Ektimo

Circular Plastics Australia , Ettamogah

Boiler and Exhaust Gases Emission Testing

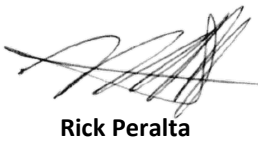
Report Number R013366

Document Information

Template Version 190722

Client Name:	Circular Plastics Australia
Report Number:	R013366
Date of Issue:	20 October 2022
Address:	10 McLaurin Rd, Ettamogah NSW 2640 Ettamogah NSW 2640
Testing Laboratory:	Ektimo Pty Ltd, ABN 86 600 381 413

Report Authorisation



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NATA Accredited Laboratory
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Please note that only numerical results pertaining to measurements conducted directly by Ektimo are covered by Ektimo's terms of NATA accreditation as described in the Test Methods table. This does not include calculations that use data supplied by third-parties, comments, conclusions, or recommendations based upon the results. Refer to 'Test Methods' for full details of testing covered by NATA accreditation.

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1 Executive Summary

1.1 Background

Ektimo was engaged by Circular Plastics Australia to perform emission testing at their Ettamogah plant. Testing was carried out in accordance with Environmental Licence 21519.

1.2 Project Objective & Overview

The objective of the project is to quantify emissions from six (6) discharge points to determine compliance with Circular Plastics Australia 's Environmental Licence.

Monitoring was performed as follows:

EPA ID	Test Parameters*	Test Date	Test Parameters*
EPA 5	Stack 5a (Boiler Unit)	29 September 2022	Total Solid Particles, Oxides of Nitrogen (as NO_2), Carbon Monoxide (CO)
EPA 6	Stack 5b (Boiler Unit)	29 August 2022	
EPA 7	Stack 7a (Starlinger Flue Gas)	30 August 2022	Total Solid Particles, Volatile Organic Compounds (VOCs)
EPA 8	Stack7b (Starlinger Vacuum Unit)		
EPA 9	Stack 8a & b (Starlinger Gas Heater)		Total Solid Particles, Oxides of Nitrogen (as NO_2), Carbon Monoxide (CO)
EPA 10	Stack 8c (Starlinger Gas Heater)		

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

All results are reported on a dry basis at STP

Plant operating conditions have been noted in the report.

1.3 Licence Comparison

The following licence comparison table shows that all analytes highlighted in green are within the licence limit set by the NSW EPA as per licence 21519 (last amended on 24 June 2022).

EPA No.	Location Description	Pollutant	Units	Licence limit	Detected values
5	Stack 5a (Boiler Unit)	Total Solid Particles	mg/m^3	50	<2
		Nitrogen Oxides (as NO_2)	mg/m^3	350	110
		Carbon Monoxide	mg/m^3	125	9.5
6	Stack 5b (Boiler Unit)	Total Solid Particles	mg/m^3	50	<3
		Nitrogen Oxides (as NO_2)	mg/m^3	350	68
		Carbon Monoxide	mg/m^3	125	17
7	Stack 7a (Starlinger Flue gas)	Total Solid Particles	mg/m^3	50	23
		Volatile Organic Compounds (VOCs)	mg/m^3	40	<2
8	Stack7b (Starlinger Vacuum Unit)	Total Solid Particles	mg/m^3	50	<3
		Volatile Organic Compounds (VOCs)	mg/m^3	40	20
9	Stack 8a+b (Starlinger Gas Heater)	Total Solid Particles	mg/m^3	50	4.7
		Nitrogen Oxides (as NO_2)	mg/m^3	350	<4
		Carbon Monoxide	mg/m^3	125	<2
10	Stack 8c (Starlinger Gas Heater)	Total Solid Particles	mg/m^3	50	<3
		Nitrogen Oxides (as NO_2)	mg/m^3	350	<4
		Carbon Monoxide	mg/m^3	125	<2

Please note that the measurement uncertainty associated with the test results was not considered when determining whether the results were compliant or non-compliant.

Refer to the Test Methods table for the measurement uncertainties.

