

Boiler 4 verification report

04 April 2023

To	John Studdert	Contact No.	9239 7233
Copy to		Email	nicholas.spurrett@ghd.com
From	Nick Spurrett	Project No.	12603635
Project Name	Boiler 4 verification report to address Development Consent 06_0228 Condition 9CA		
Subject	Boiler 4 verification report		

Dear John

1. Introduction

GHD was engaged by Shoalhaven Starches Pty Ltd (Manildra) to generate a verification report in relation to the proposed modification to the approved Shoalhaven Starches Expansion Project (SSEP) (Modification 23) (MOD23) submitted in 2022. The results of the MOD23 assessment are summarised in *Manildra Group Air Quality Assessment Mod 23* (GHD, 2022).

Subsequent to the approval of the modification, the Environmental Protection Agency (EPA) require the following from Shoalhaven Starches:

9CA. Within six months of commissioning the fuel change to the boilers, as described in MOD 23, the Applicant shall submit a written report to the Planning Secretary and the EPA detailing the results of post-commissioning monitoring. The report shall:

a) compare the results of monitoring undertaken in accordance with the EPL, with:

i. the emission limits in the EPL;

ii. the prescribed limits in the Protection of the Environment Operations (Clean Air Regulation) 2021;

iii. the emission rates in the Air Quality Assessment dated 19 January 2022, prepared by GHD;

b) assess compliance with the limits in the EPL and the prescribed limits in the Protection of the Environment Operations (Clean Air Regulation) 2021 and the emission rates in the Air Quality Assessment dated 19 January 2022, prepared by GHD; and

c) if post-commissioning monitoring shows that an emission limit is not being met, the Applicant is required to nominate and implement mitigation measures to achieve compliance with the relevant limit, in consultation with the EPA and to the satisfaction of the Planning Secretary.

2. Scope

This report has been prepared by GHD to provide a response to the emission verification requirements outlined above for the conversion of Boiler 4 (also known as EPA identification no. 42) to operate on gas fuel. This report should be read in conjunction with the MOD23 air quality assessment.

3. Limitations

This report: has been prepared by GHD for Shoalhaven Starches Pty Ltd and may only be used and relied on by Shoalhaven Starches Pty Ltd for the purpose agreed between GHD and Shoalhaven Starches Pty Ltd as set out in this report.

GHD otherwise disclaims responsibility to any person other than Shoalhaven Starches Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

GHD has prepared this report on the basis of information provided by Shoalhaven Starches Pty Ltd and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

4. Condition 9 a

As part of MOD23, Manildra sought approval to transition Boiler 4 fuel source from a mixture of coal and woodchip to biogas and natural gas. Verification of the performance of Boiler 4 includes stack emissions sampling to verify whether operation of Boiler 4 complies with the site Environmental Protection licence (EPL) number 883, Protection of the Environment Operations (Clean Air) Regulation (POEO) requirements and comparison of Boiler 4 emissions against those assumed in the MOD23 air quality assessment.

Emission sampling of Boiler 4 was undertaken over two events by Ektimo. Results of the sampling are discussed below, and the Ektimo sampling reports are provided in Appendix A.

4.1 Comparison of results against EPL data (i)

Manildra's EPL does not impose emission limits on Boiler 4. In lieu of this, comparison of the emission sampling results against EPL data could not be conducted.

4.2 Comparison of results against POEO limits (ii)

Comparison of sampling data against POEO limits for General activities and plant is summarised in Table 1. Measured Boiler 4 concentrations complied with POEO limits for all pollutants with a significant margin of compliance.

Table 1. Comparison of Sample Data for Boiler 4 (EPA 42) against POEO Emission Limits

Pollutants	Boiler 4 sampling data			POEO Limit (PV)	MV / PV (%)
	Sample 1 (30/11/2022)	Sample 2 (1/12/2022)	Maximum Value (MV)		
TSP (at 3% O ₂), mg/m ³	2	2	2	N/A	
PM ₁₀ (at 3% O ₂), mg/m ³	5	5	5	N/A	
PM _{2.5} (at 3% O ₂), mg/m ³	3	3	3	N/A	
Sulphur dioxide (at 3% O ₂), mg/m ³	7	8	8	N/A	
Nitrogen Dioxide (at 3% O ₂), mg/m ³	3	3	3	350	0.86%
Nitrogen oxides (at 3% O ₂), mg/m ³	110	110	110	N/A	
Carbon monoxide (at 3% O ₂), mg/m ³	3	3	3	125	2.4%
VOCs, mg/m ³	5	5	5	40	
PAH, mg/m ³	0.0031	0.0054	0.0054	N/A	
Antimony (Sb) Type I , mg/m ³	0.005	0.006	0.006	N/A	
Arsenic (As) Type I , mg/m ³	0.002	0.003	0.003	N/A	
Beryllium (Be) Type II, mg/m ³	0.0007	0.0007	0.0007	N/A	
Cadmium (Cd) Type I , mg/m ³	0.0007	0.0007	0.0007	0.2	0.35%
Chromium (Cr) Type II, mg/m ³	0.0011	0.0014	0.0014	N/A	
Cobalt (Co) Type II, ug/m ³	0.0008	0.0009	0.0009	N/A	
Lead (Pb) Type I, mg/m ³	0.002	0.002	0.002	N/A	
Manganese (Mn) Type II, mg/m ³	0.0075	0.0087	0.0087	N/A	
Mercury (Hg) Type I, mg/m ³	0.0005	0.0006	0.0006	0.2	0.3%
Nickel (Ni) Type II, mg/m ³	0.002	0.002	0.002	N/A	
Selenium (Se) Type II, mg/m ³	0.005	0.006	0.006	N/A	
Tin (Sn) Type II, mg/m ³	0.002	0.003	0.003	N/A	
Vanadium (V) Type II, mg/m ³	0.001	0.001	0.001	N/A	
Total Type I and Type II, mg/m ³	0.032	0.035	0.035	1	3.5%

Bolded values indicate that the sample value was an integer, un-bolded values are the upper limit of the measured value (i.e., less than).

4.3 Comparison of results against Air Quality Assessment Prediction (iii)

Estimation of emission rates for Boiler 4 was not conducted in the MOD23 air quality assessment as Boiler 4 was assigned to standby duty (non operational) for the assessment. Therefore comparison of Boiler 4 sampling data against estimated emissions rates could not be undertaken.

5. Condition 9 b

Verification report comparison of Boiler 4 performance are summarised as follows:

- **Comparison of results against EPL data** – Manildra's EPL does not impose emission limits on Boiler 4. Consequently, comparison against EPL data could not be conducted.
- **Comparison of results against POEO limits** – Sampled Boiler 4 concentrations were significantly below POEO concentrations limits for all pollutants.
- **Comparison of results against Air Quality Assessment Prediction** – Boiler 4 was assigned to standby duty (non operational) in the MOD23 air quality assessment, therefore emissions were not estimated from Boiler 4 and consequently no comparison against MOD23 emission rates could be undertaken.

6. Condition 9 c

Based on the sampling data provided by Ektimo, operation of Boiler 4 was found to comply with POEO emission concentration limits for all pollutants. Emissions comparison could not be undertaken against EPL limits or MOD23 air quality assessment emission rates.

Given the sampled concentrations were so far below the POEO limits, no mitigation measures are considered necessary.

7. Conclusion

A post-commissioning verification report for Boiler 4 operating on natural gas has been prepared by GHD. The verification report provided a comparison of Boiler 4 sampling data against the requirements of approval consents where sufficient data was available.

The operation of Boiler 4 was found to comply with POEO emission concentration limits for all pollutants. Emissions comparison could not be undertaken against EPL limits or MOD23 air quality assessment emission rates.

Therefore, operation of Boiler 4 is considered to comply with Development Consent Conditions 9CA.

