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ENVIRONMENTAL SERVICES

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: 7th - 8th June 2023
Site Address: Gremista Industrial Estate, Lerwick, Shetland, ZE1 OPX

Report Number: EK-0397 Version: 1 Visit: 1 in 2023
Date of Report: 6th July 2023
Report Author: redacted
MCERTS No: redacted MCERTS Level: redacted

Approved By: redacted Function: redacted
MCERTS No: MCERTS Level:

Signed: redacted

T: 01274 738668
E: sales@envirocare.org
Envirocare Technical Consultancy Ltd
Bradford Chamber Business Park, New Lane, Bradford, BD4 8BX

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UKAS TESTING 2522

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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 Ep1 - Incinerator 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	✓
Fluoride (as HF)	✓
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				
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**
Total Particulate Matter	R1	30	0.88	0.55	273k, 101.3kPa, Dry Gas, 11% O_2	-	18.2	11.4	07/06/2023	13:44-14:46
Carbon Monoxide	R1	50	1.2	3.0	273k, 101.3kPa, Dry Gas, 11% O_2	-	24.3	62.6	07/06/2023	17:00-21:00
Oxides of Nitrogen (as NO_2)	R1	400	248	8.9		-	5131	305	07/06/2023	17:00-21:00
Total VOC	R1	10	0.29	0.92	273k, 101.3kPa, Dry Gas, 11% O_2	-	6.1	19.0	07/06/2023	17:00-21:00
Chloride (as HCl)	R1	10	0.10	0.01	273k, 101.3kPa, Dry Gas, 11% O_2	-	2.1	0.19	07/06/2023	13:44-14:46
Sulphur Dioxide	R1	50	12.6	0.99	273k, 101.3kPa, Dry Gas, 11% O_2.	-	261	23.9	08/06/2023	09:55-10:25
Ammonia	R1	10	< 0.40	0.04	273k, 101.3kPa, Dry Gas, 11% O_2	-	< 8.3	0.85	08/06/2023	11:00-11:30
Fluoride (as HF)	R1	-	< 0.02	0.002	273k, 101.3kPa, Dry Gas, 11% O_2.	-	< 0.47	0.04	07/06/2023	13:44-14:46
Total Metals	R1	0.5	0.025	0.007	273k, 101.3kPa, Dry Gas, 11% O_2.	-	0.51	0.15	07/06/2023	09:30-10:32
Mercury	R1	0.05	< 0.00049	0.00009	273k, 101.3kPa, Dry Gas, 11% O_2.	-	0.01	0.002	07/06/2023	10:50-11:24
	R2		0.00056	0.0001			0.01	0.002	07/06/2023	11:50-12:24
	R3		0.00060	0.0001			0.01	0.002	07/06/2023	12:44-13:18
	Ave		0.00055	0.0001			0.01	0.002	-	-
Cadmium & Thallium	R1	0.05	< 0.00087	0.0003			< 0.02	0.01	07/06/2023	09:30-10:32
Oxygen	R1	-	11.5%	0.18	As Measured, Dry Gas	-	-	-	07/06/2023	17:00-21:00
Volumetric Flow Actual	R1	-	33,650 m³/h	1590	As Measured	-	-	-	07/06/2023	09:05-09:10
Volumetric Flow @ REF	R1	-	20,692 m³/h	978	273k, 101.3kPa, Dry Gas, 11% O_2.	-	-	-	07/06/2023	09:05-09:10

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O_2.

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 (I-TEQ)	R1	0.1	0.023 ng/m³	0.003	273k, 101.3kPa, Dry Gas, 11% O_2.	-	0.48 µg/h	0.07	08/06/2023	09:00-15:02
Dioxins & Furans (WHO Humans / Mammals)	R1	-	0.023 ng/m³	0.003	273k, 101.3kPa, Dry Gas, 11% O_2.	-	0.47 µg/h	0.07	08/06/2023	09:00-15:02
Dioxins & Furans (Fish)	R1	-	0.023 ng/m³	0.003	273k, 101.3kPa, Dry Gas, 11% O_2.	-	0.47 µg/h	0.07	08/06/2023	09:00-15:02
Dioxins & Furans (Birds)	R1	-	0.030 ng/m³	0.005	273k, 101.3kPa, Dry Gas, 11% O_2.	-	0.6 µg/h	0.10	08/06/2023	09:00-15:02
Dioxins Lower Limit (best case where <LOD = 0)										
Dioxins & Furans (I-TEQ)	R1	-	0.023 ng/m³	0.003	273k, 101.3kPa, Dry Gas, 11% O_2.	-	0.48 µg/h	0.07	08/06/2023	09:00-15:02
Dioxins & Furans (WHO Humans / Mammals)	R1	-	0.023 ng/m³	0.003	273k, 101.3kPa, Dry Gas, 11% O_2.	-	0.47 µg/h	0.07	08/06/2023	09:00-15:02
Dioxins & Furans (Fish)	R1	-	0.023 ng/m³	0.003	273k, 101.3kPa, Dry Gas, 11% O_2.	-	0.47 µg/h	0.07	08/06/2023	09:00-15:02
Dioxins & Furans (Birds)	R1	-	0.030 ng/m³	0.005	273k, 101.3kPa, Dry Gas, 11% O_2.	-	0.6 µg/h	0.10	08/06/2023	09:00-15:02
PCB's Upper Limit (worst case where <LOD = LOD)										
PCB's WHO TEQ Humans / Mammals	R1	-	0.0013 ng/m³	0.0001	273k, 101.3kPa, Dry Gas, 11% O_2.	-	0.027 µg/h	0.003	08/06/2023	09:00-15:02
PCB's WHO TEQ Fish	R1	-	0.000055 ng/m³	0.000005	273k, 101.3kPa, Dry Gas, 11% O_2.	-	0.0011 µg/h	0.0001	08/06/2023	09:00-15:02
PCB's WHO TEQ Birds	R1	-	0.0027 ng/m³	0.0003	273k, 101.3kPa, Dry Gas, 11% O_2.	-	0.06 µg/h	0.01	08/06/2023	09:00-15:02
PCB's Lower Limit (best case where <LOD = 0)										
Dioxins & Furans (WHO Humans / Mammals)	R1	-	0.0013 ng/m³	0.0001	273k, 101.3kPa, Dry Gas, 11% O_2.	-	0.027 µg/h	0.003	08/06/2023	09:00-15:02
PCB's WHO TEQ Fish	R1	-	0.000055 ng/m³	0.000005	273k, 101.3kPa, Dry Gas, 11% O_2.	-	0.0011 µg/h	0.0001	08/06/2023	09:00-15:02
PCB's WHO TEQ Birds	R1	-	0.0027 ng/m³	0.0003	273k, 101.3kPa, Dry Gas, 11% O_2.	-	0.056 µg/h	0.006	08/06/2023	09:00-15:02
PAH's	R1	-	1.8 ug/m³	0.43	273k, 101.3kPa, Dry Gas, 11% O_2.	-	37.0 mg/hr	9.0	07/06/2023	15:15-16:18
Oxygen	R1	-	11.5%	0.18	As Measured, Dry Gas	-	-	-	07/06/2023	17:00-21:00
Volumetric Flow Actual	R1	-	33,650 m³/h	1590	As Measured	-	-	-	07/06/2023	09:05-09:10
Volumetric Flow @ REF	R1	-	20,692 m³/h	978	273k, 101.3kPa, Dry Gas, 11% O_2.	-	-	-	07/06/2023	09:05-09:10

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O_2.

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
All Parameters	Run 1	There are no deviations associated with the monitoring undertaken.

