Environodour AUSTRALIA PTY LTD

We make scents of odour

Consulting Report

On

Air Quality Impact Assessment at 3/132 Newton Street, Wetherill Park NSW

Prepared

By

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CAQP, CASANZ

11 April 2023

Goterra Pty Ltd

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1 Background

EnvironOdour Australia (EnvironOdour) has been engaged by Goterra Pty Ltd (Goterra) to prepare air quality impact assessment for a proposed development at 3/132 Newton Road, Wetherill Park (Lot 11 DP 747795) NSW.

Goterra uses a unique modular facility based on shipping containers to process food waste and grow soldier fly larvae. This latter conversion process uses less than 1 litre of water per kilogram of insect protein, and creates a meal of dehydrated larvae that is fed to chickens, fish, and other non-ruminants requiring animal protein in their diet.

Goterra is currently operating a start-up plant in Canberra. Using black soldier fly larvae, Hermetia illucens, Goterra diverts up to 45,000 t of organic waste from Canberra's landfills at their existing waste management facility, located at 12 – 14 Arnott Street, Hume, ACT (the Facility).

This development proposal is for the set-up of a similar facility in Sydney to process up to 4,800 tonnes per annum of received organics on the proposed site. This will involve the receival, storage and processing of compostable waste and the export of fertiliser frass and protein. Goterra has received the Planning Secretary's Environmental Assessment Requirements (SEARs) for the preparation of an Environmental Impact Statement (EIS) for the above development proposal. One of the key issues is to address:

- **air quality and odour** – including:
  - a description of all potential sources of air and odour emissions during construction and operation
  - an air quality impact assessment in accordance with relevant Environment Protection Authority guidelines
  - predicted cumulative impacts given existing impacts on air quality within the area
  - a description and appraisal of air quality impact mitigation and monitoring measures.

This report describes the methodology for an air and odour sampling program at the Canberra facility and the procedures for air quality impact assessment in accordance with the Environmental Protection Authority (EPA), New South Wales (*EPA Technical Framework for Assessment and Management of Odours, November 2006*). It presents the likelihood of odour impacts from the proposed operation at the proposed site.

2 Objectives

The scope of work will include the following tasks:

- Air sampling for carbon dioxide, ammonia, hydrogen sulfide, ethyl alcohol, VOCs and odour at the existing factory
- Odour concentration analysis per AS/NZS 4323:3 - 2001: Stationary Source Emissions – Determination of Odour Concentration by Dynamic Olfactometry

- Purchasing meteorological data from BOM weather observation station and formatting them into an Ausplume air dispersion model compatible file
- Carrying out a Level 3 odour impact assessment using Ausplume air dispersion modelling following NSW EPA's Technical framework Assessment and management of odour from stationary sources in NSW
- Prepare the odour report per NSW EPA's Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales.

3 Site description

The site (Unit 3, 132 Newton Road Wetherill Park NSW) is an industrial warehouse unit in a complex of several similar warehouses. The site (as marked by a red line in Figure 1) is located on the northern side of the Wetherill Park industrial area. It is proposing a 24/7 operation for the new factory.

Figure 1 Aerial view of the site

The building has an area of 30 x 84 meters and a height of 6 m with an approximate floor area of 2500 m^2 (see Figure 2). The residents are situated in the south-east, south and south-west. The closest residents are about 1400 meters in the south.

The whole building is divided into waste receival, Modular Infrastructure Biological services (MIBs), processing, storage and despatch areas. There are also several functioning areas including dry store, microwave, loading docks, washing bays and offices. The locations of the stacks are highlighted with yellow dots.

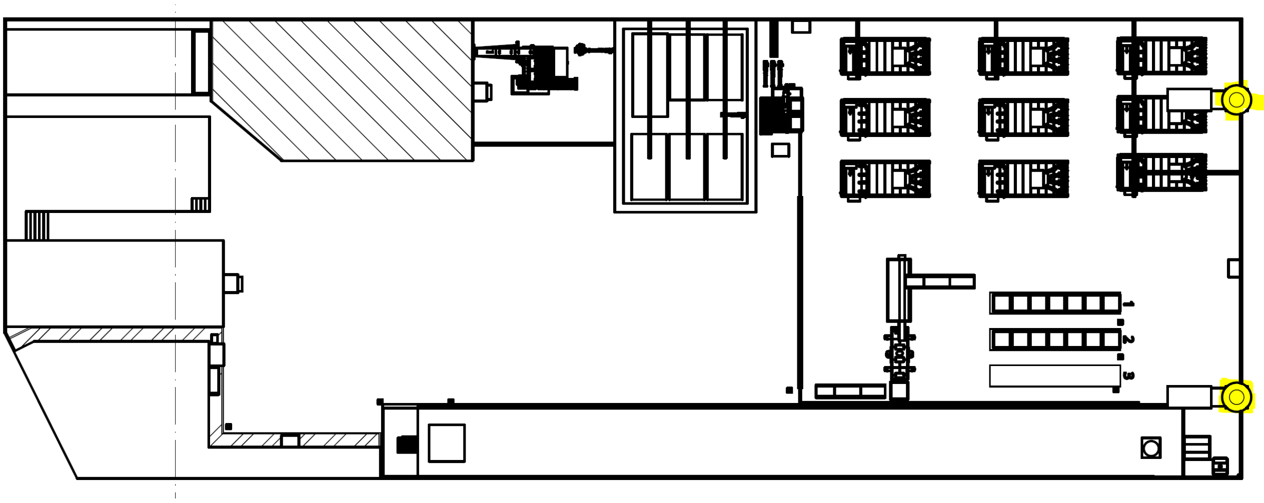

Figure 2 The proposed ground floor plan and the stack positions

The process flow chart is shown in Figure 3. The process includes waste receival, non-organics/organics sorting/separation, maceration, fermentation, feeding, organic conversion to frass and live larvae (MIBs) and processing (drying of larvae to insect protein) to final product storage.

Food waste will be received at Goterra's NSW facility (Wetherill Park) 24/6 from Mondays to Saturdays.

The waste receival area - which is dedicated for offloading - will be bunded and sloped, and will have an apron. These features prevent both food waste and leachate spills. The organic waste is first separated from the plastic package, to then be screened and moved onto a chevron conveyor belt for sorting and processing the same day it is received. This area is enclosed to stop the odour from escaping to other areas. An exhaust fan will create negative pressure in the area to push the odour through a chemical scrubber.

The organic waste is finally macerated and pumped into 6 dedicated storage tanks. This organic matter will be stored at the receival area for a minimum period of 3 days to ensure enzyme availability through natural fermentation. The storage tanks are covered and fitted with vent valves and filtration systems to mitigate any odour discharge.

The organics then undergo inline moisture testing and pass through a screw press / strain press. The strain press ensures that the organic material is reduced to a specific moisture which is suitable for food waste conversion. This flows into the separated processing area that houses the MIBs where the soldier fly larvae are added.

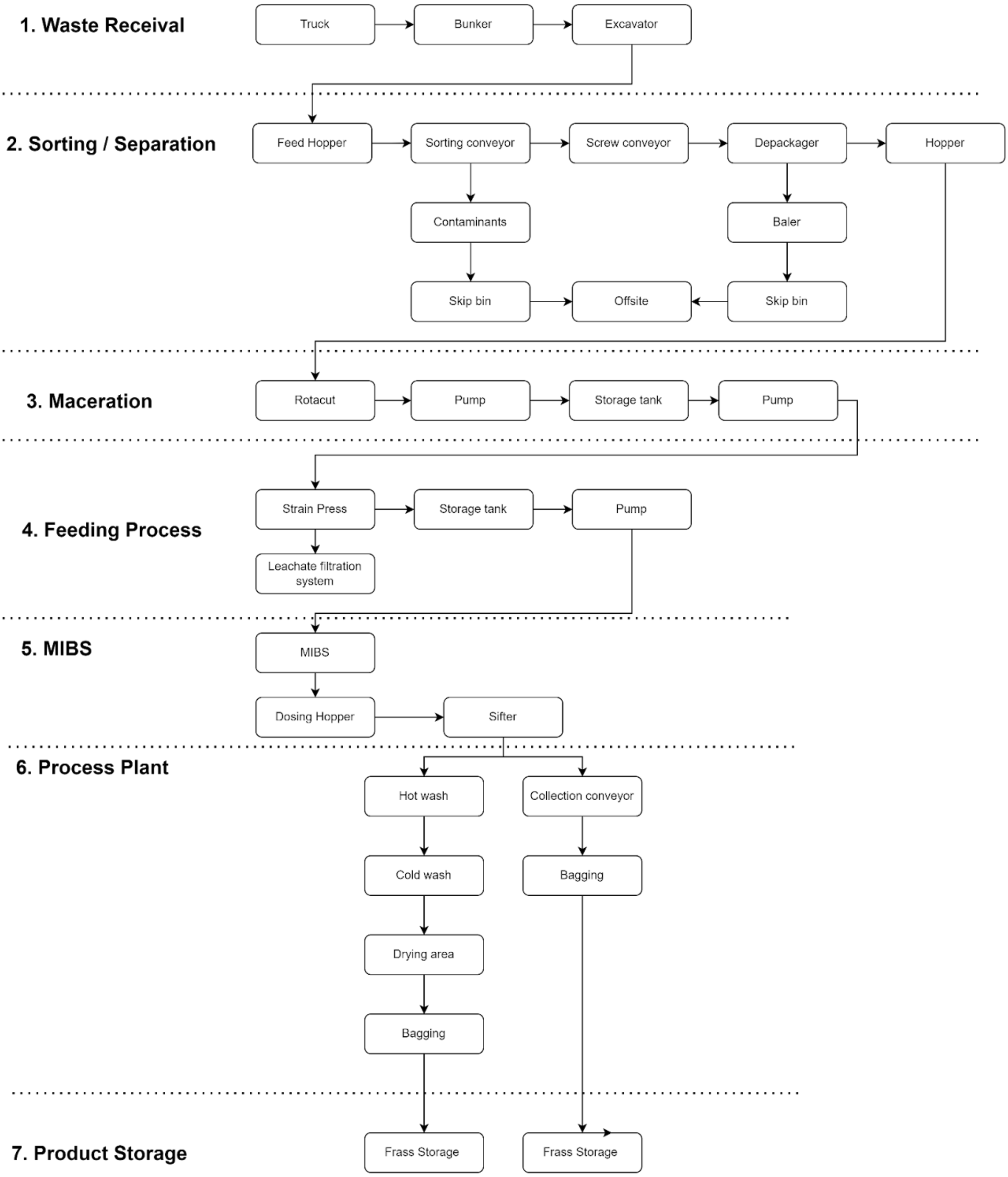

Figure 3 Production process flow chart

There are 9 MIBs placed onsite. Each unit operates independently. However, they are all controlled from a central distribution system. These units are constructed from 20ft shipping containers and designed to control an environment suitable for food waste conversion using the black soldier fly. A complete food conversion cycle takes approximately 10-14 days per unit for the soldier fly larvae to complete their feed ration within these MIBs. Digestion of the waste by the larvae will emit natural respiratory gases which includes carbon dioxide as part of the aerobic process. The system is designed to ensure high air exchanges within the units to prevent any build-up of respiratory gases.

The extraction system built into the roof of the MIB has a charcoal biofilter for odour absorption, which will be serviced monthly. The intake fans deliver air to the MIBs to ensure the environment remains aerobic and to supply oxygen to the larvae.

At the end of the food waste conversion, a mechanical sifter separates the larvae and frass. The larvae are held for two hours and then sent for a hot wash and a cold wash. The larvae are moved through an air blower to remove any trapped water and then dried in the continuous microwave drying process.

The frass is bagged into 1000Kg bulk bags and is then ready for distribution.

4 Methodology

Air quality is measured by determining the air impurities generated from the relevant activities such as volatile organic compounds (VOCs) and inorganic gases. The air sampling program is designed to capture these compounds and analyse them for their concentrations.

The primary factors which affect the extent of the odour impact are the odour emission rates and atmospheric conditions. The odour concentrations were surveyed in an odour audit. The study used the Ausplume air dispersion model to predict the offsite odour impact in the nearby areas. By changing the input conditions (odour emission rates) the offsite odour impact can be predicted and studied.

4.1 Canberra Hume facility

Goterra operates a pilot waste management facility at 12 - 14 Arnott Street, Hume, Canberra, ACT. On the 16th of March, a site inspection was carried out to determine the sampling locations. The layout drawing digram is shown in Figure 4.

