

RDF/WW Mixed High Rate Proof of Performance

2022 Trial 5 Report

Boral Cement Works, Berrima NSW

Reporting Period: 30 June -01 July 2022

Introduction

On 23 April 2019, following the completion of the initial PoPT, the DPIE approved the ongoing use of SWDF in Kiln 6 at Berrima, limiting the amount of SWDF to 40%, as a percentage of total fuel. This was limited to 40% to reflect the fuel percentages used during the trials.

On 7 July 2021, Boral sought approval to increase our SWDF usage to 50% as per our development consent. Following consultation with the EPA, the DPIE requested the completion of three additional high rate RDF trials and two mixed RDF/WW high rate trials.

The purpose of the Proof of Performance Trial (PoPT) is to establish a database for the use RDF and WW as a Solid Waste Derived Fuel energy source at a rate > 40% in accordance with the development consents, Environmental Protection Licence and to meet the requirements of Boral Cement's Health, Safety, Environment and Quality (HSEQ) management system.

The PoP testing has been undertaken in accordance with the previously approved final PoP Trial Plan for Wood Waste (WW) and Refuse Derived Fuels (RDF), approved on 17 August 2018 and 28 August 2018.

This report is the 5th in the 5 extra trials required and the 1st additional mixed RDF and WW high rate. The ratio of mix was 50% RDF and 50% WW.

Results

A trial with high rate (>40% and <50%) of mixed RDF and WW was undertaken on 30th June and 1st July 2022. CEMS and process trends are reported in Attachment 1. All parameters were compliant against EPL 1698 licence limits.

Stack testing carried out for the trial and report is attached in Attachment 2. All parameters were compliant against EPL 1698 licence limits.

RDF and Wood fuel analysis for June 2022 is included in Attachment 3. A summary of these results against the SWDF specification are outlined within Table 3. All parameters are within the SWDF specification.

Table 1: Operational Data 30/06-01/07/2022

Parameter	Unit	EPL limit	Maximum	Average
Quantity used	(% of total fuel by mass)	50	47	45
Quantity used	Total weight in tph		16.3	13.9
Solid Particles 24hrs	mg/m ³	50	29	23
NOx				
24 hour	mg/m ³	1000	785	669
1 hours	mg/m ³	1250	704	614
HCl 1hr	mg/m ³	10	0.79	0.71
SO ₂ hr	mg/m ³	50	4.17	0.74
VOC hr	ppm	40	11.5	3.4
Temp Preheater exit	C	>300	387	374
Temp inlet abatement system	C	<200	<143	115
Temp combustion vessel	C	>850	981	939

Table 2: Trial 5 stack test summary results report R012893 (see full report in attachment 2)

EPA	Parameter	Units	Licence limit	Detected values	Detected values (corrected to 10% O ₂)
EPA 2 - Kiln Stack No. 6	Mercury	mg/m ³	0.05	0.0093	0.0086
	Type 1 and Type 2 substances in aggregate	mg/m ³	0.5	<0.03	<0.03
	Solid particles	mg/m ³	50	26	24
	Nitrogen oxides	mg/m ³	1250	670	690
	Cadmium + Thallium	mg/m ³	0.05	<0.001	<0.001
	Chlorine	mg/m ³	50	≤0.013	≤0.012
	Dioxins & furans (I-TEQ middle bound)	ng/m ³	0.1	0.0029	0.0031
	Hydrogen chloride	mg/m ³	10	0.18	0.17
	Hydrogen fluoride	mg/m ³	1	<0.02	<0.02
	Sulfur dioxide	mg/m ³	50	0.03	0.028
	Sulfuric acid mist and sulfur trioxide (as SO ₃)	mg/m ³	50	0.078	0.073
	Volatile organic compounds	mg/m ³	40	1.6	1.6

Table 3: Trial 5 – Wood Waste and RDF Monthly Fuel (July) Analysis Summary against specification limits

		SWDF Specification Limits	RDF Trial 5	WW Trial 5
Parameter	as received basis			
Gross Wet Calorific Value	(MJ/kg)	>15	15.3	15.1
Ash Yield	%	<30	5.4	1.6
Moisture	%	<30	18.8	22.8
Cl	%	<1	0.15	0.06
F	%	<0.25	<0.01	<0.01
Br	%		<0.01	<0.01
I	%		<0.01	<0.01
S	%	<1	0.07	0.05
Particle size > 50 mm	%	<100 mm	3.7	2.6
K ₂ O	%	<1	0.11	0.05
Na ₂ O	%	<0.5	0.13	0.05
Hg	mg/kg	<1.2	0.06	0.05
Cd	mg/kg	<20	<1	<1
Tl	mg/kg	<20	<1	<1
Total Group II Metals (Cd, Tl)	mg/kg	<30	<5	<5
Cu	mg/kg	<1000	43	55
Pb	mg/kg	<1000	37	26
Total Group III Metals (Sb, As, Co, Cu, Cr, Pb, Mn, Ni, V)	mg/kg	<3000	<1000	<1000
Total Polychlorinated biphenyls	mg/kg	<10	<0.5	<0.2
Pentachlorophenol	mg/kg	<10	<2	<2

Compliance Summary

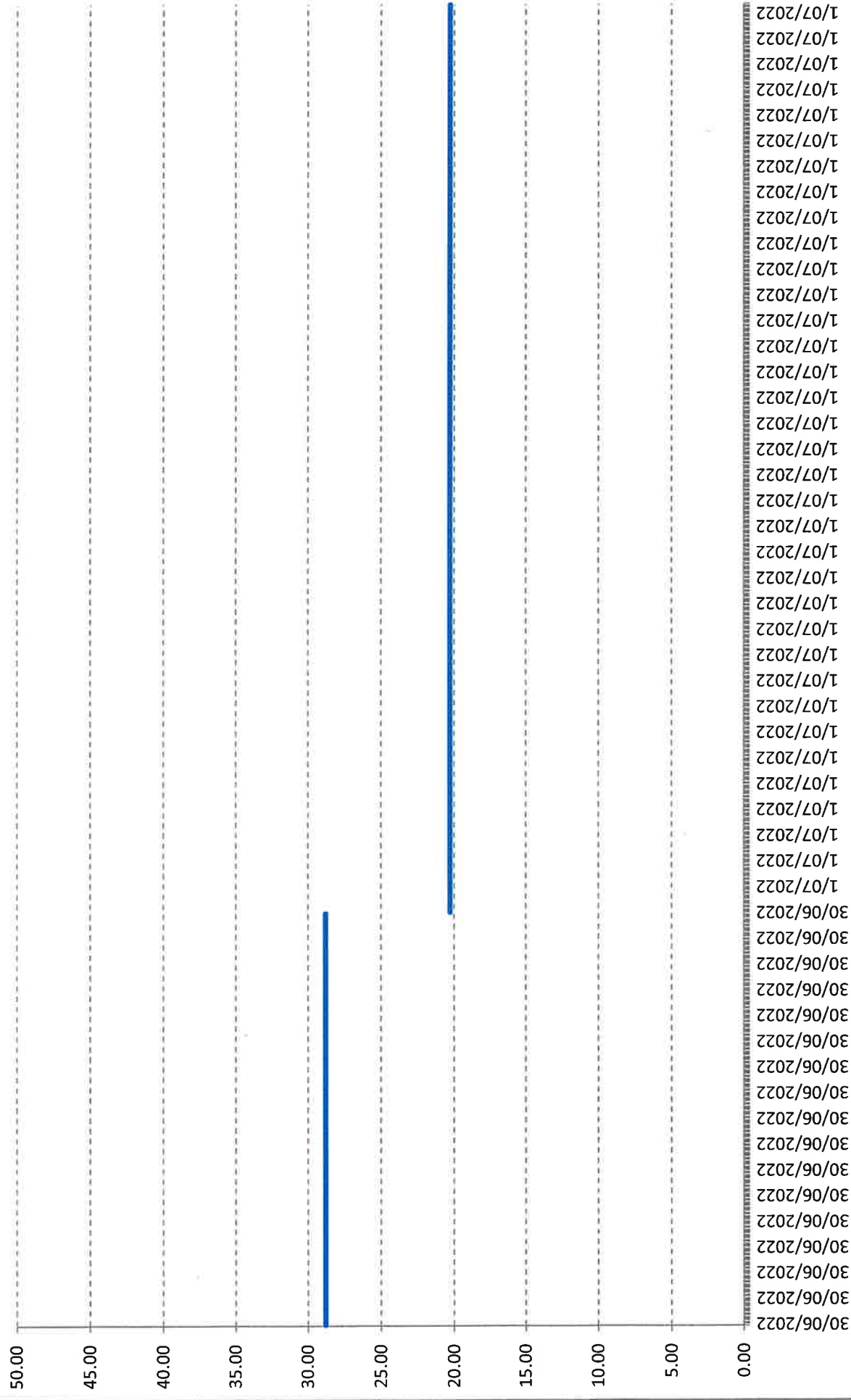
All real-time monitoring and stack testing during the trial period indicated compliance with EPL 1698.

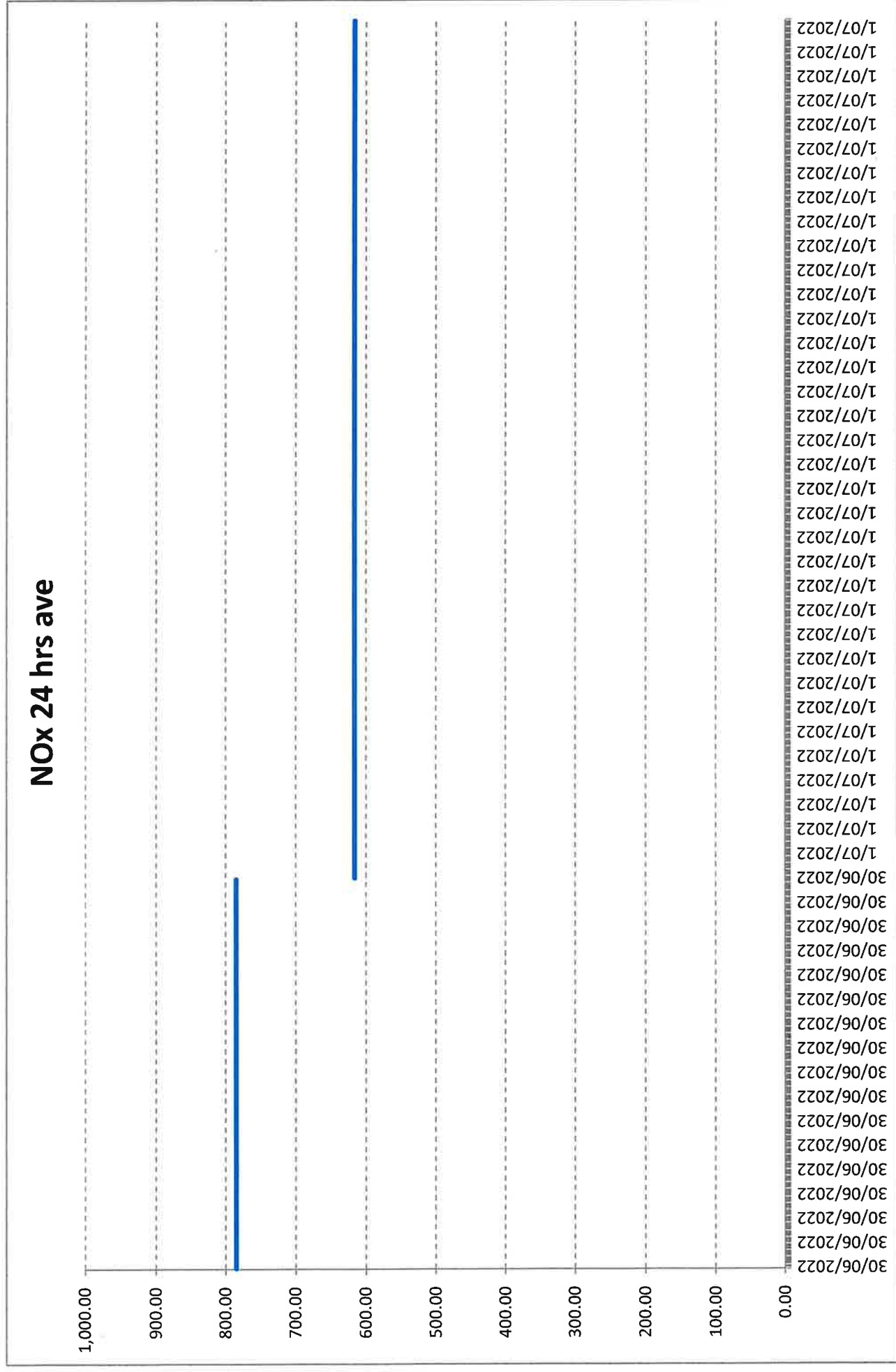
CEMS and process trends are reported in Attachment 1, with no exceedances recorded for CEMs or process data.

