

Report for the Periodic Monitoring of Emissions to Atmosphere

Shetland Islands Council

EP1 - Incinerator Stack

Permit No: PPC/A/1003141/VN03
Installation: Lerwick Energy Recovery Plant
Monitoring Dates: 31st October - 2nd November 2023
Site Address: Gremista Industrial Estate, Lerwick, Shetland, ZE1 OPX

Report Number: EK-0518
Date of Report: 27th February 2024
Report Author: redacted
MCERTS No: redacted

Version: 3 Visit: 2 in 2023

MCERTS Level:

redacted

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Executive Summary

Monitoring Objectives

Envirocare Technical Consultancy were contracted by Shetland Islands Council to carry out emissions monitoring, to determine the compliance of EK-0518 with the conditions specified in the operators permit (PPC/A/1003141/VN03) for emissions to atmosphere. The methodologies utilised and the results obtained form the basis of this report.

The substances requested for monitoring are listed below.

Emission Point Identification

Substances to be Monitored	EP1 - Incinerator Stack
Total Particulate Matter	✓
Carbon Monoxide	✓
Oxides of Nitrogen (as NO ₂)	✓
Total VOC	✓
Oxygen	✓
Ammonia (FTIR)	✓
Chloride (as HCl)	✓
Sulphur Dioxide	✓
Ammonia	✓
Cadmium & Thallium	✓
Heavy Metals	✓
Mercury	✓
Dioxins & Furans (I-TEQ)	✓
PCB's	✓
PAH's (Defra)	✓
Water Vapour	✓
Volumetric Flow	✓

Special requirements: none

Opinions and interpretations expressed within this report are outside the scope of Envirocare Technical Consultancy's MCERTS and UKAS accreditation. Envirocare accepts no responsibility for information in this report that was provided by the client, the client's representative or employees of the client. Where such information has been provided by external sources this is identified in footnotes of the respective tables.

Executive Summary

Monitoring Results

where MU = Measurement Uncertainty associated with the result (95% Confidence)

		Concentration					Mass Emission		Sampling Date	Sampling Times
Substance		Limit (mg/m³)	Result (mg/m³)	Measurement Uncertainty (MU) +/-	Reference Conditions	Limit (g/hr)	Result (g/hr)	Measurement Uncertainty (MU) +/-		
Total Particulate Matter	R1	30	1.5	0.55	273k, 101.3kPa, Dry Gas, 11% O ₂	-	33.4	11.9	01/11/2023	08:46-09:20
Carbon Monoxide	R1	50	1.3	4.2	273k, 101.3kPa, Dry Gas, 11% O ₂	-	29.0	91.5	01/11/2023	12:00-16:00
Oxides of Nitrogen (as NO ₂)	R1	400	144	8.6	273k, 101.3kPa, Dry Gas, 11% O ₂	-	3106	232	01/11/2023	12:00-16:00
Total VOC	R1	10	0.65	1.4	273k, 101.3kPa, Dry Gas, 11% O ₂	-	13.9	29.8	01/11/2023	12:00-16:00
Ammonia (FTIR)	R1	-	0.21	0.40	273k, 101.3kPa, Dry Gas, 11% O ₂	-	4.6	8.5	31/10/2023 02/11/2023	15:00-14:49
Chloride (as HCl)	R1	10	0.11	0.009	273k, 101.3kPa, Dry Gas, 11% O ₂	-	2.3	0.21	01/11/2023	08:46-09:20
Sulphur Dioxide	R1	50	0.62	0.05	273k, 101.3kPa, Dry Gas, 11% O ₂	-	13.3	1.19	01/11/2023	11:46-12:20
Ammonia	R1	10	< 0.07	0.006	273k, 101.3kPa, Dry Gas, 11% O ₂	-	< 1.5	0.15	01/11/2023	12:46-13:20
Water Vapour	Ave	-	18.7%	-	As Measured	-	-	-	-	-
Total Metals	R1	0.5	0.047	0.008	273k, 101.3kPa, Dry Gas, 11% O ₂	-	1.0	0.18	31/10/2023	12:10-12:44
Mercury	R1	0.05	< 0.00036	0.00008	273k, 101.3kPa, Dry Gas, 11% O ₂	-	0.0078	0.002	31/03/2023	13:10-13:44
	R2		< 0.00040	0.00008			0.0086	0.002	31/03/2023	14:16-14:50
	R3		0.00042	0.00008			0.0091	0.002	31/03/2023	15:16-15:50
	Ave		0.00036	0.00008			0.0078	0.002	-	-
Cadmium & Thallium	R1	0.05	< 0.0015	0.0005	273k, 101.3kPa, Dry Gas, 11% O ₂	-	< 0.03	0.02	31/10/2023	12:10-12:44
Volumetric Flow (Actual)	R1	-	35,421 m³/h	1604	As Measured	-	-	-	31/10/2023	11:20-11:26
Volumetric Flow (REF)	R1	-	21,534 m³/h	975	273k, 101.3kPa, Dry Gas, 11% O ₂	-	-	-	31/10/2023	11:20-11:26

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O₂.

Monitoring Results Continued

where MU = Measurement Uncertainty associated with the result (95% Confidence)

		Concentration				Mass Emission				
Substance		Limit (mg/m³)	Result (mg/m³)	Measurement Uncertainty (MU) +/-	Reference Conditions	Limit (g/hr)	Result (g/hr)	Measurement Uncertainty (MU) +/-	Sampling Date	Sampling Times
Dioxins Upper Limit (worst case where <LOD = LOD)										
Dioxins & Furans (H-TEQ)	R1	0.1 ng/m³	0.0011 ng/m³	0.0002	273k, 101.3kPa, Dry Gas, 11% O₂.	-	0.023 µg/h	0.004	02/11/2023	08:57-15:00
Dioxins & Furans (WHO Humans / Mammals)	R1	-	0.0010 ng/m³	0.0001		-	0.021 µg/h	0.003	02/11/2023	08:57-15:00
Dioxins & Furans (Fish)	R1	-	0.00095 ng/m³	0.0001		-	0.020 µg/h	0.003	02/11/2023	08:57-15:00
Dioxins & Furans (Birds)	R1	-	0.0024 ng/m³	0.0004		-	0.053 µg/h	0.008	02/11/2023	08:57-15:00
Dioxins Lower Limit (best case where <LOD = 0)										
Dioxins & Furans (H-TEQ)	R1	-	0.00087 ng/m³	0.0001	273k, 101.3kPa, Dry Gas, 11% O₂.	-	0.019 µg/h	0.003	02/11/2023	08:57-15:00
Dioxins & Furans (WHO Humans / Mammals)	R1	-	0.00074 ng/m³	0.0001		-	0.016 µg/h	0.002	02/11/2023	08:57-15:00
Dioxins & Furans (Fish)	R1	-	0.00065 ng/m³	0.0001		-	0.014 µg/h	0.002	02/11/2023	08:57-15:00
Dioxins & Furans (Birds)	R1	-	0.0022 ng/m³	0.0003		-	0.053 µg/h	0.007	02/11/2023	08:57-15:00
PCB's Upper Limit (worst case where <LOD = LOD)										
PCB's WHO TEQ (Humans / Mammals)	R1	-	0.000048 ng/m³	0.000004	273k, 101.3kPa, Dry Gas, 11% O₂.	-	0.0010 µg/h	0.0001	02/11/2023	08:57-15:00
PCB's WHO TEQ (Fish)	R1	-	0.0000037 ng/m³	0.0000003		-	0.000080 µg/h	0.000008	02/11/2023	08:57-15:00
PCB's WHO TEQ (Birds)	R1	-	0.00066 ng/m³	0.00006		-	0.014 µg/h	0.001	02/11/2023	08:57-15:00
PCB's Lower Limit (best case where <LOD = 0)										
PCB's WHO TEQ (Humans / Mammals)	R1	-	0.0000075 ng/m³	0.0000007	273k, 101.3kPa, Dry Gas, 11% O₂.	-	0.00016 µg/h	0.00002	02/11/2023	08:57-15:00
PCB's WHO TEQ (Fish)	R1	-	0.0000017 ng/m³	0.0000002		-	0.000036 µg/h	0.000004	02/11/2023	08:57-15:00
PCB's WHO TEQ (Birds)	R1	-	0.00062 ng/m³	0.00006		-	0.013 µg/h	0.001	02/11/2023	08:57-15:00
PAH's	R1	-	1.2 µg/m³	0.28	273k, 101.3kPa, Dry Gas, 11% O₂.	-	25.0 mg/hr	6.1	01/11/2023	14:00-15:03
Oxygen	R1	-	10.7%	0.22	As Measured, Dry Gas	-	-	-	01/11/2023	12:00-16:00
Volumetric Flow (Actual)	R1	-	35,421 m³/h	1604	As Measured	-	-	-	31/10/2023	11:20-11:26
Volumetric Flow (REF)	R1	-	21,534 m³/h	975	273k, 101.3kPa, Dry Gas, 11% O₂.	-	-	-	31/10/2023	11:20-11:26

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O₂.

Supporting Information

Appendix 1: General Information

Operating Information

Parameter	Process Details
Process Type	Waste to Energy Process
Continuous or Batch Process	Continuous
Operating Status	Normal Operation
Feedstock	Municiple Waste
Normal Load, Throughput or Continuous Rating	Approx 3 tonnes / Hour
Abatement System	ESP / Wet Scrubber / Bag Filter / SNCR
Abatement System Status	Normal Operation
Process Fuel	Natural Gas
Plume Appearance	Slight Steam Plume Visible

Monitoring Deviations

Parameter	Run	Deviation
Metals	Run 1	The absorption efficiency was less than the required 90% (85% - 89%).

Monitoring Organisation Staff Details

Personnel	Position	MCERTS Level	MCERTS Number
redacted			

Monitoring Methods

Pollutant Species	Standard	Technical Procedure	Testing MCERTS	Analysis Laboratory	Analytical Procedure	Analytical Technique	Analysis MCERTS
Volumetric Flow	BS EN ISO 16911-1	ETC-SE-24a	Yes	Pitot Tube and Thermocouple			
Total Particulate Matter	BS EN 13284-1	ETC-SE-01	Yes	Envirocare	ETC-AP-01	Gravimetric	Yes
Chloride (as HCl)	BS EN 1911	ETC-SE-05	Yes	RPS	C27(U)	IC	Yes
Sulphur Dioxide	BS EN 14791	ETC-SE-14	Yes	RPS	C27(U)	IC	Yes
Ammonia	BS EN ISO 21877	ETC-SE-15	Yes	RPS	A6(U)	IC	Yes
Carbon Monoxide	BS EN 15058	ETC-SE-10 (a/b)	Yes	NDIR by Horiba PG-250 or PG350E			
Oxides of Nitrogen	BS EN 14792	ETC-SE-10 (a/b)	Yes	Chemiluminescence by Horiba PG-250 or Horiba PG-350			
Oxygen	BS EN 14789	ETC-SE-10 (a/b)	Yes	Dry Zirconia Cell by Horiba PG-250 or Dry Paramagnetic by Horiba PG-350E			
Total VOC	BS EN 12619	ETC-SE-04	Yes	Flame Ionisation Detector by M&C Thermo FID or Sick 3006 FID			
Ammonia	PD-CEN-TS 17337	ETC-SE-28	Yes	Gasmet DX 4000 FTIR			
Dioxins & Furans	BS EN 1948	ETC-SE-18	Yes	Marchwood	WI 2002b	GCMS-HR	Yes
PCBs	BS EN 1948	ETC-SE-18	Yes	Marchwood	WI 2002b	GCMS-HR	Yes
PAHs	ISO 11338	ETC-SE-19	Yes	Marchwood	WI 2003	GC-MS (Soxhlet)	Yes
Metals	BS EN 14385	ETC-SE-09	Yes	RPS	M31(U)	ICP-MS	Yes
Mercury	BS EN 13211	ETC-SE-09	Yes	RPS	M112(U)	ICP-MS	Yes
Water Vapour	BS EN 14790	ETC-SE-11	Yes	ENV	ETC-SE-11	Gravimetric	Yes