2 Results

2.1 EPA 5 – Stack 5a (Boiler Unit)

Date	29/09/2022	**Client**	Circular Plastics Australia (PET) Pty Ltd
Report	R013366	**Stack ID**	EPA 5 Stack A Boiler Unit 1
Licence No.	21519	**Location**	10 McLaurin Road, Ettamogah
Ektimo Staff	Edward Camilleri & Tony Bakas	**State**	NSW
Process Conditions	Please refer to client records.		*220818*

Sampling Plane Details	
Sampling plane dimensions	270 mm
Sampling plane area	0.0573 m²
Sampling port size, number & depth	2" BSP (x2), 65 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Inlet >6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Ideal sampling plane

Stack Parameters		
Moisture content, %v/v	10	
Gas molecular weight, g/g mole	28.6 (wet)	29.8 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.33 (dry)
Gas density at discharge conditions, kg/m³	0.74	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1402	
Temperature, °C	201	
Temperature, K	474	
Velocity at sampling plane, m/s	7.7	
Volumetric flow rate, actual, m³/s	0.44	
Volumetric flow rate (wet STP), m³/s	0.26	
Volumetric flow rate (dry STP), m³/s	0.23	
Mass flow rate (wet basis), kg/hour	1200	

Gas Analyser Results	Average
Sampling time	0656 - 0758
	Concentration mg/m³ / Mass Rate g/min
Combustion Gases	
Nitrogen oxides (as NO_2)	110 / 1.6
Carbon monoxide	9.5 / 0.13
	Concentration % v/v
Carbon dioxide	8.8
Oxygen	6.1

Isokinetic Results	Results
Sampling time	1406-1511
	Concentration mg/m³ / Mass Rate g/min
Solid Particles	<2 / <0.03
Isokinetic Sampling Parameters	
Sampling time, min	60
Isokinetic rate, %	97
Gravimetric analysis date (total particulate)	06-10-2022

2.2 EPA 6 – Stack 5b (Boiler Unit)

Date	29/08/2022	**Client**	Circular Plastics Australia (PET) Pty Ltd
Report	R013366	**Stack ID**	EPA 6 Stack 5b Boiler Unit 2
Licence No.	21519	**Location**	10 McLaurin Road, Ettamogah
Ektimo Staff	Rick Peralta/Ish Alam	**State**	NSW
Process Conditions	Fuel: Gas: Full capacity running, modulating : Steam Pressure 50-60PSI		*220818*

Sampling Plane Details	
Sampling plane dimensions	270 mm
Sampling plane area	0.0573 m²
Sampling port size, number & depth	2" BSP (x2), 65 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Inlet >6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Ideal sampling plane

Stack Parameters		
Moisture content, %v/v	8.2	
Gas molecular weight, g/g mole	28.5 (wet)	29.4 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.31 (dry)
Gas density at discharge conditions, kg/m³	0.73	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1415 & 1550	
Temperature, °C	194	
Temperature, K	467	
Velocity at sampling plane, m/s	7	
Volumetric flow rate, actual, m³/s	0.4	
Volumetric flow rate (wet STP), m³/s	0.23	
Volumetric flow rate (dry STP), m³/s	0.21	
Mass flow rate (wet basis), kg/hour	1000	

Gas Analyser Results	Average
Sampling time	1440 - 1526
	Concentration mg/m³ / Mass Rate g/min
Combustion Gases	
Nitrogen oxides (as NO_2)	68 / 0.86
Carbon monoxide	17 / 0.21
	Concentration % v/v
Carbon dioxide	5
Oxygen	12.1

Isokinetic Results	Results
Sampling time	1443-1545
	Concentration mg/m³ / Mass Rate g/min
Solid Particles	<3 / <0.03
Isokinetic Sampling Parameters	
Sampling time, min	60
Isokinetic rate, %	107
Gravimetric analysis date (total particulate)	09-09-2022

2.3 EPA 7 – Stack 7a (Starlinger Flue Gas)

Date	30/08/2022	**Client**	Circular Plastics Australia (PET) Pty Ltd
Report	R013366	**Stack ID**	EPA 7 Starlinger 7a
Licence No.	21519	**Location**	10 McLaurin Road, Ettamogah
Ektimo Staff	Rick Peralta/Ish Alam	**State**	NSW
Process Conditions	Please refer to client records.		*220818*

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number & depth	2" BSP (x2), 20 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Inlet >6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Ideal sampling plane

Stack Parameters		
Moisture content, %v/v	2.1	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	0.83	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1010 & 1145	
Temperature, °C	141	
Temperature, K	414	
Velocity at sampling plane, m/s	8.7	
Volumetric flow rate, actual, m³/s	1.7	
Volumetric flow rate (wet STP), m³/s	1.1	
Volumetric flow rate (dry STP), m³/s	1.1	
Mass flow rate (wet basis), kg/hour	5100	

