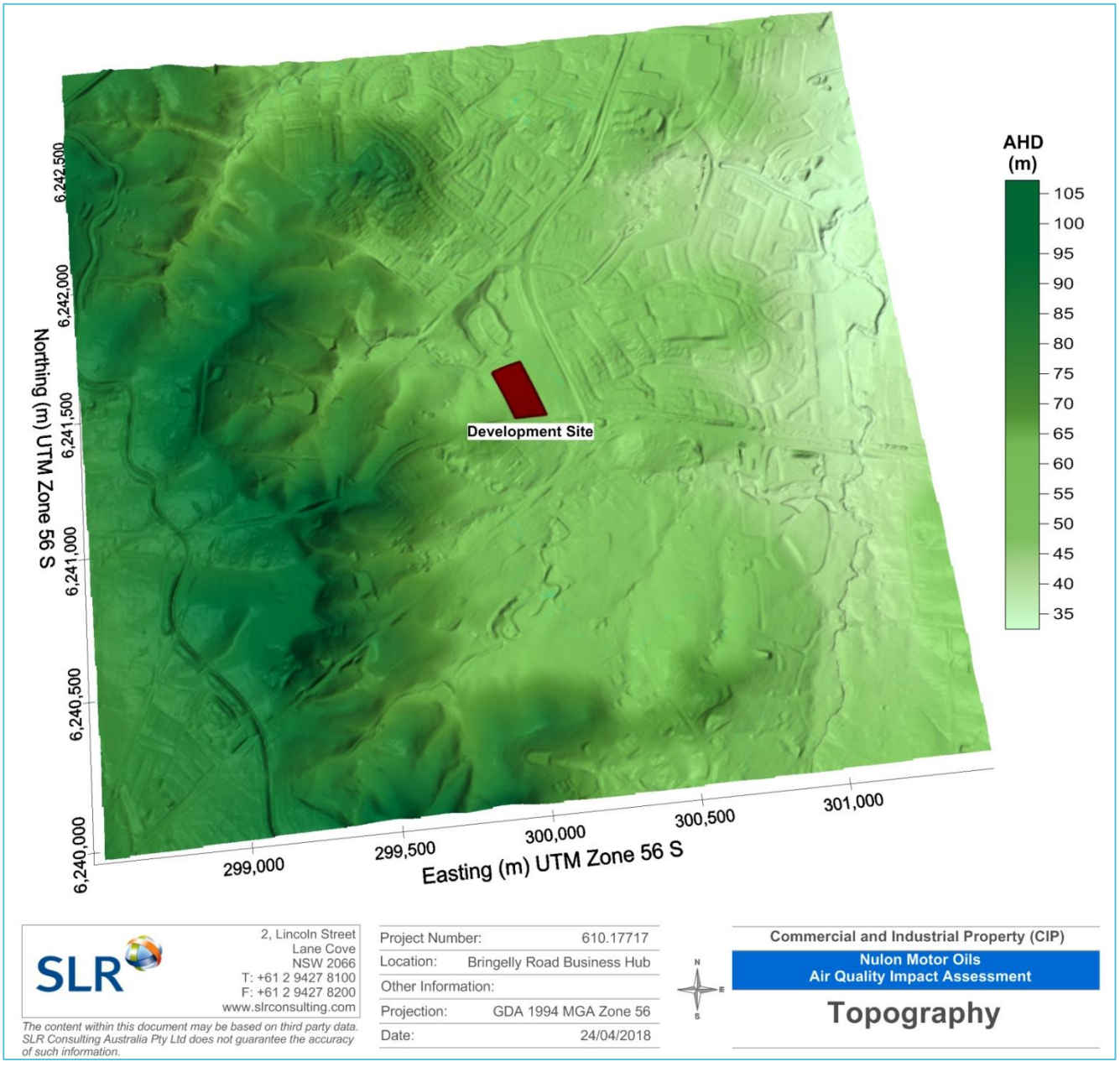
Figure 1 Regional Setting of the Proposed Development Site

2.2 Local Topography

The topography of the local area within a 1.5 km radius of Development Site ranges from an approximate elevation of 32 m to 107 m Australian Height Datum (AHD). The Development Site is located west of the Georges River. The land surface is relatively flat around the Development Site, however it slopes upward towards the west. The topography of the area surrounding the Development Site is illustrated in **Figure 2**.

The area around the Development Site is relatively open which would facilitate dispersion of air emissions and prevent 'pooling' of air pollutants.

Figure 2 Topography of Area Surrounding the Development Site



2.3 Sensitive Receptors

Residential properties have been identified as sensitive receptor locations in the area surrounding the Development Site. The closest residences are located approximately 20 metres (m) and 50 m from the Development Site boundary (R1 and R2 respectively). The locations of all identified sensitive receptors are shown in **Figure 3** and listed in **Table 2**.

Figure 3 Location of the Identified Sensitive Receptor

Table 2 List of Identified Sensitive Receptors

Receptor ID	Easting (m)	Northing (m)	Approximate Distance from the Nearest Boundary (m)
R1	300,126	6,241,449	25
R2	300,195	6,241,396	72
R3	300,304	6,241,386	175
R4	300,265	6,241,504	175
R5	300,205	6,241,650	165
R6	300,159	6,241,812	275
R7	300,089	6,241,989	430
R8	299,908	6,241,894	360
R9	299,795	6,241,782	295
R10	299,376	6,241,287	630
R11	299,636	6,241,019	510
R12	300,275	6,240,464	910
R13	300,578	6,240,876	660

2.4 Proposed Operational Activities

Operations at the Development Site will involve the preparation of motor oil products for future retail sale off-site and will include:

- bulk fluid delivery and storage;
- blending;
- bottling and packaging;
- storage;
- dispatch and distribution; and
- ancillary office administration.

A water demineralisation (DM) plant will be installed and operated at the Development Site to remove dissolved salts from the water supply to produce demineralised water. Hydrochloric acid (HCl) and caustic soda (sodium hydroxide, NaOH) will be used in the DM plant as required.

Blackie Mendham completed a State Environmental Planning Policy No.33 (SEPP 33) assessment for this Project (Blackie Mendham 2017) as part of the EIS and has now completed a preliminary hazard assessment as part of the response to submissions. A list of identified dangerous goods to be stored onsite, along with maximum quantities, is shown in **Table 3**.

A detailed list of all the raw materials to be stored onsite along with respective volumes is provided in **Section 3**.

Table 3 Materials Stored and Maximum Quantities

Description	Maximum Quantity (L)	Storage Method	Process Type
Aerosols	35,000	0.5 L cans	Dispatched as received (i.e. no processing)
Hitec 3062	615	205 L drums	Blended according to desired properties and packaged for dispatch
Hydrochloric acid	400	205 L drums	Used in the DM plant
Caustic soda liquid	400	205 L drums	Used in the DM plant
Combustible liquids	1,066,025	Above ground storage tanks 1,000 L Intermediate bulk containers (IBCs) 205 L drums	Blended according to desired properties and packaged for dispatch

Source: Blackie Mendham 2017

2.5 Site Layout

The proposed layout of the Development Site is shown in **Figure 4**. As shown in this figure:

- The raw material storage and production activities are to be located at the northern end of the Development Site (as shown in 'Pink' and 'Green' in **Figure 4**), as far as possible from the closest residential receptors (R1 and R2).
- The materials to be handled on site (see **Section 2.4**) will be stored in storage tanks located within the 'Bulk Storage' area at the northwestern corner of the proposed building (as shown in 'Orange' in **Figure 4**).
- The blending of raw materials and packaging of finished products will be undertaken within the 'Raw Materials and Production Warehouse' area in the northern end of the proposed building (as shown in 'Pink' in **Figure 4**).
- Warehousing of packaged (sealed) products will occur within the southern end of the proposed building (as shown in 'Purple' in **Figure 4**).

2.6 Hours of Operation

The actual hours of operation for the blending processes will be 6:00 am to 2:00 pm, between Monday and Friday. In addition, some overtime hours may be required based on market and operational demand. Based on this, the application is seeking approval for processing hours between 6:00 am to 10:00 pm, between Monday and Saturday.

As a worst case assessment, the modelling performed in this assessment assumes that processing occurs 24 hours a day, 7 days a week.

2.7 Material Throughputs

A maximum proposed future throughput of 12 ML/annum is proposed for the Development Site.

Figure 4 Indicative Site Layout of the Proposed Development Site

Source: Nulon Motor Oils Storage Areas v3.pdf (received by SLR on 16/05/2018)

3 Sources of Air Emissions and Proposed Mitigation Measures

3.1 Sources of Air Emissions During the Operational Phase

The raw materials will be stored and blended in above ground tanks. These tanks will be fitted with an air vent at the top of each tank (as illustrated in **Photo 1**) to vent air displaced during filling of the tank with liquid. It is noted that **Photo 1** shows the tank vents at the existing Moorebank factory. At the Development Site the air from these vents will be ducted through a common stack with carbon filters attached (see **Section 3.3**).

Photo 1 Vent Type for Storage and Blending Tanks

Source: Photos taken at the existing Moorebank factory

Air vented from the tanks has potential to contain small quantities of volatile organic compounds (VOCs) that have evaporated from the liquids within the tank. These air emissions are anticipated due to evaporative losses during blending, filling as well as working and standing losses from the storage tanks.

According to the National Pollutant Inventory's *Emission Estimation Technique Manual for Fuel and Organic Liquid Storage* (DEWHA 2012), working losses are the combined loss from filling and emptying a tank containing hydrocarbon liquids. As the liquid level increases, the pressure inside the tank increases and vapours containing VOCs are expelled from the tank. A loss during emptying occurs when air drawn into the tank becomes saturated with organic vapour and expands, thus exceeding the capacity of the vapour space.

Standing losses occur through the expulsion of vapour from a tank due to the vapour expansion and contraction as a result of changes in temperature and barometric pressure. This loss occurs without any change in the liquid level in the tank. As all tanks at the Development Site are located indoors, standing losses will be reduced compared to if the tanks were located outside in direct sunlight and exposed to ambient temperature changes.

In the case of the Proposed Development, VOC emissions from the tanks may occur due to the following:

- Working losses from:
  - Raw material is transferred from road tanker to bulk storage tanks;
  - Raw material is transferred from bulk storage to the blend tanks;

  - Raw materials are being blended to form product;
  - Final product is transferred from blend tanks to the holding tanks;
  - Final product is being packaged into the retail containers; and
- Breathing losses from:
  - Storage of raw materials and final products in the tanks.

The storage of finished product in the warehouse (see **Figure 4**) at the Development Site will not be a source of air emissions as the packaged containers will be air tight.

Fugitive air emissions may occur in the event of spillage of raw materials or products during processing or packaging. In the event of a spillage, liquids would be cleaned up immediately and any resulting waste materials would be stored in sealed containers prior to transfer off-site for disposal. Spill kits will be readily accessible to all employees at all times. This is in line with the proposed best management practices and consistent with industry standards.

The cleaning of tanks is also identified as a source of fugitive air emissions. Nulon advised that the cleaning of tanks would occur as required, for example between batches of different product etc.

Some onsite exhaust emissions associated with truck movements within the Development Site are also anticipated. The movement of trucks will be managed using best management practices, such as minimising the idling time, turning off engines when loading/unloading etc. These emissions will be minimal compared to existing emissions from road traffic on Bringelly Road and Cowpasture Road, and have therefore not been considered any further in this assessment.

3.2 Identification of Pollutants of Concern

Material Safety Data Sheets (MSDS) for the materials to be handled on site were reviewed to confirm the potential contaminants of concern. The constituent components of all raw materials to be stored or processed on-site are shown in **Table 4**. The low vapour pressures of the constituents show the low volatility of the raw materials.

A number of the VOCs present in the liquids to be handled on site are known to be odorous. Therefore, odour impacts as a mixture of odorous air pollutants are also assessed as part of this AQIA.

HCl will also be used in the DM plant (see **Section 2.4**) and will be stored on site in 205 L drums. While there is very low potential for any emissions of HCl from the storage and use of HCl at the site, potential HCl emissions from the Development Site have also been assessed, as required by NSW EPA (see **Table 1**).

In summary, the following pollutants have the potential to be emitted as a result of proposed activities at the Development Site:

- Volatile Organic Compounds (VOCs);
- Hydrogen chloride (HCl);
- Glycols; and
- Odour.

Table 4 Constituent Components of the Raw Materials

Tank ID	Size (kL)	Product	Raw Material/Product	Operating/ Maximum Temperature (°C)	Composition	Vapour Pressure Data	Pollutants to be Assessed
Tank 101	25	Vivasol 2046 (Shellsol 2046)	Kerosene, petroleum, hydrosulfurised	Not heated	100% (w/w)	No data available on vapour pressure	VOCs
			Naphthalene		<3% (w/w)		
			Ingredients determined to be Non-Hazardous		Balance		
Tank 102	25	ETRO 6	Saturates	Not heated	99%	Noack[1] volatility of 7.1%.	VOCs
			Sulphur content		5 ppm		
Tank 103	30	YUBASE 4	Distillates (petroleum), hydrotreated heavy paraffins	Not heated	100%	Vapour pressure ≤0.01 kPa (20°C)	VOCs
Tank 104	25	Brightstock 150	Residual oils (petroleum) solvent refined	Not heated	100%	Vapour pressure ≤0.001 kPa (20°C)	VOCs
Tank 105	50	EHC 50	Other ingredients determined not to be hazardous up to 100%.	Not heated	100%	Vapour pressure ≤0.013 kPa (20°C)	None
Tank 106	50	EHC 110	Other ingredients determined not to be hazardous up to 100%.	Not heated	100%	Vapour pressure ≤0.013 kPa (20°C)	None
Tank 107	50	Mono ethylene glycol	Ethylene glycol	Not heated	>60%, <100%	Vapour pressure ≤0.013 kPa (20°C)	Glycols
Tank 108	50	YUBASE 6	Distillates (petroleum), hydrotreated heavy paraffins	Not heated	100%	Vapour pressure ≤0.01 kPa (20°C)	VOCs
Tank 109	17	NB3070 GLYCOOL 670	Ethylene glycol	Not heated	>60%	No data available on vapour pressure	Glycols
			Potassium-2-ethylhexanoate		10-30%		
			Corrosion inhibitors		<10%		
			Denatonium benzoate		<10% (10ppm)		
			Other ingredients determined not to be hazardous		to 100%		
Tank 110	17	ETRO 4	Saturates	Not heated	99%	Noack[1] volatility of	VOCs

Tank ID	Size (kL)	Product	Raw Material/Product	Operating/ Maximum Temperature (°C)	Composition	Vapour Pressure Data	Pollutants to be Assessed
			Sulphur content		5 ppm	14.9%.	
Tank 111	19	YUBASE 3	Distillates (petroleum), hydrotreated light paraffinic	Not heated	100%	Vapour pressure ≤0.1 kPa (20°C)	VOCs
Tank 112	54	HOAT 5X Coolant Superconcentrate	Ethylene glycol	Not heated	65-75%	Vapour pressure ≤0.01 kPa (20°C)	Glycols
Tank 113			Ethylene glycol		65-75%		
Tank 114			Ethylene glycol		65-75%		
Tank 115	27	LZ7077R	No hazardous ingredients	Operating – 70 Maximum - 75		No data available on vapour pressure	None
Tank 116	26	Paratone 8065	Highly refined mineral oil (C15-C50) [Mineral oil contains <3% DMSO extracted by IP 346]	Operating – 70 Maximum - 75	90%	No data available on vapour pressure	VOCs
Tank 401	15	Buffer water	Water	Not heated			None
New Tank 117	18	Group III Plus (YUBASE 4 Plus)	Distillates (petroleum), hydrotreated heavy paraffins	Not heated	100%	Vapour pressure ≤0.01 kPa (20°C)	VOCs
New Tank 118	18	Group III Plus (YUBASE 6 Plus)	Distillates (petroleum), hydrotreated heavy paraffins	Not heated	100%	Vapour pressure ≤0.01 kPa (20°C)	VOCs
New Tank 119	18	Shellsol A150	Naphthalene	Not heated	<=15% (w/w)	Vapour pressure ≤1.3 kPa (20°C)	VOCs
			1,3,5 Trimethyl benzene		<10% (w/w)		
			1,2,4 Trimethyl benzene		<10% (w/w)		
New Tank 120	27	New VII (Infineum SV261)	NA	Operating – 70 Maximum - 75		Vapour pressure negligible	None
NEW TANK 121	9	NEW DI (OLOA 55516 & Lubrizol LZ16010J)	Highly refined mineral oil (C15-C50) [Mineral oil contains <3% DMSO extracted by IP 346]	Operating – 70 Maximum - 75	30-30%	No data available on vapour pressure	VOCs

Tank ID	Size (kL)	Product	Raw Material/Product	Operating/ Maximum Temperature (°C)	Composition	Vapour Pressure Data	Pollutants to be Assessed
			Zinc alkyl dithiophosphate		10-15%		
			Branched alkylphenol and calcium branched alkylphenol		01-1.5%		
NEW TANK 122	9	NEW DI (OLOA 55516 & Lubrizol LZ16010J)	Mineral oil	Operating – 70 Maximum - 75	30-60%	No data available on vapour pressure	VOCs
			Phosphorodithioic acid, mixed O,O-bis(1,3-dimethylbutyl and iso-Pr)esters, zinc salts		10-30%		
			Phenol, dodecyl-, branched		0.1-1%		
NEW TANK 123	54	Finished water	Water	Not heated			None
NEW TANK 124	27	OAT 5X SUPER CONCENTRATE CLEAR	Ethylene glycol	Not heated	80-90%	Vapour pressure ≤0.01 kPa (20°C)	Glycols
NEW TANK 125	27	OAT10X	Non-hazardous corrosion inhibitors	Not heated	<40%	No data available on vapour pressure	None
NEW TANK 126	-	Water	Water	Not heated	-		None
NEW TANK 127	54	Mono ethylene glycol	Ethylene glycol	Not heated	>60%, <100%	Vapour pressure ≤0.013 kPa (20°C)	Glycols

[1] Noack volatility test (a sample is heated at 250°C for 60 minutes) determines evaporation loss of lubricants in high temperature service.

3.3 Proposed Mitigation Measures

A review of potential air quality mitigation measures for the Development Site was completed by SLR in March 2018. Nulon has advised that a combination of dispersion and adsorption will be implemented to mitigate any potential air quality impacts from the Development Site.

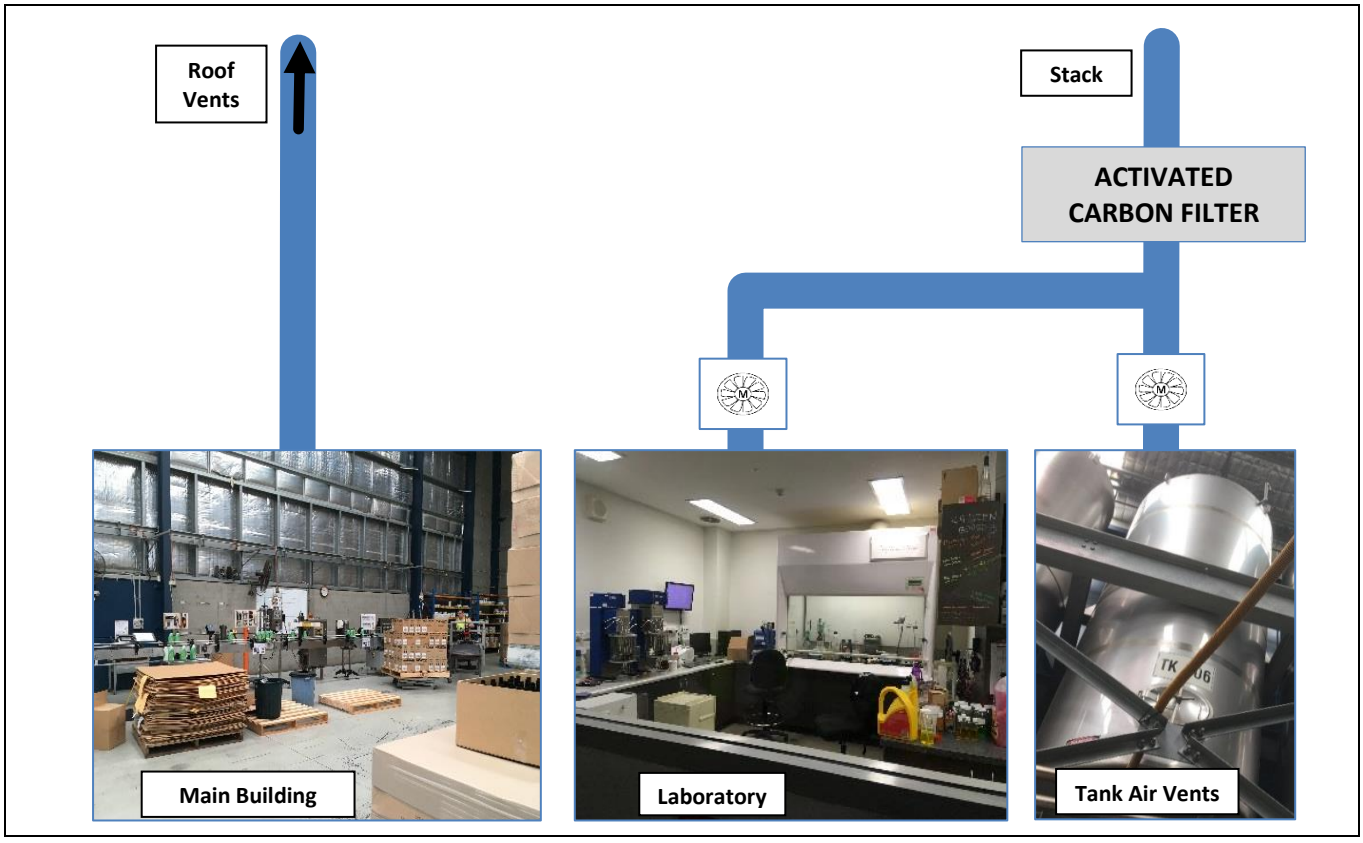
3.3.1 Dispersion

Dispersion is the simplest form of mitigation to minimise downwind impacts of air emissions, and is known to achieve dilution of pollutants to the order of 1,000:1 in the atmosphere after less than one kilometre travelled (EPA 2017a). This can be achieved by extracting air emissions from the processing activities and discharging them to atmosphere via an exhaust stack, rather than allowing the emissions to disperse into the workspace and be vented passively from open doorways and air vents.

