

WW High Rate Proof of Performance 2022 Trial 4 Report

Boral Cement Works, Berrima NSW

Reporting Period: 21-24 June 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 4th in the 5 extra trials required and the 1st additional WW high rate.

Results

A trial with high rate (>40% and <50%) of WW was undertaken on 21st June and 24th June 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.

WW 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 21-24/06/2022

Parameter	Unit	EPL limit	Maximum	Average
Quantity used	(% of total fuel by mass)	50	49	44
Quantity used	Total weight in tph		16.4	12.8
Solid Particles 24hrs	mg/m ³	50	28	26
NOx				
24 hour	mg/m ³	1000	732	730
1 hours	mg/m ³	1250	743	624
HCl 1hr	mg/m ³	10	0.83	0.73
SO2 hr	mg/m ³	50	1.07	0.6
VOC hr	ppm	40	2.3	2
Temp Preheater exit	C	>300	398	388
Temp inlet abatement system	C	<200	<166	113
Temp combustion vessel	C	>850	925	880

Table 2: Trial 4 stack test summary results report R012821 (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	0.01	0.012
	Type 1 and Type 2 substances in aggregate	mg/m ³	0.5	<0.04	<0.05
	Solid particles	mg/m ³	50	44	48
	Nitrogen oxides	mg/m ³	1250	920	840
	Cadmium + Thallium	mg/m ³	0.05	<0.0028	<0.0031
	Chlorine	mg/m ³	50	<0.01	<0.01
	Dioxins & furans (I-TEQ middle bound)	ng/m ³	0.1	0.0013	0.0012
	Hydrogen chloride	mg/m ³	10	0.094	0.11
	Hydrogen fluoride	mg/m ³	1	<0.02	<0.03
	Sulfur dioxide	mg/m ³	50	0.032	0.034
	Sulfuric acid mist and sulfur trioxide (as SO ₃)	mg/m ³	50	0.031	0.033
	Volatile organic compounds	mg/m ³	40	2	1.8

Table 3: Trial 4 – Wood Waste Monthly Fuel Analysis Summary against specification limits

		SWDF Specification Limits	WW Trial 4
Parameter	as received basis		
Gross Wet Calorific Value	(MJ/kg)	>15	15.7
Ash Yield	%	<30	1.8
Moisture	%	<30	16.5
Cl	%	<1	0.06
F	%	<0.25	<0.01
Br	%		<0.01
I	%		<0.01
S	%	<1	0.1
Particle size > 50 mm	%	<100 mm	1.7
K ₂ O	%	<1	0.07
Na ₂ O	%	<0.5	0.09
Hg	mg/kg	<1.2	<0.05
Cd	mg/kg	<20	<1
Tl	mg/kg	<20	<1
Total Group II Metals (Cd, Tl)	mg/kg	<30	<5
Cu	mg/kg	<1000	85
Pb	mg/kg	<1000	26
Total Group III Metals (Sb, As, Co, Cu, Cr, Pb, Mn, Ni, V)	mg/kg	<3000	<1000
Total Polychlorinated biphenyls	mg/kg	<10	<0.4
Pentachlorophenol	mg/kg	<10	<2

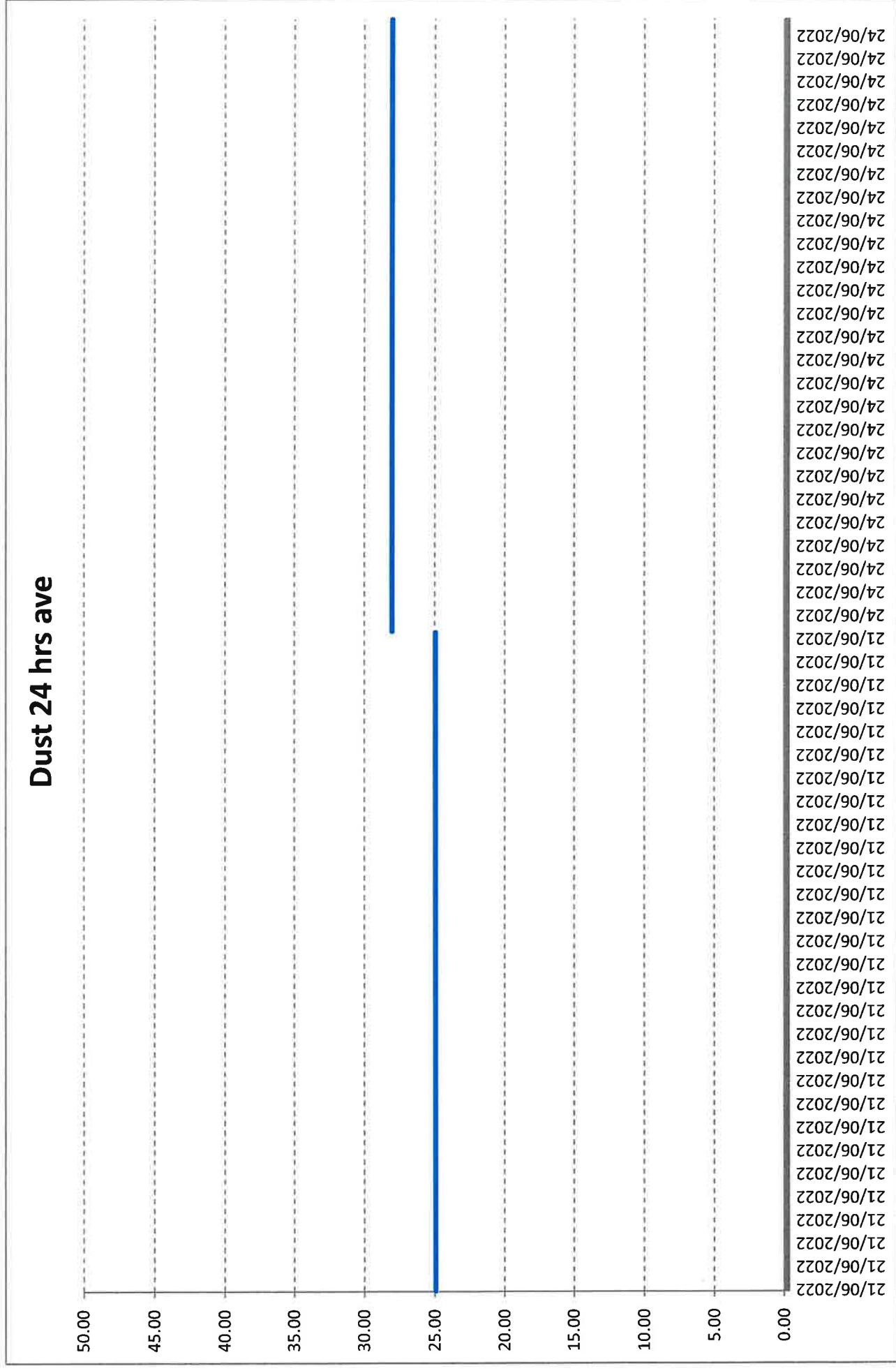
Compliance Summary

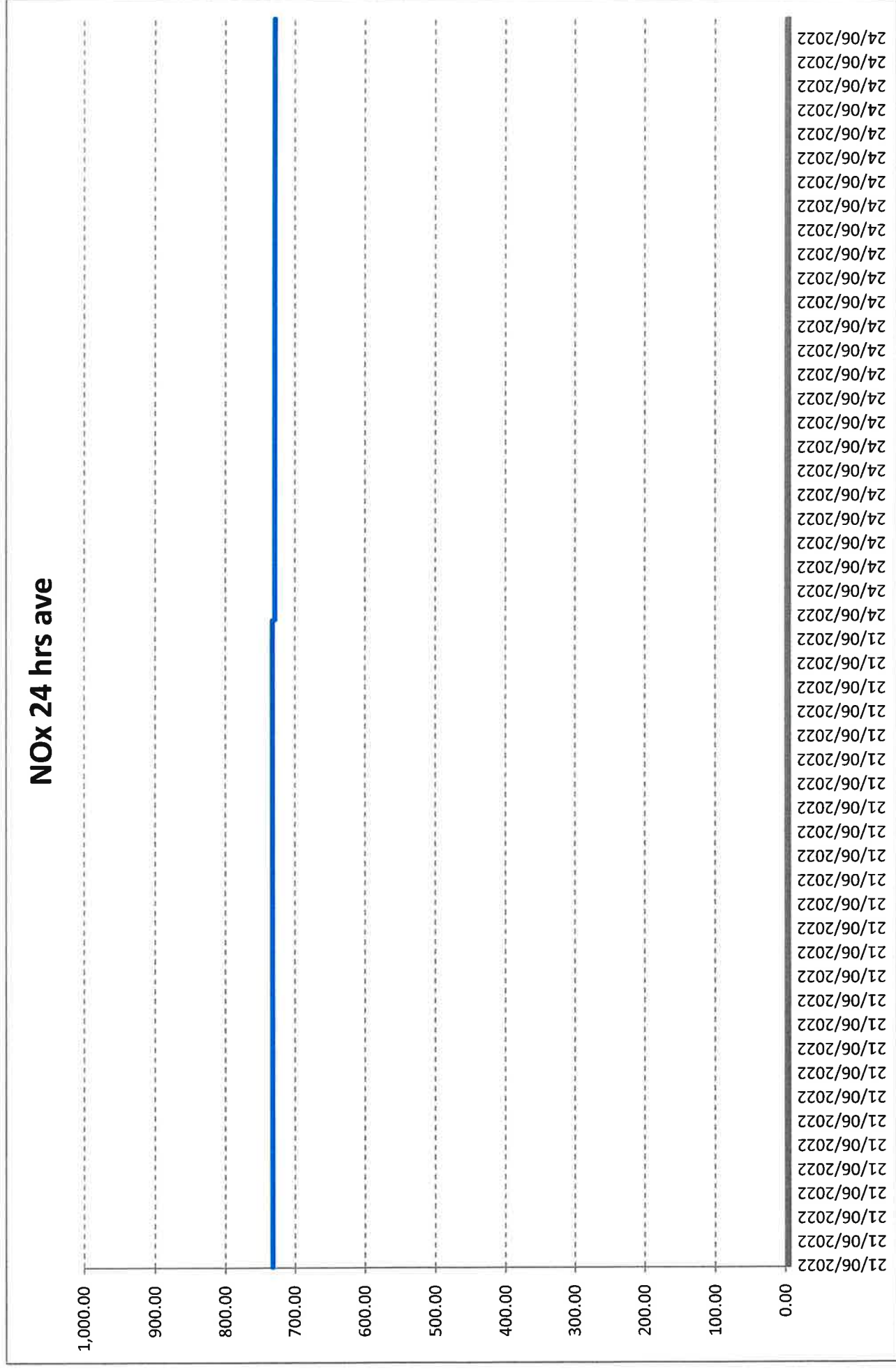
All real-time monitoring and stack testing during the trial period indicated compliance with EPL 1698.