Gas Analyser Results	Average
Sampling time	1040 - 1140
	Concentration % v/v
Carbon dioxide	<0.4
Oxygen	20.6

Isokinetic Results	Results	
Sampling time	1040-1143	
	Concentration mg/m³	Mass Rate g/min
Solid Particles	23	1.5
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	101	
Gravimetric analysis date (total particulate)	09-09-2022	

Date	30/08/2022	**Client**	Circular Plastics Australia (PET) Pty Ltd
Report	R013366	**Stack ID**	EPA 7 Starlinger 7a
Licence No.	21519	**Location**	10 McLaurin Road, Ettamogah
Ektimo Staff	Rick Peralta/Ish Alam	**State**	NSW
Process Conditions	Please refer to client records.		*220818*

Total VOCs (as n-Propane)	Results	
	Concentration mg/m³	Mass Rate g/min
C1-C4 (excluding methane)	<2	<0.1
C5-C20	<0.1	<0.009
Total	<2	<0.1

VOC's C1-C4	Results	
Sampling time	1205-1207	
	Concentration mg/m³	Mass Rate g/min
Methane	**3.5**	**0.23**
Ethane	<1	<0.09
Ethylene	<1	<0.08
Acetylene	<1	<0.08
Propane	<2	<0.1
Cyclopropane	<2	<0.1
Propylene	<2	<0.1
Propadiene	<2	<0.1
Isobutane	<3	<0.2
n-Butane	<3	<0.2
1-Butene	<3	<0.2
Propyne	<2	<0.1
trans-2-Butene	<3	<0.2
cis-2-Butene	<3	<0.2
1,3-Butadiene	<2	<0.2

VOC (speciated)	Results	
Sampling time	1100-1202	
	Concentration mg/m³	Mass Rate g/min
Detection limit[1]	<0.1	<0.009

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

2.4 EPA 8 – Stack7b (Starlinger Vacuum Unit)

Date	30/08/2022	**Client**	Circular Plastics Australia (PET) Pty Ltd
Report	R013366	**Stack ID**	EPA 8 Starlinger 7b
Licence No.	21519	**Location**	10 McLaurin Road, Ettamogah
Ektimo Staff	Rick Peralta/Ish Alam	**State**	NSW
Process Conditions	Please refer to client records.		*220818*

Sampling Plane Details	
Sampling plane dimensions	100 mm
Sampling plane area	0.00785 m²
Sampling port size, number & depth	2" BSP (x1), 20 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Bend >6 D
No. traverses & points sampled	1 2
Sample plane conformance to AS 4323.1	Non-conforming

Comments

The gas temperature of the sampling plane is below the dew point

The sampling plane is deemed to be non-conforming due to the following reasons:

The differential pressure at one or more sampling points is less than 5 Pa

Stack Parameters		
Moisture content, %v/v	1.8 (saturated)	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.19	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1020 & 1345	
Temperature, °C	16	
Temperature, K	289	
Velocity at sampling plane, m/s	<2	
Volumetric flow rate, actual, m³/s	<0.01	
Volumetric flow rate (wet STP), m³/s	<0.01	
Volumetric flow rate (dry STP), m³/s	<0.01	
Mass flow rate (wet basis), kg/hour	<50	

Gas Analyser Results	Average
Sampling time	1256 - 1356
	Concentration % v/v
Carbon dioxide	<0.4
Oxygen	20.3

Isokinetic Results	Results	
Sampling time	1240-1340	
	Concentration mg/m³	Mass Rate g/min
Solid Particles	<3	<0.002
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	102	
Gravimetric analysis date (total particulate)	09-09-2022	

Date	30/08/2022	**Client**	Circular Plastics Australia (PET) Pty Ltd
Report	R013366	**Stack ID**	EPA 8 Starlinger 7b
Licence No.	21519	**Location**	10 McLaurin Road, Ettamogah
Ektimo Staff	Rick Peralta/Ish Alam	**State**	NSW
Process Conditions	Please refer to client records.		*220818*

Total VOCs (as n-Propane)	Results	
	Concentration mg/m³	Mass Rate g/min
C1-C4 (excluding methane)	15	<0.01
C5-C20	4.7	<0.003
Total	20	<0.01