Air samples at four odour emission sources were collected from the facility. These are:

- Receiving area
- MIBS
- Frass storage
- Processing area

For more details, please refer to Appendix 4 Photos.

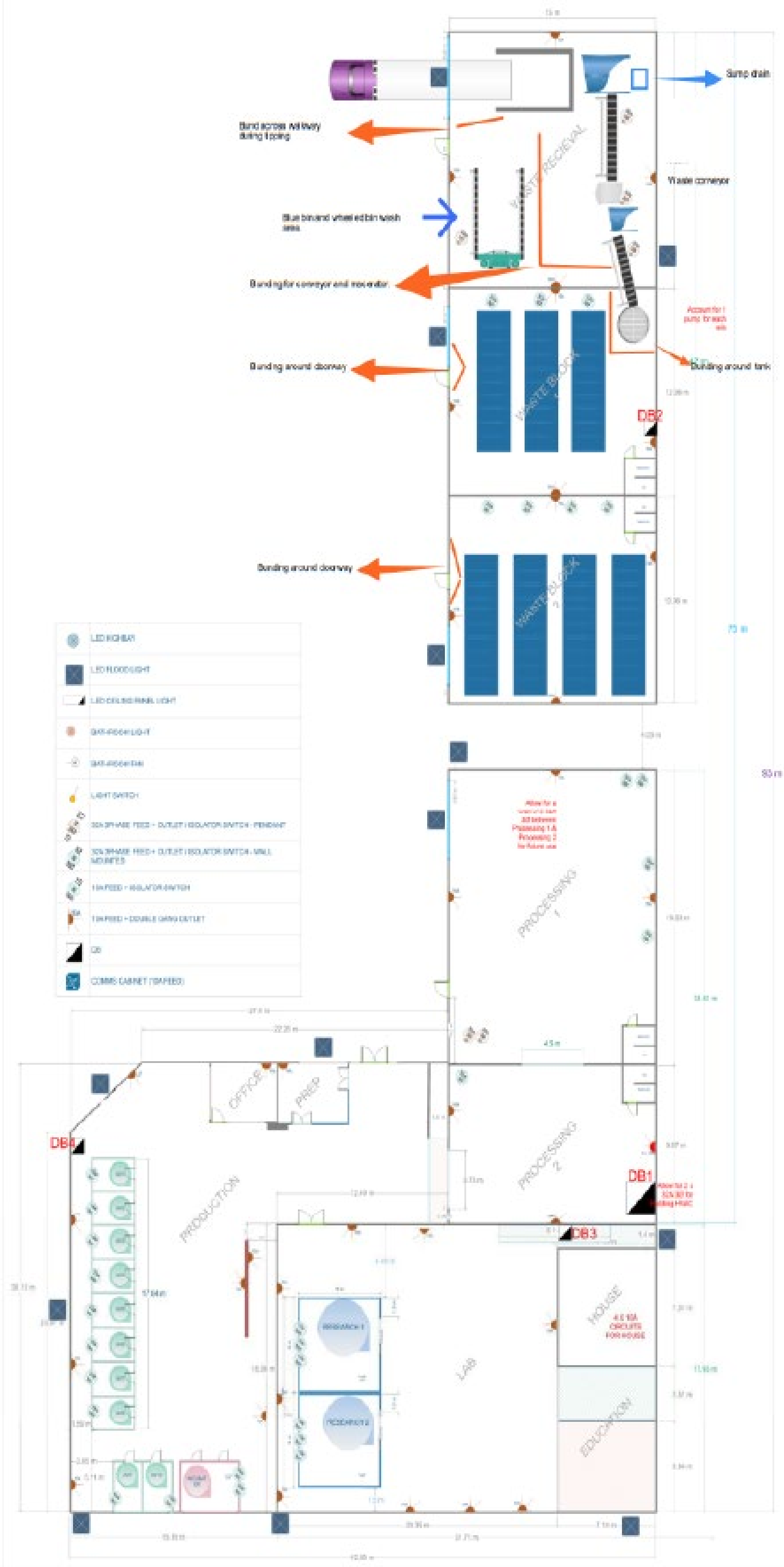

Figure 4 The layout drawing of the Hume Facility.

4.2 Sample collection

The collection and testing of odour samples were carried out according to the EPA document 'Approved methods for the sampling and analysis of air pollutants in NSW'. In this document, the selection of sampling positions must be done according to the Australian standard *AS 4323.1 Stationary source emissions, method 1: selection of sampling positions*. As the sampling involves gaseous emissions, Appendix B sets out the relevant requirements.

All the odour samples were collected in Nalophan sampling bags using a vacuum sampling drum (Figure 4). To avoid sample losses, a thicker Nalophan (25 microns) was used. The sampling time for each sample was approximately 180 seconds. The sampling volume for each sample was between 4 and 12 litres depending on the estimated odour strength.

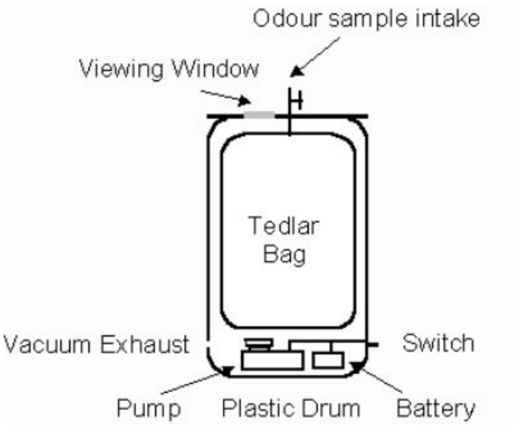

Figure 5 Schematic of DynaDrum sampling system

All sampling equipment used in the study was constructed using stainless steel, PTFE or Nalophan. The sampling bags were constructed out of Nalophan and are valid for a single use only. This ensures there is no cross-contamination between samples. A new sampling tube was used for each sample point.

All the samples were transported back to the EnvironOdour laboratory for olfactometry testing the next morning.

4.3 Odour concentration measurement

The strength of an environmental odour is determined as an 'odour concentration', which is the number of times a sample needs to be diluted to arrive at the odour threshold. By definition, the odour threshold corresponds to an odour concentration of one odour unit per cubic metre (i.e. 1 OU/m^3). Odour testing was carried out using dynamic olfactometry in accordance with the Australian standard AS/NZS 4323.3:2001 *Determination of odour concentration by dynamic olfactometry*.

Odour measurement was performed using the DynaScent Digital Olfactometer (Figure 5), one of the proprietary products from EnvironOdour Australia. A panel of four trained panellists were used to assess the odour samples. As required in the standard, the assessors are first trained and screened using 60000 ppb n-butanol standard reference gas. After 10 panel sessions, the average and standard deviation of the n-butanol thresholds are calculated. If the n-butanol odour threshold of an assessor is between 20-80 ppb and their standard deviation is less than 2.3, the assessor can become an odour panellist.

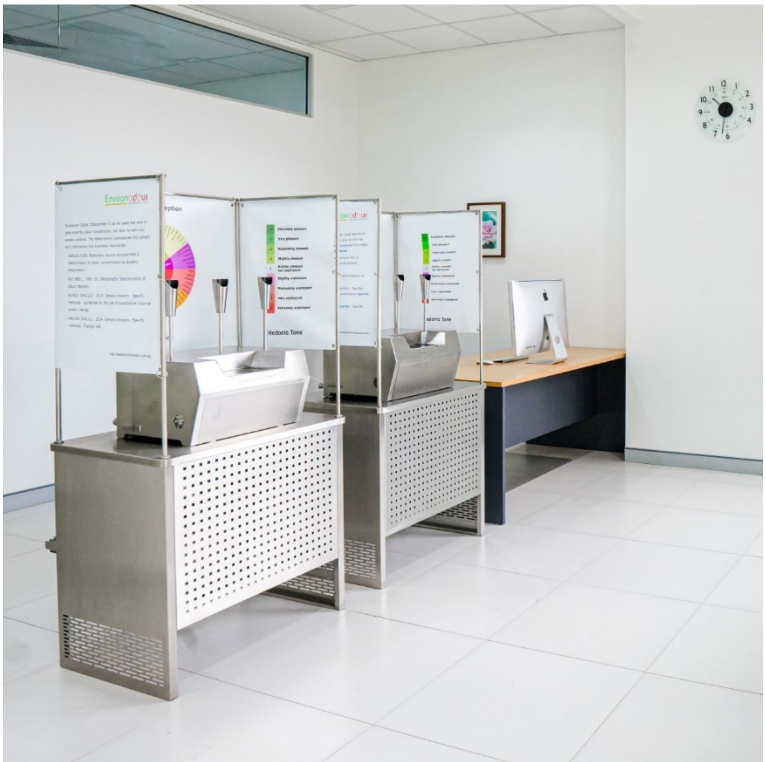

Figure 6 EnvironOdour DynaScent olfactometers

The odorous gas sample was presented at decreasing dilutions to one of three sniffing cups at random while the other two cups contain only odourless air. For each dilution ratio, each panellist sniffed the three ports and chose one as the one with the odorous sample (i.e. making a 'forced choice'). In addition to their forced choice among the three cups, the panellists were required to indicate whether their confidence during the assessment was based on a 'guess', 'inkling' or 'certainty'. The process was then repeated with increasing concentrations presented at the sniffing cups at regular intervals until all the panellists chose the correct cup with certainty. This is one round. For the purpose of measuring odour concentration, two rounds are required for each sample.

4.4 CO_2 gas monitor

A handheld CO_2 sensor (Q-Trak 7575) with datalogging capability was set up on a table placed near the vents from MIBs to record the CO_2 concentrations over 24 hours. The datalogging interval on the CO_2 monitor was one minute over the entire sampling period. The measurement range for the monitor is 0-5000 ppm.

During the sampling period, the building was shut to minimise unnecessary interference.

4.5 VOCs sampling

Active air sampling is an accurate way of measuring any contamination in the air. This is a standard air sampling method for checking indoor air quality recommended by NSW TestSafe. A total of 4 air samples at these sampling locations were taken. The air is drawn into an Anasorb coconut charcoal sorbent tube (supplied by SKC) at a sampling rate of 200 ml/min over 4 hours (half the work shift). The tubes are sealed and stored in a cool bag to prevent any sample losses.

Table 1 List of 73 VOCs and their LOQs

	Aliphatic hydrocarbons (LOQ = 5μg)		Aromatic hydrocarbons (LOQ = 1μg)
1	2-Methylbutane	39	Benzene and TVOC
2	n-Pentane	40	Ethylbenzene
3	2-Methylpentane	41	Isopropylbenzene
4	3-Methylpentane	42	1,2,3-Trimethylbenzene
5	Cyclopentane	43	1,2,4-Trimethylbenzene
6	Methylcyclopentane	44	1,3,5-Trimethylbenzene
7	2,3-Dimethylpentane	45	Styrene
8	n-Hexane	46	Toluene
9	3-Methylhexane	47	p-Xylene and/or m-Xylene
10	Cyclohexane	48	o-Xylene
11	Methylcyclohexane		**Ketones (LOQ = 25μg)**
12	2,2,4-Trimethylpentane	49	Acetone
13	n-Heptane	50	Acetoin
14	n-Octane	51	Diacetone alcohol
15	n-Nonane	52	Cyclohexanone
16	n-Decane	53	Isophorone
17	n-Undecane	54	Methyl ethyl ketone (MEK)
18	n-Dodecane	55	Methyl isobutyl ketone (MIBK)
19	n-Tridecane		**Alcohols (LOQ = 25μg)**
20	n-Tetradecane	56	Ethyl alcohol
21	α-Pinene	57	n-Butyl alcohol
22	b-Pinene	58	Isobutyl alcohol
23	D-Limonene	59	Isopropyl alcohol
	Chlorinated hydrocarbons (LOQ = 5μg)	60	2-Ethyl hexanol
		61	Cyclohexanol
24	Dichloromethane		**Acetates (LOQ = 25μg)**
25	1,1-Dichloroethane	62	Ethyl acetate
26	1,2-Dichloroethane	63	n-Propyl acetate
27	Chloroform	64	n-Butyl acetate
28	1,1,1-Trichloroethane	65	Isobutyl acetate
29	1,1,2-Trichloroethane		**Ethers (LOQ = 25μg)**
30	Trichloroethylene	66	Ethyl ether
31	Carbon tetrachloride	67	tert-Butyl methyl ether (MTBE)
32	Perchloroethylene	68	Tetrahydrofuran (THF)
33	1,1,2,2-Tetrachloroethane		**Glycols (LOQ = 25μg)**
34	Chlorobenzene	69	Propylene glycol monomethyl ether
35	1,2-Dichlorobenzene	70	Ethylene glycol diethyl ether
36	1,4-Dichlorobenzene	71	Propylene Glycol monomethyl ether acetate
	Miscellaneous (LOQ #37 = 5μg and #38 = 25μg)	72	Cellosolve acetate
		73	Diethylene glycol monoethyl ether acetate
37	Acetonitrile		
38	n-Vinyl-2-pyrrolidinone		

TestSafe Australia Chemical laboratory provides Gas Chromatography Mass Spectrometry (GC-MS) analysis to determine the exposure levels of chemicals in the air. The analytical method (WCA.207 Analysis of volatile organic compounds in workplace by gas chromatography and mass spectrometry) was recommended by the TestSafe laboratory. The complete list of these Volatile Organic Compounds and the method detection expressed as Limits of Quantification (LOQ) is listed in Table 1.