Attachments:

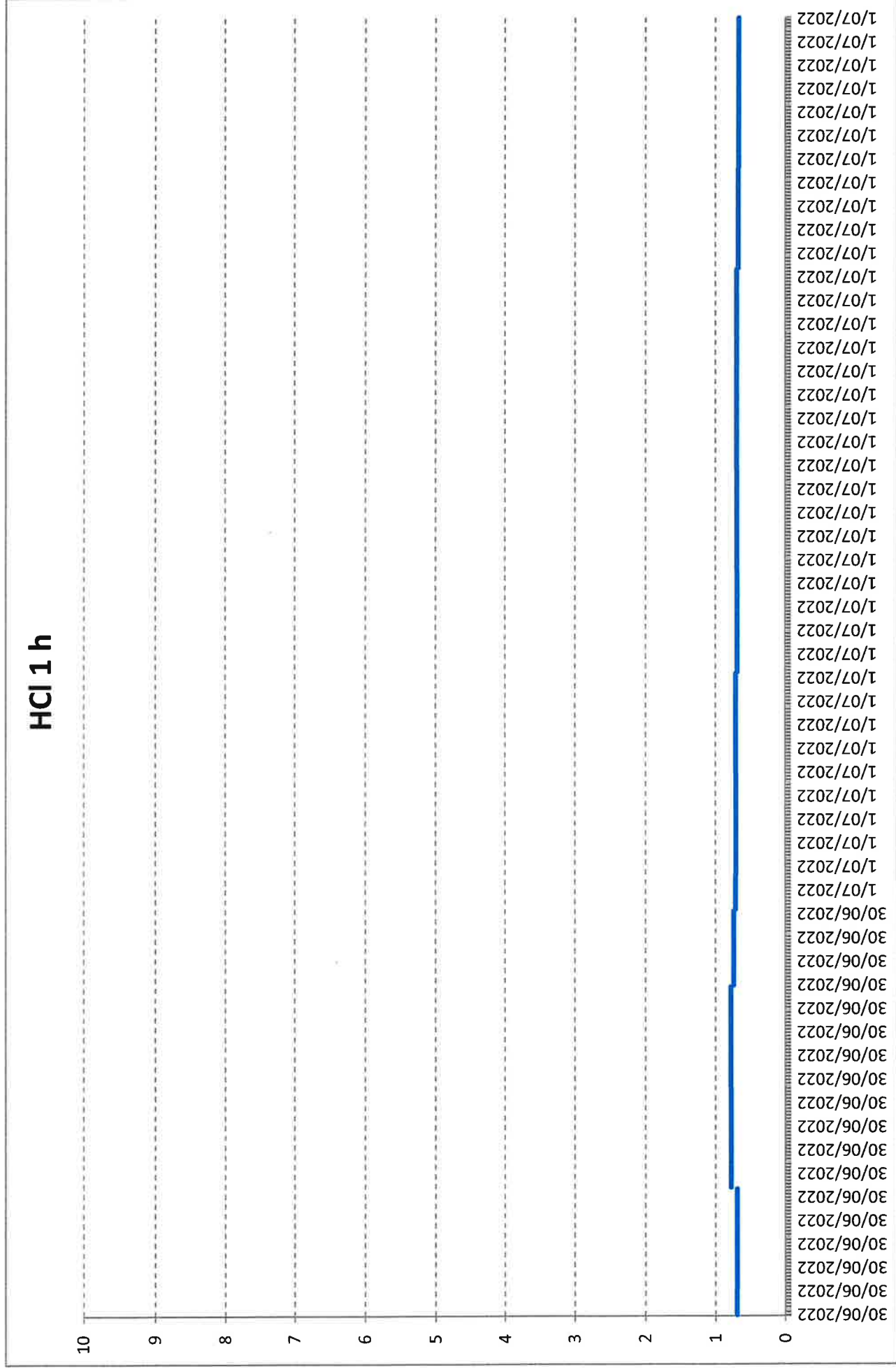
1. CEMs and Process data for 30 June-01 July 2022
2. Stack test Report
3. RDF & WW Lab results July 2022

