REPORT NUMBER R011402

Air Emission Monitoring Report - 2021
Veolia Environmental Services (Australia) Pty Ltd, Berrimah, NT

Document Information

Template Version; 230621

Client Name:	Veolia Environmental Services (Australia) Pty Ltd
Report Number:	R011402
Date of Issue:	18 October 2021
Attention:	Paulo Castro
Address:	500 Churchill Rd Kilburn SA 5084
Testing Laboratory:	Ektimo Pty Ltd, ABN 86 600 381 413

Report Authorisation

Mitchell Steele
Client Manager

NATA Accredited Laboratory
No. 14601

Greg Sceneay
Ektimo Signatory

Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC mutual recognition arrangement for the mutual recognition of the equivalence of testing, calibration and inspection reports.

Please note that only numerical results pertaining to measurements conducted directly by Ektimo are covered by Ektimo's terms of NATA accreditation. This does not include comments, conclusions or recommendations based upon the results. Refer to 'Test Methods' for full details of testing covered by NATA accreditation.

Table of Contents

1 EXECUTIVE SUMMARY

1.1 Background

Ektimo was engaged by Veolia Environmental Services (Australia) Pty Ltd to perform emission testing at their Berrimah plant. Testing was carried out in accordance with Northern Territory Environmental Protection Licence EPL 202 (formerly EPL 104).

Due to the strong wind conditions during the field odour assessment, three of the five sensitive receptor locations required for odour assessment (Dennis Court, Moo Street and Frank Court) were deemed not suitable. The field odour assessment was performed at five locations downwind of the site.

1.2 Project Objectives

The objectives of the project were to conduct a monitoring programme to quantify emissions from the discharge points below to determine compliance with Veolia Environmental Services (Australia) Pty Ltd's Environmental Licence. A field odour survey was also conducted as part of this project (refer to section 3, Field Odour Survey for full details).

Monitoring was performed as follows:

Location	Test Date	Test Parameters
Autoclave Flue (Stack Source)	08 September2021	**Duplicate sampling -** Speciated volatile organic compounds (VOCs), phenol, formaldehyde, acid gases (HCl, HF, Cl_2, NH_3), odour and character*
Autoclave bin cooling area	08 September 2021	Speciated volatile organic compounds (VOCs), phenol, formaldehyde, acid gases (HCl, HF, Cl_2, NH_3), odour and character
Dewatering IBC	08 September 2021	Odour and character
Electro DAF Shed	08 September 2021	Odour and character
Underground Sump	08 September 2021	Odour and character

* Flow rate, velocity, temperature and moisture were also determined.

Location	Test Date	Test Parameters
Survey locations 1-5	07 September 2021	Field odour intensity surveys

All results are reported on a dry basis at STP (except odour wet – STP).

Plant operating conditions have been noted in the report.

1.3 Project Overview

1.3.1 Plant Test Locations

Autoclave Stack

The autoclave is a batch process and operates over a cycle time of approximately 1 hour. During the cycle, significant emissions to air only occur during the venting phase. Generally, four venting periods occur for a total of approximately 5 minutes. At the start and at the end of the autoclave cycle two short vents occur within ~5 mins of each other. During the remainder of the cycle, there is either no significant discharge flow or a negative airflow. This was confirmed via continuous measurement of stack velocity over the entire sampled batch cycles during testing.

For these reasons, all analytes were sampled during the venting phases of the cycle. Test 1 was sampled continuously from the start of the first vent to the end of the second vent, and again from the start of the third vent to the end of the fourth vent. This captured a larger sample size. Test 2 was sampled for the exact time each vent cycle occurred.

This testing required modification of some of the sampling methodology to obtain meaningful results (Refer to section 5 Deviations from Test Methods).

Bin Cooling Area

At the end of the autoclave cycle the four bins containing waste are emptied into a large industrial size bin. This bin is usually located just outside the rear entry door, the waste is then left to cool. Time between the end of the autoclave cycle to bin transfer is approximately 15 minutes.

Sampling was conducted at the top of the bin immediately after the waste from Test 1 had been transferred.

Underground Sump

The underground sump receives odorous wastewater from the condenser serving the autoclave. The condensate is hot and requires cooling before it is pumped from the sump. A blower is used to duct cooling air into the sump for this purpose. The blower operates for approximately 10 minutes per autoclave cycle. This corresponds to 30-40 minutes of aeration per operational day (assuming 3-4 autoclave cycles are conducted during a standard day).

Odour emissions are at a maximum when the blower is operating due to the forced airflow through the sump. Odour emissions are expected to be minimal (but not zero) by comparison when the blower is off.

Testing for the Underground Sump was performed when the blower was operating. This was conducted by collecting an odour sample directly from the sump and measuring the air flow rate supplied by the blower fan.

Electro DAF Shed

The Electro DAF Shed odour sample was collected as a grab sample from within the shed, at the far east corner next to the last holding tank, to determine odour concentration.

De-watering IBC

The De-watering IBC sample was collected as a grab sample at the opening of the IBC to determine odour concentration.

1.3.2 Field Odour Survey Methodology

Odour is assessed based on a number of parameters:

- **Intensity** (0 – 6 scale from not perceptible to extremely strong);
- **Hedonic tone** (Scale ranging from extremely pleasant to extremely unpleasant);
- **Frequency** (how long is the odour detectable);
- **Character** (what does the odour smell like)

During the field survey, at each observation location, the individual observers note the odour intensity, the hedonic tone and the character (or nature) of the odour. The odour intensity and hedonic tone scales presented below, are utilised from the method VDI 3940 Part 3: Measurement of Odour Impact by Field Inspection.