4.6 Gas Detection Tubes

For some gases such as ammonia (NH_3), hydrogen sulfide (H_2S), and ethyl alcohol (C_2H_5OH), a traditional gas analytical method is to use gas detection tube. An air sample is drawn through a tube containing a reagent that causes a colour change. The concentration is then read from the length of the colour stain in the tube. The advantages of detection tubes over other analytical methods are simplicity of use, rapid response, low costs and very low maintenance.

The measurement range is 0.2 - 20 ppm for ammonia, 0.1 - 6 ppm for hydrogen sulfide and 500 – 50000 ppm (0.05 – 5%) for ethyl alcohol. It is expected that the tubes meet the accuracy of less than 15% and precision of less than 10%.

4.7 Ausplume dispersion modelling

The Ausplume computer model is used to predict ground level concentrations of odours from the premises. Ausplume is a Gaussian dispersion model developed by the Environment Protection Authority of Victoria (EPAV, 1999). The model has undergone continual revisions since then and is widely used throughout Australia to assess air quality impacts from industrial and other sources. The Ausplume version used in the study is 6.0. The model is a default air dispersion model in NSW.

Ausplume requires a meteorological data file typically consisting of 1-hour averaged values such as wind speed, wind direction, sigma theta, temperature, mixing heights and stability class. Ausplume calculates the ground level odour concentration every hour at each receptor. A five-year meteorological data set gives 43,800 1-hour average concentration values at each receptor. As required, the 99^{th} highest odour concentrations are used to plot the odour concentration contour. The predicted odour contour can then be compared to applicable criteria.

Ausplume has many user-selectable options for the adjustment of dispersion parameters. The options considered most appropriate for the circumstances are selected. Special issues are discussed in the remainder of this section.

4.7.1 Source characterisation

The proposed site is occupied by a single building. The manufacturing area is largely sealed and quarantined. The replenished air is filtered. The excessive heat is ventilated through several mechanical fans. From a modelling point of view, these are the 10 stacks on the building roof that remove the baking heat and 3 stacks to remove the product heat.

As the wind blows across a building, the plume trapped in building wakes can either be recirculated in the cavity region immediately downwind of a building or subjected to plume downwash and enhanced horizontal or vertical spreading due to the turbulent zone that exists further downwind. This can effectively increase the ground level odour concentrations.

Ausplume has a built-in utility program called Building Profile Input Program (BPIP). After entering the heights and corner locations of buildings in the vicinity of the stack (see Figure 6), the program estimates 36 wind direction dependant building heights and widths when viewed in 10 degrees intervals in the direction of the wind flow. The results are then incorporated in the Ausplume modelling.

As we are looking into the 24x7 operation, a constant odour emission rates were applied in the modelling and no other adjustments were made.

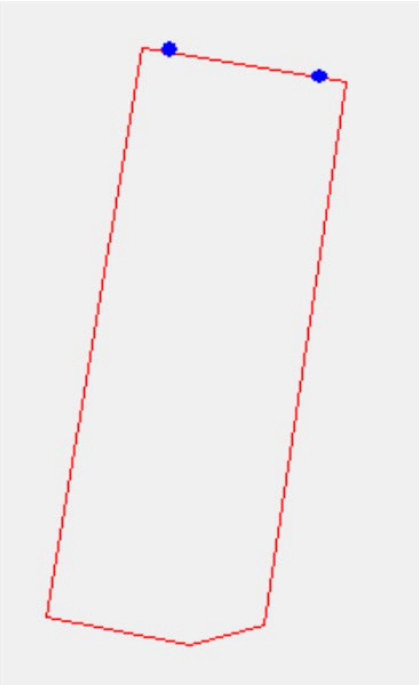

Figure 7 Building corners and the locations of emission sources in blue dots

4.7.2 Meteorological data

The meteorological data was prepared using the 10-minute observation data recorded from the Horsley Park Equestrian Centre AWS (Site No. 67119) over the period from January 2017 to 20 June 2022. There are 47928 hours in the file. The centre is about 3 km away to the southwest from the site.

In-house software (MetAnaysis) was used to prepare the hourly temperature, wind speed, wind direction, atmospheric stability, atmospheric mixing height and sigma theta in Ausplume format. The MetAnalysis has been developed over the past twenty years to comply with NSW EPA's requirements for the purpose of odour impact assessment reports.

4.7.3 Roughness height

The site has a mixture of commercial areas in the north, east and west, as well as urban residential areas in the south. A conservative estimate of the roughness height in these circumstances is 0.8 metres, which is consistent with a predominantly industrial environment.

4.7.4 Topography

The topography of the site is very flat. No terrain data was used.

4.7.5 Receptor grid

The two-dimensional receptor grid was defined from the south-west corner of the map limits in UTM coordinates at 50 metres spacing over an area of 1000m x 1000m. The Ausplume calculates the odour concentrations at each node and the concentration contours can be plotted around the odour emission sources. The fine grid means a longer computer processing time and results in slightly smoother contours.

4.7.6 Sensitive receptors

In addition to the above gridded receptors, discrete receptors are also manually selected. For a new development, compliance with the odour impact criteria should be assessed at the nearest sensitive receptors. Two sensitive receptors have been selected on the proposed site of Archbold Road where they have the shortest distance.

4.7.7 Odour performance criteria for acceptable odour impact

Odour performance criteria are contained in “Technical framework: assessment and management of odour from stationary sources in NSW”, produced by the Department of Environment and Conservation (NSW DEC, 2006). These are shown in Table 1.

Table 2 Odour performance criteria

Population of affected community	Impact assessment criteria for complex mixtures of odorous air pollutants (OU/m^3)
Urban area (≥ 2000) and/or schools and hospitals	2.0
~ 500	3.0
~ 125	4.0
~ 30	5.0
~ 10	6.0
Single residence (≤ ~ 2)	7.0

Table 3 P/M60 ratios for estimating peak concentrations in flat terrain

Source type	Pasquill–Gifford stability class	Near-field P/M60*	Far-field P/M60*
Area	A, B, C, D	2.5	2.3
	E, F	2.3	1.9
Line	A–F	6	6
Surface wake-free point	A, B, C	12	4
	D, E, F	25	7
Tall wake-free point	A, B, C	17	3
	D, E, F	35	6
Wake-affected point	A–F	2.3	2.3
Volume	A–F	2.3	2.3

* Ratio of peak 1-second average concentrations to mean 1-hour average concentrations

The area around the site is an urban area with approximately 2000 residents. Therefore, the relevant odour performance criterion is 2 OU/m^3 as a nose response time.

For a one hour averaged value, the peak-to-mean ratios shown in Table 2 must be used to convert the nose response time to a one hour averaged value (P/M60) as Ausplume dispersion model uses (NSW DEC, 2006). For the wake-affected point sources, the applicable P/M60 ratio is 2.3 for both the near-field and far-field at all the atmospheric stabilities. Therefore, the assumption of a P/M60 ratio of 2.3 for modelling emissions from the premises will give a conservative estimate of odour impacts for comparison to the odour performance criterion.

The odour performance criteria, applicable in the current study, are 1-hour averaged odour concentrations of 2 OU/m^3 in the 99th percentile at the sensitive receptor locations when a P/M60 ratio of 2.3 is applied for the waked affected point sources.

5 Results and discussions

On the 17th of March 2023, a CO_2 monitor was installed near the MIBs area to monitor the diurnal variation along with the temperature and relative humidity. On the following day, all the gas monitoring and odour samples were taken after the shed was closed overnight.

The odour sampling analysis, meteorological data and odour dispersion modelling are discussed here.

5.1 CO2 concentrations

Carbon dioxide is one of the major constituents for the composting industrial. It reflects the activities of microorganisms. The CO_2 monitor records the diurnal variation pattern of CO_2, the temperature and the relative humidity (see Figure 8). During the sampling period, the building was closed to maintain a minimum ventilation. The maximum CO_2

concentration could reach was about 1600 ppm at night. The sudden drop of CO_2 might be caused by the increase of the ventilation such as wind speed.

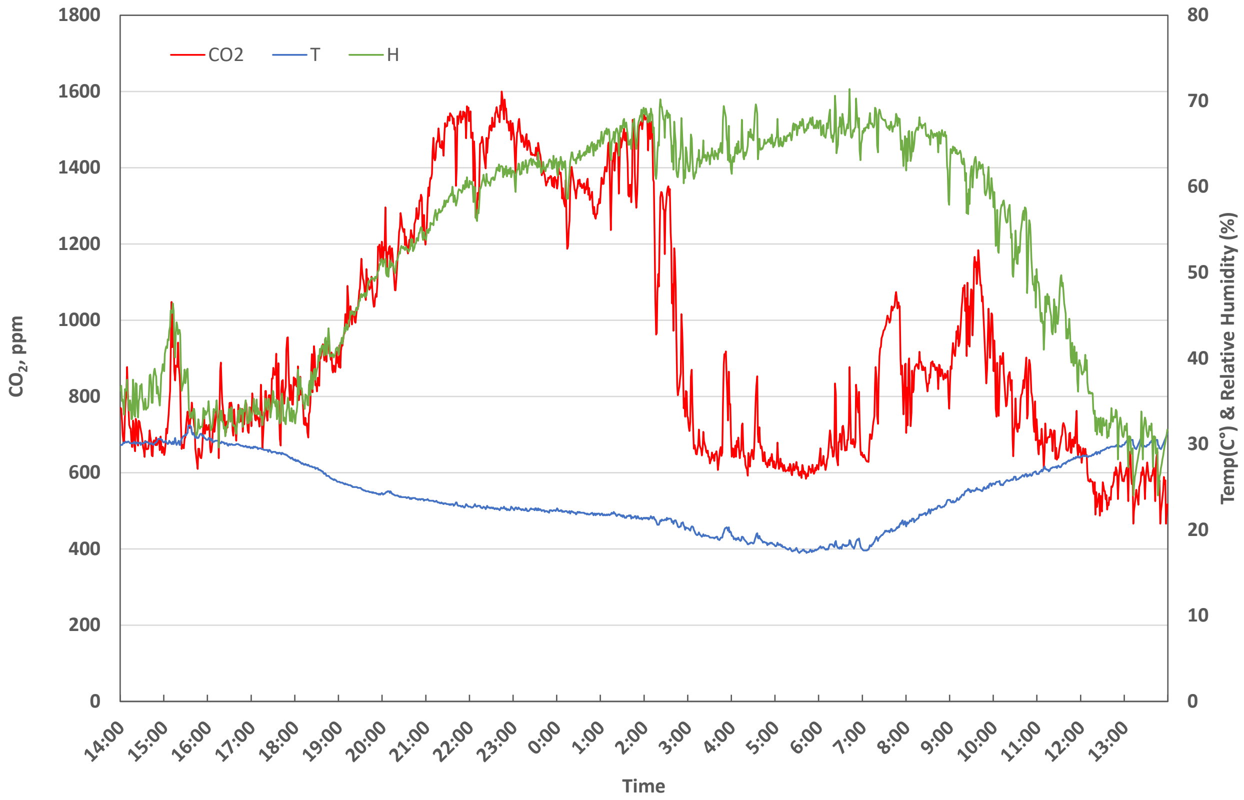

Figure 8 Diurnal variation for CO_2 and the environment conditions

5.2 Gas detection tubes

The results from gas detection tubes are summarised in Table 4. At the receival and processing area, all the gases were not detected (N/D). Both ammonia and ethyl alcohol were found at low ends on the measurement ranges at the MIBs and frass storage areas.