Envirocare: 2522 | RPS Laboratories Ltd (RPS): 0605 | Marchwood Scientific Services: 1668

Equipment Checklist

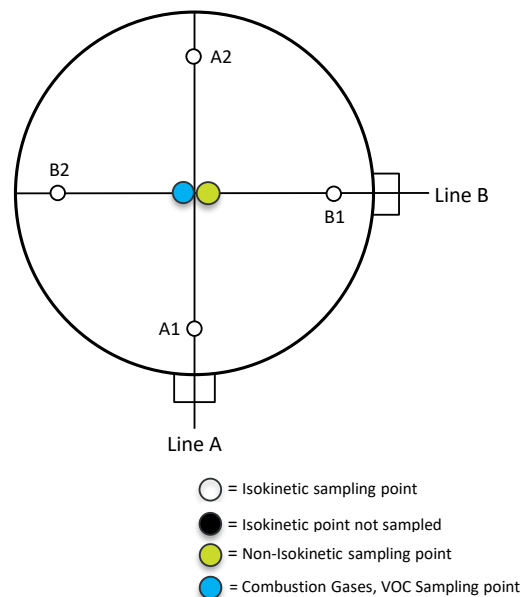
Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM	ETC-S8.07	Horiba PG-250	-	Tape Measure	ETC-S17.04
Box Thermocouples	ETC-S2.07a	Horiba PG-250 SRM	-	Bevel Box	-
Box Thermocouple In	ETC-S3.28	Horiba PG-350	ETC-S12.11	Stopwatch	ETC-S10.07
Box Thermocouple Out	ETC-S3.29	JCT JCC Cooler	-	Barometer	ETC-S11.05
Control Box Timer	ETC-S10.07	MAK10 Cooler	-	Digital Manometer	ETC-S25.04a/b
Umbilical	ETC-S2.07a	Horiba PS200 Cooler	-	Digital Temperature Meter	ETC-S25.04a/b
Oven Box	ETC-S9.03	M&C PSS Gas Preparation	ETC-S3.45b	Dual Channel Heat Controller	-
Heated Probe (1)	ETC-S4.23	Gasmet DX4000 FTIR	ETC-S15.01	1m Heated Line	ETC-S5.13
Heated Probe (2)	ETC-S4.19	Gasmet Sampling System	ETC-S15.01b	3m Heated Line	ETC-S5.14
Stack Thermocouple (1)	ETC-S1.67 / ETC-S1.68	SK-Thermo FID	ETC-S13.06	5m Heated Line	-
Stack Thermocouple (2)	ETC-S1.68	Bernath 3006 FID	-	10m Heated Line	-
S-Type Pitot (1)	ETC-S20.12S	Testo 350XL	-	20m Heated Line	ETC-S20.27
S-Type Pitot (2)	ETC-S20.21S	M&C PSP 4000	ETC-S7.07	30m Heated Line	-
L-Type Pitot	-	Easylogger EN-EL-12 Bit	-	Impinger Arm Thermocouple (1)	ETC-S3.14a
Site Balance	ETC-S18.07	Hioki 5043 (V)	-	Impinger Arm Thermocouple (2)	ETC-S3.03a
500g Check Weight	ETC-S18.07	Analyser Temperature Logger	ETC-S29.03	Dioxins Kit Thermocouple	-
1KG Check Weight	ETC-S18.07	-	-	Sample Temperature Logger	-
Digital Callipers	ETC-S16.07	-	-	Laboratory Balance	-

Appendix 2: EP1 - Incinerator Stack Results and Calculations

Picture of the sampling location



Sampling Points Diagram



Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.80
Width	m	-
Area	m ²	0.50
Port Depth	cm	15.0
Orientation of Stack / Duct	-	Vertical
Sampling Port Size	-	4" BSP
Number of Ports	-	2

Manual Sampling Points	Used / Required
Number of Sampling Lines	2 / 2
Number of Sampling Points	4 / 4
Instrumental Sampling Points	Used / Required
Number of Sampling Lines	1 / 1
Number of Sampling Points	1 / 1

Platform Type and Location	
Platform Type - Permanent / Temporary	Permanent
Location - Inside / Outside	Inside

EA Technical Guidance Note M1 Platform Requirements		
Load Baring Capacity	Load baring capacity of platform sufficient to fulfil the measurement objective	Yes
Position & Work Space	Sufficient work area to manipulate probe & operate the measurement instruments	Yes
	Depth of work area > internal diameter of stack and wall thickness plus 1.5m	No
	Ports on vertical ducts 1.2m to 1.5m above platform floor	Yes
	Platform has chains / self closing gates at top of ladders	Yes
Fall Prevention	Platform has adequate drainage to prevent accumulation of free-standing water	Yes
	Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	Yes
	Gaps between handrails not >0.5m	Yes
Access	Platform has vertical base boards (approx. 0.25m high)	Yes
	Access to sampling ports unhindered by obstructions	Yes
	Easy & safe access and egress available	Yes

Sampling Location / Platform Recommendations

The depth of the sampling platform does not allow for easy insertion of the sampling equipment, in an ideal world, the depth of the sampling platform would be equal to the stack diameter plus 1.5m.

Flow Criteria Measurements

Duct Diameter (m)	Cross Sectional Area (m²)	Barometric Pressure (mbar)	Ambient Temperature (°C)	Mean Oxygen (%)	Mean Carbon Dioxide (%)	Mean Water Vapour (%)	Stack Gas Molecular mass (g/mol)	Pitot Coefficient
0.80	0.50	1001	18	10.7	9.2	18.7	27.7	0.851

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (Pa)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
A	A1	11.7	234.2	234.2	234.2	234.2	19.4	98.9	3
	A2	68.3	245.6	245.6	245.6	245.6	19.9	99.1	3

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (Pa)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
B	B1	11.7	228.9	228.9	228.9	228.9	19.2	99.0	3
	B2	68.3	239.8	239.8	239.8	239.8	19.7	99.1	6

Parameter	Mean Duct Velocity	Velocity Ratio (Max:Min)	Mean Stack Temperature	Mean Stack Temperature	Stack Gas Volume Flow	Stack Gas Volume Flow (STP Wet)	Stack Gas Volume Flow (REF)
Value	19.6	1.0:1	99.0	372	35421	25685	21534
Units	m/s	-	°C	K	m³/hr	Nm³/hr	Nm³/hr

Total Particulate Matter - Run 1 Calculations

Parameter	Value	Unit
Meter Box Number	8.07	-
Gas Meter Coefficient	1.071	-
Pitot Coefficient	0.849	-
Stack Gas Molecular Weight	29.8	g/mole
Static Pressure in Stack	-1.5	cmH ₂ O

Parameter	Value	Unit
Nozzle Diameter	6.0	mm
Average Gas Meter Temperature	15.1	°C
Average Stack Temperature	99.0	°C
Average Stack Velocity	19.6	m/s
Isokineticity	101.8	%
Total Sampling Time	32	min
Gas Meter Difference	647	L
Corrected Gas Meter Volume	693	L
Mean Sampling Rate	21.6	L/min

Date	Operators
01/11/2023	SD / AL

Parameter	Before	After	Unit
Barometric Pressure	999	999	mbar
Ambient Temperature	16.0	17.0	°C
Leak Check	0.08	-	L/min
Time	08:46	09:20	-

Parameter	Value	Unit
Gas Meter Volume (STP Dry)	0.647	Nm ³
Gas Meter Volume (REF)	0.671	Nm ³
Stack Gas Water Vapour Content	18.73	% v/v
Stack Gas Oxygen Content	10.6	% v/v
TPM Concentration (REF)	1.5	mg/Nm ³
TPM Mass Emissions (REF)	33.4	g/hr

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O₂

Total Particulate Matter - Analysis Results

Sampling Run Number	Filter Reference	Filter Type	Filter Mass	Probe Wash Mass (mg)	Total Mass Deposit (mg)
			Change (mg)		
Blank	47-5498	47mm GFA	0.08	< 0.25	0.33
1	47-5039	47mm GFA	0.79	< 0.25	1.0

Sampling Run Number	Measured	Impinger Mass (g)				Collected Mass (g)
		1	2	3	4	
1	Before	696	709	706	957	120
	After	787	734	710	957	

Parameter	Value	Unit
Emission Limit Value (ELV)	30	mg/m ³
Overall Blank Value (OBV)	0.50	mg/m ³
OBV <10% of ELV	Yes	-

Date of Analysis	10/11/2023
Analytical Laboratory	Envirocare
Analytical Method	Gravimetric
Accreditation	MCERTS

Instrumental Gas Analyser Calibrations

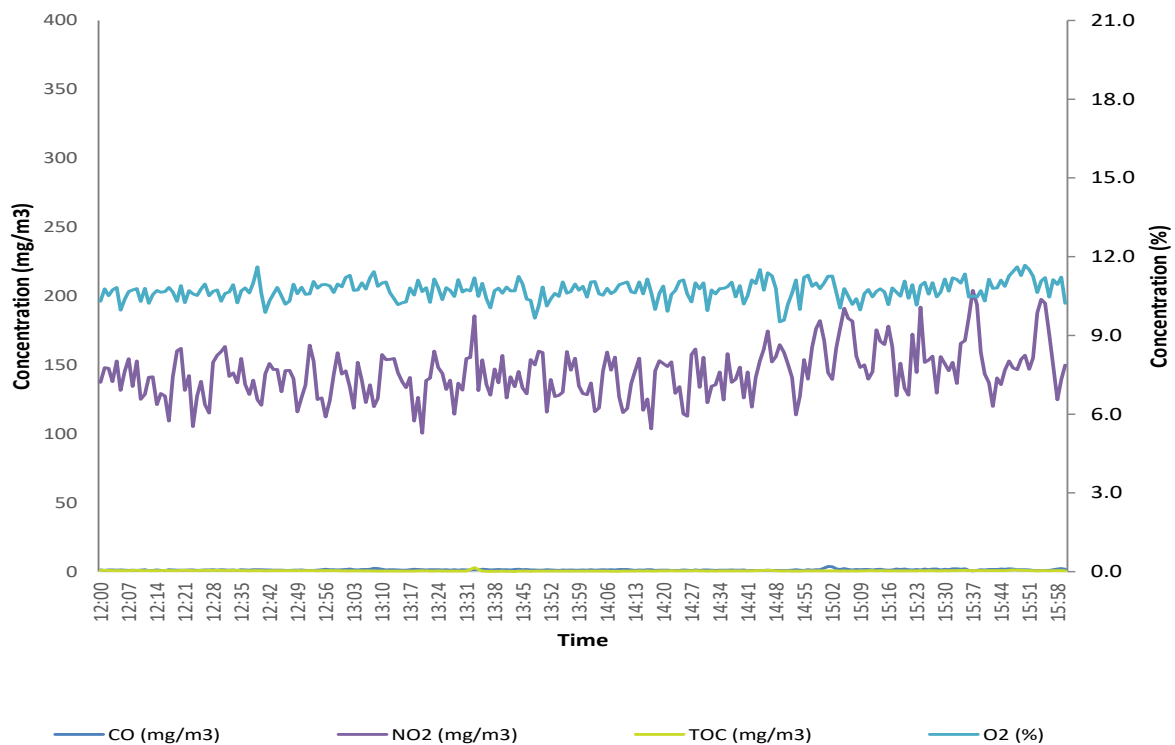
Date	Operators	Combustion Gas Analyser	Flame Ionisation Detector
01/11/2023	redacted	12.11	13.06