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
Fluoride (as HF)	CEN/TS 17340	ETC-SE-20(b)	Yes	RPS	C27(U)	IC	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			
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

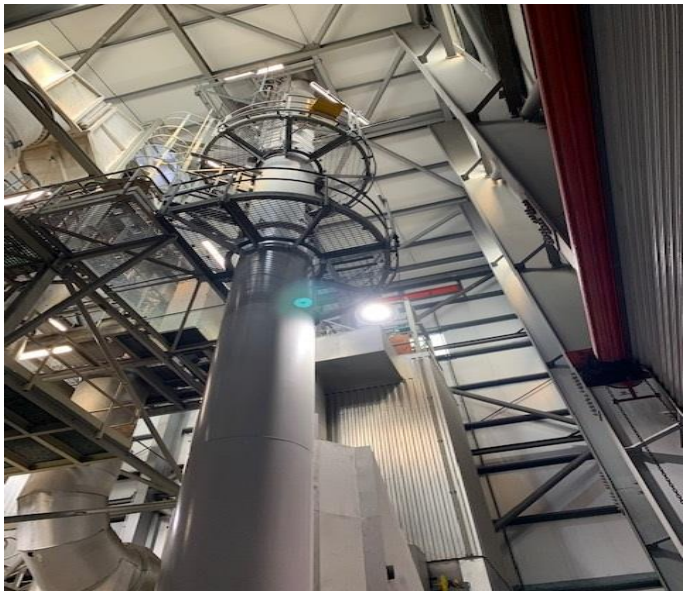
RPS Laboratories Ltd (RPS): 0605 | Marchwood Scientific Services: 1668 | Envirocare: 2522

Equipment Checklist

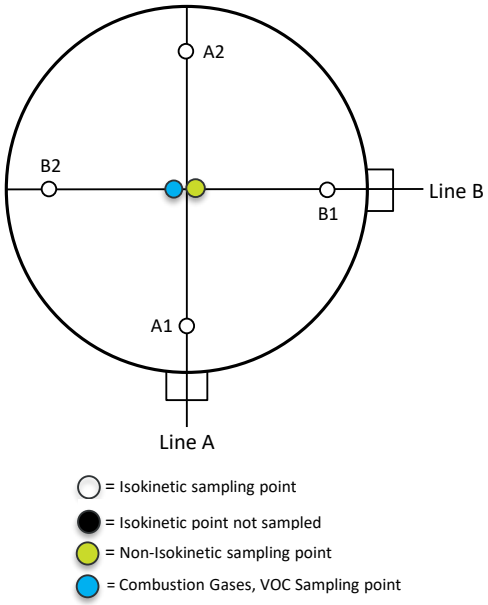
Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	**Equipment I.D.**	**Equipment Type**	**Equipment I.D.**	**Equipment Type**	**Equipment I.D.**
Control Box DGM	8.07	Horiba PG-250		Tape Measure	17.04
Box Thermocouples	2.07a	Horiba PG-250 SRM		Bevel Box	
Box Thermocouple In	3.28	Horiba PG-350	12.11	Stopwatch	10.07
Box Thermocouple Out	3.29	JCT JCC Cooler		Barometer	11.05
Control Box Timer	10.07	MAK10 Cooler		Digital Manometer	25.04a/b
Umbilical	2.07a	Horiba PS200 Cooler		Digital Temperature Meter	25.04a/b
Oven Box	9.03	M&C PSS Gas Preparation	3.45b	Dual Channel Heat Controller	
Heated Probe (1)	4.19	Gasmet DX4000 FTIR		1m Heated Line	
Heated Probe (2)	4.21	Gasmet Sampling System		3m Heated Line	
Stack Thermocouple (1)	1.61 / 1.63	SK-Thermo FID	13.08	5m Heated Line	
Stack Thermocouple (2)	1.42	Bernath 3006 FID		10m Heated Line	
S-Type Pitot (1)	20.12S	Testo 350XL		20m Heated Line	5.27
S-Type Pitot (2)	4-3-20-3 / 6-9-20-3	M&C PSP 4000	7.07	30m Heated Line	
L-Type Pitot		Easylogger EN-EL-12 Bit		Impinger Arm Thermocouple (1)	3.14a
Site Balance	18.07	Hioki 5043 (V)		Impinger Arm Thermocouple (2)	3.03a
500g Check Weight	19.07	Analyser Temperature Logger	29.03	Dioxins Kit Thermocouple	3.56d
1KG Check Weight	19.07	-		Sample Temperature Logger	
Digital Callipers	16.07	-		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	m²	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
	Platform has adequate drainage to prevent accumulation of free-standing water	Yes
Fall Prevention	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	0.5	1013	20.0	10.7	9.6	18.4	27.8	0.851

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (cmH2O)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
A	A1	11.7	2.1	2.1	2.1	2.1	18.2	99.1	3
	A2	68.3	2.3	2.3	2.3	2.3	19.1	99.2	4

Sample Line	Traverse Point	Position (cm)	Differential Pressure Reading (cmH2O)				Stack Velocity (m/s)	Stack Temp (°C)	Angle of Swirl
			1	2	3	Average			
B	B1	11.7	2.0	2.0	2.0	2.0	17.9	99.2	4
	B2	68.3	2.4	2.4	2.4	2.4	19.2	99.2	4

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 Conditions
Value	18.6	1.1:1	99	372	33650	24683	20692
Units	m/s	-	°C	K	m^3/hr	Nm^3/hr	Nm^3/hr

Total Particulate Matter - Run 1 Calculations

Parameter	Value	Unit
Meter Box Number	8.07	-
Gas Meter Coefficient	1.040	-
Pitot Coefficient	0.849	-
Stack Gas Molecular Weight	29.9	g/mole
Static Pressure in Stack	-0.5	cmH_2O

Date	Operators
07/06/2023	redacted

Parameter	Before	After	Unit
Barometric Pressure	1016	1016	mbar
Ambient Temperature	24.0	25.0	°C
Leak Check	0.13	-	L/min
Time	13:44	14:46	-

Parameter	Value	Unit
Nozzle Diameter	6.1	mm
Average Gas Meter Temperature	22.4	°C
Average Stack Temperature	99	°C
Average Stack Velocity	19.3	m/s
Isokineticity	106.5	%
Total Sampling Time	60	min
Gas Meter Difference	1320	L
Corrected Gas Meter Volume	1373	L
Mean Sampling Rate	22.9	L/min

Parameter	Value	Unit
Gas Meter Volume (STP Dry)	1.273	Nm^3
Gas Meter Volume (REF)	1.349	Nm^3
Stack Gas Water Vapour Content	18.6	% v/v
Stack Gas Oxygen Content	10.4	% v/v
TPM Concentration (REF)	0.9	mg/Nm^3
TPM Mass Emissions (REF)	18	g/hr

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O_2

Total Particulate Matter - Analysis Results

Sampling Run Number	Filter Reference	Filter Type	Filter Mass Change (mg)	Probe Wash Mass (mg)	Total Mass Deposit (mg)
Blank	47-4930	47mm GFA	<0.03	<0.25	<0.28
1	47-4926	47mm GFA	0.31	0.87	1.2

Sampling Run Number	Measured	Impinger Mass (g)				Collected Mass (g)
		1	2	3	4	
1	Before	613	705	691	988	234
	After	775	759	702	994	

Parameter	Value	Unit
Emission Limit Value (ELV)	30	mg/m^3
Overall Blank Value (OBV)	< 0.21	mg/m^3
OBV <10% of ELV	Yes	-

Date of Analysis	19/06/2023
Analytical Laboratory	Envirocare
Analytical Method	Gravimetric
Accreditation	MCERTS

Instrumental Gas Analyser Calibrations

Date	Operators	Combustion Gas Analyser	Flame Ionisation Detector
07/06/2023	redacted	12.11	13.08

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	41.0	163	0.10	163	-0.70	165	-0.43	1.6	Yes
Nitrogen Monoxide	205.28ppm	250ppm	50.0	205	-0.30	205	-0.10	209	-0.05	1.8	Yes
Propane	79.82ppm	100ppm	14.0	79.8	-0.11	79.7	-0.04	79.7	-0.05	-0.09	Yes
Oxygen	21.27%	25%	47.0	21.3	-0.01	21.3	0.00	21.2	0.00	-0.52	Yes

Instrumental Gas Analyser Results

Substance	Run	Corrected Concentration			Units	Basis	O_2 Correction
		Average	Max	Min			
Carbon Monoxide	1	1.2	2.8	0.54	mg/m^3	-	11%
Oxides of Nitrogen (as NO_2)	1	248	320	159	mg/m^3	NO_x as NO_2	11%
Total VOC	1	0.29	1.10	0.20	mg/m^3	VOC as C	11%
Oxygen	1	11.5	17.0	9.0	%	-	-

Instrumental Gas Analyser Chart - Run 1

Fluoride (as HF) - Run 1 Calculations

Sampling Details		
Meter Box Number	8.07	-
Gas Meter Coefficient	1.040	-
Pitot Coefficient	0.849	-
Stack Gas Molecular Weight	29.9	g/mole
Static Pressure in Stack	-0.52	cmH_2O