Appendices

Appendix A

**Emission Testing Report EPA ID 42 –
Boiler 4 Report Number R013746
(Ektimo, 2023)**

**Manildra Group, Shoalhaven Starches Pty Ltd, Bomaderry
Emission Testing Report
EPA ID 42 – Boiler 4
Report Number R013746**

Document Information

Template Version 190722

Client Name: Manildra Group
Report Number: R013746
Date of Issue: 14 March 2023
Attention: John Studdert
Address: 160 Bolong Rd
Bomaderry NSW 2541
Testing Laboratory: Ektimo Pty Ltd, ABN 86 600 381 413

Report Authorisation



Zoe Parker
Air Monitoring Consultant

NATA Accredited Laboratory
No. 14601

Steven Cooper
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.

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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 Manildra Group to perform emission testing at their Bomaderry plant. Testing was carried out in accordance with Environment Protection Licence 883.

1.2 Project Objective

The objective of the project was to quantify emissions from one (1) discharge point to determine emission to atmosphere.

Monitoring was performed as follows:

Location	Test Date	Test Parameters*
EPA ID 42 – Boiler 4	30 November 2022	Total solid particles, fine particulate matter <10µm (PM ₁₀), fine particulate matter <2.5µm (PM _{2.5}) Metals - type 1 & 2 substances in aggregate (Sb, As, Cd, Pb, Hg, Be, Cr, Co, Mn, Ni, Se, Sn, V)
	1 December 2022	Polycyclic aromatic hydrocarbons (PAHs) Nitrogen dioxide (NO ₂), sulfur dioxide (SO ₂), carbon monoxide (CO), carbon dioxide (CO ₂), oxygen (O ₂) Volatile organic compounds (TOC)

* 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 Results Summary

The limits in the results summary correspond to the Schedule 2 - Standards of Concentrations for Scheduled Premises – General Activities and Plant, Group 6 in the *Protection of the Environment Operations (Clean Air) Regulation, 2022*.

Location	Date	Pollutant	Units	Limit (corrected to 3% O ₂)	Detected values	Detected values (corrected to 3% O ₂)
Boiler 4	30-Nov-22	Solid particles	mg/m ³	50	<2	<2
		Nitrogen oxides (as NO ₂)	mg/m ³	350	89	110
		Volatile organic compounds (as n-propane equivalent)	mg/m ³	40	<4	<5
		Type 1 & 2 substances in aggregate	mg/m ³	1	<0.025	<0.032
		Cadmium	mg/m ³	0.2	<0.0005	0.0007
		Mercury	mg/m ³	0.2	<0.0004	<0.0005
		Fine particulates (PM ₁₀)	mg/m ³	-	<4	<5
		Fine particulates (PM _{2.5})	mg/m ³	-	<3	<3
		Sulfur dioxide	mg/m ³	-	<6	<7
		Carbon monoxide	mg/m ³	-	<2	<3
		PAHs (Upper bound)	mg/m ³	-	25	-
Boiler 4	1-Dec-22	Solid particles	ng/m ³	50	<2	<2
		Nitrogen oxides (as NO ₂)	mg/m ³	350	82	110
		Volatile organic compounds (as n-propane equivalent)	mg/m ³	40	<4	<5
		Type 1 & 2 substances in aggregate	mg/m ³	1	<0.026	<0.035
		Cadmium	mg/m ³	0.2	<0.0006	<0.0007
		Mercury	mg/m ³	0.2	<0.0005	<0.0006
		Fine particulates (PM ₁₀)	mg/m ³	-	<4	<5
		Fine particulates (PM _{2.5})	mg/m ³	-	<3	<3
		Sulfur dioxide	mg/m ³	-	<6	<8
		Carbon monoxide	mg/m ³	-	<2	<3
		PAHs (Upper bound)	ng/m ³	-	33	-

Refer to the Test Methods table for the measurement uncertainties.

2 Results

2.1 EPA ID 42 – Boiler 4 – 30 November 2022

Date	30/11/2022	Client	Manildra Group
Report	R013746	Stack ID	EPA ID 42 - Boiler 4
Licence No.	883	Location	Bomaderry
Ektimo Staff	Zoe Parker & Scott Woods	State	NSW
Process Conditions	Please refer to client records.		

221124

Sampling Plane Details

Sampling plane dimensions	1140 mm
Sampling plane area	1.02 m ²
Sampling port size, number & depth	4" BSP (x2), 100 mm
Access & height of ports	Stairs 30 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >3 D
Upstream disturbance	Change in diameter 1 D
No. traverses & points sampled	2 16
Sample plane conformance to AS 4323.1	Non-conforming

Comments

The velocity difference for isokinetic testing is outside the criteria ($\pm 10\%$)
 The velocity difference for PM10 or PM2.5 is outside the criteria ($\pm 20\%$)

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

The upstream disturbance is <2D from the sampling plane

Stack Parameters

Moisture content, %v/v	9.9	
Gas molecular weight, g/g mole	28.5 (wet)	29.7 (dry)
Gas density at STP, kg/m ³	1.27 (wet)	1.32 (dry)
Gas density at discharge conditions, kg/m ³	0.87	
% Oxygen correction & Factor	3 %	1.28

Gas Flow Parameters

Flow measurement time(s) (hhmm)	1005 & 1142
Temperature, °C	128
Temperature, K	401
Velocity at sampling plane, m/s	9.3
Volumetric flow rate, actual, m ³ /s	9.5
Volumetric flow rate (wet STP), m ³ /s	6.5
Volumetric flow rate (dry STP), m ³ /s	5.9
Mass flow rate (wet basis), kg/hour	30000

Date	30/11/2022	Client	Manildra Group
Report	R013746	Stack ID	EPA ID 42 - Boiler 4
Licence No.	883	Location	Bomaderry
Ektimo Staff	Zoe Parker & Scott Woods	State	NSW
Process Conditions	Please refer to client records.		

221124

Isokinetic Results	Sampling time	Results		
		1017-1139	1017-1139 (PM10&2.5)	
		Concentration mg/m ³	Corrected to 3% O ₂ mg/m ³	Mass Rate g/min
Solid Particles		<2	<2	<0.6
Fine particulates (PM10)		<4	<5	<1
Fine particulates (PM2.5)		<3	<3	<0.9
D50 cut size, 10µm			10.3	
D50 cut size, 2.5µm			2.32	
Antimony		<0.004	<0.005	<0.001
Arsenic		<0.002	<0.002	<0.0006
Beryllium		<0.0005	<0.0007	<0.0002
Cadmium		<0.0005	<0.0007	<0.0002
Chromium		0.00086	0.0011	0.00031
Cobalt		<0.0006	<0.0008	<0.0002
Lead		<0.002	<0.002	<0.0005
Manganese		0.0059	0.0075	0.0021
Mercury		<0.0004	<0.0005	<0.0001
Nickel		<0.001	<0.002	<0.0005
Selenium		<0.004	<0.005	<0.001
Tin		<0.002	<0.002	<0.0006
Vanadium		<0.001	<0.001	<0.0004
Type 1 & 2 Substances				
Upper Bound				
Total Type 1 Substances		<0.008	<0.01	<0.003
Total Type 2 Substances		≤0.016	≤0.021	≤0.0058
Total Type 1 & 2 Substances		≤0.025	≤0.032	≤0.0088
Isokinetic Sampling Parameters				
Sampling time, min		80		80
Isokinetic rate, %		101		100
Velocity difference, %		22		22
Gravimetric analysis date (total particulate)			05-12-2022	
Gravimetric analysis date (PM ₁₀ /PM _{2.5})			05-12-2022	

Date	30/11/2022	Client	Manildra Group
Report	R013746	Stack ID	EPA ID 42 - Boiler 4
Licence No.	883	Location	Bomaderry
Ektimo Staff	Zoe Parker & Scott Woods	State	NSW
Process Conditions	Please refer to client records.		