Odour Intensity Scale						
0 no odour	**1** very weak	**2** weak	**3** distinct	**4** strong	**5** very strong	**6** extremely strong

Hedonic Tone Scale								
-4 extremely unpleasant	**-3**	**-2**	**-1**	**0** neutral (neither pleasant nor unpleasant)	**1**	**2**	**3**	**4** extremely pleasant

The surveys are then accumulated into a cumulative frequency distribution that indicates for each location the percentage of survey time that the odour intensity is below a given value.

Odour observations conducted at all sites were assessed by two observers with each observer recording the odour intensity every 10 seconds for a period of 10 minutes. Wind speed and direction for each location was also determined using a handheld anemometer and a compass respectively. Figure 1 details each location on an aerial image in relation to the site boundary, and the range of wind direction on the morning of the survey. Weather conditions on the morning of September 7th were recorded from the nearest weather station at Darwin Airport (Figure 2).

The field odour survey comprised of five locations downwind of the Veolia Environmental Services site. Survey locations included two sites on Beaton Road, and three sites on Vigilant Lane.

Figure 1- Survey locations, site boundary and range of wind direction

Time	Temp. °C	Dew Point °C	Relative Humidity %	Rain mm	Wind km/h	Gust km/h
8am	24.1	5.5	30	0	S 30	37
9am	25.1	4.8	27	0	SE 28	33
10am	27	4.7	24	0	SE 26	32
11 am	29.6	5.6	22	0	SE 22	26

* Data obtained from Bureau of Meterology weather app

Figure 2 – Weather conditions from Darwin Airport

1.4 Results Summary

1.4.1 Onsite testing

Testing results conducted on the Autoclave Stack, Underground Sump, the Electro DAF Shed and the De-watering IBC area are summarised in the Results Summary (Section 1.4). Full details are in Section 2 Results.

Results reported for the Autoclave Stack are only applicable to the venting phase of the cycle during which time the measurements were conducted. Venting occurs for approximately 5 minutes per cycle only; on a standard operational day, typically 3-4 autoclave cycles are conducted. At other periods of the Autoclave cycle (e.g. heating) there is minimal (close to zero) airflow exiting the stack or a negative airflow (air entering the stack exhaust).

Results reported for the Underground Sump are applicable to when the blower is in operation. This occurs for approximately 10 minutes per autoclave cycle. At other periods when the blower is not operating, odour emissions would be expected to be significantly lower by comparison.

Results reported for the Electro DAF shed are applicable to when water treatment was is in operation.

The below table shows detected values for all analytes as per the Veolia's Emission Monitoring Plan (Doc. PLA-NT-800B-001-2) in accordance with the reporting requirements for Northern Territory Environmental Protection Authority (EPA) licence number EPL 202 (formerly EPL 104).

Monitoring results are summarized in the following table:

Location Description	Pollutant	Units	Detected Values
Autoclave Stack	Phenol	mg/m^3	<0.07
	Formaldehyde	mg/m^3	0.16
	Ethyl benzene	mg/m^3	1.1
	Styrene	mg/m^3	3.3
	Hydrogen chloride	mg/m^3	≤0.033
	Hydrogen fluoride	mg/m^3	<0.02
	Chlorine	mg/m^3	0.72
	Ammonia	mg/m^3	4.9
	Odour	ou	61,000
Autoclave Bin Cooling Area	Phenol	mg/m^3	<0.02
	Formaldehyde	mg/m^3	0.024
	Ethyl benzene	mg/m^3	<0.2
	Styrene	mg/m^3	<0.2
	Hydrogen chloride	mg/m^3	<0.02
	Hydrogen fluoride	mg/m^3	<0.02
	Chlorine	mg/m^3	<0.04
	Ammonia	mg/m^3	0.049
	Odour	ou	560
Underground Sump	Odour	ou	100
Dewatering IBC	Odour	ou	69000
Electro DAF Shed	Odour	ou	64000

1.4.2 Field Odour Survey

Five field odour surveys were conducted downwind of the site, only two of the five sensitive receptor locations were surveyed due to wind conditions in excess of permissible speeds on the day. The locations of Moo St, Frank Ct and Dennis Ct were screened prior to the field odour survey between 8am-8.30am and revealed no detectable odour from the site. These three locations are east, south and south-east of the site.

The field odour survey revealed very weak detectable odours, characterised as oily waste and rubbish. It must be noted that the survey was not conducted during the operational period of the Autoclave stack. Due to maintenance, the Autoclave was not operational on the 7th of September and therefore could not be included as a part of the odour survey.

Wind velocities were moderate to fresh and wind direction was consistent, blowing from the south-east. The survey was conducted downwind of the Veolia site to gauge the potential odour impact for neighbouring receptors. Two of the five nearest receptors were captured during the survey, the other three nearest receptor locations were pre-screened prior to the survey. It was noted that impacting odour from site would not be detected due to the current wind conditions.

2 RESULTS

2.1 Autoclave Flue (Stack Source)

Date	8/09/2021	**Client**	Veolia Environmental Services
Report	R011402	**Stack ID**	Autoclave Stack
Licence No.	EPL 202	**Location**	Darwin
Ektimo Staff	Mitchell Steele, Micah Faboade	**State**	NT
Process Conditions	Please refer to client records.		*210823*

Sampling Plane Details		
Sampling plane dimensions	200 mm	
Sampling plane area	0.0314 m²	
Sampling port size, number & depth	2", 2 mm	
Access & height of ports	Step ladder	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Exit 40 D	
Upstream disturbance	Change in diameter 5 D	
No. traverses & points sampled	1 2	
Sample plane compliance to AS4323.1	Compliant but non-ideal	

Comments

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	43	
Gas molecular weight, g/g mole	24.5 (wet)	29.4 (dry)
Gas density at STP, kg/m³	1.09 (wet)	1.31 (dry)
Gas density at discharge conditions, kg/m³	0.83	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0818 & 1138	
Temperature, °C	87	
Velocity at sampling plane, m/s	6.1	
Volumetric flow rate, actual, m³/min	12	
Volumetric flow rate (wet STP), m³/min	8.8	
Volumetric flow rate (dry STP), m³/min	5	
Mass flow rate (wet basis), kg/hour	570	

Gas Analyser Results	Average
Sampling time	1147 - 1149
	Concentration mg/m³ / Mass Rate g/min
Combustion Gases	Concentration % v/v
Carbon dioxide	3.2
Oxygen	19.2

Non-isokinetics	Average		Test 1		Test 2	
Sampling time			0818-0842		1138-1145	
	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min
Chlorine	0.72	0.0036	0.28	0.0014	1.2	0.0057
Ammonia	4.9	0.025	0.98	0.0049	8.9	0.044

Note: Sample time represents the total run time for each test. Actual sampling was conducted during the venting phase of the cycle. Reported velocity, flow rates and calculated mass rates represent the averages during the venting phase of the cycle.