For the Development Site, it is proposed that the air vents from all the tanks (bulk storage, blending and holding) will be connected and piped to a central exhaust system for discharge to atmosphere via a single stack, along with emissions from the laboratory. An overview of the proposed ventilation configuration is shown in **Figure 5**.

Modelling of the dispersion of emissions from the proposed stack has been performed to verify the level of dispersion expected between the discharge point and the nearest sensitive receptors, under worst case meteorological conditions (see **Section 6** and **Section 7**).

Figure 5 Overview of the Proposed Ventilation and Control System



3.3.2 Adsorption

In adsorption, the polluted air is pulled through a packed bed of medium (in this case, activated carbon) using a suction pump. The organic contaminants are physically adsorbed into the activated carbon, with the cleaned air then released into the atmosphere. An example of the adsorption system is shown in **Figure 6**.

For the Development Site, it is proposed that the air extracted from the tanks and the laboratory will be passed through the activated carbon bed, before being discharged to the atmosphere (see **Figure 5**).

Detailed performance testing performed by the US EPA on a range of industrial activated carbon adsorption systems concluded that properly designed and operated carbon adsorption systems can achieve 95% removal on a continuous basis. This removal efficiency was achievable for numerous inlet compositions and bed ages (US EPA 1988).

Due to the build-up of organics within the adsorption media, the activated carbon beds become less effective over time and must be replaced as part of ongoing maintenance and management of the system to prevent 'break through' of contaminants in the exhaust air stream. The frequency of replacement depends on the loading of the system (a function of the hours of operation, air flowrate and concentration of organics within the inlet air stream) as well as the size/design of the system installed, and would be determined as part of the detailed design.

Figure 6 Illustration of FiltaCarb™ Carbon Filter Technology

Source: FiltaCarb – Carbon Vapour Filtration, Bioaction Pty Ltd.

The specifications of proposed FiltaCarb™ carbon filter technology are shown in **Table 5**.

Table 5 Specifications of FiltaCarb™ Carbon Filter Technology

Model	Capacity	Duct Size
FC75x1	270 m^3/h	100 mm

Source: FiltaCarb – Carbon Vapour Filtration, Bioaction Pty Ltd.

4 Emissions Estimation

4.1 Emissions Monitoring

SLR conducted air emissions monitoring at the existing Nulon factory on the 4th and 11th April 2018. The aim of the monitoring program was to obtain data on air emissions from the preparation and storage of motor oil products as currently undertaken by Nulon at their existing facility, to assist in the estimation of emissions from the Development Site.

4.1.1 Production Conditions

On the day of testing, the plant operating procedures and production rates were considered 'normal' by Nulon personnel. A summary of the product throughputs on the days of testing is presented in **Table 6**.

Table 6 Production Conditions at the Existing Nulon Factory – 4 and 11 April 2018

	4th April 2018	11th April 2018
Monitoring period	8:45 am to 1:30 pm	10:25 am to 12:00 pm
Total product throughput	24,962 kg	28,455 kg
Products processed	PMC blend DIC blend SEM10w40-5 ED15W40-10 HT10W30-4 HP15W40-20	LLTU blend PM20W50-5 RLLTU-1 PIC

4.1.2 Monitoring Locations

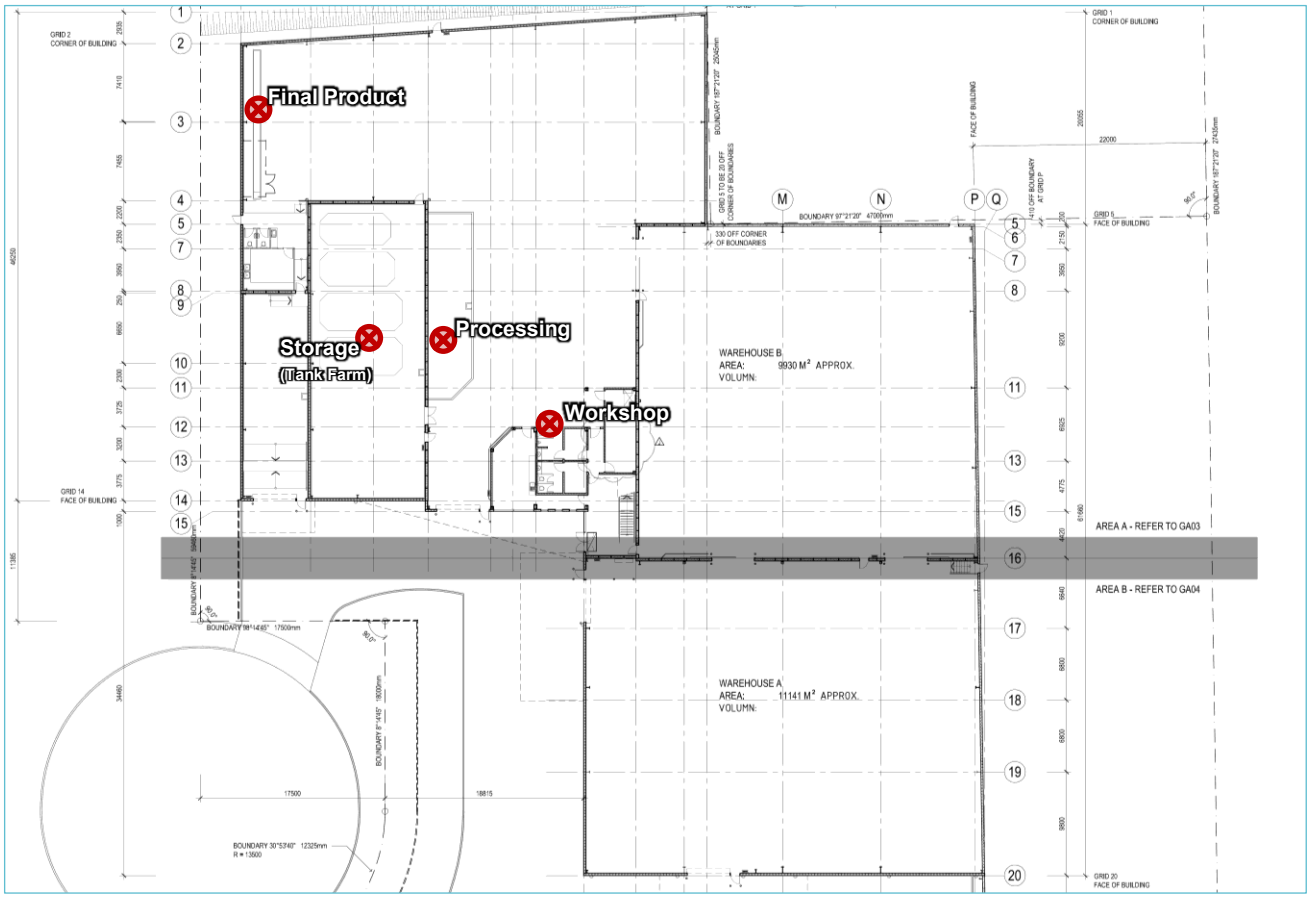
A site visit was performed on 27 March 2018 to identify the best locations for sampling and to confirm the number and types of samples to be collected. Based on this site visit, the following areas were identified for sampling in order to target areas anticipated to have the highest concentration of pollutants.

- The tank farm - This area is similar to the 'bulk storage area' proposed at the Development Site (see **Section 2.5**). At the existing Nulon factory, the tanks vent into the airspace (see **Photo 2**), whereas at the Development Site, all the tank vents will be connected and directed to the emissions control system.

- The processing area – The samples were taken on the elevated platform, as close to the vent as possible (see **Photo 3**). Similar to the tank farm area, the tanks at the existing Nulon factory vent into the building airspace, whereas at the Development Site, all the tank vents will be connected and directed to the emissions control system.
- The workshop - The samples were taken near the workshop (see **Photo 4**).
- The final product area – The samples were taken close to the packaging line (see **Photo 5**).

Duplicate samples were collected within the tank farm and single samples were collected from the other three locations. The selected monitoring locations are illustrated in **Figure 7**.

Figure 7 Air Emissions Monitoring Locations – Existing Nulon Factory



Source: D+R Architects, Job no. 05007, drawing no. GA02, Ground Floor Reference and Setout Plan, August 2005.

Photo 2 Tank Farm (Storage) Sampling Location

Photo 3 Processing Area Sampling Location

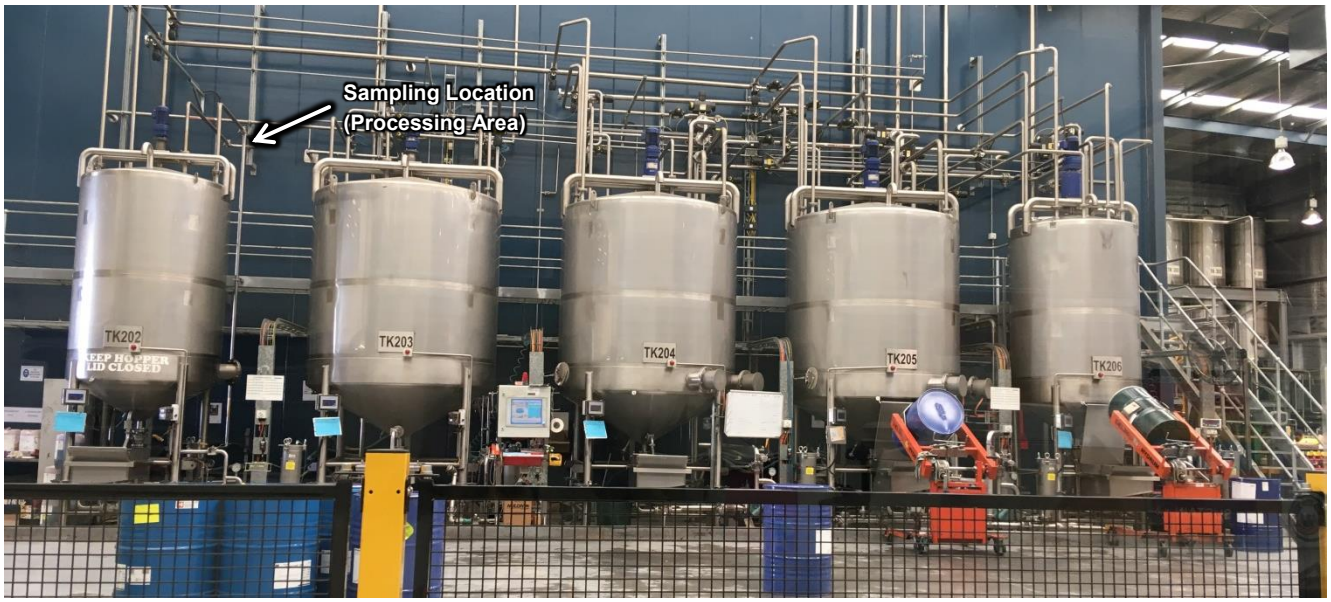


Photo 4 Workshop Sampling Location

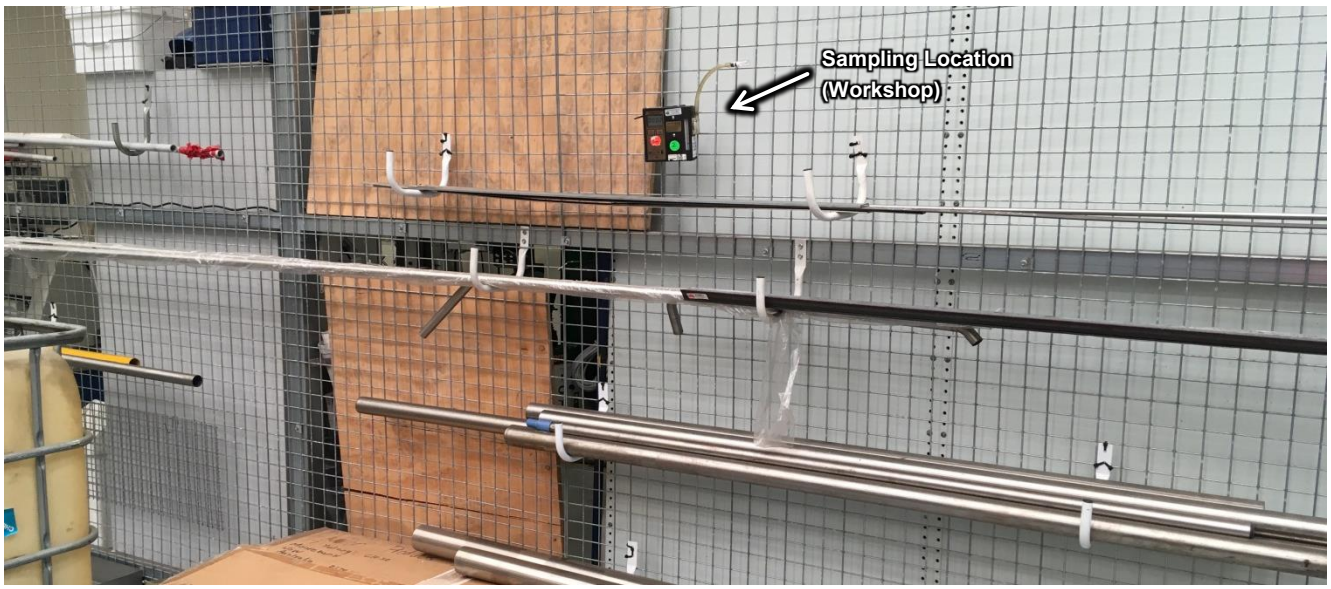


Photo 5 Final Product Area Sampling Location

4.1.3 Monitoring Methodology

The air monitoring was performed in accordance with *Approved Methods for Sampling and Analysis of Air Pollutants in NSW* (hereafter 'Approved Methods for Sampling' DEC 2006) for VOCs and odour.

For glycols and inorganic acids, in the absence of prescribed sampling methods under the Approved Methods for Sampling, monitoring was performed in accordance with the relevant methods prescribed by National Institute for Occupational Safety and Health (NIOSH).

Further details on the sampling methods are provided below.

4.1.3.1 Volatile Organic Compounds (VOCs)

Sampling for VOCs was performed in accordance with NSW OEH method TM-34. A sample of air was drawn through an activated carbon adsorption tube (SKC 226-09) at a controlled flow rate of approximately 2 litres per minute (lpm) using battery powered sample pumps. The activated carbon tubes contain 400 milligrams (mg) of activated carbon in the primary sorbent bed and 200 mg in the backup bed, preceded by a glass fibre filter.

The sample trains were calibrated at the start and end of sampling using a calibrated dry flow meter to determine the volume of air sampled. All samples were carefully recovered, capped and made ready for transport to the NATA-accredited laboratory TestSafe Australia (NATA accreditation # 3726) for subsequent solvent desorption and analysis by Gas Chromatography/Mass Spectrometry.

4.1.3.2 Glycols

Sampling for glycols was performed in accordance with NIOSH Method 5523. A sample of air was drawn through a XAD7/OVS tube (SKC 226-57) at a controlled flow rate of approximately 1 lpm using battery powered sample pumps. The XAD7/OVS tubes contain 200 mg of XAD-7 in the primary sorbent bed and 100 mg in the backup bed, preceded by a glass fibre filter secured with a polytetrafluoroethylene (PTFE) retaining ring.

The sample trains were calibrated at the start and end of sampling using a calibrated dry flow meter to determine the volume of air sampled. All samples were carefully recovered, capped and made ready for transport to the NATA-accredited laboratory TestSafe Australia (NATA accreditation # 3726) for subsequent solvent desorption, ultrasonication and analysis by Gas Chromatography/Flame Ionization Detector.

4.1.3.3 Inorganic Acids

Sampling for acids, including hydrobromic acid, hydrochloric acid, hydrofluoric acid, nitric acid, oxalic acid, phosphoric acid and sulfuric acid, was performed in accordance with NIOSH Method 7903. A sample of air was drawn through a silica gel tube (SKC 226-10-03) at a controlled flow rate of approximately 0.5 lpm using battery powered sample pumps. The silica gel tubes contain 400 mg of silica gel in the primary sorbent bed and 200 mg in the backup bed, preceded by a glass fibre filter.

The sample trains were calibrated at the start and end of sampling using a calibrated dry flow meter to determine the volume of air sampled. All samples were carefully recovered, capped and made ready for transport to the NATA-accredited laboratory TestSafe Australia (NATA accreditation # 3726) for subsequent solvent desorption and analysis by High-Performance Liquid Chromatography (HPLC).

4.1.3.4 Odour

Sampling for odours was performed in accordance with Standards Association of Australia AS4323.3 and NSW OEH method OM-7. A sample of air was drawn through a teflon (PTFE) sample probe which then passed through a stainless steel tube connected to a nalophane sampling bag. The sampling pump was connected to the airtight plastic container to provide a sample gas flow-rate of approximately 1.5 lpm. After the required volume was sampled, the pump was stopped, the bag sealed with a stainless steel screw-on cap and made ready for transport to the NATA accredited laboratory The Odour Unit (NATA accreditation # 14974) for Dynamic Olfactometry Analysis. All samples were analysed within 30 hours of sampling.

4.2 Monitoring Results

A summary of the monitoring results is shown in **Table 7**. As shown in shown in **Table 7**, VOCs were only detected in the sample collected from within the final product area.

Concentrations of inorganic acids and glycols were also below the detection limit for all locations. The concentrations reported in **Table 7** for glycols and inorganic acids have therefore been calculated based on the detection limit of the relevant samples.

Table 7 Summary of Monitoring Results - Existing Nulon Factory – 4 and 11 April 2018

Sampling Location/ Parameter	Value	Units	Sample ID	Laboratory Reference	Notes
Odour					
Tank Farm Sample 1	41	ou	6467	The Odour Unit Project number: N1869R	
Tank Farm Sample 2	45	ou	6468		
Processing area	45	ou	6470		
Workshop	45	ou	6471		
Final product area	76	ou	6472		
VOCs					
Tank Farm Sample 1	ND	µg/m^3	6474	TestSafe report number: 2018-1408	ND for all speciated VOCs
Tank Farm Sample 2	ND	µg/m^3	6475		ND for all speciated VOCs
Processing area	ND	µg/m^3	6477		ND for all speciated VOCs
Workshop	ND	µg/m^3	6478		ND for all speciated VOCs
Final product area: 1,2,3 – Trimethylbenzene	93	µg/m^3	6479		
Final product area: Toluene	1,308	µg/m^3	6479		
Final product area: Acetone	1,214	µg/m^3	6479		
Final product area: Methyl ethyl ketone (MEK)	1,121	µg/m^3	6479		
Inorganic Acids					
Tank Farm Sample 1	<180[1]	µg/m^3	6481	TestSafe report number: 2018-1409	Detection limit of 2.5 µg acid/sample
Tank Farm Sample 2	<180[1]	µg/m^3	6482		
Processing area	<100[1]	µg/m^3	6484		
Workshop	<111[1]	µg/m^3	6485		
Final product area	<96[1]	µg/m^3	6486		
Glycols					
Tank Farm Sample 1	<836[2]	µg/m^3	6524	TestSafe report	Detection limit of 25 µg /sample for ethylene glycol, propylene
Tank Farm Sample 2	<785[2]	µg/m^3	6525		

Sampling Location/ Parameter	Value	Units	Sample ID	Laboratory Reference	Notes
Processing area	<717[2]	µg/m^3	6526	number: 2018-1458	glycol and 1,3 Butylene glycol Detection limit of 50 µg /sample for diethylene glycol and triethylene glycol
Workshop	<736[2]	µg/m^3	6527		
Final product area	<781[2]	µg/m^3	6528		

ND = None Detected

[1] Calculated based on detection limit of 2.5 µg/sample.

[2] Calculated based on detection limit of 25 µg/sample.

The laboratory certificates are attached in **Appendix A**.

4.3 Emissions Inventory

The pollutant concentrations calculated in **Table 7** were used to estimate pollutant emission rates for the Development Site. In the absence of a detailed ventilation design for the Development Site, reference has been made to the air flow parameters (i.e. 270 m^3/hr) prescribed by the FiltaCarb^{TM} carbon filter technology (see **Table 5**).