221124

Sampling Plane Details

Sampling plane dimensions	1140 mm
Sampling plane area	1.02 m ²
Sampling port size, number & depth	4" BSP (x2), 100 mm
Access & height of ports	Stairs 30 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >3 D
Upstream disturbance	Change in diameter 1 D
No. traverses & points sampled	2 16
Sample plane conformance to AS 4323.1	Non-conforming

Comments

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

The upstream disturbance is <2D from the sampling plane

Stack Parameters

Moisture content, %v/v	13	
Gas molecular weight, g/g mole	28.1 (wet)	29.7 (dry)
Gas density at STP, kg/m ³	1.26 (wet)	1.33 (dry)
Gas density at discharge conditions, kg/m ³	0.86	
% Oxygen correction & Factor	3 %	1.26

Gas Flow Parameters

Flow measurement time(s) (hhmm)	1142 & 1318
Temperature, °C	129
Temperature, K	402
Velocity at sampling plane, m/s	10
Volumetric flow rate, actual, m ³ /s	10
Volumetric flow rate (wet STP), m ³ /s	7.1
Volumetric flow rate (dry STP), m ³ /s	6.1
Mass flow rate (wet basis), kg/hour	32000

Gas Analyser Results

Sampling time	Average 1150 - 1311			Minimum 1150 - 1311			Maximum 1150 - 1311		
	Corrected to 3%			Corrected to 3%			Corrected to 3%		
	Concentration mg/m ³	O ₂ mg/m ³	Mass Rate g/min	Concentration mg/m ³	O ₂ mg/m ³	Mass Rate g/min	Concentration mg/m ³	O ₂ mg/m ³	Mass Rate g/min
Combustion Gases									
Nitrogen dioxide (as NO ₂)	<2	<3	<0.8	<2	<3	<0.8	<2	<3	<0.8
Nitrogen oxides (as NO ₂)	89	110	33	87	110	32	90	110	33
Sulfur dioxide	<6	<7	<2	<6	<7	<2	<6	<7	<2
Carbon monoxide	<2	<3	<0.9	<2	<3	<0.9	<2	<3	<0.9
	Concentration % v/v			Concentration % v/v			Concentration % v/v		
Carbon dioxide	8.2			8.1			8.3		
Oxygen	6.6			6.4			6.8		
	Corrected to 3%			Corrected to 3%			Corrected to 3%		
	Concentration mg/m ³	O ₂ mg/m ³	Mass Rate g/min	Concentration mg/m ³	O ₂ mg/m ³	Mass Rate g/min	Concentration mg/m ³	O ₂ mg/m ³	Mass Rate g/min
Total Organic Compounds (TOC)									
TOC (as Propane)	<4	<5	<1	<4	<5	<1	<4	<5	<1

Date	30/11/2022	Client	Manildra Group
Report	R013746	Stack ID	EPA ID 42 - Boiler 4
Licence No.	883	Location	Bomaderry
Ektimo Staff	Zoe Parker & Scott Woods	State	NSW
Process Conditions	Please refer to client records.		

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Polycyclic Aromatic Hydrocarbons (PAHs)		Results	
Sampling time		1150 - 1312	
		Concentration ng/m ³	Mass Rate ng/min
Naphthalene		1600	600000
2-Methylnaphthalene		250	91000
Acenaphthylene		13	4800
Acenaphthene		39	14000
Fluorene		150	55000
Phenanthrene		650	240000
Anthracene		41	15000
Fluoranthene		140	53000
Pyrene		72	26000
Benz(a)anthracene		13	4800
Chrysene		120	46000
Benzo(b)fluoranthene		16	6000
Benzo(k)fluoranthene		<10	<5000
Benzo(e)pyrene		<10	<5000
Benzo(a)pyrene		<10	<5000
Perylene		<10	<5000
Indeno(1,2,3-cd)pyrene		<10	<5000
Dibenz(ah)anthracene		<10	<5000
Benzo(ghi)perylene		<10	<5000
Total 16 PAHs		2900	1100000
Total 19 PAHs		3100	1200000
BaP-TEQ			
Lower Bound		4.2	1500
Middle Bound		15	5400
Upper Bound		25	9200

Abbreviations and definitions	
BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.
TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency	

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	80
Isokinetic rate, %	102%

2.2 EPA ID 42 – Boiler 4 – 1 December 2022

Date	1/12/2022	Client	Manildra Group
Report	R013746	Stack ID	EPA ID 42 - Boiler 4
Licence No.	883	Location	Bomaderry
Ektimo Staff	Zoe Parker & Scott Woods	State	NSW
Process Conditions	Please refer to client records.		

221124

Sampling Plane Details

Sampling plane dimensions	1140 mm
Sampling plane area	1.02 m ²
Sampling port size, number & depth	4" BSP (x2), 100 mm
Access & height of ports	Stairs 30 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >3 D
Upstream disturbance	Change in diameter 1 D
No. traverses & points sampled	2 16
Sample plane conformance to AS 4323.1	Non-conforming

Comments

The velocity difference for isokinetic testing is outside the criteria ($\pm 10\%$)

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

The upstream disturbance is <2D from the sampling plane

Stack Parameters

Moisture content, %v/v	11	
Gas molecular weight, g/g mole	28.3 (wet)	29.6 (dry)
Gas density at STP, kg/m ³	1.26 (wet)	1.32 (dry)
Gas density at discharge conditions, kg/m ³	0.88	
% Oxygen correction & Factor	3 %	1.34

Gas Flow Parameters

Flow measurement time(s) (hhmm)	1140 & 1320
Temperature, °C	119
Temperature, K	393
Velocity at sampling plane, m/s	7.5
Volumetric flow rate, actual, m ³ /s	7.6
Volumetric flow rate (wet STP), m ³ /s	5.3
Volumetric flow rate (dry STP), m ³ /s	4.7
Mass flow rate (wet basis), kg/hour	24000

Date	1/12/2022	Client	Manildra Group
Report	R013746	Stack ID	EPA ID 42 - Boiler 4
Licence No.	883	Location	Bomaderry
Ektimo Staff	Zoe Parker & Scott Woods	State	NSW
Process Conditions	Please refer to client records.		

221124

Isokinetic Results	Sampling time	Results		
		1146-1308	1146-1308 (PM10&2.5)	
			Corrected to	
		Concentration mg/m³	3% O2 mg/m³	Mass Rate g/min
Solid Particles		<2	<2	<0.5
Fine particulates (PM10)		<4	<5	<1
Fine particulates (PM2.5)		<3	<3	<0.7
D50 cut size, 10µm			10.1	
D50 cut size, 2.5µm			2.24	
Antimony		<0.004	<0.006	<0.001
Arsenic		<0.002	<0.003	<0.0005
Beryllium		<0.0005	<0.0007	<0.0002
Cadmium		<0.0006	<0.0007	<0.0002
Chromium		0.001	0.0014	0.00029
Cobalt		<0.0007	<0.0009	<0.0002
Lead		<0.001	<0.002	<0.0004
Manganese		0.0065	0.0087	0.0018
Mercury		<0.0005	<0.0006	<0.0001
Nickel		<0.001	<0.002	<0.0004
Selenium		<0.004	<0.006	<0.001
Tin		<0.002	<0.003	<0.0005
Vanadium		<0.001	<0.001	<0.0003
Type 1 & 2 Substances				
Upper Bound				
Total Type 1 Substances		<0.009	<0.01	<0.002
Total Type 2 Substances		≤0.017	≤0.023	≤0.0049
Total Type 1 & 2 Substances		≤0.026	≤0.035	≤0.0073
Isokinetic Sampling Parameters		Isokinetic	PM10&2.5	
Sampling time, min		80	80	
Isokinetic rate, %		103	104	
Velocity difference, %		-15	-15	
Gravimetric analysis date (total particulate)		05-12-2022		
Gravimetric analysis date (PM10/PM2.5)		05-12-2022		

Date	1/12/2022	Client	Manildra Group
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Sampling Plane Details

Sampling plane dimensions	1140 mm
Sampling plane area	1.02 m ²
Sampling port size, number & depth	4" BSP (x2), 100 mm
Access & height of ports	Stairs 30 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >3 D
Upstream disturbance	Change in diameter 1 D
No. traverses & points sampled	2 16
Sample plane conformance to AS 4323.1	Non-conforming