Analysis Details		
Collection Media	De-ionised Water	
1st Collector Reference	Imp A&B	
1st Collector Concentration	<23.67	µg
2nd Collector Reference	Imp C	
2nd Collector Concentration	<6.675	µg
Blank Concentration	< 0.012	mg/Nm^3
Has breakthrough occurred?	No	-

Isokineticity Details		
Nozzle Diameter	6.1	mm
Average Gas Meter Temperature	22.4	°C
Average Stack Temperature	98.8	°C
Average Stack Velocity	19.3	m/s
Isokineticity	106.5	%

Date	Operators
07/06/2023	redacted

Parameter	Before	After	Unit
Barometric Pressure	1016	1016	mbar
Ambient Temperature	24.0	25.0	°C
Leak Check	0.13	-	L/min
Time	13:44	14:46	-

Emissions Calculations		
Total Sampling Time	60.0	min
Gas Meter Difference	1320.0	L
Corrected Gas Meter Volume	1373.2	L
Mean Sampling Rate	22.9	L/min
Gas Meter Volume (STP Dry)	1.273	Nm^3
Gas Meter Volume (REF)	1.349	Nm^3
Stack Gas Water Vapour Content	18.6	% v/v
Stack Gas Oxygen Content	10.4	% v/v
Emission Limit Value	-	mg/Nm^3
HF Concentration (REF)	< 0.02	mg/Nm^3
HF Mass Emissions (REF)	< 0.47	g/hr

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O_2.

Chloride (as HCl) - Run 1 Calculations

Sampling Details		
Meter Box Number	8.07	-
Gas Meter Coefficient	1.040	-
Pitot Coefficient	0.849	-
Stack Gas Molecular Weight	29.9	g/mole
Static Pressure in Stack	-0.52	cmH_2O

Analysis Details		
Collection Media	De-ionised Water	
1st Collector Reference	Imp A&B	
1st Collector Concentration	127.818	µg
2nd Collector Reference	Imp C	
2nd Collector Concentration	6.675	µg
Blank Concentration	< 0.012	mg/Nm^3
Has breakthrough occurred?	No	-

Isokineticity Details		
Nozzle Diameter	6.1	mm
Average Gas Meter Temperature	22.4	°C
Average Stack Temperature	98.8	°C
Average Stack Velocity	19.3	m/s
Isokineticity	106.5	%

Date	Operators
07/06/2023	redacted

Parameter	Before	After	Unit
Barometric Pressure	1016	1016	mbar
Ambient Temperature	24.0	25.0	°C
Leak Check	0.13	-	L/min
Time	13:44	14:46	-

Emissions Calculations		
Total Sampling Time	60.0	min
Gas Meter Difference	1320.0	L
Corrected Gas Meter Volume	1373.2	L
Mean Sampling Rate	22.9	L/min
Gas Meter Volume (STP Dry)	1.273	Nm^3
Gas Meter Volume (REF)	1.349	Nm^3
Stack Gas Water Vapour Content	18.6	% v/v
Stack Gas Oxygen Content	10.4	% v/v
Emission Limit Value	10	mg/Nm^3
HCl Concentration (REF)	0.10	mg/Nm^3
HCl Mass Emissions (REF)	2.1	g/hr

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O_2

Sulphur Dioxide - Run 1 Calculations

Sampling Details		
Meter Box Number	8.07	-
Gas Meter Coefficient	1.040	-
Pitot Coefficient	0.849	-
Stack Gas Molecular Weight	29.8	g/mole
Static Pressure in Stack	-0.52	cmH_2O

Analysis Details		
Collection Media	H2O2	
1st Collector Reference	Imp A&B	
1st Collector Concentration	1523.094	µg
2nd Collector Reference	Imp C	
2nd Collector Concentration	34.71	µg
Blank Concentration	0.18	mg/Nm^3
Has breakthrough occurred?	No	-

Isokineticity Details		
Nozzle Diameter	-	mm
Average Gas Meter Temperature	18.3	°C
Average Stack Temperature	99.0	°C
Average Stack Velocity	18.9	m/s
Isokineticity	-	%

Date	Operators
08/06/2023	redacted

Parameter	Before	After	Unit
Barometric Pressure	1019	1019	mbar
Ambient Temperature	19.0	21.0	°C
Leak Check	0.04	0.04	L/min
Time	09:55	10:25	-

Emissions Calculations		
Total Sampling Time	30.0	min
Gas Meter Difference	123.4	L
Corrected Gas Meter Volume	128.4	L
Mean Sampling Rate	4.3	L/min
Gas Meter Volume (STP Dry)	0.121	Nm^3
Gas Meter Volume (REF)	0.123	Nm^3
Stack Gas Water Vapour Content	19.9	% v/v
Stack Gas Oxygen Content	10.8	% v/v
Emission Limit Value	50	mg/Nm^3
SO_2 Concentration (REF)	12.6	mg/Nm^3
SO_2 Mass Emissions (REF)	261	g/hr

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O_2.

Ammonia - Run 1 Calculations

Sampling Details		
Meter Box Number	8.07	-
Gas Meter Coefficient	1.040	-
Pitot Coefficient	0.849	-
Stack Gas Molecular Weight	30.0	g/mole
Static Pressure in Stack	-0.52	cmH_2O

Analysis Details		
Collection Media	H2SO4	
1st Collector Reference	Imp A&B	
1st Collector Concentration	<27.97	µg
2nd Collector Reference	Imp C	
2nd Collector Concentration	<14.01	µg
Blank Concentration	< 0.30	mg/Nm^3
Has breakthrough occurred?	No	-

Isokineticity Details		
Nozzle Diameter	-	mm
Average Gas Meter Temperature	19.3	°C
Average Stack Temperature	99.0	°C
Average Stack Velocity	18.89	m/s
Isokineticity	-	%

Date	Operators
08/06/2023	redacted

Parameter	Before	After	Unit
Barometric Pressure	1019	1019	mbar
Ambient Temperature	20.00	21.00	°C
Leak Check	0.04	0.04	L/min
Time	11:00	11:30	-

Emissions Calculations		
Total Sampling Time	30.0	min
Gas Meter Difference	103.2	L
Corrected Gas Meter Volume	107.4	L
Mean Sampling Rate	3.6	L/min
Gas Meter Volume (STP Dry)	0.101	Nm^3
Gas Meter Volume (REF)	0.105	Nm^3
Stack Gas Water Vapour Content	19.8	% v/v
Stack Gas Oxygen Content	10.6	% v/v
Emission Limit Value	10.0	mg/Nm^3
NH_3 Concentration (REF)	< 0.40	mg/Nm^3
NH_3 Mass Emissions (REF)	< 8.3	g/hr

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O_2

Metals - Run 1 Calculations

Parameter	Value	Unit
Meter Box Number	8.07	-
Gas Meter Coefficient	1.040	-
Pitot Coefficient	0.849	-
Stack Gas Molecular Weight	29.9	g/mole
Static Pressure in Stack	-0.52	cmH_2O

Date	Operators
07/06/2023	redacted

Parameter	Before	After	Unit
Barometric Pressure	1016	1016	mbar
Ambient Temperature	18.0	20.0	°C
Leak Check	0.13	0.16	L/min
Time	09:30	10:32	-

Parameter	Value	Unit
Nozzle Diameter	6.1	mm
Average Gas Meter Temperature	15.6	°C
Average Stack Temperature	97.2	°C
Average Stack Velocity	18.5	m/s
Isokineticity	101.5	%
Total Sampling Time	60	min
Gas Meter Difference	1245	L
Corrected Gas Meter Volume	1295	L
Mean Sampling Rate	21.6	L/min

Parameter	Value	Unit
Gas Meter Volume (STP Dry)	1.229	Nm^3
Gas Meter Volume (REF)	1.282	Nm^3
Mass of Water Vapour Collected	168.5	g
Volume of Water Vapour Collected	209.8	NL
Stack Gas Water Vapour Content	14.6	% v/v
Stack Gas Oxygen Content	10.6	% v/v

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O_2.