VOC's (as n-Propane)	Results	
Sampling time	1256 - 1356	
	Concentration mg/m³	Mass Rate g/min
Methane	**4.9**	**<0.003**
Ethane	<1	<0.0009
Ethylene	**9.6**	**<0.006**
Acetylene	<1	<0.0008
Propane	<2	<0.001
Cyclopropane	<2	<0.001
Propylene	<2	<0.001
Propadiene	<2	<0.001
Isobutane	<3	<0.002
n-Butane	<3	<0.002
1-Butene	<3	<0.002
Propyne	<2	<0.001
trans-2-Butene	<3	<0.002
cis-2-Butene	<3	<0.002
1,3-Butadiene	<2	<0.002

VOC (speciated)	Results	
Sampling time	1300-1405	
	Concentration mg/m³	Mass Rate g/min
Detection limit[1]	<0.1	<0.00009
Acetone	2.1	<0.001
Benzene	4.3	<0.003
Methyl methacrylate	0.95	<0.0006
Toluene	0.56	<0.0004

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

2.5 EPA 9 – Stack 8a & b (Starlinger Gas Heater)

Date	30/08/2022	**Client**	Circular Plastics Australia (PET) Pty Ltd
Report	R013366	**Stack ID**	EPA 9 Starlinger 8a & b
Licence No.	21519	**Location**	10 McLaurin Road, Ettamogah
Ektimo Staff	Rick Peralta/Ish Alam	**State**	NSW
Process Conditions	Please refer to client records.		*220818*

Sampling Plane Details	
Sampling plane dimensions	250 mm
Sampling plane area	0.0491 m²
Sampling port size, number & depth	2" BSP (x2), 20 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Inlet >6 D
No. traverses & points sampled	2 4
Sample plane conformance to AS 4323.1	Non-conforming

Comments

The gas temperature of the sampling plane is below the dew point

The sampling plane is deemed to be non-conforming due to the following reasons:

The differential pressure at one or more sampling points is less than 5 Pa

Stack Parameters		
Moisture content, %v/v	2.3	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.16	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1358 & 1526	
Temperature, °C	21	
Temperature, K	294	
Velocity at sampling plane, m/s	<2	
Volumetric flow rate, actual, m³/s	<0.08	
Volumetric flow rate (wet STP), m³/s	<0.07	
Volumetric flow rate (dry STP), m³/s	<0.07	
Mass flow rate (wet basis), kg/hour	<300	

Gas Analyser Results	Average
Sampling time	1418 - 1418
	Concentration mg/m³ / Mass Rate g/min
Combustion Gases	
Nitrogen oxides (as NO_2)	<4 / <0.02
Carbon monoxide	<2 / <0.01
	Concentration % v/v
Carbon dioxide	<0.4
Oxygen	20.9

Isokinetic Results	Results
Sampling time	1420-1520
	Concentration mg/m³ / Mass Rate g/min
Solid Particles	4.7 / <0.02
Isokinetic Sampling Parameters	
Sampling time, min	60
Isokinetic rate, %	101
Gravimetric analysis date (total particulate)	10-10-2022

2.6 EPA 10 – Stack 8c (Starlinger Gas Heater)

Date	30/08/2022	**Client**	Circular Plastics Australia (PET) Pty Ltd
Report	R013366	**Stack ID**	EPA 10 Starlinger 8c
Licence No.	21519	**Location**	10 McLaurin Road, Ettamogah
Ektimo Staff	Rick Peralta/Ish Alam	**State**	NSW
Process Conditions	Please refer to client records.		*220818*

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number & depth	2" BSP (x2), 20 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 1.8 D
Upstream disturbance	Inlet >6 D
No. traverses & points sampled	2 8
Sample plane conformance to AS 4323.1	Non-conforming

The sampling plane is deemed to be non-conforming due to the following reasons:
The differential pressure at one or more sampling points is less than 5 Pa
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D

Stack Parameters		
Moisture content, %v/v	0.78	
Gas molecular weight, g/g mole	28.9 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.20	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1529 & 1650	
Temperature, °C	14	
Temperature, K	287	
Velocity at sampling plane, m/s	<2	
Volumetric flow rate, actual, m³/s	<0.3	
Volumetric flow rate (wet STP), m³/s	<0.3	
Volumetric flow rate (dry STP), m³/s	<0.3	
Mass flow rate (wet basis), kg/hour	<1000	

Gas Analyser Results	Average
Sampling time	1546 - 1645
	Concentration mg/m³ / Mass Rate g/min
Combustion Gases	
Nitrogen oxides (as NO_2)	<4 / <0.07
Carbon monoxide	<2 / <0.04
	Concentration % v/v
Carbon dioxide	<0.4
Oxygen	20.9