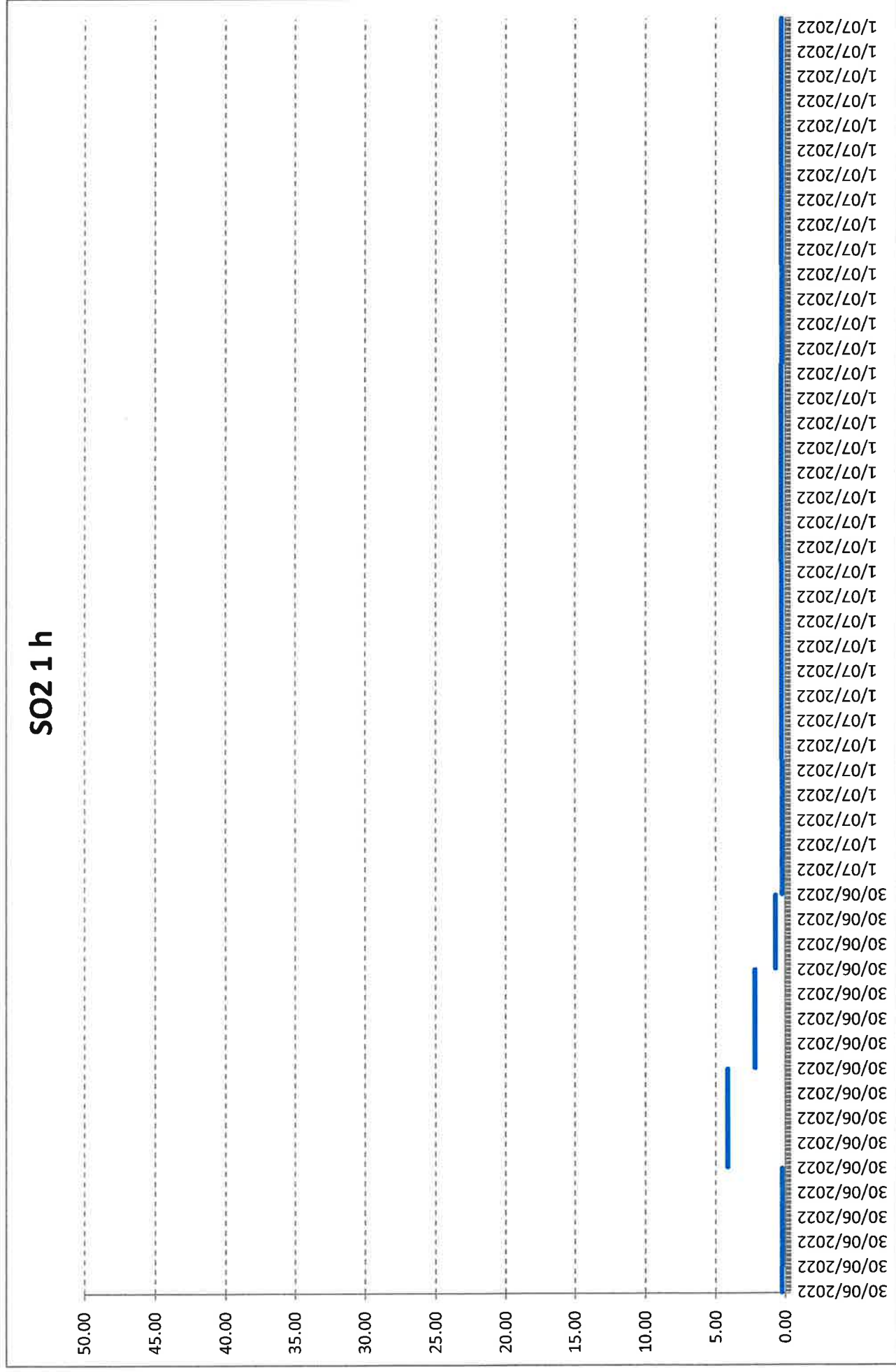
Dust 24 hrs ave

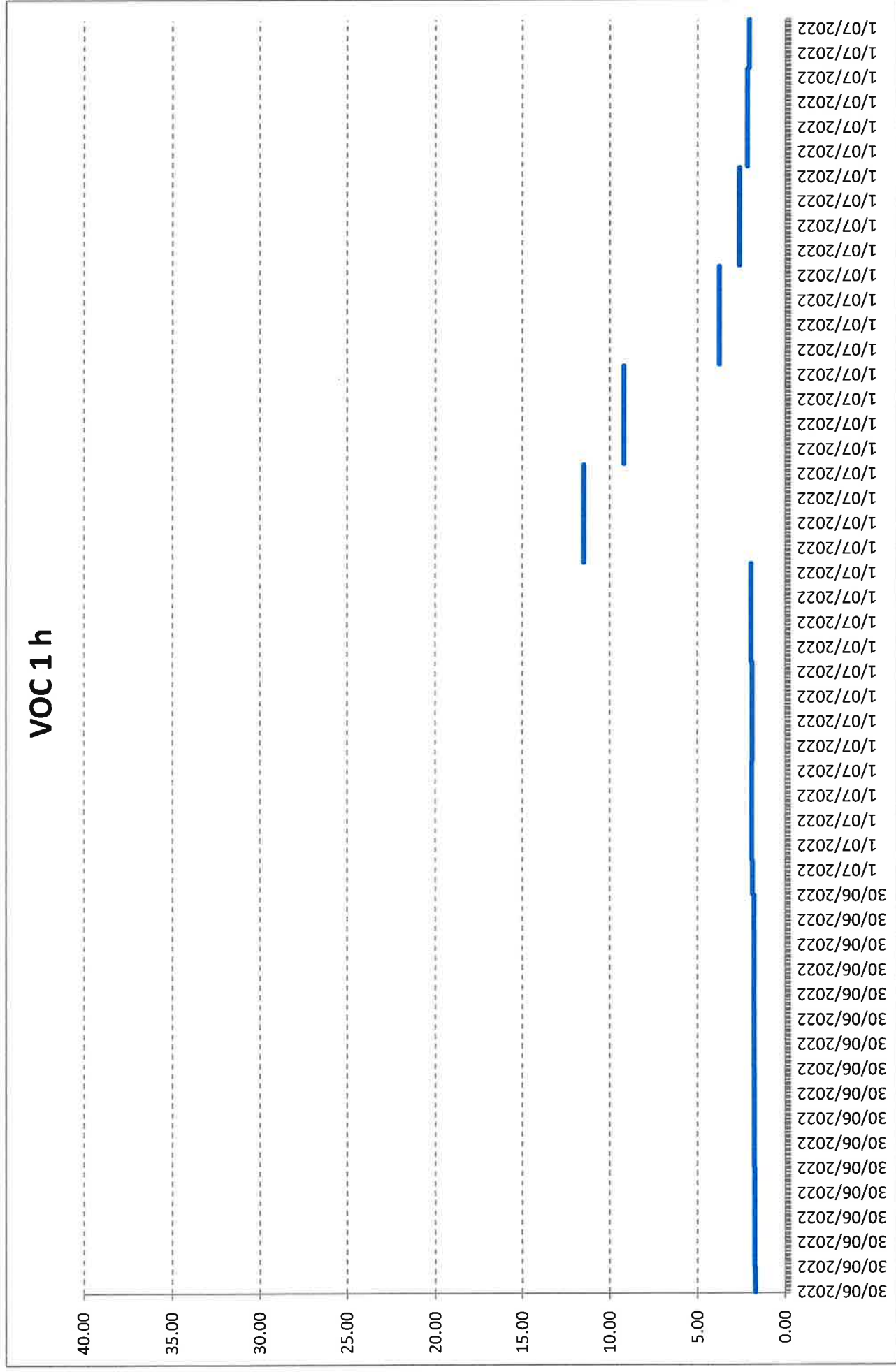


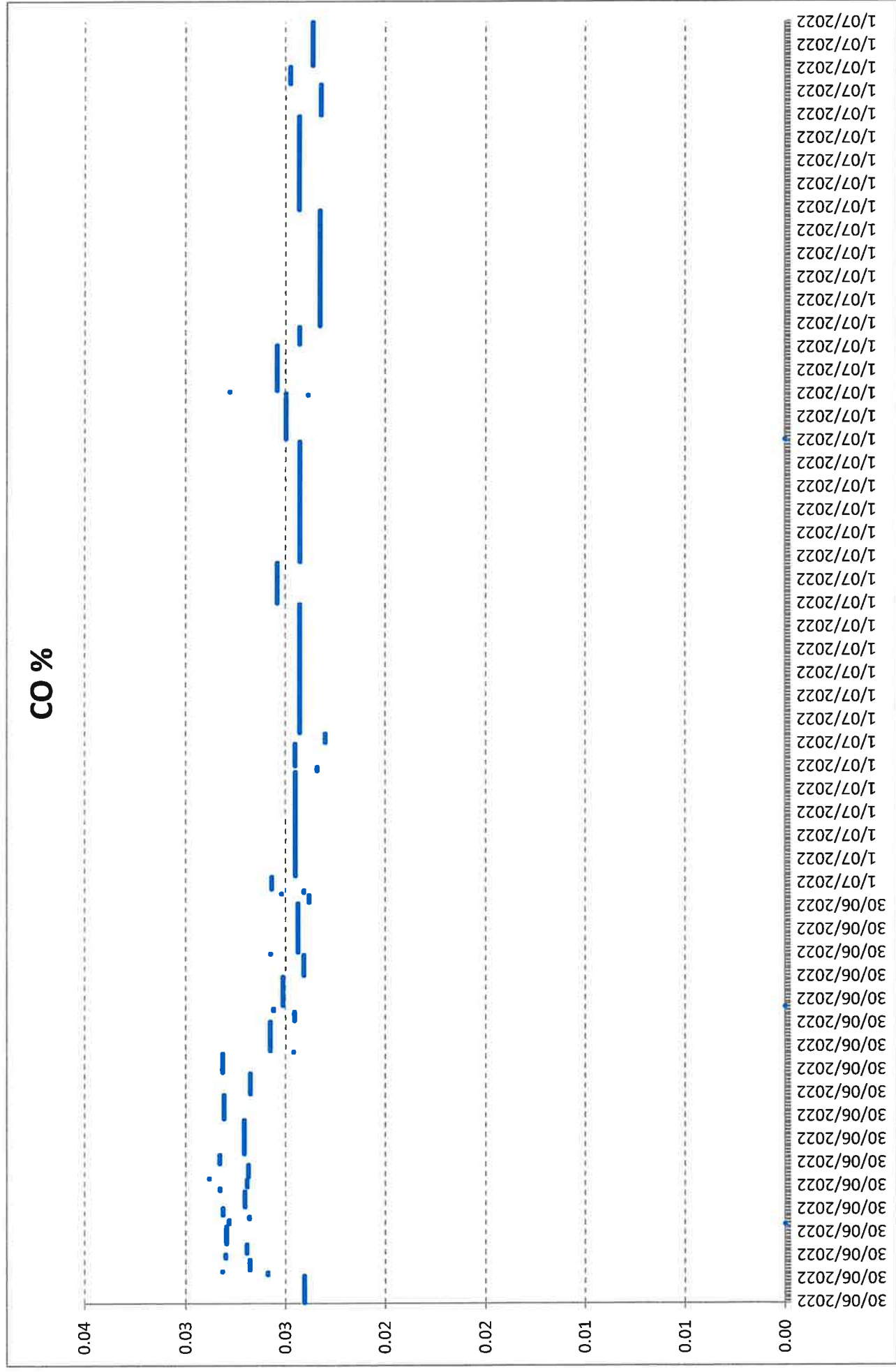




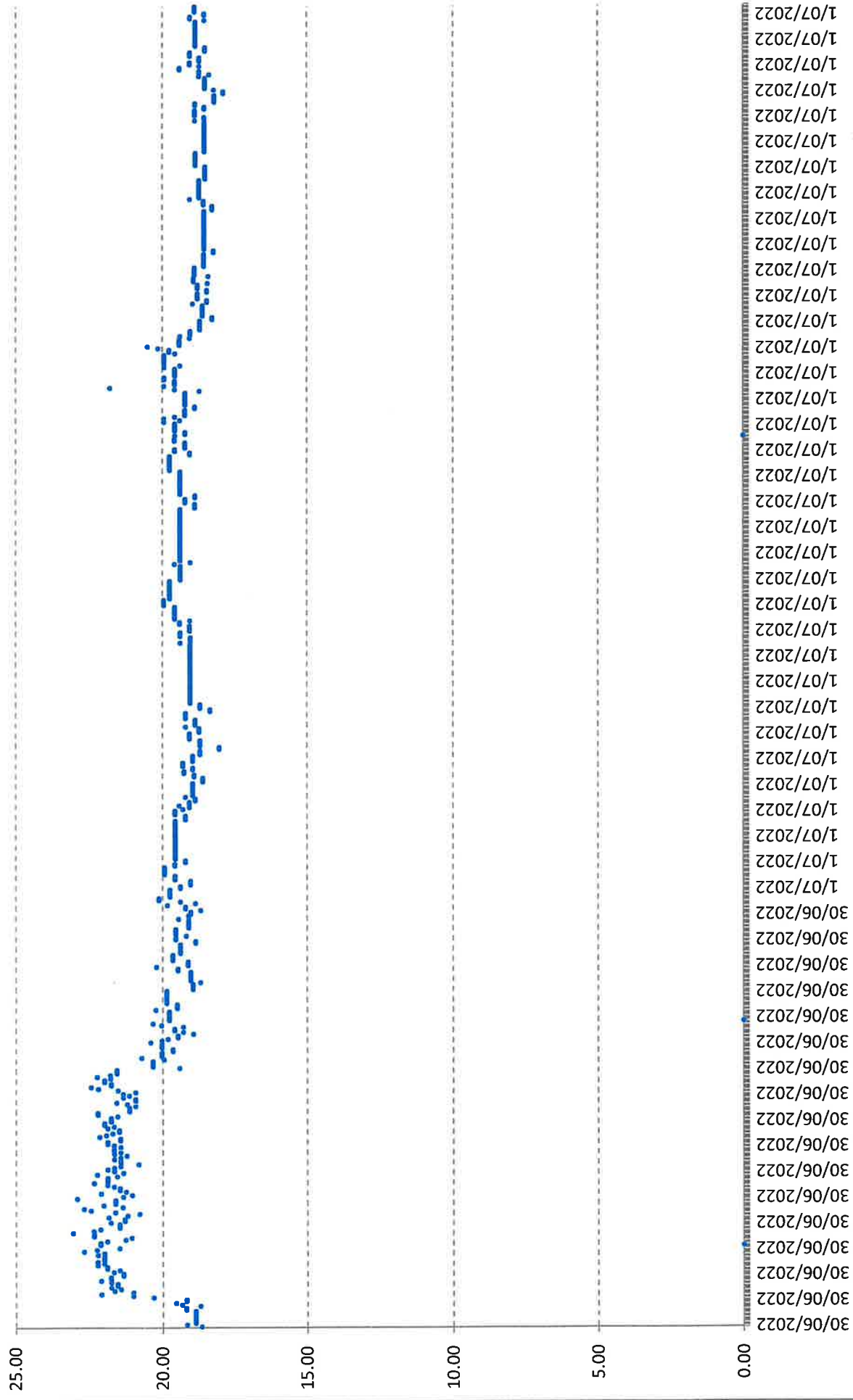




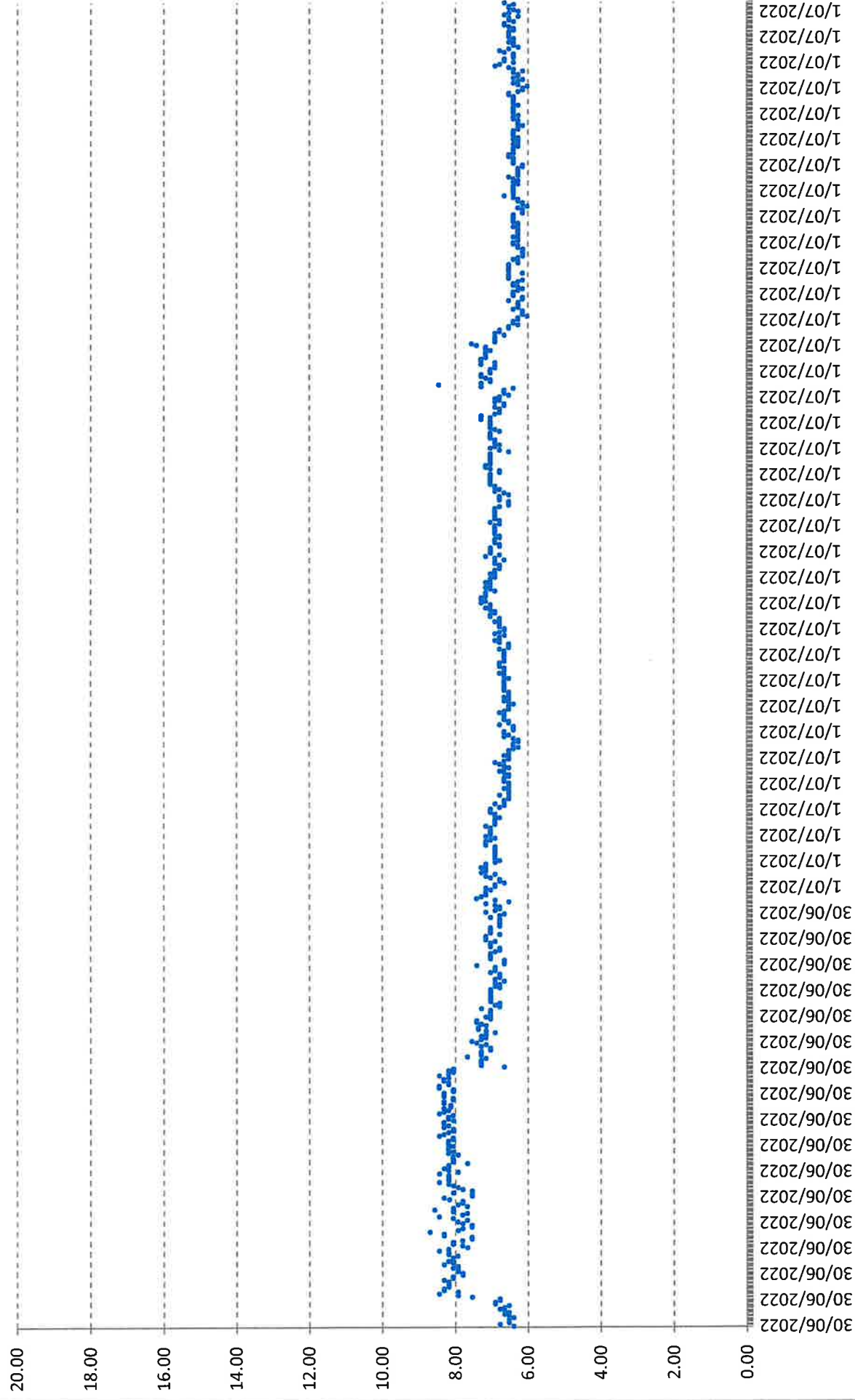




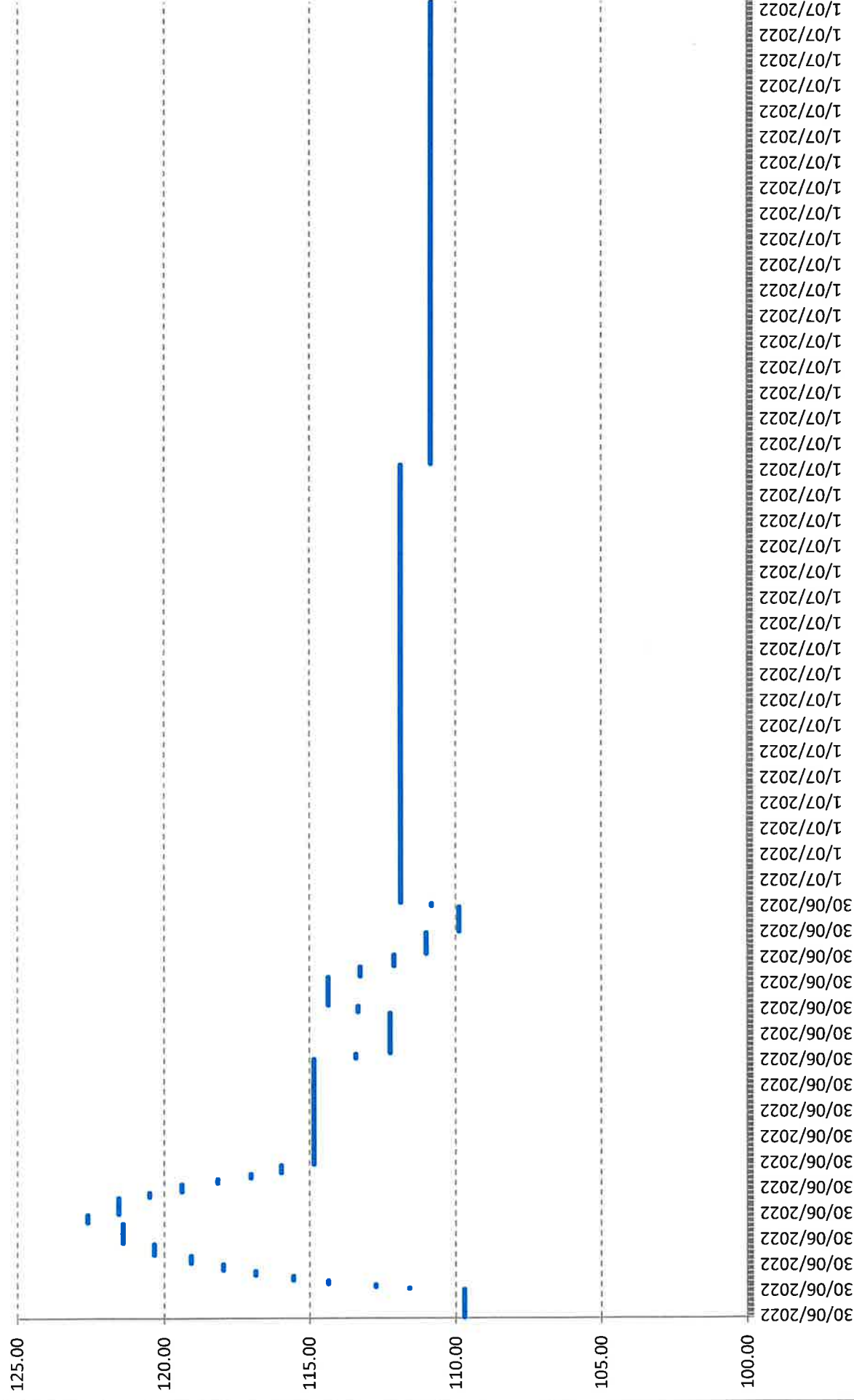
CO2



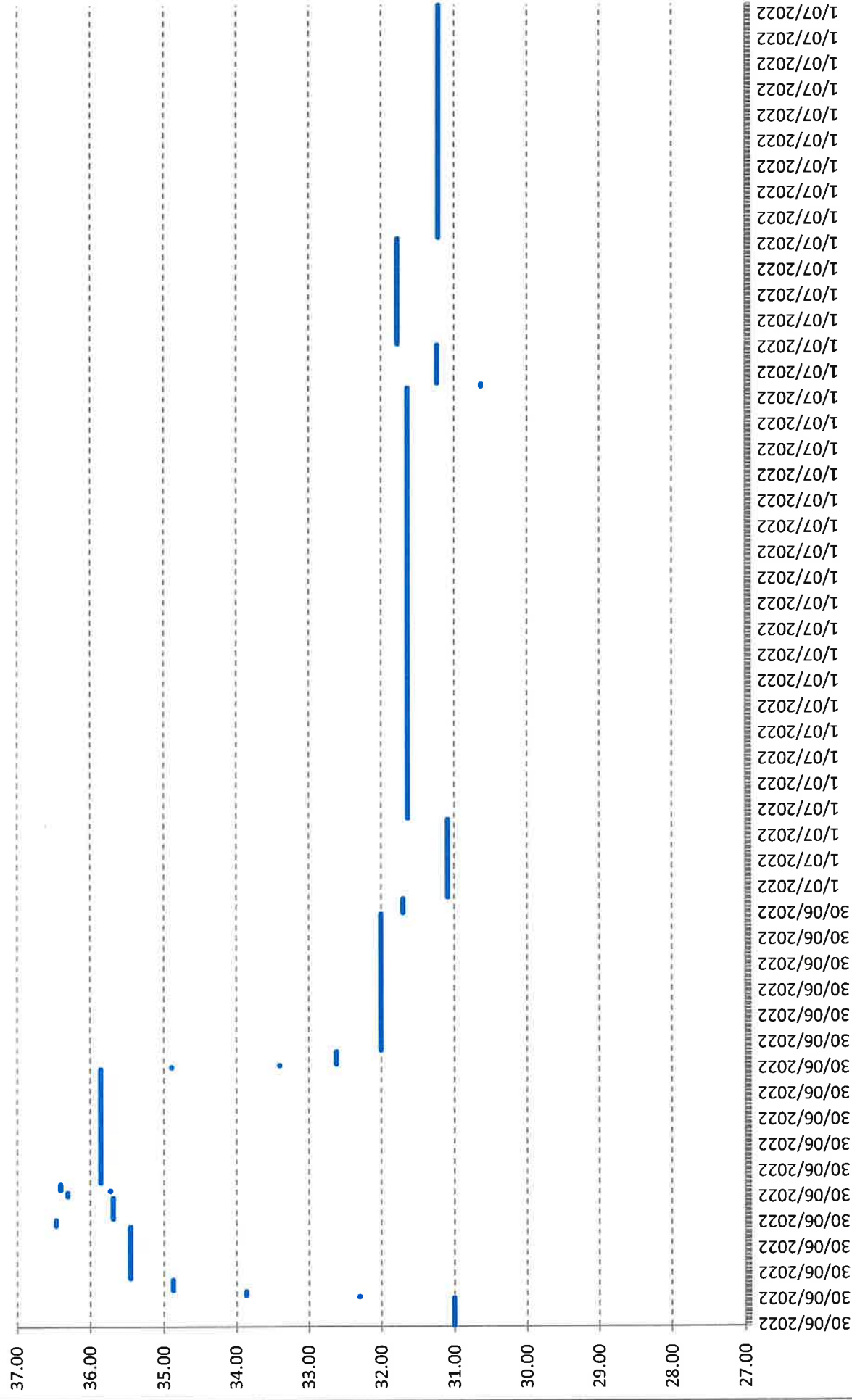
02



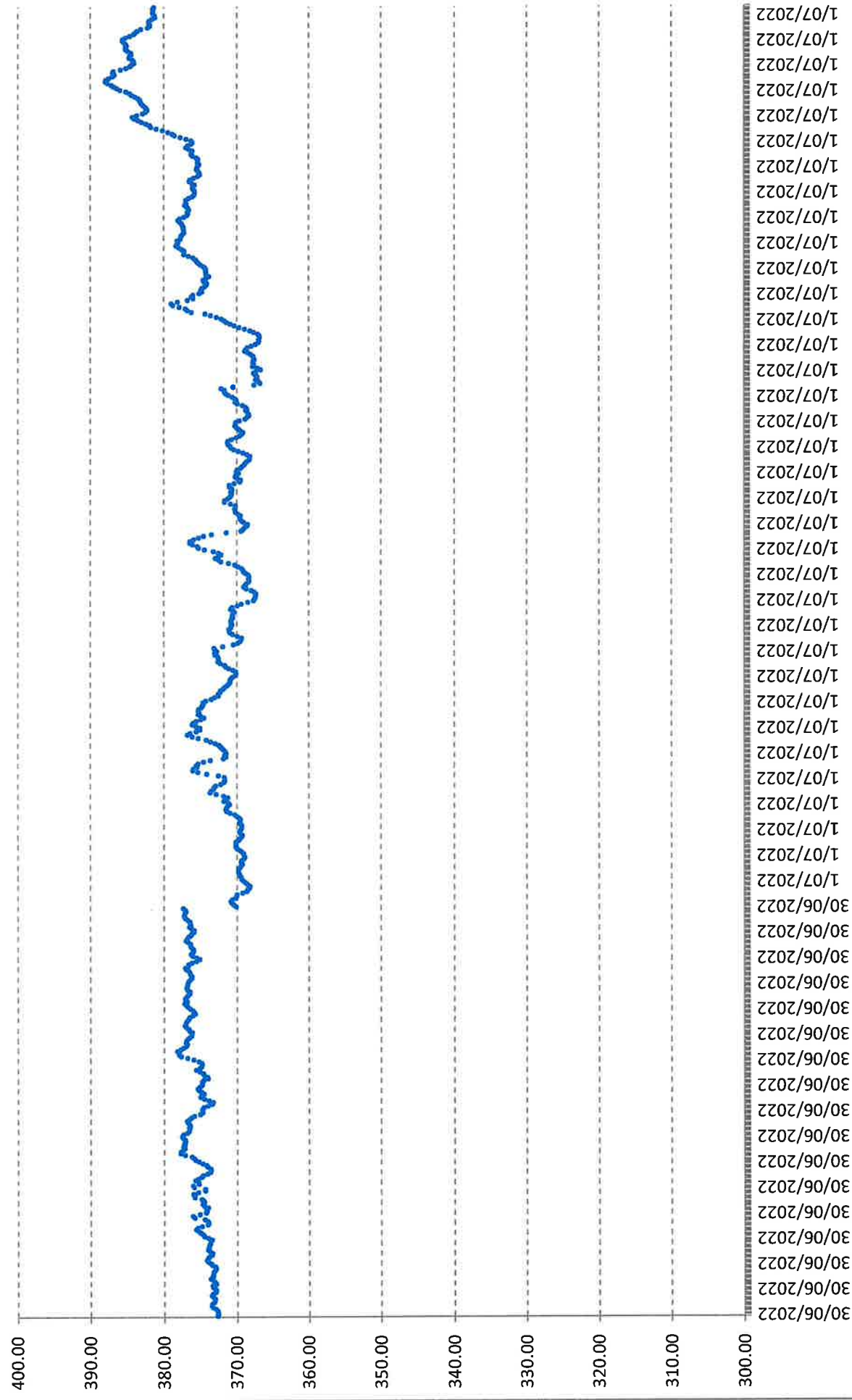
Stack Temp



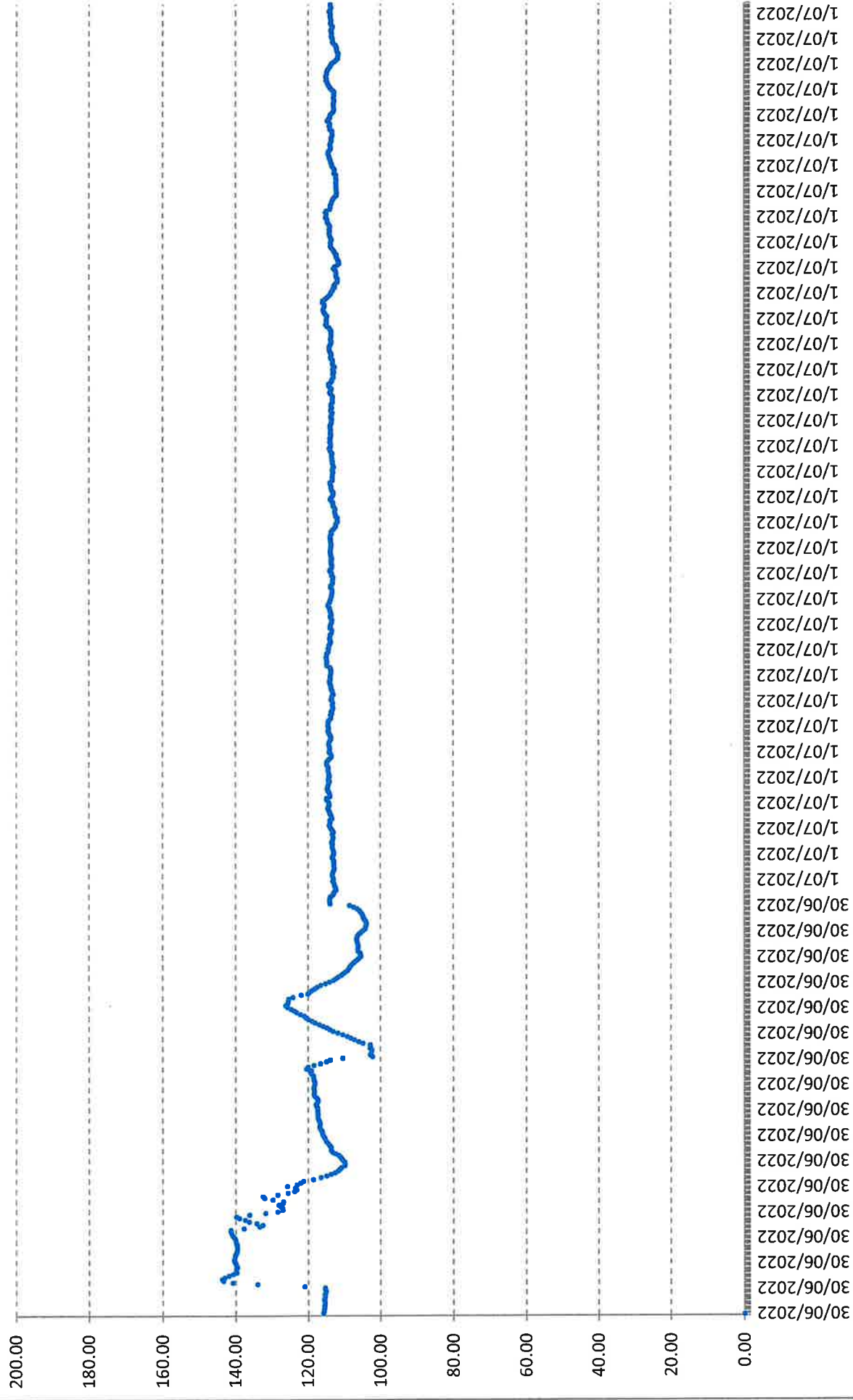
Velocity

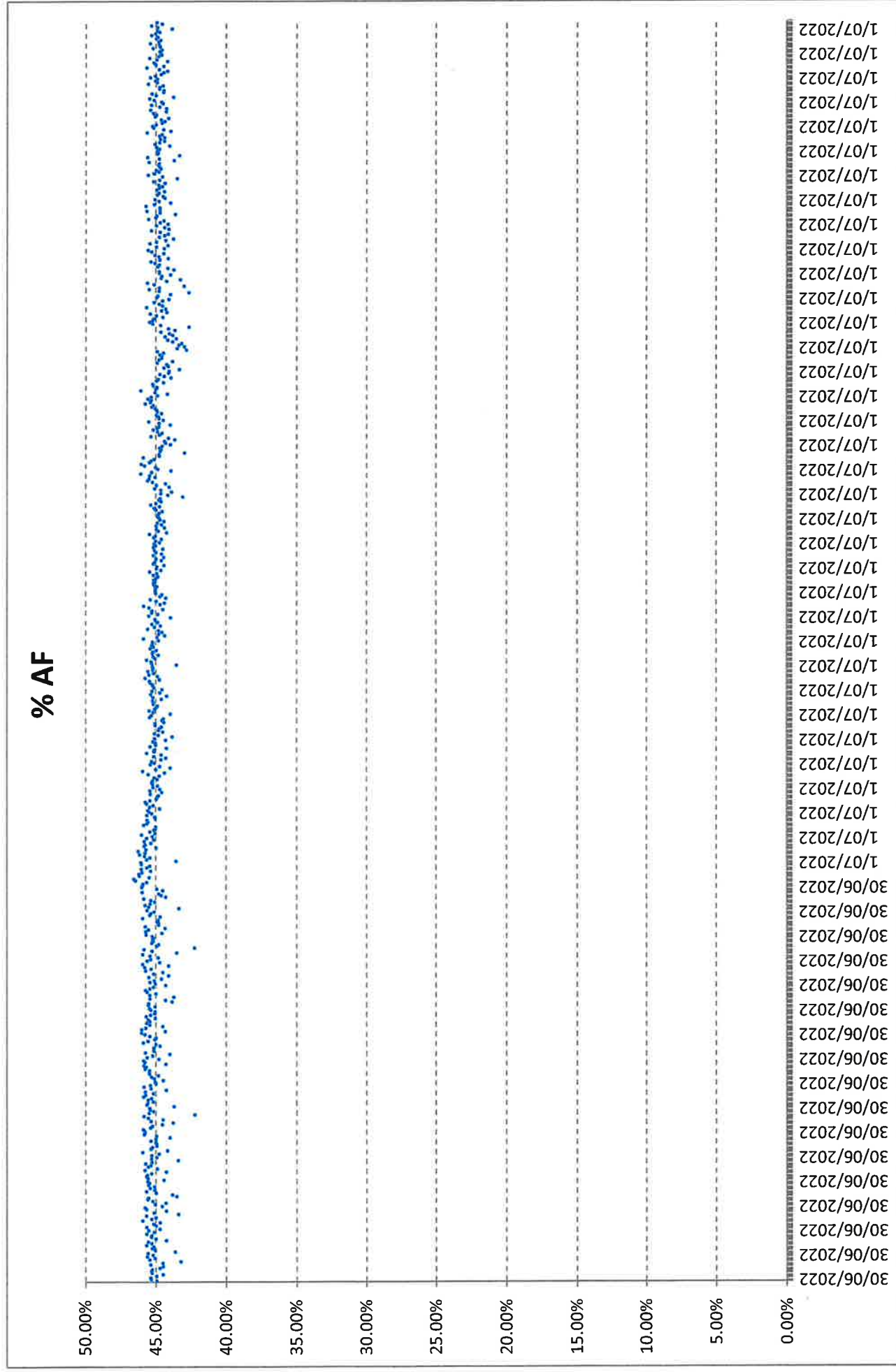


Preheater exit temp



Abatement Max Temp





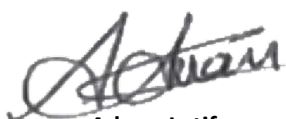
**Boral Cement Ltd, New Berrima
Kiln Emission Testing Report – Trial 5
Report Number R012893**

Document Information

Template Version 270622

Client Name: Boral Cement Ltd (Berrima)
Report Number: R012893
Date of Issue: 2 September 2022
Attention: Gabriel Paicu
Address: Taylor Avenue
New Berrima NSW 2577
Testing Laboratory: Ektimo Pty Ltd, ABN 86 600 381 413

Report Authorisation



Adnan Latif
Air Monitoring Consultant



NATA Accredited Laboratory
No. 14601



Aaron Davis
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 Boral Cement Ltd to perform emission monitoring at their Berrima plant.