Comments

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

The upstream disturbance is <2D from the sampling plane

Stack Parameters

Moisture content, %v/v	13	
Gas molecular weight, g/g mole	28.2 (wet)	29.7 (dry)
Gas density at STP, kg/m ³	1.26 (wet)	1.32 (dry)
Gas density at discharge conditions, kg/m ³	0.87	
% Oxygen correction & Factor	3 %	1.34

Gas Flow Parameters

Flow measurement time(s) (hhmm)	0955 & 1140
Temperature, °C	123
Temperature, K	396
Velocity at sampling plane, m/s	8
Volumetric flow rate, actual, m ³ /s	8.1
Volumetric flow rate (wet STP), m ³ /s	5.6
Volumetric flow rate (dry STP), m ³ /s	4.9
Mass flow rate (wet basis), kg/hour	25000

Gas Analyser Results

Sampling time	Average 1009 - 1130			Minimum 1009 - 1130			Maximum 1009 - 1130		
	Corrected to 3%			Corrected to 3%			Corrected to 3%		
	Concentration mg/m ³	O ₂ mg/m ³	Mass Rate g/min	Concentration mg/m ³	O ₂ mg/m ³	Mass Rate g/min	Concentration mg/m ³	O ₂ mg/m ³	Mass Rate g/min
Combustion Gases									
Nitrogen dioxide (as NO ₂)	<2	<3	<0.6	<2	<3	<0.6	<2	<3	<0.6
Nitrogen oxides (as NO ₂)	82	110	24	80	110	24	83	110	24
Sulfur dioxide	<6	<8	<2	<6	<8	<2	<6	<8	<2
Carbon monoxide	<2	<3	<0.7	<2	<3	<0.7	<2	<3	<0.7
	Concentration % v/v			Concentration % v/v			Concentration % v/v		
Carbon dioxide		7.7			7.6			7.9	
Oxygen		7.5			7.3			7.7	
	Corrected to 3%			Corrected to 3%			Corrected to 3%		
	Concentration mg/m ³	O ₂ mg/m ³	Mass Rate g/min	Concentration mg/m ³	O ₂ mg/m ³	Mass Rate g/min	Concentration mg/m ³	O ₂ mg/m ³	Mass Rate g/min
Total Organic Compounds (TOC)									
TOC (as Propane)	<4	<5	<1	<4	<5	<1	5.9	7.9	1.7

Date	1/12/2022	Client	Manildra Group
Report	R013746	Stack ID	EPA ID 42 - Boiler 4
Licence No.	883	Location	Bomaderry
Ektimo Staff	Zoe Parker & Scott Woods	State	NSW
Process Conditions	Please refer to client records.		

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Polycyclic Aromatic Hydrocarbons (PAHs)		Results	
	Sampling time	1010 - 1132	
		Concentration ng/m ³	Mass Rate ng/min
Naphthalene		2700	780000
2-Methylnaphthalene		330	96000
Acenaphthylene		17	5000
Acenaphthene		130	38000
Fluorene		320	93000
Phenanthrene		1300	380000
Anthracene		72	21000
Fluoranthene		220	65000
Pyrene		170	50000
Benz(a)anthracene		22	6500
Chrysene		190	55000
Benzo(b)fluoranthene		17	5000
Benzo(k)fluoranthene		<20	<5000
Benzo(e)pyrene		<20	<5000
Benzo(a)pyrene		<20	<5000
Perylene		<20	<5000
Indeno(1,2,3-cd)pyrene		<20	<5000
Dibenz(ah)anthracene		<20	<5000
Benzo(ghi)perylene		<20	<5000
Total 16 PAHs		5100	1500000
Total 19 PAHs		5400	1600000
BaP-TEQ			
Lower Bound		5.8	1700
Middle Bound		20	5700
Upper Bound		33	9800

Abbreviations and definitions	
BaP-TEQ	Benzo(a)pyrene toxic equivalents.
Lower Bound	Defines values reported below detection as equal to zero.
Middle Bound	Defines values reported below detection are equal to half the detection limit.
Upper Bound	Defines values reported below detection are equal to the detection limit.
TEQs are calculated by multiplying the quantified result for each toxic compound by its corresponding toxic equivalency	

Isokinetic Sampling Parameters	Results
PAHs	
Sampling time, min	80
Isokinetic rate, %	102%

3 Plant Operating Conditions

Plant operating conditions were supplied by Manildra Group personnel. See Manildra Group records for complete process conditions.

From information received from the site operator, unless otherwise noted it is our understanding that samples were collected during normal plant operations. Unless otherwise noted all samples were collected in compliance with Ektimo's QA/QC standards.

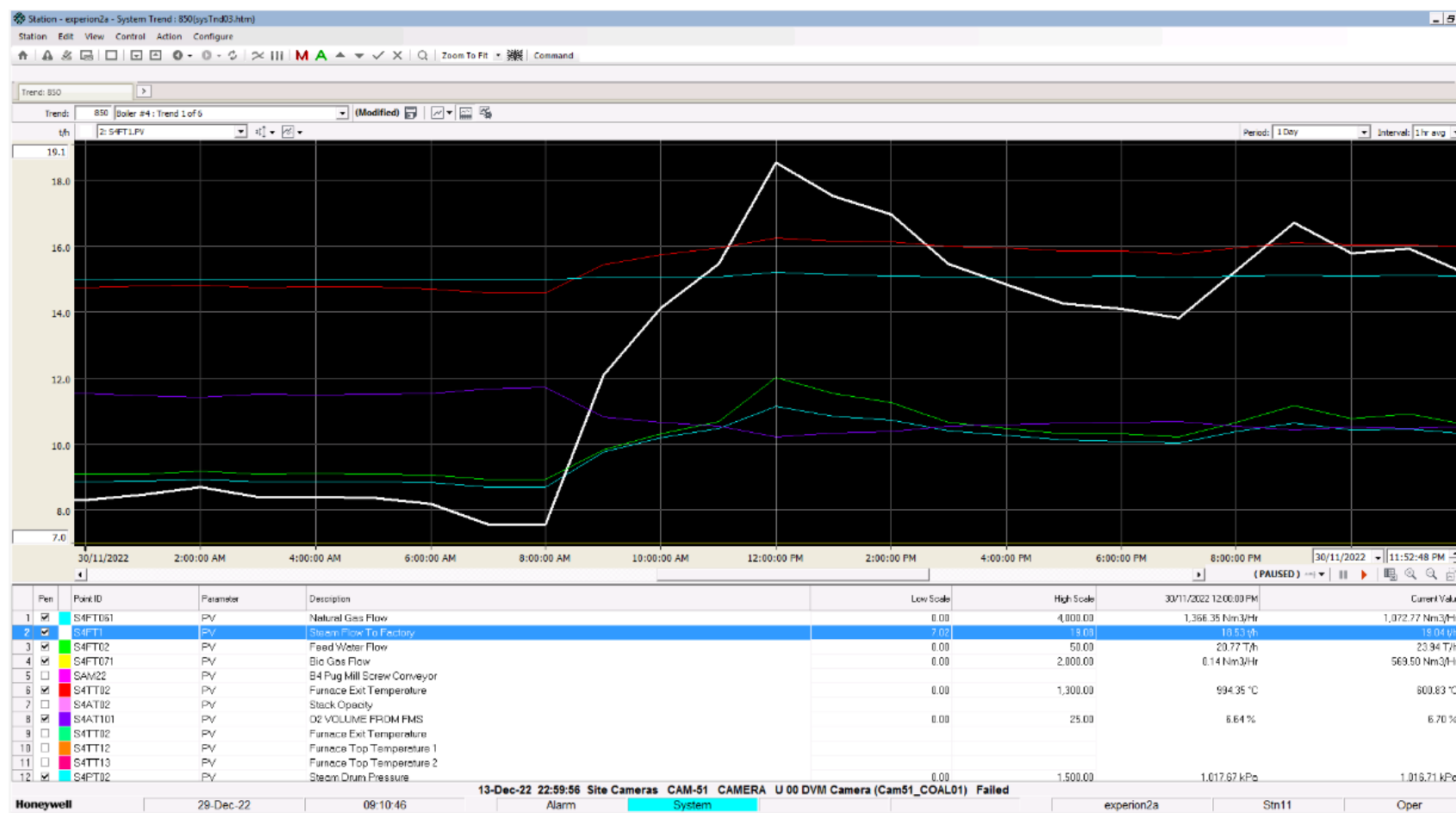


Figure 1. Plant Operating Conditions - 30 November 2022.