It is acknowledged that, despite the care taken in the selection of monitoring locations (see **Section 4.1.2**), uncertainty exists in regards to capturing the worst case air emissions that would be representative of the proposed storage and blending operations at the Development Site. This is because the individual storage tank vents at the existing Nulon factory vent directly into the workspace, rather than being extracted and ducted to a single discharge point. Each individual tank would therefore have a different composition of emissions depending on the products being stored or processed in it. Sampling was performed in the workspace in the vicinity of the tanks, with the intention of measuring the concentration of contaminants in the general area, as affected by emissions from all the tanks in the vicinity of the sampling location. However, as shown in **Table 7**, all VOC concentrations in the samples collected near the tank farm and processing area were below the limit of detection. This is reflective of the very low volatility of the compounds present in the raw materials and products handled at the site.

To provide a worst case assessment of potential VOC emissions, the VOC concentrations measured in the final products area (the only sample where VOCs were recorded above the limit of detection) have been used to estimate emissions from the Development Site. Concentrations of other VOCs that were not detected but do have ambient air quality criteria, have been assumed to be at the limit of detection of the sampling method (as per the methodology used for inorganic acids and glycols).

To estimate concentrations of pollutants in the air extracted from the tanks at the Development Site, the measured concentrations shown in **Table 7** have been multiplied by 100, to conservatively account for any dilution between the tank vents and the sampling point. As noted in **Section 3.3.1**, in the atmosphere, pollutants can be expected to be diluted to the order of 1,000:1 relatively close to the source. Given that the tank vents and sampling points are located inside a building where there is no wind to disperse the emissions, dilution will be much less significant. It is also noted that at the existing Nulon factory, the emissions occur passively. At the Development Site, the tanks will be connected to a mechanical ventilation system, which is likely to dilute the concentrations of VOCs in the emitted air by continuously flushing clean air through the headspace of the tank. Multiplying the measured concentrations by a factor of 100 is therefore expected to be conservative approach.

Also, as discussed in **Section 1.2**, the current production rate at the existing Nulon facory is approximately 8 ML/annum while the maximum proposed throughput for the Development Site is 12 ML/annum. The emissions estimated using the methodology outlined above were therefore scaled up by a factor of 1.5 to provide conservative, worst case estimates of emissions for the proposed Development Site.

Odour emissions were estimated based on the maximum measured odour concentration at the existing Nulon factory, and applying the scaling factors of 100 and 1.5 outlined above.

No HCl was detected in any of the samples collected, as expected given the low potential for any fumes to be generated from HCl solution at ambient temperatures and the fact that the containers are stored sealed. The DM Plant does not generate emissions of HCl fume of chlorine gas as part of the regeneration process. Given this, the relatively small amounts of HCl to be handled and used on site (400 L) and the results of the sampling, it is concluded that there is no potential for significant emissions of HCl from the Development Site and no modelling has been performed for this compound.

The emission inventory is shown in **Table 8**. A detailed emission inventory, including VOCs measured below the limit of detection, is attached in **Appendix B**.

Table 8 Emissions Inventory for the Development Site (Uncontrolled)

Pollutant	Estimated Worst Case Emission Concentration [1]	Uncontrolled Emission Rate [1]
Acetone	1.214 mg/m^3	0.014 g/s
Ethylene Glycol	0.836 mg/m^3	0.009 g/s
1,2,3 - Trimethylbenzene	0.093 mg/m^3	0.001 g/s
Methyl ethyl ketone (MEK)	1.121 mg/m^3	0.013 g/s
Toluene	1.308 mg/m^3	0.015 g/s
Odour	76 ou	855 ou.m^3/s

[1] Prior to treatment in the proposed activated carbon filter.

5 Relevant Air Quality Criteria

5.1 Protection of the Environment Operations Act (POEO) 1997

The POEO Act (and Amendment Act 2011) is a key piece of environment protection legislation administered by the NSW EPA, to establish instruments for setting environmental standards, goals, protocols and guidelines.

The following sections of the POEO Act are of relevance to the Development Site:

- Section 124 and 125 of the POEO Act states that any plant located at premises should be maintained in an efficient condition and operated in a proper and efficient manner to reduce the potential for air pollution.
- Section 126 of the POEO Act requires that materials are managed in a proper and efficient manner to prevent air pollution (e.g. VOCs, odour).

- Section 128 of the POEO Act states:
  - The occupier of a premises must not carry out any activity or operate any plant in or on the premises in such a manner to cause or permit the emission at any point specified in or determined in accordance with the regulation of air impurities in excess of [the standard of concentration and/or the rate] prescribed by the regulations in respect of any such activity or any such plant.
  - Where neither such a standard nor rate has been so prescribed, the occupier of any premises must carry on activity, or operate any plant, in or on the premises by such practicable means as may be necessary to prevent or minimise air pollution.

5.2 Protection of the Environment Operations (Clean Air) Regulation 2010

The POEO (Clean Air) Regulation 2010 (the Regulation):

- Provides for the certification of domestic solid fuel heaters (Part 2);
- Controls burning generally by imposing an obligation to prevent or minimise emissions, by prohibiting the burning of certain articles and requiring approval for certain fires/incinerators (Part 3);
- Requires the fitting of anti-pollution devices to certain motor vehicles and prescribes an offence of emitting excessive air impurities (Part 4);
- Imposes certain requirements and standards on the supply of petrol (Part 4);
- Prescribes standards for certain groups of plant and premises to regulate industry's air impurity emissions (Part 5); and
- Imposes requirements on the control, storage and transport of volatile organic liquids (Part 6).

Of the above, only Part 5 and Part 6 would potentially be relevant to the proposed activities at the Development Site.

Part 5 of the Regulation refers to Schedules 3, 4 and 6 of the Regulation, which set out pollutant emission limits for various types of activities and plants. Those potentially relevant to the proposed activities at the Development Site are identified as follows:

- Schedule 3 - *Standards of concentration for scheduled premises: activities and plant used for specific purposes*
  - No relevant limits for type of facility proposed
- Schedule 4 - *Standards of concentration for scheduled premises: general activities and plant*
  - HCl – 100 mg/m^3
  - VOCs – no relevant limits for non-combustion sources
- Schedule 6 - *Standards of concentration for non-scheduled premises*
  - No relevant limits

As discussed in **Section 4.3**, no HCl was detected in any of the samples collected at the existing Nulon factory. Given this, the relatively small amounts of HCl to be used on site (400 L stored on site) and the fact that it will not be heated or used for any purpose that would result in significant emissions of HCl vapours, it is concluded that there is no potential for significant emissions of HCl from the Development Site. Any minor fugitive emissions that could occur would not have any potential for impact beyond the very immediate work area and there would be no emission points that would emit HCl fumes at concentrations that would have any potential to approach the limit of 100 mg/m^3 in the Regulation. No other limits apply to the proposed operations.

Part 6 of the Regulation prescribes the measures to be implemented to control emissions to air from the storage and handling of volatile organic liquids. Clause 59 in Part 6 defines volatile organic liquids as:

> *'any organic compound that exists as a liquid at actual conditions of use or storage, unless it has a true vapour pressure of less than or equal to 25.8 mm mercury (0.5 psia)'*

A vapour pressure of 25.8 mm mercury is equivalent to 3.44 kilopascals (kPa). As shown in **Table 4**, the vapour pressures of the liquids to be stored on site (where data is provided in the MSDS) are all below 3.44 kPa, and in most cases far below this value. Part 6 of the Regulation is designed to control emissions of VOCs from petrol stations, petrol tankers and other facilities handling much higher volatility products. It is therefore concluded that the requirements of Part 6 are not relevant to the proposed operations at the Development Site.

5.3 Approved Methods

Section 7 of the Approved Methods sets out the assessment criteria that are to be used in NSW to interpret dispersion modelling results. Those relevant to the proposed activities at the Development Site are identified below.

5.3.1 Volatile Organic Compounds (VOCs)

Based on the results of the sampling performed at the existing Nulon factory, the impact assessment criteria for the VOCs that will potentially be emitted from the Development Site are shown in **Table 9**.

Table 9 NSW EPA Criteria for Individual Odorous and Toxic Air Pollutants

Pollutant	Reason for Classification	Averaging Time	Design Criteria (mg/m^3)
Acetone	Toxicity	1-hour	22
Ethylene glycol (vapour)	Toxicity	1-hour	1.0
Methyl ethyl ketone (MEK)	Odour	1-hour	3.2
Trimethylbenzene (mixed isomers)	Toxicity	1-hour	2.2
Toluene	Odour	1-hour	0.36

Source: Section 7.2 and Section 7.4, Approved Methods (EPA 2017)

5.3.2 Hydrochloric Acid

Hydrochloric acid (HCl) solution will be used in the DM plant (see **Section 2.4**). Vapours of HCl have potential to form if the HCl solution is heated, however in the absence of heat, any emissions to atmosphere would be minimal. HCl will be stored at the Development Site at ambient temperatures with no heating.

The health effects of HCl can vary from conjunctivitis and corneal burns in case of exposure to less concentrated solutions, to death by asphyxia due to glottic oedema in the case of exposure to highly concentrated solutions (NPI 2018). The EPA impact assessment criterion for HCl is shown in **Table 10**.

Table 10 NSW EPA Criteria for Hydrogen Chloride

Pollutant	Reason for Classification	Averaging Time	Design Criteria (mg/m^3)
Hydrogen chloride	Toxicity	1-hour	0.14

Source: Section 7.2, Approved Methods (EPA 2017)

5.3.3 Odour

Impacts from odorous air contaminants are often nuisance-related rather than health-related. Odour performance goals guide decisions on odour management, but are generally intended to achieve "no offensive odour" rather than "no odour".

Under the odour measurement methods used in Australia (AS/NZS 4323.3), the detectability of an odour is a sensory property that refers to the theoretical minimum concentration that produces an olfactory response or sensation. This point is called the *odour threshold* and defines how many times the original odour must be diluted with odour free air to reach the point of detectability. At the level of detectability, the person experiencing the odour would be able to say that the diluted odour was present without being able to ascribe an odour character to it. This is called the Detection threshold.

For example, if one volume of an odour sample required to be diluted with 499 volumes of odour free air to reach the Detection threshold, the original odour sample would be reported as 500 odour units (ou). At this level of dilution, no character can be ascribed to the diluted odour. In order for the diluted odour to be strong enough to have an odour character, less dilution would be required, and this level of dilution would be called the Recognition threshold. Again for example, a particular odour may have a Detection threshold of 500 ou and have a Recognition threshold of 250 ou (the stronger odour has the lower ou value).

It should be realised that these ou values are measured by trained odour assessors in an odour sterile laboratory. In 'real life' conditions, due to the presence of ambient odours and other factors, the Detection threshold of an odour cannot be determined over the ambient background odour level. Only odours at or above the Recognition threshold normally illicit a response by the general population, and their potential reaction to the presence of this odour is assessed in the following terms:

- *Frequency:* how often the odour occurs
- *Intensity:* how strong the odour is perceived to be
- *Duration:* how long the odour is present for
- *Offensiveness:* how offensive the odour is perceived to be
- *Location or Context:* where the person is experiencing the odour

An example for this can be shown in a theoretical case of a bakery. A person walking past the bakery may smell the bakery odours and like these baking odours (it can be shown that people generally react positively to baking odours). However, a person living next to the bakery and who experiences the baking odours throughout their house and garden on a continuous basis may find the baking odours offensive to the point where they complain to local authorities.

Other factors may also come into play when assessing odour impacts, such as:

- *Population sensitivity:* any given population contains individuals with a range of sensitivities to odour. The larger a population, the greater the number of sensitive individuals it may contain.
- *Background level:* whether a given odour source, because of its location, is likely to contribute to a cumulative odour impact. In areas with more closely-located sources it may be necessary to apply a lower threshold to prevent offensive odour.
- *Public expectation:* whether a given community is tolerant of a particular type of odour and does not find it offensive, even at relatively high concentrations. For example, background agricultural odours may not be considered offensive until a higher threshold is reached than for odours from a landfill facility.

Odour performance goals need to be designed to take into account the range in sensitivities to odours within the community, and provide additional protection for individuals with a heightened response to odours, using a statistical approach which depends on the size of the affected population. As the affected population size increases, the number of sensitive individuals is also likely to increase, which suggests that more stringent goals are necessary in these situations. In addition, the potential for cumulative odour impacts in relatively sparsely populated areas can be more easily defined and assessed than in highly populated urban areas. It is often not possible or practical to determine and assess the cumulative odour impacts of all odour sources that may impact on a receptor in an urban environment. Therefore, the odour performance goals allow for population density, cumulative impacts, and anticipated odour levels during adverse meteorological conditions and community expectations of amenity.

A summary of the odour impact assessment criteria given for various population densities, as set out in the Approved Methods, is given in **Table 11**. As a conservative measure, an odour criterion of 2 ou (99th percentile, nose response time) has been adopted for this assessment.

The Approved Methods states that the impact assessment criteria for complex mixtures of odorous air pollutants must be applied at the nearest existing or likely future off-site sensitive receptor(s).

Table 11 NSW EPA Impact Assessment Criteria for Complex Mixtures of Odorous Air Pollutants

Population of Affected Community	Impact Assessment Criteria for Complex Mixtures of Odours (ou, nose-response-time average, 99th percentile)
Urban area (> 2000)	2.0
~300	3.0
~125	4.0
~30	5.0
~10	6.0
Single residence (< 2)	7.0

Source: Section 7.3, Approved Methods (EPA 2017)

It is also important to note that the odour assessment criterion is based on the nose-response time, which is intended to represent the instantaneous perception of odours by the human nose. Dispersion modelling predictions are based on 1-hour average meteorological data. These 1-hour average model predictions therefore need to be scaled using a 'peak to mean ratio' to convert them to short-term peak impacts. The Approved Methods requires that for a wake-affected point source, as in the case of the main stack at the Development Site, a peak to mean ratio of 2.3 be used for all stability conditions.

6 Air Dispersion Modelling Methodology

6.1 Model Selection

Dispersion modelling was performed using the US EPA's CALPUFF (Version 6) modelling system, as recommended by the Approved Methods.

CALPUFF is a transport and dispersion model that ejects "puffs" of material emitted from modelled sources, simulating dispersion and transformation processes along the way. In doing so, it typically uses the fields generated by a meteorological pre-processor CALMET, discussed further below. Temporal and spatial variations in the meteorological fields selected are explicitly incorporated in the resulting distribution of puffs throughout a simulation period.

The primary output files from CALPUFF contain either hourly concentration or hourly deposition fluxes evaluated at selected receptor locations. The CALPOST post-processor is then used to process these files, producing tabulations that summarise results of the simulation for user-selected averaging periods.

6.2 Meteorological Modelling Methodology

To adequately characterise the dispersion meteorology of the project, information is needed on the prevailing wind regime, mixing depth and atmospheric stability and other parameters such as ambient temperature, rainfall and relative humidity.

6.2.1 Selection of the Meteorological Year

To determine a representative meteorological year for use in dispersion modelling, five years of meteorological data (2013-2017) from the closest meteorological monitoring station (i.e. Liverpool AQMS) were analysed against the long term meteorological conditions. Specifically, the following parameters were analysed:

- Percentage of calm wind speed events (wind speed <0.5 m/s). Calm wind conditions are conducive to higher downwind pollutant concentrations due to poor dispersion of the plume;
- Frequency and distribution of the predominant wind directions (i.e. wind rose);
- Hourly averaged wind speed;
- Hourly averaged temperature; and
- Hourly averaged relative humidity.

Based on this analysis, it was concluded that year 2015 was representative of the five years of meteorological conditions experienced at the Development Site and was adopted for use in this AQIA. A detailed long terms meteorological analysis is presented in **Appendix C**.

6.2.2 TAPM

To calculate all required meteorological parameters required by the dispersion modelling process, meteorological modelling using The Air Pollution Model (TAPM, v 4.0.4) has been performed. TAPM, developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) is a prognostic model which may be used to predict three-dimensional meteorological data and air pollution concentrations.

TAPM predicts wind speed and direction, temperature, pressure, water vapour, cloud, rain water and turbulence. The program allows the user to generate synthetic observations by referencing databases (covering terrain, vegetation and soil type, sea surface temperature and synoptic scale meteorological analyses) which are subsequently used in the model input to generate site-specific hourly meteorological observations at user-defined levels within the atmosphere.

TAPM may assimilate actual local wind observations so that they can optionally be included in a model solution. Wind speed and direction observations obtained from the nearest meteorological stations have also been used in the TAPM modelling as well as the subsequent CALMET component of the modelling (see **Table 12** and **Table 13**).

Table 12 Meteorological Parameters used for this Study (TAPM v 4.0.4)

Parameter	Value
Modelling Period	1 January 2015 to 31 December 2015
Centre of analysis	300,027 E 6,241,445 S (UTM Coordinates)
Number of grid points	25 × 25 × 35
Number of grids (spacing)	4 (30 km, 10 km, 3 km, 1 km)
Data assimilation	Camden Airport AWS (Station # 68192) Badgerys Creek AWS (Station # 67108) Horsley Park Equestrian Park AWS (Station # 67119) Bankstown Airport AWS (Station # 66137) NSW OEH Bringelly AQMS NSW OEH Liverpool AQMS
Terrain	AUSLIG 9 second DEM

6.2.3 CALMET

In the simplest terms, CALMET is a meteorological model that develops hourly wind and other meteorological fields on a three-dimensional gridded modelling domain that are required as inputs to the CALPUFF dispersion model. Associated two dimensional fields such as mixing height, surface characteristics and dispersion properties are also included in the file produced by CALMET. The interpolated wind field is then modified within the model to account for the influences of topography, sea breeze, as well as differential heating and surface roughness associated with different land uses across the modelling domain. These modifications are applied to the winds at each grid point to develop a final wind field. The final hourly varying wind field thus reflects the influences of local topography and land uses.

The CALMET domain (25 km × 25 km) was modelled with a horizontal grid spacing of 0.1 km. TAPM-generated three dimensional meteorological data was used as the initial guess wind field and the local topography and available surface weather observations in the area were used to refine the wind field predetermined by the TAPM data. Hourly averaged surface meteorological data from Bankstown Airport as well as Liverpool and Bringelly AQMSs were incorporated in the modelling.

The gap filled and filtered (vegetation and obstacles removed) topographical data derived from the United States Geological Service's Shuttle Radar Topography Mission database data was obtained from Geo Science, Australia which has recorded topography across Australia with a 3 arc second spacing (approximately 90 m). The land use data file was created using the latest publically available aerial imagery. **Table 13** details the parameters used in the CALMET meteorological modelling.

Table 13 Meteorological Parameters used in this Assessment (CALMET v 6.42)

Parameter	Value
Modelling Period	1 January 2015 to 31 December 2015
Meteorological grid size	25 km × 25 km
Meteorological grid resolution	100 m
Surface station data	Bankstown Airport (Station # 66137) NSW OEH Bringelly AQMS NSW OEH Liverpool AQMS
Initial guess field	3D output from TAPM modelling

6.3 Meteorological Data Used in Modelling

To provide a summary of the meteorological conditions predicted at the Development Site using the methodology described in **Section 6.2**, a single-point, ground-level meteorological dataset was 'extracted' from the 3-dimensional dataset at the Development Site and a summary of the key dispersion parameters for the site is presented in this section.

6.3.1 Wind Speed and Direction

A summary of the annual wind behaviour predicted by CALMET (extracted at the Development Site) is presented as wind roses in **Figure 8**.

The wind roses show the frequency of occurrence of winds by direction and strength. The bars correspond to the 16 compass points (degrees from north). The direction of the bar shows the direction from which the wind is blowing. 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. Thus it is possible to visualise how often winds of a certain direction and strength occur over a long period, either for all hours of the day, or for particular periods during the day. There are times when the wind is calm (defined as being from zero to 0.5 metres/second), and the percentage of the time that winds are calm are also shown on the wind rose.

The following description of wind speeds references the Beaufort Wind Scale, as outlined in **Table 14**. Use of the Beaufort Wind Scale is consistent with terminology used by the BoM.

Table 14 Beaufort Wind Scale

Beaufort Scale #	Description	m/s	Description on land
0	Calm	0-0.5	Smoke rises vertically
1	Light air	0.5-1.5	Smoke drift indicates wind direction
2-3	Light/gentle breeze	1.5-5.3	Wind felt on face, leaves rustle, light flags extended, ordinary vanes moved by wind
4	Moderate winds	5.3-8.0	Raises dust and loose paper, small branches are moved
5	Fresh winds	8.0-10.8	Small trees in leaf begin to sway, crested wavelets form on inland waters
6	Strong winds	>10.8	Large branches in motion, whistling heard in telephone wires; umbrellas used with difficulty

Source: http://www.bom.gov.au/lam/glossary/beaufort.shtml

Figure 8 indicates that winds experienced in the study area are predominantly light to moderate (between 1.5 m/s and 8 m/s) and predominatly blow from the west-southwest. Calm wind conditions (wind speed less than 0.5 m/s) were predicted to occur 9.3% of the time throughout the modelling period.