Measured	Impinger Mass (g)							Collected Mass (g)
	1	2	3	4	5	6	7	
Before	682.4	710.2	716.1	966.1	-	-	-	168.5
After	718.7	778.3	758.3	988.0	-	-	-	

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					
Arsenic	< 0.20	< 0.30	< 0.10	< 0.06	-	-	< 0.66	100%	< 0.00051	< 0.59	0.00046
Cadmium	< 0.20	< 0.30	< 0.07	< 0.04	-	-	< 0.61	100%	< 0.00047	< 0.56	0.00044
Cobalt	< 0.20	< 0.30	< 0.07	< 0.04	-	-	< 0.61	100%	< 0.00047	< 0.56	0.00044
Chromium	0.40	2.6	10.3	2.8	-	-	16.0	82.7%	0.012	2.8	0.0022
Copper	< 0.20	0.80	0.28	0.15	-	-	1.4	89.6%	0.0011	< 0.72	0.00057
Manganese	0.20	0.90	< 0.07	< 0.04	-	-	1.2	100%	0.00094	0.76	0.00059
Nickel	< 0.50	5.6	< 0.24	0.17	-	-	6.5	97.4%	0.0051	< 0.69	0.00054
Lead	< 0.30	2.7	< 0.83	0.48	-	-	4.3	88.8%	0.0034	< 0.56	0.00044
Antimony	< 0.40	< 0.20	0.07	< 0.04	-	-	0.71	100%	0.00055	< 0.66	0.00052
Thallium	< 0.20	< 0.20	< 0.07	< 0.04	-	-	< 0.51	100%	< 0.00039	< 0.46	0.00036
Vanadium	< 0.20	< 0.20	0.03	< 0.02	-	-	0.45	100%	0.00035	< 0.43	0.00034
Total Metals							31.9	95.4%	0.025	7.8	0.0061
Cadmium & Thallium							< 1.1	100%	< 0.00087	< 1.0	< 0.00080

Mercury - Run 1 Calculations

Parameter	Value	Unit
Meter Box Number	8.07	-
Gas Meter Coefficient	1.040	-
Pitot Coefficient	0.849	-
Stack Gas Molecular Weight	29.9	g/mole
Static Pressure in Stack	-0.52	cmH_2O

Date	Operators
07/06/2023	redacted

Parameter	Before	After	Unit
Barometric Pressure	1016	1016	mbar
Ambient Temperature	20.0	21.0	°C
Leak Check	0.11	0.13	L/min
Time	10:50	11:24	-

Parameter	Value	Unit
Nozzle Diameter	6.1	mm
Average Gas Meter Temperature	21.8	°C
Average Stack Temperature	98.0	°C
Average Stack Velocity	18.3	m/s
Isokineticity	106.8	%
Total Sampling Time	32	min
Gas Meter Difference	676	L
Corrected Gas Meter Volume	703	L
Mean Sampling Rate	22.0	L/min

Parameter	Value	Unit
Gas Meter Volume (STP Dry)	0.653	Nm^3
Gas Meter Volume (REF)	0.638	Nm^3
Mass of Water Vapour Collected	116.1	g
Volume of Water Vapour Collected	144.6	NL
Stack Gas Water Vapour Content	18.1	% v/v
Stack Gas Oxygen Content	11.2	% v/v

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O_2.

Measured	Impinger Mass (g)							Collected Mass (g)
	1	2	3	4	5	6	7	
Before	681.9	678.1	667.5	849.7	-	-	-	116.1
After	736.7	712.9	683.0	860.7	-	-	-	

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	< 0.03	< 0.18	< 0.07	-	-	< 0.31	100%	< 0.0005	0.25	0.00039

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O_2.

Mercury - Run 2 Calculations

Parameter	Value	Unit
Meter Box Number	8.07	-
Gas Meter Coefficient	1.040	-
Pitot Coefficient	0.849	-
Stack Gas Molecular Weight	29.9	g/mole
Static Pressure in Stack	-0.52	cmH_2O

Date	Operators
07/06/2023	redacted

Parameter	Before	After	Unit
Barometric Pressure	1016	1016	mbar
Ambient Temperature	22.0	23.0	°C
Leak Check	0.15	0.17	L/min
Time	11:50	12:24	-

Parameter	Value	Unit
Nozzle Diameter	6.1	mm
Average Gas Meter Temperature	21.0	°C
Average Stack Temperature	97.4	°C
Average Stack Velocity	18.7	m/s
Isokineticity	107.0	%
Total Sampling Time	32	min
Gas Meter Difference	689	L
Corrected Gas Meter Volume	717	L
Mean Sampling Rate	22.4	L/min

Parameter	Value	Unit
Gas Meter Volume (STP Dry)	0.668	Nm^3
Gas Meter Volume (REF)	0.678	Nm^3
Mass of Water Vapour Collected	120.8	g
Volume of Water Vapour Collected	150.4	NL
Stack Gas Water Vapour Content	18.4	% v/v
Stack Gas Oxygen Content	10.8	% v/v

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O_2.

Measured	Impinger Mass (g)							Collected Mass (g)
	1	2	3	4	5	6	7	
Before	683.5	674.6	685.4	860.7	-	-	-	120.8
After	743.8	712.8	701.9	866.5	-	-	-	

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	0.10	0.02	< 0.18	< 0.08	-	-	0.38	100.0%	0.00056

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O_2.

Mercury - Run 3 Calculations

Parameter	Value	Unit
Meter Box Number	8.07	-
Gas Meter Coefficient	1.040	-
Pitot Coefficient	0.849	-
Stack Gas Molecular Weight	29.8	g/mole
Static Pressure in Stack	-0.52	cmH_2O

Date	Operators
07/06/2023	redacted

Parameter	Before	After	Unit
Barometric Pressure	1016	1016	mbar
Ambient Temperature	22.0	24.0	°C
Leak Check	0.11	0.14	L/min
Time	12:44	13:18	-

Parameter	Value	Unit
Nozzle Diameter	6.1	mm
Average Gas Meter Temperature	21.8	°C
Average Stack Temperature	97.3	°C
Average Stack Velocity	18.8	m/s
Isokineticity	104.2	%
Total Sampling Time	32	min
Gas Meter Difference	687	L
Corrected Gas Meter Volume	715	L
Mean Sampling Rate	22.3	L/min

Parameter	Value	Unit
Gas Meter Volume (STP Dry)	0.664	Nm^3
Gas Meter Volume (REF)	0.629	Nm^3
Mass of Water Vapour Collected	110.0	g
Volume of Water Vapour Collected	137.0	NL
Stack Gas Water Vapour Content	17.1	% v/v
Stack Gas Oxygen Content	11.5	% v/v

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O_2.

Measured	Impinger Mass (g)							Collected Mass (g)
	1	2	3	4	5	6	7	
Before	678.7	677.7	670.7	866.5	-	-	-	110.0
After	734.4	712.6	684.0	872.6	-	-	-	

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	0.10	< 0.03	< 0.17	< 0.07	-	-	0.38	100%	0.00060

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O_2.

Dioxins & Furans Calculations

Parameter	Value	Unit
Meter Box Number	8.07	-
Gas Meter Coefficient	1.040	-
Pitot Coefficient	0.849	-
Stack Gas Molecular Weight	29.9	g/mole
Static Pressure in Stack	-0.52	cmH_2O

Date	Operators
08/06/2023	redacted

Parameter	Before	After	Unit
Barometric Pressure	1019	1019	mbar
Ambient Temperature	17.0	21.0	°C
Leak Check	0.27	0.27	L/min
Time	09:00	15:02	-

Parameter	Value	Unit
Nozzle Diameter	4.07	mm
Average Gas Meter Temperature	20.9	°C
Average Stack Temperature	99.0	°C
Average Stack Velocity	18.88	m/s
Isokineticity	108.4	%
Total Sampling Time	360	min
Gas Meter Difference	3526	L
Corrected Gas Meter Volume	3668	L
Mean Sampling Rate	10.2	L/min

Parameter	Value	Unit
STP Dry Gas Meter Volume	3428	NL
STP Dry Gas Meter Volume (REF)	2319	NL
Mass of Water Vapour Collected	655	g
Volume of Water Vapour Collected	815	NL
Stack Gas Water Vapour Content	19.2	% v/v
Stack Oxygen Content	10.9	% v/v

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O_2.