Calibration Gas	Certified Concentration	Analyser Range	T90 Time	Analyser Span	Pre-sample Cal		Post-sample Cal		Zero Drift (%)	Span Drift (%)	Drift Acceptable
					Zero	Span	Zero	Span			
Carbon Monoxide	162.84ppm	200ppm	40	163	0.20	163	0.10	160	0.06	-1.8	Yes
Nitrogen Monoxide	205.28ppm	250ppm	49	205	0.10	205	0.20	202	0.10	-1.9	Yes
Propane	83.2ppm	100ppm	15	83.2	-0.03	81.8	-0.45	81.4	-0.54	-1.6	Yes
Oxygen	20.77%	25%	44	20.8	0.04	20.8	0.11	21.0	0.53	0.34	Yes

Instrumental Gas Analyser Results

Substance	Run	Corrected Concentration			Units	Basis	O ₂ Correction
		Average	Max	Min			
Carbon Monoxide	1	1.3	3.7	0.64	mg/m ³	-	11%
Oxides of Nitrogen (as NO ₂)	1	144	204	100	mg/m ³	NO _x as NO ₂	11%
Total VOC	1	0.65	3.0	0.14	mg/m ³	VOC as C	11%
Oxygen	1	10.7	11.7	9.5	%	-	-

Instrumental Gas Analyser Chart - Run 1



Instrumental FTIR Gas Analyser Calibrations

Date	Operators	FTIR Analyser
31/10/2023	redacted	15.01

Instrumental FTIR Gas Analyser Results

Substance	Run	Corrected Concentration			Units	Analysis Areas (Wave Number Limits)	O ₂ Correction
		Average	Max	Min			
Ammonia	1	0.21	0.57	0.07	mg/m ³	910 - 1150	11.0%

FTIR Analyser Details

Parameter	Details
FTIR Path Length (m)	5.0
FTIR Cell Temperature (°C)	180.0
FTIR Cell Pressure (mbar)	1006

Sampling System Details

Parameter	Details
Sampling Probe Type	Stainless Steel
Filtration Type	0.1 µm GF
Heated Line Temperature (°C)	180

Quality Assurance

Parameter	Details
Minimum Energy in Cell (AU)	-0.0004
Maximum Energy in Cell (AU)	0.0010
Allowable Energy in Cell (±AU)	+/- 0.005

Calibration Gas Details

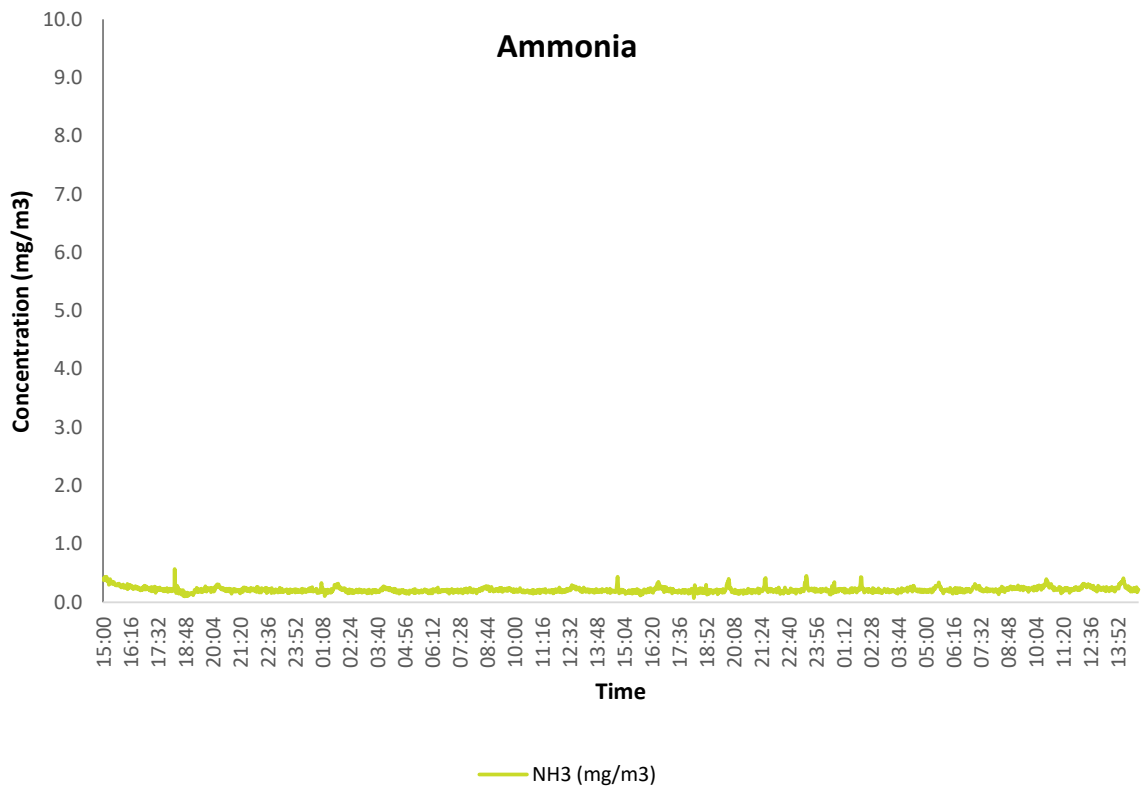
Parameter	CO	SO ₂	NO	C ₃ H ₈
Zero Gas Type	Nitrogen 5.0	Nitrogen 5.0	Nitrogen 5.0	Nitrogen 5.0
Check Gas Type	CO	SO ₂	NO	C ₃ H ₈
Check Gas Reference Number	253289SG	253289SG	253289SG	253289SG
Check Gas Concentration (ppm)	100.17	98.64	410.61	81.99
Check Gas Uncertainty (%)	2.0	2.0	2.0	2.0
Sample Line Validation Gas	HCl	HCl	HCl	HCl
Validation Gas Reference Number	302080SG	302080SG	302080SG	302080SG
Validation Gas Concentration (ppm)	15.84	15.84	15.84	15.84
Validation Gas Uncertainty (%)	2.0	2.0	2.0	2.0

Interference Check

Parameter	Max (r _i)	Max (s _i)	Max (δ _i)
Ammonia	0.0005	0.046	1.1

						Line Validation Gas
Check Gases Check - Pre Test	Units	NO	CO	SO ₂	C ₃ H ₈	HCl
Response Time Site (T ₉₀)	Seconds	20	20	25	20	25
Allowable Response Time	Seconds	200	200	200	200	300
Response Time Acceptable	Seconds	Yes	Yes	Yes	Yes	Yes
Response Time (ASC T ₉₀)	Seconds	10	15	45	15	45
System Lag Time (T ₉₀ - ASC T ₉₀)	Seconds	10	5	-20.0	5	-20.0
Check Gas Reference	-	253289SG	253289SG	253289SG	253289SG	302080SG
Check Gas Concentration	ppm	410.6	100.2	98.6	82.0	15.8
FTIR Response	ppm	403.6	99.8	97.5	80.6	15.7
Diffrence	ppm	-7.0	-0.41	-1.1	-1.4	-0.13
Allowable Diffrence (5%)	±ppm	20.5	5.0	4.9	4.1	0.79
FTIR Response Acceptable	-	Yes	Yes	Yes	Yes	Yes
FTIR Response - Pre Test	ppm	403.6	99.8	97.5	80.6	15.7
FTIR Response - Post Test	ppm	397.3	99.8	98.2	78.4	15.6
FTIR Response Drift	%	-1.5	0.04	0.71	-2.8	-1.0
Allowable Diffrence	%	5.0	5.0	5.0	5.0	5.0
Drift Acceptable	-	Yes	Yes	Yes	Yes	Yes

FTIR Gas Analyser Chart - Run 1



Chloride (as HCl) - Run 1 Calculations

Sampling Details		
Meter Box Number	8.07	-
Gas Meter Coefficient	1.071	-
Pitot Coefficient	0.849	-
Stack Gas Molecular Weight	29.8	g/mole
Static Pressure in Stack	-1.5	cmH ₂ O

Analysis Details		
Collection Media	De-ionised Water	
1st Collector Reference	Imp A&B	
1st Collector Concentration	66.082	µg
2nd Collector Reference	Imp C	
2nd Collector Concentration	<6.055	µg
Blank Concentration	< 0.025	mg/Nm ³
Has breakthrough occurred?	No	-

Isokineticity Details		
Nozzle Diameter	6.0	mm
Average Gas Meter Temperature	15.1	°C
Average Stack Temperature	99.0	°C
Average Stack Velocity	19.6	m/s
Isokineticity	101.8	%

Date	Operators
01/11/2023	redacted

Parameter	Before	After	Unit
Barometric Pressure	999	999	mbar
Ambient Temperature	16.0	17.0	°C
Leak Check	0.08	-	L/min
Time	08:46	09:20	-

Emissions Calculations		
Total Sampling Time	32.0	min
Gas Meter Difference	647.0	L
Corrected Gas Meter Volume	692.6	L
Mean Sampling Rate	21.6	L/min
Gas Meter Volume (STP Dry)	0.647	Nm ³
Gas Meter Volume (REF)	0.671	Nm ³
Stack Gas Water Vapour Content	18.7	% v/v
Stack Gas Oxygen Content	10.6	% v/v
Emission Limit Value	10	mg/Nm ³
Concentration (REF)	0.11	mg/Nm ³
Mass Emissions (REF)	2.3	g/hr

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O₂

Sulphur Dioxide - Run 1 Calculations

Sampling Details		
Meter Box Number	8.07	-
Gas Meter Coefficient	1.071	-
Pitot Coefficient	0.849	-
Stack Gas Molecular Weight	29.8	g/mole
Static Pressure in Stack	-1.5	cmH ₂ O

Analysis Details		
Collection Media	H2O2	
1st Collector Reference	Imp A&B	
1st Collector Concentration	393.354	µg
2nd Collector Reference	Imp C	
2nd Collector Concentration	22.591	µg
Blank Concentration	0.05	mg/Nm ³
Has breakthrough occurred?	Yes	-

Isokineticity Details		
Nozzle Diameter	6.0	mm
Average Gas Meter Temperature	16.8	°C
Average Stack Temperature	98.0	°C
Average Stack Velocity	19.6	m/s
Isokineticity	101.2	%

Date	Operators
01/11/2023	redacted

Parameter	Before	After	Unit
Barometric Pressure	999	999	mbar
Ambient Temperature	16.0	17.0	°C
Leak Check	0.08	-	L/min
Time	11:46	12:20	-

Emissions Calculations		
Total Sampling Time	32.0	min
Gas Meter Difference	653.0	L
Corrected Gas Meter Volume	699.0	L
Mean Sampling Rate	21.8	L/min
Gas Meter Volume (STP Dry)	0.649	Nm ³
Gas Meter Volume (REF)	0.675	Nm ³
Stack Gas Water Vapour Content	18.2	% v/v
Stack Gas Oxygen Content	10.6	% v/v
Emission Limit Value	50	mg/Nm ³
Concentration (REF)	0.62	mg/Nm ³
Mass Emissions (REF)	13.3	g/hr

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O₂

Ammonia - Run 1 Calculations

Sampling Details		
Meter Box Number	8.07	-
Gas Meter Coefficient	1.071	-
Pitot Coefficient	0.849	-
Stack Gas Molecular Weight	29.8	g/mole
Static Pressure in Stack	-1.5	cmH ₂ O

Analysis Details		
Collection Media	H2SO4	
1st Collector Reference	Imp A&B	
1st Collector Concentration	<34.89	µg
2nd Collector Reference	Imp C	
2nd Collector Concentration	<12.13	µg
Blank Concentration	< 0.05	mg/Nm ³
Has breakthrough occurred?	No	-

Isokineticity Details		
Nozzle Diameter	6.05	mm
Average Gas Meter Temperature	18.2	°C
Average Stack Temperature	97.4	°C
Average Stack Velocity	19.29	m/s
Isokineticity	104.3	%

Date	Operators
01/11/2023	redacted

Parameter	Before	After	Unit
Barometric Pressure	999	999	mbar
Ambient Temperature	17.00	17.00	°C
Leak Check	0.08	-	L/min
Time	12:46	13:20	-