The seasonal wind roses indicate that typically:

- In summer, winds are light to moderate and are experienced predominantly from the eastern quadrant, with a smallest percentage of winds from the northwestern quadrant. Calm winds were experienced 9.8% of the time during summer.
- In autumn, winds are predominantly light to moderate and from the west-southwestern quadrant, with the lowest percentage of winds from the north-northeastern quadrant. Calm winds were experienced 9.4% of the time during autumn.
- In winter, winds are light to moderate and blow predominantly from the west and west-southwest, with very few winds from other directions. Calm winds were experienced 6.9% of the time during winter.
- In spring, winds are light to moderate predominantly from the west-southwestern quadrant with the lowest frequency of winds from the northern quadrant. Calm winds were experienced 11% of the time during spring.

The windroses indicate that emissions from the Development Site would be predominantly be blown towards the east-northeast.

Figure 8 Annual and Seasonal Wind Roses for the Development Site (CALMET Predictions, 2015)

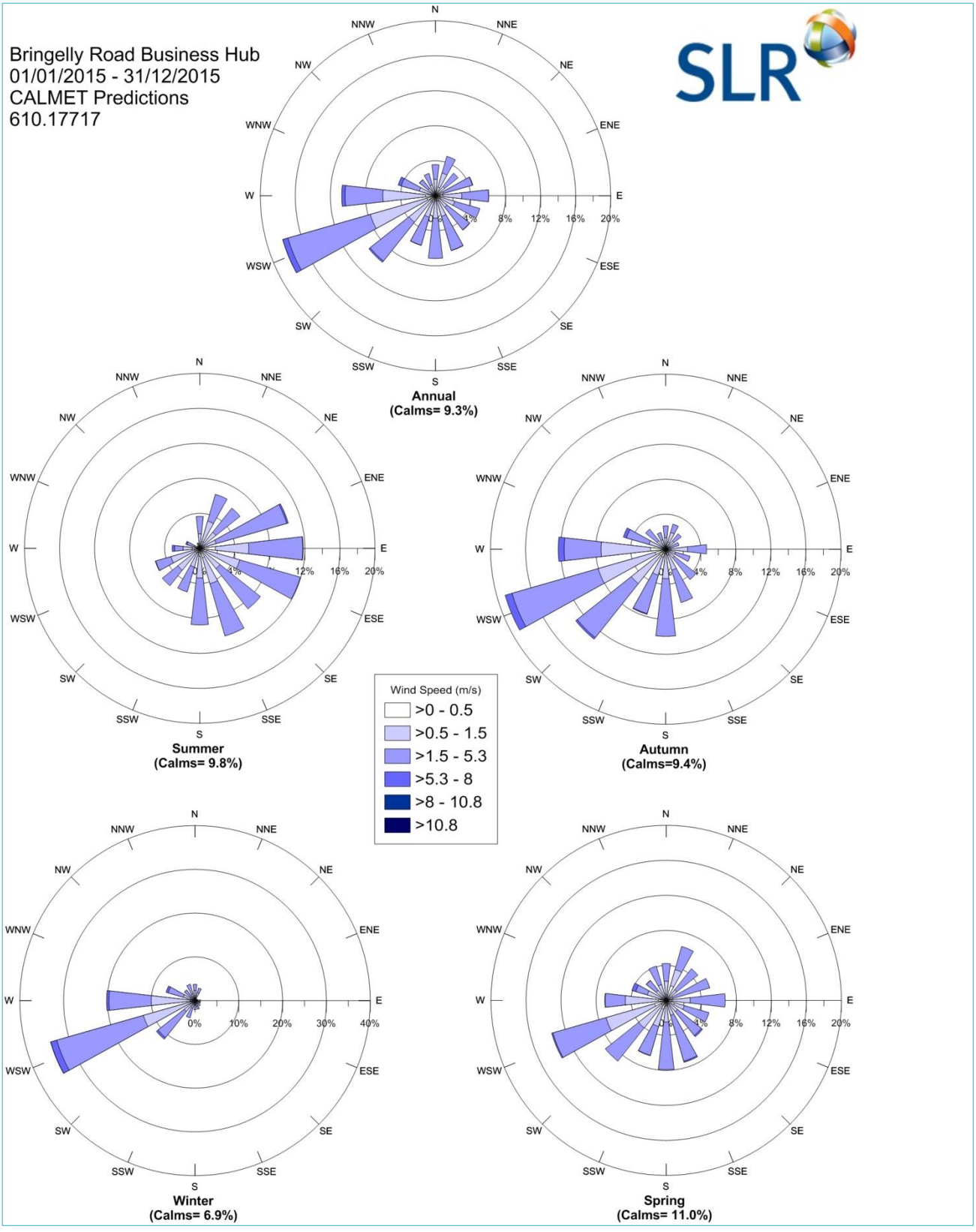
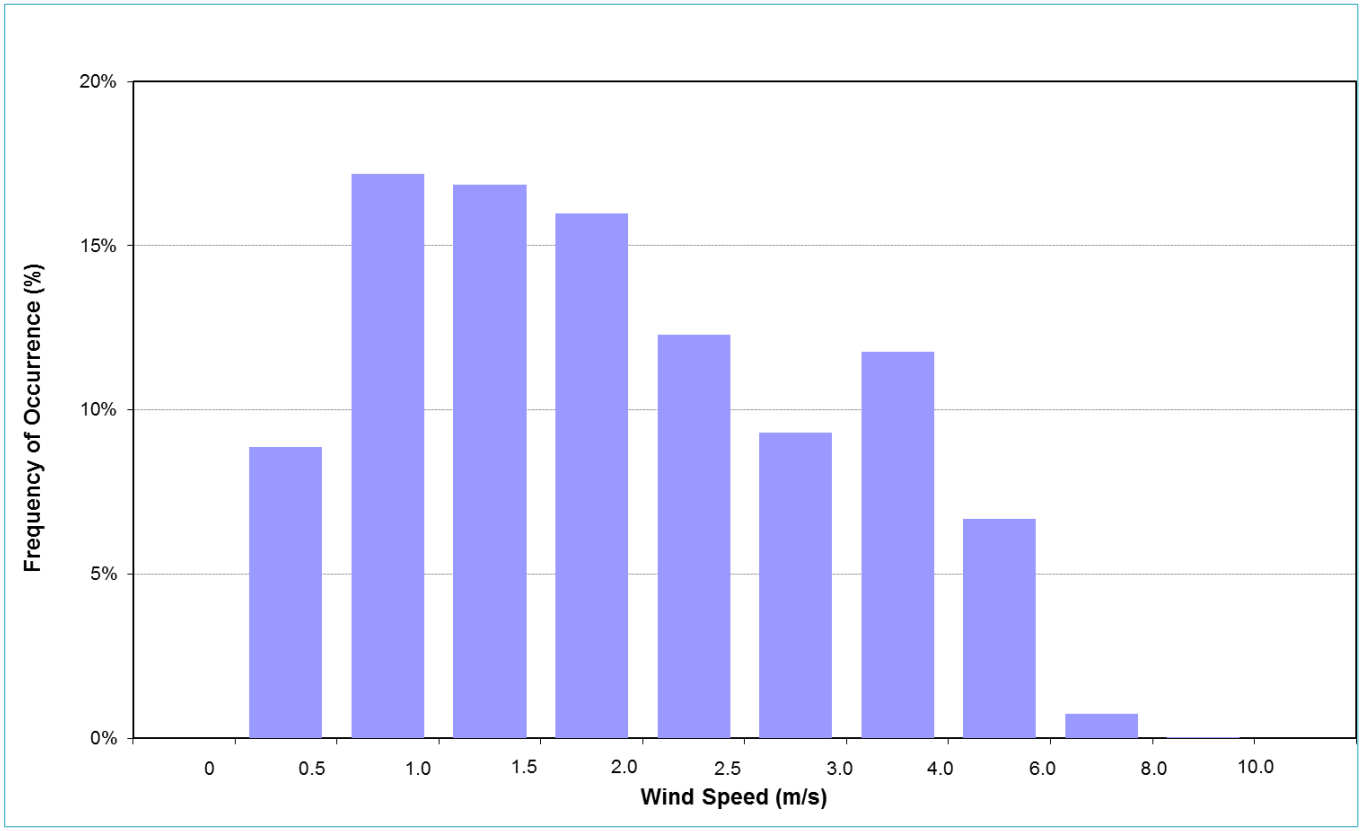


Figure 9 Annual Wind Speed Frequencies at the Development Site (CALMET predictions, 2015)



6.3.2 Atmospheric Stability

Atmospheric stability refers to the tendency of the atmosphere to resist or enhance vertical motion. The Pasquill-Gifford-Turner (PGT) assignment scheme identifies six stability classes, A to F, to categorise the degree of atmospheric stability as follows:

- A = Extremely unstable conditions
- B = Moderately unstable conditions
- C = Slightly unstable conditions
- D = Neutral conditions
- E = Slightly stable conditions
- F = Moderately stable conditions

The meteorological conditions defining each PGT stability class are shown in **Table 15**.

Table 15 Meteorological Conditions Defining PGT Stability Classes

Surface wind speed (m/s)	Daytime insolation			Night-time conditions	
	Strong	Moderate	Slight	Thin overcast or > 4/8 low cloud	<= 4/8 cloudiness
< 2	A	A - B	B	E	F
2 - 3	A - B	B	C	E	F
3 - 5	B	B - C	C	D	E
5 - 6	C	C - D	D	D	D
> 6	C	D	D	D	D

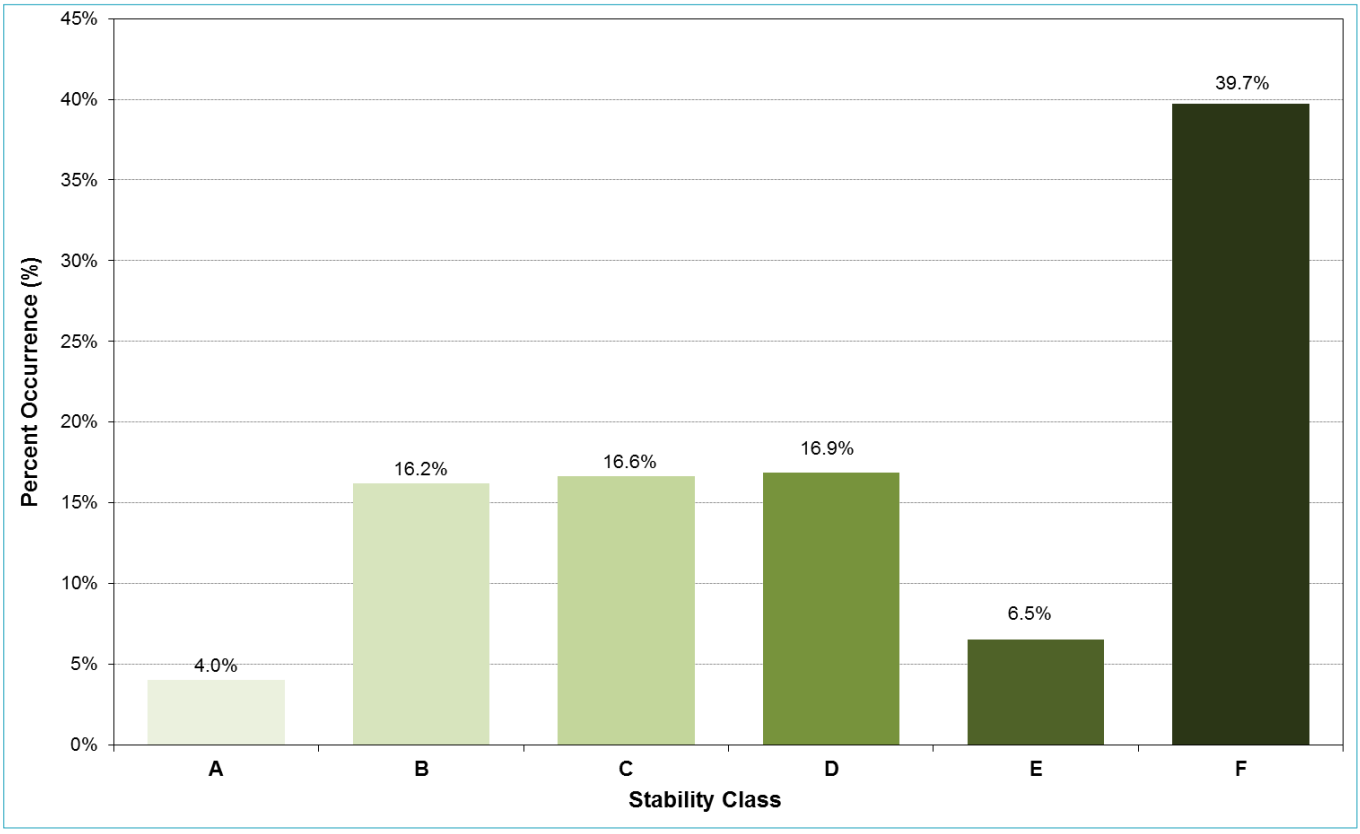
Source: NOAA 2018

Notes:

1. Strong insolation corresponds to sunny midday in midsummer in England; slight insolation to similar conditions in midwinter.
2. Night refers to the period from 1 hour before sunset to 1 hour after sunrise.
3. The neutral category D should also be used, regardless of wind speed, for overcast conditions during day or night and for any sky conditions during the hour preceding or following night as defined above.

The frequency of each stability class predicted by CALMET, extracted at the Development Site, during the modelling period is presented in **Figure 10**. The results indicate a high frequency of conditions typical to Stability Class F. Stability Class F is indicative of stable night time conditions, which will inhibit pollutant dispersion resulting in higher pollutant concentrations at ground level at surrounding areas.

Figure 10 Predicted Stability Class Frequencies at the Development Site (CALMET predictions, 2015)

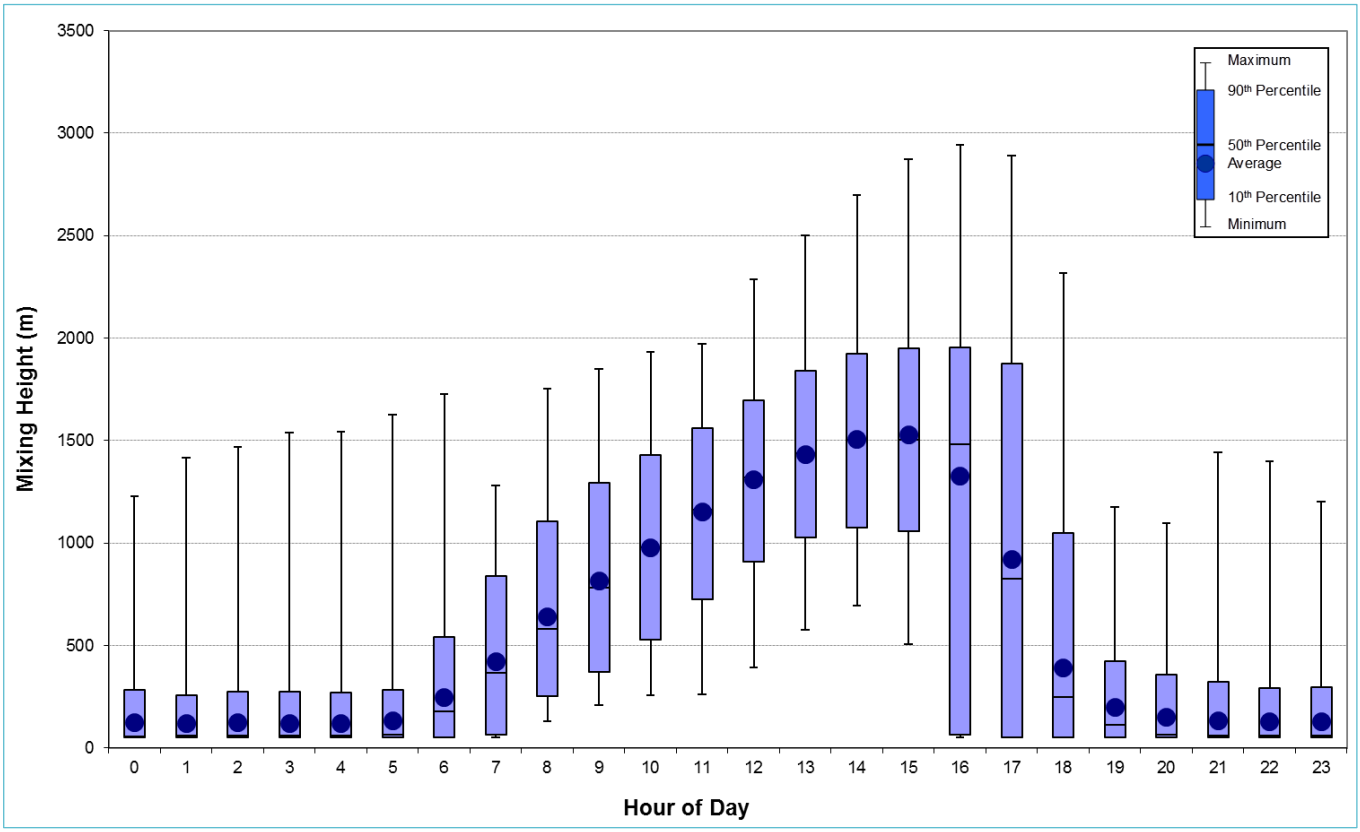


6.3.3 Mixing Heights

Diurnal variations in maximum and average mixing heights predicted by CALMET at the Development Site during the 2015 modelling period are illustrated in **Figure 11**.

As would be expected, an increase in mixing depth during the morning is apparent, arising due to the onset of vertical mixing following sunrise. Maximum mixing heights occur in the mid to late afternoon, due to the dissipation of ground based temperature inversions and growth of the convective mixing layer.

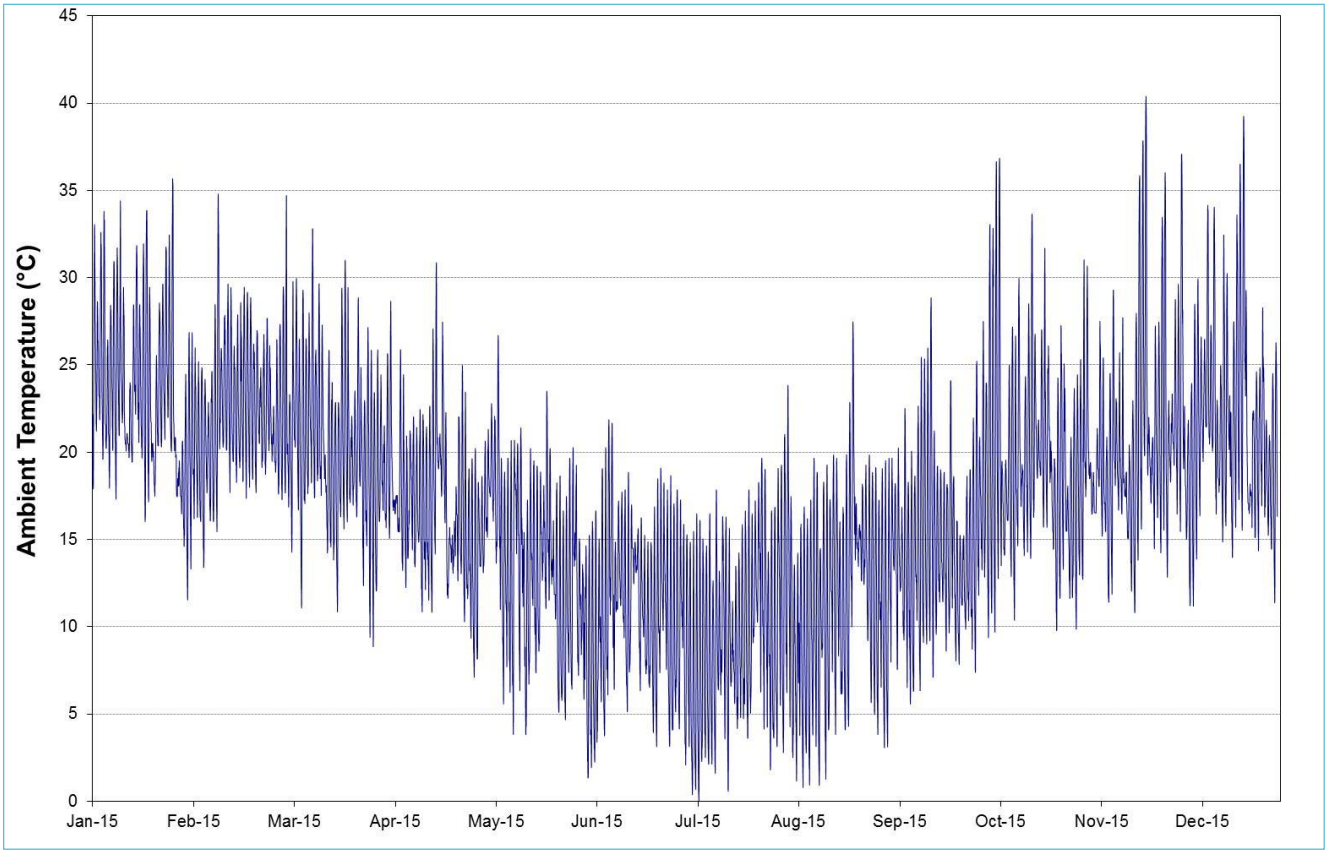
Figure 11 Predicted Mixing Heights at the Development Site (CALMET predictions, 2015)



6.3.4 Ambient Temperature

The modelled temperature variations as predicted at the Development Site during 2015 are illustrated in **Figure 12**. The maximum temperature (40.4°C) is predicted on 20 November 2015 and the minimum temperature (-0.3°C) is predicted on 6 July 2015.