1.2 Project Objective

The objective of the project was to conduct a monitoring programme to quantify emissions from one (1) discharge point to determine compliance with Boral Cement Ltd Environmental Licence, 1698.

Monitoring was performed as follows:

Location	Test Date	Test Parameters*
EPA 2 – No.6 Kiln Stack	30 June 2022	Speciated volatile organic compounds (VOCs) Dioxins and furans (PCDD & PCDF) Polycyclic aromatic hydrocarbons (PAHs) Nitrogen oxides, carbon monoxide, carbon dioxide, oxygen
	1 July 2022	Solid particles, fine particulates (PM ₁₀) by particle size analysis (PSA), fine particulates (PM _{2.5}) by particle size analysis (PSA), coarse particulates Sulfur dioxide, sulfur acid mist and sulfur trioxide (as SO ₃) Type 1 & 2 substances in aggregate (Sb, As, Cd, Pb, Hg, Be, Cr, Co, Mn, Ni, Se, Sn, V), copper, thallium, zinc Total fluoride, hydrogen chloride, chlorine Hexavalent chromium

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

All results are reported on a dry basis at STP

PM₁₀ and PM_{2.5} results determined as sample fractions from particle size analysis (PSA), are calculated based on the assumption that the density of the sample material is 1 g/cm³, i.e., no corrections have been made for sample density.