Emissions Calculations		
Total Sampling Time	32.0	min
Gas Meter Difference	660.0	L
Corrected Gas Meter Volume	706.5	L
Mean Sampling Rate	22.1	L/min
Gas Meter Volume (STP Dry)	0.653	Nm ³
Gas Meter Volume (REF)	0.668	Nm ³
Stack Gas Water Vapour Content	19.0	% v/v
Stack Gas Oxygen Content	10.8	% v/v
Emission Limit Value	10.0	mg/Nm ³
Concentration (REF)	< 0.07	mg/Nm ³
Mass Emissions (REF)	< 1.5	g/hr

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O₂

Metals - Run 1 Calculations

Parameter	Value	Unit
Meter Box Number	8.07	-
Gas Meter Coefficient	1.071	-
Pitot Coefficient	0.849	-
Stack Gas Molecular Weight	30.2	g/mole
Static Pressure in Stack	-1.5	cmH ₂ O

Parameter	Value	Unit
Nozzle Diameter	6.0	mm
Average Gas Meter Temperature	15.0	°C
Average Stack Temperature	98.5	°C
Average Stack Velocity	19.9	m/s
Isokineticity	111.8	%
Total Sampling Time	32	min
Gas Meter Difference	712	L
Corrected Gas Meter Volume	762	L
Mean Sampling Rate	23.8	L/min

Date	Operators
31/10/2023	Redacted

Parameter	Before	After	Unit
Barometric Pressure	1001	1001	mbar
Ambient Temperature	15.0	16.0	°C
Leak Check	0.11	0.14	L/min
Time	12:10	12:44	-

Parameter	Value	Unit
Gas Meter Volume (STP Dry)	0.714	Nm ³
Gas Meter Volume (REF)	0.737	Nm ³
Mass of Water Vapour Collected	142.4	g
Volume of Water Vapour Collected	177.3	NL
Stack Gas Water Vapour Content	19.9	% v/v
Stack Gas Oxygen Content	10.7	% v/v

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O₂.

Measured	Impinger Mass (g)							Collected Mass (g)
	1	2	3	4	5	6	7	
Before	690.3	702.2	701.0	950.0	-	-	-	142.4
After	784.5	734.1	710.2	957.1	-	-	-	

Metal	Run Filter (µg)	Run Rinse (µg)	Run Impingers (µg)				Run Total (µg)	Run Absorb Eff.	Run Emission (mg/m ³)	Blank Total (µg)	Blank Emission (mg/m ³)
			1+2	3	5	6					
Arsenic	< 0.20	< 0.30	< 0.10	< 0.04	-	-	< 0.64	100%	< 0.00087	< 0.60	< 0.00082
Cadmium	< 0.20	< 0.30	< 0.07	< 0.02	-	-	< 0.59	100%	< 0.00081	< 0.60	< 0.00082
Cobalt	< 0.20	0.30	< 0.07	< 0.02	-	-	0.59	100%	0.00081	< 0.57	< 0.00077
Chromium	0.60	1.3	1.9	19.4	-	-	23.1	16.3%	0.031	3.5	0.0047
Copper	< 0.20	0.70	0.35	0.10	-	-	1.3	92.8%	0.0018	< 0.73	< 0.0010
Manganese	0.30	1.5	< 0.07	< 0.02	-	-	1.9	100%	0.0026	0.57	0.00077
Nickel	< 0.50	1.8	0.35	0.06	-	-	2.7	97.8%	0.0037	< 0.70	< 0.00095
Lead	< 0.30	2.6	0.38	0.07	-	-	3.4	97.8%	0.0046	< 0.57	< 0.00077
Antimony	< 0.40	< 0.20	< 0.07	< 0.02	-	-	< 0.69	100%	< 0.00094	< 0.67	< 0.00091
Thallium	< 0.20	< 0.20	< 0.07	< 0.02	-	-	< 0.49	100%	< 0.00067	< 0.47	< 0.00063
Vanadium	< 0.20	< 0.20	< 0.03	< 0.01	-	-	< 0.45	100%	< 0.00061	< 0.43	< 0.00059
Total Metals	-						34.8	89.4%	0.047	8.3	0.011
Cadmium & Thallium	-						< 1.1	100%	< 0.0015	< 1.1	< 0.0015

Mercury - Run 1 Calculations

Parameter	Value	Unit
Meter Box Number	8.07	-
Gas Meter Coefficient	1.071	-
Pitot Coefficient	0.849	-
Stack Gas Molecular Weight	30.2	g/mole
Static Pressure in Stack	-1.5	cmH ₂ O

Parameter	Value	Unit
Nozzle Diameter	6.0	mm
Average Gas Meter Temperature	14.6	°C
Average Stack Temperature	98.0	°C
Average Stack Velocity	18.9	m/s
Isokineticity	107.8	%
Total Sampling Time	32	min
Gas Meter Difference	675	L
Corrected Gas Meter Volume	723	L
Mean Sampling Rate	22.6	L/min

Date	Operators
31/03/2023	redacted

Parameter	Before	After	Unit
Barometric Pressure	1001	1001	mbar
Ambient Temperature	15.0	16.0	°C
Leak Check	0.10	0.12	L/min
Time	13:10	13:44	-

Parameter	Value	Unit
Gas Meter Volume (STP Dry)	0.678	Nm ³
Gas Meter Volume (REF)	0.700	Nm ³
Mass of Water Vapour Collected	112.0	g
Volume of Water Vapour Collected	139.5	NL
Stack Gas Water Vapour Content	17.1	% v/v
Stack Gas Oxygen Content	10.7	% v/v

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O₂.

Measured	Impinger Mass (g)							Collected Mass (g)
	1	2	3	4	5	6	7	
Before	669.1	691.4	680.9	857.3	-	-	-	112.0
After	701.2	726.9	705.6	877.0	-	-	-	

Metal	Run Filter (µg)	Run Rinse (µg)	Run Impingers (µg)				Run Total (µg)	Run Absorb Eff.	Run Emission (mg/m3)	Blank Total (µg)	Blank Emission (mg/m3)
			1+2	3	5	6					
Mercury	< 0.03	< 0.02	< 0.14	< 0.07	-	-	< 0.25	100%	< 0.00036	< 0.21	< 0.00030

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O₂.

Mercury - Run 2 Calculations

Parameter	Value	Unit
Meter Box Number	8.07	-
Gas Meter Coefficient	1.071	-
Pitot Coefficient	0.849	-
Stack Gas Molecular Weight	30.2	g/mole
Static Pressure in Stack	-1.5	cmH ₂ O

Parameter	Value	Unit
Nozzle Diameter	6.0	mm
Average Gas Meter Temperature	13.9	°C
Average Stack Temperature	98.0	°C
Average Stack Velocity	19.2	m/s
Isokineticity	102.5	%
Total Sampling Time	32	min
Gas Meter Difference	632	L
Corrected Gas Meter Volume	677	L
Mean Sampling Rate	21.1	L/min

Date	Operators
31/03/2023	redacted

Parameter	Before	After	Unit
Barometric Pressure	1001	1001	mbar
Ambient Temperature	15.0	17.0	°C
Leak Check	0.13	0.13	L/min
Time	14:16	14:50	-

Parameter	Value	Unit
Gas Meter Volume (STP Dry)	0.636	Nm ³
Gas Meter Volume (REF)	0.662	Nm ³
Mass of Water Vapour Collected	123.7	g
Volume of Water Vapour Collected	154.0	NL
Stack Gas Water Vapour Content	19.5	% v/v
Stack Gas Oxygen Content	10.6	% v/v

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O₂.

Measured	Impinger Mass (g)							Collected Mass (g)
	1	2	3	4	5	6	7	
Before	678.2	694.0	680.9	857.3	-	-	-	123.7
After	708.4	736.0	707.5	882.2	-	-	-	

Metal	Run Filter (µg)	Run Rinse (µg)	Run Impingers (µg)				Run Total (µg)	Run Absorb Eff.	Run Emission (mg/m3)
			1+2	3	5	6			
Mercury	< 0.03	< 0.02	< 0.15	< 0.07	-	-	< 0.27	100%	< 0.00040

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O₂.

Mercury - Run 3 Calculations

Parameter	Value	Unit
Meter Box Number	8.07	-
Gas Meter Coefficient	1.071	-
Pitot Coefficient	0.849	-
Stack Gas Molecular Weight	30.2	g/mole
Static Pressure in Stack	-1.5	cmH ₂ O

Parameter	Value	Unit
Nozzle Diameter	6.0	mm
Average Gas Meter Temperature	13.2	°C
Average Stack Temperature	98.0	°C
Average Stack Velocity	19.0	m/s
Isokineticity	101.1	%
Total Sampling Time	32	min
Gas Meter Difference	623	L
Corrected Gas Meter Volume	668	L
Mean Sampling Rate	20.9	L/min

Date	Operators
31/03/2023	redacted

Parameter	Before	After	Unit
Barometric Pressure	1001	1001	mbar
Ambient Temperature	15.0	16.0	°C
Leak Check	0.09	0.12	L/min
Time	15:16	15:50	-

Parameter	Value	Unit
Gas Meter Volume (STP Dry)	0.629	Nm ³
Gas Meter Volume (REF)	0.659	Nm ³
Mass of Water Vapour Collected	114.1	g
Volume of Water Vapour Collected	142.1	NL
Stack Gas Water Vapour Content	18.4	% v/v
Stack Gas Oxygen Content	10.5	% v/v

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O₂.

Measured	Impinger Mass (g)							Collected Mass (g)
	1	2	3	4	5	6	7	
Before	683.5	685.2	682.1	873.2	-	-	-	114.1
After	746.2	721.0	692.4	878.5	-	-	-	

Metal	Run Filter (µg)	Run Rinse (µg)	Run Impingers (µg)				Run Total (µg)	Run Absorb Eff.	Run Emission (mg/m3)
			1+2	3	5	6			
Mercury	< 0.03	< 0.02	< 0.17	< 0.06	-	-	< 0.28	100%	< 0.00042

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O₂.

Dioxins & Furans Calculations

Parameter	Value	Unit
Meter Box Number	8.07	-
Gas Meter Coefficient	1.071	-
Pitot Coefficient	0.849	-
Stack Gas Molecular Weight	29.8	g/mole
Static Pressure in Stack	-1.5	cmH ₂ O

Parameter	Value	Unit
Nozzle Diameter	4.12	mm
Average Gas Meter Temperature	19.3	°C
Average Stack Temperature	98.6	°C
Average Stack Velocity	18.95	m/s
Isokineticity	100.8	%
Total Sampling Time	360	min
Gas Meter Difference	3305	L
Corrected Gas Meter Volume	3538	L
Mean Sampling Rate	9.8	L/min

Date	Operators
02/11/2023	redacted

Parameter	Before	After	Unit
Barometric Pressure	989	989	mbar
Ambient Temperature	16.0	17.0	°C
Leak Check	0.15	0.23	L/min
Time	08:57	15:00	-

Parameter	Value	Unit
Gas Meter Volume (STP Dry)	3.226	Nm ³
Gas Meter Volume (REF)	3.307	Nm ³
Mass of Water Vapour Collected	577	g
Volume of Water Vapour Collected	719	NL
Stack Gas Water Vapour Content	18.2	% v/v
Stack Oxygen Content	10.8	% v/v

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O₂.