Table 4 Summary of gas detection tubes (ppm)

Source	MIBs	Receival	Frass storage	Processing
Ammonia	0.5	N/D	1.2	N/D
H_2S	N/D	N/D	N/D	N/D
Ethyl alcohol	1000	N/D	1000	N/D

5.3 VOCs

The VOCs analytical reports are shown in Appendix 3.

These VOCs were above their LOQs along with their exposure limits in the workplace expressed as 8-hour Time Weighted Average (TWAs) are summarised in Table 5. From the table, these VOCs found in the workplace environment were much lower than the exposure limits.

Table 5 Summarised VOCs results (mg/m^3)

Source	MIBs	Receival	Frass storage	TWA
Sample ID	700	709	711	
D-Limonene	0.8	0.1	0.8	150
MEK	0.1	0.0	0.2	445
Ethyl Alcohol	142.0	22.0	144.2	1880
isopropyl alcohol	0.1	0.0	0.1	980
Ethyl acetate	2.9	0.3	2.9	720
n-propyl acetate	0.2	0.0	0.3	1040

5.4 Odour concentration analysis

The dynamic olfactometry results are attached in Appendix 1. These odour concentrations at different locations within the sheds are summarised in Table 6.

Table 6 Summary of odour concentration measurement (OU/m^3)

Source	Odour Conc
Receival	202
MIBs	404
FRASS bunker	440
Final Product	370
Averaged	354

It is proposed to house all the processing units within the same building. The final odour concentration is more likely to be averaged crossing these sources.

For the proposed development, there are 2 exhaust fans are proposed (Figure 2). Based on the mechanical engineer's design, the discharging heights, the ventilation rate, stack diameter, exiting velocities, air flowrates, temperature (Temp), the odour concentrations and the odour emission rates (OER) are summarised in Table 7.

It is recommended to install a chemical scrubber to remove the odour from receival area and frass storage area.

Table 7 Summary of stack conditions

Source	Exhaust Fan 1	Exhaust Fan 2
Temperature, °C	28	28
Exhaust fan height, m	6	6
Ventilation rate, m^3/s	2.8	2.8
Stack diameter, m	1	1
Exiting velocity, m/s	3.5	3.5
Odour concentration, OU/m^3	175	175
P/M60 ratio	2.3	2.3
Odour emission rate used in the model, OU/s	1118	1118

5.5 Analysis of meteorological data

The statistics of the meteorological data is summarised in Appendix 3. The frequency distribution of wind direction as a function of the atmospheric stability class is shown in Table 5. The frequency distribution of wind speed as a function of the atmospheric stability class is shown in Table 6. The stability class distribution versus time of the day is listed Table 7. Frequency distribution of wind direction as a function of wind speed is listed in Table 8. Wind speed, wind direction, wind stability ambient temperature, mixing height and standard deviation distributions are also shown in Figure 9 - Figure 14 respectively.

Generally, odour does not disperse and mix as readily at night as it does during the day. Atmospheric stability refers to the potential of air to disperse and is defined using the Pasquill Gifford scheme, where the atmosphere is categorised from unstable (category A) to stable (category F). Optimum dispersion occurs under unstable conditions. In simple terms, the lower the stability class (closer to A), the greater the odour dispersion and thus the lower the potential of odour complaints.

The maximum ground level concentrations occur when the wind speed is low, such as 1 m/s. Low wind speeds are often associated with more stable atmospheric conditions (D, E, F). The combined effects result in less atmospheric dispersion and therefore a high ground concentration.

The analysis for the current meteorological data has shown a high percentage of calm conditions of 6.7% for the period of January 2017 to June 2022. This is slightly more than the average level at other locations (e.g. about 5% in Sydney).

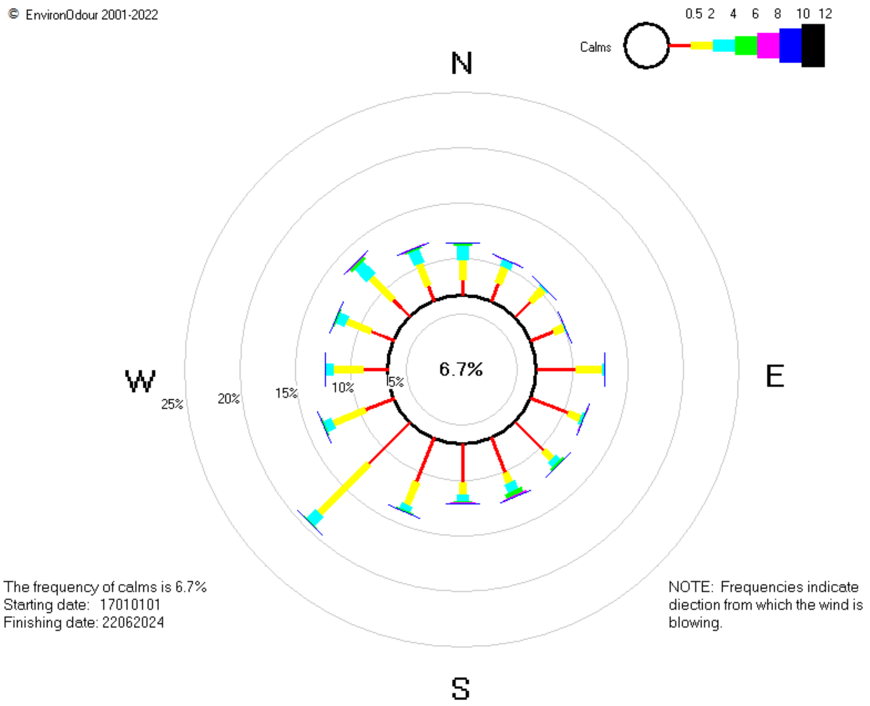

Figure 9 Wind rose for meteorological data (Jan 2017 – June 2022)

The seasonal wind roses are shown in Figure 9. It shows that the dominant wind direction for the period is from the south-west. The dominant wind direction confirms that odour dissipation is favoured and could push the odour emission away from the majority residential area in the east.

5.6 Odour impact assessment

The 24/7 operation was modelled throughout the year. No reduced odour emission rates were used in the modelling due to the weekends.

The odour concentration contours (in cyan) are shown in Figure 10. Four discrete receptor locations (in while plus sign) are the property corners. No sensitive receptors were chosen. The predicted odour concentrations at the ground level are less than 2 OU/m^3.

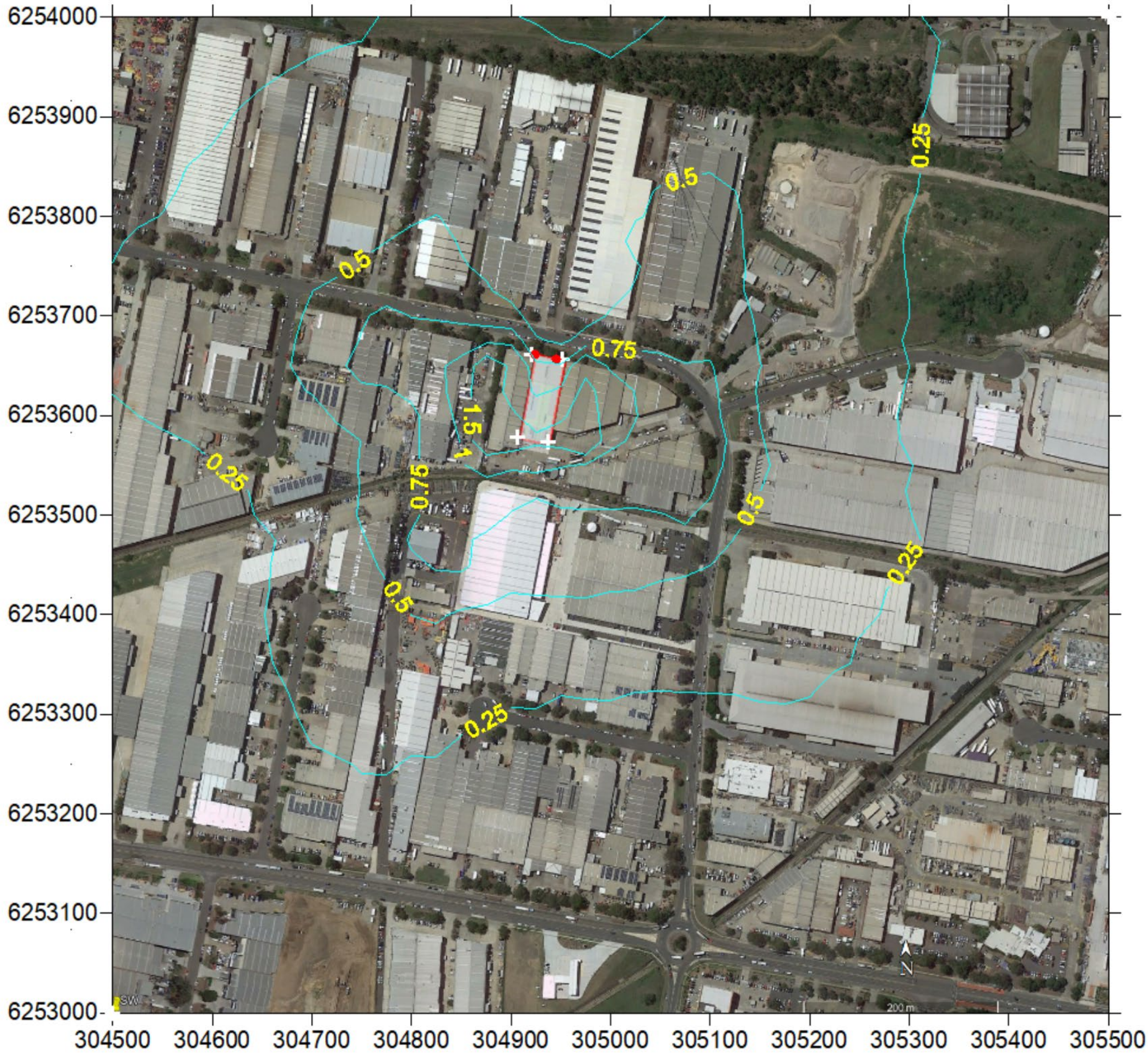

Figure 10 Odour concentration contour at 99.0% for minimum ventilation

6 Conclusion and recommendation

The maximum carbon dioxide concentration was around 1600 ppm and the minimum value was about 600 ppm during a diurnal monitoring near the MIBs.

A total of 4 sampling locations were selected for air sampling and analysis. No hydrogen sulfide were detected. Both ammonia and ethyl alcohol were found at the low end of the measurement range. VOCs analysis also confirmed ethyl alcohol is the most significant constituent in the gas. The dynamic olfactometry analysis confirmed the odour concentrations ranged from 202 OU/m^3 – 440 OU/m^3 with an averaged value of 354 OU/m^3 at these locations.

Meteorological data over the period of January 2017 – June 2022 was formatted and analysed. The site has a slightly above average calm condition of 6.7%. The prevailing wind direction in the period is south-west. From an odour dissipation point of view, the site has a favourable atmospheric condition for odour to dissipate.

A level 3 odour impact assessment was conducted using the Ausplume air dispersion model as per the *NSW EPA Technical Framework for Assessment and Management of Odours*. The ground odour concentrations were less than the NSW odour performance criteria of 2 OU/m^3. This confirms that the proposed operation meets the NSW EPA guideline and does not have an impact on neighbouring property.

The level 3 odour impact assessment is a 'pass'.

After the factory commissioning, an air sampling and testing should be arranged to confirm the assumption of the odour emission rates used in the odour dispersion modellings. The proposed operation can demonstrate the compliance with the odour performance criteria of NSW EPA.

Appendix 1. Olfactometry report

We make scents of odour

EnvironOdour Australia Pty Ltd ABN: 83 003 175 705 ACN: 103 510 685 Email: admin@environodour.com.au

Odour Testing Report (Odour Concentration)

Client: Volant **Job No:** EJ509 **Session:** S230318-1 **Testing Date:** Sat, 18 Mar 2023

Odour testing was carried out using the DynaScent digital dynamic olfactometer and fully complies with Australia Standard AS/NZS4323.3:2001. The olfactometer was calibrated against mass flow on 22/11/2018. Odour Concentration (OC) was calculated using a retrospective screening procedure and based upon 'certain and correct' criteria. Pre-Dilution Ratio (PDR) has been applied to the results (if applicable).