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 1698 (last amended on 18 December 2019).

EPA	Parameter	Units	Licence limit	Detected values	Detected values (corrected to 10% O ₂)
EPA 2 - Kiln Stack No. 6	Mercury	mg/m ³	0.05	0.0093	0.0086
	Type 1 and Type 2 substances in aggregate	mg/m ³	0.5	<0.03	<0.03
	Solid particles	mg/m ³	50	26	24
	Nitrogen oxides	mg/m ³	1250	670	690
	Cadmium + Thallium	mg/m ³	0.05	<0.001	<0.001
	Chlorine	mg/m ³	50	≤0.013	≤0.012
	Dioxins & furans (I-TEQ middle bound)	ng/m ³	0.1	0.0029	0.0031
	Hydrogen chloride	mg/m ³	10	0.18	0.17
	Hydrogen fluoride	mg/m ³	1	<0.02	<0.02
	Sulfur dioxide	mg/m ³	50	0.03	0.028
	Sulfuric acid mist and sulfur trioxide (as SO ₃)	mg/m ³	50	0.078	0.073
	Volatile organic compounds	mg/m ³	40	1.6	1.6

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 2 – No.6 Kiln Stack

Date	1/07/2022	Client	Boral Cement Ltd
Report	R012893	Stack ID	EPA 2: No.6 Kiln Stack
Licence No.	1698	Location	New Berrima
Ektimo Staff	Adnan Latif / Ahmad Ramiz	State	NSW
Process Conditions	Please refer to client records.		