Condenser Exit Temperature	Value	Unit
Maximum Temperature Recorded	17.0	°C

Measured	Impinger Mass (g)							Collected Mass (g)
	1	2	3	4	5	6	7	
Before	356.0	601.3	602.5	940.8	-	-	-	577.4
After	867.9	653.4	603.0	953.7	-	-	-	

Dioxins & Furans Blank

Congener	Result ng	DL ng	TEFs NATO	TEQ1 NATO I-TEQ	TEQ2 NATO I-TEQ	TEFs Mammals	TEQ1 Mammals	TEQ2 Mammals	TEFs Fish	TEQ1 Fish	TEQ2 Fish	TEFs Birds	TEQ1 Birds	TEQ2 Birds	Rec %
2378-TCDD	ND	0.00042	1.000	0.00042	0.00000	1.000	0.00042	0.00000	1.000	0.00042	0.00000	1.0000	0.00042	0.00000	102
12378-PCDD	ND	0.00107	0.500	0.00054	0.00000	1.000	0.00107	0.00000	1.000	0.00107	0.00000	1.0000	0.00107	0.00000	88
123478-HxCDD	ND	0.00047	0.100	0.00005	0.00000	0.100	0.00005	0.00000	0.500	0.00024	0.00000	0.0500	0.00002	0.00000	84
123678-HxCDD	ND	0.00053	0.100	0.00005	0.00000	0.100	0.00005	0.00000	0.010	0.00001	0.00000	0.0100	0.00001	0.00000	95
123789-HxCDD	ND	0.00049	0.100	0.00005	0.00000	0.100	0.00005	0.00000	0.010	0.00000	0.00000	0.1000	0.00005	0.00000	-
1234678-HpCDD	0.0068	0.0007	0.010	0.00007	0.00007	0.010	0.00007	0.00007	0.001	0.00001	0.00001	0.0010	0.00001	0.00000	82
OCDD	0.0169	0.0022	0.001	0.00002	0.00002	0.0003	0.00001	0.00001	0.0001	0.00000	0.00000	0.0001	0.00000	0.00000	76
Total Dioxins	0.0237	0.0059	-	0.00119	0.00008	-	0.00171	0.00007	-	0.00174	0.00001	-	0.00158	0.00000	-
2378TCDF	0.00168	0.00074	0.100	0.00017	0.00017	0.100	0.00017	0.00017	0.050	0.00008	0.00008	1.0000	0.00168	0.00168	95
12378-PCDF	ND	0.00036	0.050	0.00002	0.00000	0.030	0.00001	0.00000	0.050	0.00002	0.00000	0.1000	0.00004	0.00000	107
23478-PCDF	ND	0.00035	0.500	0.00018	0.00000	0.300	0.00011	0.00000	0.500	0.00018	0.00000	1.0000	0.00035	0.00000	90
123478-HxCDF	0.00095	0.00034	0.100	0.00010	0.00010	0.100	0.00010	0.00010	0.100	0.00010	0.00010	0.1000	0.00010	0.00010	82
123678-HxCDF	0.00103	0.00032	0.100	0.00010	0.00010	0.100	0.00010	0.00010	0.100	0.00010	0.00010	0.1000	0.00010	0.00010	83
234678-HxCDF	ND	0.00029	0.100	0.00003	0.00000	0.100	0.00003	0.00000	0.100	0.00003	0.00000	0.1000	0.00003	0.00000	92
123789-HxCDF	ND	0.00026	0.100	0.00003	0.00000	0.100	0.00003	0.00000	0.100	0.00003	0.00000	0.1000	0.00003	0.00000	71
1234678-HpCDF	0.00364	0.00029	0.010	0.00004	0.00004	0.010	0.00004	0.00004	0.010	0.00004	0.00004	0.0100	0.00004	0.00004	73
1234789-HpCDF	0.00049	0.00034	0.010	0.00000	0.00000	0.010	0.00000	0.00000	0.010	0.00000	0.00000	0.0100	0.00000	0.00000	97
OCDF	ND	0.00064	0.001	0.00000	0.00000	0.0003	0.00000	0.00000	0.0001	0.00000	0.00000	0.0001	0.00000	0.00000	75
Total Furans	0.0315	-	-	0.00066	0.00041	-	0.00058	0.00041	-	0.00057	0.00032	-	0.0024	0.0019	-
Totals ng	0.0315	-	-	0.0018	0.00049	-	0.0023	0.0005	-	0.0023	0.00033	-	0.0039	0.00192	-
Total Concentration ng/m ³	-	-	-	0.00056	0.00015	-	0.00069	0.0001	-	0.00070	0.00010	-	0.0012	0.00058	-

Dioxins & Furans Calculations Continued

Dioxins & Furans Run 1

Congener	Result ng	DL ng	TEFs NATO	TEQ1 NATO I-TEQ	TEQ2 NATO I-TEQ	TEFs Mammals	TEQ1 Mammals	TEQ2 Mammals	TEFs Fish	TEQ1 Fish	TEQ2 Fish	TEFs Birds	TEQ1 Birds	TEQ2 Birds	Rec %
2378-TCDD	ND	0.0003	1.0000	0.0003	0.0000	1.0000	0.0003	0.0000	1.0000	0.0003	0.0000	1.0000	0.0003	0.0000	110
12378-PCDD	ND	0.0004	0.5000	0.0002	0.0000	1.0000	0.0004	0.0000	1.0000	0.0004	0.0000	1.0000	0.0004	0.0000	106
123478-HxCDD	ND	0.0004	0.1000	0.0000	0.0000	0.1000	0.0000	0.0000	0.5000	0.0002	0.0000	0.0500	0.0000	0.0000	96
123678-HxCDD	0.0026	0.0004	0.1000	0.0003	0.0003	0.1000	0.0003	0.0003	0.0100	0.0000	0.0000	0.0100	0.0000	0.0000	96
123789-HxCDD	0.0013	0.0004	0.1000	0.0001	0.0001	0.1000	0.0001	0.0001	0.0100	0.0000	0.0000	0.1000	0.0001	0.0001	-
1234678-HpCDD	0.0169	0.0004	0.0100	0.0002	0.0002	0.0100	0.0002	0.0002	0.0010	0.0000	0.0000	0.0010	0.0000	0.0000	76
OCDD	0.0285	0.0005	0.0010	0.0000	0.0000	0.0003	0.0000	0.0000	0.0001	0.0000	0.0000	0.0001	0.0000	0.0000	87
Total Dioxins	0.0493	0.0030	-	0.0012	0.0006	-	0.0014	0.0006	-	0.0010	0.0001	-	0.0010	0.0002	-
2378TCDF	0.0042	0.0004	0.1000	0.0004	0.0004	0.1000	0.0004	0.0004	0.0500	0.0002	0.0002	1.0000	0.0042	0.0042	86
12378-PCDF	0.0017	0.0004	0.0500	0.0001	0.0001	0.0300	0.0001	0.0001	0.0500	0.0001	0.0001	0.1000	0.0002	0.0002	106
23478-PCDF	0.0019	0.0004	0.5000	0.0010	0.0010	0.3000	0.0006	0.0006	0.5000	0.0010	0.0010	1.0000	0.0019	0.0019	92
123478-HxCDF	0.0018	0.0003	0.1000	0.0002	0.0002	0.1000	0.0002	0.0002	0.1000	0.0002	0.0002	0.1000	0.0002	0.0002	83
123678-HxCDF	0.0023	0.0003	0.1000	0.0002	0.0002	0.1000	0.0002	0.0002	0.1000	0.0002	0.0002	0.1000	0.0002	0.0002	89
234678-HxCDF	0.0031	0.0003	0.1000	0.0003	0.0003	0.1000	0.0003	0.0003	0.1000	0.0003	0.0003	0.1000	0.0003	0.0003	89
123789-HxCDF	ND	0.0002	0.1000	0.0000	0.0000	0.1000	0.0000	0.0000	0.1000	0.0000	0.0000	0.1000	0.0000	0.0000	73
1234678-HpCDF	0.0093	0.0003	0.0100	0.0001	0.0001	0.0100	0.0001	0.0001	0.0100	0.0001	0.0001	0.0100	0.0001	0.0001	68
1234789-HpCDF	0.0014	0.0004	0.0100	0.0000	0.0000	0.0100	0.0000	0.0000	0.0100	0.0000	0.0000	0.0100	0.0000	0.0000	100
OCDF	0.0155	0.0004	0.0010	0.0000	0.0000	0.0003	0.0000	0.0000	0.0001	0.0000	0.0000	0.0001	0.0000	0.0000	70
Total Furans	0.0411	0.0033	-	0.0023	0.0023	-	0.0019	0.0019	-	0.0021	0.0021	-	0.0071	0.0071	-
Totals ng	0.09	-	-	0.0035	0.0029	-	0.0033	0.0024	-	0.0031	0.0021	-	0.0081	0.0073	-
Total Concentration ng/m ³		-	-	0.0011	0.0009	-	0.0010	0.0007	-	0.0009	0.0006	-	0.0024	0.0022	-
Limit of Detection ng/m ³		0.00032	-	-	-	-	-	-	-	-	-	-	-	-	-

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O₂.

Key: ND - Isomer Not Detected

DL - Analytical Limit of Detection

TEQ1 - Concentration of Non Detected Congeners at Detection Limit

TEQ2 - Concentration of Non Detected Congeners at Zero

Recoveries - Percentage of Sample Recovered

PCB's Calculations

Parameter	Value	Unit
Meter Box Number	8.07	-
Gas Meter Coefficient	1.071	-
Pitot Coefficient	0.849	-
Stack Gas Molecular Weight	29.8	g/mole
Static Pressure in Stack	-1.5	cmH ₂ O

Parameter	Value	Unit
Nozzle Diameter	4.12	mm
Average Gas Meter Temperature	19.3	°C
Average Stack Temperature	98.6	°C
Average Stack Velocity	18.95	m/s
Isokineticity	100.8	%
Total Sampling Time	360	min
Gas Meter Difference	3305	L
Corrected Gas Meter Volume	3538	L
Mean Sampling Rate	9.8	L/min

Date	Operators
02/11/2023	redacted

Parameter	Before	After	Unit
Barometric Pressure	989	989	mbar
Ambient Temperature	16.0	17.0	°C
Leak Check	0.15	0.23	L/min
Time	08:57	15:00	-

Parameter	Value	Unit
Gas Meter Volume (STP Dry)	3.226	Nm ³
Gas Meter Volume (REF)	3.307	Nm ³
Mass of Water Vapour Collected	577	g
Volume of Water Vapour Collected	719	NL
Stack Gas Water Vapour Content	18.2	% v/v
Stack Oxygen Content	10.8	% v/v

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O₂.

Condenser Exit Temperature	Value	Unit
Maximum Temperature Recorded	17.0	°C

Measured	Impinger Mass (g)							Collected Mass (g)
	1	2	3	4	5	6	7	
Before	356.0	601.3	602.5	940.8	-	-	-	577.4
After	867.9	653.4	603.0	953.7	-	-	-	

PCB's Blank

Congener	Result (ng)	DL (ng)	TEFs	TEQ ¹	TEQ2	TEFs	TEQ ¹	TEQ2	TEFs	TEQ ¹	TEQ2	Rec %
			Mammals			Fish			Birds			
PCB-81	ND	0.00051	0.00030	0.0000002	0.0000000	0.0005000	0.0000003	0.0000000	0.1000000	0.0000510	0.0000000	81
PCB-77	0.0371	0.00042	0.00010	0.0000037	0.0000037	0.0001000	0.0000037	0.0000037	0.0500000	0.0018550	0.0018550	97
PCB-123	0.0043	0.00225	0.00003	0.0000001	0.0000001	0.0000050	0.0000000	0.0000000	0.0000100	0.0000000	0.0000000	72
PCB-118	0.104	0.00249	0.00003	0.0000031	0.0000031	0.0000050	0.0000005	0.0000005	0.0000100	0.0000010	0.0000010	69
PCB-114	0.00223	0.00209	0.00003	0.0000001	0.0000001	0.0000050	0.0000000	0.0000000	0.0001000	0.0000002	0.0000002	79
PCB-105	0.0515	0.0021	0.00003	0.0000015	0.0000015	0.0000050	0.0000003	0.0000003	0.0001000	0.0000052	0.0000052	70
PCB-126	ND	0.003	0.10000	0.0002760	0.0000000	0.0050000	0.0000138	0.0000000	0.1000000	0.0002760	0.0000000	114
PCB-167	0.0138	0.00045	0.00003	0.0000004	0.0000004	0.0000050	0.0000001	0.0000001	0.0000100	0.0000001	0.0000001	90
PCB-156	0.00877	0.00049	0.00003	0.0000003	0.0000003	0.0000050	0.0000000	0.0000000	0.0001000	0.0000009	0.0000009	88
PCB-157	ND	0.00051	0.00003	0.0000000	0.0000000	0.0000050	0.0000000	0.0000000	0.0001000	0.0000001	0.0000000	90
PCB-169	ND	0.00005	0.03000	0.0000015	0.0000000	0.0000500	0.0000000	0.0000000	0.0010000	0.0000001	0.0000000	107
PCB-189	0.00041	0.00017	0.00003	0.0000000	0.0000000	0.0000050	0.0000000	0.0000000	0.0000100	0.0000000	0.0000000	97
Total ng	0.222	-	-	0.00029	0.0000093	-	0.000019	0.0000046	-	0.0022	0.0019	-
Concentration ng/m ³		-	-	0.000087	0.0000028	-	0.0000057	0.00000140	-	0.00066	0.00056	-

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O₂.