Condenser Exit Temperature	Value	Unit
Maximum Temperature Recorded	16.0	°C

Measured	Impinger Mass (g)							Collected Mass (g)
	1	2	3	4	5	6	7	
Before	368.9	609.8	605.4	940.3	-	-	-	654.7
After	955.8	653.8	605.5	964.0	-	-	-	

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	0.00012	1.000	0.00012	0.00000	1.000	0.00012	0.00000	1.000	0.00012	0.00000	1.0000	0.00012	0.00000	113
12378-PCDD	ND	0.00046	0.500	0.00023	0.00000	1.000	0.00046	0.00000	1.000	0.00046	0.00000	1.0000	0.00046	0.00000	100
123478-HxCDD	ND	0.00022	0.100	0.00002	0.00000	0.100	0.00002	0.00000	0.500	0.00011	0.00000	0.0500	0.00001	0.00000	91
123678-HxCDD	0.001	0.00024	0.100	0.00010	0.00010	0.100	0.00010	0.00010	0.010	0.00001	0.00001	0.0100	0.00001	0.00000	82
123789-HxCDD	0.001	0.00025	0.100	0.00010	0.00010	0.100	0.00010	0.00010	0.010	0.00001	0.00001	0.1000	0.00010	0.00000	-
1234678-HpCDD	0.0102	0.00021	0.010	0.00010	0.00010	0.010	0.00010	0.00010	0.001	0.00001	0.00001	0.0010	0.00001	0.00000	86
OCDD	0.0308	0.0005	0.001	0.00003	0.00003	0.0003	0.00001	0.00001	0.0001	0.00000	0.00000	0.0001	0.00000	0.00000	90
Total Dioxins	0.0430	0.0020	-	0.00071	0.00033	-	0.00092	0.00031	-	0.00072	0.00003	-	0.00071	0.00000	-
2378TCDF	0.0011	0.00019	0.100	0.00011	0.00011	0.100	0.00011	0.00011	0.050	0.00006	0.00006	1.0000	0.00114	0.00114	99
12378-PCDF	0.0008	0.0002	0.050	0.00004	0.00004	0.030	0.00002	0.00002	0.050	0.00004	0.00004	0.1000	0.00008	0.00008	99
23478-PCDF	0.0012	0.0002	0.500	0.00060	0.00060	0.300	0.00036	0.00036	0.500	0.00060	0.00060	1.0000	0.00119	0.00119	93
123478-HxCDF	0.0013	0.00021	0.100	0.00013	0.00013	0.100	0.00013	0.00013	0.100	0.00013	0.00013	0.1000	0.00013	0.00013	84
123678-HxCDF	0.0015	0.0002	0.100	0.00015	0.00015	0.100	0.00015	0.00015	0.100	0.00015	0.00015	0.1000	0.00015	0.00015	83
234678-HxCDF	0.0019	0.00019	0.100	0.00019	0.00019	0.100	0.00019	0.00019	0.100	0.00019	0.00019	0.1000	0.00019	0.00019	87
123789-HxCDF	ND	0.00019	0.100	0.00002	0.00000	0.100	0.00002	0.00000	0.100	0.00002	0.00000	0.1000	0.00002	0.00000	87
1234678-HpCDF	0.0052	0.00009	0.010	0.00005	0.00005	0.010	0.00005	0.00005	0.010	0.00005	0.00005	0.0100	0.00005	0.00005	81
1234789-HpCDF	0.0007	0.00011	0.010	0.00001	0.00001	0.010	0.00001	0.00001	0.010	0.00001	0.00001	0.0100	0.00001	0.00001	108
OCDF	0.004	0.00029	0.001	0.00000	0.00000	0.0003	0.00000	0.00000	0.0001	0.00000	0.00000	0.0001	0.00000	0.00000	86
Total Furans	0.0607	-	-	0.0013	0.0013	-	0.0010	0.0010	-	0.0012	0.0012	-	0.00062	0.0029	-
Totals ng	0.0607	-	-	0.0020	0.0016	-	0.0020	0.0013	-	0.0020	0.0012	-	0.0037	0.0029	-
Total Concentration ng/m^3		-	-	0.00086	0.00069	-	0.00084	0.0006	-	0.00084	0.00054	-	0.0016	0.0013	-

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	0.0007	0.0005	1.0000	0.0007	0.0007	1.0000	0.0007	0.0007	1.0000	0.0007	0.0007	1.0000	0.0007	0.0007	113
12378-PCDD	0.0096	0.0011	0.5000	0.0048	0.0048	1.0000	0.0096	0.0096	1.0000	0.0096	0.0096	1.0000	0.0096	0.0096	104
123478-HxCDD	0.0175	0.0008	0.1000	0.0018	0.0018	0.1000	0.0018	0.0018	0.5000	0.0088	0.0088	0.0500	0.0009	0.0009	101
123678-HxCDD	0.0444	0.0009	0.1000	0.0044	0.0044	0.1000	0.0044	0.0044	0.0100	0.0004	0.0004	0.0100	0.0004	0.0004	89
123789-HxCDD	0.0335	0.0009	0.1000	0.0034	0.0034	0.1000	0.0034	0.0034	0.0100	0.0003	0.0003	0.1000	0.0034	0.0034	-
1234678-HpCDD	0.5010	0.0006	0.0100	0.0050	0.0050	0.0100	0.0050	0.0050	0.0010	0.0005	0.0005	0.0010	0.0005	0.0005	95
OCDD	0.8910	0.0007	0.0010	0.0009	0.0009	0.0003	0.0003	0.0003	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	94
Total Dioxins	1.4976	0.0054	-	0.0209	0.0209	-	0.0250	0.0250	-	0.0203	0.0203	-	0.0155	0.0155	-
2378TCDF	0.0104	0.0013	0.1000	0.0010	0.0010	0.1000	0.0010	0.0010	0.0500	0.0005	0.0005	1.0000	0.0104	0.0104	102
12378-PCDF	0.0072	0.0009	0.0500	0.0004	0.0004	0.0300	0.0002	0.0002	0.0500	0.0004	0.0004	0.1000	0.0007	0.0007	99
23478-PCDF	0.0252	0.0009	0.5000	0.0126	0.0126	0.3000	0.0076	0.0076	0.5000	0.0126	0.0126	1.0000	0.0252	0.0252	98
123478-HxCDF	0.0259	0.0009	0.1000	0.0026	0.0026	0.1000	0.0026	0.0026	0.1000	0.0026	0.0026	0.1000	0.0026	0.0026	91
123678-HxCDF	0.0334	0.0008	0.1000	0.0033	0.0033	0.1000	0.0033	0.0033	0.1000	0.0033	0.0033	0.1000	0.0033	0.0033	90
234678-HxCDF	0.0948	0.0008	0.1000	0.0095	0.0095	0.1000	0.0095	0.0095	0.1000	0.0095	0.0095	0.1000	0.0095	0.0095	96
123789-HxCDF	0.0036	0.0008	0.1000	0.0004	0.0004	0.1000	0.0004	0.0004	0.1000	0.0004	0.0004	0.1000	0.0004	0.0004	86
1234678-HpCDF	0.2730	0.0003	0.0100	0.0027	0.0027	0.0100	0.0027	0.0027	0.0100	0.0027	0.0027	0.0100	0.0027	0.0027	88
1234789-HpCDF	0.0330	0.0003	0.0100	0.0003	0.0003	0.0100	0.0003	0.0003	0.0100	0.0003	0.0003	0.0100	0.0003	0.0003	114
OCDF	0.1910	0.0004	0.0010	0.0002	0.0002	0.0003	0.0001	0.0001	0.0001	0.0000	0.0000	0.0001	0.0000	0.0000	92
Total Furans	0.6976	0.0074	-	0.033	0.033	-	0.028	0.028	-	0.032	0.032	-	0.055	0.055	-
Totals ng	2.20	-	-	0.054	0.054	-	0.053	0.053	-	0.053	0.053	-	0.071	0.071	-
Total Concentration ng/m^3		-	-	0.023	0.023	-	0.023	0.023	-	0.023	0.023	-	0.030	0.030	-
Limit of Detection ng/m^3		0.0010	-	-	-	-	-	-	-	-	-	-	-	-	-

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O_2.

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	1.040	-
Pitot Coefficient	0.849	-
Stack Gas Molecular Weight	29.9	g/mole
Static Pressure in Stack	-0.52	cmH_2O

Date	Operators
08/06/2023	redacted

Parameter	Before	After	Unit
Barometric Pressure	1019	1019	mbar
Ambient Temperature	17.0	21.0	°C
Leak Check	0.27	0.27	L/min
Time	09:00	15:02	-

Parameter	Value	Unit
Nozzle Diameter	4.07	mm
Average Gas Meter Temperature	20.9	°C
Average Stack Temperature	99.0	°C
Average Stack Velocity	18.88	m/s
Isokineticity	108.4	%
Total Sampling Time	360	min
Gas Meter Difference	3526	L
Corrected Gas Meter Volume	3668	L
Mean Sampling Rate	10.2	L/min

Parameter	Value	Unit
STP Dry Gas Meter Volume	3428	NL
STP Dry Gas Meter Volume (REF)	2319	NL
Mass of Water Vapour Collected	655	g
Volume of Water Vapour Collected	815	NL
Stack Gas Water Vapour Content	19.2	% v/v
Stack Oxygen Content	10.9	% v/v

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O_2.