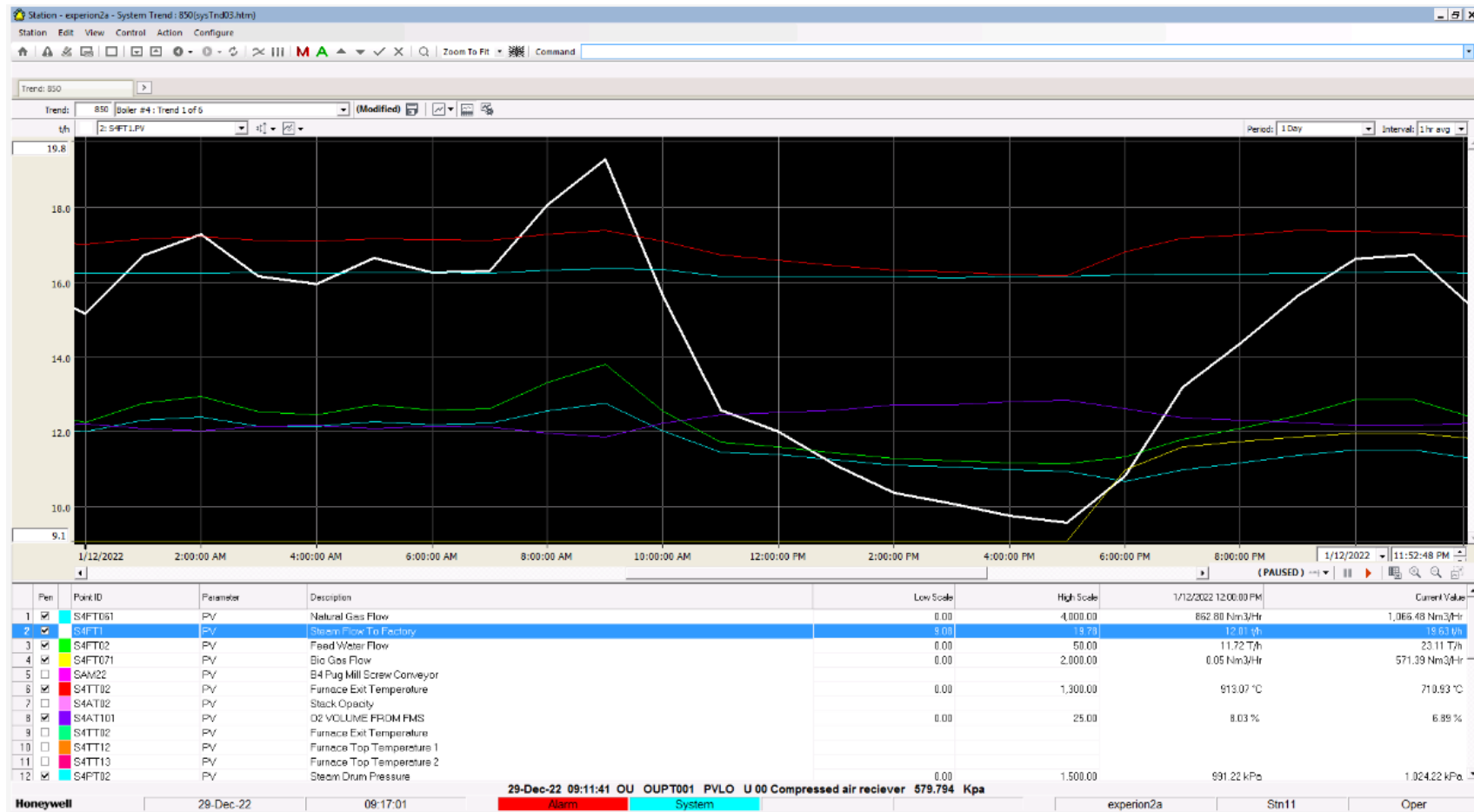


Figure 2. Plant Operating Conditions – 1 December 2022.

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 & 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%	✓	✓
Sulfur dioxide	NSW EPA TM-4 (USEPA Method 6C)	NSW EPA TM-4 (USEPA Method 6C)	12%	✓	✓
Volatile organic compounds	NSW EPA TM-34 (USEPA Method 25B)	NSW EPA TM-34 (USEPA Method 25B)	not specified	✓	✓
Particulate matter (PM ₁₀ & PM _{2.5})	NSW EPA OM-5 (USEPA Method 201A)	NSW EPA OM-5 (USEPA Method 201A)	6%	✓	✓ ^{††}
Solid particles (total)	NSW EPA TM-15 (AS 4323.2)	NSW EPA TM-15 (AS 4323.2)	3%	✓	✓ ^{††}
Total (gaseous & particulate) metals & metallic compounds	NSW EPA TM-12, NSW EPA TM-13, NSW EPA TM-14 (USEPA Method 29)	EnviroLab in-house methods Metals-006, Metals-022 & Metals-021	15%	✓	✓ [‡]
Type 1 substances (As, Cd, Hg, Pb, Sb)	NSW EPA TM-12 (USEPA Method 29)	EnviroLab in-house methods Metals-006, Metals-022 & Metals-021	15%	✓	✓ [‡]
Type 2 substances (Be, Cr, Co, Mn, Ni, Se, Sn, V)	NSW EPA TM-13 (USEPA Method 29)	EnviroLab in-house methods Metals-006, Metals-022 & Metals-021	15%	✓	✓ [‡]
Polycyclic aromatic hydrocarbons (PAHs)	NSW EPA OM-6	NMI in-house method NGCMS 11.27	21%	✓	✓ [¶]

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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).

†† Gravimetric analysis conducted at the Ektimo Unanderra, NSW laboratory, NATA accreditation number 14601.

‡ Analysis performed by EnviroLab, NATA accreditation number 2901. Results were reported to Ektimo on 12 January 2023 in report 313988.

¶ Analysis performed by Australian Government National Measurement Institute, NATA accreditation number 198. Results were reported to Ektimo on 30 January 2023 in report RN1380239.

5 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.

6 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
AS	Australian Standard
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.
EPA	Environment Protection Authority
FTIR	Fourier transform infra-red
ISC	Intersociety Committee, Methods of Air Sampling and Analysis
ISO	International Organisation for Standardisation
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
OM	Other approved method
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).
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
Velocity difference	The percentage difference between the average of initial flows and after flows.
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.
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.

7 Appendix 1: Site Photos



Figure 3. EPA ID 42 - Boiler 4

9 Appendix 2: Laboratory Results

CERTIFICATE OF ANALYSIS 313988

Client Details

Client	Ektimo (Unanderra)
Attention	Zoe Parker
Address	1/251 Princes Hwy, Unanderra, NSW, 2526

Sample Details

Your Reference	<u>R013746</u>
Number of Samples	4 Filter, 8 Liquid
Date samples received	05/01/2023
Date completed instructions received	05/01/2023

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	12/01/2023
Date of Issue	12/01/2023
NATA Accreditation Number 2901. This document shall not be reproduced except in full.	
Accredited for compliance with ISO/IEC 17025 - Testing. Tests not covered by NATA are denoted with *	