Date	8/09/2021	**Client**	Veolia Environmental Services
Report	R011402	**Stack ID**	Autoclave Stack
Licence No.	EPL 202	**Location**	Darwin
Ektimo Staff	Mitchell Steele, Micah Faboade	**State**	NT
Process Conditions	Please refer to client records.		*210823*

Phenol	Average		Test 1		Test 2	
Sampling time			0818-0842		1138-1145	
	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min
Phenol	<0.07	<0.0004	<0.04	<0.0002	<0.1	<0.0005

Aldehydes	Average		Test 1		Test 2	
Sampling time			0838-0938		1138-1238	
	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min
Formaldehyde	0.16	0.00082	0.17	0.00086	0.15	0.00077

Acid gases	Average		Test 1		Test 2	
Sampling time			0838-0938		1138-1238	
	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min
Hydrogen chloride	≤0.033	≤0.00016	<0.02	<0.0001	0.046	0.00023
Hydrogen fluoride (soluble)	<0.02	<0.0001	<0.02	<0.0001	<0.02	<0.0001

Odour	Average		Test 1		Test 2	
Sampling time			0818 - 0827		1237 - 1241	
	Concentration ou	Mass Rate oum³/min	Concentration ou	Mass Rate oum³/min	Concentration ou	Mass Rate oum³/min
Results	61000	540000	64000	560000	59000	520000
Lower uncertainty limit	45000		41000		38000	
Upper uncertainty limit	83000		98000		91000	
Hedonic tone			very unpleasant		very unpleasant	
Odour character			waste, mouldy, rubbish, landfill		waste, mouldy, rubbish, landfill	
Analysis date & time			09/09/21, 1000		09/09/21, 1000	
Holding time			26 hours		22 hours	
Dilution factor			6		6	
Bag material			Nalophan		Nalophan	
Butanol threshold (ppb)	77					
Laboratory temp (°C)	21					
Last calibration date	January 2021					

Date	8/09/2021	**Client**	Veolia Environmental Services
Report	R011402	**Stack ID**	Autoclave Stack
Licence No.	EPL 202	**Location**	Darwin
Ektimo Staff	Mitchell Steele, Micah Faboade	**State**	NT
Process Conditions	Please refer to client records.		*210823*

Total Speciated VOCs	Average		Test 1		Test 2	
Sampling time						
	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min
Total	1100	5.3	810	4	1300	6.5

VOC's C5-C20	Average		Test 1		Test 2	
Sampling time			0842-0942		1138-1238	
	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min
Detection limit[(2)]	<0.2	<0.0009	<0.2	<0.0009	<0.2	<0.0009
Ethanol	390	1.9	100	0.51	670	3.3
Isopropanol	280	1.4	150	0.74	410	2.1
Chloroform	2.9	0.014	2.9	0.014	2.8	0.014
Benzene	0.74	0.0037	0.55	0.0027	0.94	0.0047
Toluene	3.4	0.017	3.4	0.017	3.4	0.017
Ethylbenzene	1.1	0.0053	1.3	0.0065	0.82	0.0041
m + p-Xylene	1.2	0.0061	1.8	0.0088	0.68	0.0034
Styrene	3.3	0.016	4.2	0.021	2.5	0.012
o-Xylene	0.82	0.0041	1.3	0.0065	0.35	0.0017
1,3,5-Trimethylbenzene	7.1	0.035	12	0.06	2.1	0.01
1,2,4-Trimethylbenzene	16	0.079	27	0.13	4.7	0.023
1,2,3-Trimethylbenzene	7.1	0.035	12	0.06	2.2	0.011
Methyl ethyl ketone	≤4.1	≤0.02	<0.2	<0.0009	8	0.04
Ethyl acetate	≤4.1	≤0.02	<0.2	<0.0009	8	0.04
Heptane	≤0.75	≤0.0037	<0.2	<0.0009	1.3	0.0066
Octane	≤0.65	≤0.0032	1.1	0.0055	<0.2	<0.0009
Butyl acetate	≤0.3	≤0.0015	<0.2	<0.0009	0.41	0.0021
Nonane	≤19	≤0.093	37	0.18	<0.2	<0.0009
alpha-Pinene	≤2.4	≤0.012	<0.2	<0.0009	4.6	0.023
beta-Pinene	≤1.5	≤0.0075	<0.2	<0.0009	2.8	0.014
Decane	140	0.72	250	1.2	37	0.18
D-Limonene	61	0.3	9	0.045	110	0.56
Undecane	91	0.45	160	0.79	24	0.12
Dodecane	18	0.091	29	0.14	7.6	0.038
Tridecane	5	0.025	7.1	0.036	2.9	0.015
Tetradecane	1.4	0.007	1.9	0.0092	0.94	0.0047

(1) Compounds marked with an asterisk have been semi-quantified (refer to Definitions) and are therefore not covered by the scope of Ektimo's NATA accreditation.