Condenser Exit Temperature	Value	Unit
Maximum Temperature Recorded	16.0	°C

Measured	Impinger Mass (g)							Collected Mass (g)
	1	2	3	4	5	6	7	
Before	368.9	609.8	605.4	940.3	-	-	-	654.7
After	955.8	653.8	605.5	964.0	-	-	-	

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	0.00098	0.0003	0.00030	0.0000003	0.0000003	0.0005000	0.0000005	0.0000005	0.1000000	0.0000980	0.0000980	97
PCB-77	0.0224	0.0003	0.00010	0.0000022	0.0000022	0.0001000	0.0000022	0.0000022	0.0500000	0.0011200	0.0011200	96
PCB-123	ND	0.0017	0.00003	0.0000001	0.0000000	0.0000050	0.0000000	0.0000000	0.0000100	0.0000000	0.0000000	92
PCB-118	0.0824	0.0014	0.00003	0.0000025	0.0000025	0.0000050	0.0000004	0.0000004	0.0000100	0.0000008	0.0000008	90
PCB-114	ND	0.0014	0.00003	0.0000000	0.0000000	0.0000050	0.0000000	0.0000000	0.0001000	0.0000001	0.0000000	93
PCB-105	0.0309	0.0013	0.00003	0.0000009	0.0000009	0.0000050	0.0000002	0.0000002	0.0001000	0.0000031	0.0000031	99
PCB-126	0.00194	0.001	0.10000	0.0001940	0.0001940	0.0050000	0.0000097	0.0000097	0.1000000	0.0001940	0.0001940	103
PCB-167	0.00375	0.0006	0.00003	0.0000001	0.0000001	0.0000050	0.0000000	0.0000000	0.0000100	0.0000000	0.0000000	101
PCB-156	0.00613	0.0005	0.00003	0.0000002	0.0000002	0.0000050	0.0000000	0.0000000	0.0001000	0.0000006	0.0000006	104
PCB-157	ND	0.0005	0.00003	0.0000000	0.0000000	0.0000050	0.0000000	0.0000000	0.0001000	0.0000001	0.0000000	101
PCB-169	ND	0.00030	0.03000	0.0000090	0.0000000	0.0000500	0.0000000	0.0000000	0.0010000	0.0000003	0.0000000	102
PCB-189	0.00129	0.0002	0.00003	0.0000000	0.0000000	0.0000050	0.0000000	0.0000000	0.0000100	0.0000000	0.0000000	98
Total ng	0.150	-	-	0.00021	0.0002003	-	0.0000131	0.0000131	-	0.0014	0.0014	-
Concentration ng		-	-	0.000090	0.0000863	-	0.0000056	0.00000563	-	0.00061	0.00061	-

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O_2.

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	0.00861	0.0003	0.00030	0.0000026	0.0000026	0.000500	0.00000431	0.00000431	0.100000	0.00086100	0.00086100	98
PCB-77	0.0614	0.0003	0.00010	0.0000061	0.0000061	0.000100	0.00000614	0.00000614	0.050000	0.00307000	0.00307000	96
PCB-123	0.00406	0.0022	0.00003	0.0000001	0.0000001	0.000005	0.00000002	0.00000002	0.000010	0.00000004	0.00000004	93
PCB-118	0.182	0.002	0.00003	0.0000055	0.0000055	0.000005	0.00000091	0.00000091	0.000010	0.00000182	0.00000182	90
PCB-114	0.0048	0.002	0.00003	0.0000001	0.0000001	0.000005	0.00000002	0.00000002	0.000100	0.00000048	0.00000048	93
PCB-105	0.0914	0.0018	0.00003	0.0000027	0.0000027	0.000005	0.00000046	0.00000046	0.000100	0.00000914	0.00000914	100
PCB-126	0.0228	0.0007	0.10000	0.0022800	0.0022800	0.005000	0.00011400	0.00011400	0.100000	0.00228000	0.00228000	105
PCB-167	0.0229	0.0012	0.00003	0.0000007	0.0000007	0.000005	0.00000011	0.00000011	0.000010	0.00000023	0.00000023	117
PCB-156	0.0822	0.001	0.00003	0.0000025	0.0000025	0.000005	0.00000041	0.00000041	0.000100	0.00000822	0.00000822	118
PCB-157	0.0212	0.0009	0.00003	0.0000006	0.0000006	0.000005	0.00000011	0.00000011	0.000100	0.00000212	0.00000212	115
PCB-169	0.0243	0.0003	0.03000	0.0007290	0.0007290	0.000050	0.00000122	0.00000122	0.001000	0.00002430	0.00002430	108
PCB-189	0.0182	0.0005	0.00003	0.0000005	0.0000005	0.000005	0.00000009	0.00000009	0.000010	0.00000018	0.00000018	102
Total ng	0.54	-	-	0.0030	0.0030	-	0.00013	0.00013	-	0.0063	0.0063	-
Concentration ng		-	-	0.0013	0.0013	-	0.000055	0.000055	-	0.0027	0.0027	-
Limit of Detection ng/m^3		0.00003		-	-	-	-	-	-	-	-	-

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O_2.

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	1.040	-
Pitot Coefficient	0.849	-
Stack Gas Molecular Weight	29.9	g/mole
Static Pressure in Stack	-0.52	cmH_2O

Date	Operators
07/06/2023	redacted

Parameter	Before	After	Unit
Barometric Pressure	1016	1016	mbar
Ambient Temperature	23.0	24.0	°C
Leak Check	0.17	0.15	L/min
Time	15:15	16:18	-

Parameter	Value	Unit
Nozzle Diameter	5.06	mm
Average Gas Meter Temperature	22.7	°C
Average Stack Temperature	98.2	°C
Average Stack Velocity	17.74	m/s
Isokineticity	105.9	%
Total Sampling Time	60	min
Gas Meter Difference	842	L
Corrected Gas Meter Volume	876	L
Mean Sampling Rate	14.6	L/min

Parameter	Value	Unit
STP Dry Gas Meter Volume	811	NL
STP Dry Gas Meter Volume (REF)	567	NL
Mass of Water Vapour Collected	155	g
Volume of Water Vapour Collected	193	NL
Stack Gas Water Vapour Content	19.2	% v/v
Stack Oxygen Content	10.5	% v/v

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O_2.

Condenser Exit Temperature	Value	Unit
Maximum Temperature Recorded	15.0	°C

Measured	Impinger Mass (g)							Collected Mass (g)
	1	2	3	4	5	6	7	
Before	367.9	609.6	605.7	937.3	-	-	-	154.8
After	517.8	609.7	607.5	940.3	-	-	-	

PAH's Blank & Run 1

Congener	Detection Limit (ug)	Blank Run (ug)	Sample Run (ug)	Blank Concentration (ug/m³)	Sample Run Concentration (ug/m³)	Measurement Uncertainty (MU) ug/m³ +/-
Napthalene	0.010	0.353	0.747	0.622	1.316	0.315
Fluoranthene	0.010	0.049	0.127	0.086	0.224	0.054
Benzo(b)naptho(2,1-d)thiophene	0.010	< 0.010	< 0.010	< 0.018	< 0.018	0.004
Benzo(c)phenanthrene	0.010	< 0.010	< 0.010	< 0.018	< 0.018	0.004
Benzo(a)anthracene	0.010	< 0.010	< 0.010	< 0.018	< 0.018	0.004
Chrysene	0.010	< 0.010	< 0.010	< 0.018	< 0.018	0.004
Cyclopenta(c,d)pyrene	0.010	< 0.010	< 0.010	< 0.018	< 0.018	0.004
Benzo(b)fluoranthene	0.010	< 0.010	< 0.010	< 0.018	< 0.018	0.004
Benzo(k)fluoranthene	0.010	< 0.010	< 0.010	< 0.018	< 0.018	0.004
Benzo(a)pyrene	0.010	< 0.010	< 0.010	< 0.018	< 0.018	0.004
Cholanthrene	0.010	< 0.010	< 0.010	< 0.018	< 0.018	0.004
Indeno(1,2,3-cd)pyrene	0.010	< 0.010	< 0.010	< 0.018	< 0.018	0.004
Benzo(ghi)perylene	0.010	< 0.010	< 0.010	< 0.018	< 0.018	0.004
Dibenzo(ah)anthracene	0.010	< 0.010	< 0.010	< 0.018	< 0.018	0.004
Anthanthrene	0.010	< 0.010	< 0.010	< 0.018	< 0.018	0.004
Dibenzo(a,i)pyrene	0.010	< 0.010	< 0.010	< 0.018	< 0.018	0.004
Total Mass collected ug	0.16	0.54	1.0	-	-	-
Concentration ug/m^3	0.28	0.95	1.8	0.95	1.8	-

Reference conditions (REF) are: 273k, 101.3kPa, Dry Gas, 11% O_2.