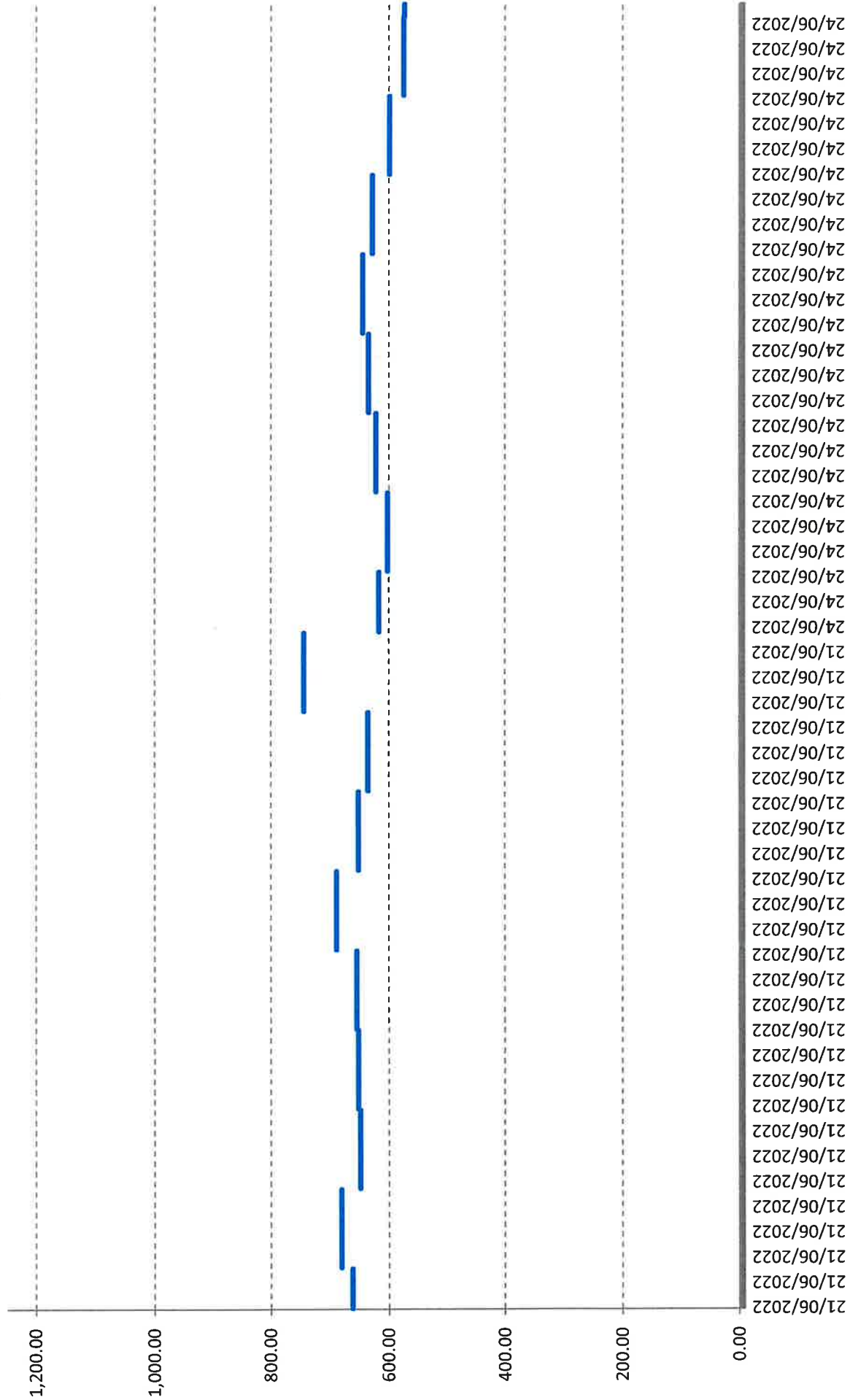
CEMS and process trends are reported in Attachment 1, with no exceedances recorded for CEMs or process data.

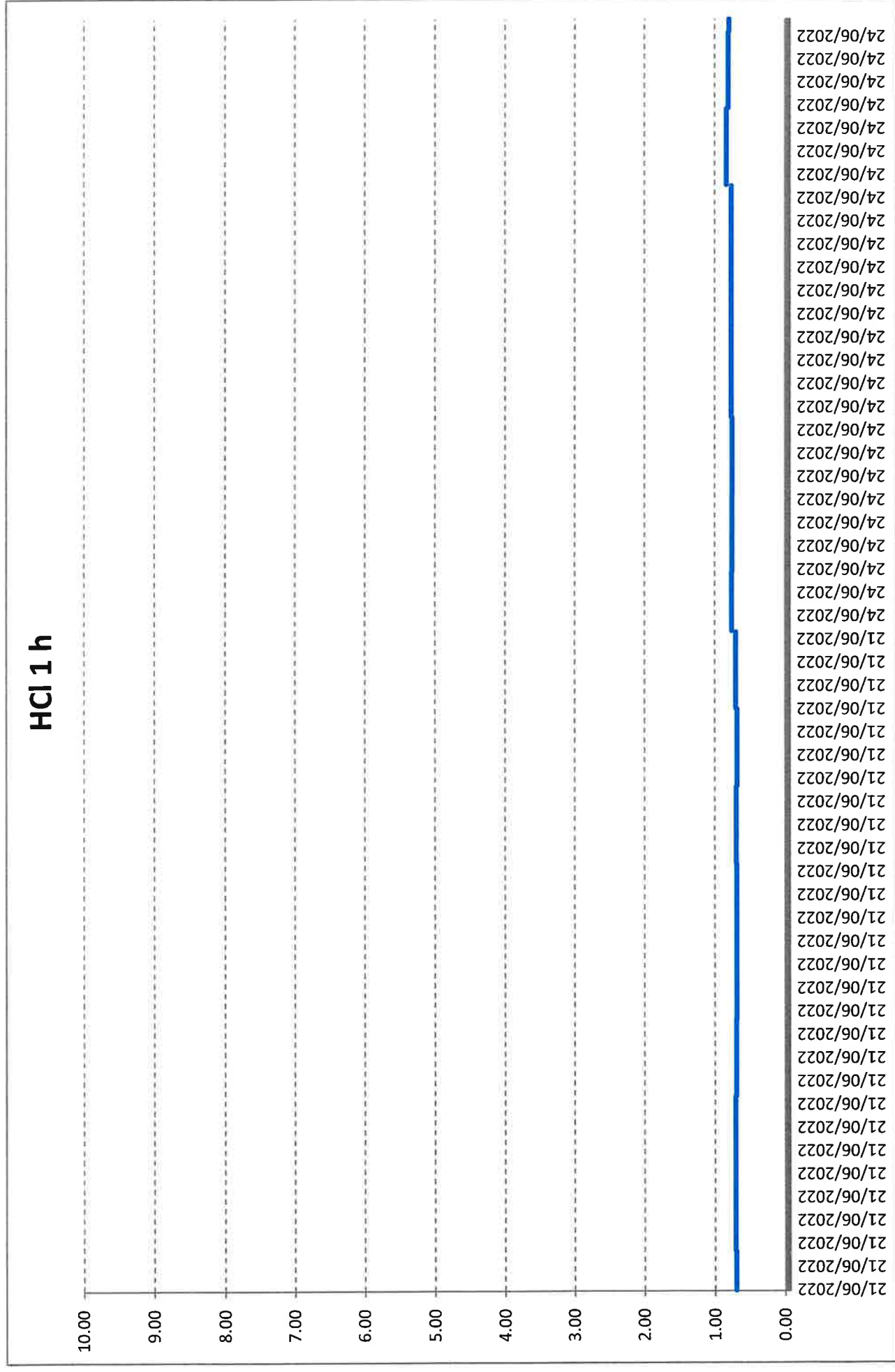
Attachments:

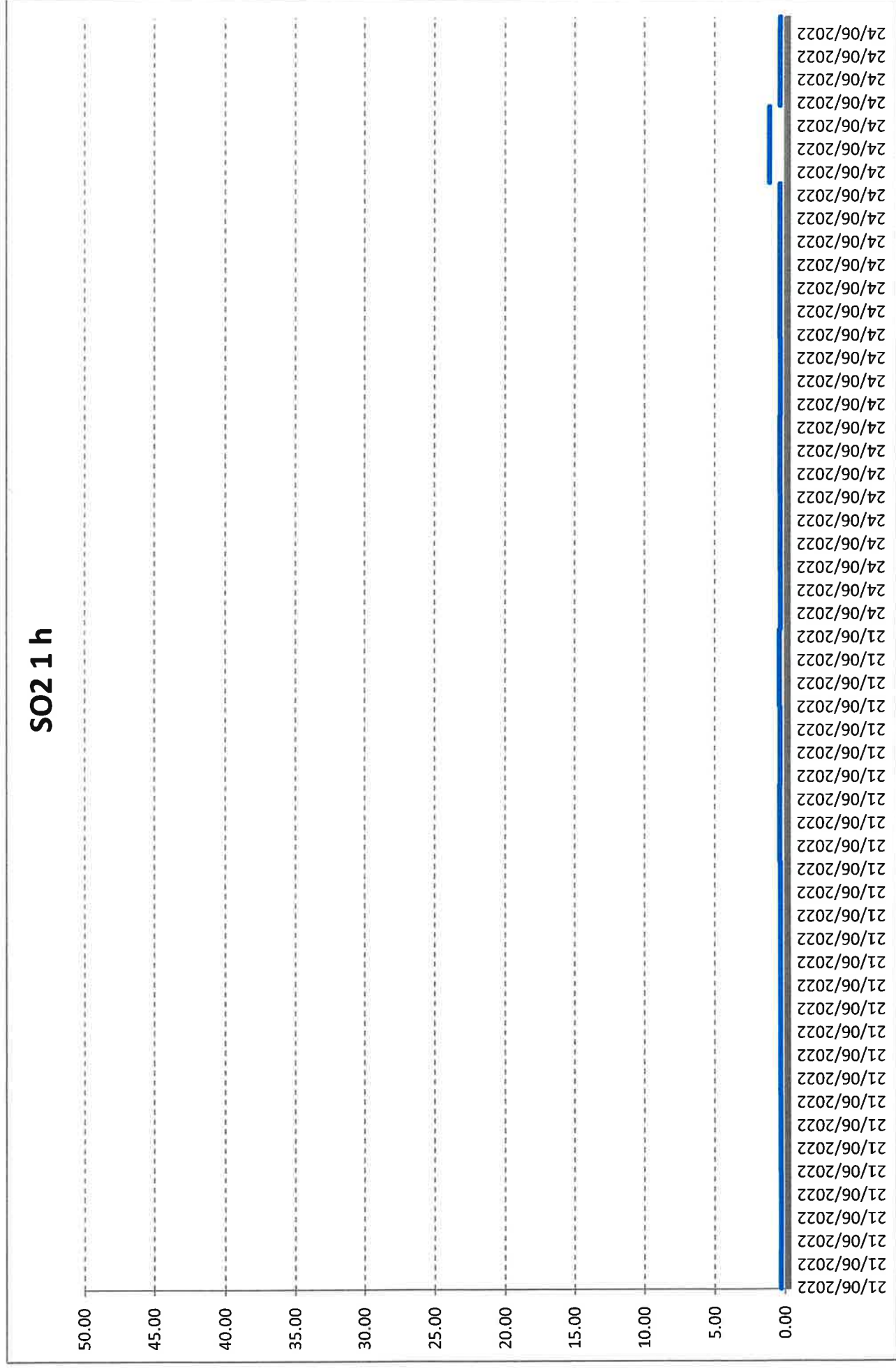
1. CEMs and Process data for 21-24 June 2022
2. Stack test Report
3. WW Lab results June 2022