Figure 12 Predicted Temperatures at the Development Site (CALMET predictions, 2015)



6.4 Background Concentrations

The regional and local setting of this Project (see **Section 2.1**) shows that there are no other potentially significant sources of the pollutants of interest in this study located in the vicinity of the Development Site. Therefore, the background concentrations for these pollutants are assumed to be zero and only incremental concentrations are presented in this assessment.

6.5 Source Characteristics

The stack parameters adopted in dispersion modelling are shown in **Table 16**.

Table 16 Stack Parameters used in Dispersion Modelling

Stack Parameters	Value	Units	Notes
Diameter	0.1	m	Based on FiltaCarb™ package systems (Model FC75x1)
Area	0.008	m^2	Calculated
Exit velocity	9.5	m/s	Based on maximum exit flowrate of 270 m^3/h (see **Section 3.3.2**)
Temperature	298	K	Assuming the exhaust air to be at room temperature
Height	11.7	m	Assuming 1 m above the Bulk Storage Warehouse

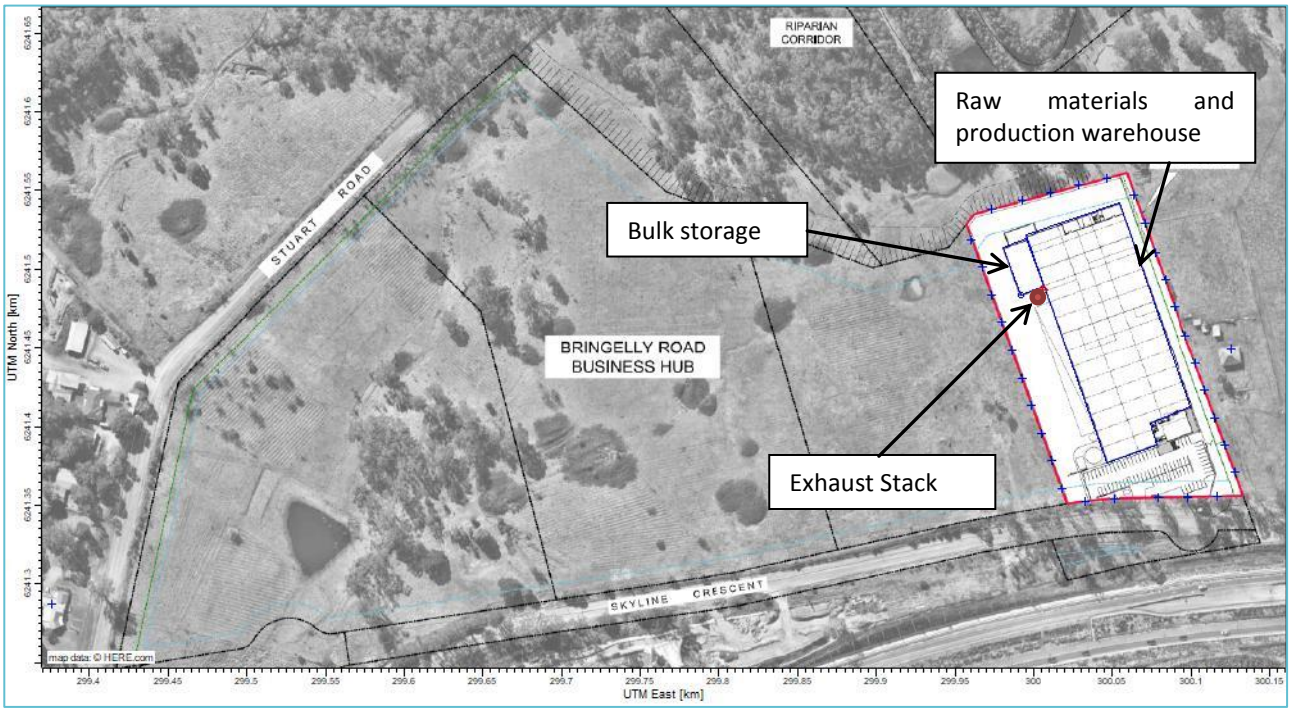
As discussed in **Section 2.6**, the exhaust stack was modelled as emitting continuously to provide worst case predictions of off-site concentrations.

6.6 Building Wake Effects

Building wake effects have the potential to influence plume behaviour and may result in higher concentrations close to the stack through premature plume grounding, and potentially lower concentrations further away from the stack due to the initial increased mixing effects.

The buildings included in the dispersion modelling are shown in **Figure 13**. A building height of 10.7 m and 13.7 m was used for the Bulk Storage Warehouse and Raw Materials and Production Warehouse respectively.

Figure 13 Building Layout included in the Dispersion Modelling



7 Impact Assessment

The maximum concentrations of VOCs and odour predicted by the dispersion modelling at the residences nominated in **Section 2.3** are presented in **Section 7.1.1** to **Section 7.1.2**. Pollutant isopleth plots are also provided in the respective sections, which show the incremental concentrations (Project operations only) of the pollutants assessed predicted across the modelling domain. The results presented are for the uncontrolled emission rates shown in **Table 8**.

As discussed in **Section 6.4**, the background concentrations in the area surrounding the Development Site have been assumed to be zero. Therefore, only incremental concentrations are presented and compared against the relevant criteria.

7.1.1 Volatile Organic Compounds (VOCs)

Table 17 presents the maximum (99.9th percentile) incremental 1-hour average VOC concentrations predicted at surrounding representative sensitive receptors based on the uncontrolled emission rates presented in **Table 8**. As noted in **Section 3.3.2**, VOC control efficiencies of 95% can be achieved through the use of an activated carbon filtration system, hence actual off-site concentrations will be less than 5% of the results presented for each individual compound. Modelling results for those VOC compounds that were measured to be below the limit of detection of the sampling program are presented in **Appendix D**.

Contour plots of the predicted incremental 9th highest 1-hour average concentrations (for uncontrolled emissions) are presented in **Figure 14** to **Figure 18**.

Even without the control efficiency of the activated carbon filtration system being accounted for, the predicted incremental 1-hour average concentrations at all receptors, and at the site boundary, are well below the relevant EPA criteria. **On this basis, there would be no requirement to include filtration of the emissions to achieve the assessment criteria.** However, Nulon proposes to include an activated carbon filtration system to treat air extracted from the storage and blending tank vents prior to discharge to atmosphere, as part of their ongoing environmental responsibility policy. VOC control efficiencies of such systems are reported to be at least 95%, which means that off-site ground level concentrations would be only 5% of the levels presented in **Table 8** and in **Figure 14** to **Figure 18**.

Table 17 Predicted 9th Highest 1-hour Average VOC Concentrations at Sensitive Receptors

Receptor ID	Incremental Concentrations (mg/m^3) Predicted for Uncontrolled Emissions				
	Acetone	Ethylene Glycol	Trimethyl Benzene	MEK	Toluene
R1	0.01	<0.01	<0.01	<0.01	0.01
R2	<0.01	<0.01	<0.01	<0.01	<0.01
R3	<0.01	<0.01	<0.01	<0.01	<0.01
R4	<0.01	<0.01	<0.01	<0.01	<0.01
R5	<0.01	<0.01	<0.01	<0.01	<0.01
R6	<0.01	<0.01	<0.01	<0.01	<0.01
R7	<0.01	<0.01	<0.01	<0.01	<0.01
R8	<0.01	<0.01	<0.01	<0.01	<0.01
R9	<0.01	<0.01	<0.01	<0.01	<0.01
R10	<0.01	<0.01	<0.01	<0.01	<0.01
R11	<0.01	<0.01	<0.01	<0.01	<0.01
R12	<0.01	<0.01	<0.01	<0.01	<0.01
R13	<0.01	<0.01	<0.01	<0.01	<0.01
Maximum at Site Boundary	***0.02***	***0.01***	***<0.01***	***0.02***	***0.02***
Criterion	22	1.0	2.2	3.2	0.36

Figure 14 Predicted 9th Highest 1-Hour Average Acetone Concentrations (Uncontrolled Emissions)

Figure 15 Predicted 9th Highest 1-hour Average Ethylene Glycol Concentrations (Uncontrolled Emissions)

Figure 16 Predicted 9th Highest 1-hour Average Trimethyl Benzene Concentrations (Uncontrolled Emissions)

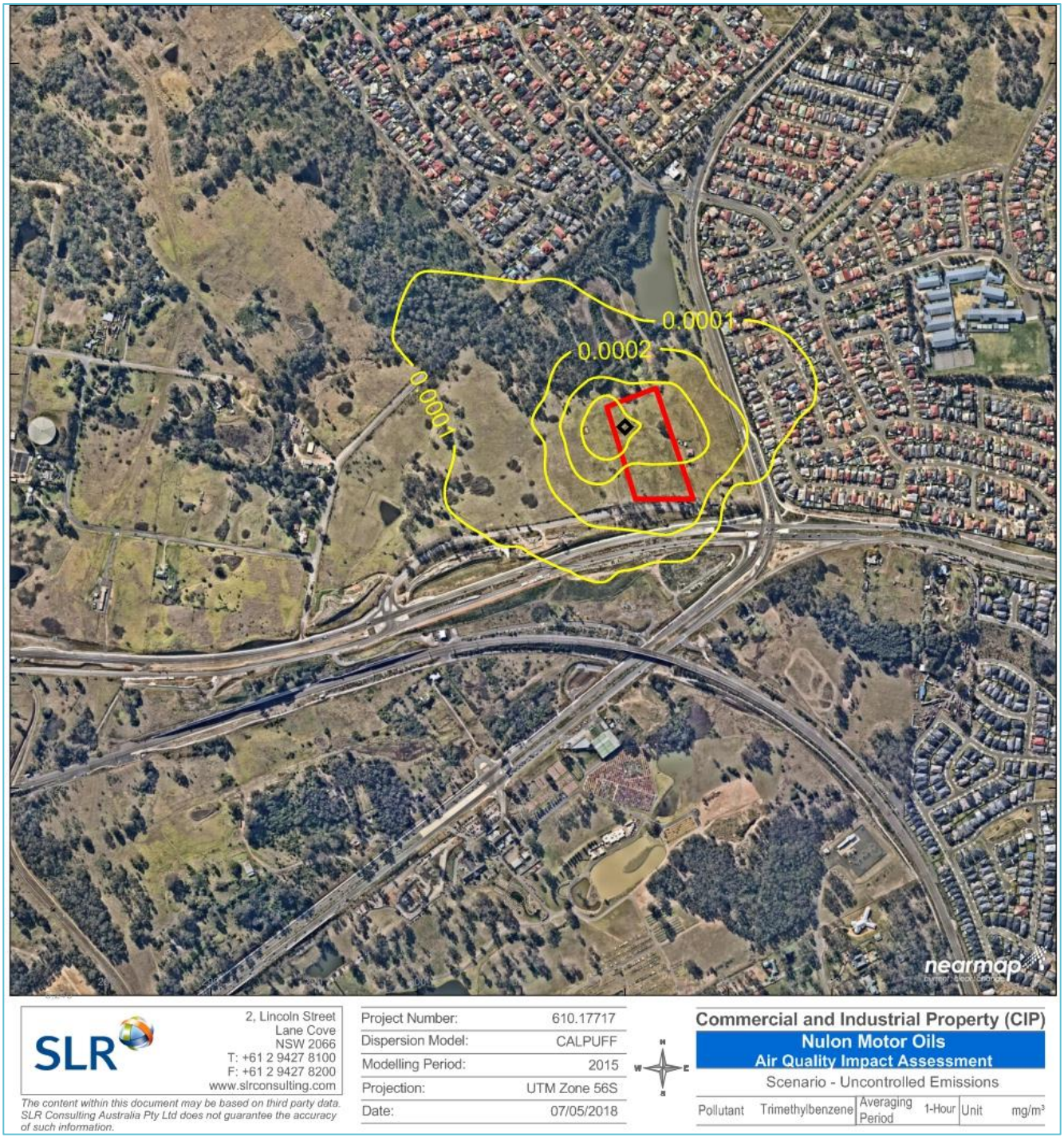


Figure 17 Predicted 9th Highest 1-hour Average MEK Concentrations (Uncontrolled Emissions)

Figure 18 Predicted 9th Highest 1-hour Average Toluene Concentrations (Uncontrolled Emissions)

7.1.2 Odour

Table 18 presents the incremental 99th percentile (nose-response time) odour concentrations predicted at surrounding representative sensitive receptors based on the uncontrolled emission rate presented in **Table 8** and using a peak to mean ratio of 2.3 (refer **Section 5.3.3**).

A contour plot of the predicted incremental 88th highest odour concentrations (nose-response time) is presented in **Figure 19**.

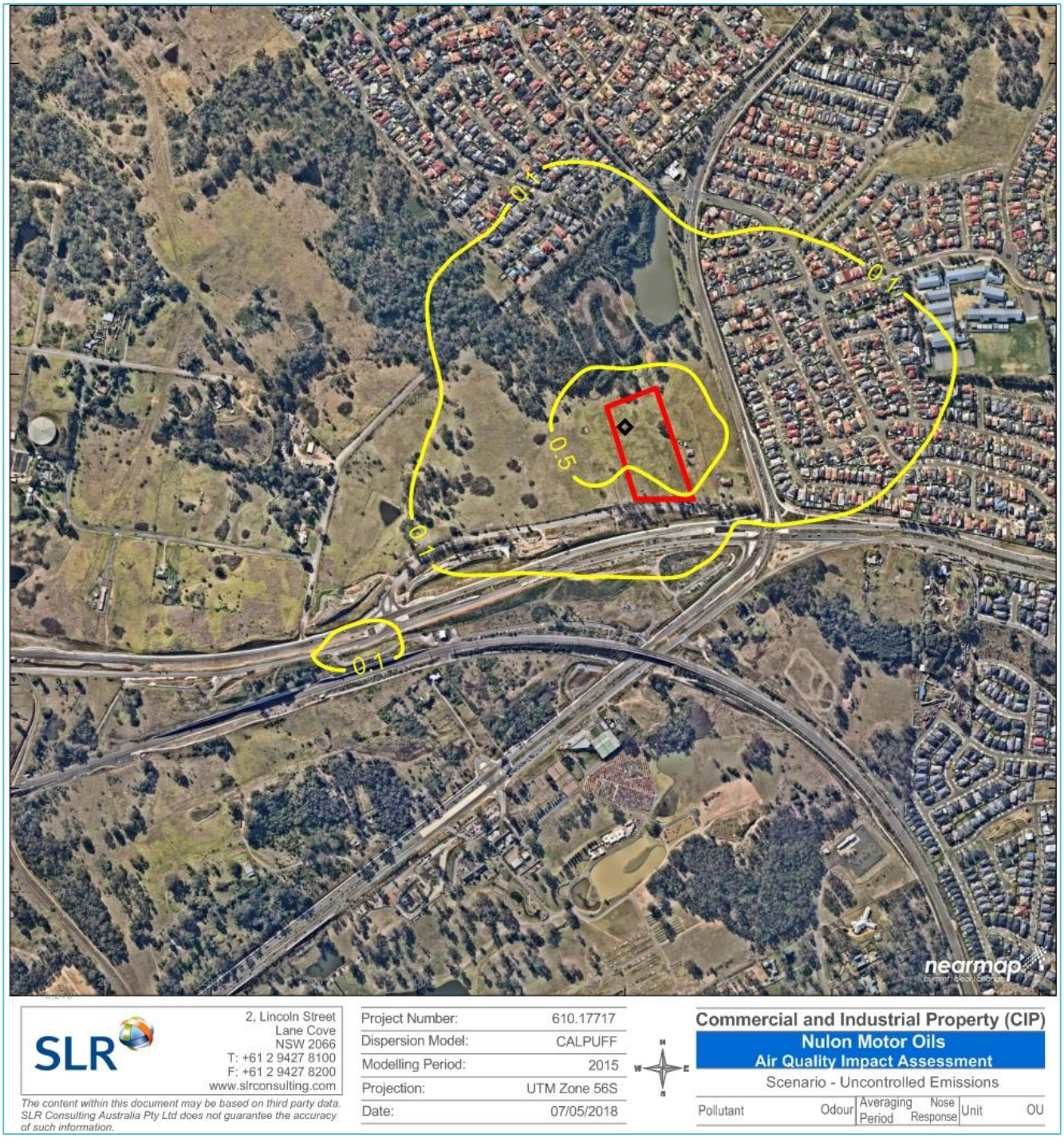
The predicted odour concentrations at all receptors based on the estimated uncontrolled odour emission rate are well below the EPA criterion of 2 ou (nose-response time).

Even without the control efficiency of the activated carbon filtration system being accounted for, the predicted off-site odour concentrations at all receptors are well below the relevant EPA criterion. On this basis, there would be no requirement to include filtration of the emissions to achieve the assessment criterion. However, Nulon proposes to include an activated carbon filtration system to treat air extracted from the storage and blending tank vents prior to discharge to atmosphere, as part of their ongoing environmental responsibility policy. This system will effectively remove odours from the discharged air and actual off-site ground level odour concentrations can be expected to be much lower than the uncontrolled impacts presented in **Table 18** and **Figure 19**.

Table 18 Predicted 88th Highest Odour Concentrations at Sensitive Receptors

Receptor ID	Incremental Concentrations Predicted for Uncontrolled Emissions (ou, nose-response time)
R1	<1
R2	<1
R3	<1
R4	<1
R5	<1
R6	<1
R7	<1
R8	<1
R9	<1
R10	<1
R11	<1
R12	<1
R13	<1
Criterion	2

Figure 19 Predicted 88th Highest Odour Concentrations



7.1.3 Hydrochloric Acid (HCl)

As mentioned in **Section 2.4**, HCl will be used in the DM plant to produced demineralised water for sale. Monitoring results showed that concentrations of inorganic acids were below the detection limit for all locations (see **Section 4.2**). Given this, the relatively small amounts of HCl to be used on site and the fact that it will not be heated or used for any purpose that would result in significant emissions of HCl vapours, it is concluded that there is no potential for significant emissions of HCl from the Development Site.

8 Conclusions

SLR Consulting Australia Pty Ltd (SLR) was commissioned by Commercial and Industrial Property (CIP) and Charter Hall (CH) on behalf of Nulon Products Australia Pty Ltd (Nulon), to prepare an Air Quality Impact Assessment (AQIA) for the operation of a proposed motor oils blending and packaging facility to be located on proposed Lot 8 within the Bringelly Road Business Park (Development Site). The operations at the Development Site will replace an existing factory located in Moorebank (existing Nulon factory). Blending and packaging equipment currently in use at the existing Nulon factory will be relocated to the Development Site, in addition to the installation of new equipment to facilitate the increased throughput proposed at the new site.

SLR completed a qualitative AQIA for the Development Site in December 2017 (610.17717-R01-v1.0, hereafter 'the 2017 AQIA') as part of the as part of the Environmental Impact Statement (EIS) for the development proposal. The air quality impacts during construction and operation were assessed using a qualitative (risk-based) approach. The 2017 AQIA concluded that during construction, there is a low risk for dust emissions to cause nuisance impacts at the off-site receptor locations. For the operational phase, the AQIA concluded that the potential impact significance of operations at the Development Site on local sensitive receptors is expected to be *neutral*.

Following a review of the AQIA, the NSW Environmental Protection Authority (EPA) requested that a comprehensive AQIA be completed to determine the potential offsite air impacts from the Development Site. This AQIA was completed in accordance with the Approved Methods using the CALPUFF model.

A detailed analysis of the constituent components of all raw materials was performed, which confirmed that the raw materials that will be stored and handled at the Development Site have very low volatility. Volatile organic compounds (VOCs), ethylene glycol and odour were identified to be key pollutants of interest.

SLR conducted emissions monitoring at the existing Nulon factory on the 4th and 11th April 2018. The aim of the monitoring program was to obtain data on air emissions from the preparation and storage of motor oil products currently undertaken by Nulon at their existing facility, to assist in the estimation of emissions from the Development Site. The sampling locations were chosen so that they are as close as possible to the tank vents, packaging line and workshop, which were identified as the main potential air emission sources. Concentrations of inorganic acids and glycols were recorded to be below the detection limit for all locations and VOCs were only detected in the sample collected from within the final product area. This is as expected given the very low volatility of the liquids being stored and handled on site.

Dispersion modelling was completed using conservative assumptions, such as the emissions being emitted on a 24/7 basis and use of uncontrolled emission rates based on the limit of detection of the sampling method where no compounds were detected. The predicted 1-hour average 99.9th percentile (9th highest) VOC concentrations are well below the respective NSW EPA ambient air quality criteria at all sensitive receptor locations identified in the vicinity of the Development Site and at the site boundary. The highest site boundary concentrations are predicted for toluene, which is only 6% of the relevant criterion, even if no emissions control was assumed.

The modelling results for odour show that 99th percentile (88th highest) concentrations (based on a 'nose-response' averaging period) are well below the respective NSW EPA ambient air quality criterion at all sensitive receptor locations identified in the vicinity of the Development Site, even if no emissions control was assumed.