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Uncertainty

Uncertainty of Total Particulate Matter - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	30	mg/m³
Mean Sampling Rate	22.9	L/min
Leak Rate	0.13	L/min
Barometric Pressure	1016	mbar
Average Stack Temperature	98.8	°C
Sampled Stack Gas Volume	1320	L

Parameter	Value	Unit
Mean Emission Concentration	0.88	mg/m³
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 EN 13284-1		Envirocare Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u²
		Uncertainty Criteria	Max. Value					
Weighing Procedure	Std	5% of limit value	1.5	0.28	mg	0.93	0.28	0.08
Leak Rate	Rect	<2% of sampling rate	0.46	0.13	L/min	0.57	0.003	0.000008
Time	Std	1sec in 1hour = 0.028%	2.0	1.0	sec	0.03	0.0002	0.00000006
Gasmeter Volume	Std	<2%	26.4	4.9	L	0.37	0.003	0.00001
Temperature	Std	1% of value	1.0	0.24	°c	0.24	0.002	0.000005
Pressure	Std	1% of value	10.2	1.0	mbar	0.10	0.0009	0.0000007

Total	0.08
Combined Standard Uncertainty [(sum u²)$^{0.5}$]	0.28
Expanded Total Uncertainty as a % of emission conc. (95% confidence)	62.4
Expanded Total Uncertainty (mg/m³) (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/m³
Reading	0.94	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 u²
Zero Drift/Lower limit of detection (ppm)	0.60	Rectangular	1.73	0.35	0.12
Span Drift (ppm)	-1.9	Rectangular	1.73	-1.1	1.2
Linearity (% of value)	0.25	Rectangular	1.73	0.001	0.000002
Setting Gas Divider (% of value)	0.35	Normal	1.00	0.003	0.00001
Interference (% of value)	-0.48	Rectangular	1.73	-0.003	0.000007
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	1.5
Combined Standard Uncertainty [(sum u²)$^{0.5}$]	1.2
Expanded Total Uncertainty (ppm) (95% confidence)	2.4
Expanded Total Uncertainty as a % of emission conc. (95% confidence)	258
Expanded Total Uncertainty (mg/m³) (95% confidence)	3.0
Expanded Total Uncertainty as a % of emission limit value (95% confidence)	6.0

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

Parameter	Value	Unit
Emission Limit Value (ELV)	400	mg/m³
Reading	120.8	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 u²
Zero Drift/Lower limit of detection (ppm)	-0.20	Rectangular	1.73	-0.12	0.01
Span Drift (ppm)	-3.6	Rectangular	1.73	-2.1	4.3
Linearity (% of value)	0.52	Rectangular	1.73	0.36	0.13
Setting Gas Divider (% of value)	0.35	Normal	1.00	0.42	0.18
Interference (% of value)	0.63	Rectangular	1.73	0.44	0.19
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	4.9
				Combined Standard Uncertainty [(sum u²)$^{0.5}$]	2.2
				Expanded Total Uncertainty (ppm) (95% confidence)	4.3
				Expanded Total Uncertainty as a % of emission conc. (95% confidence)	3.6
				Expanded Total Uncertainty (mg/m³) (95% confidence)	8.9
				Expanded Total Uncertainty as a % of emission limit value (95% confidence)	2.2

Uncertainty of Total VOC by FID - Run1

Parameter	Value	Unit
Emission Limit Value (ELV)	10	mg/m³
Reading	0.18	ppm
Span Gas Certified Value	79.8	ppm
Range	100	ppm

Cal Gas
C_3H_8

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u²
Zero Drift/Lower limit of detection (ppm)	-0.07	Rectangular	1.73	-0.04	0.002
Span Drift (ppm)	0.03	Rectangular	1.73	0.02	0.0003
Linearity (% of value)	0.96	Rectangular	1.73	0.001	0.000001
Setting Gas Divider (% of value)	0.35	Normal	1.00	0.0006	0.0000004
Noise (ppm)	0.10	Rectangular	1.73	0.06	0.003
Temperature Drift (% of value)	1.0	Rectangular	1.73	0.001	0.000001
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	0.09
				Combined Standard Uncertainty [(sum u²)$^{0.5}$]	0.29
				Expanded Total Uncertainty (ppm) (95% confidence)	0.57
				Expanded Total Uncertainty as a % of emission conc. (95% confidence)	312
				Expanded Total Uncertainty (mg/m³) (95% confidence)	0.92
				Expanded Total Uncertainty as a % of emission limit value (95% confidence)	9.2

Uncertainty of Oxygen by Horiba Gas Analyser - Run 1

Parameter	Value	Unit
Reading	11.5	%
Span Gas Certified Value	21.3	%
Range	25.0	%

Cal Gas
O_2

Source of Uncertainty	Uncertainty Criteria	Probability Distribution	Divisor	Source Uncertainty u	Combined Uncertainty u²
Zero Drift/Lower limit of detection (%vol)	0.09	Rectangular	1.73	0.05	0.003
Span Drift (%vol)	0.11	Rectangular	1.73	0.06	0.004
Linearity (% of value)	0.24	Rectangular	1.73	0.02	0.0003
Setting Gas Divider (% of value)	0.35	Normal	1.00	0.04	0.002
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	0.009
				Combined Standard Uncertainty [(sum u²)$^{0.5}$]	0.09
				Expanded Total Uncertainty (%) (95% confidence)	0.18
				Expanded Total Uncertainty as a % of emission conc. (95% confidence)	1.6

Uncertainty of Fluoride (as HF) - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	-	mg/m³
Mean Sampling Rate	22.9	L/min
Leak Rate	0.13	L/min
Barometric Pressure	1016	mbar
Average Stack Temperature	98.8	°C
Sampled Stack Gas Volume	1320	L

Parameter	Value	Unit
Mean Emission Concentration	0.02	mg/m³
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*	CEN/TS 17340		Envirocare Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u²
		Uncertainty Criteria	Max. Value					
Analysis Procedure	Std	-	-	7.9	%	4.0	0.0009	0.0000008
Leak Rate	Rect	<2% of sampling rate	0.46	0.13	L/min	0.57	0.00007	0.000000005
Time	Std	1sec in 1hour = 0.028%	2.0	1.00	sec	0.03	0.000006	0.00000000004
Gasmeter Volume	Std	<2% actual volume	26.4	4.9	L	0.37	0.00008	0.000000007
Temperature	Std	<1% absolute temperature	1.0	0.24	k	0.24	0.00005	0.000000003
Pressure	Std	<1% absolute pressure	10.2	1.0	mbar	0.10	0.00002	0.0000000005
							Total	0.0000008
							Combined Standard Uncertainty [(sum u²)$^{0.5}$]	0.0009
							Expanded Total Uncertainty as a % of emission conc. (95% confidence)	8.0
							Expanded Total Uncertainty (mg/m³) (95% confidence)	0.002
							Expanded Total Uncertainty as a % of emission limit value (95% confidence)	-

Uncertainty of Chloride (as HCl) - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	10	mg/m³
Mean Sampling Rate	22.9	L/min
Leak Rate	0.13	L/min
Barometric Pressure	1016	mbar
Average Stack Temperature	98.8	°C
Sampled Stack Gas Volume	1320	L