(2) Unless otherwise reported, the following target compounds were found to be below detection:
Dichloromethane, 1,1-Dichloroethene, trans-1,2-Dichloroethene, cis-1,2-Dichloroethene, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Carbon tetrachloride, Butanol, 1-Methoxy-2-propanol, Trichloroethylene, 1,1,2-Trichloroethane, Tetrachloroethene, Chlorobenzene, 2-Butoxyethanol, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, Propylbenzene, tert-Butylbenzene, Acetone, Pentane, Acrylonitrile, n-Hexane, Cyclohexane, 2-Methylhexane, Isopropyl acetate, 2,3-Dimethylpentane, 3-Methylhexane, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 2-Hexanone, 1-Methoxy-2-propyl acetate, Butyl acrylate, Cellosolve acetate, 3-Carene

2.2 Autoclave Bin Cooling Area

Date	8/09/2021	**Client**	Veolia Environmental Services
Report	R011402	**Stack ID**	Bin cooling area
Licence No.	EPL 202	**Location**	Darwin
Ektimo Staff	Mitchell Steele, Micah Faboade	**State**	NT
Process Conditions	Please refer to client records.		

Stack Parameters		
Moisture content, %v/v	0.63	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)

Non-isokinetics	Results
Sampling time	1014-1114
	Concentration mg/m³
Chlorine	<0.04
Ammonia	0.049

Phenol	Results
Sampling time	1014-1114
	Concentration mg/m³
Phenol	<0.02

Aldehydes	Results
Sampling time	1024-1114
	Concentration mg/m³
Formaldehyde	0.024

Acid gases	Results
Sampling time	1014-1114
	Concentration mg/m³
Hydrogen chloride	<0.02
Hydrogen fluoride (soluble)	<0.02

Odour	Results
Sampling time	1014 - 1034
	Concentration ou
Results	560
Lower uncertainty limit	360
Upper uncertainty limit	860
Hedonic tone	
Odour character	dirty socks, rubbish, plastic
Analysis date & time	09/09/21 1000
Holding time	24 hours
Dilution factor	1
Bag material	Nalophan
Butanol threshold (ppb)	77.0
Laboratory temp (℃)	21
Last calibration date	January 2021

Date	8/09/2021	**Client**	Veolia Environmental Services
Report	R011402	**Stack ID**	Bin cooling area
Licence No.	EPL 202	**Location**	Darwin
Ektimo Staff	Mitchell Steele, Micah Faboade	**State**	NT
Process Conditions	Please refer to client records.		

Total Speciated VOCs	Results
Sampling time	
	Concentration mg/m³
Total	4.8

VOC's C5-C20	Results
Sampling time	1014-1114
	Concentration mg/m³
Detection limit[(2)]	<0.2
Decane	1.1
Undecane	1.6
Dodecane	1.1
Tridecane	0.66
Tetradecane	0.33

(1) Compounds marked with an asterisk have been semi-quantified (refer to Definitions) and are therefore not covered by the scope of Ektimo's NATA accreditation.

(2) Unless otherwise reported, the following target compounds were found to be below detection:
Dichloromethane, Ethanol, Isopropanol, 1,1-Dichloroethene, trans-1,2-Dichloroethene, cis-1,2-Dichloroethene, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Benzene, Carbon tetrachloride, Butanol, 1-Methoxy-2-propanol, Trichloroethylene, Toluene, 1,1,2-Trichloroethane, Tetrachloroethene, Chlorobenzene, Ethylbenzene, m +p-Xylene, Styrene, o-Xylene, 2-Butoxyethanol, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, Propylbenzene, 1,3,5-Trimethylbenzene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, 1,2,3-Trimethylbenzene, Acetone, Pentane, Acrylonitrile, Methyl ethyl ketone, n-Hexane, Ethyl acetate, Cyclohexane, 2-Methylhexane, Isopropyl acetate, 2,3-Dimethylpentane, 3-Methylhexane, Heptane, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, 2-Hexanone, Octane, Butyl acetate, 1-Methoxy-2-propyl acetate, Butyl acrylate, Nonane, Cellosolve acetate, alpha-Pinene, beta-Pinene, 3-Carene, D-Limonene

2.3 Dewatering IBC

Date	8/09/2021	**Client**	Veolia Environmental Services
Report	R011402	**Stack ID**	Dewatering IBC
Licence No.	EPL 202	**Location**	Darwin
Ektimo Staff	Mitchell Steele, Micah Faboade	**State**	NT
Process Conditions	Please refer to client records.		

Odour	Results
Sampling time	0723 - 0733
	Concentration
	ou
Results	69000
Lower uncertainty limit	45000
Upper uncertainty limit	110000
Hedonic tone	very unpleasant
Odour character	rotten, landfill gas
Analysis date & time	09/09/21, 1000
Holding time	27 hours
Dilution factor	6.5
Bag material	Nalophan
Butanol threshold (ppb)	77.0
Laboratory temp (°C)	21
Last calibration date	January 2021

2.4 Electro DAF Shed

Date	8/09/2021	**Client**	Veolia Environmental Services
Report	R011402	**Stack ID**	Electro DAF Shed
Licence No.	EPL 202	**Location**	Darwin
Ektimo Staff	Mitchell Steele, Micah Faboade	**State**	NT
Process Conditions	Please refer to client records.		

Odour	Results
Sampling time	0738 - 0747
	Concentration
	ou
Results	64000
Lower uncertainty limit	41000
Upper uncertainty limit	98000
Hedonic tone	very unpleasant
Odour character	rotten, organic decomposed
Analysis date & time	09/09/21, 1000
Holding time	27 hours
Dilution factor	6
Bag material	Nalophan
Butanol threshold (ppb)	77.0
Laboratory temp (°C)	21
Last calibration date	January 2021

2.5 Underground Sump

Date	8/09/2021	**Client**	Veolia Environmental Services
Report	R011402	**Stack ID**	Underground Sump
Licence No.	EPL 202	**Location**	Darwin
Ektimo Staff	Mitchell Steele, Micah Faboade	**State**	NT
Process Conditions	Please refer to client records.		