As concluded in the 2017 AQIA, the potential for any air impacts due to the proposed operations at the Development Site are considered to be negligible. However, Nulon proposes to install an activated carbon filter as part of their ongoing environmental responsibility policy. Assuming 95% control efficiency for the carbon filter (USEPA 1988), the site boundary concentrations will be only 5% of the impacts predicted in this study.

The requested assessment of potential HCl emissions identified no significant path for emissions to air and concluded that there would be no potential for off-site impacts from HCl vapours.

9 References

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- DEC 2006, Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales, Department of Environment and Conservation NSW, December 2006.
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- DECCW 2009, Better Regulation Statement - Expansion of Vapour Recovery at Petrol Service Stations in the NSW Greater Metropolitan Region, NSW Department of Environment, Climate Change and Water, November 2009.
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- NOAA 2018, Pasquill Stability Classes, National Oceanic and Atmospheric Administration, United States Department of Commerce, available online at https://ready.arl.noaa.gov/READYpgclass.php, last updated February 14, 2018.
- USEPA 2005, Federal Register, Part III – Environmental Protection Agency 40CFR Part 51, November 9 2005.
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- USEPA 1998, *Carbon Adsorption for Control of VOC Emissions: Theory and Full Scale System Performance*, United States Environmental Protection Agency, Office of Air Quality Planning and Standards, EPA-450/3-88-012, June 1988.
- VIVA 2017, Material Safety Data Sheet, VivaSol 2046, CAS Registry Number: 64742-81-0, available online at https://www.vivaenergy.com.au/services/sds, accessed on 20 December 2017.
- Woodfield M, Hall D, Odour Measurement and Control - An Update, Prepared on behalf of the Department of Environment, AEA Technology, August 1994.

APPENDIX A - LABORATORY CERTIFICATES

- The Odour Concentration Measurement Results (The Odour Unit Pty Ltd) – TOU Project # N1869R
- Report of Analysis – Volatile Organic Compounds, TestSafe Australia, Lab Reference 2018-1408
- Report of Analysis - Inorganic Acid Screen, TestSafe Australia, Lab Reference 2018-1409
- Report of Analysis - Glycols, TestSafe Australia, Lab Reference 2018-1458

THE ODOUR UNIT PTY LTD

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ABN: 53 091 165 061

NATA

Accreditation Number: 14974

Odour Concentration Measurement Results

The measurement was commissioned by:

Organisation	SLR Consulting	Telephone	02 9428 8100
Contact	M. Brecko	Facsimile	-
Sampling Site	Undisclosed	Email	mbrecko@slrconsulting.com
Sampling Method	Undisclosed	Sampling Team	SLR Consulting

Order details:

Order requested by	M. Brecko	Order accepted by	A. Schulz
Date of order	03.04.2018	TOU Project #	N1869R
Order number	24143	Project Manager	J. Schulz
Signed by	M. Brecko	Testing operator	A. Schulz

Investigated Item	Odour concentration in odour units 'ou', determined by sensory odour concentration measurements, of an odour sample supplied in a sampling bag.
Identification	The odour sample bags were labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification), sampling date and time, dilution ratio (if dilution was used) and whether further chemical analysis was required.
Method	The odour concentration measurements were performed using dynamic olfactometry according to the Australian Standard 'Determination of Odour Concentration by Dynamic Olfactometry' AS/NZS4323.3:2001. The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for butanol calibration. Accredited for compliance with ISO/IEC 17025 – Testing. This report shall not be reproduced, except in full. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.
Measuring Range	The measuring range of the olfactometer is $2^2 \leq \chi \leq 2^{18}$ ou. If the measuring range was insufficient the odour samples will have been pre-diluted. The machine is not calibrated beyond dilution setting 2^{17}. This is specifically mentioned with the results.
Environment	The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained between 22ºC and 25ºC.
Measuring Dates	The date of each measurement is specified with the results.
Instrument Used	The olfactometer used during this testing session was: ODORMAT SERIES V02
Instrumental Precision	The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.477$ in accordance with the Australian Standard AS/NZS4323.3:2001. ODORMAT SERIES V02: $r = 0.1366$ (Aug - Oct 2017) Compliance – Yes
Instrumental Accuracy	The accuracy of this instrument for a sensory calibration must be $A \leq 0.217$ in accordance with the Australian Standard AS/NZS4323.3:2001. ODORMAT SERIES V02: $A = 0.2128$ (Aug - Oct 2017) Compliance – Yes
Lower Detection Limit (LDL)	The LDL for the olfactometer has been determined to be 16 ou (4 times the lowest dilution setting)
Traceability	The measurements have been performed using standards for which the traceability to the national standard has been demonstrated. The assessors are individually selected to comply with fixed criteria and are monitored in time to keep within the limits of the standard. The results from the assessors are traceable to primary standards of n-butanol in nitrogen.

Date: Monday, 09 April 2018

Panel Roster Number: SYD20180405_023

J. Schulz
NSW Laboratory Coordinator

A. Schulz
Authorised Signatory

THE ODOUR UNIT PTY LTD

Accreditation Number: 14974

Odour Sample Measurement Results
Panel Roster Number: SYD20180405_023

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Nominal Sample Dilution	Actual Sample Dilution (Adjusted for Temperature)	Sample Odour Concentration (as received, in the bag) (ou)	Sample Odour Concentration (Final, allowing for dilution) (ou)	Specific Odour Emission Rate ($ou.m^3/m^2/s$)
Tank Farm R1	SC18142	04.04.2018 1045 hrs	05.04.2018 1058 hrs	4	8	--	--	41	41	--
Tank Farm R2	SC18143	04.04.2018 1100 hrs	05.04.2018 1131 hrs	4	8	-	-	45	45	--
Ambient – 1 Between Processing Blending Tanks & Ctrl Room	SC18144	04.04.2018 1205 hrs	05.04.2018 1202 hrs	4	8	-	-	45	45	--
Ambient – 2 Between Control Room & Packing Line	SC18145	04.04.2018 1215 hrs	05.04.2018 1305 hrs	4	8	-	-	45	45	--
Ambient – 3 Between Packing Line Tanks & Packing Line Coolant	SC18146	04.04.2018 1225 hrs	05.04.2018 1335 hrs	4	8	-	-	76	76	--

Note: Where parties other than The Odour Unit perform the dilution of samples, the result that has been modified by the dilution factor is not covered by The Odour Unit's NATA accreditation.

THE ODOUR UNIT PTY LTD

Accreditation Number: 14974

Odour Panel Calibration Results

Reference Odorant	Reference Odorant Panel Roster Number	Concentration of Reference gas (ppb)	Panel Target Range for n-butanol (ppb)	Measured Concentration (ou)	Measured Panel Threshold (ppb)	Does this panel calibration measurement comply with AS/NZS4323.3:2001 (Yes / No)
n-butanol	SYD20180405_023	51,500	$20 \leq \chi \leq 80$	1,024	50	Yes

Comments Odour characters (non-NATA accredited) as determined by odour laboratory panel:

SC18142 musty
SC18143 musty
SC18144 musty
SC18145 musty
SC18146 musty

Disclaimer Parties, other than TOU, responsible for collecting odour samples hereby certify that they have voluntarily furnished these odour samples, appropriately collected and labelled, to The Odour Unit Pty Ltd for the purpose of odour testing. The collection of odour samples by parties other than The Odour Unit Pty Ltd relinquishes The Odour Unit Pty Ltd from all responsibility for the sample collection and any effects or actions that the results from the test(s) may have.

Note This report shall not be reproduced, except in full, without written approval of The Odour Unit Pty Ltd. Any attachments to this Report are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd.

END OF DOCUMENT

NSW GOVERNMENT | SafeWork NSW

Test Safe AUSTRALIA

Michael Brecko
SLR Consulting Australia Pty Ltd
Level 2
2 Lincoln Street
LANE COVE NSW 2066

Lab. Reference: 2018-1408

SAMPLE ORIGIN: Project No. 610.17717.00100.0020

DATE OF INVESTIGATION: 04/04/2018 **DATE RECEIVED:** 5/04/18

ANALYSIS REQUIRED: Volatile Organic Compounds

REPORT OF ANALYSIS

See attached sheet(s) for sample description and test results.

The results of this report have been approved by the signatory whose signature appears below.

For all administrative or account details please contact the Laboratory.

Increment and total pagination can be seen on the following pages.

Martin Mazereeuw
Manager

Date: 16/04/18

TestSafe Australia – Chemical Analysis Branch
Level 2, Building 1, 9-15 Chilvers Road, Thornleigh, NSW 2120, Australia
T: +61 2 9473 4000 E: lab@safework.nsw.gov.au W: testsafe.com.au
ABN 81 913 830 179

ilac-MRA NATA
Accreditation No. 3726
Accredited for compliance with ISO/IEC 17025

NSW GOVERNMENT | SafeWork NSW

Test Safe AUSTRALIA

Analysis of Volatile Organic Compounds in Workplace Air by GC/MS

Client : Michael Brecko **Date Sampled : 4-Apr-2018**

Sample ID : 6474 **Reference Number le : 2018-1408-1**

No	Compounds	CAS No	Front µg/section	Back µg/section	No	Compounds	CAS No	Front µg/section	Back µg/section
	Aliphatic hydrocarbons (LOQ = 5µg/compound/section)					**Aromatic hydrocarbons** (LOQ = 1µg/compound/section)			
1	2-Methylbutane	*78-78-4*	ND	ND	39	Benzene	*71-43-2*	ND	ND
2	n-Pentane	*109-66-0*	ND	ND	40	Ethylbenzene	*100-41-4*	ND	ND
3	2-Methylpentane	*107-83-5*	ND	ND	41	Isopropylbenzene	*98-82-8*	ND	ND
4	3-Methylpentane	*96-14-0*	ND	ND	42	1,2,3-Trimethylbenzene	*526-73-8*	ND	ND
5	Cyclopentane	*287-92-3*	ND	ND	43	1,2,4-Trimethylbenzene	*95-63-6*	ND	ND
6	Methylcyclopentane	*96-37-7*	ND	ND	44	1,3,5-Trimethylbenzene	*108-67-8*	ND	ND
7	2,3-Dimethylpentane	*565-59-3*	ND	ND	45	Styrene	*100-42-5*	ND	ND
8	n-Hexane	*110-54-3*	ND	ND	46	Toluene	*108-88-3*	ND	ND
9	3-Methylhexane	*589-34-4*	ND	ND	47	p-Xylene &/or m-Xylene	*106-42-3 & 108-38-3*	ND	ND
10	Cyclohexane	*110-82-7*	ND	ND	48	o-Xylene	*95-47-6*	ND	ND
11	Methylcyclohexane	*108-87-2*	ND	ND		**Ketones** (LOQ #49, #54 & #55 =5µg/c/s; #50, #51, #52 & #53 =25µg/c/s)			
12	2,2,4-Trimethylpentane	*540-84-1*	ND	ND	49	Acetone	*67-64-1*	ND	ND
13	n-Heptane	*142-82-5*	ND	ND	50	Acetoin	*513-86-0*	ND	ND
14	n-Octane	*111-65-9*	ND	ND	51	Diacetone alcohol	*123-42-2*	ND	ND
15	n-Nonane	*111-84-2*	ND	ND	52	Cyclohexanone	*108-94-1*	ND	ND
16	n-Decane	*124-18-5*	ND	ND	53	Isophorone	*78-59-1*	ND	ND
17	n-Undecane	*1120-21-4*	ND	ND	54	Methyl ethyl ketone (MEK)	*78-93-3*	ND	ND
18	n-Dodecane	*112-40-3*	ND	ND	55	Methyl isobutyl ketone (MIBK)	*108-10-1*	ND	ND
19	n-Tridecane	*629-50-5*	ND	ND		**Alcohols** (LOQ = 25µg/compound/section)			
20	n-Tetradecane	*629-59-4*	ND	ND	56	Ethyl alcohol	*64-17-5*	ND	ND
21	α-Pinene	*80-56-8*	ND	ND	57	n-Butyl alcohol	*71-36-3*	ND	ND
22	β-Pinene	*127-91-3*	ND	ND	58	Isobutyl alcohol	*78-83-1*	ND	ND
23	D-Limonene	*138-86-3*	ND	ND	59	Isopropyl alcohol	*67-63-0*	ND	ND
	Chlorinated hydrocarbons (LOQ = 5µg/compound/section)				60	2-Ethyl hexanol	*104-76-7*	ND	ND
24	Dichloromethane	*75-09-2*	ND	ND	61	Cyclohexanol	*108-93-0*	ND	ND
25	1,1-Dichloroethane	*75-34-3*	ND	ND		**Acetates** (LOQ = 25µg/compound/section)			
26	1,2-Dichloroethane	*107-06-2*	ND	ND	62	Ethyl acetate	*141-78-6*	ND	ND
27	Chloroform	*67-66-3*	ND	ND	63	n-Propyl acetate	*109-60-4*	ND	ND
28	1,1,1-Trichloroethane	*71-55-6*	ND	ND	64	n-Butyl acetate	*123-86-4*	ND	ND
29	1,1,2-Trichloroethane	*79-00-5*	ND	ND	65	Isobutyl acetate	*110-19-0*	ND	ND
30	Trichloroethylene	*79-01-6*	ND	ND		**Ethers** (LOQ = 25µg/compound/section)			
31	Carbon tetrachloride	*56-23-5*	ND	ND	66	Ethyl ether	*60-29-7*	ND	ND
32	Perchloroethylene	*127-18-4*	ND	ND	67	*tert*-Butyl methyl ether (MTBE)	*1634-04-4*	ND	ND
33	1,1,2,2-Tetrachloroethane	*79-34-5*	ND	ND	68	Tetrahydrofuran (THF)	*109-99-9*	ND	ND
34	Chlorobenzene	*108-90-7*	ND	ND		**Glycols** (LOQ = 25µg/compound/section)			
35	1,2-Dichlorobenzene	*95-50-1*	ND	ND	69	PGME	*107-98-2*	ND	ND
36	1,4-Dichlorobenzene	*106-46-7*	ND	ND	70	Ethylene glycol diethyl ether	*629-14-1*	ND	ND
	Miscellaneous (LOQ #37= 5µg & #38=25µg/compound/section)				71	PGMEA	*108-65-6*	ND	ND
37	Acetonitrile	*75-05-8*	ND	ND	72	Cellosolve acetate	*111-15-9*	ND	ND
38	n-Vinyl-2-pyrrolidinone	*88-12-0*	ND	ND	73	DGMEA	*112-15-2*	ND	ND
	Total VOCs (LOQ =50µg/compound/section)		ND	ND		Worksheet check		yes	yes

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Test Safe AUSTRALIA

Analysis of Volatile Organic Compounds in Workplace Air by GC/MS

Client : Michael Brecko **Date Sampled : 4-Apr-2018**

Sample ID : 6475 **Reference Number le : 2018-1408-2**

No	Compounds	CAS No	Front µg/section	Back µg/section	No	Compounds	CAS No	Front µg/section	Back µg/section
	Aliphatic hydrocarbons (LOQ = 5µg/compound/section)					**Aromatic hydrocarbons** (LOQ = 1µg/compound/section)			
1	2-Methylbutane	*78-78-4*	ND	ND	39	Benzene	*71-43-2*	ND	ND
2	n-Pentane	*109-66-0*	ND	ND	40	Ethylbenzene	*100-41-4*	ND	ND
3	2-Methylpentane	*107-83-5*	ND	ND	41	Isopropylbenzene	*98-82-8*	ND	ND
4	3-Methylpentane	*96-14-0*	ND	ND	42	1,2,3-Trimethylbenzene	*526-73-8*	ND	ND
5	Cyclopentane	*287-92-3*	ND	ND	43	1,2,4-Trimethylbenzene	*95-63-6*	ND	ND
6	Methylcyclopentane	*96-37-7*	ND	ND	44	1,3,5-Trimethylbenzene	*108-67-8*	ND	ND
7	2,3-Dimethylpentane	*565-59-3*	ND	ND	45	Styrene	*100-42-5*	ND	ND
8	n-Hexane	*110-54-3*	ND	ND	46	Toluene	*108-88-3*	ND	ND
9	3-Methylhexane	*589-34-4*	ND	ND	47	p-Xylene &/or m-Xylene	*106-42-3 & 108-38-3*	ND	ND
10	Cyclohexane	*110-82-7*	ND	ND	48	o-Xylene	*95-47-6*	ND	ND
11	Methylcyclohexane	*108-87-2*	ND	ND		**Ketones** (LOQ #49, #54 & #55 =5µg/c/s; #50, #51, #52 & #53 =25µg/c/s)			
12	2,2,4-Trimethylpentane	*540-84-1*	ND	ND	49	Acetone	*67-64-1*	ND	ND
13	n-Heptane	*142-82-5*	ND	ND	50	Acetoin	*513-86-0*	ND	ND
14	n-Octane	*111-65-9*	ND	ND	51	Diacetone alcohol	*123-42-2*	ND	ND
15	n-Nonane	*111-84-2*	ND	ND	52	Cyclohexanone	*108-94-1*	ND	ND
16	n-Decane	*124-18-5*	ND	ND	53	Isophorone	*78-59-1*	ND	ND
17	n-Undecane	*1120-21-4*	ND	ND	54	Methyl ethyl ketone (MEK)	*78-93-3*	ND	ND
18	n-Dodecane	*112-40-3*	ND	ND	55	Methyl isobutyl ketone (MIBK)	*108-10-1*	ND	ND
19	n-Tridecane	*629-50-5*	ND	ND		**Alcohols** (LOQ = 25µg/compound/section)			
20	n-Tetradecane	*629-59-4*	ND	ND	56	Ethyl alcohol	*64-17-5*	ND	ND
21	α-Pinene	*80-56-8*	ND	ND	57	n-Butyl alcohol	*71-36-3*	ND	ND
22	β-Pinene	*127-91-3*	ND	ND	58	Isobutyl alcohol	*78-83-1*	ND	ND
23	D-Limonene	*138-86-3*	ND	ND	59	Isopropyl alcohol	*67-63-0*	ND	ND
	Chlorinated hydrocarbons (LOQ = 5µg/compound/section)				60	2-Ethyl hexanol	*104-76-7*	ND	ND
24	Dichloromethane	*75-09-2*	ND	ND	61	Cyclohexanol	*108-93-0*	ND	ND
25	1,1-Dichloroethane	*75-34-3*	ND	ND		**Acetates** (LOQ = 25µg/compound/section)			
26	1,2-Dichloroethane	*107-06-2*	ND	ND	62	Ethyl acetate	*141-78-6*	ND	ND
27	Chloroform	*67-66-3*	ND	ND	63	n-Propyl acetate	*109-60-4*	ND	ND
28	1,1,1-Trichloroethane	*71-55-6*	ND	ND	64	n-Butyl acetate	*123-86-4*	ND	ND
29	1,1,2-Trichloroethane	*79-00-5*	ND	ND	65	Isobutyl acetate	*110-19-0*	ND	ND
30	Trichloroethylene	*79-01-6*	ND	ND		**Ethers** (LOQ = 25µg/compound/section)			
31	Carbon tetrachloride	*56-23-5*	ND	ND	66	Ethyl ether	*60-29-7*	ND	ND
32	Perchloroethylene	*127-18-4*	ND	ND	67	*tert*-Butyl methyl ether (MTBE)	*1634-04-4*	ND	ND
33	1,1,2,2-Tetrachloroethane	*79-34-5*	ND	ND	68	Tetrahydrofuran (THF)	*109-99-9*	ND	ND
34	Chlorobenzene	*108-90-7*	ND	ND		**Glycols** (LOQ = 25µg/compound/section)			
35	1,2-Dichlorobenzene	*95-50-1*	ND	ND	69	PGME	*107-98-2*	ND	ND
36	1,4-Dichlorobenzene	*106-46-7*	ND	ND	70	Ethylene glycol diethyl ether	*629-14-1*	ND	ND
	Miscellaneous (LOQ #37= 5µg & #38=25µg/compound/section)				71	PGMEA	*108-65-6*	ND	ND
37	Acetonitrile	*75-05-8*	ND	ND	72	Cellosolve acetate	*111-15-9*	ND	ND
38	n-Vinyl-2-pyrrolidinone	*88-12-0*	ND	ND	73	DGMEA	*112-15-2*	ND	ND
	Total VOCs (LOQ =50µg/compound/section)		ND	ND		Worksheet check		yes	yes

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Analysis of Volatile Organic Compounds in Workplace Air by GC/MS