220628

Sampling Plane Details	
Sampling plane dimensions	3000 mm
Sampling plane area	7.07 m ²
Sampling port size, number	3" BSP and 4" Flange
Access & height of ports	Elevator 30 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 8 D
Upstream disturbance	Junction 8 D
No. traverses & points sampled	2 24
Sample plane conformance to AS 4323.1	Ideal sampling plane

Stack Parameters		
Moisture content, %v/v	12	
Gas molecular weight, g/g mole	30.2 (wet)	31.8 (dry)
Gas density at STP, kg/m³	1.35 (wet)	1.42 (dry)
Gas density at discharge conditions, kg/m³	0.87	
% Oxygen correction & Factor	10 %	0.92
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1045 & 1258	
Temperature, °C	117	
Temperature, K	390	
Velocity at sampling plane, m/s	31	
Volumetric flow rate, actual, m³/s	220	
Volumetric flow rate (wet STP), m³/s	140	
Volumetric flow rate (dry STP), m³/s	120	
Mass flow rate (wet basis), kg/hour	680000	

Isokinetic Results	Sampling time	Average			Test 1 1050-1252			Test 2 1050-1251		
		Corrected to			Corrected to			Corrected to		
		Concentration mg/m ³	10% O2 mg/m ³	Mass Rate g/min	Concentration mg/m ³	10% O2 mg/m ³	Mass Rate g/min	Concentration mg/m ³	10% O2 mg/m ³	Mass Rate g/min
Antimony		<0.003	<0.002	<0.02	<0.003	<0.002	<0.02	<0.003	<0.002	<0.02
Arsenic		<0.001	<0.001	<0.009	<0.001	<0.001	<0.009	<0.001	<0.001	<0.009
Beryllium		<0.0003	<0.0003	<0.002	<0.0003	<0.0003	<0.003	<0.0003	<0.0003	<0.002
Cadmium		<0.0003	<0.0002	<0.002	<0.0003	<0.0003	<0.002	<0.0003	<0.0002	<0.002
Chromium		0.00061	0.00056	0.0045	0.00073	0.00067	0.0054	0.00049	0.00045	0.0036
Cobalt		<0.0004	<0.0004	<0.003	<0.0004	<0.0004	<0.003	<0.0004	<0.0004	<0.003
Copper		0.0019	0.0018	0.014	0.00089	0.00082	0.0066	0.003	0.0027	0.022
Lead		0.0013	0.0012	0.0095	0.00089	0.00082	0.0066	0.0017	0.0015	0.012
Manganese		0.012	0.011	0.088	0.0083	0.0077	0.062	0.015	0.014	0.11
Mercury		0.0093	0.0086	0.07	0.011	0.01	0.081	0.0078	0.0072	0.058
Nickel		0.0013	0.0012	0.0099	0.00096	0.00089	0.0072	0.0017	0.0016	0.013
Selenium		<0.003	<0.003	<0.02	<0.003	<0.003	<0.02	<0.003	<0.003	<0.02
Thallium		<0.001	<0.001	<0.009	<0.001	<0.001	<0.009	<0.001	<0.001	<0.009
Tin		<0.001	<0.001	<0.009	<0.001	<0.001	<0.009	<0.001	<0.001	<0.009
Vanadium		≤0.00083	≤0.00076	≤0.0062	<0.0007	<0.0006	<0.005	0.00097	0.0009	0.0073
Zinc		0.0032	0.0029	0.024	0.0024	0.0022	0.018	0.0039	0.0036	0.03
Type 1 & 2 Substances										
Upper Bound										
Total Type 1 Substances		<0.01	<0.01	<0.1	≤0.016	≤0.014	≤0.12	≤0.013	≤0.012	≤0.1
Total Type 2 Substances		<0.02	<0.02	<0.1	≤0.015	≤0.014	≤0.12	≤0.024	≤0.022	≤0.18
Total Type 1 & 2 Substances		<0.03	<0.03	<0.3	≤0.031	≤0.029	≤0.23	≤0.037	≤0.034	≤0.28
Isokinetic Sampling Parameters										
Sampling time, min					120			120		
Isokinetic rate, %					95			98		

Date	1/07/2022	Client	Boral Cement Ltd
Report	R012893	Stack ID	EPA 2: No.6 Kiln Stack
Licence No.	1698	Location	New Berrima
Ektimo Staff	Adnan Latif / Ahmad Ramiz	State	NSW
Process Conditions	Please refer to client records.		

220628

Sampling Plane Details	
Sampling plane dimensions	3000 mm
Sampling plane area	7.07 m ²
Sampling port size, number	3" BSP and 4" Flange
Access & height of ports	Elevator 30 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 8 D
Upstream disturbance	Junction 8 D
No. traverses & points sampled	2 24
Sample plane conformance to AS 4323.1	Ideal sampling plane

Stack Parameters		
Moisture content, %v/v	14	
Gas molecular weight, g/g mole	29.9 (wet)	31.8 (dry)
Gas density at STP, kg/m³	1.34 (wet)	1.42 (dry)
Gas density at discharge conditions, kg/m³	0.86	
% Oxygen correction & Factor	10 %	0.90
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1511 & 1728	
Temperature, °C	117	
Temperature, K	390	
Velocity at sampling plane, m/s	32	
Volumetric flow rate, actual, m³/s	230	
Volumetric flow rate (wet STP), m³/s	150	
Volumetric flow rate (dry STP), m³/s	130	
Mass flow rate (wet basis), kg/hour	700000	

Isokinetic Results	Sampling time	Average			Test 1 1520-1722			Test 2 1520-1721		
		Corrected to			Corrected to			Corrected to		
		Concentration mg/m ³	10% O ₂ mg/m ³	Mass Rate g/min	Concentration mg/m ³	10% O ₂ mg/m ³	Mass Rate g/min	Concentration mg/m ³	10% O ₂ mg/m ³	Mass Rate g/min
Hexavalent chromium		0.004	0.0036	0.03	0.004	0.0036	0.03	0.004	0.0036	0.03
Isokinetic Sampling Parameters										
Sampling time, min						120			120	
Isokinetic rate, %						100			101	

Date	1/07/2022	Client	Boral Cement Ltd
Report	R012893	Stack ID	EPA 2: No.6 Kiln Stack
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Ektimo Staff	Adnan Latif / Ahmad Ramiz	State	NSW
Process Conditions	Please refer to client records.		

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Sampling Plane Details	
Sampling plane dimensions	3000 mm
Sampling plane area	7.07 m ²
Sampling port size, number	3" BSP and 4" Flange
Access & height of ports	Elevator 30 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 8 D
Upstream disturbance	Junction 8 D
No. traverses & points sampled	2 24
Sample plane conformance to AS 4323.1	Ideal sampling plane

Stack Parameters		
Moisture content, %v/v	13	
Gas molecular weight, g/g mole	30.1 (wet)	31.8 (dry)
Gas density at STP, kg/m³	1.34 (wet)	1.42 (dry)
Gas density at discharge conditions, kg/m³	0.87	
% Oxygen correction & Factor	10 %	0.93
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0834 & 1045	
Temperature, °C	116	
Temperature, K	390	
Velocity at sampling plane, m/s	31	
Volumetric flow rate, actual, m³/s	220	
Volumetric flow rate (wet STP), m³/s	140	
Volumetric flow rate (dry STP), m³/s	130	
Mass flow rate (wet basis), kg/hour	690000	

Isokinetic Results	Sampling time	Average			Test 1 0840-1041			Test 2 0840-1041		
		Corrected to			Corrected to			Corrected to		
		Concentration mg/m³	10% O2 mg/m³	Mass Rate g/min	Concentration mg/m³	10% O2 mg/m³	Mass Rate g/min	Concentration mg/m³	10% O2 mg/m³	Mass Rate g/min
Solid Particles		26	24	200	28	26	210	24	23	180
Fine particulates (PM10)	(PSA)	17	15	120	18	17	140	15	14	110
Fine particulates (PM2.5)	(PSA)	7.4	6.9	55	8.3	7.8	63	6.4	6	48
Coarse Particulates		9.5	8.9	72	9.6	9	72	9.4	8.8	71
Sulfur dioxide		0.03	0.028	0.23	0.03	0.028	0.22	0.03	0.028	0.23
Sulfur trioxide and/or Sulfuric acid (as SO3)		0.078	0.073	0.59	0.078	0.073	0.59	0.078	0.073	0.58
Isokinetic Sampling Parameters										
Sampling time, min						120			120	
Isokinetic rate, %						101			103	
Gravimetric analysis date (total particulate)						07-08-2022			07-08-2022	

Date	1/07/2022	Client	Boral Cement Ltd
Report	R012893	Stack ID	EPA 2: No.6 Kiln Stack
Licence No.	1698	Location	New Berrima
Ektimo Staff	Adnan Latif / Ahmad Ramiz	State	NSW
Process Conditions	Please refer to client records.		

220628

Sampling Plane Details	
Sampling plane dimensions	3000 mm
Sampling plane area	7.07 m ²
Sampling port size, number	3" BSP and 4" Flange
Access & height of ports	Elevator 30 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 8 D
Upstream disturbance	Junction 8 D
No. traverses & points sampled	2 24
Sample plane conformance to AS 4323.1	Ideal sampling plane

Stack Parameters		
Moisture content, %v/v	13	
Gas molecular weight, g/g mole	29.9 (wet)	31.8 (dry)
Gas density at STP, kg/m³	1.34 (wet)	1.42 (dry)
Gas density at discharge conditions, kg/m³	0.86	
% Oxygen correction & Factor	10 %	0.93
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1258 & 1511	
Temperature, °C	116	
Temperature, K	390	
Velocity at sampling plane, m/s	31	
Volumetric flow rate, actual, m³/s	220	
Volumetric flow rate (wet STP), m³/s	140	
Volumetric flow rate (dry STP), m³/s	120	
Mass flow rate (wet basis), kg/hour	690000	

Isokinetic Results	Sampling time	Average			Test 1 1305-1506			Test 2 1305-1505		
		Corrected to			Corrected to			Corrected to		
		Concentration mg/m ³	10% O ₂ mg/m ³	Mass Rate g/min	Concentration mg/m ³	10% O ₂ mg/m ³	Mass Rate g/min	Concentration mg/m ³	10% O ₂ mg/m ³	Mass Rate g/min
Chloride (as HCl)		0.18	0.17	1.4	0.15	0.14	1.1	0.21	0.2	1.6
Chlorine		≤0.013	≤0.012	≤0.098	<0.01	<0.009	<0.07	0.017	0.016	0.12
Total fluoride (as HF)		<0.02	<0.02	<0.2	<0.02	<0.02	<0.2	<0.02	<0.02	<0.2
Isokinetic Sampling Parameters										
Sampling time, min					120			120		
Isokinetic rate, %					100			101		

Date	30/06/2022	Client	Boral Cement Ltd
Report	R012893	Stack ID	EPA 2: No.6 Kiln Stack
Licence No.	1698	Location	New Berrima
Ektimo Staff	Aaron Davis / Ahmad Ramiz	State	NSW
Process Conditions	Please refer to client records.		

220620

Sampling Plane Details	
Sampling plane dimensions	3000 mm
Sampling plane area	7.07 m ²
Sampling port size, number	3" BSP and 4" Flange
Access & height of ports	Elevator 30 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 8 D
Upstream disturbance	Junction 8 D
No. traverses & points sampled	2 24
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane

Stack Parameters		
Moisture content, %v/v	12	
Gas molecular weight, g/g mole	29.8 (wet)	31.4 (dry)
Gas density at STP, kg/m³	1.33 (wet)	1.40 (dry)
Gas density at discharge conditions, kg/m³	0.85	
% Oxygen correction & Factor	10 %	1.04
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0950 & 1350	
Temperature, °C	122	
Temperature, K	395	
Velocity at sampling plane, m/s	36	
Volumetric flow rate, actual, m³/s	260	
Volumetric flow rate (wet STP), m³/s	160	
Volumetric flow rate (dry STP), m³/s	140	
Mass flow rate (wet basis), kg/hour	780000	

Gas Analyser Results	Average			Minimum			Maximum		
	1041 - 1345			1041 - 1345			1041 - 1345		
Sampling time	Corrected to			Corrected to			Corrected to		
	Concentration	10% O ₂	Mass Rate	Concentration	10% O ₂	Mass Rate	Concentration	10% O ₂	Mass Rate
	mg/m ³	mg/m ³	g/min	mg/m ³	mg/m ³	g/min	mg/m ³	mg/m ³	g/min
Combustion Gases									
Nitrogen oxides (as NO ₂)	670	690	5700	480	500	4200	800	830	6900
Carbon monoxide	330	340	2800	250	260	2200	980	1000	8400
	Concentration			Concentration			Concentration		
	% v/v			% v/v			% v/v		
Carbon dioxide	18.1			16.4			19.7		
Oxygen	10.4			9.4			11.4		

Date	30/06/2022	Client	Boral Cement Ltd
Report	R012893	Stack ID	EPA 2: No.6 Kiln Stack
Licence No.	1698	Location	New Berrima
Ektimo Staff	Aaron Davis / Ahmad Ramiz	State	NSW
Process Conditions	Please refer to client records.		