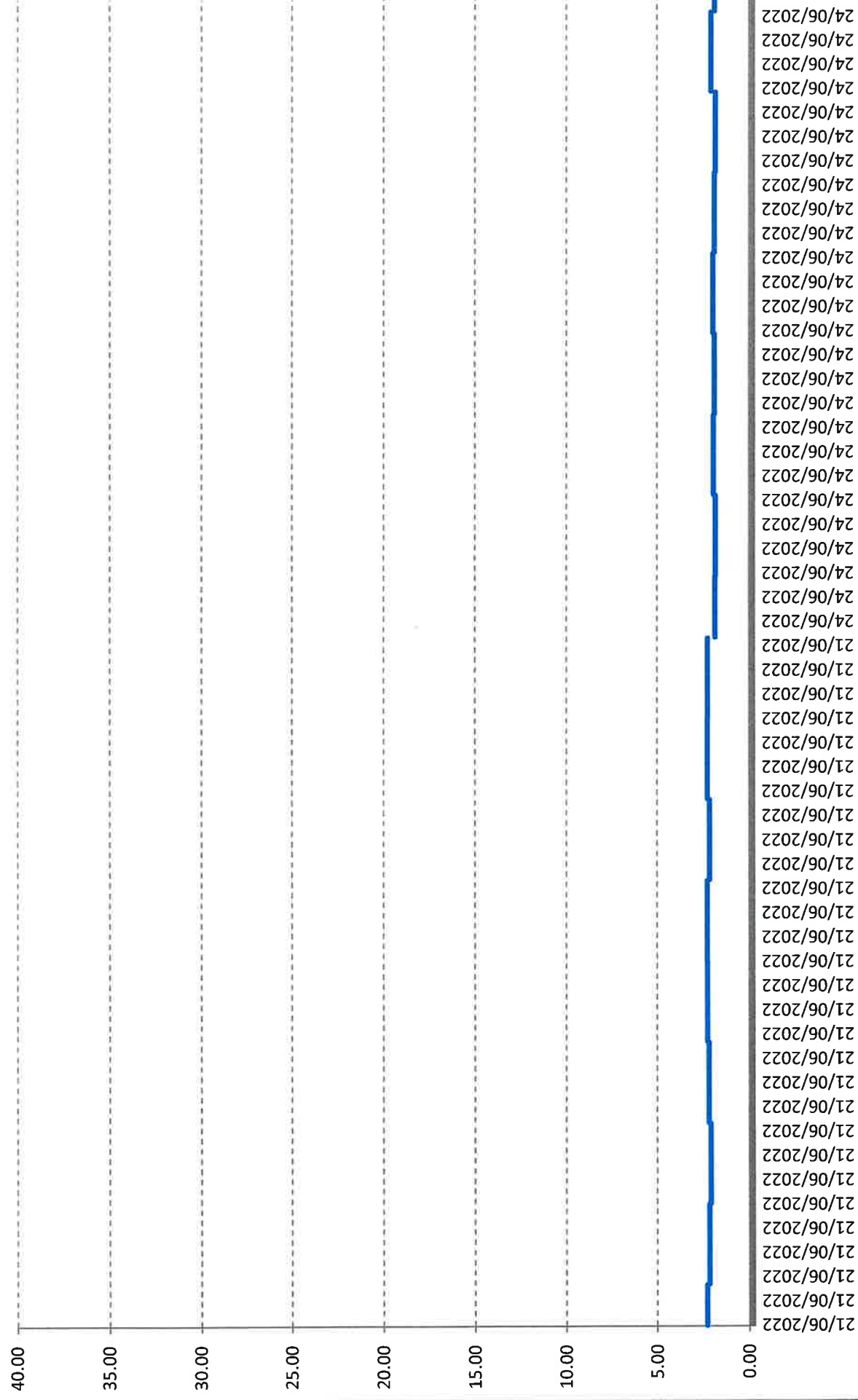


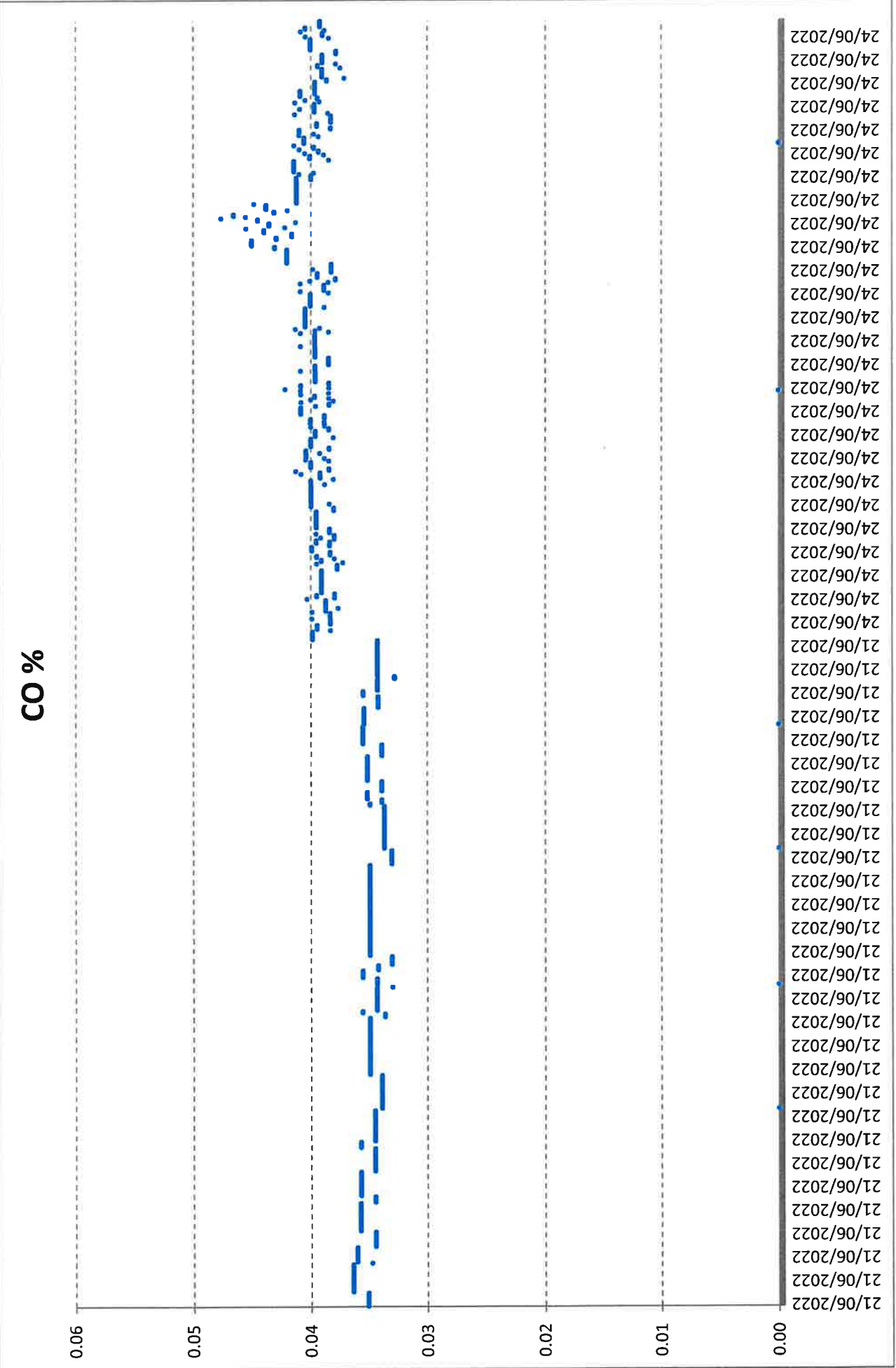




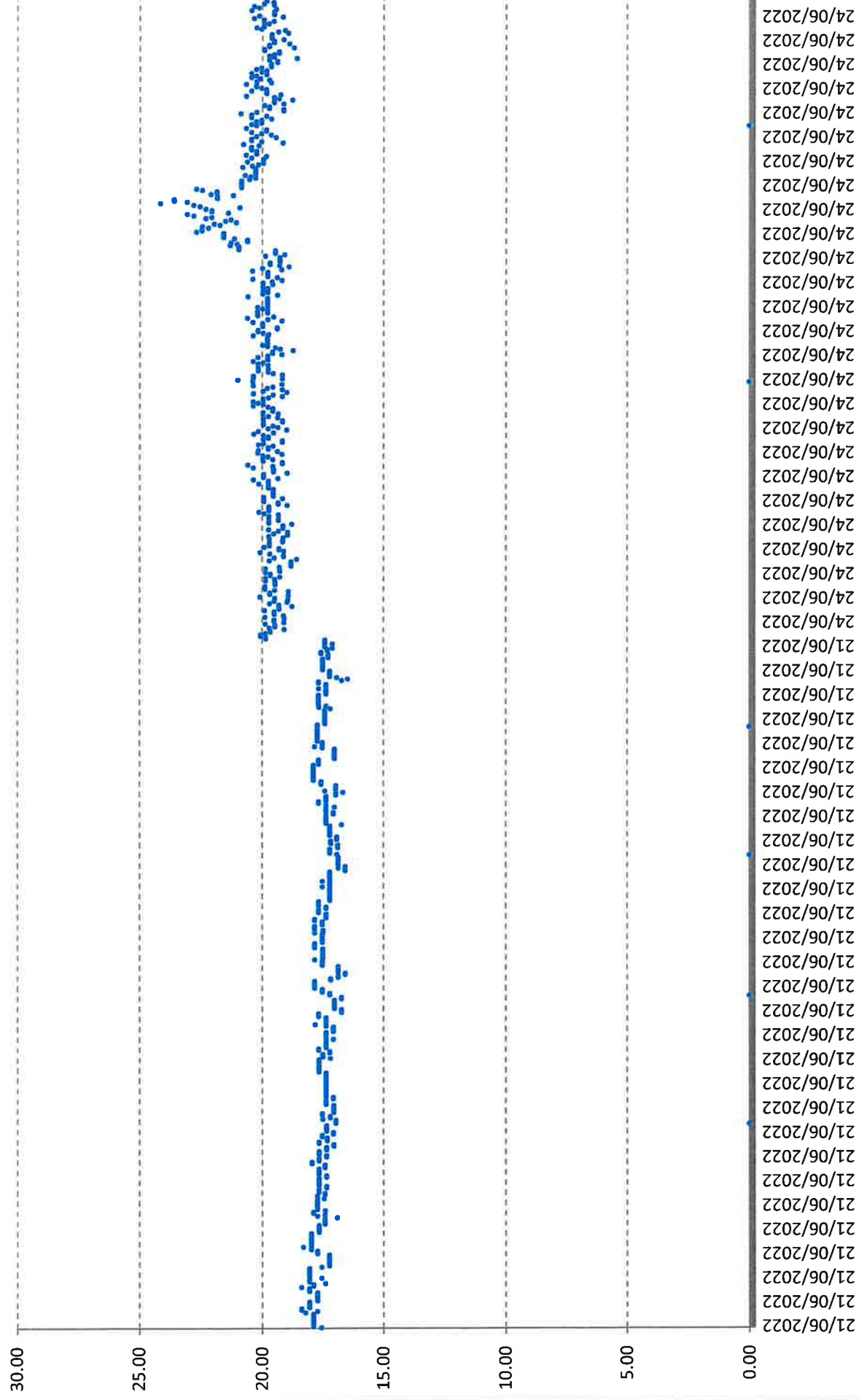


VOC 1 h

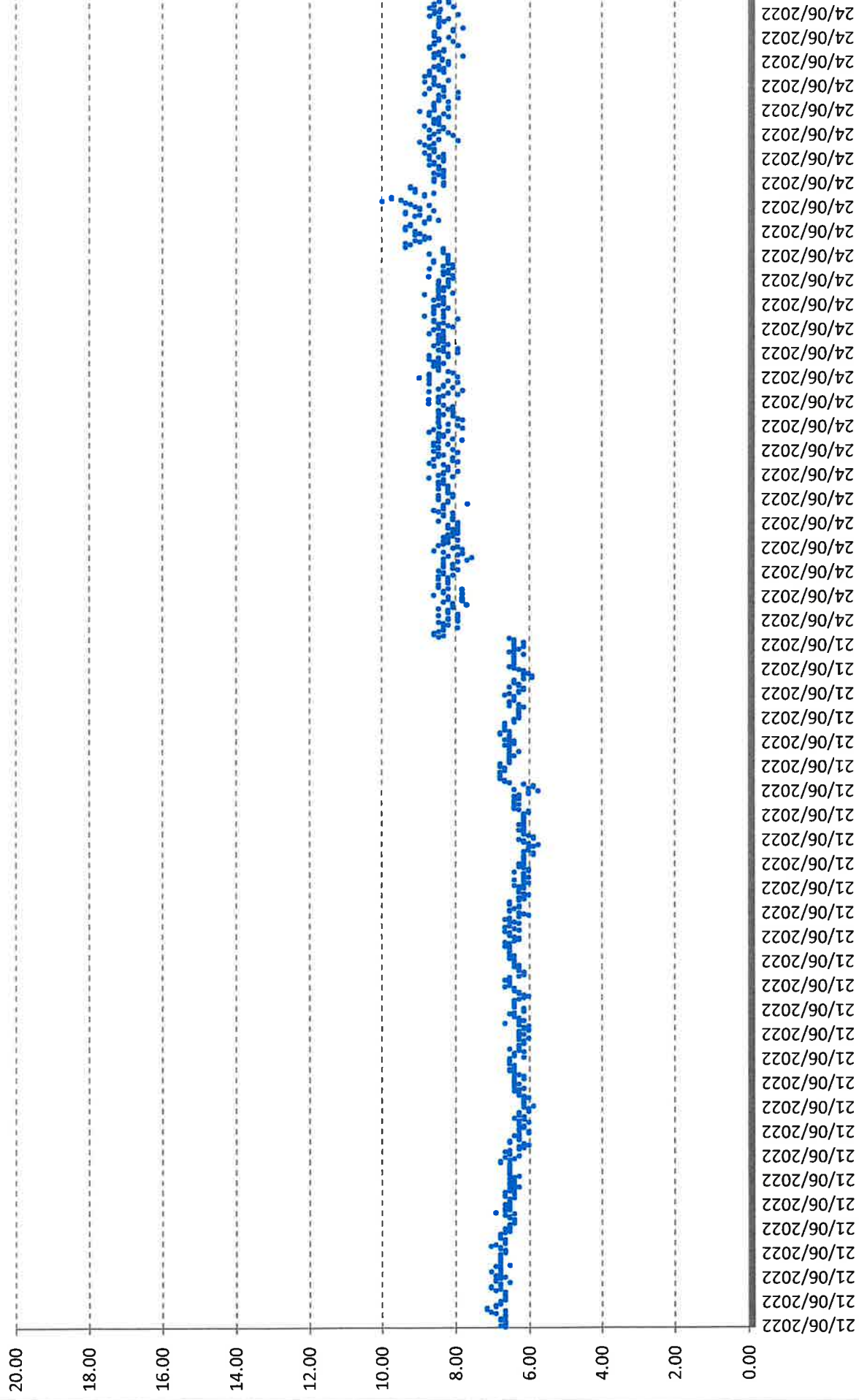


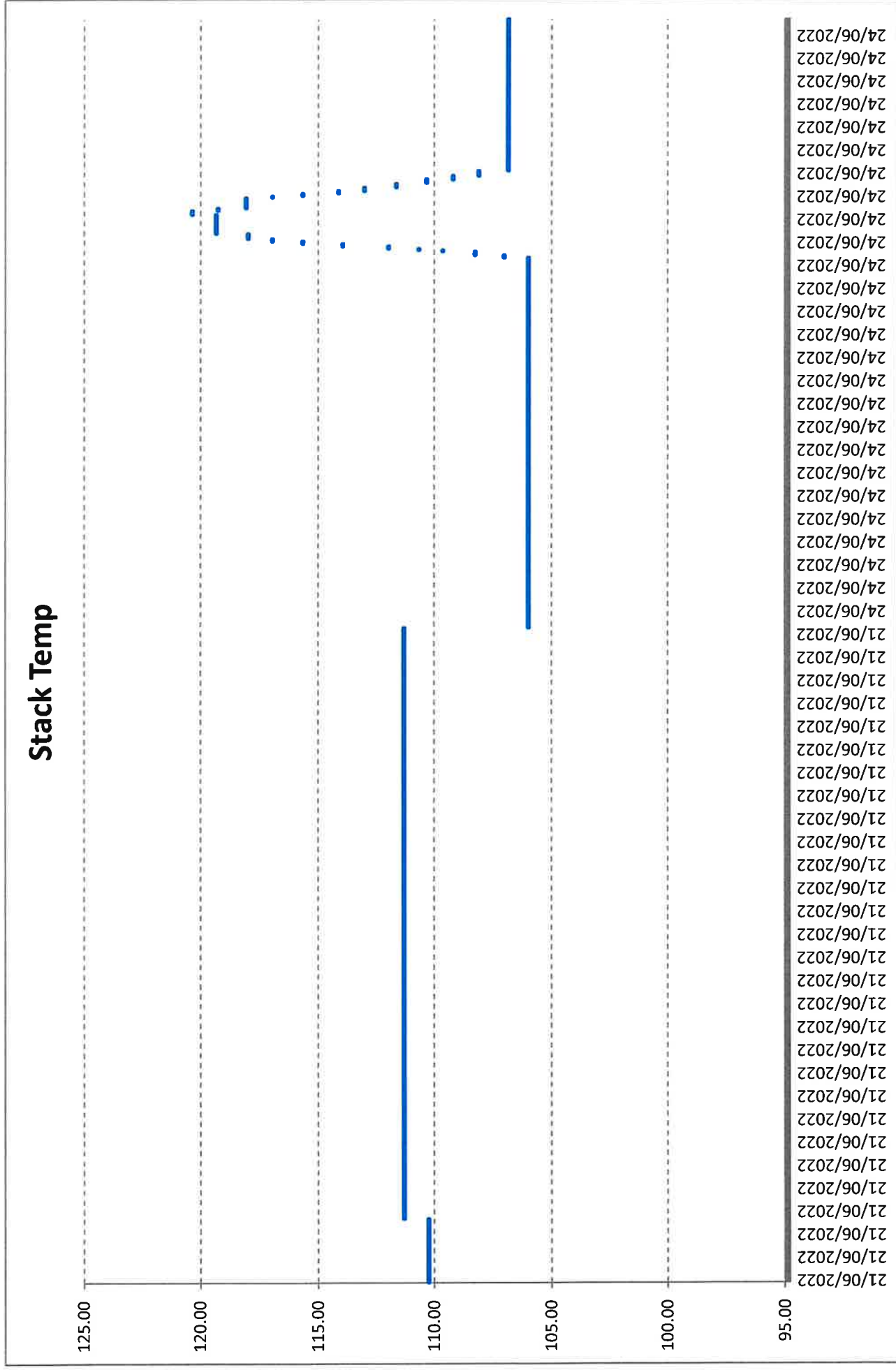


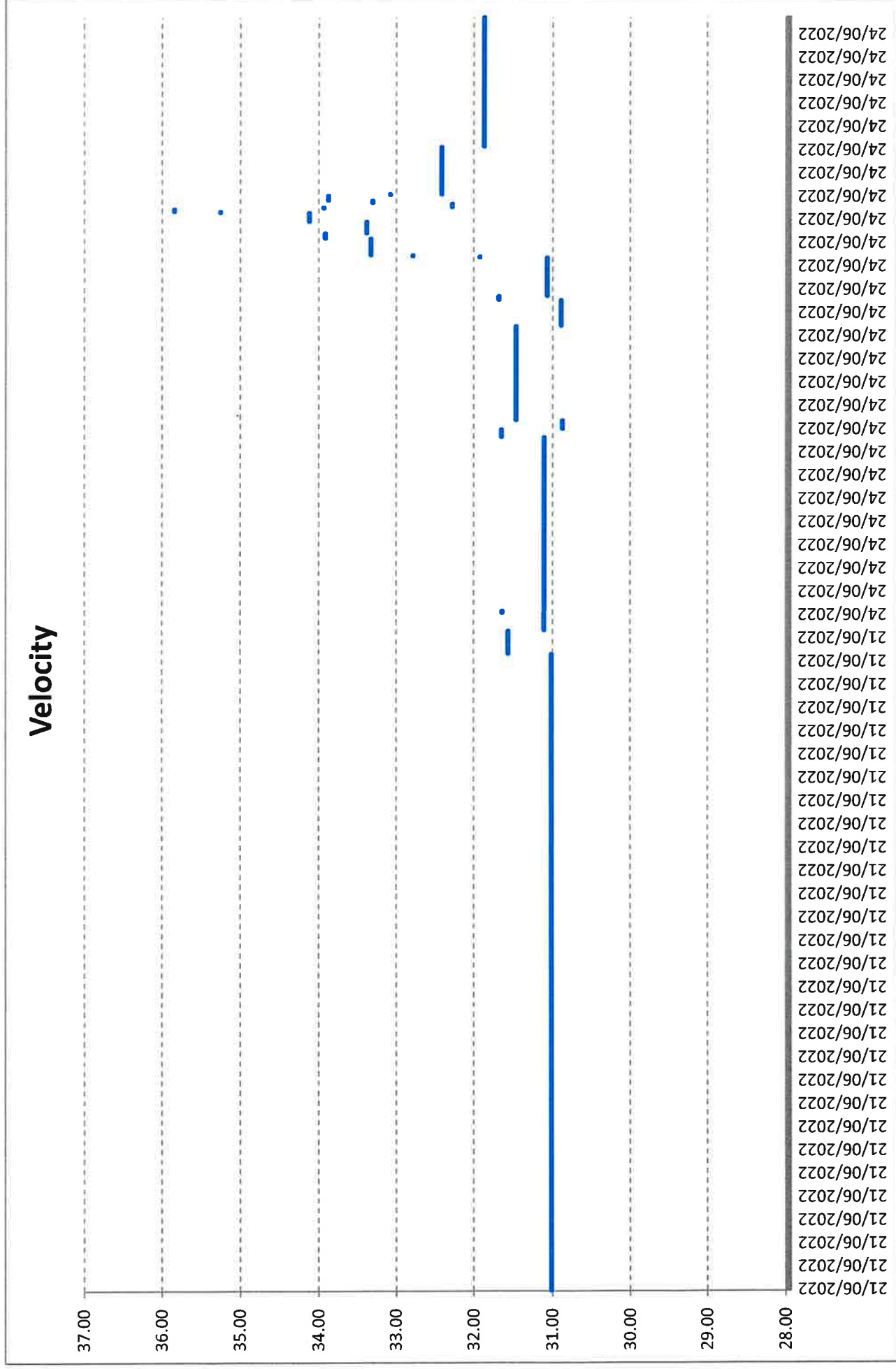
CO2



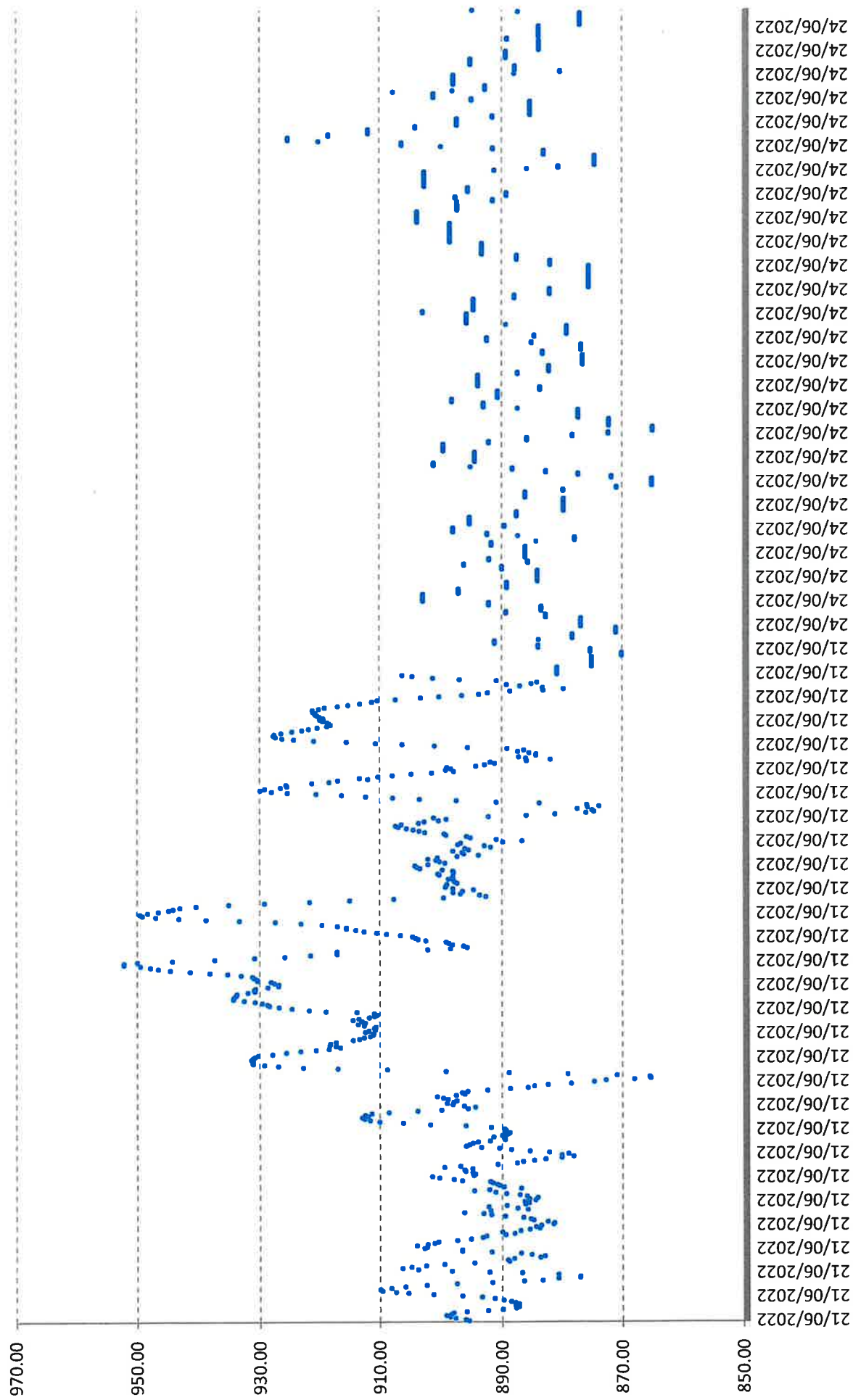
02



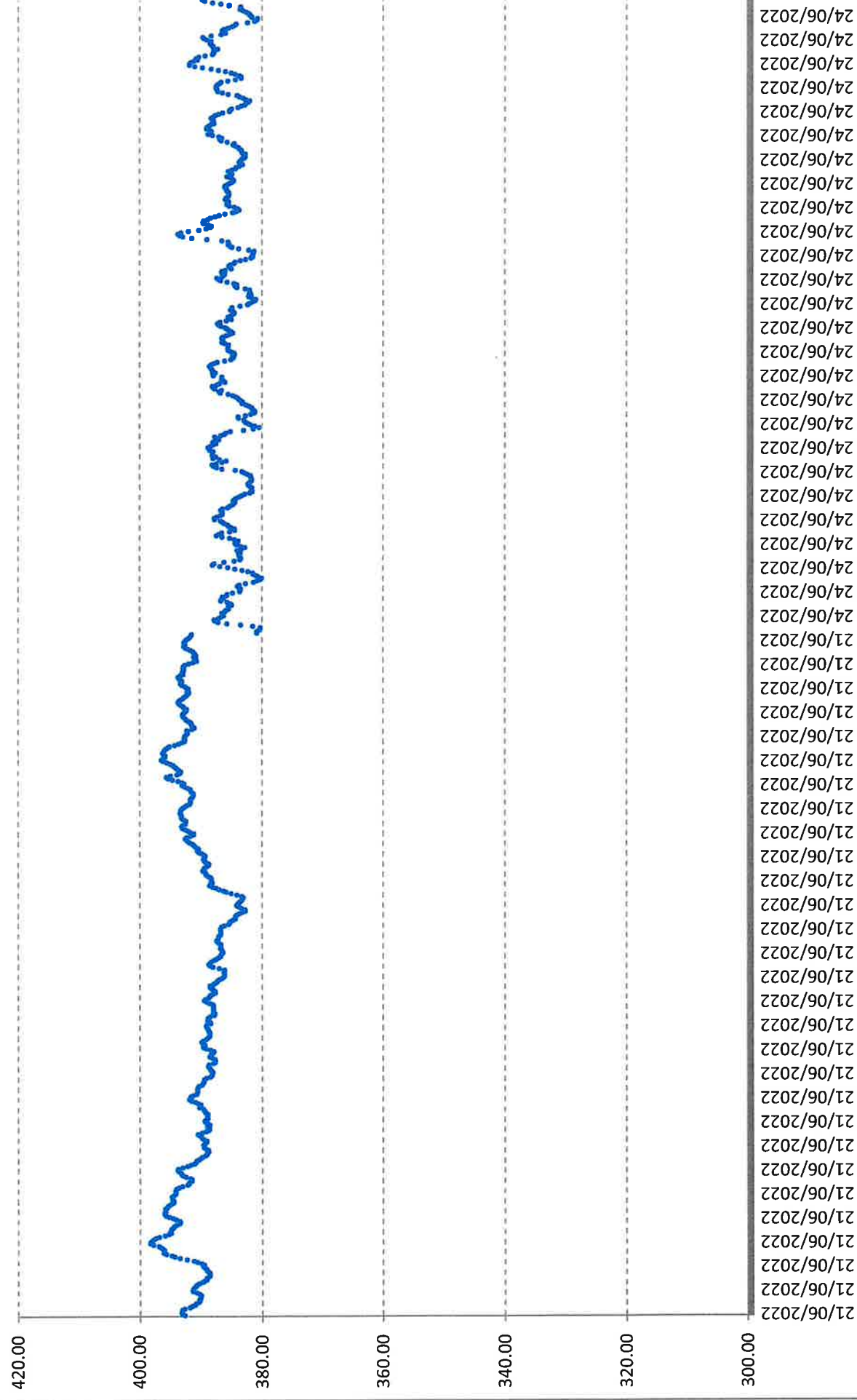


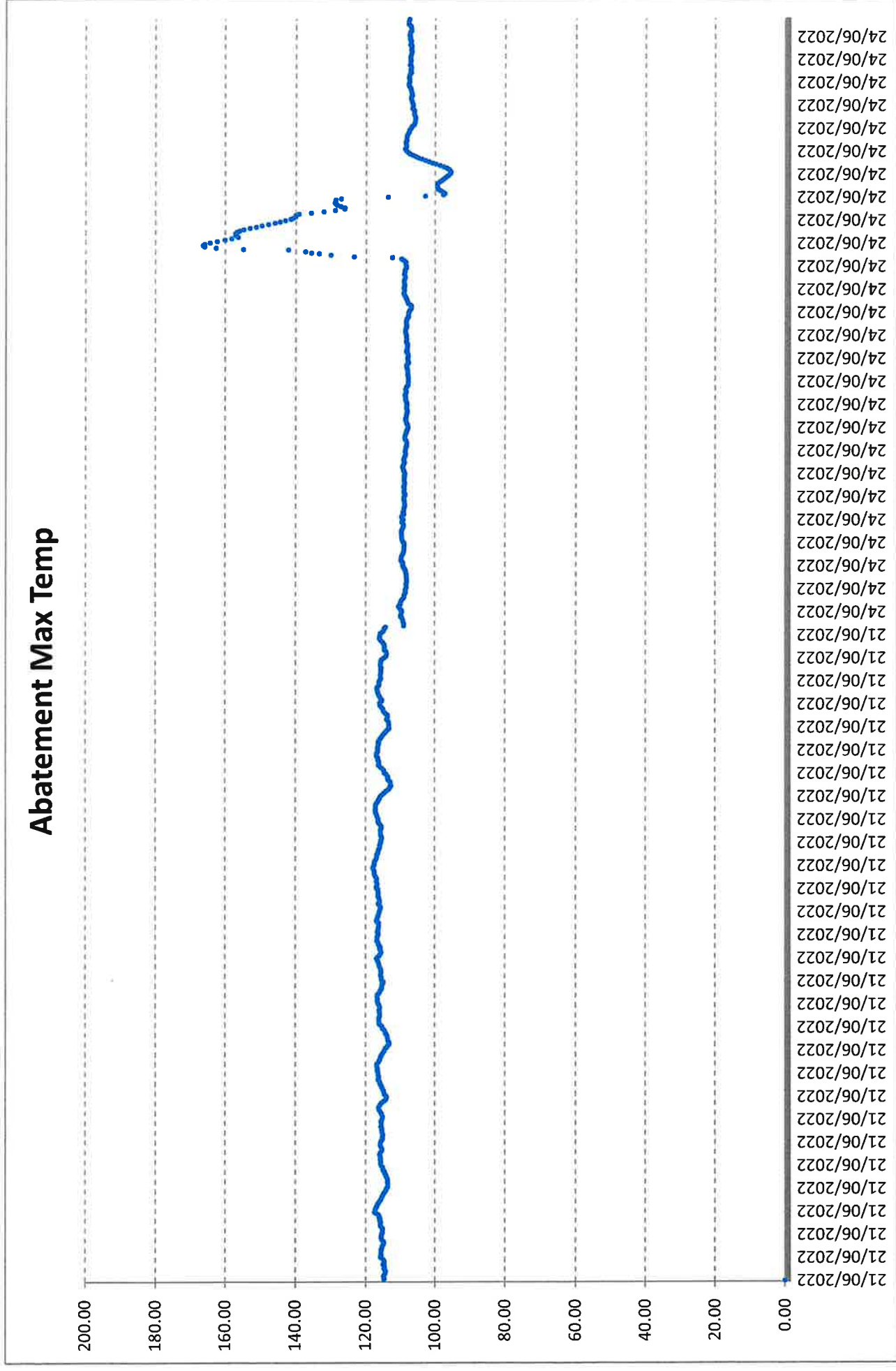