Client : Michael Brecko **Date Sampled : 4-Apr-2018**

Sample ID : 6477 **Reference Number le : 2018-1408-3**

No	Compounds	CAS No	Front µg/section	Back µg/section	No	Compounds	CAS No	Front µg/section	Back µg/section
	Aliphatic hydrocarbons (LOQ = 5µg/compound/section)					**Aromatic hydrocarbons** (LOQ = 1µg/compound/section)			
1	2-Methylbutane	*78-78-4*	ND	ND	39	Benzene	*71-43-2*	ND	ND
2	n-Pentane	*109-66-0*	ND	ND	40	Ethylbenzene	*100-41-4*	ND	ND
3	2-Methylpentane	*107-83-5*	ND	ND	41	Isopropylbenzene	*98-82-8*	ND	ND
4	3-Methylpentane	*96-14-0*	ND	ND	42	1,2,3-Trimethylbenzene	*526-73-8*	ND	ND
5	Cyclopentane	*287-92-3*	ND	ND	43	1,2,4-Trimethylbenzene	*95-63-6*	ND	ND
6	Methylcyclopentane	*96-37-7*	ND	ND	44	1,3,5-Trimethylbenzene	*108-67-8*	ND	ND
7	2,3-Dimethylpentane	*565-59-3*	ND	ND	45	Styrene	*100-42-5*	ND	ND
8	n-Hexane	*110-54-3*	ND	ND	46	Toluene	*108-88-3*	ND	ND
9	3-Methylhexane	*589-34-4*	ND	ND	47	p-Xylene &/or m-Xylene	*106-42-3 &/ 108-38-3*	ND	ND
10	Cyclohexane	*110-82-7*	ND	ND	48	o-Xylene	*95-47-6*	ND	ND
11	Methylcyclohexane	*108-87-2*	ND	ND		**Ketones** (LOQ #49, #54 & #55 =5µg/c/s; #50, #51, #52 & #53 =25µg/c/s)			
12	2,2,4-Trimethylpentane	*540-84-1*	ND	ND	49	Acetone	*67-64-1*	ND	ND
13	n-Heptane	*142-82-5*	ND	ND	50	Acetoin	*513-86-0*	ND	ND
14	n-Octane	*111-65-9*	ND	ND	51	Diacetone alcohol	*123-42-2*	ND	ND
15	n-Nonane	*111-84-2*	ND	ND	52	Cyclohexanone	*108-94-1*	ND	ND
16	n-Decane	*124-18-5*	ND	ND	53	Isophorone	*78-59-1*	ND	ND
17	n-Undecane	*1120-21-4*	ND	ND	54	Methyl ethyl ketone (MEK)	*78-93-3*	ND	ND
18	n-Dodecane	*112-40-3*	ND	ND	55	Methyl isobutyl ketone (MIBK)	*108-10-1*	ND	ND
19	n-Tridecane	*629-50-5*	ND	ND		**Alcohols** (LOQ = 25µg/compound/section)			
20	n-Tetradecane	*629-59-4*	ND	ND	56	Ethyl alcohol	*64-17-5*	ND	ND
21	α-Pinene	*80-56-8*	ND	ND	57	n-Butyl alcohol	*71-36-3*	ND	ND
22	β-Pinene	*127-91-3*	ND	ND	58	Isobutyl alcohol	*78-83-1*	ND	ND
23	D-Limonene	*138-86-3*	ND	ND	59	Isopropyl alcohol	*67-63-0*	ND	ND
	Chlorinated hydrocarbons (LOQ = 5µg/compound/section)				60	2-Ethyl hexanol	*104-76-7*	ND	ND
24	Dichloromethane	*75-09-2*	ND	ND	61	Cyclohexanol	*108-93-0*	ND	ND
25	1,1-Dichloroethane	*75-34-3*	ND	ND		**Acetates** (LOQ = 25µg/compound/section)			
26	1,2-Dichloroethane	*107-06-2*	ND	ND	62	Ethyl acetate	*141-78-6*	ND	ND
27	Chloroform	*67-66-3*	ND	ND	63	n-Propyl acetate	*109-60-4*	ND	ND
28	1,1,1-Trichloroethane	*71-55-6*	ND	ND	64	n-Butyl acetate	*123-86-4*	ND	ND
29	1,1,2-Trichloroethane	*79-00-5*	ND	ND	65	Isobutyl acetate	*110-19-0*	ND	ND
30	Trichloroethylene	*79-01-6*	ND	ND		**Ethers** (LOQ = 25µg/compound/section)			
31	Carbon tetrachloride	*56-23-5*	ND	ND	66	Ethyl ether	*60-29-7*	ND	ND
32	Perchloroethylene	*127-18-4*	ND	ND	67	*tert*-Butyl methyl ether (MTBE)	*1634-04-4*	ND	ND
33	1,1,2,2-Tetrachloroethane	*79-34-5*	ND	ND	68	Tetrahydrofuran (THF)	*109-99-9*	ND	ND
34	Chlorobenzene	*108-90-7*	ND	ND		**Glycols** (LOQ = 25µg/compound/section)			
35	1,2-Dichlorobenzene	*95-50-1*	ND	ND	69	PGME	*107-98-2*	ND	ND
36	1,4-Dichlorobenzene	*106-46-7*	ND	ND	70	Ethylene glycol diethyl ether	*629-14-1*	ND	ND
	Miscellaneous (LOQ #37= 5µg & #38=25µg/compound/section)				71	PGMEA	*108-65-6*	ND	ND
37	Acetonitrile	*75-05-8*	ND	ND	72	Cellosolve acetate	*111-15-9*	ND	ND
38	n-Vinyl-2-pyrrolidinone	*88-12-0*	ND	ND	73	DGMEA	*112-15-2*	ND	ND
	Total VOCs (LOQ =50µg/compound/section)		ND	ND		Worksheet check		yes	yes

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Analysis of Volatile Organic Compounds in Workplace Air by GC/MS

Client : Michael Brecko **Date Sampled : 4-Apr-2018**

Sample ID : 6478 **Reference Number le : 2018-1408-4**

No	Compounds	CAS No	Front µg/section	Back µg/section	No	Compounds	CAS No	Front µg/section	Back µg/section
	Aliphatic hydrocarbons (LOQ = 5µg/compound/section)					**Aromatic hydrocarbons** (LOQ = 1µg/compound/section)			
1	2-Methylbutane	*78-78-4*	ND	ND	39	Benzene	*71-43-2*	ND	ND
2	n-Pentane	*109-66-0*	ND	ND	40	Ethylbenzene	*100-41-4*	ND	ND
3	2-Methylpentane	*107-83-5*	ND	ND	41	Isopropylbenzene	*98-82-8*	ND	ND
4	3-Methylpentane	*96-14-0*	ND	ND	42	1,2,3-Trimethylbenzene	*526-73-8*	ND	ND
5	Cyclopentane	*287-92-3*	ND	ND	43	1,2,4-Trimethylbenzene	*95-63-6*	ND	ND
6	Methylcyclopentane	*96-37-7*	ND	ND	44	1,3,5-Trimethylbenzene	*108-67-8*	ND	ND
7	2,3-Dimethylpentane	*565-59-3*	ND	ND	45	Styrene	*100-42-5*	ND	ND
8	n-Hexane	*110-54-3*	ND	ND	46	Toluene	*108-88-3*	ND	ND
9	3-Methylhexane	*589-34-4*	ND	ND	47	p-Xylene &/or m-Xylene	*106-42-3 & 108-38-3*	ND	ND
10	Cyclohexane	*110-82-7*	ND	ND	48	o-Xylene	*95-47-6*	ND	ND
11	Methylcyclohexane	*108-87-2*	ND	ND		**Ketones** (LOQ #49, #54 & #55 =5µg/c/s; #50, #51, #52 & #53 =25µg/c/s)			
12	2,2,4-Trimethylpentane	*540-84-1*	ND	ND	49	Acetone	*67-64-1*	ND	ND
13	n-Heptane	*142-82-5*	ND	ND	50	Acetoin	*513-86-0*	ND	ND
14	n-Octane	*111-65-9*	ND	ND	51	Diacetone alcohol	*123-42-2*	ND	ND
15	n-Nonane	*111-84-2*	ND	ND	52	Cyclohexanone	*108-94-1*	ND	ND
16	n-Decane	*124-18-5*	ND	ND	53	Isophorone	*78-59-1*	ND	ND
17	n-Undecane	*1120-21-4*	ND	ND	54	Methyl ethyl ketone (MEK)	*78-93-3*	ND	ND
18	n-Dodecane	*112-40-3*	ND	ND	55	Methyl isobutyl ketone (MIBK)	*108-10-1*	ND	ND
19	n-Tridecane	*629-50-5*	ND	ND		**Alcohols** (LOQ = 25µg/compound/section)			
20	n-Tetradecane	*629-59-4*	ND	ND	56	Ethyl alcohol	*64-17-5*	ND	ND
21	α-Pinene	*80-56-8*	ND	ND	57	n-Butyl alcohol	*71-36-3*	ND	ND
22	β-Pinene	*127-91-3*	ND	ND	58	Isobutyl alcohol	*78-83-1*	ND	ND
23	D-Limonene	*138-86-3*	ND	ND	59	Isopropyl alcohol	*67-63-0*	ND	ND
	Chlorinated hydrocarbons (LOQ = 5µg/compound/section)				60	2-Ethyl hexanol	*104-76-7*	ND	ND
24	Dichloromethane	*75-09-2*	ND	ND	61	Cyclohexanol	*108-93-0*	ND	ND
25	1,1-Dichloroethane	*75-34-3*	ND	ND		**Acetates** (LOQ = 25µg/compound/section)			
26	1,2-Dichloroethane	*107-06-2*	ND	ND	62	Ethyl acetate	*141-78-6*	ND	ND
27	Chloroform	*67-66-3*	ND	ND	63	n-Propyl acetate	*109-60-4*	ND	ND
28	1,1,1-Trichloroethane	*71-55-6*	ND	ND	64	n-Butyl acetate	*123-86-4*	ND	ND
29	1,1,2-Trichloroethane	*79-00-5*	ND	ND	65	Isobutyl acetate	*110-19-0*	ND	ND
30	Trichloroethylene	*79-01-6*	ND	ND		**Ethers** (LOQ = 25µg/compound/section)			
31	Carbon tetrachloride	*56-23-5*	ND	ND	66	Ethyl ether	*60-29-7*	ND	ND
32	Perchloroethylene	*127-18-4*	ND	ND	67	*tert*-Butyl methyl ether (MTBE)	*1634-04-4*	ND	ND
33	1,1,2,2-Tetrachloroethane	*79-34-5*	ND	ND	68	Tetrahydrofuran (THF)	*109-99-9*	ND	ND
34	Chlorobenzene	*108-90-7*	ND	ND		**Glycols** (LOQ = 25µg/compound/section)			
35	1,2-Dichlorobenzene	*95-50-1*	ND	ND	69	PGME	*107-98-2*	ND	ND
36	1,4-Dichlorobenzene	*106-46-7*	ND	ND	70	Ethylene glycol diethyl ether	*629-14-1*	ND	ND
	Miscellaneous (LOQ #37= 5µg & #38=25µg/compound/section)				71	PGMEA	*108-65-6*	ND	ND
37	Acetonitrile	*75-05-8*	ND	ND	72	Cellosolve acetate	*111-15-9*	ND	ND
38	n-Vinyl-2-pyrrolidinone	*88-12-0*	ND	ND	73	DGMEA	*112-15-2*	ND	ND
	Total VOCs (LOQ =50µg/compound/section)		ND	ND		Worksheet check		yes	yes

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Analysis of Volatile Organic Compounds in Workplace Air by GC/MS

Client : Michael Brecko **Date Sampled : 4-Apr-2018**

Sample ID : 6479 **Reference Number le : 2018-1408-5**

No	Compounds	CAS No	Front µg/section	Back µg/section	No	Compounds	CAS No	Front µg/section	Back µg/section
	Aliphatic hydrocarbons (LOQ = 5µg/compound/section)					**Aromatic hydrocarbons** (LOQ = 1µg/compound/section)			
1	2-Methylbutane	*78-78-4*	ND	ND	39	Benzene	*71-43-2*	ND	ND
2	n-Pentane	*109-66-0*	ND	ND	40	Ethylbenzene	*100-41-4*	ND	ND
3	2-Methylpentane	*107-83-5*	ND	ND	41	Isopropylbenzene	*98-82-8*	ND	ND
4	3-Methylpentane	*96-14-0*	ND	ND	42	1,2,3-Trimethylbenzene	*526-73-8*	1	ND
5	Cyclopentane	*287-92-3*	ND	ND	43	1,2,4-Trimethylbenzene	*95-63-6*	ND	ND
6	Methylcyclopentane	*96-37-7*	ND	ND	44	1,3,5-Trimethylbenzene	*108-67-8*	ND	ND
7	2,3-Dimethylpentane	*565-59-3*	ND	ND	45	Styrene	*100-42-5*	ND	ND
8	n-Hexane	*110-54-3*	ND	ND	46	Toluene	*108-88-3*	14	ND
9	3-Methylhexane	*589-34-4*	ND	ND	47	p-Xylene &/or m-Xylene	*106-42-3 & 108-38-3*	ND	ND
10	Cyclohexane	*110-82-7*	ND	ND	48	o-Xylene	*95-47-6*	ND	ND
11	Methylcyclohexane	*108-87-2*	ND	ND		**Ketones** (LOQ #49, #54 & #55 =5µg/c/s; #50, #51, #52 & #53 =25µg/c/s)			
12	2,2,4-Trimethylpentane	*540-84-1*	ND	ND	49	Acetone	*67-64-1*	13	ND
13	n-Heptane	*142-82-5*	ND	ND	50	Acetoin	*513-86-0*	ND	ND
14	n-Octane	*111-65-9*	ND	ND	51	Diacetone alcohol	*123-42-2*	ND	ND
15	n-Nonane	*111-84-2*	ND	ND	52	Cyclohexanone	*108-94-1*	ND	ND
16	n-Decane	*124-18-5*	ND	ND	53	Isophorone	*78-59-1*	ND	ND
17	n-Undecane	*1120-21-4*	17	ND	54	Methyl ethyl ketone (MEK)	*78-93-3*	12	ND
18	n-Dodecane	*112-40-3*	18	ND	55	Methyl isobutyl ketone (MIBK)	*108-10-1*	ND	ND
19	n-Tridecane	*629-50-5*	ND	ND		**Alcohols** (LOQ = 25µg/compound/section)			
20	n-Tetradecane	*629-59-4*	ND	ND	56	Ethyl alcohol	*64-17-5*	ND	ND
21	α-Pinene	*80-56-8*	ND	ND	57	n-Butyl alcohol	*71-36-3*	ND	ND
22	β-Pinene	*127-91-3*	ND	ND	58	Isobutyl alcohol	*78-83-1*	ND	ND
23	D-Limonene	*138-86-3*	ND	ND	59	Isopropyl alcohol	*67-63-0*	ND	ND
	Chlorinated hydrocarbons (LOQ = 5µg/compound/section)				60	2-Ethyl hexanol	*104-76-7*	ND	ND
24	Dichloromethane	*75-09-2*	ND	ND	61	Cyclohexanol	*108-93-0*	ND	ND
25	1,1-Dichloroethane	*75-34-3*	ND	ND		**Acetates** (LOQ = 25µg/compound/section)			
26	1,2-Dichloroethane	*107-06-2*	ND	ND	62	Ethyl acetate	*141-78-6*	ND	ND
27	Chloroform	*67-66-3*	ND	ND	63	n-Propyl acetate	*109-60-4*	ND	ND
28	1,1,1-Trichloroethane	*71-55-6*	ND	ND	64	n-Butyl acetate	*123-86-4*	ND	ND
29	1,1,2-Trichloroethane	*79-00-5*	ND	ND	65	Isobutyl acetate	*110-19-0*	ND	ND
30	Trichloroethylene	*79-01-6*	ND	ND		**Ethers** (LOQ = 25µg/compound/section)			
31	Carbon tetrachloride	*56-23-5*	ND	ND	66	Ethyl ether	*60-29-7*	ND	ND
32	Perchloroethylene	*127-18-4*	ND	ND	67	*tert*-Butyl methyl ether (MTBE)	*1634-04-4*	ND	ND
33	1,1,2,2-Tetrachloroethane	*79-34-5*	ND	ND	68	Tetrahydrofuran (THF)	*109-99-9*	ND	ND
34	Chlorobenzene	*108-90-7*	ND	ND		**Glycols** (LOQ = 25µg/compound/section)			
35	1,2-Dichlorobenzene	*95-50-1*	ND	ND	69	PGME	*107-98-2*	ND	ND
36	1,4-Dichlorobenzene	*106-46-7*	ND	ND	70	Ethylene glycol diethyl ether	*629-14-1*	ND	ND
	Miscellaneous (LOQ #37= 5µg & #38=25µg/compound/section)				71	PGMEA	*108-65-6*	ND	ND
37	Acetonitrile	*75-05-8*	ND	ND	72	Cellosolve acetate	*111-15-9*	ND	ND
38	n-Vinyl-2-pyrrolidinone	*88-12-0*	ND	ND	73	DGMEA	*112-15-2*	ND	ND
	Total VOCs (LOQ =50µg/compound/section)		237	ND		Worksheet check		yes	yes

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ilac-MRA NATA

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Analysis of Volatile Organic Compounds in Workplace Air by GC/MS

Client : Michael Brecko

ND = Not Detected

Method : Analysis of Volatile Organic Compounds in Workplace Air by Gas Chromatography/Mass Spectrometry
Method Number : WCA.207
Limit of Quantitation : 5µg/section; 25µg/section for oxygenated hydrocarbons except acetone, MEK and MIBK at 5µg/section.
Brief Description : Volatile organic compounds are trapped from the workplace air onto charcoal tubes by the use of a personal air monitoring pump. The volatile organic compounds are then desorbed from the charcoal in the laboratory with CS_2. An aliquot of the desorbant is analysed by capillary gas chromatography with mass spectrometry detection.

PGME : Propylene Glycol Monomethyl Ether
PGMEA : Propylene Glycol Monomethyl Ether Acetate
DGMEA : Diethylene Glycol Monoethyl Ether Acetate

Measurement Uncertainty
The measurement uncertainty is an estimate that characterises the range of values within which the true value is asserted to lie. The uncertainty estimate is an expanded uncertainty using a coverage factor of 2, which gives a level of confidence of approximately 95%. The estimate is compliant with the "ISO Guide to the Expression of Uncertainty in Measurement" and is a full estimate based on in-house method validation and quality control data.

Quality Assurance
In order to ensure the highest degree of accuracy and precision in our analytical results, we undertake extensive intra- and inter-laboratory quality assurance (QA) activities. Within our own laboratory, we analyse laboratory and field blanks and perform duplicate and repeat analysis of samples. Spiked QA samples are also included routinely in each run to ensure the accuracy of the analyses. WorkCover Laboratory Services has participated for many years in several national and international inter-laboratory comparison programs listed below:-
- Workplace Analysis Scheme for Proficiency (WASP) conducted by the Health & Safety Executive UK;
- Quality Management in Occupational and Environmental Medicine QA Program, conducted by the Institute for Occupational, Social and Environmental Medicine, University of Erlangen – Nuremberg, Germany;
- Quality Control Technologies QA Program, Australia;
- Royal College of Pathologists QA Program, Australia.

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NSW GOVERNMENT | SafeWork NSW

Test Safe AUSTRALIA

Michael Brecko
SLR Consulting Australia Pty Ltd
Level 2
2 Lincoln Street
LANE COVE NSW 2066

Lab. Reference: 2018-1409

SAMPLE ORIGIN: Project No. 610.17717.00100.0020

DATE OF INVESTIGATION: 4th April 2018 **DATE RECEIVED:** 5/04/18

ANALYSIS REQUIRED: Inorganic Acid Screen

REPORT OF ANALYSIS

See attached sheet(s) for sample description and test results.

The results of this report have been approved by the signatory whose signature appears below.

For all administrative or account details please contact the Laboratory.

Increment and total pagination can be seen on the following pages.

Martin Mazereeuw
Manager

Date: 13/04/18

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Test Safe AUSTRALIA

Analysis of Inorganic Acids in Air

Client : Mr M. Brecko

SLR Consulting

Date Sampled: 04 Apr 2018

Reference Number	Sample ID	Hydrofluoric Acid (µg/Sample)	
		Front Section	Back Section
2018-1409-1	6481	ND	ND
2018-1409-2	6482	ND	ND
2018-1409-3	6484	ND	ND
2018-1409-4	6485	ND	ND
2018-1409-5	6486	ND	ND

Reference Number	Sample ID	Hydrochloric Acid (µg/Sample)	
		Front Section	Back Section
2018-1409-1	6481	ND	ND
2018-1409-2	6482	ND	ND
2018-1409-3	6484	ND	ND
2018-1409-4	6485	ND	ND
2018-1409-5	6486	ND	ND

Reference Number	Sample ID	Hydrobromic Acid (µg/Sample)	
		Front Section	Back Section
2018-1409-1	6481	ND	ND
2018-1409-2	6482	ND	ND
2018-1409-3	6484	ND	ND
2018-1409-4	6485	ND	ND
2018-1409-5	6486	ND	ND

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Analysis of Inorganic Acids in Air

Client : Mr M. Brecko

Reference Number	Sample ID	Nitric Acid (µg/Sample)	
		Front Section	Back Section
2018-1409-1	6481	ND	ND
2018-1409-2	6482	ND	ND
2018-1409-3	6484	ND	ND
2018-1409-4	6485	ND	ND
2018-1409-5	6486	ND	ND

Reference Number	Sample ID	Sulphuric Acid (µg/Sample)	
		Front Section	Back Section
2018-1409-1	6481	ND	ND
2018-1409-2	6482	ND	ND
2018-1409-3	6484	ND	ND
2018-1409-4	6485	ND	ND
2018-1409-5	6486	ND	ND

Reference Number	Sample ID	Phosphoric Acid (µg/Sample)	
		Front Section	Back Section
2018-1409-1	6481	ND	ND
2018-1409-2	6482	ND	ND
2018-1409-3	6484	ND	ND
2018-1409-4	6485	ND	ND
2018-1409-5	6486	ND	ND

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Analysis of Inorganic Acids in Air

Client : Mr M. Brecko

The samples have not been blank corrected.