The butanol threshold for the current session is 35 ppb. The butanol threshold for the past ten sessions is 41 ppb. The sensory performance criteria is between 20-80 ppb. The precision of the laboratory is 0.077 (< 0.477). The accuracy of the laboratory is 0.014 (< 0.217).

Sample ID	Test ID	Source	Collecting Date and Time	Testing date and time	PDR	OC (OU/m^3)
6513	103114	Receival	18/03/2023 14:58	18/03/2023 15:00	1.0	202
6514	103115	MIBs	17/03/2023 08:50	18/03/2023 15:16	1.0	404
6515	103116	FRASS Bunker	18/03/2023 08:52	18/03/2023 15:31	1.0	440
6516	103113	Final Product	17/03/2023 09:02	18/03/2023 14:12	1.0	370
Butanol	B2303181	B-20221	18/03/2023 13:56	18/03/2023 13:56	1.0	1726

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Comments:

Issued by: Date:

Printed on Friday, 14 April 2023 Page 1 of 1

Appendix 2. Analysis of meteorological data

Table 8 Frequency distribution of wind direction versus atmospheric stability class

WD \ AS	A	B	C	D	E	F	Sum
N	0.5%	0.6%	0.7%	2.5%	0.5%	0.4%	5.1%
NNE	0.5%	0.4%	0.2%	2.2%	0.6%	0.6%	4.6%
NE	1.2%	0.5%	0.0%	1.4%	0.5%	0.6%	4.2%
ENE	1.1%	0.7%	0.0%	1.2%	0.3%	0.2%	3.6%
E	1.0%	0.9%	0.0%	3.6%	0.6%	0.3%	6.5%
ESE	0.7%	0.6%	0.1%	2.9%	0.8%	0.3%	5.3%
SE	0.8%	0.6%	0.3%	2.9%	0.8%	0.4%	5.8%
SSE	0.7%	0.6%	0.7%	2.7%	0.8%	0.5%	6.1%
S	0.8%	0.8%	0.4%	2.1%	1.0%	0.7%	5.8%
SSW	0.7%	1.0%	0.5%	3.1%	1.7%	0.9%	7.7%
SW	0.5%	0.8%	0.4%	8.2%	2.6%	0.9%	13.4%
WSW	0.4%	0.4%	0.3%	4.3%	1.1%	0.6%	7.2%
W	0.4%	0.6%	0.3%	3.4%	1.0%	0.3%	6.0%
WNW	0.4%	0.8%	0.6%	2.8%	0.9%	0.4%	5.9%
NW	0.5%	0.8%	0.9%	3.9%	0.8%	0.5%	7.5%
NNW	0.6%	0.6%	0.7%	2.7%	0.5%	0.3%	5.4%
Sum	10.9%	10.7%	6.3%	49.9%	14.4%	7.9%	100.0%

Table 9 Frequency distribution of wind speed versus atmospheric stability class

WS \ AS	A	B	C	D	E	F	Sum
< 0.5	1.0%	0.3%	0.0%	3.8%	2.6%	4.4%	12.1%
1.54	4.7%	2.0%	0.0%	13.1%	7.2%	2.5%	29.5%
3.09	5.1%	4.2%	0.0%	18.6%	4.6%	1.0%	33.6%
5.14	0.0%	4.1%	4.2%	11.7%	0.1%	0.0%	20.2%
8.23	0.0%	0.0%	2.0%	2.5%	0.0%	0.0%	4.5%
10.5	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.2%
> 10.8	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Sum	5.8%	4.2%	1.4%	16.8%	4.0%	2.8%	100.0%

Table 10 Frequency distribution of stability class with time of day

Time \ AS	A	B	C	D	E	F	Sum
1-2	0.0%	0.0%	0.0%	3.8%	2.8%	1.7%	8.3%
3-4	0.0%	0.0%	0.0%	3.9%	2.6%	1.8%	8.3%
5-6	0.2%	0.3%	0.0%	5.7%	1.2%	0.9%	8.3%
7-8	0.8%	1.3%	0.2%	6.1%	0.0%	0.0%	8.3%
9-10	2.4%	2.4%	0.6%	2.9%	0.0%	0.0%	8.3%
11-12	3.5%	2.3%	1.0%	1.6%	0.0%	0.0%	8.3%
13-14	2.8%	2.2%	1.6%	1.8%	0.0%	0.0%	8.3%
15-16	1.0%	1.6%	1.9%	3.9%	0.0%	0.0%	8.3%
17-18	0.3%	0.8%	1.0%	6.3%	0.0%	0.0%	8.3%
19-20	0.0%	0.0%	0.0%	5.3%	2.2%	0.8%	8.3%
21-22	0.0%	0.0%	0.0%	4.4%	2.7%	1.2%	8.3%
23-24	0.0%	0.0%	0.0%	4.0%	2.8%	1.5%	8.3%
Sum	10.9%	10.7%	6.3%	49.9%	14.4%	7.9%	100.0%

Table 11 Frequency distribution of wind direction with wind speed

WD \ WS	0	0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	>10	Sum
N	0.23%	2.29%	2.75%	0.63%	0.08%	0.%	0.%	5.97%
NNE	0.24%	2.31%	2.37%	0.86%	0.09%	0.01%	0.%	5.89%
NE	0.55%	2.2%	2.84%	1.58%	0.29%	0.04%	0.%	7.48%
ENE	0.38%	1.48%	2.17%	1.28%	0.14%	0.01%	0.%	5.45%
E	0.45%	1.39%	1.77%	1.39%	0.1%	0.%	0.%	5.11%
ESE	0.7%	1.7%	1.6%	0.57%	0.03%	0.%	0.%	4.6%
SE	0.55%	1.98%	1.57%	0.11%	0.01%	0.%	0.%	4.23%
SSE	0.32%	2.16%	1.04%	0.03%	0.01%	0.%	0.%	3.55%
S	0.4%	3.53%	2.35%	0.2%	0.02%	0.%	0.%	6.5%
SSW	0.29%	3.58%	1.23%	0.17%	0.06%	0.%	0.%	5.32%
SW	0.35%	3.59%	1.13%	0.53%	0.19%	0.03%	0.%	5.81%
WSW	0.39%	3.33%	0.99%	0.83%	0.42%	0.1%	0.%	6.07%
W	0.45%	3.49%	1.16%	0.54%	0.14%	0.02%	0.%	5.81%
WNW	0.57%	4.3%	2.18%	0.56%	0.09%	0.%	0.%	7.7%
NW	0.54%	5.29%	6.37%	1.08%	0.08%	0.%	0.%	13.36%
NNW	0.3%	2.8%	3.16%	0.76%	0.11%	0.01%	0.%	7.15%
Sum	6.7%	45.42%	34.7%	11.11%	1.85%	0.21%	0.01%	100.%