Odour	Results
Sampling time	0826 - 0838
	Concentration
	ou
Results	100
Lower uncertainty limit	67
Upper uncertainty limit	160
Hedonic tone	neutral
Odour character	chemical, onions, garlic
Analysis date & time	09/09/21, 1000
Holding time	26 hours
Dilution factor	1
Bag material	Nalophan
Butanol threshold (ppb)	77.0
Laboratory temp (℃)	21
Last calibration date	January 2021

2.6 Odour Survey Results

Table 1: Odour Survey Results – Person 1

Location	Observation Time	Odour observations - Person 1				
		Intensity	Frequency	Accumulated Frequency	Hedonic tone/s	Character
Field survey #1 Vigilant Lane 1	0905-0915	0 - No odour 1 - Very weak 2 - Weak	86.7% 8.3% 5.0%	86.7% 95.0% 100.0%	Unpleasant, midly unpleasant	Oily, waste/rubbish
Field survey #2 Vigilant Lane 2	0921-0931	0 - No odour 1 - Very weak	98.3% 1.7%	98.3% 100.0%	Mildly unpleasant	Oily
Field survey #3 Vigilant Lane 3	0940-0950	0 - No odour 1 - Very weak	96.7% 3.3%	96.7% 100.0%	Unpleasant, midly unpleasant	Oily, waste/rubbish
Field survey #4 Beaton Road 1	0955-1005	0 - No odour 1 - Very weak 2 - Weak	70.0% 21.7% 8.3%	70.0% 91.7% 100.0%	Mildly unpleasant, pleasant	Oily, cardboard, sweet/chemical
Field survey #5 Beaton Road 2	1012-1022	0 - No odour 1 - Very weak	100.0% 0.0%	100.0% 100.0%	-	-

Table 2: Odour Survey Results – Person 2

Location	Observation Time	Odour observations				
		Intensity	Frequency	Accumulated Frequency	Hedonic tone/s	Character
Field survey #1 Vigilant Lane 1	0905-0915	0 - No odour 1 - Very weak 2 - Weak	78.3% 11.7% 10.0%	78.3% 90.0% 100.0%	Mildy unpleasant	Sewage
Field survey #2 Vigilant Lane 2	0921-0931	0 - No odour 1 - Very weak	96.7% 3.3%	96.7% 100.0%	Mildly unpleasant	Sewage
Field survey #3 Vigilant Lane 3	0940-0950	0 - No odour 1 - Very weak	100.0% 0.0%	100.0% 100.0%	-	-
Field survey #4 Beaton Road 1	0955-1005	0 - No odour 1 - Very weak	78.3% 21.7%	78.3% 100.0%	Mildly unpleasant, neutral	Rubbish, oily
Field survey #5 Beaton Road 2	1012-1022	0 - No odour 1 - Very weak	95.0% 5.0%	95.0% 100.0%	Mildly unpleasant	Compost, stale

Table 1 and 2 show the results from the field odour surveys conducted on 7 September 2021. An average of the frequency of Person 1 and Person 2 has been used in the comments below.

Location #1 was conducted from 9:05 AM with light breezes (0-3.1m/s) from the south-east (SE). Observations were made from Vigilant Lane as shown in Figure 1 (GPS: latitude -12.43396, longitude 130.91996). Results from field survey #1 indicate that for 82.5% of the of the 10-minute survey, no odour was detectable. For 10% of the survey, a very weak odour was detected and for 7.5% of the survey a weak odour was detected. The hedonic tone was established as unpleasant, mildly unpleasant, with character recorded as oily, waste/rubbish and sewage.

Location #2 was conducted from 9:21 AM with light breezes (0.5-4.6m/s) from the south-south-east (SSE). Observations were made from Vigilant Lane as shown in Figure 1 (GPS: latitude -12.43357, longitude 130.91883). Results from field survey 2 shows that for 97.5% of the of the survey, no odour was detectable. For 2.5% of the survey, a very weak odour was detected. The hedonic tone was established as mildly unpleasant, with character recorded as oily, and sewage.

Location #3 was conducted from 9:40 AM with light breezes (0.8-6.3m/s) from the south-south-east (SSE). Observations were made from Vigilant Lane as shown in Figure1 (GPS: latitude -12.43295, longitude 130.91740). Results from field survey 3 shows that for 98.3% of the survey, no odour was detectable. For 1.7% of the survey, a very weak odour was detected. The hedonic tone was established as unpleasant, mildly unpleasant, with the character recorded as oily, waste/rubbish.

Location #4 was conducted from 9:55 AM with light breezes (0.2-4.9m/s) from the southeast (SE). Observations were made from the Veolia Front Gate as shown in Figure 1 (GPS: latitude -12.43540, longitude 130.91944). Results from field survey 4 shows that for 74.2% of the survey, no odour was detectable. For 21.7% of the survey, a very weak odour was detected, and a weak odour was detected for 4.2% of the survey. The hedonic tone was established as neutral, pleasant or mildly unpleasant with character recorded as rubbish, oily, cardboard, sweet/chemical.

Location #5 was conducted from 10:12 AM with light breezes (0.5-6.7m/s) from the southeast (SE). Observations were made from Beaton Road as shown in Figure 1 (GPS: latitude -12.43482, longitude 130.91790). Results from field survey 5 shows that for 97.5% of the survey, no odour was detectable. For 2.5% of the survey, a very weak odour was detected. The hedonic tone was established as mildly unpleasant with character recorded as compost and stale.

3 PLANT OPERATING CONDITIONS

The below plant operating conditions have been supplied by Veolia personnel.