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Dioxins & Furans (PCDDs & PCDFs)	Sampling time	Average			Test 1 0945 - 1345			Test 2 0945 - 1345		
		Corrected to			Corrected to			Corrected to		
		Concentration ng/m ³	10% O ₂ ng/m ³	Mass Rate ng/min	Concentration ng/m ³	10% O ₂ ng/m ³	Mass Rate ng/min	Concentration ng/m ³	10% O ₂ ng/m ³	Mass Rate ng/min
2,3,7,8-TCDF		0.00059	0.00061	5.1	0.00059	0.00062	5.1	0.00059	0.00061	5.1
2,3,7,8-TCDD		<0.0009	<0.0009	<8	<0.0008	<0.0009	<7	<0.0009	<0.0009	<8
1,2,3,7,8-PeCDF		0.0001	0.00011	0.87	0.00012	0.00012	1	0.000084	0.000087	0.72
2,3,4,7,8-PeCDF		0.0012	0.0012	10	0.0014	0.0014	12	0.00095	0.00099	8.2
1,2,3,7,8-PeCDD		<0.0002	<0.0002	<2	<0.0002	<0.0002	<2	<0.0002	<0.0002	<2
1,2,3,4,7,8-HxCDF		0.00016	0.00016	1.3	0.0002	0.00021	1.7	0.00011	0.00011	0.94
1,2,3,6,7,8-HxCDF		0.00011	0.00011	0.93	0.00014	0.00015	1.2	0.000077	0.00008	0.66
2,3,4,6,7,8-HxCDF		<0.00006	<0.00007	<0.6	<0.00008	<0.00009	<0.7	<0.00005	<0.00005	<0.4
1,2,3,7,8,9-HxCDF		<0.00003	<0.00003	<0.3	<0.00003	<0.00004	<0.3	<0.00003	<0.00003	<0.3
1,2,3,4,7,8-HxCDD		<0.00004	<0.00004	<0.3	<0.00003	<0.00004	<0.3	<0.00005	<0.00005	<0.4
1,2,3,6,7,8-HxCDD		≤0.000052	≤0.000054	≤0.45	0.000059	0.000062	0.51	<0.00005	<0.00005	<0.4
1,2,3,7,8,9-HxCDD		<0.00004	<0.00004	<0.3	<0.00003	<0.00004	<0.3	<0.00005	<0.00005	<0.4
1,2,3,4,6,7,8-HpCDF		0.000013	0.000014	0.12	0.000017	0.000018	0.15	0.0000095	0.0000099	0.082
1,2,3,4,7,8,9-HpCDF		<0.000004	<0.000004	<0.03	<0.000004	<0.000004	<0.03	<0.000004	<0.000004	<0.04
1,2,3,4,6,7,8-HpCDD		0.000028	0.000029	0.24	0.000041	0.000043	0.35	0.000014	0.000015	0.12
OCDF		≤0.00000094	≤0.00000098	≤0.0081	0.00000097	0.000001	0.0084	<0.0000009	<0.0000009	<0.008
OCDD		0.0001	0.00011	0.88	0.00017	0.00018	1.5	0.000035	0.000037	0.3
Total TCDF isomers		0.2	0.21	1800	0.19	0.2	1600	0.22	0.23	1900
Total TCDD isomers		0.0076	0.0079	65	0.0093	0.0097	80	0.0059	0.0061	51
Total PeCDF isomers		0.028	0.029	240	0.03	0.031	260	0.026	0.027	230
Total PeCDD isomers		≤0.0041	≤0.0043	≤35	0.0055	0.0057	47	<0.003	<0.003	<20
Total HxCDF isomers		0.0076	0.0079	65	0.0097	0.01	84	0.0054	0.0056	47
Total HxCDD isomers		0.0044	0.0046	38	0.0072	0.0075	62	0.0016	0.0017	14
Total HpCDF isomers		0.0014	0.0015	12	0.0019	0.002	16	0.00095	0.00099	8.2
Total HpCDD isomers		0.007	0.0073	60	0.01	0.011	87	0.0038	0.004	33
Total PCDDs + PCDFs		0.37	0.38	3100	0.43	0.45	3700	0.3	0.31	2600
I-TEQ										
Lower Bound		0.0023	0.0024	20	0.0027	0.0028	23	0.0019	0.0019	16
Middle Bound		0.0029	0.0031	25	0.0033	0.0035	29	0.0025	0.0026	22
Upper Bound		0.0036	0.0037	31	0.004	0.0041	34	0.0032	0.0033	28

Abbreviations and definitions

I-TEQ	International toxic equivalents for dioxins and furans
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 factor.

Isokinetic Sampling Parameters	Test 1	Test 2
PAHs, Dioxins & Furans		
Sampling time, min	240	240
Isokinetic rate, %	108	107

Date	30/06/2022	Client	Boral Cement Ltd
Report	R012893	Stack ID	EPA 2: No.6 KiIn Stack
Licence No.	1698	Location	New Berrima
Ektimo Staff	Aaron Davis / Ahmad Ramiz	State	NSW
Process Conditions	Please refer to client records.		

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Polycyclic Aromatic Hydrocarbons (PAHs)	Sampling time	Average			Test 1 0945 - 1345			Test 2 0945 - 1345		
		Corrected to			Corrected to			Corrected to		
		Concentration ng/m ³	10% O ₂ ng/m ³	Mass Rate ng/min	Concentration ng/m ³	10% O ₂ ng/m ³	Mass Rate ng/min	Concentration ng/m ³	10% O ₂ ng/m ³	Mass Rate ng/min
Naphthalene		120000	120000	1000000000	97000	100000	840000000	140000	140000	1200000000
2-Methylnaphthalene		40000	42000	350000000	36000	37000	310000000	45000	47000	390000000
Acenaphthylene		3200	3400	28000000	3100	3200	27000000	3400	3500	29000000
Acenaphthene		200	210	1700000	260	270	2200000	140	150	1200000
Fluorene		260	270	2200000	310	330	2700000	200	210	1700000
Phenanthrene		3400	3500	29000000	3600	3700	31000000	3300	3400	28000000
Anthracene		63	66	540000	68	71	580000	59	61	510000
Fluoranthene		190	190	1600000	240	250	2100000	130	140	1100000
Pyrene		120	120	1000000	130	130	1100000	110	110	940000
Benz(a)anthracene		26	27	220000	35	36	300000	17	17	140000
Chrysene		86	90	740000	140	140	1200000	37	38	320000
Benzo(b)fluoranthene		<9	<9	<80000	<8	<9	<70000	<9	<9	<80000
Benzo(k)fluoranthene		<9	<9	<80000	<8	<9	<70000	<9	<9	<80000
Benzo(e)pyrene		≤38	≤40	≤330000	68	71	580000	<9	<9	<80000
Benzo(a)pyrene		≤30	≤31	≤260000	51	53	440000	<9	<9	<80000
Perylene		<9	<9	<80000	<8	<9	<70000	<9	<9	<80000
Indeno(1,2,3-cd)pyrene		<9	<9	<80000	<8	<9	<70000	<9	<9	<80000
Dibenz(a,h)anthracene		<9	<9	<80000	<8	<9	<70000	<9	<9	<80000
Benzo(ghi)perylene		<9	<9	<80000	<8	<9	<70000	<9	<9	<80000
Total 16 PAHs		150000	150000	1300000000	110000	110000	900000000	190000	200000	1600000000
Total 19 PAHs		160000	170000	1400000000	140000	150000	1200000000	190000	200000	1600000000
BaP-TEQ										
Lower Bound		29	30	250000	56	58	480000	2	2.1	18000
Middle Bound		34	36	290000	59	61	500000	9.7	10	84000
Upper Bound		39	41	340000	62	64	530000	17	18	150000

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 factor.

Isokinetic Sampling Parameters	Test 1	Test 2
PAHs, Dioxins & Furans		
Sampling time, min	240	240
Isokinetic rate, %	108	107

Total VOCs (as n-Propane)	Average			Test 1			Test 2		
	Corrected to			Corrected to			Corrected to		
	Concentration mg/m ³	10% O ₂ mg/m ³	Mass Rate g/min	Concentration mg/m ³	10% O ₂ mg/m ³	Mass Rate g/min	Concentration mg/m ³	10% O ₂ mg/m ³	Mass Rate g/min
Total	1.6	1.6	14	1.4	1.5	12	1.7	1.8	15

VOC (speciated)	Average			Test 1 1330-1430			Test 2 1330-1430		
Sampling time	Corrected to			Corrected to			Corrected to		
	Concentration mg/m ³	10% O ₂ mg/m ³	Mass Rate g/min	Concentration mg/m ³	10% O ₂ mg/m ³	Mass Rate g/min	Concentration mg/m ³	10% O ₂ mg/m ³	Mass Rate g/min
Detection limit ⁽¹⁾	<0.06	<0.06	<0.5	<0.06	<0.06	<0.5	<0.06	<0.06	<0.5
Benzene	1.8	1.9	16	1.6	1.7	14	2	2.1	18
Toluene	0.65	0.68	5.6	0.63	0.66	5.4	0.68	0.71	5.8
m + p-Xylene	0.065	0.068	0.56	0.063	0.066	0.54	0.068	0.071	0.58
Heptane	≤0.099	≤0.1	≤0.85	<0.06	<0.06	<0.5	0.14	0.15	1.2
Methylcyclohexane	0.088	0.092	0.76	0.08	0.083	0.69	0.096	0.1	0.83
Octane	0.16	0.17	1.4	0.17	0.18	1.5	0.16	0.16	1.4
Nonane	0.12	0.12	1	0.12	0.13	1	0.12	0.12	1
Decane	0.082	0.086	0.71	0.08	0.083	0.69	0.085	0.088	0.73

(1) Unless otherwise reported, the following target compounds were found to be below detection:

Dichloromethane, Ethanol, Isopropanol, 1,1-Dichloroethene, trans-1,2-Dichloroethene, Chloroform, 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, Ethylbenzene, 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, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 3-Methylhexane, Ethyl acrylate, Methyl methacrylate, Propyl acetate, Methyl isobutyl Ketone, 2-Hexanone, Butyl acetate, 1-Methoxy-2-propyl acetate, Butyl acrylate, Cellosolve acetate, alpha-Pinene, beta-Pinene, 3-Carene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane

3 Plant Operating Conditions

See Boral Cement Ltd (Berrima) records for complete process conditions.

4 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.