Temp combustion



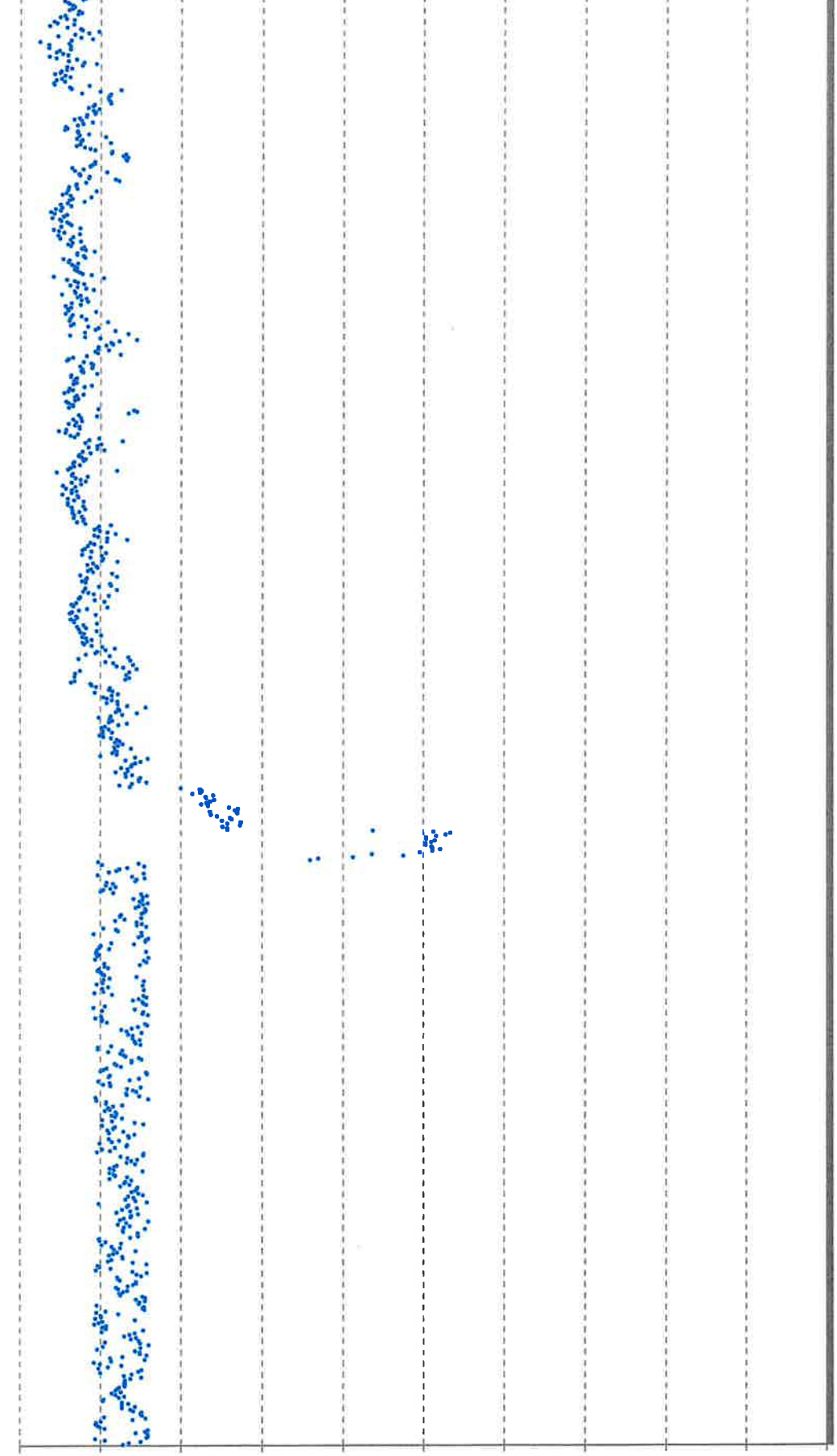
Preheater exit temp





% AF

50.00%
45.00%
40.00%
35.00%
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%



**Boral Cement Ltd, New Berrima
Kiln Emission Testing Report – Trial 4
Report Number R012821**

Document Information

Template Version 270622

Client Name: Boral Cement Ltd (Berrima)
Report Number: R012821
Date of Issue: 26 August 2022
Attention: Gabriel Paicu
Address: Taylor Avenue
New Berrima NSW 2577
Testing Laboratory: Ektimo Pty Ltd, ABN 86 600 381 413

Report Authorisation



Aaron Davis
Senior Air Monitoring
Consultant



NATA Accredited Laboratory
No. 14601

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 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	21 June 2022	Speciated volatile organic compounds (VOCs) Dioxins and furans (PCDD & PCDF) Polycyclic aromatic hydrocarbons (PAHs) Nitrogen oxides, carbon monoxide, carbon dioxide, oxygen Hexavalent chromium
	24 June 2022	Type 1 & 2 substances in aggregate (Sb, As, Cd, Pb, Hg, Be, Cr, Co, Mn, Ni, Se, Sn, V), copper, thallium, zinc 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) Total fluoride, hydrogen chloride, chlorine