Results Approved By

Hannah Nguyen, Metals Supervisor
Loren Bardwell, Development Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Metals on filters					
Our Reference		313988-1	313988-4	313988-7	313988-10
Your Reference	UNITS	N 17370	N 17374	N 17377	N 17382
Type of sample		Filter	Filter	Filter	Filter
Date prepared	-	09/01/2023	09/01/2023	09/01/2023	09/01/2023
Date analysed	-	10/01/2023	10/01/2023	10/01/2023	10/01/2023
Antimony	µg/filter	<5	<5	<5	<5
Arsenic	µg/filter	<2	<2	<2	<2
Cadmium	µg/filter	<0.5	<0.5	<0.5	<0.5
Lead	µg/filter	<1	<1	<1	<1
Mercury	µg/filter	<0.2	<0.2	<0.2	<0.2
Beryllium	µg/filter	<0.5	<0.5	<0.5	<0.5
Chromium	µg/filter	<0.5	0.7	0.6	0.9
Cobalt	µg/filter	<0.5	<0.5	<0.5	<0.5
Manganese	µg/filter	<0.5	<0.5	<0.5	<0.5
Nickel	µg/filter	<1	1	<1	<1
Selenium	µg/filter	<5	<5	<5	<5
Vanadium	µg/filter	<1	<1	<1	<1
Tin	µg/filter	<2	<2	<2	<2

Metals in water - mass units						
Our Reference		313988-2	313988-3	313988-5	313988-6	313988-8
Your Reference	UNITS	N 17371	N 17372	N 17375	N 17376	N 17378
Type of sample		Liquid	Liquid	Liquid	Liquid	Liquid
Volume	mL	139	207	313	185	295
Antimony	µg	<0.5	[NA]	<0.5	[NA]	<0.5
Arsenic	µg	<0.5	[NA]	<0.5	[NA]	<0.5
Cadmium	µg	<0.05	[NA]	0.07	[NA]	0.2
Lead	µg	<0.5	[NA]	2	[NA]	0.9
Mercury	µg	<10	<1	<10	<1	<10
Beryllium	µg	<0.5	[NA]	<0.5	[NA]	<0.5
Chromium	µg	0.7	[NA]	1	[NA]	1
Cobalt	µg	<0.5	[NA]	<0.5	[NA]	<0.5
Manganese	µg	<3	[NA]	<3	[NA]	7
Nickel	µg	<0.5	[NA]	14	[NA]	0.7
Selenium	µg	<0.5	[NA]	<0.5	[NA]	<0.5
Vanadium	µg	<0.5	[NA]	<0.5	[NA]	<0.5
Tin	µg	<0.5	[NA]	<0.5	[NA]	<0.5
Date prepared	-	10/01/2023	10/01/2023	10/01/2023	10/01/2023	10/01/2023
Date analysed	-	10/01/2023	10/01/2023	10/01/2023	10/01/2023	10/01/2023
Antimony-Dissolved	µg/L	<1	[NA]	<1	[NA]	<1
Arsenic-Dissolved	µg/L	<1	[NA]	<1	[NA]	<1
Cadmium-Dissolved	µg/L	0.2	[NA]	0.2	[NA]	0.7
Lead-Dissolved	µg/L	<1	[NA]	5	[NA]	3
Mercury-Dissolved	µg/L	<1	<0.1	<1	0.2	<1
Beryllium-Dissolved	µg/L	<0.5	[NA]	<0.5	[NA]	<0.5
Chromium-Dissolved	µg/L	5	[NA]	4	[NA]	4
Cobalt-Dissolved	µg/L	<1	[NA]	<1	[NA]	<1
Manganese-Dissolved	µg/L	<5	[NA]	<5	[NA]	25
Nickel-Dissolved	µg/L	1	[NA]	44	[NA]	3
Selenium-Dissolved	µg/L	<1	[NA]	1	[NA]	<1
Vanadium-Dissolved	µg/L	<1	[NA]	<1	[NA]	<1
Tin-Dissolved	µg/L	3	[NA]	1	[NA]	<1

Metals in water - mass units				
Our Reference		313988-9	313988-11	313988-12
Your Reference	UNITS	N 17379	N 17383	N 17384
Type of sample		Liquid	Liquid	Liquid
Volume	mL	210	348	207
Antimony	µg	[NA]	<0.5	[NA]
Arsenic	µg	[NA]	<0.5	[NA]
Cadmium	µg	[NA]	0.2	[NA]
Lead	µg	[NA]	0.6	[NA]
Mercury	µg	<1	<10	<1
Beryllium	µg	[NA]	<0.5	[NA]
Chromium	µg	[NA]	1	[NA]
Cobalt	µg	[NA]	<0.5	[NA]
Manganese	µg	[NA]	8	[NA]
Nickel	µg	[NA]	0.6	[NA]
Selenium	µg	[NA]	<0.5	[NA]
Vanadium	µg	[NA]	<0.5	[NA]
Tin	µg	[NA]	<0.5	[NA]
Date prepared	-	10/01/2023	10/01/2023	10/01/2023
Date analysed	-	10/01/2023	10/01/2023	10/01/2023
Antimony-Dissolved	µg/L	[NA]	<1	[NA]
Arsenic-Dissolved	µg/L	[NA]	<1	[NA]
Cadmium-Dissolved	µg/L	[NA]	0.6	[NA]
Lead-Dissolved	µg/L	[NA]	2	[NA]
Mercury-Dissolved	µg/L	<0.1	<1	<0.1
Beryllium-Dissolved	µg/L	[NA]	<0.5	[NA]
Chromium-Dissolved	µg/L	[NA]	3	[NA]
Cobalt-Dissolved	µg/L	[NA]	<1	[NA]
Manganese-Dissolved	µg/L	[NA]	23	[NA]
Nickel-Dissolved	µg/L	[NA]	2	[NA]
Selenium-Dissolved	µg/L	[NA]	<1	[NA]
Vanadium-Dissolved	µg/L	[NA]	<1	[NA]
Tin-Dissolved	µg/L	[NA]	1	[NA]

Method ID	Methodology Summary
Metals-020/021/022	Determination of various metals on filters by ICP-AES/MS and or CV/AAS. Note - air volume measurements are not covered by Envirolab's NATA accreditation.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.

QUALITY CONTROL: Metals on filters					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			09/01/2023	[NT]	[NT]	[NT]	[NT]	09/01/2023	[NT]
Date analysed	-			10/01/2023	[NT]	[NT]	[NT]	[NT]	10/01/2023	[NT]
Antimony	µg/filter	5	Metals-020/021/022	<5	[NT]	[NT]	[NT]	[NT]	105	[NT]
Arsenic	µg/filter	2	Metals-020/021/022	<2	[NT]	[NT]	[NT]	[NT]	98	[NT]
Cadmium	µg/filter	0.5	Metals-020/021/022	<0.5	[NT]	[NT]	[NT]	[NT]	108	[NT]
Lead	µg/filter	1	Metals-020/021/022	<1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Mercury	µg/filter	0.2	Metals-020/021/022	<0.2	[NT]	[NT]	[NT]	[NT]	94	[NT]
Beryllium	µg/filter	0.5	Metals-020/021/022	<0.5	[NT]	[NT]	[NT]	[NT]	105	[NT]
Chromium	µg/filter	0.5	Metals-020/021/022	<0.5	[NT]	[NT]	[NT]	[NT]	100	[NT]
Cobalt	µg/filter	0.5	Metals-020/021/022	<0.5	[NT]	[NT]	[NT]	[NT]	103	[NT]
Manganese	µg/filter	0.5	Metals-020/021/022	<0.5	[NT]	[NT]	[NT]	[NT]	107	[NT]
Nickel	µg/filter	1	Metals-020/021/022	<1	[NT]	[NT]	[NT]	[NT]	95	[NT]
Selenium	µg/filter	5	Metals-020/021/022	<5	[NT]	[NT]	[NT]	[NT]	107	[NT]
Vanadium	µg/filter	1	Metals-020/021/022	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Tin	µg/filter	2	Metals-020/021/022	<2	[NT]	[NT]	[NT]	[NT]	115	[NT]