5 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%	✓	✓
Sulfur dioxide	NSW EPA TM-4 (USEPA Method 8)	Ektimo 235	16%	✓	✓ [†]
Speciated volatile organic compounds (VOCs)	NSW EPA TM-34 ^d (USEPA Method 18)	Ektimo 344	19%	✓	✓ [†]
Coarse particulates	NSW EPA OM-9	NSW EPA OM-9	not specified	✓	✓ ⁺⁺
Particulate matter (PM ₁₀ and PM _{2.5}) by particle size analysis	AS 4323.2	HRL in-house method using Malvern Mastersizer 2000	not specified	✗	✗ ^{**}
Solid particles (total)	NSW EPA TM-15 (AS 4323.2)	NSW EPA TM-15 (AS 4323.2)	3%	✓	✓ ⁺⁺
Total (gaseous and particulate) metals and 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%	✓	✓ [‡]
Total and hexavalent chromium	NSW EPA OM-4 (CARB 425)	EnviroLab in-house method Metals-006 & Inorg-024	16%	✓	✓ [‡]
Dioxins and furans (PCDDs and PCDFs)	NSW EPA TM-18 (USEPA Method 23)	NMI in-house method AUTL_MET_02	16%	✓	✓ [¶]
Fluorine & fluorine compounds	NSW EPA TM-9 (USEPA Method 13B)	ALS in-house method EA144C & Ektimo 240	25%	✓	✓ ^{#,†}
Hydrogen chloride	NSW EPA TM-8 (USEPA Method 26A)	Ektimo 235	14%	✓	✓ [†]
Chlorine	NSW EPA TM-7 (USEPA Method 26A)	Ektimo 235	14%	✓	✓ [†]
Polycyclic aromatic hydrocarbons (PAHs)	NSW EPA OM-6	NMI in-house method NGCMS 11.27	21%	✓	✓ [¶]
Sulfuric acid mist and/or sulfur trioxide	NSW EPA TM-3 (USEPA Method 8)	Ektimo 235	16%	✓	✓ [†]

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Please see the next page for details of the Laboratory results

- * 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.
14 July 2022 in report R012893-ISE F.
15 July 2022 in report LV-003126.
15 July 2022 in report LV-003072.
20 July 2022 in report LV-003147.
- †† Gravimetric analysis conducted at the Ektimo Unanderra, NSW laboratory, NATA accreditation number 14601.
- ‡ Analysis performed by Envirolab, NATA accreditation number 2901. Results was reported to Ektimo on 15 July 2022 in report 299985.
- ‡‡ Specified metals are not listed in USEPA Method 29 and are therefore not covered by NATA accreditation for sampling.
- ¶ Analysis performed by Australian Government National Measurement Institute, NATA accreditation number 198. Results were reported to Ektimo on.
15 August 2022 in report ORG22_062.
18 August 2022 in report DAU22_192.
- ** Analysis performed by HRL Technology using a laser-diffraction particle size analyser. NATA accreditation does not cover the performance of this service. Results was reported to Ektimo on 12 July 2022 in report 220812.
- # Analysis (solid fluoride only) performed by Australian Laboratory Services Pty Ltd, NATA accreditation number 825. Results was reported to Ektimo on 15 July 2022 in report EN2206506.
- d Excludes recovery study as specified in section 8.4.3 of USEPA Test Method 18.

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
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.

7 Appendix 1: Site Photos



EPA 2 – No.6 Kiln Stack



Ektimo

ektimo.com.au

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Result Sheet

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Unit 4, Level 1, 677 Springvale Road
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AUSTRALIA

Date: **14/09/2022** File No. **67210327** Report No. **220832**
To: Name **Thomas O'Connor**
Company **Resource Co**
Address
Fax No. Tel No.
From: Name Tel No.
Number of pages including this page: 4

ANALYSIS OF FUEL SAMPLE

1. INTRODUCTION

A monthly fuel sample was received from Resource Co for analysis. The requested parameters are detailed in the methods section of this report.

Results from this analysis are presented below.

14/09/2022 – A retain sample was received for a Cl repeat. The report has been amended to add this.

Signed:


Andrew Grietman
Analytical Chemist - LATS

Approved:


Jarryd Cutting
Analytical Chemist – LATS

Distribution: Copy 1: Client. Copy 2: HRL Project File.

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The results presented in this report relate exclusively to the samples selected by the client for the purpose of testing. No responsibility is taken for the representativeness of these samples.

HRL's ISO9001 Quality Management System is certified by BSI under certificate number FS605116

QA741F

2. ANALYTICAL METHODS

2.1 *Sample Preparation*

All samples were recorded in the HRL LIMS database and given a unique identification number.

Each sample was weighed and then dried at 40°C in order to remove all free moisture from the sample.

Each sample was taken following drying and further milled in order to prepare an analysis sample.

This preparation process required to produce an analysis sample involved the grinding and milling of the sample to reduce the particle size to a nominal top size of <1mm.

2.2 *Analysis methods*

Analysis	Test Method
Sample Preparation and size reduction	EN 15443:2011
Total Moisture	CEN/TS 15414:2010
Ash Yield	EN 15403:2011
Calorific Value	EN 15400:2011
S, Cl, Br, F, I	EN 15408:2011
Trace Metals	EN 15411:2011
Major Elements	EN 15410:2011
Particle Size	CEN/TS 15149-1

3. ANALYTICAL RESULTS

Results from the analysis of the samples are presented below.

hrl: Sample Description	220832-1	220973-1
Client's sample Description	June 2022	June 2022 Retain
Ash Yield (% ar)		
Ash Yield	6.5	-
Total Moisture (% ar)		
Moisture	25.0	-
Calorific Value		
Gross Dry Calorific Value (MJ/kg db)	19.8	-
Gross Wet Calorific Value (MJ/kg ar)	14.8	-
S, Cl, F, Br, I (% ar)		
S	0.10	-
Cl	0.76	0.06
F	<0.01	-
Br	<0.01	-
I	<0.01	-
Oxides (In Sample) (% ar)		
K ₂ O	0.13	-
Na ₂ O	0.18	-
Particle Size %		
> 50 mm	4.4	-
> 35 mm	10.3	-
< 35 mm	85.3	-
Biomass Content %		
Biomass Content	>90	-

hrl: Sample Description	220832-1
Client's sample Description	June 2022
Trace Metals mg/kg (ar)	
As	28
Be	<1
Cd	1
Cr	52
Co	6
Cu	35
Hg	<0.05
Mn	64
Ni	2
Pb	69
Sb	7
Se	<1
Sn	2
Tl	<1
V	2
Zn	426
Total Metals (mg/kg ar)	
Total Group II Metals (Cd, Tl)	<5
Total Group III Metals (Sb, As, Co, Cu, Cr, Pb, Mn, Ni, V)	<3000

Result Sheet

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HRL Technology Group Pty Ltd
ABN 89 609 887 327

Unit 4, Level 1, 677 Springvale Road
Mulgrave Victoria 3170
AUSTRALIA

Date: **21/09/2022** File No. **67220283** Report No. **220972-1**
To: Name **Floyde Gilbert**
Company **Benedict**
Address **33-39 Riverside Road Chipping Norton NSW 2170**
Fax No. Tel No.
From: Name Tel No.
Number of pages including this page: 5

ANALYSIS OF FUEL SAMPLE

1. INTRODUCTION

A sample was received from Benedict for analysis. The requested parameters are detailed in the methods section of this report.

Results from this analysis are presented below.

Signed:

Andrew Gietman
Analytical Chemist - LATS

Approved:

Jarryd Cutting
Analytical Chemist – LATS

Distribution: Copy 1: Client. Copy 2: HRL Project File.

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The results presented in this report relate exclusively to the samples selected by the client for the purpose of testing. No responsibility is taken for the representativeness of these samples.

HRL's ISO9001 Quality Management System is certified by BSI under certificate number FS605116

QA741F

Result Sheet No.: 220972-1

2. ANALYTICAL METHODS

2.1 *Sample Preparation*

All samples were recorded in the HRL LIMS database and given a unique identification number.

Each sample was weighed and then dried at 40°C in order to remove all moisture from the sample.

Each sample was taken following drying and further milled in order to prepare an analysis sample.

The preparation process required to produce an analysis sample involves the grinding and milling of the sample to reduce the particle size to a nominal top size of <1mm.

2.2 *Analysis methods*

Analysis	Test Method
Sample Preparation and size reduction	I.S. EN 15413:2011 & I.S. EN 15443:2011
Total Moisture	CEN/TS 15414:2010
Ash Yield at 550°C	I.S. EN 15403:2011
Calorific Value	I.S. EN 15400:2011
S, Cl, Br, F, I	I.S. EN 15408:2011
Trace Metals	I.S. EN 15411:2011
Major Elements	I.S. EN 15410:2011
Particle Size	CEN/TS 15149-2

3. ANALYTICAL RESULTS

Results from the analysis of the samples are presented below.

HRL Sample Description	220972-1
Client's sample Description	WWDF July 2022
Ash Yield (% db)	
Ash Yield at 550°C	1.6
Total Moisture (% ar)	
Moisture Content	22.8
Calorific Value	
Gross Dry Calorific Value (MJ/kg db)	19.5
Gross Wet Calorific Value (MJ/kg ar)	15.1
S, Cl, F, Br, I (% db)	
S	0.05
Cl	0.06
F	<0.01
Br	<0.01
I	<0.01
Oxides (In Sample) (% db)	
K ₂ O	0.05
Na ₂ O	0.07
Biomass Content %	
Biomass Content	>90
Particle Size %	
> 50 mm	2.6
> 35 mm	10.7
< 35 mm	86.7

HRL Sample Description	220972-1
Client's sample Description	WWDF July 2022
Trace Metals mg/kg (db)	
As	48
Be	<1
Cd	<1
Cr	72
Co	1
Cu	55
Hg	0.05
Mn	47
Ni	1
Pb	26
Sb	2
Se	<1
Sn	1
Tl	<1
V	1
Total Metals (mg/kg db)	
Total Group II Metals (Cd, Tl)	<5
Total Group III Metals (Sb, As, Co, Cu, Cr, Pb, Mn, Ni, V)	<1000

CERTIFICATE OF ANALYSIS

Work Order : **EM2218812**
Client : **HRL TECHNOLOGY GROUP PTY LTD**
Contact : JARRYD CUTTING
Address : Level 1, Unit 4, 677 Springvale Rd
 Mulgrave VIC 3170
Telephone : ----
Project : PCB and PCP analysis
Order number : 5140
C-O-C number : ----
Sampler : ----
Site : ----
Quote number : EN/333
No. of samples received : 1
No. of samples analysed : 1

Page : 1 of 3
Laboratory : Environmental Division Melbourne
Contact : Customer Services EM
Address : 4 Westall Rd Springvale VIC Australia 3171
Telephone : +61 3 8549 9600
Date Samples Received : 27-Sep-2022 11:15
Date Analysis Commenced : 28-Sep-2022
Issue Date : 03-Oct-2022 12:48



Accreditation No. 825
 Accredited for compliance with
 ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Xing Lin	Senior Organic Chemist	Melbourne Organics, Springvale, VIC



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
 LOR = Limit of reporting
 ^ = This result is computed from individual analyte detections at or above the level of reporting
 ø = ALS is not NATA accredited for these tests.
 ~ = Indicates an estimated value.

- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a,h)anthracene (1.0), Benzo(g,h,i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- EP066: Particular samples required dilution prior to analysis due to matrix interferences. LOR values have been adjusted accordingly.

Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				220972-1	----	----	----	----
Sampling date / time				21-Sep-2022 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EM2218812-001	-----	-----	-----	-----
Result					----	----	----	----
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.2	----	----	----	----
EP075(SIM)A: Phenolic Compounds								
Pentachlorophenol	87-86-5	2	mg/kg	<2	----	----	----	----
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	70.7	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	93.1	----	----	----	----
2-Chlorophenol-D4	93951-73-6	0.5	%	85.5	----	----	----	----
2,4,6-Tribromophenol	118-79-6	0.5	%	110	----	----	----	----
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	103	----	----	----	----
Anthracene-d10	1719-06-8	0.5	%	102	----	----	----	----
4-Terphenyl-d14	1718-51-0	0.5	%	123	----	----	----	----



Surrogate Control Limits

Sub-Matrix: **SOIL**

		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP066S: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	36	140
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	54	125
2-Chlorophenol-D4	93951-73-6	65	123
2,4,6-Tribromophenol	118-79-6	34	122
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	61	125
Anthracene-d10	1719-06-8	62	130
4-Terphenyl-d14	1718-51-0	67	133