* 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	0.01	0.012
	Type 1 and Type 2 substances in aggregate	mg/m ³	0.5	<0.04	<0.05
	Solid particles	mg/m ³	50	44	48
	Nitrogen oxides	mg/m ³	1250	920	840
	Cadmium + Thallium	mg/m ³	0.05	<0.0028	<0.0031
	Chlorine	mg/m ³	50	<0.01	<0.01
	Dioxins & furans (I-TEQ middle bound)	ng/m ³	0.1	0.0013	0.0012
	Hydrogen chloride	mg/m ³	10	0.094	0.11
	Hydrogen fluoride	mg/m ³	1	<0.02	<0.03
	Sulfur dioxide	mg/m ³	50	0.032	0.034
	Sulfuric acid mist and sulfur trioxide (as SO ₃)	mg/m ³	50	0.031	0.033
	Volatile organic compounds	mg/m ³	40	2	1.8

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	24/06/2022	Client	Boral Cement Ltd
Report	R012821	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	29.6 (wet)	31.2 (dry)
Gas density at STP, kg/m³	1.32 (wet)	1.39 (dry)
Gas density at discharge conditions, kg/m³	0.87	
% Oxygen correction & Factor	10 %	1.12
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1500 & 1710	
Temperature, °C	110	
Temperature, K	383	
Velocity at sampling plane, m/s	31	
Volumetric flow rate, actual, m³/s	220	
Volumetric flow rate (wet STP), m³/s	150	
Volumetric flow rate (dry STP), m³/s	130	
Mass flow rate (wet basis), kg/hour	690000	

Isokinetic Results	Sampling time	Average			Test 1 1505-1707			Test 2 1505-1707		
		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
Antimony		<0.003	<0.003	<0.02	<0.002	<0.003	<0.02	<0.003	<0.003	<0.02
Arsenic		<0.001	<0.001	<0.009	<0.001	<0.001	<0.008	<0.001	<0.001	<0.009
Beryllium		<0.0003	<0.0004	<0.003	<0.0003	<0.0004	<0.002	<0.0003	<0.0004	<0.003
Cadmium		<0.0003	<0.0003	<0.002	<0.0003	<0.0003	<0.002	<0.0004	<0.0004	<0.003
Chromium		0.0011	0.0012	0.0084	0.00058	0.00065	0.0045	0.0016	0.0018	0.012
Cobalt		<0.0004	<0.0005	<0.003	<0.0004	<0.0005	<0.003	<0.0004	<0.0005	<0.003
Copper		0.0021	0.0023	0.016	0.0012	0.0013	0.0089	0.003	0.0033	0.023
Lead		0.0013	0.0014	0.0097	0.0013	0.0014	0.0098	0.0012	0.0014	0.0096
Manganese		0.02	0.023	0.16	0.015	0.017	0.12	0.025	0.029	0.2
Mercury		0.01	0.012	0.081	0.0092	0.01	0.071	0.012	0.013	0.091
Nickel		<0.0008	<0.0009	<0.006	<0.0006	<0.0007	<0.005	<0.001	<0.001	<0.008
Selenium		<0.004	<0.004	<0.03	<0.003	<0.003	<0.02	<0.004	<0.005	<0.03
Thallium		0.0028	0.0031	0.022	0.0022	0.0025	0.017	0.0034	0.0038	0.026
Tin		<0.001	<0.001	<0.009	<0.001	<0.001	<0.008	<0.001	<0.001	<0.009
Vanadium		0.0012	0.0013	0.009	0.0009	0.001	0.0069	0.0014	0.0016	0.011
Zinc		0.0034	0.0038	0.026	0.0021	0.0024	0.016	0.0047	0.0053	0.036
Type 1 & 2 Substances										
Upper Bound										
Total Type 1 Substances		<0.02	<0.02	<0.1	≤0.014	≤0.016	≤0.11	≤0.017	≤0.019	≤0.13
Total Type 2 Substances		<0.03	<0.03	<0.2	≤0.022	≤0.024	≤0.17	≤0.036	≤0.04	≤0.28
Total Type 1 & 2 Substances		<0.04	<0.05	<0.3	≤0.036	≤0.04	≤0.28	≤0.053	≤0.059	≤0.41
Isokinetic Sampling Parameters										
Sampling time, min					120			120		
Isokinetic rate, %					98			98		

Date	21/06/2022	Client	Boral Cement Ltd
Report	R012821	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.		

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	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)	1445 & 1658	
Temperature, °C	115	
Temperature, K	388	
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 1450-1651			Test 2 1450-1652		
		Concentration mg/m ³	Corrected to 10% O ₂ mg/m ³	Mass Rate g/min	Concentration mg/m ³	Corrected to 10% O ₂ mg/m ³	Mass Rate g/min	Concentration mg/m ³	Corrected to 10% O ₂ mg/m ³	Mass Rate g/min
Hexavalent chromium		<0.002	<0.002	<0.02	<0.002	<0.002	<0.02	<0.003	<0.002	<0.02
Isokinetic Sampling Parameters										
Sampling time, min						120			120	
Isokinetic rate, %						98			97	

Date	24/06/2022	Client	Boral Cement Ltd
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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	29.7 (wet)	31.3 (dry)
Gas density at STP, kg/m³	1.33 (wet)	1.40 (dry)
Gas density at discharge conditions, kg/m³	0.87	
% Oxygen correction & Factor	10 %	1.08
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0910 & 1120	
Temperature, °C	109	
Temperature, K	382	
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		Average			Test 1 0915-1117			Test 2 0915-1117		
		Concentration mg/m ³	Corrected to 10% O ₂ mg/m ³	Mass Rate g/min	Concentration mg/m ³	Corrected to 10% O ₂ mg/m ³	Mass Rate g/min	Concentration mg/m ³	Corrected to 10% O ₂ mg/m ³	Mass Rate g/min
Solid Particles		44	48	340	44	48	340	44	48	330
Fine particulates (PM10)	(PSA)	28	30	210	27	29	210	28	31	220
Fine particulates (PM2.5)	(PSA)	11	12	85	11	11	81	12	13	89
Coarse Particulates		17	18	130	17	19	130	16	17	120
Sulfur dioxide		0.032	0.034	0.24	0.024	0.026	0.18	0.039	0.043	0.3
Sulfur trioxide and/or Sulfuric acid (as SO ₃)		0.031	0.033	0.23	0.031	0.034	0.24	0.03	0.032	0.23
Isokinetic Sampling Parameters										
Sampling time, min						120			120	
Isokinetic rate, %						95			96	
Gravimetric analysis date (total particulate)						29-06-2022			29-06-2022	

Date	24/06/2022	Client	Boral Cement Ltd
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Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane

Stack Parameters		
Moisture content, %v/v	12	
Gas molecular weight, g/g mole	29.6 (wet)	31.1 (dry)
Gas density at STP, kg/m ³	1.32 (wet)	1.39 (dry)
Gas density at discharge conditions, kg/m ³	0.86	
% Oxygen correction & Factor	10 %	1.18
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1120 & 1345	
Temperature, °C	110	
Temperature, K	383	
Velocity at sampling plane, m/s	31	
Volumetric flow rate, actual, m ³ /s	220	
Volumetric flow rate (wet STP), m ³ /s	140	
Volumetric flow rate (dry STP), m ³ /s	130	
Mass flow rate (wet basis), kg/hour	680000	

Isokinetic Results	Sampling time	Average			Test 1 1140-1341			Test 2 1140-1341		
		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)		0.094	0.11	0.72	0.095	0.11	0.72	0.094	0.11	0.72
Chlorine		<0.01	<0.01	<0.07	<0.01	<0.01	<0.08	<0.009	<0.01	<0.07
Total fluoride (as HF)		<0.02	<0.03	<0.2	<0.03	<0.03	<0.2	<0.02	<0.03	<0.2
Isokinetic Sampling Parameters										
Sampling time, min					120			120		
Isokinetic rate, %					95			97		

Date	21/06/2022	Client	Boral Cement Ltd
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Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane

Stack Parameters		
Moisture content, %v/v	13	
Gas molecular weight, g/g mole	30.0 (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 %	0.91
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0822 & 1445	
Temperature, °C	115	
Temperature, K	388	
Velocity at sampling plane, m/s	32	
Volumetric flow rate, actual, m³/s	220	
Volumetric flow rate (wet STP), m³/s	150	
Volumetric flow rate (dry STP), m³/s	130	
Mass flow rate (wet basis), kg/hour	700000	

Gas Analyser Results	Sampling time	Average			Minimum			Maximum		
		1028 - 1128			1028 - 1128			1028 - 1128		
		Concentration	Corrected to	Mass Rate	Concentration	Corrected to	Mass Rate	Concentration	Corrected to	Mass Rate
		mg/m ³	10% O ₂	g/min	mg/m ³	10% O ₂	g/min	mg/m ³	10% O ₂	g/min
			mg/m ³			mg/m ³			mg/m ³	
Combustion Gases										
Nitrogen oxides (as NO ₂)		920	840	7000	850	770	6400	1000	920	7700
Carbon monoxide		510	460	3900	440	400	3300	630	570	4800
		Concentration			Concentration			Concentration		
		% v/v			% v/v			% v/v		
Carbon dioxide		20.4			19.7			21.6		
Oxygen		8.9			8.4			9.5		

Date	21/06/2022	Client	Boral Cement Ltd
Report	R012821	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.		