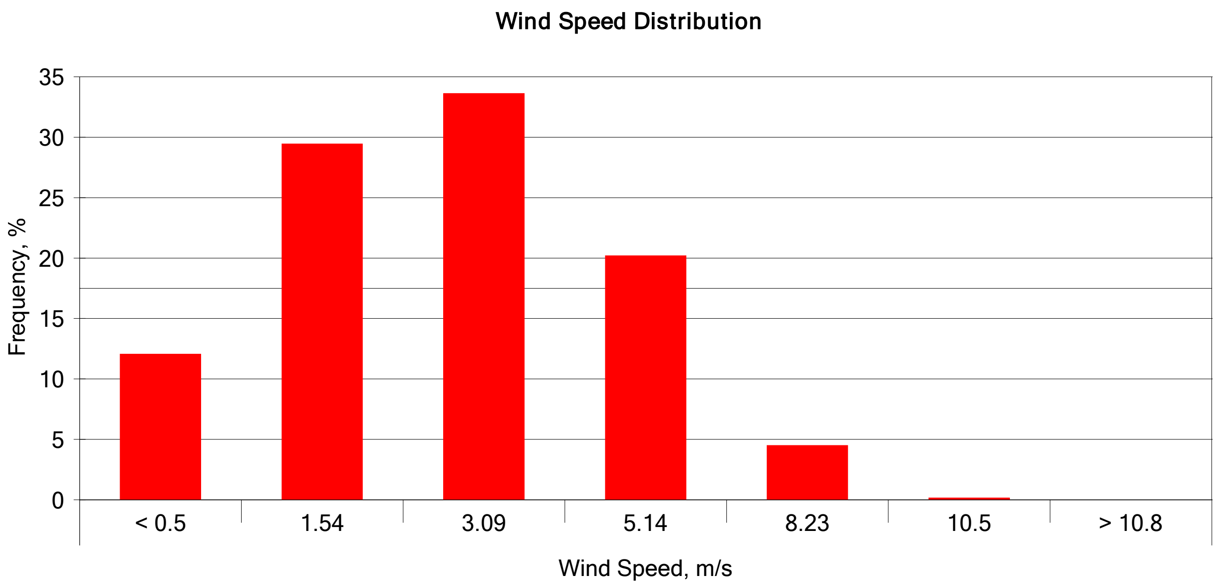

Figure 11 Wind speed distribution

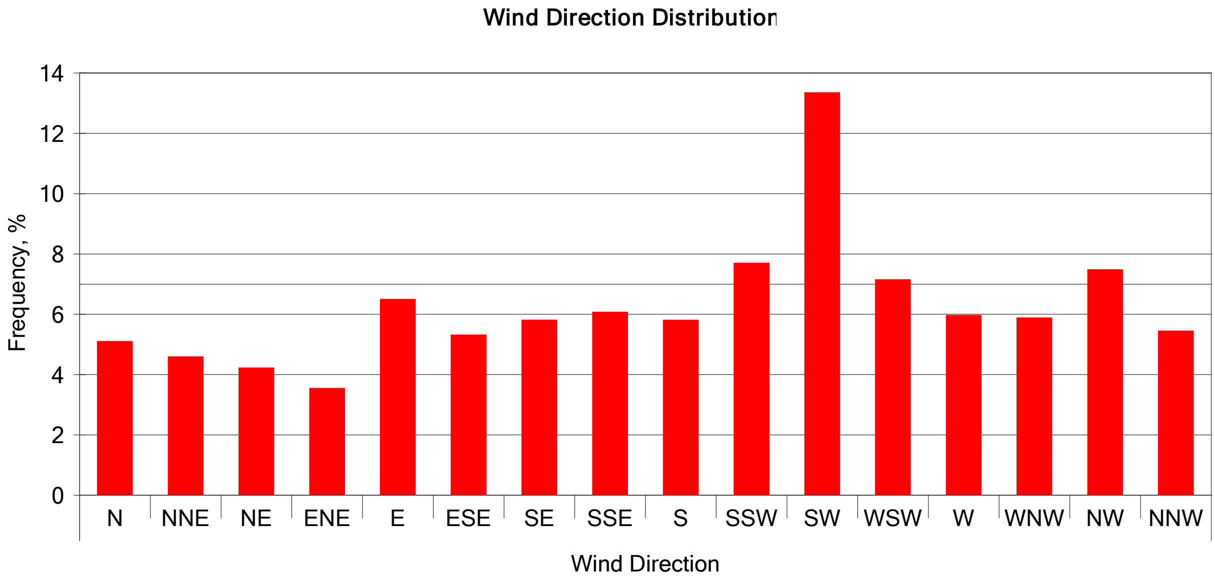

Figure 12 Wind direction distribution

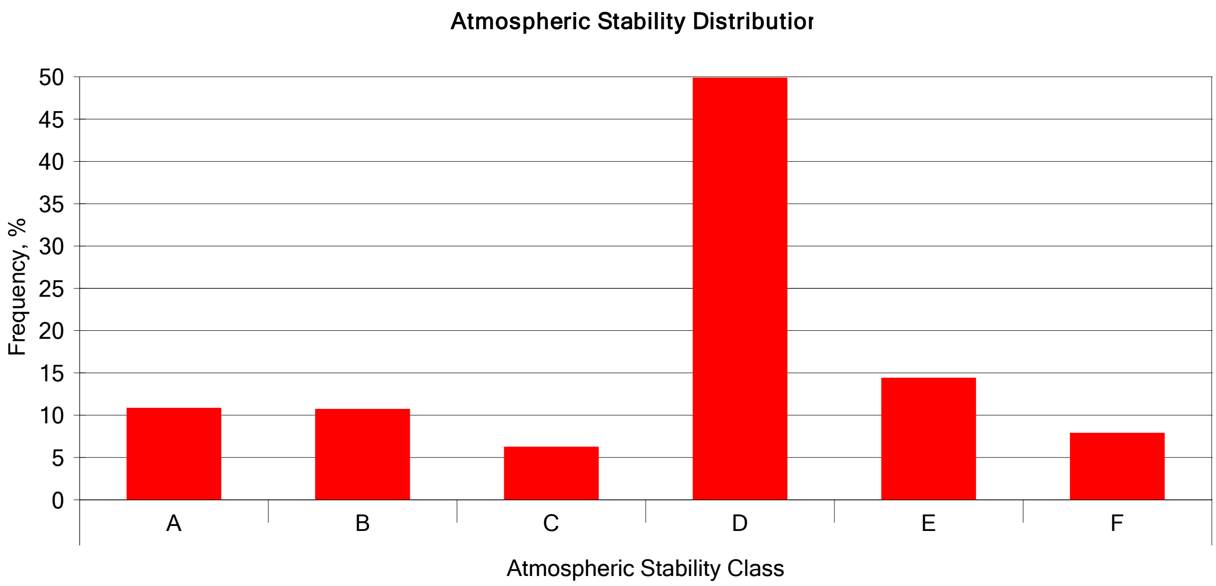

Figure 13 Wind stability class distribution

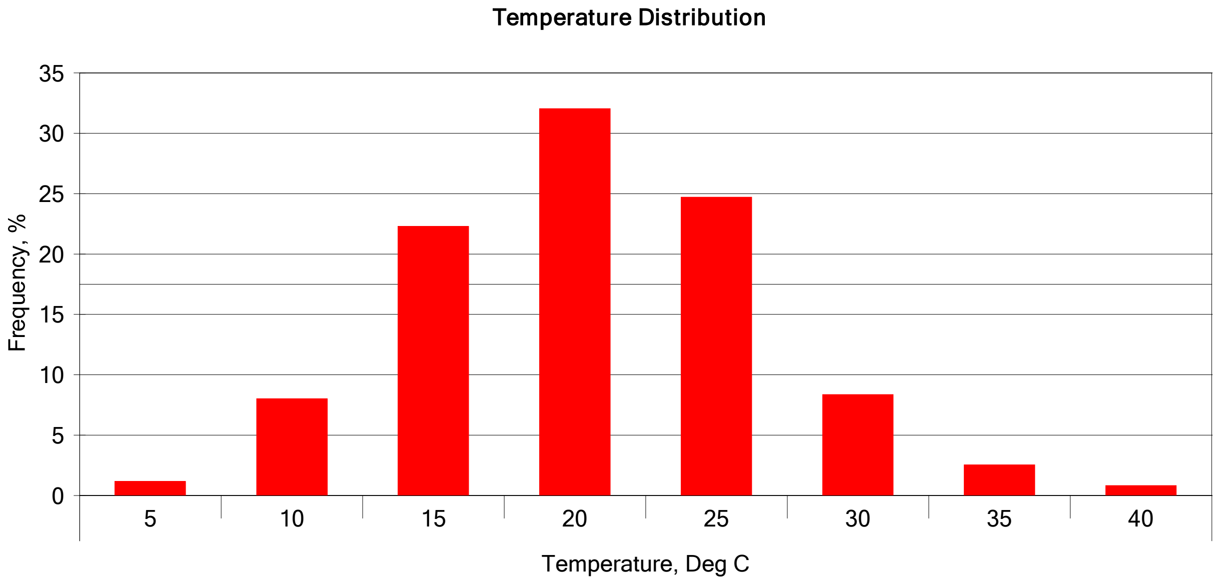

Figure 14 Ambient temperature distribution

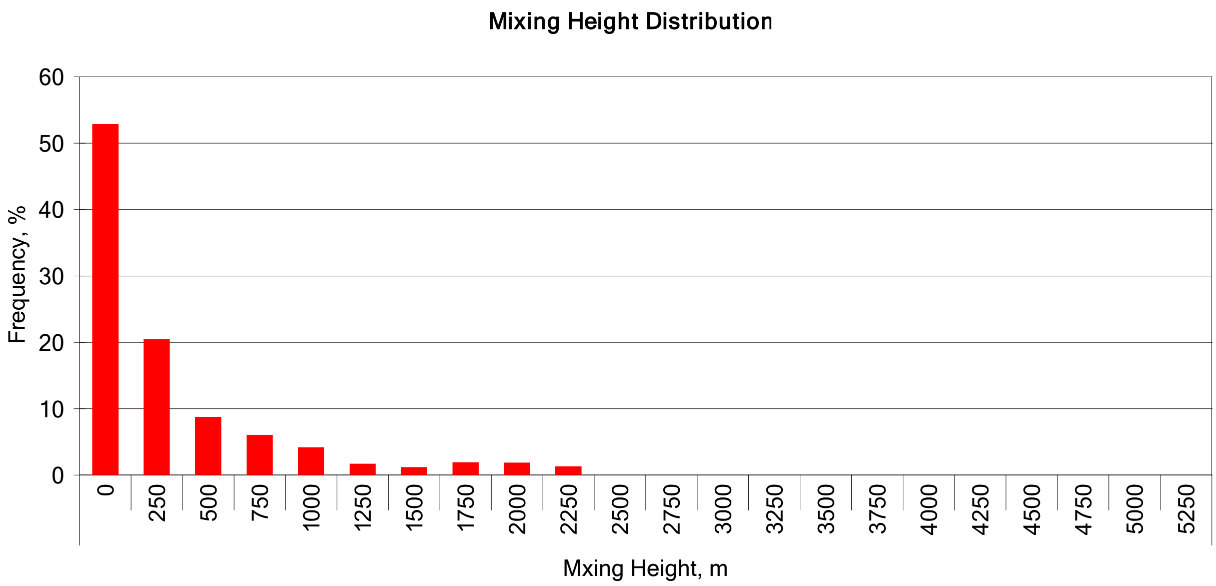

Figure 15 Mixing height distribution

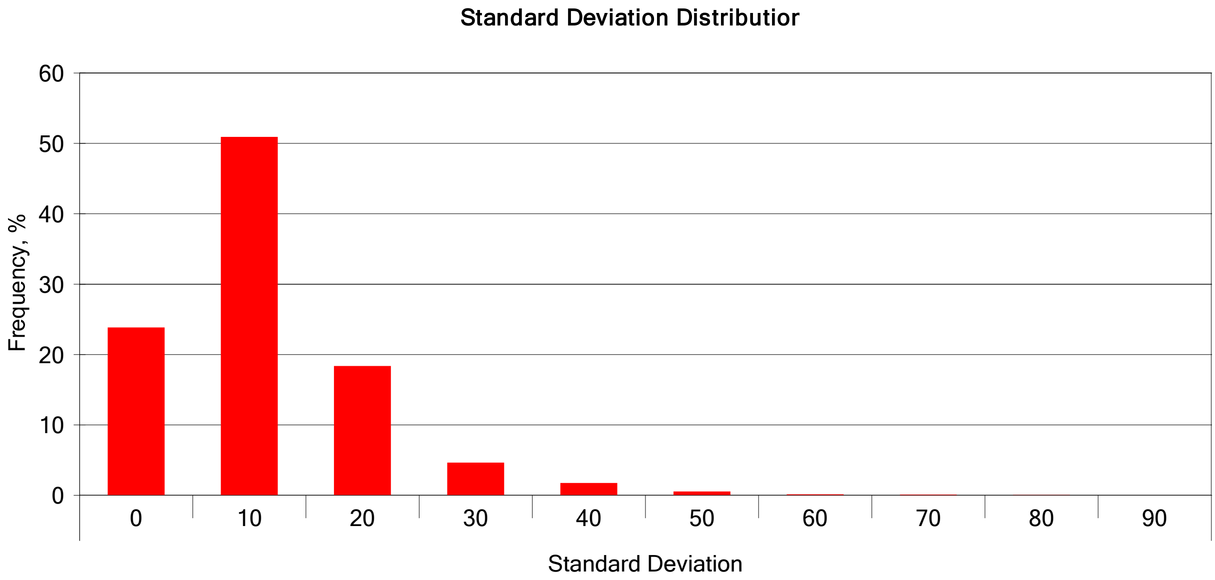

Figure 16 Standard deviation wind direction distribution

Appendix 3. TestSafe laboratory analytical report

NSW GOVERNMENT | SafeWork NSW

TestSafe AUSTRALIA

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

Client: EnvironOdour Australia
Sample ID: 711

Date Sampled : 17/03/2023
Date Analysed : 24/03/2023
Reference Number : 2023-2050-1

No	Compounds	CAS No	Front (µg/section)	Back (µg/section)
	Aliphatic hydrocarbons (LOQ =1µg/c/s; #18 - #23 =5µg/c/s)			
1	2-Methylbutane	*78-78-4*	<LOQ	<LOQ
2	n-Pentane	*109-66-0*	<LOQ	<LOQ
3	2-Methylpentane	*107-83-5*	<LOQ	<LOQ
4	3-Methylpentane	*96-14-0*	<LOQ	<LOQ
5	Cyclopentane	*287-92-3*	<LOQ	<LOQ
6	Methylcyclopentane	*96-37-7*	<LOQ	<LOQ
7	2,3-Dimethylpentane	*565-59-3*	<LOQ	<LOQ
8	n-Hexane	*110-54-3*	<LOQ	<LOQ
9	3-Methylhexane	*589-34-4*	<LOQ	<LOQ
10	Cyclohexane	*110-82-7*	<LOQ	<LOQ
11	Methylcyclohexane	*108-87-2*	<LOQ	<LOQ
12	2,2,4-Trimethylpentane	*540-84-1*	<LOQ	<LOQ
13	n-Heptane	*142-82-5*	<LOQ	<LOQ
14	n-Octane	*111-65-9*	<LOQ	<LOQ
15	n-Nonane	*111-84-2*	<LOQ	<LOQ
16	n-Decane	*124-18-5*	<LOQ	<LOQ
17	n-Undecane	*1120-21-4*	<LOQ	<LOQ
18	n-Dodecane	*112-40-3*	<LOQ	<LOQ
19	n-Tridecane	*629-50-5*	<LOQ	<LOQ
20	n-Tetradecane	*629-59-4*	<LOQ	<LOQ
21	α-Pinene	*80-56-8*	<LOQ	<LOQ
22	β-Pinene	*127-91-3*	<LOQ	<LOQ
23	D-Limonene	*138-86-3*	38	<LOQ
	Chlorinated hydrocarbons (LOQ = 1µg/compound/sample)			
24	Dichloromethane	*75-09-2*	<LOQ	<LOQ
25	1,1-Dichloroethane	*75-34-3*	<LOQ	<LOQ
26	1,2-Dichloroethane	*107-06-2*	<LOQ	<LOQ
27	Chloroform	*67-66-3*	<LOQ	<LOQ
28	1,1,1-Trichloroethane	*71-55-6*	<LOQ	<LOQ
29	1,1,2-Trichloroethane	*79-00-5*	<LOQ	<LOQ
30	Trichloroethylene	*79-01-6*	<LOQ	<LOQ
31	Carbon tetrachloride	*56-23-5*	<LOQ	<LOQ
32	Perchloroethylene	*127-18-4*	<LOQ	<LOQ
33	1,1,2,2-Tetrachloroethane	*79-34-5*	<LOQ	<LOQ
34	Chlorobenzene	*108-90-7*	<LOQ	<LOQ
35	1,2-Dichlorobenzene	*95-50-1*	<LOQ	<LOQ
36	1,4-Dichlorobenzene	*106-46-7*	<LOQ	<LOQ
	Miscellaneous (LOQ #37= 10µg & #38=50µg/compound/sample)			
37	Acetonitrile	*75-05-8*	<LOQ	<LOQ
38	n-Vinyl-2-pyrrolidinone	*88-12-0*	<LOQ	<LOQ
	Extra compound (LOQ = 10µg/compound/sample)			
74	Bromopropane *	*106-94-5*	<LOQ	<LOQ
	Total VOCs (LOQ =50µg/compound/section)		**4642**	**2484**