Test 1 autoclave:

- Autoclave started 0809
- initial phase venting started 0818-0819, 0830-0832
- final phase venting started 0918-0919, 0925-0928

Test 2 autoclave:

- Autoclave started 1127
- initial phase venting 1138-1139, 1147-1149
- final phase venting 1237-1240, 1245-1246

See Veolia Environmental Services (Australia) Pty Ltd's records for complete process conditions.

4 TEST METHODS

All sampling and analysis performed by Ektimo unless otherwise specified. Specific details of the methods are available upon request.

Parameter	Sampling Method	Analysis Method	Uncertainty*	NATA Accredited	
				Sampling	Analysis
Sampling points - Selection	AS 4323.1	NA	NA	✓	NA
Flow rate, temperature and velocity	ISO 10780	ISO 10780	8%, 2%, 7%	NA	✓
Moisture	USEPA Alt-008	USEPA Alt-008	19%	✓	✓
Carbon dioxide and oxygen	USEPA Method 3A	USEPA Method 3A	13%	✓	✓
Ammonia	Ektimo 260	Envirolab in-house methods Inorg-093 & Inorg-057	18%	✓	✓‡
Hydrogen halides and halogens	USEPA Method 26	Ektimo 235	14%	✓	✓†
Phenol and phenolic compounds	Ektimo 320	Ektimo 320	17%	✓	✓†
Aldehydes and ketones	Ektimo 332	Ektimo 332	16%	✓	✓†
Speciated volatile organic compounds	Ektimo 344	Ektimo 344	19%	✓	✓†,d
Odour	AS 4323.3	AS4323.3	Refer to results	✓	✓¥
Odour characterisation	NA	direct observation	NA	NA	×
Odour survey	NA	based on VDI 3940	NA	NA	×
Acid gases	NIOSH 7903	Ektimo 235	not specified	×	✓†

210723

* Uncertainties cited in this table are estimated using typical values and are calculated at the 95% confidence level (coverage factor = 2).

† Analysis conducted at the Ektimo Mitcham, VIC laboratory, NATA accreditation number 14601. Results were reported on
23 September 2021 in report LV-001941.
30 September 2021 in report LV-001957.
30 September 2021 in report LV-001967.

‡ Analysis performed by Envirolab, NATA accreditation number 2901. Results were reported to Ektimo on 21 September 2021 in report 278080.

¥ Odour analysis conducted at the Cockburn Central, WA laboratory by forced choice olfactometry, NATA accreditation number 14601. Results were reported on 9 September 2021 in report WO-00199.

d Excludes recovery study as specified in section 8.4.3 of USEPA Test Method 18.

5 DEVIATIONS TO TEST METHODS

Deviation from analytical method: Due to COVID-19 social distancing requirements, the minimum number of panellists stipulated in AS4323.3 of four (4) cannot be adhered to. Three (3) panellists were used and the number of dilution series for each sample was increased to achieve comparable calculated uncertainty and meet the minimum ITE requirement (8) of the method.

Due to short venting times, only short test times were available for sampling. Consequently, all test times were reduced.

The methods NIOSH 7903 (Hydrogen Fluoride) and Ektimo 344 (Speciated VOCs), were captured via an SKC flexfoil bag and then extracted through their respective sorbent tube sampling media. This method deviation was performed to increase the sampling time of the test and therefore maintaining the recommended sampling rates.

6 QUALITY ASSURANCE/QUALITY CONTROL INFORMATION

Ektimo is accredited by the National Association of Testing Authorities (NATA) for the sampling and analysis of air pollutants from industrial sources. Unless otherwise stated test methods used are accredited with the National Association of Testing Authorities. For full details, search for Ektimo at NATA's website www.nata.com.au.

Ektimo is accredited by NATA (National Association of Testing Authorities) to ISO/IEC 17025 - Testing. ISO/IEC 17025 - Testing requires that a laboratory have adequate equipment to perform the testing, as well as laboratory personnel with the competence to perform the testing. This quality assurance system is administered and maintained by the Quality Director.

NATA is a member of APAC (Asia Pacific Accreditation Co-operation) and of ILAC (International Laboratory Accreditation Co-operation). Through mutual recognition arrangements with these organisations, NATA accreditation is recognised worldwide.

7 DEFINITIONS

The following symbols and abbreviations may be used in this test report:

% v/v	Volume to volume ratio, dry or wet basis
~	Approximately
<	Less than
>	Greater than
≥	Greater than or equal to
APHA	American Public Health Association, Standard Methods for the Examination of Water and Waste Water
AS	Australian Standard
BSP	British standard pipe
CARB	Californian Air Resources Board
CEM/CEMS	Continuous Emission Monitoring/Continuous Emission Monitoring System
CTM	Conditional test method
D	Duct diameter or equivalent duct diameter for rectangular ducts
D_{50}	'Cut size' of a cyclone is defined as the particle diameter at which the cyclone achieves a 50% collection efficiency i.e. half of the particles are retained by the cyclone and half pass through it. The D_{50} method simplifies the capture efficiency distribution by assuming that a given cyclone stage captures all of the particles with a diameter equal to or greater than the D_{50} of that cyclone and less than the D_{50} of the preceding cyclone.
DECC	Department of Environment & Climate Change (NSW)
Disturbance	A flow obstruction or instability in the direction of the flow which may impede accurate flow determination. This includes centrifugal fans, axial fans, partially closed or closed dampers, louvres, bends, connections, junctions, direction changes or changes in pipe diameter.
DWER	Department of Water and Environmental Regulation (WA)
DEHP	Department of Environment and Heritage Protection (QLD)
EPA	Environment Protection Authority
FTIR	Fourier Transform Infra-red
ISC	Intersociety Committee, Methods of Air Sampling and Analysis
ISO	International Organisation for Standardisation
ITE	Individual threshold estimate
Lower bound	When an analyte is not present above the detection limit, the result is assumed to be equal to zero.
Medium bound	When an analyte is not present above the detection limit, the result is assumed to be equal to half of the detection limit.
NA	Not applicable
NATA	National Association of Testing Authorities
NIOSH	National Institute of Occupational Safety and Health
NT	Not tested or results not required
OM	Other approved method
OU	Odour unit. One OU is that concentration of odorant(s) at standard conditions that elicits a physiological response from a panel equivalent to that elicited by one Reference Odour Mass (ROM), evaporated in one cubic metre of neutral gas at standard conditions.
PM_{10}	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 10 microns (µm).
$PM_{2.5}$	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 2.5 microns (µm).
PSA	Particle size analysis
RATA	Relative accuracy test audit
Semi-quantified VOCs	Unknown VOCs (those not matching a standard compound), are identified by matching the mass spectrum of the chromatographic peak to the NIST Standard Reference Database (version 14.0), with a match quality exceeding 70%. An estimated concentration is determined by matching the area of the peak with the nearest suitable compound in the analytical calibration standard mixture.
STP	Standard temperature and pressure. Gas volumes and concentrations are expressed on a dry basis at 0°C, at discharge oxygen concentration and an absolute pressure of 101.325 kPa, unless otherwise specified.
TM	Test method
TOC	The sum of all compounds of carbon which contain at least one carbon-to-carbon bond, plus methane and its derivatives.
USEPA	United States Environmental Protection Agency
VDI	Verein Deutscher Ingenieure (Association of German Engineers)
Velocity difference	The percentage difference between the average of initial flows and after flows.
Vic EPA	Victorian Environment Protection Authority
VOC	Volatile organic compound. A carbon-based chemical compound with a vapour pressure of at least 0.010 kPa at 25°C or having a corresponding volatility under the given conditions of use. VOCs may contain oxygen, nitrogen and other elements. VOCs do not include carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonate salts.
XRD	X-ray diffractometry
Upper bound	When an analyte is not present above the detection limit, the result is assumed to be equal to the detection limit.
95% confidence interval	Range of values that contains the true result with 95% certainty. This means there is a 5% risk that the true result is outside this range.

8 APPENDIX 1: 2017 – 2021 RESULTS COMPARISON

Pollutant	2017 ou	2018 ou	2019 ou	2020 ou	2021 ou	2017 mg/m³	2018 mg/m³	2019 mg/m³	2020 mg/m³	2021 mg/m³	2017 oum³/min	2018 oum³/min	2019 oum³/min	2020 oum³/min	2021 oum³/min	2018 g/min	2019 g/min	2020 g/min	2020 g/min	2021 g/min
Autoclave Stack																				
Hydrogen chloride						1.3	0.58	1.5	≤0.049	≤0.033						0.0044	0.013	≤0.00018	≤0.00018	≤0.00016
Chlorine						0.51	<0.08	0.38	<0.06	0.72						<0.0006	0.0034	<0.0002	<0.0002	0.0036
Hydrogen fluoride						<0.06	1.3	<5	<0.04	<0.02						0.01	<0.05	<0.0001	<0.0001	<0.0001
Ammonia						2	0.3	0.46	1.1	4.9						0.0022	0.0041	0.004	0.004	0.025
Phenol						<0.06	≤0.13	≤0.44	<0.05	<0.07						≤0.00095	≤0.0039	<0.0002	<0.0002	<0.0004
Formaldehyde						0.8	1.2	≤0.22	4.7	0.16						0.0088	≤0.0019	0.017	0.017	0.00082
Odour	770000	480000	270000	58000	61000						3100000	4200000	2800000	270000	540000					
Ethanol						32	96	20	39	390						0.73	0.18	0.14	0.14	1.9
Chloroform						2.3	2.4	8.6	8.2	2.9						0.018	0.076	0.03	0.03	0.014
Benzene						4.7	2.3	≤1.1	0.84	0.74						0.017	≤0.01	0.0031	0.0031	0.0037
Toluene						92	17	13	1.7	3.4						0.13	0.11	0.0064	0.0064	0.017
Tetrachloroethene						1.3	<0.4	<0.3	<0.3	<0.2						<0.003	<0.003	<0.001	<0.001	<0.0009
Ethylbenzene						1100	29	5.5	2.5	1.1						0.22	0.049	0.009	0.009	0.0053
m + p-Xylene						1700	4.9	2.2	≤0.51	1.2						0.037	0.02	≤0.0019	≤0.0019	0.0061
Styrene						<0.3	80	14	3.7	3.3						0.6	0.12	0.014	0.014	0.016
o-Xylene						1000	2	1.1	<0.3	0.82						0.015	0.0094	<0.001	<0.001	0.0041
Isopropylbenzene						100	5.6	<0.3	≤0.36	<0.2						0.042	<0.003	≤0.0013	≤0.0013	<0.0009
Propylbenzene						250	3.2	0.74	<0.3	<0.2						0.024	0.0066	<0.001	<0.001	<0.0009
1,3,5-trimethylbenzene						480	<0.4	<0.3	<0.3	7.1						<0.003	<0.003	<0.001	<0.001	0.035
1,2,4-trimethylbenzene						1100	<0.4	<0.3	<0.3	16						<0.003	<0.003	<0.001	<0.001	0.079
1,2,3-trimethylbenzene						350	<0.4	<0.3	<0.3	7.1						<0.003	<0.003	<0.001	<0.001	0.035
Acetone						13	<0.4	≤9.9	16	<0.2						<0.003	≤0.088	0.058	0.058	<0.0009
Pentane						≤27	65	<0.3	<0.3	<0.2						0.49	<0.003	<0.001	<0.001	<0.0009
n-Hexane						≤4.6	<0.4	<0.3	<0.3	<0.2						<0.003	<0.003	<0.001	<0.001	<0.0009
Ethyl acetate						26	51	22	21	≤4.1						0.39	0.19	0.078	0.078	≤0.02
Heptane						10	7.1	3.5	1.7	≤0.75						0.054	0.031	0.0064	0.0064	≤0.0037
Methyl methacrylate						34	<0.4	<0.3	<0.3	<0.2						<0.003	<0.003	<0.001	<0.001	<0.0009
Methylcyclohexane						1.8	1.1	<0.3	<0.3	<0.2						0.0085	<0.003	<0.001	<0.001	<0.0009
MIBK						3.1	<0.4	<0.3	<0.3	<0.2						<0.003	<0.003	<0.001	<0.001	<0.0009
Octane						18	11	4.6	2.2	≤0.65						0.084	0.041	0.0082	0.0082	≤0.0032
Butyl acetate						73	1.2	<0.3	<0.3	≤0.3						0.009	<0.003	<0.001	<0.001	≤0.0015
Nonane						35	<0.4	<0.3	<0.3	≤19						<0.003	<0.003	<0.001	<0.001	≤0.093
alpha-Pinene						44	9.8	63	5.9	≤2.4						0.074	0.56	0.022	0.022	≤0.012
beta-Pinene						16	6.9	36	2.2	≤1.5						0.052	0.32	0.0079	0.0079	≤0.0075
Decane						38	4	2.6	≤0.43	140						0.031	0.023	≤0.0016	≤0.0016	0.72
3-Carene						<0.3	8.4	8.9	0.89	0.2						0.063	0.079	0.0032	0.0032	<0.0009
D-Limonene						210	220	460	250	61						1.6	4.1	0.91	0.91	0.3
Undecane						19	2.9	3.4	≤0.51	91						0.022	0.03	≤0.0019	≤0.0019	0.45
Dodecane						≤5.5	7	4.7	≤0.46	18						0.053	0.042	≤0.0017	≤0.0017	0.091
Tridecane						≤1.9	1.7	<0.3	<0.3	5						0.013	<0.003	<0.001	<0.001	0.025
Tetradecane						≤0.91	5.4	<0.3	<0.3	1.4						0.041	<0.003	<0.001	<0.001	0.007
Electro DAF Shed																				
Odour	640	110	1000	3000	64000															
Underground Sump																				
Odour	17000	4000	3300	4100	100						110000	65000	52000	38000	N/A					