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Dioxins & Furans (PCDDs & PCDFs)	Sampling time	Average			Test 1 0830 - 1437			Test 2 0830 - 1438		
		Corrected to			Corrected to			Corrected to		
		Concentration ng/m ³	10% O2 ng/m ³	Mass Rate ng/min	Concentration ng/m ³	10% O2 ng/m ³	Mass Rate ng/min	Concentration ng/m ³	10% O2 ng/m ³	Mass Rate ng/min
2,3,7,8-TCDF		0.00031	0.00028	2.4	0.00022	0.0002	1.6	0.0004	0.00037	3.1
2,3,7,8-TCDD		<0.0002	<0.0002	<2	<0.0001	<0.0001	<1	<0.0003	<0.0002	<2
1,2,3,7,8-PeCDF		0.000042	0.000039	0.32	0.00003	0.000027	0.23	0.000055	0.00005	0.42
2,3,4,7,8-PeCDF		0.00054	0.00049	4.1	0.00028	0.00025	2.1	0.00081	0.00073	6.1
1,2,3,7,8-PeCDD		<0.0001	<0.00009	<0.8	<0.00007	<0.00006	<0.5	<0.0001	<0.0001	<1
1,2,3,4,7,8-HxCDF		0.000054	0.000049	0.41	0.000031	0.000028	0.24	0.000076	0.00007	0.58
1,2,3,6,7,8-HxCDF		0.000051	0.000046	0.39	0.000028	0.000026	0.22	0.000074	0.000067	0.56
2,3,4,6,7,8-HxCDF		0.000035	0.000032	0.27	0.000019	0.000017	0.14	0.000051	0.000046	0.39
1,2,3,7,8,9-HxCDF		<0.00001	<0.00001	<0.09	<0.000009	<0.000009	<0.07	<0.00001	<0.00001	<0.1
1,2,3,4,7,8-HxCDD		<0.00001	<0.00001	<0.08	<0.000008	<0.000007	<0.06	<0.00001	<0.00001	<0.1
1,2,3,6,7,8-HxCDD		≤0.000013	≤0.000012	≤0.1	<0.000008	<0.000007	<0.06	0.000019	0.000017	0.14
1,2,3,7,8,9-HxCDD		<0.00001	<0.00001	<0.08	<0.000008	<0.000007	<0.06	<0.00001	<0.00001	<0.1
1,2,3,4,6,7,8-HpCDF		0.0000061	0.0000056	0.047	0.0000039	0.0000036	0.03	0.0000083	0.0000076	0.063
1,2,3,4,7,8,9-HpCDF		<0.000002	<0.000002	<0.01	<0.000001	<0.000001	<0.008	<0.000003	<0.000002	<0.02
1,2,3,4,6,7,8-HpCDD		0.000013	0.000012	0.1	0.0000051	0.0000047	0.039	0.000021	0.00002	0.16
OCDF		0.00000023	0.00000021	0.0017	0.0000002	0.00000018	0.0015	0.00000025	0.00000023	0.0019
OCDD		0.000047	0.000043	0.36	0.00001	0.0000095	0.079	0.000085	0.000077	0.64
Total TCDF isomers		0.052	0.047	390	0.037	0.033	280	0.067	0.061	510
Total TCDD isomers		0.0037	0.0034	28	0.0015	0.0014	11	0.0059	0.0054	45
Total PeCDF isomers		0.015	0.014	120	0.011	0.0096	80	0.02	0.018	150
Total PeCDD isomers		≤0.002	≤0.0018	≤15	<0.001	<0.001	<10	0.0027	0.0024	20
Total HxCDF isomers		0.0036	0.0033	28	0.0022	0.002	16	0.0051	0.0046	39
Total HxCDD isomers		0.0016	0.0014	12	0.00049	0.00044	3.7	0.0027	0.0024	20
Total HpCDF isomers		0.00061	0.00056	4.7	0.00039	0.00036	3	0.00083	0.00076	6.3
Total HpCDD isomers		0.0027	0.0025	21	0.001	0.00093	7.8	0.0044	0.004	34
Total PCDDs + PCDFs		0.13	0.12	980	0.063	0.058	480	0.19	0.18	1500
I-TEQ										
Lower Bound		0.0011	0.001	8.4	0.00062	0.00057	4.7	0.0016	0.0015	12
Middle Bound		0.0013	0.0012	9.7	0.00074	0.00067	5.6	0.0018	0.0017	14
Upper Bound		0.0015	0.0013	11	0.00086	0.00078	6.5	0.002	0.0019	16

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	360	360
Isokinetic rate, %	95	94

Date	21/06/2022	Client	Boral Cement Ltd
Report	R012821	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.		

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Polycyclic Aromatic Hydrocarbons (PAHs)	Sampling time	Average			Test 1 0830 - 1437			Test 2 0830 - 1438		
		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	110000	880000000	130000	120000	1000000000	99000	90000	760000000
2-Methylnaphthalene		37000	34000	280000000	42000	38000	320000000	32000	29000	240000000
Acenaphthylene		1500	1400	120000000	1500	1400	110000000	1600	1500	120000000
Acenaphthene		≤11	≤9.8	≤82000	<3	<2	<20000	19	17	140000
Fluorene		110	97	810000	100	93	780000	110	100	850000
Phenanthrene		590	540	4500000	540	490	4100000	640	590	4900000
Anthracene		14	12	100000	12	11	94000	15	13	110000
Fluoranthene		73	66	550000	39	36	300000	110	96	810000
Pyrene		42	39	320000	26	23	200000	59	54	450000
Benz(a)anthracene		≤17	≤15	≤130000	<3	<2	<20000	31	28	230000
Chrysene		≤55	≤50	≤420000	<3	<2	<20000	110	98	820000
Benzo(b)fluoranthene		<3	<2	<20000	<3	<2	<20000	<3	<2	<20000
Benzo(k)fluoranthene		<3	<2	<20000	<3	<2	<20000	<3	<2	<20000
Benzo(e)pyrene		<3	<2	<20000	<3	<2	<20000	<3	<2	<20000
Benzo(a)pyrene		<3	<2	<20000	<3	<2	<20000	<3	<2	<20000
Perylene		<3	<2	<20000	<3	<2	<20000	<3	<2	<20000
Indeno(1,2,3-cd)pyrene		<3	<2	<20000	<3	<2	<20000	<3	<2	<20000
Dibenz(ah)anthracene		<3	<2	<20000	<3	<2	<20000	<3	<2	<20000
Benzo(ghi)perylene		<3	<2	<20000	<3	<2	<20000	<3	<2	<20000
Total 16 PAHs		130000	120000	1000000000	130000	120000	1000000000	130000	120000	1000000000
Total 19 PAHs		160000	140000	1200000000	180000	160000	1300000000	130000	120000	1000000000
BaP-TEQ										
Lower Bound		2.1	1.9	16000	0	0	0	4.2	3.8	32000
Middle Bound		4.4	4	34000	2.4	2.2	19000	6.4	5.9	49000
Upper Bound		6.8	6.2	52000	4.9	4.5	37000	8.7	7.9	66000

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	360	360
Sampling time, min	95	94
Isokinetic rate, %		

Total VOCs (as n-Propane)	Average			Test 1			Test 2		
	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
Total	2	1.8	15	2.2	2	17	1.7	1.5	13

VOC (speciated)	Sampling time	Average			Test 1 0925-1025			Test 2 0925-1025		
		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
Detection limit ⁽¹⁾		<0.1	<0.09	<0.8	<0.1	<0.09	<0.8	<0.1	<0.09	<0.8
Benzene		2.3	2.1	17	2.8	2.5	21	1.8	1.6	14
Toluene		1.1	0.97	8.1	0.67	0.61	5.1	1.5	1.3	11
Heptane		≤0.17	≤0.15	≤1.3	0.23	0.21	1.8	<0.1	<0.09	<0.8
Methylcyclohexane		≤0.13	≤0.12	≤0.99	0.15	0.14	1.2	<0.1	<0.09	<0.8
Octane		≤0.18	≤0.16	≤1.4	0.26	0.23	2	<0.1	<0.09	<0.8
Nonane		≤0.15	≤0.13	≤1.1	0.19	0.17	1.4	<0.1	<0.09	<0.8

(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, m + p-Xylene, Styrene, o-Xylene, 2-Butoxyethanol, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, Propylbenzene, 1,3,5-Trimethylbenzene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, 1,2,3-Trimethylbenzene, Acetone, Pentane, Acrylonitrile, Methyl ethyl ketone, n-Hexane, Ethyl acetate, Cyclohexane, 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, Decane, 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%	✓	✓
Dry gas density	NA	NSW EPA TM-23 (USEPA Method 3)	not specified	NA	✓
Molecular weight	NA	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.
4 July 2022 in report LV-003036.
12 July 2022 in report LV-003050.
14 July 2022 in report R012821-ISE F.
15 July 2022 in report LV-003120.
- †† 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 6 July 2022 in report 299082-[R00].
- ‡‡ 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.
19 July 2022 in report ORG22_050.
29 July 2022 in report DAU22_178.
- ** Analysis performed by HRL Technology using a laser-diffraction particle size analyser. NATA accreditation does not cover the performance of this service. Results were reported to Ektimo on 4 July 2022 in report 220765.
- # Analysis (solid fluoride only) performed by Australian Laboratory Services Pty Ltd, NATA accreditation number 825. Results were reported to Ektimo on 7 July 2022 in report EN2206187.
- 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 odourant(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

1300 364 005

MELBOURNE (Head Office)

26 Redland Drive

Mitcham

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Result Sheet

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Date: **08/08/2022** File No. **6720283** Report No. **220805**
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

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	220805-1
Client's sample Description	WWDF June 2022
Ash Yield (% db)	
Ash Yield at 550°C	1.8
Total Moisture (% ar)	
Moisture Content	16.5
Calorific Value	
Gross Dry Calorific Value (MJ/kg db)	18.8
Gross Wet Calorific Value (MJ/kg ar)	15.7
S, Cl, F, Br, I (% db)	
S	0.10
Cl	0.06
F	<0.01
Br	<0.01
I	<0.01
Oxides (In Sample) (% db)	
K ₂ O	0.07
Na ₂ O	0.09
Biomass Content %	
Biomass Content	>90
Particle Size %	
> 50 mm	1.7
> 35 mm	13.5
< 35 mm	84.8

HRL Sample Description	220805-1
Client's sample Description	WWDF June 2022
Trace Metals mg/kg (db)	
As	84
Be	<1
Cd	<1
Cr	121
Co	<1
Cu	85
Hg	<0.05
Mn	52
Ni	3
Pb	26
Sb	2
Se	<1
Sn	1
Tl	<1
V	2
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 : **EM2215348**
Client : **HRL TECHNOLOGY GROUP PTY LTD**
Contact : **MR ANDREW GIETMAN**
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 : 11-Aug-2022 10:40
Date Analysis Commenced : 11-Aug-2022
Issue Date : 12-Aug-2022 14:26



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
Nancy Wang	2IC 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 due to the presence of high level contaminants. LOR values have been adjusted accordingly.

Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sample ID

				220805-1	----	----	----	----
Sampling date / time				11-Aug-2022 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EM2215348-001	-----	-----	-----	-----
Result					----	----	----	----
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.4	----	----	----	----
EP075(SIM)A: Phenolic Compounds								
Pentachlorophenol	87-86-5	2	mg/kg	<2	----	----	----	----
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	118	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	114	----	----	----	----
2-Chlorophenol-D4	93951-73-6	0.5	%	95.5	----	----	----	----
2,4,6-Tribromophenol	118-79-6	0.5	%	120	----	----	----	----
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	104	----	----	----	----
Anthracene-d10	1719-06-8	0.5	%	110	----	----	----	----
4-Terphenyl-d14	1718-51-0	0.5	%	114	----	----	----	----



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