No	Compounds	CAS No	Front (µg/section)	Back (µg/section)
	Aromatic hydrocarbons (LOQ = 1µg/compound/section)			
39	Benzene	*71-43-2*	<LOQ	<LOQ
40	Ethylbenzene	*100-41-4*	<LOQ	<LOQ
41	Isopropylbenzene	*98-82-8*	<LOQ	<LOQ
42	1,2,3-Trimethylbenzene	*526-73-8*	<LOQ	<LOQ
43	1,2,4-Trimethylbenzene	*95-63-6*	<LOQ	<LOQ
44	1,3,5-Trimethylbenzene	*108-67-8*	<LOQ	<LOQ
45	Styrene	*100-42-5*	<LOQ	<LOQ
46	Toluene	*108-88-3*	<LOQ	<LOQ
47	p-Xylene &/or m-Xylene	*106-42-3 & 108-38-3*	<LOQ	<LOQ
48	o-Xylene	*95-47-6*	<LOQ	<LOQ
	Ketones (LOQ =1µg/c/s; LOQ #49, #53 =10µg/c/s; #50, #51 =50µg/c/s)			
49	Acetone	*67-64-1*	<LOQ	<LOQ
50	Acetoin	*513-86-0*	<LOQ	<LOQ
51	Diacetone alcohol	*123-42-2*	<LOQ	<LOQ
52	Cyclohexanone	*108-94-1*	<LOQ	<LOQ
53	Isophorone	*78-59-1*	<LOQ	<LOQ
54	Methyl ethyl ketone (MEK)	*78-93-3*	10	<LOQ
55	Methyl isobutyl ketone (MIBK)	*108-10-1*	<LOQ	<LOQ
	Alcohols (LOQ =1µg/c/s; #56, #57, #58, #60 =10µg/c/s)			
56	Ethyl alcohol	*64-17-5*	4437	2484
57	n-Butyl alcohol	*71-36-3*	<LOQ	<LOQ
58	Isobutyl alcohol	*78-83-1*	<LOQ	<LOQ
59	Isopropyl alcohol	*67-63-0*	5	<LOQ
60	2-Ethyl hexanol	*104-76-7*	<LOQ	<LOQ
61	Cyclohexanol	*108-93-0*	<LOQ	<LOQ
	Acetates (LOQ =1µg/c/s; #62 =10µg/c/s)			
62	Ethyl acetate	*141-78-6*	139	<LOQ
63	n-Propyl acetate	*109-60-4*	13	<LOQ
64	n-Butyl acetate	*123-86-4*	<LOQ	<LOQ
65	Isobutyl acetate	*110-19-0*	<LOQ	<LOQ
	Ethers (LOQ =1µg/c/s; #66 =10µg/c/s)			
66	Ethyl ether	*60-29-7*	<LOQ	<LOQ
67	*tert*-Butyl methyl ether (MTBE)	*1634-04-4*	<LOQ	<LOQ
68	Tetrahydrofuran (THF)	*109-99-9*	<LOQ	<LOQ
	Glycols (LOQ =1µg/c/s; #69, #73 =50µg/c/s)			
69	PGME	*107-98-2*	<LOQ	<LOQ
70	Ethylene glycol diethyl ether	*629-14-1*	<LOQ	<LOQ
71	PGMEA	*108-65-6*	<LOQ	<LOQ
72	Cellosolve acetate	*111-15-9*	<LOQ	<LOQ
73	DGMEA	*112-15-2*	<LOQ	<LOQ
	Extra compound (LOQ = 50µg/compound/sample)			
75	Naphthalene *	*91-20-3*	<LOQ	<LOQ
	Worksheet check		2023-2050-1	

2023-2050

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

ilac-MRA NATA

Accreditation No. 3726

Accredited for compliance with ISO/IEC 17025 - Testing

SW08051 0817

NSW GOVERNMENT | SafeWork NSW

TestSafe AUSTRALIA

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

Client: EnvironOdour Australia
Sample ID: 709

Date Sampled : 17/03/2023
Date Analysed : 24/03/2023
Reference Number : 2023-2050-2

No	Compounds	CAS No	Front (µg/section)	Back (µg/section)
	Aliphatic hydrocarbons (LOQ =1µg/c/s; #18 - #23 =5µg/c/s)			
1	2-Methylbutane	78-78-4	<LOQ	<LOQ
2	n-Pentane	109-66-0	<LOQ	<LOQ
3	2-Methylpentane	107-83-5	<LOQ	<LOQ
4	3-Methylpentane	96-14-0	<LOQ	<LOQ
5	Cyclopentane	287-92-3	<LOQ	<LOQ
6	Methylcyclopentane	96-37-7	<LOQ	<LOQ
7	2,3-Dimethylpentane	565-59-3	<LOQ	<LOQ
8	n-Hexane	110-54-3	<LOQ	<LOQ
9	3-Methylhexane	589-34-4	<LOQ	<LOQ
10	Cyclohexane	110-82-7	<LOQ	<LOQ
11	Methylcyclohexane	108-87-2	<LOQ	<LOQ
12	2,2,4-Trimethylpentane	540-84-1	<LOQ	<LOQ
13	n-Heptane	142-82-5	<LOQ	<LOQ
14	n-Octane	111-65-9	<LOQ	<LOQ
15	n-Nonane	111-84-2	<LOQ	<LOQ
16	n-Decane	124-18-5	<LOQ	<LOQ
17	n-Undecane	1120-21-4	<LOQ	<LOQ
18	n-Dodecane	112-40-3	<LOQ	<LOQ
19	n-Tridecane	629-50-5	<LOQ	<LOQ
20	n-Tetradecane	629-59-4	<LOQ	<LOQ
21	α-Pinene	80-56-8	<LOQ	<LOQ
22	β-Pinene	127-91-3	<LOQ	<LOQ
23	D-Limonene	138-86-3	6	<LOQ
	Chlorinated hydrocarbons (LOQ = 1µg/compound/sample)			
24	Dichloromethane	75-09-2	<LOQ	<LOQ
25	1,1-Dichloroethane	75-34-3	<LOQ	<LOQ
26	1,2-Dichloroethane	107-06-2	<LOQ	<LOQ
27	Chloroform	67-66-3	<LOQ	<LOQ
28	1,1,1-Trichloroethane	71-55-6	<LOQ	<LOQ
29	1,1,2-Trichloroethane	79-00-5	<LOQ	<LOQ
30	Trichloroethylene	79-01-6	<LOQ	<LOQ
31	Carbon tetrachloride	56-23-5	<LOQ	<LOQ
32	Perchloroethylene	127-18-4	<LOQ	<LOQ
33	1,1,2,2-Tetrachloroethane	79-34-5	<LOQ	<LOQ
34	Chlorobenzene	108-90-7	<LOQ	<LOQ
35	1,2-Dichlorobenzene	95-50-1	<LOQ	<LOQ
36	1,4-Dichlorobenzene	106-46-7	<LOQ	<LOQ
	Miscellaneous (LOQ #37= 10µg & #38=50µg/compound/sample)			
37	Acetonitrile	75-05-8	<LOQ	<LOQ
38	n-Vinyl-2-pyrrolidinone	88-12-0	<LOQ	<LOQ
	Extra compound (LOQ = 10µg/compound/sample)			
74	Bromopropane *	106-94-5	<LOQ	<LOQ
	Total VOCs (LOQ =50µg/compound/section)		691	388

No	Compounds	CAS No	Front (µg/section)	Back (µg/section)
	Aromatic hydrocarbons (LOQ = 1µg/compound/section)			
39	Benzene	71-43-2	<LOQ	<LOQ
40	Ethylbenzene	100-41-4	<LOQ	<LOQ
41	Isopropylbenzene	98-82-8	<LOQ	<LOQ
42	1,2,3-Trimethylbenzene	526-73-8	<LOQ	<LOQ
43	1,2,4-Trimethylbenzene	95-63-6	<LOQ	<LOQ
44	1,3,5-Trimethylbenzene	108-67-8	<LOQ	<LOQ
45	Styrene	100-42-5	<LOQ	<LOQ
46	Toluene	108-88-3	<LOQ	<LOQ
47	p-Xylene &/or m-Xylene	106-42-3 & 108-38-3	<LOQ	<LOQ
48	o-Xylene	95-47-6	<LOQ	<LOQ
	Ketones (LOQ =1µg/c/s; LOQ #49, #53 =10µg/c/s; #50, #51 =50µg/c/s)			
49	Acetone	67-64-1	<LOQ	<LOQ
50	Acetoin	513-86-0	<LOQ	<LOQ
51	Diacetone alcohol	123-42-2	<LOQ	<LOQ
52	Cyclohexanone	108-94-1	<LOQ	<LOQ
53	Isophorone	78-59-1	<LOQ	<LOQ
54	Methyl ethyl ketone (MEK)	78-93-3	2	<LOQ
55	Methyl isobutyl ketone (MIBK)	108-10-1	<LOQ	<LOQ
	Alcohols (LOQ =1µg/c/s; #56, #57, #58, #60 =10µg/c/s)			
56	Ethyl alcohol	64-17-5	666	388
57	n-Butyl alcohol	71-36-3	<LOQ	<LOQ
58	Isobutyl alcohol	78-83-1	<LOQ	<LOQ
59	Isopropyl alcohol	67-63-0	<LOQ	<LOQ
60	2-Ethyl hexanol	104-76-7	<LOQ	<LOQ
61	Cyclohexanol	108-93-0	<LOQ	<LOQ
	Acetates (LOQ =1µg/c/s; #62 =10µg/c/s)			
62	Ethyl acetate	141-78-6	16	<LOQ
63	n-Propyl acetate	109-60-4	1	<LOQ
64	n-Butyl acetate	123-86-4	<LOQ	<LOQ
65	Isobutyl acetate	110-19-0	<LOQ	<LOQ
	Ethers (LOQ =1µg/c/s; #66 =10µg/c/s)			
66	Ethyl ether	60-29-7	<LOQ	<LOQ
67	*tert*-Butyl methyl ether (MTBE)	1634-04-4	<LOQ	<LOQ
68	Tetrahydrofuran (THF)	109-99-9	<LOQ	<LOQ
	Glycols (LOQ =1µg/c/s; #69, #73 =50µg/c/s)			
69	PGME	107-98-2	<LOQ	<LOQ
70	Ethylene glycol diethyl ether	629-14-1	<LOQ	<LOQ
71	PGMEA	108-65-6	<LOQ	<LOQ
72	Cellosolve acetate	111-15-9	<LOQ	<LOQ
73	DGMEA	112-15-2	<LOQ	<LOQ
	Extra compound (LOQ = 50µg/compound/sample)			
75	Naphthalene *	91-20-3	<LOQ	<LOQ
	Worksheet check		2023-2050-2	