ND = Not Detected
Method : Analysis of Inorganic Acids (Anions) in Air by Liquid Ion-Chromatography
Method No : WCA.194
Detection Limit : 2.5 µg Acid/Sample
Brief Description : This method is applicable to the determination of hydrochloric acid, phosphoric acid, ortho-phosphoric acid, meta-phosphoric acid, hydrobromic acid, nitric acid, nitrous acid, hydrofluoric acid and sulphuric acid mists in workplace air. The acids are collected onto silica gel sorbent tubes or cellulose ester filters. They were then desorbed with millipore water and determined as their corresponding anion by liquid ion-chromatography with conductivity detection.

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Test Safe AUSTRALIA

Michael Brecko
SLR Consulting
Level 2, 15 Astor Terrace
SPRING HILL QLD 4000

Lab. Reference: 2018-1458

SAMPLE ORIGIN: Project No. 610.17717.00100.0020

DATE OF INVESTIGATION: 11/04/2018 **DATE RECEIVED:** 11/04/18

ANALYSIS REQUIRED: Glycols

REPORT OF ANALYSIS

See attached sheet(s) for sample description and test results.

The results of this report have been approved by the signatory whose signature appears below.

For all administrative or account details please contact the Laboratory.

Increment and total pagination can be seen on the following pages.

Martin Mazereeuw
Manager

Date: 30/04/18

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Analysis of Glycols in Air

Client: Michael Brecko

SLR Consulting

Date Sampled: 11-Apr-18

Sample ID	6524		6525		6526	
Reference Number	2018-1458-1		2018-1458-2		2018-1458-3	
	Front Section	Back Section	Front Section	Back Section	Front Section	Back Section
Chemical Compounds	mg/section	mg/section	mg/section	mg/section	mg/section	mg/section
Ethylene glycol	ND	ND	ND	ND	ND	ND
Propylene glycol	ND	ND	ND	ND	ND	ND
1,3-Butylene glycol	ND	ND	ND	ND	ND	ND
Diethylene glycol	ND	ND	ND	ND	ND	ND
Triethylene glycol	ND	ND	ND	ND	ND	ND

Sample ID	6527		6528	
Reference Number	2018-1458-4		2018-1458-5	
	Front Section	Back Section	Front Section	Back Section
Chemical Compounds	mg/section	mg/section	mg/section	mg/section
Ethylene glycol	ND	ND	ND	ND
Propylene glycol	ND	ND	ND	ND
1,3-Butylene glycol	ND	ND	ND	ND
Diethylene glycol	ND	ND	ND	ND
Triethylene glycol	ND	ND	ND	ND

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SW08052 1215

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Analysis of Glycols in Air

Client: Michael Brecko

SLR Consulting

Date Sampled: 11-Apr-18

ND = Not Detected

Method : Analysis of Glycols in Air by Gas Chromatography

Method Number : WCA.209
Limit of Quantitation : 25 µg/sample for Ethylene glycol, Propylene glycol and 1,3-Butylene glycol.
50 µg/sample for Diethylene glycol and Triethylene glycol.

Brief Description : Glycols in air trapped on XAD-7 tube are desorbed in the laboratory with methanol and an aliquot of the desorbant is analysed by gas chromatography with mass spectroscopy.

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SW08052 1215

APPENDIX B – DETAILED EMISSIONS INVENTORY

Parameter	Value	Units	Sample #	Reference	Notes	Detection Limit (µg/sample)	Sampling volumetric flowrate (L/min)	Sampling duration (min)	Concentration (ou)
Odour									
Tank Farm 1	41	ou	6467	The Odour Unit Project number: N1869R					41
Tank Farm 2	45	ou	6468	The Odour Unit Project number: N1869R					45
Processing area	45	ou	6470	The Odour Unit Project number: N1869R					45
Workshop	45	ou	6471	The Odour Unit Project number: N1869R					45
Final product area	76	ou	6472	The Odour Unit Project number: N1869R					76
Parameter	**Value**	**Units**	**Sample #**	**Reference**	**Notes**	Detection Limit (µg/sample)	Sampling volumetric flowrate (L/min)	Sampling duration (min)	Concentration ($\mu g/m^3$)
VOC Results									
Tank Farm 1	ND	µg/sample	6474	TestSafe report number: 2018-1408	ND for all speciated VOCs		0.232	25	-
Tank Farm 2	ND	µg/sample	6475	TestSafe report number: 2018-1408	ND for all speciated VOCs		0.232	25	-
Processing area	ND	µg/sample	6477	TestSafe report number: 2018-1408	ND for all speciated VOCs		0.232	45	-
Workshop	ND	µg/sample	6478	TestSafe report number: 2018-1408	ND for all speciated VOCs		0.211	45	-
Final product area									-
n-Undecane	17	µg/sample	6479	TestSafe report number: 2018-1408	No criterion				-
n-Dodecane	18	µg/sample	6479	TestSafe report number: 2018-1408	No criterion				-
1,2,3 - Trimethylbenzene	1	µg/sample	6479	TestSafe report number: 2018-1408			0.238	45	93
Toluene	14	µg/sample	6479	TestSafe report number: 2018-1408			0.238	45	1,308
Acetone	13	µg/sample	6479	TestSafe report number: 2018-1408			0.238	45	1,214
Methyl ethyl ketone (MEK)	12	µg/sample	6479	TestSafe report number: 2018-1408			0.238	45	1,121
Total VOCs	237	µg/sample	6479	TestSafe report number: 2018-1408	No criterion		-	-	-
Acid Screen Results									
Tank Farm 1	ND	µg/sample	6481	TestSafe report number: 2018-1409		2.5	0.557	25	180
Tank Farm 2	ND	µg/sample	6482	TestSafe report number: 2018-1409		2.5	0.557	25	180
Processing area	ND	µg/sample	6484	TestSafe report number: 2018-1409		2.5	0.557	45	100
Workshop	ND	µg/sample	6485	TestSafe report number: 2018-1409		2.5	0.500	45	111
Final product area	ND	µg/sample	6486	TestSafe report number: 2018-1409		2.5	0.579	45	96
Ethylene Glycol Results									
Tank Farm 1	ND	µg/sample	6524	TestSafe report number: 2018-1458		25	0.965	31	836
Tank Farm 2	ND	µg/sample	6525	TestSafe report number: 2018-1458		25	0.965	33	785
Processing area	ND	µg/sample	6526	TestSafe report number: 2018-1458		25	1.124	31	717
Workshop	ND	µg/sample	6527	TestSafe report number: 2018-1458		25	1.062	32	736
Final product area	ND	µg/sample	6528	TestSafe report number: 2018-1458		25	1.033	31	781

APPENDIX C - SELECTION OF REPRESENTATIVE METEOROLOGICAL DATA

In dispersion modelling, one of the key considerations is the representative nature of the meteorological data used. Once emitted to atmosphere, emissions will:

- Rise according to the momentum and buoyancy of the emission at the discharge point relative to the prevailing atmospheric conditions;
- Be adverted from the source according to the strength and direction of the wind at the height which the plume has risen in the atmosphere;
- Be diluted due to mixing with the ambient air, according to the intensity of turbulence; and
- (Potentially) be chemically transformed and/or depleted by deposition processes.

Dispersion is the combined effect of these processes.

Dispersion modelling is used as a tool to simulate the air quality effects of specific emission sources, given the meteorology typical for a local area together with the expected emissions. Selection of a year when the meteorological data is atypical means that the resultant predictions may not appropriately represent the most likely air quality impacts.

The year of meteorological data used for the dispersion modelling was selected by reviewing the most recent five years of historical surface observations at Liverpool AQMS (2013 to 2017 inclusive) to determine the year that is most representative of long-term conditions. Wind direction, wind speed and ambient temperature were compared to long term averages for the region to determine the most representative year.

Data collected from 2013 to 2017 is summarised in **Figure A1** to **Figure A3**. Examination of the data indicates the following:

- **Figure A1** indicates relatively similar wind roses for all five years analysed
- **Figure A2** indicates that 2013 and 2015 exhibit wind speeds that are closest to the long term average
- **Figure A3** shows that temperatures in 2015 more closely reflect the long term average

Years 2013 and 2015 indicate average wind speeds that are slightly lower than the long term average. Using these years as the representative year would therefore be a conservative approach because low wind speeds are associated with less effective plume dispersion. No other parameters significantly deter the use of any one of these years of data. Consequently, 2015 was selected as the representative year of meteorology.

Figure A1 Frequency of Winds at Liverpool AQMS for 2013 – 2017

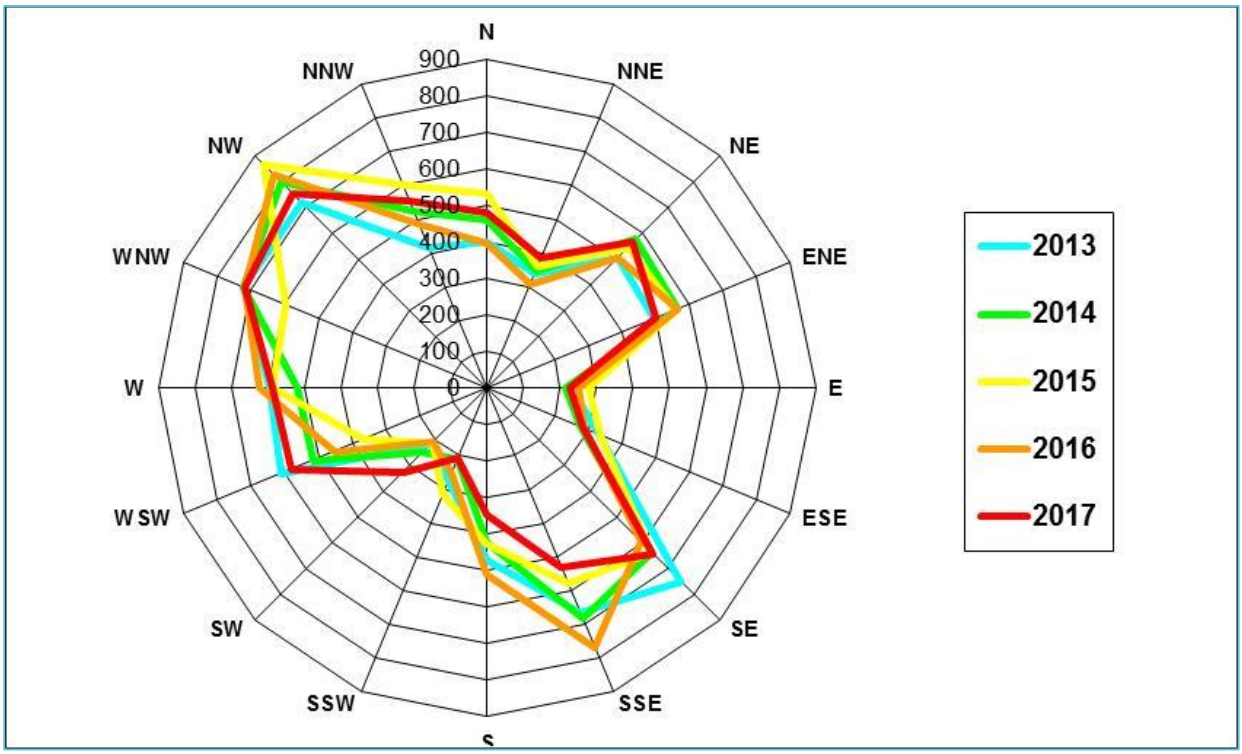


Figure A2 Monthly Average Wind Speed at Liverpool AQMS for 2013 – 2017

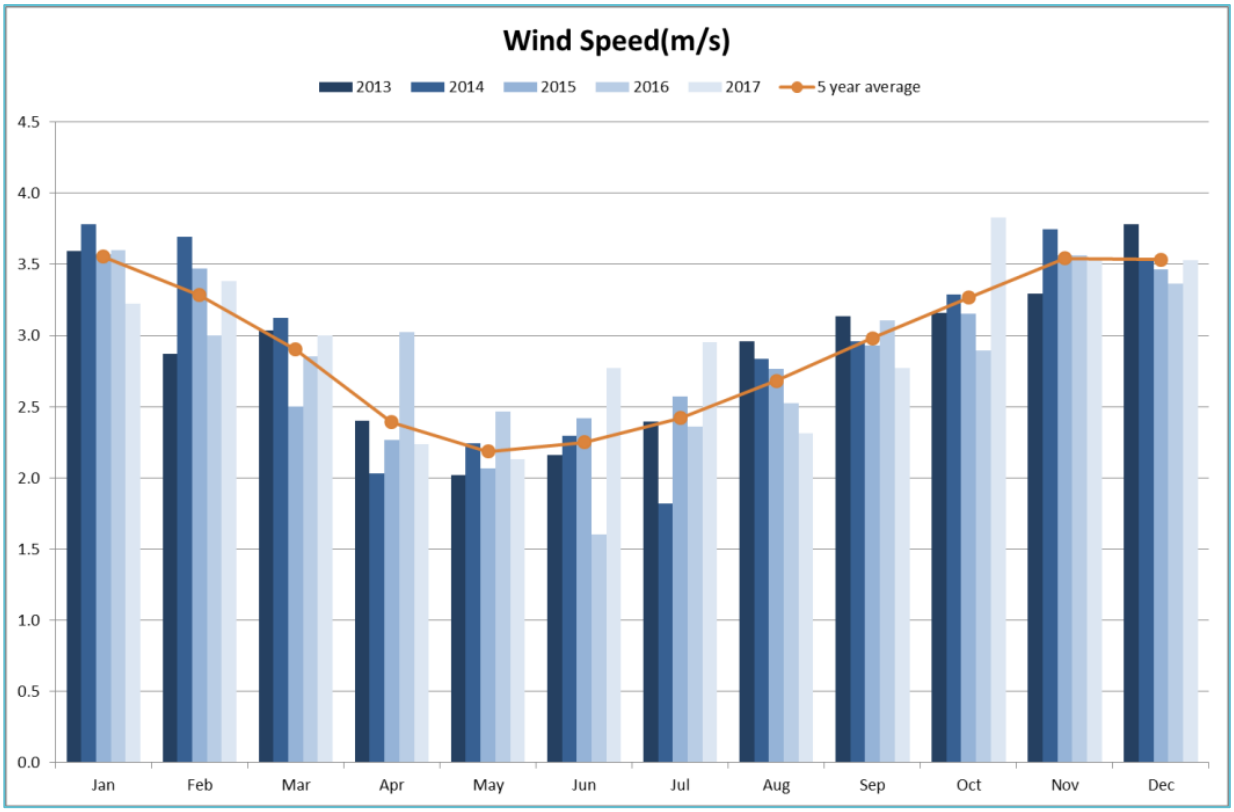
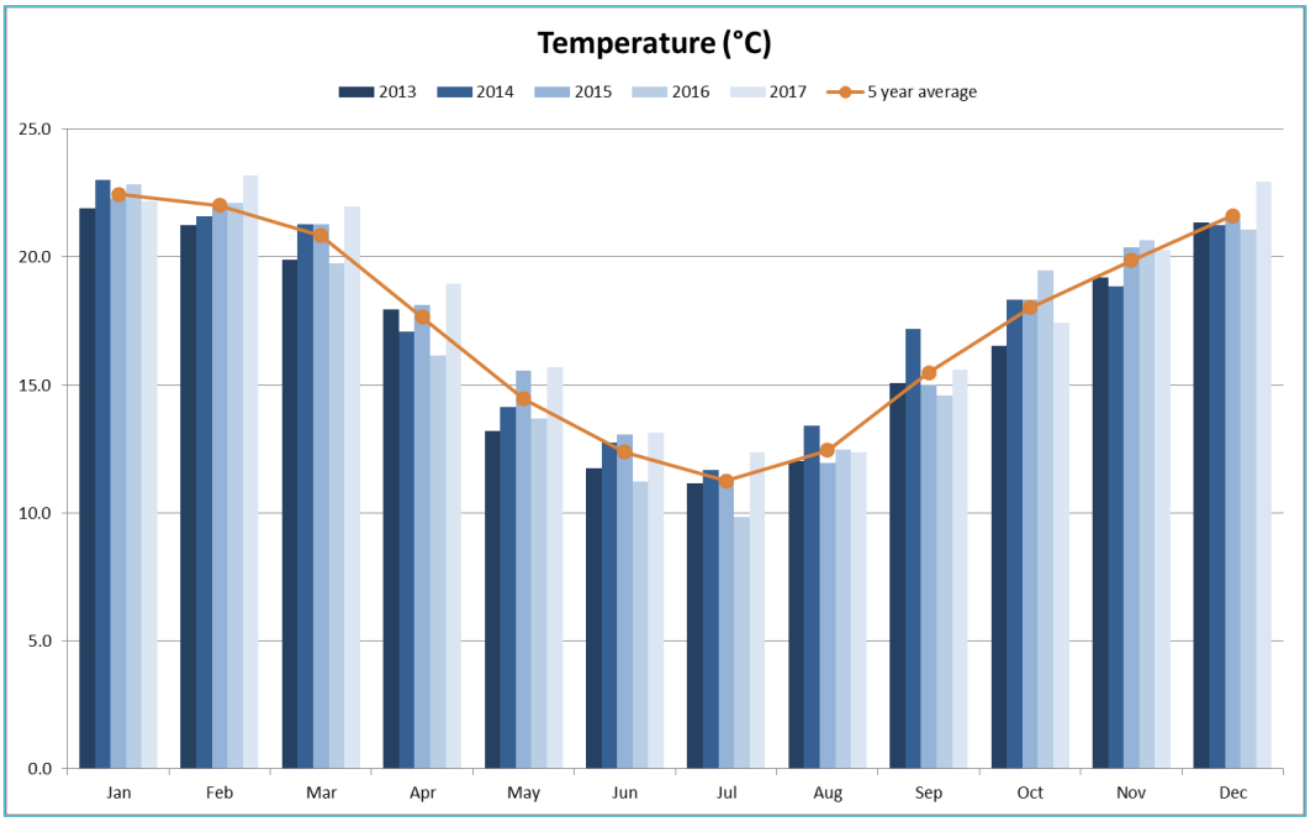


Figure A3 Monthly Average Temperature at Liverpool AQMS for 2013 – 2017



APPENDIX D – MODELLING RESULTS FOR OTHER VOLATILE ORGANIC COMPOUNDS

Pollutant	Detection Limit (µg/compound)	Modelled 99.9th Percentile Concentration (Maximum at boundary) (mg/m^3)	Criteria (mg/m^3)	Exceedance	Percentage of Criteria
1,1,1-trichloroethane	5	0.0150	12.5	No Exceedance	0.1%
1,1,2-trichloroethane	5	0.0150	1	No Exceedance	1.5%
1,2-dichloroethane (ethylene dichloride)	5	0.0150	0.07	No Exceedance	21.4%
Acetone	5	0.0150	22	No Exceedance	0.1%
Benzene	1	0.0030	0.029	No Exceedance	10.3%
Chlorobenzene	5	0.0150	0.1	No Exceedance	15.0%
Chloroform	5	0.0150	0.9	No Exceedance	1.7%
Cyclohexane	5	0.0150	19	No Exceedance	0.1%
Cyclohexanol	25	0.0748	3.8	No Exceedance	2.0%
Cyclohexanone	25	0.0748	0.26	No Exceedance	28.8%
Diacetone alcohol	25	0.0748	0.7	No Exceedance	10.7%
Diacetone alcohol	25	0.0748	0.7	No Exceedance	10.7%
Ethanol	25	0.0748	2.1	No Exceedance	3.6%
Ethyl acetate	25	0.0748	12.1	No Exceedance	0.6%
Ethylbenzene	1	0.0030	8	No Exceedance	0.0%
Methyl isobutyl ketone	5	0.0150	0.23	No Exceedance	6.5%
Methylene chloride (dichloromethane)	5	0.0150	3.19	No Exceedance	0.5%
n-Butanol	25	0.0748	0.5	No Exceedance	15.0%
n-butyl acetate	25	0.0748	1.02	No Exceedance	7.3%
n-hexane	5	0.0150	3.2	No Exceedance	0.5%

Pollutant	Detection Limit (µg/compound)	Modelled 99.9th Percentile Concentration (Maximum at boundary) (mg/m^3)	Criteria (mg/m^3)	Exceedance	Percentage of Criteria
n-pentane	5	0.0150	33	No Exceedance	0.0%
Perchlorethylene	5	0.0150	3.5	No Exceedance	0.4%
Propylene glycol monomethyl ether	25	0.0748	6.6	No Exceedance	1.1%
Styrene	1	0.0030	0.12	No Exceedance	2.5%
Trichloroethylene	5	0.0150	0.5	No Exceedance	3.0%
Trimethylbenzene	1	0.0030	2.2	No Exceedance	0.1%
Xylenes	1	0.0030	0.19	No Exceedance	1.6%

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