PCB's Calculations Continued

PCB's Run 1

Congener	Result (ng)	DL (ng)	TEFs	TEQ ¹	TEQ2	TEFs	TEQ ¹	TEQ2	TEFs	TEQ ¹	TEQ2	Rec
			Mammals			Fish			Birds			%
PCB-81	0.00131	0.00045	0.00030	0.0000004	0.0000004	0.000500	0.00000066	0.00000066	0.100000	0.00013100	0.00013100	63
PCB-77	0.038	0.00027	0.00010	0.0000038	0.0000038	0.000100	0.00000380	0.00000380	0.050000	0.00190000	0.00190000	99
PCB-123	ND	0.00743	0.00003	0.0000002	0.0000000	0.000005	0.00000004	0.00000000	0.000010	0.00000007	0.00000000	90
PCB-118	0.138	0.00611	0.00003	0.0000041	0.0000041	0.000005	0.00000069	0.00000069	0.000010	0.00000138	0.00000138	104
PCB-114	ND	0.0128	0.00003	0.0000004	0.0000000	0.000005	0.00000006	0.00000000	0.000100	0.00000128	0.00000000	60
PCB-105	0.0609	0.00582	0.00003	0.0000018	0.0000018	0.000005	0.00000030	0.00000030	0.000100	0.00000609	0.00000609	100
PCB-126	ND	0.00132	0.10000	0.0001320	0.0000000	0.005000	0.00000660	0.00000000	0.100000	0.00013200	0.00000000	97
PCB-167	0.0156	0.00168	0.00003	0.0000005	0.0000005	0.000005	0.00000008	0.00000008	0.000010	0.00000016	0.00000016	72
PCB-156	ND	0.0019	0.00003	0.0000001	0.0000000	0.000005	0.00000001	0.00000000	0.000100	0.00000019	0.00000000	68
PCB-157	ND	0.00228	0.00003	0.0000001	0.0000000	0.000005	0.00000001	0.00000000	0.000100	0.00000023	0.00000000	65
PCB-169	0.00047	0.00004	0.03000	0.0000141	0.0000141	0.000050	0.00000002	0.00000002	0.001000	0.00000047	0.00000047	100
PCB-189	ND	0.00097	0.00003	0.0000000	0.0000000	0.000005	0.00000000	0.00000000	0.000010	0.00000001	0.00000000	59
Total ng	0.25	-	-	0.00016	0.000025	-	0.000012	0.0000056	-	0.0022	0.0020	-
Concentration ng/m ³		-	-	0.000048	0.0000075	-	0.0000037	0.0000017	-	0.00066	0.00062	-
Limit of Detection ng/m ³		0.00004		-	-	-	-	-	-	-	-	-

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O₂.

Key: ND - Isomer Not Detected

DL - Analytical Limit of Detection

TEQ1 - Concentration of Non Detected Congeners at Detection Limit

TEQ2 - Concentration of Non Detected Congeners at Zero

Recoveries - Percentage of Sample Recovered

PAH's Calculations

Parameter	Value	Unit
Meter Box Number	8.07	-
Gas Meter Coefficient	1.071	-
Pitot Coefficient	0.849	-
Stack Gas Molecular Weight	29.9	g/mole
Static Pressure in Stack	-1.5	cmH ₂ O

Parameter	Value	Unit
Nozzle Diameter	6.05	mm
Average Gas Meter Temperature	19.8	°C
Average Stack Temperature	99.5	°C
Average Stack Velocity	19.22	m/s
Isokineticity	100.9	%
Total Sampling Time	60	min
Gas Meter Difference	1191	L
Corrected Gas Meter Volume	1275	L
Mean Sampling Rate	21.2	L/min

Date	Operators
01/11/2023	redacted

Parameter	Before	After	Unit
Barometric Pressure	999	999	mbar
Ambient Temperature	18.0	18.0	°C
Leak Check	0.19	0.23	L/min
Time	14:00	15:03	-

Parameter	Value	Unit
Gas Meter Volume (STP Dry)	1.173	Nm ³
Gas Meter Volume (REF)	1.203	Nm ³
Mass of Water Vapour Collected	222	g
Volume of Water Vapour Collected	276	NL
Stack Gas Water Vapour Content	19.1	% v/v
Stack Oxygen Content	10.7	% v/v

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O₂.

Condenser Exit Temperature	Value	Unit
Maximum Temperature Recorded	14.0	°C

Measured	Impinger Mass (g)							Collected Mass (g)
	1	2	3	4	5	6	7	
Before	353.9	603.3	602.7	930.7	-	-	-	221.6
After	564.1	604.3	603.0	940.8	-	-	-	

PAH's Blank & Run 1

Congener	Detection Limit (ug)	Blank Run (ug)	Sample Run (ug)	Blank Concentration (ug/m ³)	Sample Run Concentration (ug/m ³)	Measurement Uncertainty (MU) ug/m ³ +/-
Napthalene	0.010	1.080	1.220	0.898	1.014	0.243
Fluoranthene	0.010	0.047	0.036	0.039	0.030	0.007
Benzo(b)naptho(2,1-d)thiophene	0.010	< 0.010	< 0.010	< 0.008	< 0.008	0.002
Benzo(c)phenanthrene	0.010	< 0.010	< 0.010	< 0.008	< 0.008	0.002
Benzo(a)anthracene	0.010	< 0.010	< 0.010	< 0.008	< 0.008	0.002
Chrysene	0.010	< 0.010	< 0.010	< 0.008	< 0.008	0.002
Cyclopenta(c,d)pyrene	0.010	< 0.010	< 0.010	< 0.008	< 0.008	0.002
Benzo(b)fluoranthene	0.010	< 0.010	< 0.010	< 0.008	< 0.008	0.002
Benzo(k)fluoranthene	0.010	< 0.010	< 0.010	< 0.008	< 0.008	0.002
Benzo(a)pyrene	0.010	< 0.010	< 0.010	< 0.008	< 0.008	0.002
Cholanthrene	0.010	< 0.010	< 0.010	< 0.008	< 0.008	0.002
Indeno(1,2,3-cd)pyrene	0.010	< 0.010	< 0.010	< 0.008	< 0.008	0.002
Benzo(ghi)perylene	0.010	< 0.010	< 0.010	< 0.008	< 0.008	0.002
Dibenzo(ah)anthracene	0.010	< 0.010	< 0.010	< 0.008	< 0.008	0.002
Anthanthrene	0.010	< 0.010	< 0.010	< 0.008	< 0.008	0.002
Dibenzo(a,i)pyrene	0.010	< 0.010	< 0.010	< 0.008	< 0.008	0.002
Total Mass collected ug	0.16	1.3	1.4	-	-	-
Concentration ug/m ³	0.13	1.1	1.2	1.1	1.2	-

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O₂.

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Uncertainty

Uncertainty of Total Particulate Matter - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	30	mg/m ³
Mean Sampling Rate	21.6	L/min
Leak Rate	0.08	L/min
Barometric Pressure	999	mbar
Average Stack Temperature	99	°C
Sampled Stack Gas Volume	647	L

Parameter	Value	Unit
Mean Emission Concentration	1.55	mg/m ³
Monitoring Duration	32	min
Console ID	8.07	-
Temperature Uncertainty	0.24	°C
Gas Meter Uncertainty	0.37	%
Barometer Uncertainty	1.0	mbar

Source of Uncertainty	ASD*	BS EN 13284-1		Envirocare Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u ²
		Uncertainty Criteria	Max. Value					
Weighing Procedure	Std	5% of limit value	1.5	0.28	mg	0.9	0.28	0.08
Leak Rate	Rect	<2% of sampling rate	0.43	0.08	L/min	0.37	0.003	0.00001
Time	Std	1 sec in 1 hour = 0.028%	2.0	0.5	sec	0.03	0.0004	0.0000002
Gasmeter Volume	Std	<2%	12.9	2.4	L	0.37	0.01	0.0000
Temperature	Std	1% of value	1.0	0.24	°C	0.24	0.004	0.00001
Pressure	Std	1% of value	10.0	1.0	mbar	0.10	0.002	0.00000
Total								0.08
Combined Standard Uncertainty [(sum u ²) ^{0.5}]								0.28
Expanded Total Uncertainty as a % of emission conc. (95% confidence)								35.4
Expanded Total Uncertainty (mg/m ³) (95% confidence)								0.55
Expanded Total Uncertainty as a % of emission limit value (95% confidence)								1.8

Uncertainty of Carbon Monoxide by Horiba Gas Analyser - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	50	mg/m ³
Reading	1.1	ppm
Span Gas Certified Value	163	ppm
Range	200	ppm

Cal Gas
CO

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u ²
Zero Drift/Lower limit of detection (ppm)	0.00	Rectangular	1.73	0.000	0.000
Span Drift (ppm)	2.9	Rectangular	1.73	1.7	2.8
Linearity (% of value)	0.25	Rectangular	1.73	0.002	0.000002
Setting Gas Divider (% of value)	0.35	Normal	1.00	0.004	0.00001
Interference (% of value)	-0.48	Rectangular	1.73	-0.003	0.000009
Standard deviation of repeatability at zero point (% of range)	0.10	Rectangular	-	0.20	0.04
Standard deviation of repeatability at span point (% of range)	0.20	Rectangular	-	0.40	0.16
Total					3.0
Combined Standard Uncertainty [(sum u ²) ^{0.5}]					1.7
Expanded Total Uncertainty (ppm) (95% confidence)					3.4
Expanded Total Uncertainty as a % of emission conc. (95% confidence)					315
Expanded Total Uncertainty (mg/m ³) (95% confidence)					4.2
Expanded Total Uncertainty as a % of emission limit value (95% confidence)					8.5

Uncertainty of Oxides of Nitrogen by Horiba Gas Analyser - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	400	mg/m ³
Reading	70.3	ppm
Span Gas Certified Value	205	ppm
Range	250	ppm

Cal Gas
NO

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u ²
Zero Drift/Lower limit of detection (ppm)	-0.10	Rectangular	1.73	-0.06	0.003
Span Drift (ppm)	3.60	Rectangular	1.73	2.1	4.3
Linearity (% of value)	0.52	Rectangular	1.73	0.21	0.04
Setting Gas Divider (% of value)	0.35	Normal	1.00	0.25	0.06
Interference (% of value)	0.63	Rectangular	1.73	0.26	0.07
Standard deviation of repeatability at zero point (% of range)	0.00	Rectangular	-	0.000	0.000
Standard deviation of repeatability at span point (% of range)	0.10	Rectangular	-	0.25	0.06
Total					4.6
Combined Standard Uncertainty [(sum u²)^{0.5}]					2.1
Expanded Total Uncertainty (ppm) (95% confidence)					4.2
Expanded Total Uncertainty as a % of emission conc. (95% confidence)					6.0
Expanded Total Uncertainty (mg/m³) (95% confidence)					8.6
Expanded Total Uncertainty as a % of emission limit value (95% confidence)					2.1