Isokinetic Results	Results
Sampling time	1543-1646
	Concentration mg/m³ / Mass Rate g/min
Solid Particles	<3 / <0.05
Isokinetic Sampling Parameters	
Sampling time, min	60
Isokinetic rate, %	101
Gravimetric analysis date (total particulate)	09-09-2022

3 Plant Operating Conditions

See Circular Plastics Australia 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	NSW EPA TM-1 (AS 4323.1)	NA	NA	✓	NA
Flow rate, temperature and velocity	NSW EPA TM-2 (USEPA Method 2)	NSW EPA TM-2 (USEPA Method 2)	8%, 2%, 7%	NA	✓
Moisture content	NSW EPA TM-22 (USEPA Method 4)	NSW EPA TM-22 (USEPA Method 4)	8%	✓	✓
Molecular weight	NA	NSW EPA TM-23 (USEPA Method 3)	not specified	NA	✓
Dry gas density	NA	NSW EPA TM-23 (USEPA Method 3)	not specified	NA	✓
Carbon dioxide	NSW EPA TM-24 (USEPA Method 3A)	NSW EPA TM-24 (USEPA Method 3A)	13%	✓	✓
Carbon monoxide	NSW EPA TM-32 (USEPA Method 10)	NSW EPA TM-32 (USEPA Method 10)	12%	✓	✓
Nitrogen oxides	NSW EPA TM-11 (USEPA Method 7E)	NSW EPA TM-11 (USEPA Method 7E)	12%	✓	✓
Oxygen	NSW EPA TM-25 (USEPA Method 3A)	NSW EPA TM-25 (USEPA Method 3A)	13%	✓	✓
C_1-C_4 hydrocarbons	Ektimo 200	Ektimo 340	19%	✓	✓†
Speciated volatile organic compounds (VOCs)	NSW EPA TM-34[d] (USEPA Method 18)	Ektimo 344	19%	✓	✓†
Solid particles (total)	NSW EPA TM-15 (AS 4323.2)	NSW EPA TM-15 (AS 4323.2)	3%	✓	✓††

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* 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.
5 September 2022 in report LV-003279.
21 September 2022 in report LV-003344.

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

5 Deviations to Test Methods

NSW EPA TM-34 (USEPA 18)

Ektimo notes that the sampling and analysis of Volatile Organic Compounds (VOCs), per USEPA Method 18 has excluded the recovery study as specified in Section 8.4.3. Performing the recovery study described in Section 8.4.3 of USEPA Method 18 for analytes present at low levels is problematic. Given this, Ektimo applies a threshold of 50µg as a lower-bound mass, below which the 'spiking' of specific volatile organic compounds is not performed. For the purposes of this round of monitoring, the following compounds were present above the detection limit (0.1 µg) but were below 50µg (unless **bolded**). Therefore, recovery studies for the following analytes were not performed:

- Acetone (31µg)
- **Benzene (64µg)**
- Toluene (8.3µg)
- Methyl methacrylate (14µg)

Regarding the above compounds, Ektimo refers to guidance within USEPA Method 18 (8.2.4) in relation to choosing appropriate adsorbent tube media for each detected compound above 50µg (benzene).

NIOSH 1501 – Hydrocarbons, Aromatic (benzene)

Benzene is specifically referred as a compound to be sampled under this method, and the recommended adsorbent media for sampling is 'Solid Sorbent Tube, coconut shell charcoal'; Ektimo used the recommended sampling media (SKC brand 226-01). Since the adsorbent media is deemed appropriate by NIOSH 1501, Ektimo opted not to perform the recovery study for this compound.

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 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}	Particulate matter having an equivalent aerodynamic diameter less than or equal to 10 microns (µm).
$PM_{2.5}$	Particulate matter having an equivalent aerodynamic diameter less than or equal to 2.5 microns (µm).
PSA	Particle size analysis. PSA provides a distribution of geometric diameters, for a given sample, determined using laser diffraction.
RATA	Relative accuracy test audit
Semi-quantified VOCs	Unknown VOCs (those for which an analytical standard is not available), 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.
TM	Test method
TOC	Total organic carbon. This is 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: Site Photos

Figure 1 – EPA 5 Stack 5a (Boiler unit1) & EPA 6 Stack 5b (Boiler unit 2)

Figure 2 – EPA 7 Stack 7a (Starlinger Flue gas) & EPA 10 Stack 8c (Starlinger Gas Heater)

Figure 3 - EPA 8 Stack7b (Starlinger Vacuum unit) & EPA 9 Stack 8a + b (Starlinger Gas Heater)

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