9 APPENDIX 2: CHAIN OF CUSTODY DETAILS

Location Description	Test Date	Test Time (Darwin Time)	Dilution Air (L)	Sample Air (L)
Autoclave Test 1	08/09/2021	0818-0827	0	18.1
Autoclave Test 2	08/09/2021	1237-1241	0	14.1
Autoclave Bin Cooling Area	08/09/2021	1014-1034	0	20.2
Underground Sump	08/09/2021	0826-0838	0	24.3
Electro DAF Shed	08/09/2021	0738-0747	0	18.2
Dewatering IBC	08/09/2021	0723-0733	0	20.1

Ektimo

Chain Of Custody

Checked at Ektimo Dispatch by: VDo

Please email sample receipt acknowledgement and results to:laboratory@ektimo.com.au

	Job No.	Analysis Required	Units Required	Analytical Lab	Purchase Order No.	Ektimo Contact
Q6675	R011402	Phenols	ug/L	Ektimo		Mitchell Steele
Q6676	R011402	Phenols	ug/L	Ektimo		Mitchell Steele
Q6677	R011402	Phenols	ug/L	Ektimo		Mitchell Steele
Q6678	R011402	Phenols	ug/L	Ektimo		Mitchell Steele
Q6679	R011402	Phenols	ug/L	Ektimo		Mitchell Steele
Q6680	R011402	Phenols	ug/L	Ektimo		Mitchell Steele
Q6681	R011402	Phenols	ug/L	Ektimo		Mitchell Steele
Q6682	R011402	Chlorine	ug/L	Ektimo		Mitchell Steele
Q6683	R011402	Chlorine	ug/L	Ektimo		Mitchell Steele
Q6684	R011402	Chlorine	ug/L	Ektimo		Mitchell Steele
Q6685	R011402	Chlorine	ug/L	Ektimo		Mitchell Steele
Q6686	R011402	Ammonia	ug/L	Envirolabs	W007086	Mitchell Steele
Q6687	R011402	Ammonia	ug/L	Envirolabs	W007086	Mitchell Steele
Q6688	R011402	Ammonia	ug/L	Envirolabs	W007086	Mitchell Steele
Q6689	R011402	Ammonia	ug/L	Envirolabs	W007086	Mitchell Steele
Q6690	R011402	VOCs	ug	Ektimo		Mitchell Steele
Q6691	R011402	VOCs	ug	Ektimo		Mitchell Steele
Q6692	R011402	VOCs	ug	Ektimo		Mitchell Steele
Q6693	R011402	VOCs	ug	Ektimo		Mitchell Steele
Q6694	R011402	Formaldehyde	ug	Ektimo		Mitchell Steele
Q6695	R011402	Formaldehyde	ug	Ektimo		Mitchell Steele
Q6696	R011402	Formaldehyde	ug	Ektimo		Mitchell Steele
Q6697	R011402	Formaldehyde	ug	Ektimo		Mitchell Steele
Q6698	R011402	Acid gases (HF, HCl)	ug	Ektimo		Mitchell Steele
Q6699	R011402	Acid gases (HF, HCl)	ug	Ektimo		Mitchell Steele
Q6700	R011402	Acid gases (HF, HCl)	ug	Ektimo		Mitchell Steele
Q6701	R011402	Acid gases (HF, HCl)	ug	Ektimo		Mitchell Steele

Address (Head Office)
26 Redland Drive
Mitcham VIC 3132

Postal Address
52 Cooper Road
Cockburn Central WA 6164

Office Locations
VIC NSW WA QLD

Freecall: 1300 364 005
www.ektimo.com.au
ABN 86 600 381 413