QUALITY CONTROL: Metals in water - mass units					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	313988-8
Antimony	µg	0.5	Metals-022	<0.5	5	<0.5	<0.5	0	[NT]	[NT]
Arsenic	µg	0.5	Metals-022	<0.5	5	<0.5	<0.5	0	[NT]	[NT]
Cadmium	µg	0.05	Metals-022	<0.05	5	0.07	0.06	15	[NT]	[NT]
Lead	µg	0.5	Metals-022	<0.5	5	2	2	0	[NT]	[NT]
Mercury	µg	0.5	Metals-021	<0.5	5	<10	<10	0	[NT]	[NT]
Beryllium	µg	0.5	Metals-022	<0.5	5	<0.5	<0.5	0	[NT]	[NT]
Chromium	µg	0.5	Metals-022	<0.5	5	1	1	0	[NT]	[NT]
Cobalt	µg	0.5	Metals-022	<0.5	5	<0.5	<0.5	0	[NT]	[NT]
Manganese	µg	3	Metals-022	<3	5	<3	<3	0	[NT]	[NT]
Nickel	µg	0.5	Metals-022	<0.5	5	14	14	0	[NT]	[NT]
Selenium	µg	0.5	Metals-022	<0.5	5	<0.5	<0.5	0	[NT]	[NT]
Vanadium	µg	0.5	Metals-022	<0.5	5	<0.5	<0.5	0	[NT]	[NT]
Tin	µg	0.5	Metals-022	<0.5	5	<0.5	<0.5	0	[NT]	[NT]
Date prepared	-			10/01/2023	5	10/01/2023	10/01/2023		10/01/2023	10/01/2023
Date analysed	-			10/01/2023	5	10/01/2023	10/01/2023		10/01/2023	10/01/2023
Antimony-Dissolved	µg/L	1	Metals-022	<1	5	<1	<1	0	108	100
Arsenic-Dissolved	µg/L	1	Metals-022	<1	5	<1	<1	0	88	91
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	5	0.2	0.2	0	100	101
Lead-Dissolved	µg/L	1	Metals-022	<1	5	5	5	0	95	98
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	5	<1	<1	0	97	[NT]
Beryllium-Dissolved	µg/L	0.5	Metals-022	<0.5	5	<0.5	<0.5	0	97	107
Chromium-Dissolved	µg/L	1	Metals-022	<1	5	4	4	0	89	94
Cobalt-Dissolved	µg/L	1	Metals-022	<1	5	<1	<1	0	93	97
Manganese-Dissolved	µg/L	5	Metals-022	<5	5	<5	<5	0	98	103
Nickel-Dissolved	µg/L	1	Metals-022	<1	5	44	45	2	86	91
Selenium-Dissolved	µg/L	1	Metals-022	<1	5	1	1	0	98	96
Vanadium-Dissolved	µg/L	1	Metals-022	<1	5	<1	<1	0	96	101
Tin-Dissolved	µg/L	1	Metals-022	<1	5	1	1	0	102	103

QUALITY CONTROL: Metals in water - mass units					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	313988-9
Mercury	µg	0.5	Metals-021	[NT]	6	<1	<1	0	[NT]	[NT]
Date prepared	-			[NT]	6	10/01/2023	10/01/2023		[NT]	10/01/2023
Date analysed	-			[NT]	6	10/01/2023	10/01/2023		[NT]	10/01/2023
Mercury-Dissolved	µg/L	0.05	Metals-021	[NT]	6	0.2	0.2	0	[NT]	88

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.
Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.	
The recommended maximums for analytes in urine are taken from "2018 TLVs and BEIs", as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.	
Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2	

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

Metals in water - mass units - The PQL has been raised for Hg due to the sample matrix requiring dilution.



REPORT OF ANALYSIS

Page: 1 of 4

Report No. RN1380239

Client : EKTIMO PTY LTD 52 COOPER ROAD COCKBURN CENTRAL WA 6164	Job No. : EKTIO1/230105/2 Quote No. : QT-02083 Order No. : W010319 Date Sampled : Date Received : 05-JAN-2023 Sampled By : CLIENT
Attention : ZOE PARKER Project Name : Your Client Services Manager : Tim Reddan	Phone : 03 9644 4854

Lab Reg No.	Sample Ref	Sample Description
N23/000105	N 17373	RESIN RINSE FILTER JOB: R013746
N23/000106	N 17380	RESIN RINSE FILTER JOB: R013746

Lab Reg No.		N23/000105	N23/000106	
Sample Reference		N 17373	N 17380	
	Units			Method
PAH				
Naphthalene (91-20-3)	ng	1700	2500	NGCMS_1127
2-Methylnaphthalene (91-57-6)	ng	830	380	NGCMS_1127
Acenaphthylene (208-96-8)	ng	< 20	< 20	NGCMS_1127
Acenaphthene (83-32-9)	ng	< 20	60	NGCMS_1127
Fluorene (86-73-7)	ng	870	230	NGCMS_1127
Phenanthrene (85-01-8)	ng	1000	1000	NGCMS_1127
Anthracene (120-12-7)	ng	42	63	NGCMS_1127
Fluoranthene (206-44-0)	ng	360	220	NGCMS_1127
Pyrene (129-00-0)	ng	< 20	110	NGCMS_1127
Benz(a)anthracene (56-55-3)	ng	< 20	20	NGCMS_1127
Chrysene (218-01-9)	ng	220	190	NGCMS_1127
Benzo(b)fluoranthene (205-99-2)	ng	< 20	25	NGCMS_1127
Benzo(k)fluoranthene (207-08-9)	ng	< 20	< 20	NGCMS_1127
Benzo(e)pyrene (192-97-2)	ng	< 20	< 20	NGCMS_1127
Benzo(a)pyrene (50-32-8)	ng	< 20	< 20	NGCMS_1127
Perylene (198-55-0)	ng	< 20	< 20	NGCMS_1127
Indeno(1,2,3-cd)pyrene (193-39-5)	ng	< 20	< 20	NGCMS_1127
Dibenz(ah)anthracene (53-70-3)	ng	< 20	< 20	NGCMS_1127
Benzo(ghi)perylene (50-32-8)	ng	< 20	< 20	NGCMS_1127
Field Surogate				
Surrogate: d14-Terphenyl	%	98	109	NGCMS_1127
Labelled Internal Recovery %				
d8-Naphthalene	%	41	27	NGCMS_1127
d8-Acenaphthylene	%	71	41	NGCMS_1127
d10-Acenaphthene	%	94	61	NGCMS_1127
d10-Fluorene	%	56	55	NGCMS_1127
d10-Phenanthrene	%	52	47	NGCMS_1127
d10-Fluoranthene	%	54	45	NGCMS_1127
d12-Benz(a)anthracene	%	53	41	NGCMS_1127

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REPORT OF ANALYSIS

Page: 2 of 4
Report No. RN1380239

Lab Reg No.		N23/000105	N23/000106	
Sample Reference		N 17373	N 17380	
	Units			Method
Labelled Internal Recovery %				
d12-Chrysene	%	70	58	NGCMS_1127
d12-Benzo(b)fluoranthene	%	52	42	NGCMS_1127
d12-Benzo(k)fluoranthene	%	67	45	NGCMS_1127
d12-Benzo(a)pyrene	%	65	54	NGCMS_1127
d12-Indeno(1,2,3-c,d)pyrene	%	61	49	NGCMS_1127
d14-Dibenz(ah)anthracene	%	66	51	NGCMS_1127
d12-Benzo(ghi)perylene	%	68	52	NGCMS_1127
CARB - Benzo(a)pyrene Toxic Equivalent Summary				
BaP-TEQPAH Lower Bound [excl LOR]	ng	2.2	6.4	NGCMS_1127
BaP-TEQPAH Middle Bound [incl 1/2 LOR]	ng	20	22	NGCMS_1127
BaP-TEQPAH Upper Bound [incl LOR]	ng	38	38	NGCMS_1127
Dates				
Date extracted		10-JAN-2023 00:00	10-JAN-2023 00:00	
Date analysed		25-JAN-2023 00:00	25-JAN-2023 00:00	

N23/000105

N23/000107

Standard acceptable recovery range is 50 to 150%.

Labelled Internal Standard % Recoveries are outside this range for samples

N23/000106 and N23/000107.

The samples were re-extracted and re-analysed and the low recoveries were confirmed.

Results are acceptable as signal to noise is > 10.