Uncertainty of Total VOC by FID - Run1

Parameter	Value	Unit
Emission Limit Value (ELV)	10	mg/m ³
Reading	0.40	ppm
Span Gas Certified Value	83.2	ppm
Range	100	ppm

Cal Gas
C ₃ H ₈

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u ²
Zero Drift/Lower limit of detection (ppm)	0.42	Rectangular	1.73	0.24	0.06
Span Drift (ppm)	0.39	Rectangular	1.73	0.23	0.05
Linearity (% of value)	0.68	Rectangular	1.73	0.002	0.000002
Setting Gas Divider (% of value)	0.35	Normal	1.00	0.001	0.000002
Noise (ppm)	0.10	Rectangular	1.73	0.06	0.003
Temperature Drift (% of value)	1.0	Rectangular	1.73	0.002	0.000005
Standard deviation of repeatability at zero point (% of range)	0.20	Rectangular	-	0.20	0.04
Standard deviation of repeatability at span point (% of range)	0.20	Rectangular	-	0.20	0.04
Total					0.19
Combined Standard Uncertainty [(sum u²)^{0.5}]					0.44
Expanded Total Uncertainty (ppm) (95% confidence)					0.86
Expanded Total Uncertainty as a % of emission conc. (95% confidence)					215
Expanded Total Uncertainty (mg/m³) (95% confidence)					1.4
Expanded Total Uncertainty as a % of emission limit value (95% confidence)					13.8

Uncertainty of Oxygen by Horiba Gas Analyser - Run 1

Parameter	Value	Unit
Reading	10.7	%
Span Gas Certified Value	20.8	%
Range	25.0	%

Cal Gas
O ₂

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u ²
Zero Drift/Lower limit of detection (%vol)	-0.03	Rectangular	1.73	-0.02	0.0003
Span Drift (%vol)	-0.18	Rectangular	1.73	-0.10	0.01
Linearity (% of value)	0.24	Rectangular	1.73	0.01	0.0002
Setting Gas Divider (% of value)	0.35	Normal	1.00	0.04	0.001
Interference (% of value)	0.00	Rectangular	1.73	0.000	0.000
Standard deviation of repeatability at zero point (% of range)	0.02	Rectangular	-	0.005	0.00003
Standard deviation of repeatability at span point (% of range)	0.02	Rectangular	-	0.005	0.00003
Total					0.01
Combined Standard Uncertainty [(sum u²)^{0.5}]					0.11
Expanded Total Uncertainty (%) (95% confidence)					0.22
Expanded Total Uncertainty as a % of emission conc. (95% confidence)					2.1

Uncertainty of Ammonia by FTIR - Run 1

Uncertainty Budget Table from C.5. - PD CEN/TS 17337:2019				Measured (ppm)	0.28
Ammonia - Run 1				Range (ppm)	10.0
Source of Uncertainty	Value (±%)	Probability Distribution	Divisor	Conversion Factor	ui ppm
Repeatability standard deviation at span point	0.20	normal	1.0	0.003	0.001
Lack of fit	0.76	rectangular	√3	0.10	0.04
Short-term zero drift	0.50	rectangular	√3	0.10	0.03
Short-term span drift	2.0	rectangular	√3	0.10	0.12
Influence of ambient temperature	0.29	rectangular	√3	0.03	0.00
Influence of electrical voltage	-0.03	rectangular	√3	0.04	-0.001
Influence of vibration	1.1	rectangular	√3	0.10	0.06
Influence of sample gas pressure	0.00	rectangular	√3	0.000	0.0000
influence of sample gas flow	-0.20	rectangular	√3	0.10	-0.01
Cross-sensitivity	3.2	rectangular	√3	0.10	0.18
Losses & leakage in the sample gas line	2.0	rectangular	√3	0.10	0.12
Certified reference material	2.0	normal	2.0	0.003	0.00
Combined Uncertainty	-	normal	-	-	0.26
Expanded Uncertainty (ppm)	-	t-distribution (k=2)	-	-	0.5
Expanded Uncertainty (%age of Reading)	-	t-distribution (k=2)	-	-	184.5

Uncertainty of Chloride (as HCl) - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	10	mg/m ³
Mean Sampling Rate	21.6	L/min
Leak Rate	0.08	L/min
Barometric Pressure	999	mbar
Average Stack Temperature	99.0	°C
Sampled Stack Gas Volume	647	L

Parameter	Value	Unit
Mean Emission Concentration	0.11	mg/m ³
Monitoring Duration	32	min
Console ID	8.07	-
Temperature Uncertainty	0.24	°C
Gas Meter Uncertainty	0.37	%
Barometer Uncertainty	1.0	mbar

Source of Uncertainty	ASD*	BS EN 1911		Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u ²
		Uncertainty Criteria	Max. Value					
Analysis Procedure	Std	<2.5% of measured value	-	7.9	%	4.0	0.004	0.00002
Leak Rate	Rect	<2% of sampling rate	0.43	0.08	L/min	0.37	0.0002	0.00000005
Time	Std	1 sec in 1 hour = 0.028%	2.0	0.5	sec	0.03	0.00003	0.000000009
Gasmeter Volume	Std	<2% of measured value	12.9	2.4	L	0.37	0.0004	0.0000002
Temperature	Std	<2.5K cal. uncertainty	1.0	0.24	°C	0.24	0.0003	0.00000007
Pressure	Std	1% of absolute pressure	10.0	1.0	mbar	0.10	0.0001	0.00000001
Total								0.00002
Combined Standard Uncertainty [(sum u ²) ^{0.5}]								0.004
Expanded Total Uncertainty as a % of emission conc. (95% confidence)								8.0
Expanded Total Uncertainty (mg/m ³) (95% confidence)								0.009
Expanded Total Uncertainty as a % of emission limit value (95% confidence)								0.09

Uncertainty of Sulphur Dioxide - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	50	mg/m ³
Mean Sampling Rate	21.8	L/min
Leak Rate	0.08	L/min
Barometric Pressure	999	mbar
Average Stack Temperature	98.0	°C
Sampled Stack Gas Volume	653	L

Parameter	Value	Unit
Mean Emission Concentration	0.62	mg/m ³
Monitoring Duration	32	min
Console ID	8.07	-
Temperature Uncertainty	0.24	°C
Gas Meter Uncertainty	0.37	%
Barometer Uncertainty	1.0	mbar

Source of Uncertainty	ASD*	BS EN 14791		Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u ²
		Uncertainty Criteria	Max. Value					
Analysis Procedure	Std	<2.5% of measured value	-	7.7	%	3.9	0.0	0.0
Leak Rate	Rect	<2% of sampling rate	0.44	0.08	L/min	0.37	0.00	0.00
Time	Std	1 sec in 1 hour = 0.028%	2.0	0.53	sec	0.03	0.00	0.0000
Gasmeter Volume	Std	<2.5% volume of gas	16.3	2.4	L	0.37	0.00	0.00
Temperature	Std	<1% absolute temperature	1.0	0.24	°C	0.24	0.00	0.00
Pressure	Std	<1% absolute pressure	10.0	1.0	mbar	0.10	0.00	0.000
Total								0.0
Combined Standard Uncertainty [(sum u ²) ^{0.5}]								0.0
Expanded Total Uncertainty as a % of emission conc. (95% confidence)								7.8
Expanded Total Uncertainty (mg/m ³) (95% confidence)								0.0
Expanded Total Uncertainty as a % of emission limit value (95% confidence)								0.1

Uncertainty of Ammonia - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	10	mg/m ³
Mean Sampling Rate	22.1	L/min
Leak Rate	0.08	L/min
Barometric Pressure	999	mbar
Average Stack Temperature	97	°C
Sampled Stack Gas Volume	660	L

Parameter	Value	Unit
Mean Emission Concentration	0.07	mg/m ³
Monitoring Duration	32	min
Console ID	8.07	-
Temperature Uncertainty	0.24	°C
Gas Meter Uncertainty	0.37	%
Barometer Uncertainty	1.0	mbar

Source of Uncertainty	ASD*	BS EN ISO 21877		Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u ²
		Uncertainty Criteria	Max. Value					
Analysis Procedure	Std	<2.5% of measured value	-	8.9	%	4.5	0.003	0.00001
Leak Rate	Rect	<2% of sampling rate	0.44	0.08	L/min	0.36	0.0001	0.00000002
Time	Std	1 sec in 1 hour = 0.028%	2.0	0.53	sec	0.03	0.00002	0.000000004
Gasmeter Volume	Std	<2.5% volume of gas	16.5	2.44	L	0.37	0.0003	0.00000007
Temperature	Std	<1% absolute temperature	1.0	0.24	°C	0.25	0.0002	0.00000003
Pressure	Std	<1% absolute pressure	10.0	1.0	mbar	0.10	0.00007	0.000000005
Total								0.00001
Combined Standard Uncertainty [(sum u²)^{0.5}]								0.003
Expanded Total Uncertainty as a % of emission conc. (95% confidence)								9.0
Expanded Total Uncertainty (mg/m³) (95% confidence)								0.006
Expanded Total Uncertainty as a % of emission limit value (95% confidence)								0.06

Uncertainty of Metals - Run 1

Parameter	Value	Unit
Mean Sampling Rate	23.8	L/min
Leak Rate	0.13	L/min
Barometric Pressure	1001	mbar
Average Stack Temperature	98.5	°C
Sampled Stack Gas Volume	712	L

Parameter	Value	Unit
Monitoring Duration	32	min
Console ID	8.07	-
Temperature Uncertainty	0.24	°C
Gas Meter Uncertainty	0.37	%
Barometer Uncertainty	1.0	mbar

Source of Uncertainty	ASD*	BS EN 14385		Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u ²
		Uncertainty Criteria	Max. Value					
Leak Rate	Rect	<2% of sampling rate	0.48	0.13	L/min	0.52	0.0001	0.00000002
Time	Std	1 sec in 1 hour = 0.028%	2.0	0.53	sec	0.03	0.00001	0.0000000002
Gasmeter Volume	Std	<2%	14.2	2.6	L	0.37	0.0002	0.00000003
Temperature	Std	1% of value	1.0	0.24	°C	0.24	0.0001	0.00000001
Pressure	Std	1% of value	10.0	1.0	mbar	0.10	0.00005	0.000000002
Total								0.00000007

Metal	Analysis		Analysis Unc. U (mg)	Analysis u2	Sampling u2	Total sqrt(u2)	Measurement Uncertainty (95% Confidence) (mg/Nm ³)	Expanded Total Uncertainty as a percentage of (95% Confidence)	
	(µg)	Unc (%)						Emissions Concentration	Emission Limit Value
Arsenic	0.64	13.7	0.00009	0.000000008	0.000000007	0.0003	0.0005	61.5	-
Cadmium	0.59	10.2	0.00006	0.000000004	0.000000007	0.0003	0.0005	64.5	-
Cobalt	0.59	10.5	0.00006	0.000000004	0.000000007	0.0003	0.0005	64.6	-
Chromium	23.1	13.8	0.003	0.00001	0.000000007	0.003	0.0063	20.0	-
Copper	1.3	11.6	0.0002	0.000000002	0.000000007	0.0003	0.0006	32.4	-
Manganese	1.9	14.9	0.0003	0.000000008	0.000000007	0.0004	0.0007	29.1	-
Nickel	2.7	11.4	0.0003	0.0000000096	0.000000007	0.0004	0.0008	21.5	-
Lead	3.4	9.4	0.0003	0.00000001	0.000000007	0.0004	0.0008	17.6	-
Antimony	0.69	8.8	0.00006	0.000000004	0.000000007	0.0003	0.0005	55.3	-
Thallium	0.49	12.8	0.00006	0.000000004	0.000000007	0.0003	0.0005	77.8	-
Vanadium	0.45	10.3	0.00005	0.000000002	0.000000007	0.0003	0.0005	84.8	-
Total Metals	35	11.6	0.004	0.00002	0.000000007	0.004	0.008	16.8	1.6
Cadmium & Thallium	0.54	11.5	0.00006	0.000000004	0.000000007	0.0003	0.0005	35.3	1.0