2023-2050

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SW08051 0817

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TestSafe AUSTRALIA

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

Client: EnvironOdour Australia — **Date Sampled : 17/03/2023**

Sample ID: 700 — **Date Analysed : 24/03/2023**

Reference Number : 2023-2050-3

No	Compounds	CAS No	Front (µg/section)	Back (µg/section)	No	Compounds	CAS No	Front (µg/section)	Back (µg/section)
	Aliphatic hydrocarbons (LOQ =1µg/c/s; #18 - #23 =5µg/c/s)					**Aromatic hydrocarbons** (LOQ = 1µg/compound/section)			
1	2-Methylbutane	78-78-4	<LOQ	<LOQ	39	Benzene	71-43-2	<LOQ	<LOQ
2	n-Pentane	109-66-0	<LOQ	<LOQ	40	Ethylbenzene	100-41-4	<LOQ	<LOQ
3	2-Methylpentane	107-83-5	<LOQ	<LOQ	41	Isopropylbenzene	98-82-8	<LOQ	<LOQ
4	3-Methylpentane	96-14-0	<LOQ	<LOQ	42	1,2,3-Trimethylbenzene	526-73-8	<LOQ	<LOQ
5	Cyclopentane	287-92-3	<LOQ	<LOQ	43	1,2,4-Trimethylbenzene	95-63-6	<LOQ	<LOQ
6	Methylcyclopentane	96-37-7	<LOQ	<LOQ	44	1,3,5-Trimethylbenzene	108-67-8	<LOQ	<LOQ
7	2,3-Dimethylpentane	565-59-3	<LOQ	<LOQ	45	Styrene	100-42-5	<LOQ	<LOQ
8	n-Hexane	110-54-3	<LOQ	<LOQ	46	Toluene	108-88-3	<LOQ	<LOQ
9	3-Methylhexane	589-34-4	<LOQ	<LOQ	47	p-Xylene &/or m-Xylene	106-42-3 & 108-38-3	<LOQ	<LOQ
10	Cyclohexane	110-82-7	<LOQ	<LOQ	48	o-Xylene	95-47-6	<LOQ	<LOQ
11	Methylcyclohexane	108-87-2	<LOQ	<LOQ		**Ketones** (LOQ =1µg/c/s; LOQ #49, #53 =10µg/c/s; #50, #51 =50µg/c/s)			
12	2,2,4-Trimethylpentane	540-84-1	<LOQ	<LOQ	49	Acetone	67-64-1	<LOQ	<LOQ
13	n-Heptane	142-82-5	<LOQ	<LOQ	50	Acetoin	513-86-0	<LOQ	<LOQ
14	n-Octane	111-65-9	<LOQ	<LOQ	51	Diacetone alcohol	123-42-2	<LOQ	<LOQ
15	n-Nonane	111-84-2	<LOQ	<LOQ	52	Cyclohexanone	108-94-1	<LOQ	<LOQ
16	n-Decane	124-18-5	<LOQ	<LOQ	53	Isophorone	78-59-1	<LOQ	<LOQ
17	n-Undecane	1120-21-4	<LOQ	<LOQ	54	Methyl ethyl ketone (MEK)	78-93-3	5	<LOQ
18	n-Dodecane	112-40-3	<LOQ	<LOQ	55	Methyl isobutyl ketone (MIBK)	108-10-1	<LOQ	<LOQ
19	n-Tridecane	629-50-5	<LOQ	<LOQ		**Alcohols** (LOQ =1µg/c/s; #56, #57, #58, #60 =10µg/c/s)			
20	n-Tetradecane	629-59-4	<LOQ	<LOQ	56	Ethyl alcohol	64-17-5	4483	2333
21	α-Pinene	80-56-8	<LOQ	<LOQ	57	n-Butyl alcohol	71-36-3	<LOQ	<LOQ
22	β-Pinene	127-91-3	<LOQ	<LOQ	58	Isobutyl alcohol	78-83-1	<LOQ	<LOQ
23	D-Limonene	138-86-3	36	<LOQ	59	Isopropyl alcohol	67-63-0	4	<LOQ
	Chlorinated hydrocarbons (LOQ = 1µg/compound/sample)				60	2-Ethyl hexanol	104-76-7	<LOQ	<LOQ
24	Dichloromethane	75-09-2	<LOQ	<LOQ	61	Cyclohexanol	108-93-0	<LOQ	<LOQ
25	1,1-Dichloroethane	75-34-3	<LOQ	<LOQ		**Acetates** (LOQ =1µg/c/s; #62 =10µg/c/s)			
26	1,2-Dichloroethane	107-06-2	<LOQ	<LOQ	62	Ethyl acetate	141-78-6	140	<LOQ
27	Chloroform	67-66-3	<LOQ	<LOQ	63	n-Propyl acetate	109-60-4	11	<LOQ
28	1,1,1-Trichloroethane	71-55-6	<LOQ	<LOQ	64	n-Butyl acetate	123-86-4	1	<LOQ
29	1,1,2-Trichloroethane	79-00-5	<LOQ	<LOQ	65	Isobutyl acetate	110-19-0	<LOQ	<LOQ
30	Trichloroethylene	79-01-6	<LOQ	<LOQ		**Ethers** (LOQ =1µg/c/s; #66 =10µg/c/s)			
31	Carbon tetrachloride	56-23-5	<LOQ	<LOQ	66	Ethyl ether	60-29-7	<LOQ	<LOQ
32	Perchloroethylene	127-18-4	<LOQ	<LOQ	67	*tert*-Butyl methyl ether (MTBE)	1634-04-4	<LOQ	<LOQ
33	1,1,2,2-Tetrachloroethane	79-34-5	<LOQ	<LOQ	68	Tetrahydrofuran (THF)	109-99-9	<LOQ	<LOQ
34	Chlorobenzene	108-90-7	<LOQ	<LOQ		**Glycols** (LOQ =1µg/c/s; #69, #73 =50µg/c/s)			
35	1,2-Dichlorobenzene	95-50-1	<LOQ	<LOQ	69	PGME	107-98-2	<LOQ	<LOQ
36	1,4-Dichlorobenzene	106-46-7	<LOQ	<LOQ	70	Ethylene glycol diethyl ether	629-14-1	<LOQ	<LOQ
	Miscellaneous (LOQ #37= 10µg & #38=50µg/compound/sample)				71	PGMEA	108-65-6	<LOQ	<LOQ
37	Acetonitrile	75-05-8	<LOQ	<LOQ	72	Cellosolve acetate	111-15-9	<LOQ	<LOQ
38	n-Vinyl-2-pyrrolidinone	88-12-0	<LOQ	<LOQ	73	DGMEA	112-15-2	<LOQ	<LOQ
	Extra compound (LOQ = 10µg/compound/sample)					**Extra compound** (LOQ = 50µg/compound/sample)			
74	Bromopropane *	106-94-5	<LOQ	<LOQ	75	Naphthalene *	91-20-3	<LOQ	<LOQ
	Total VOCs (LOQ =50µg/compound/section)		4681	2333		Worksheet check		2023-2050-3	

2023-2050

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Test Safe AUSTRALIA

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

All compounds (numbered 1-73) that are reported in the analysis are covered within the scope of NATA accreditation. Any additional compounds denoted with * are not covered by NATA accreditation.

Method : WCA.207 Analysis of Volatile Organic Compounds in Workplace Air by Gas Chromatography/Mass Spectrometry

Limit of Quantitation (LOQ) : 1 µg/sample except n-Dodecane, n-Tridecane, n-Tetradecane, a-Pinene, b-Pinene, Limonene and Trichloroethylene at 5 µg/sample; 10 µg/sample for Acetonitrile, Acetone, Isophorone, Ethanol, n-Butyl alcohol, Isobutyl alcohol, 2-Ethyl hexanol, Ethyl acetate, Ethyl ether and Bromopropane; 50 µg/sample for n-Vinyl-2-pyrrolidione, Acetoin, Diacetone alcohol, PGME, DGMEA and Naphthalene.

Method Description : Volatile organic compounds were trapped from the workplace air onto charcoal tubes by the use of a personal air monitoring pump. The volatile organic compounds were desorbed from the charcoal in the laboratory with CS_2 . An aliquot of the desorbant was analysed by 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. The measurement uncertainty relates to the analysis of the analyte on the sampling device and does not take into consideration the sampling parameters such as pump flowrate, time, temperature and pressure. The measurement of uncertainty estimates are available upon request.

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Appendix 4. Photos

Figure 17 Goterra Hume waste processing facility

Figure 18 Receiving and sorting area

Figure 19 MIBs

Figure 20 Frass storage

Figure 21 Processing area

Figure 22 Frass bulky bags

Figure 23 Air sampling for CO_2, VOCs and odour

Appendix 5. Ausplume dispersion modelling configuration

1

Unit 3 132 Newton St Wetherill Park

Concentration or deposition Concentration
Emission rate units OUV/second
Concentration units Odour_Units
Units conversion factor 1.00E+00
Constant background concentration 0.00E+00
Terrain effects None
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m
Use the convective PDF algorithm? No
Averaging time for sigma-theta values 60 min.

DISPERSION CURVES

Horizontal dispersion curves for sources <100m high Sigma-theta
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS

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

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

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

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

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

AVERAGING TIMES
1 hour

1

Unit 3 132 Newton St Wetherill Park

SOURCE CHARACTERISTICS

STACK SOURCE: 1

X(m)	Y(m)	Ground Elev.	Stack Height	Diameter	Temperature	Speed
304924	6253661	0m	7m	1.00m	28C	3.5m/s

Effective building dimensions (in metres)

Flow direction	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°
Effective building width	32	46	58	68	76	82	85	87	87	85	89	90
Effective building height	6	6	6	6	6	6	6	6	6	6	6	6
Along-flow building length	85	89	90	88	84	77	68	57	44	32	46	58
Along-flow distance from stack	-86	-84	-81	-76	-68	-57	-45	-32	-18	-4	-4	-4
Across-flow distance from stack	-12	-19	-25	-31	-35	-39	-41	-43	-44	-43	-40	-36

Flow direction	130°	140°	150°	160°	170°	180°	190°	200°	210°	220°	230°	240°
Effective building width	88	84	77	68	57	44	32	46	58	68	76	82
Effective building height	6	6	6	6	6	6	6	6	6	6	6	6

Along-flow building length	68	76	82	86	87	87	85	89	90	88	84	77
Along-flow distance from stack	-3	-3	-2	-2	-1	0	1	-4	-9	-13	-17	-20
Across-flow distance from stack	-31	-25	-19	-11	-4	4	12	19	26	31	36	39

Flow direction	250°	260°	270°	280°	290°	300°	310°	320°	330°	340°	350°	360°
Effective building width	85	87	87	85	88	90	88	84	77	68	57	44
Effective building height	6	6	6	6	6	6	6	6	6	6	6	6
Along-flow building length	68	57	44	32	46	58	68	76	82	85	87	87
Along-flow distance from stack	-23	-25	-26	-28	-42	-54	-65	-74	-80	-84	-87	-87
Across-flow distance from stack	42	43	44	43	40	36	32	25	19	11	4	-4

(Constant) emission rate = 1.12E+03 OUV/second
No gravitational settling or scavenging.

STACK SOURCE: 2

X(m)	Y(m)	Ground Elev.	Stack Height	Diameter	Temperature	Speed
304946	6253657	0m	7m	1.00m	28C	3.6m/s

_______ Effective building dimensions (in metres) _______

Flow direction	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°
Effective building width	32	46	58	68	76	82	85	87	87	85	89	90
Effective building height	6	6	6	6	6	6	6	6	6	6	6	6
Along-flow building length	85	89	90	88	84	77	68	57	44	32	46	58
Along-flow distance from stack	-85	-88	-89	-87	-82	-74	-65	-53	-40	-26	-26	-25
Across-flow distance from stack	10	3	-4	-11	-18	-25	-30	-35	-40	-43	-44	-44

Flow direction	130°	140°	150°	160°	170°	180°	190°	200°	210°	220°	230°	240°
Effective building width	88	84	77	68	57	44	32	46	58	68	76	82
Effective building height	6	6	6	6	6	6	6	6	6	6	6	6
Along-flow building length	68	76	82	86	87	87	85	89	90	88	84	77
Along-flow distance from stack	-23	-20	-17	-13	-9	-4	1	-1	-1	-2	-3	-3
Across-flow distance from stack	-42	-40	-36	-31	-25	-18	-10	-3	4	12	19	25

Flow direction	250°	260°	270°	280°	290°	300°	310°	320°	330°	340°	350°	360°
Effective building width	85	87	87	85	88	90	88	84	77	68	57	44
Effective building height	6	6	6	6	6	6	6	6	6	6	6	6
Along-flow building length	68	57	44	32	46	58	68	76	82	85	87	87
Along-flow distance from stack	-3	-4	-4	-6	-20	-33	-45	-56	-66	-73	-79	-83
Across-flow distance from stack	30	35	40	43	44	43	43	40	36	31	25	18

(Constant) emission rate = 1.12E+03 OUV/second

No gravitational settling or scavenging.

1

Unit 3 132 Newton St Wetherill Park

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
304500.m 304525.m 304550.m 304575.m 304600.m 304625.m 304650.m
304675.m 304700.m 304725.m 304750.m 304775.m 304800.m 304825.m
304850.m 304875.m 304900.m 304925.m 304950.m 304975.m 305000.m
305025.m 305050.m 305075.m 305100.m 305125.m 305150.m 305175.m
305200.m 305225.m 305250.m 305275.m 305300.m 305325.m 305350.m
305375.m 305400.m 305425.m 305450.m 305475.m 305500.m

and these y-values (or northings):
6253000.m 6253025.m 6253050.m 6253075.m 6253100.m 6253125.m 6253150.m
6253175.m 6253200.m 6253225.m 6253250.m 6253275.m 6253300.m 6253325.m
6253350.m 6253375.m 6253400.m 6253425.m 6253450.m 6253475.m 6253500.m
6253525.m 6253550.m 6253575.m 6253600.m 6253625.m 6253650.m 6253675.m
6253700.m 6253725.m 6253750.m 6253775.m 6253800.m 6253825.m 6253850.m
6253875.m 6253900.m 6253925.m 6253950.m 6253975.m 6254000.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	304500	6253000	0.0	1.0	4	304920	6253661	0.0	3.0
2	305500	6254000	0.0	2.0	5	304951	6253656	0.0	3.0
3	304906	6253578	0.0	3.0	6	304937	6253573	0.0	3.0

METEOROLOGICAL DATA : -33.8510S, 150.8567E UA_ID: 067119