Luke Baker, Analyst

Organics - NSW

Accreditation No. 198

30-JAN-2023

REPORT OF ANALYSIS

Page: 3 of 4

Report No. RN1380239

Client : EKTIMO PTY LTD 52 COOPER ROAD COCKBURN CENTRAL WA 6164	Job No. : EKTIO1/230105/2 Quote No. : QT-02083 Order No. : W010319 Date Sampled : Date Received : 05-JAN-2023 Sampled By : CLIENT
Attention : ZOE PARKER Project Name : Your Client Services Manager : Tim Reddan	Phone : 03 9644 4854

Lab Reg No.	Sample Ref	Sample Description
N23/000107	N 17381	RESIN RINSE FILTER JOB: R013746

Lab Reg No.		N23/000107		
Sample Reference		N 17381		
	Units			Method
PAH				
Naphthalene (91-20-3)	ng	3100		NGCMS_1127
2-Methylnaphthalene (91-57-6)	ng	380		NGCMS_1127
Acenaphthylene (208-96-8)	ng	<20		NGCMS_1127
Acenaphthene (83-32-9)	ng	150		NGCMS_1127
Fluorene (86-73-7)	ng	370		NGCMS_1127
Phenanthrene (85-01-8)	ng	1500		NGCMS_1127
Anthracene (120-12-7)	ng	84		NGCMS_1127
Fluoranthene (206-44-0)	ng	260		NGCMS_1127
Pyrene (129-00-0)	ng	200		NGCMS_1127
Benz(a)anthracene (56-55-3)	ng	26		NGCMS_1127
Chrysene (218-01-9)	ng	220		NGCMS_1127
Benzo(b)fluoranthene (205-99-2)	ng	20		NGCMS_1127
Benzo(k)fluoranthene (207-08-9)	ng	<20		NGCMS_1127
Benzo(e)pyrene (192-97-2)	ng	<20		NGCMS_1127
Benzo(a)pyrene (50-32-8)	ng	<20		NGCMS_1127
Perylene (198-55-0)	ng	<20		NGCMS_1127
Indeno(1,2,3-cd)pyrene (193-39-5)	ng	<20		NGCMS_1127
Dibenz(ah)anthracene (53-70-3)	ng	<20		NGCMS_1127
Benzo(ghi)perylene (50-32-8)	ng	<20		NGCMS_1127
Field Surogate				
Surrogate: d14-Terphenyl	%	58		NGCMS_1127
Labelled Internal Recovery %				
d8-Naphthalene	%	15		NGCMS_1127
d8-Acenaphthylene	%	35		NGCMS_1127
d10-Acenaphthene	%	45		NGCMS_1127
d10-Fluorene	%	41		NGCMS_1127
d10-Phenanthrene	%	35		NGCMS_1127
d10-Fluoranthene	%	33		NGCMS_1127
d12-Benz(a)anthracene	%	31		NGCMS_1127
d12-Chrysene	%	48		NGCMS_1127

REPORT OF ANALYSIS

Page: 4 of 4
Report No. RN1380239

Lab Reg No.		N23/000107		
Sample Reference		N 17381		
	Units			Method
Labelled Internal Recovery %				
d12-Benzo(b)fluoranthene	%	24		NGCMS_1127
d12-Benzo(k)fluoranthene	%	36		NGCMS_1127
d12-Benzo(a)pyrene	%	41		NGCMS_1127
d12-Indeno(1,2,3-c,d)pyrene	%	37		NGCMS_1127
d14-Dibenz(ah)anthracene	%	43		NGCMS_1127
d12-Benzo(ghi)perylene	%	38		NGCMS_1127
CARB - Benzo(a)pyrene Toxic Equivalent Summary				
BaP-TEQPAH Lower Bound [excl LOR]	ng	6.8		NGCMS_1127
BaP-TEQPAH Middle Bound [incl 1/2 LOR]	ng	23		NGCMS_1127
BaP-TEQPAH Upper Bound [incl LOR]	ng	39		NGCMS_1127
Dates				
Date extracted		10-JAN-2023 00:00		
Date analysed		25-JAN-2023 00:00		



Luke Baker, Analyst
Organics - NSW
Accreditation No. 198

30-JAN-2023



WORLD RECOGNISED
ACCREDITATION

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This report shall not be reproduced except in full.
Results relate only to the sample(s) as received and tested.

This Report supersedes reports: *RN1380228*

Measurement Uncertainty is available upon request.

Chemical Accreditation 198: 105 Delhi Road, North Ryde, NSW, 2113

0317

28 July 4/1/23

SignVDate

Sample ID	Job No.	Analysis Required	Units Required	Analytical Lab	Purchase Order No.	Exltimo Contact	Notes	TAT Required (days)
1	R013746	Metals - Type 1 & 2 substances (Sb, As, Cd, Pb, Hg, Be, Cr, Co, Mn, Ni, Se, V, Sn)	ug/sample	EnviroLab	W010316	Zoe Parker	Blank Filter	
2	R013746	Metals - Type 1 & 2 substances (Sb, As, Cd, Pb, Hg, Be, Cr, Co, Mn, Ni, Se, V, Sn)	ug/litre	EnviroLab	W010316	Zoe Parker	Blank solution	
3	R013746	Metals - Type 1 & 2 substances (Sb, As, Cd, Pb, Hg, Be, Cr, Co, Mn, Ni, Se, V, Sn)	ug/litre	EnviroLab	W010316	Zoe Parker	Blank solution	
4	R013746	Metals - Type 1 & 2 substances (Sb, As, Cd, Pb, Hg, Be, Cr, Co, Mn, Ni, Se, V, Sn)	ug/sample	EnviroLab	W010316	Zoe Parker	Filter A	
5	R013746	Metals - Type 1 & 2 substances (Sb, As, Cd, Pb, Hg, Be, Cr, Co, Mn, Ni, Se, V, Sn)	ug/litre	EnviroLab	W010316	Zoe Parker	Imp A+B	
6	R013746	Metals - Type 1 & 2 substances (Sb, As, Cd, Pb, Hg, Be, Cr, Co, Mn, Ni, Se, V, Sn)	ug/litre	EnviroLab	W010316	Zoe Parker	Imp A+B	
7	R013746	Metals - Type 1 & 2 substances (Sb, As, Cd, Pb, Hg, Be, Cr, Co, Mn, Ni, Se, V, Sn)	ug/sample	EnviroLab	W010316	Zoe Parker	Filter A	
8	R013746	Metals - Type 1 & 2 substances (Sb, As, Cd, Pb, Hg, Be, Cr, Co, Mn, Ni, Se, V, Sn)	ug/litre	EnviroLab	W010316	Zoe Parker	Imp A+B	
9	R013746	Metals - Type 1 & 2 substances (Sb, As, Cd, Pb, Hg, Be, Cr, Co, Mn, Ni, Se, V, Sn)	ug/litre	EnviroLab	W010316	Zoe Parker	Imp A+B	
10	R013746	Metals - Type 1 & 2 substances (Sb, As, Cd, Pb, Hg, Be, Cr, Co, Mn, Ni, Se, V, Sn)	ug/sample	EnviroLab	W010316	Zoe Parker	Filter A	
11	R013746	Metals - Type 1 & 2 substances (Sb, As, Cd, Pb, Hg, Be, Cr, Co, Mn, Ni, Se, V, Sn)	ug/litre	EnviroLab	W010316	Zoe Parker	Imp A+B	
12	R013746	Metals - Type 1 & 2 substances (Sb, As, Cd, Pb, Hg, Be, Cr, Co, Mn, Ni, Se, V, Sn)	ug/litre	EnviroLab	W010316	Zoe Parker	Imp A+B	

ENVIROLAB
Quality
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No:

31 39 88

Date Received: 05/01/23

Date Received: _____
Time Received: _____

Time Received: 0930
Received By: C

Received by: 
Temp: Cool/Ambient

Cooling: Ice/Icepack
 Condition: Intact/Broken/None

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Project name		Boiler 4 verification report to address Development Consent 06_0228 Condition 9CA					
Document title		Boiler 4 verification report					
Project number		12603635					
File name		12603635-REP_Report to address Development Consent 06_0228 Condition 9CA.docx					
Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S4	0	N Spurrett	E Smith		E Smith		04/04/2023

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