Uncertainty of Mercury - Run 1

Parameter	Value	Unit
Mean Sampling Rate	22.6	L/min
Leak Rate	0.11	L/min
Barometric Pressure	1001	mbar
Average Stack Temperature	98.0	°C
Sampled Stack Gas Volume	675	L

Parameter	Value	Unit
Monitoring Duration	32	min
Console ID	8.07	-
Temperature Uncertainty	0.24	°C
Gas Meter Uncertainty	0.37	%
Barometer Uncertainty	1.0	mbar

Source of Uncertainty	ASD*	BS EN 14385		Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u ²
		Uncertainty Criteria	Max. Value					
Leak Rate	Rect	<2% of sampling rate	0.45	0.11	L/min	0.49	0.000001	0.000000000001
Time	Std	1 sec in 1 hour = 0.028%	2.0	0.53	sec	0.03	0.000001	0.000000000001
Gasmeter Volume	Std	<2%	13.5	2.5	L	0.37	0.000001	0.000000000002
Temperature	Std	1% of value	1.0	0.24	°C	0.24	0.0000009	0.000000000008
Pressure	Std	1% of value	10.0	1.0	mbar	0.10	0.0000004	0.000000000001
Total								0.000000000004

Metal	Analysis		Analysis Unc. U (mg)	Analysis u ²	Sampling u ²	Total sqrt(u ²)	Measurement Uncertainty (95% Confidence) (mg/Nm ³)	Expanded Total Uncertainty as a percentage of (95% Confidence)	
	(µg)	Unc (%)						Emissions Concentration	Emission Limit Value
Mercury	0.25	15.3	0.00004	0.000000001	0.000000000004	0.00004	0.00008	21.0	0.15

Uncertainty of Mercury - Run 2

Parameter	Value	Unit
Mean Sampling Rate	21.1	L/min
Leak Rate	0.13	L/min
Barometric Pressure	1001	mbar
Average Stack Temperature	98.0	°C
Sampled Stack Gas Volume	632	L

Parameter	Value	Unit
Monitoring Duration	32	min
Console ID	8.07	-
Temperature Uncertainty	0.24	°C
Gas Meter Uncertainty	0.37	%
Barometer Uncertainty	1.0	mbar

Source of Uncertainty	ASD*	BS EN 14385		Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u ²
		Uncertainty Criteria	Max. Value					
Leak Rate	Rect	<2% of sampling rate	0.42	0.13	L/min	0.61	0.000001	0.000000000002
Time	Std	1 sec in 1 hour = 0.028%	2.0	0.53	sec	0.03	0.000001	0.000000000001
Gasmeter Volume	Std	<2%	12.6	2.3	L	0.37	0.000001	0.000000000002
Temperature	Std	1% of value	1.0	0.24	°C	0.24	0.000001	0.000000000001
Pressure	Std	1% of value	10.0	1.0	L	0.10	0.0000004	0.000000000002
Total								0.000000000005

Metal	Analysis		Analysis Unc. U (mg)	Analysis u ²	Sampling u ²	Total sqrt(u ²)	Measurement Uncertainty (95% Confidence) (mg/Nm ³)	Expanded Total Uncertainty as a percentage of (95% Confidence)	
	(µg)	Unc (%)						Emissions Concentration	Emission Limit Value
Mercury	0.27	15.3	0.00004	0.000000002	0.000000000005	0.00004	0.00008	19.9	0.16

Uncertainty of Mercury - Run 3

Parameter	Value	Unit
Mean Sampling Rate	20.9	L/min
Leak Rate	0.11	L/min
Barometric Pressure	1001	mbar
Average Stack Temperature	98.0	°C
Sampled Stack Gas Volume	623	L

Parameter	Value	Unit
Monitoring Duration	32	min
Console ID	8.07	-
Temperature Uncertainty	0.24	°C
Gas Meter Uncertainty	0.37	%
Barometer Uncertainty	1.0	mbar

Source of Uncertainty	ASD*	BS EN 14385		Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u ²
		Uncertainty Criteria	Max. Value					
Leak Rate	Rect	<2% of sampling rate	0.42	0.11	L/min	0.50	0.000001	0.000000000002
Time	Std	1sec in 1hour = 0.028%	2.0	0.53	sec	0.03	0.0000001	0.00000000000001
Gasmeter Volume	Std	<2%	12.5	2.3	L	0.37	0.000002	0.0000000000002
Temperature	Std	1% of value	1.0	0.24	°C	0.24	0.000001	0.0000000000001
Pressure	Std	1% of value	10.0	1.0	mbar	0.10	0.0000004	0.0000000000002
Total								0.0000000000005

Metal	Analysis		Analysis Unc. U (mg)	Analysis u ²	Sampling u ²	Total sqrt(u ²)	Measurement Uncertainty (95% Confidence) (mg/Nm ³)	Expanded Total Uncertainty as a percentage of (95% Confidence)	
	(µg)	Unc (%)						Emissions Concentration	Emission Limit Value
Mercury	0.28	15.3	0.00004	0.000000002	0.000000000005	0.00004	0.00008	19.8	0.17

Uncertainty of Dioxins & Furans - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	0.1	ng/m ³
Mean Sampling Rate	9.8	L/min
Leak Rate	0.19	L/min
Barometric Pressure	989	mbar
Average Stack Temperature	98.6	°C
Sampled Stack Gas Volume	3305	L

Parameter	Value	Unit
Mean Emission Concentration	0.0011	ng/m ³
Monitoring Duration	360	min
Console ID	8.07	-
Temperature Uncertainty	0.24	°C
Gas Meter Uncertainty	0.37	%
Barometer Uncertainty	1.0	mbar

Source of Uncertainty	ASD*	BS EN 1948		Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u ²
		Uncertainty Criteria	Max. Value					
Leak Rate	Rect	<2% of sampling rate	0.20	0.19	L/min	1.9	0.00001	0.0000000001
Time	Std	1sec in 1hour = 0.028%	2.0	6.0	sec	0.03	0.0000003	0.0000000000009
Gasmeter Volume	Std	<2%	66.1	12.2	L	0.37	0.000004	0.000000000002
Temperature	Std	1% of value	1.0	0.24	°C	0.24	0.000003	0.0000000000007
Pressure	Std	1% of value	9.9	1.0	mbar	0.10	0.000001	0.0000000000001
Measured Concentration	0.0011	Total						0.000000006
Analysis Uncertainty %	7.4	Combined Standard Uncertainty [(sum u ²) ^{0.5}]						0.00008
Analysis Uncertainty u ng	0.00008	Expanded Total Uncertainty as a % of emission conc. (95% confidence)						14.7
Analysis Total u ²	0.00000001	Expanded Total Uncertainty (ng/m ³) (95% confidence)						0.0002
		Expanded Total Uncertainty as a % of emission limit value (95% confidence)						0.16

Uncertainty of PCB's - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	-	ng/m ³
Mean Sampling Rate	9.8	L/min
Leak Rate	0.19	L/min
Barometric Pressure	989	mbar
Average StackTemperature	98.6	°C
Sampled Stack Gas Volume	3305	L

Parameter	Value	Unit
Mean Emission Concentration	0.000048	ng/m ³
Monitoring Duration	360	min
Console ID	8.07	-
Temperature Uncertainty	0.24	°C
Gas Meter Uncertainty	0.37	%
Barometer Uncertainty	1.0	mbar

Source of Uncertainty	ASD*	BS EN 1948		Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u ²
		Uncertainty Criteria	Max. Value					
Leak Rate	Rect	<2% of sampling rate	0.20	0.19	L/min	1.9	0.0000005	0.0000000000003
Time	Std	1sec in 1 hour = 0.028%	2.0	6.0	sec	0.03	0.00000001	0.000000000000002
Gasmeter Volume	Std	<2%	66.1	12.2	L	0.37	0.0000002	0.000000000000003
Temperature	Std	1% of value	1.0	0.24	°C	0.24	0.0000001	0.000000000000001
Pressure	Std	1% of value	9.9	1.0	mbar	0.10	0.00000005	0.000000000000002
Measured Concentration	0.000048	Total						0.0000000000005
Analysis Uncertainty %	4.6	Combined Standard Uncertainty [(sum u ²) ^{0.5}]						0.000002
Analysis Uncertainty u ng	0.000002	Expanded Total Uncertainty as a % of emission conc. (95% confidence)						9.2
Analysis Total u2	0.000000000005	Expanded Total Uncertainty (ng/m³) (95% confidence)						0.000004
		Expanded Total Uncertainty as a % of emission limit value (95% confidence)						-

Uncertainty of PAH's - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	-	ug/m ³
Mean Sampling Rate	21.2	L/min
Leak Rate	0.21	L/min
Barometric Pressure	999	mbar
Average StackTemperature	99.5	°C
Sampled Stack Gas Volume	1191	L

Parameter	Value	Unit
Mean Emission Concentration	1.2	ug/m ³
Monitoring Duration	60	min
Console ID	8.07	-
Temperature Uncertainty	0.24	°C
Gas Meter Uncertainty	0.37	%
Barometer Uncertainty	1.0	mbar

Source of Uncertainty		ASD*	BS ISO 11338		Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u ²
			Uncertainty Criteria	Max. Value					
Leak Rate		Rect	<2% of sampling rate	0.42	0.21	L/min	0.99	0.007	0.00004
Time		Std	1sec in 1 hour = 0.028%	2.0	1.0	sec	0.03	0.0003	0.0000001
Gasmeter Volume		Std	<2%	23.8	4.4	L	0.37	0.004	0.00002
Temperature		Std	1% of value	1.0	0.24	°C	0.24	0.003	0.000008
Pressure		Std	1% of value	10.0	1.0	mbar	0.10	0.001	0.000001
Measured Concentration	1.2		Total						0.02
Analysis Uncertainty %	12.2		Combined Standard Uncertainty [(sum u ²) ^{0.5}]						0.14
Analysis Uncertainty u ug	0.14		Expanded Total Uncertainty as a % of emission conc. (95% confidence)						24.0
Analysis Total u2	0.02		Expanded Total Uncertainty (ug/m ³) (95% confidence)						0.28
			Expanded Total Uncertainty as a % of emission limit value (95% confidence)						-

Uncertainty of Volumetric Flow - Run 1

Parameter	Value	Unit
Measured Volumetric Flow Rate Actual	35421	m³/hr

Performance Characteristics & Source Value	Value	Units
Standard Uncertainty - Pitot tube Coefficient	0.005	-
Standard Uncertainty - Mean Local Dynamic Pressure	1.1	Pa
Standard Uncertainty - Molar Mass of Stack Gas	0.0001	-
Standard Uncertainty - Stack Gas Temperature	0.50	K
Standard Uncertainty - Absolute Pressure in Duct	176	Pa
Standard Uncertainty - Density of Stack Gas	0.006	-
Standard Uncertainty - Mean Velocity	0.14	m/s
Expanded Uncertainty Mean Velocity (95% confidence)	0.27	m/s
Expanded Uncertainty Mean Velocity (95% Confidence), Relative	1.4	%
Standard Uncertainty - Volumetric Flow Rate	818	-
Standard Uncertainty - Volumetric Flow Rate (95% Confidence)	1604	m³/hr
Standard Uncertainty - Volumetric Flow Rate (95% Confidence), Relative	4.5	%

95% confidence interval factor - 1.96

Document Version Number	Record of change within different version numbers
V1	Original version of the document issued to client.
V2	SO ₂ result amended, due to updated Analytical Laboratory certificate.
V3	Transcription error for barometric pressure corrected. Reported velocity, volumetric flow rate & mass emissions have changed due to this correction.