Parameter	Value	Unit
Mean Emission Concentration	0.10	mg/m³
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 EN 1911		Envirocare Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u²
		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	0.46	0.13	L/min	0.57	0.0003	0.0000001
Time	Std	1sec in 1hour = 0.028%	2.0	1.0	sec	0.03	0.00003	0.0000000008
Gasmeter Volume	Std	<2% of measured value	26.4	4.9	L	0.37	0.0004	0.0000001
Temperature	Std	<2.5K cal. uncertainty	1.0	0.24	°C	0.24	0.0002	0.00000006
Pressure	Std	1% of absolute pressure	10.2	1.0	mbar	0.10	0.0001	0.00000001
							Total	0.00002
							Combined Standard Uncertainty [(sum u²)$^{0.5}$]	0.004
							Expanded Total Uncertainty as a % of emission conc. (95% confidence)	8.0
							Expanded Total Uncertainty (mg/m³) (95% confidence)	0.008
							Expanded Total Uncertainty as a % of emission limit value (95% confidence)	0.08

Uncertainty of Sulphur Dioxide - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	50	mg/m³
Mean Sampling Rate	4.3	L/min
Leak Rate	0.04	L/min
Barometric Pressure	1019	mbar
Average Stack Temperature	99.0	°C
Sampled Stack Gas Volume	123	L

Parameter	Value	Unit
Mean Emission Concentration	12.6	mg/m³
Monitoring Duration	30	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		Envirocare Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u²
		Uncertainty Criteria	Max. Value					
Analysis Procedure	Std	<2.5% of measured value	-	7.7	%	3.9	0.50	0.25
Leak Rate	Rect	<2% of sampling rate	0.09	0.04	L/min	0.93	0.07	0.005
Time	Std	1sec in 1hour = 0.028%	2.0	0.5	sec	0.03	0.004	0.00001
Gasmeter Volume	Std	<2.5% volume of gas	3.1	0.46	L	0.37	0.05	0.002
Temperature	Std	<1% absolute temperature	1.0	0.24	°C	0.24	0.03	0.0009
Pressure	Std	<1% absolute pressure	10.2	1.0	mbar	0.10	0.01	0.0002
							Total	0.25
							Combined Standard Uncertainty [(sum u²)$^{0.5}$]	0.50
							Expanded Total Uncertainty as a % of emission conc. (95% confidence)	7.8
							Expanded Total Uncertainty (mg/m³) (95% confidence)	0.99
							Expanded Total Uncertainty as a % of emission limit value (95% confidence)	2.0

Uncertainty of Ammonia - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	10	mg/m³
Mean Sampling Rate	3.6	L/min
Leak Rate	0.04	L/min
Barometric Pressure	1019	mbar
Average Stack Temperature	99.0	°C
Sampled Stack Gas Volume	103	L

Parameter	Value	Unit
Mean Emission Concentration	0.40	mg/m³
Monitoring Duration	30	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		Envirocare Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u²
		Uncertainty Criteria	Max. Value					
Analysis Procedure	Std	<2.5% of measured value	-	8.9	%	4.5	0.02	0.0003
Leak Rate	Rect	<2% of sampling rate	0.07	0.04	L/min	1.1	0.003	0.000007
Time	Std	1sec in 1hour = 0.028%	2.0	0.5	sec	0.03	0.0001	0.00000001
Gasmeter Volume	Std	<2.5% volume of gas	2.6	0.38	L	0.37	0.001	0.000002
Temperature	Std	<1% absolute temperature	1.0	0.24	°C	0.24	0.001	0.0000009
Pressure	Std	<1% absolute pressure	10.2	1.0	mbar	0.10	0.0004	0.0000002
							Total	0.0003
							Combined Standard Uncertainty [(sum u²)$^{0.5}$]	0.02
							Expanded Total Uncertainty as a % of emission conc. (95% confidence)	9.0
							Expanded Total Uncertainty (mg/m³) (95% confidence)	0.04
							Expanded Total Uncertainty as a % of emission limit value (95% confidence)	0.36

Uncertainty of Metals - Run 1

Parameter	Value	Unit
Mean Sampling Rate	21.6	L/min
Leak Rate	0.15	L/min
Barometric Pressure	1016	mbar
Average Stack Temperature	97.2	°C
Sampled Stack Gas Volume	1245	L

Parameter	Value	Unit
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 EN 14385		Envirocare Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u²
		Uncertainty Criteria	Max. Value					
Leak Rate	Rect	<2% of sampling rate	0.43	0.15	L/min	0.67	0.0001	0.000000009
Time	Std	1sec in 1hour = 0.028%	2.0	1.0	sec	0.03	0.000007	0.00000000005
Gasmeter Volume	Std	<2%	24.9	4.6	L	0.37	0.00009	0.000000008
Temperature	Std	1% of value	1.0	0.24	°C	0.25	0.00006	0.000000004
Pressure	Std	1% of value	10.2	1.0	mbar	0.10	0.00002	0.0000000006
							Total	0.00000002

Metal	Analysis		Analysis Unc. U (mg)	Analysis u2	Sampling u2	Total sqrt(u2)	Measurement Uncertainty (95% Confidence) (mg/Nm3)	Expanded Total Uncertainty as a percentage of (95% Confidence)	
	(µg)	Unc (%)						Emissions Concentration	Emission Limit Value
Arsenic	0.66	13.7	0.00009	0.000000008	0.00000002	0.0002	0.0003	66.4	-
Cadmium	0.61	10.2	0.00006	0.000000004	0.00000002	0.0002	0.0003	66.8	-
Cobalt	0.61	10.5	0.00006	0.000000004	0.00000002	0.0002	0.0003	67.1	-
Chromium	16.0	13.8	0.002	0.000005	0.00000002	0.002	0.0043	34.7	-
Copper	1.4	11.6	0.0002	0.00000003	0.00000002	0.0002	0.0004	39.2	-
Manganese	1.2	14.9	0.0002	0.00000003	0.00000002	0.0002	0.0005	48.5	-
Nickel	6.5	11.4	0.0007	0.0000006	0.00000002	0.0008	0.001	29.3	-
Lead	4.3	9.4	0.0004	0.0000002	0.00000002	0.0004	0.0008	25.2	-
Antimony	0.71	8.8	0.00006	0.000000004	0.00000002	0.0002	0.0003	57.5	-
Thallium	0.51	12.8	0.00006	0.000000004	0.00000002	0.0002	0.0003	80.6	-
Vanadium	0.45	10.3	0.00005	0.000000002	0.00000002	0.0002	0.0003	86.6	-
Total Metals	31.9	11.6	0.004	0.00001	0.00000002	0.004	0.007	29.2	1.5
Cadmium & Thallium	0.56	11.5	0.00006	0.000000004	0.00000002	0.0002	0.0003	36.6	0.63

Uncertainty of Mercury - Run 1

Parameter	Value	Unit
Mean Sampling Rate	22.0	L/min
Leak Rate	0.12	L/min
Barometric Pressure	1016	mbar
Average Stack Temperature	97.4	°C
Sampled Stack Gas Volume	676	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		Envirocare Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u²
		Uncertainty Criteria	Max. Value					
Leak Rate	Rect	<2% of sampling rate	0.44	0.12	L/min	0.55	0.000002	0.000000000002
Time	Std	1sec in 1hour = 0.028%	2.0	0.53	sec	0.03	0.0000001	0.00000000000002
Gasmeter Volume	Std	<2%	13.5	2.5	L	0.37	0.000002	0.000000000003
Temperature	Std	1% of value	1.0	0.24	°C	0.25	0.000001	0.000000000001
Pressure	Std	1% of value	10.2	1.0	mbar	0.10	0.0000005	0.00000000000002
							Total	0.000000000007

Metal	Analysis		Analysis Unc. U (mg)	Analysis u2	Sampling u2	Total sqrt(u2)	Measurement Uncertainty (95% Confidence) (mg/Nm3)	Expanded Total Uncertainty as a percentage of (95% Confidence)	
	(µg)	Unc (%)						Emissions Concentration	Emission Limit Value
Mercury	0.31	15.3	0.00005	0.000000002	0.000000000007	0.00005	0.00009	19.2	0.19

Uncertainty of Mercury - Run 2

Parameter	Value	Unit
Mean Sampling Rate	22.4	L/min
Leak Rate	0.16	L/min
Barometric Pressure	1016	mbar
Average Stack Temperature	97.4	°C
Sampled Stack Gas Volume	689	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		Envirocare Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u²
		Uncertainty Criteria	Max. Value					
Leak Rate	Rect	<2% of sampling rate	0.45	0.16	L/min	0.71	0.000002	0.000000000005
Time	Std	1sec in 1hour = 0.028%	2.0	0.53	sec	0.03	0.0000002	0.00000000000002
Gasmeter Volume	Std	<2%	13.8	2.5	L	0.37	0.000002	0.000000000004
Temperature	Std	1% of value	1.0	0.24	°C	0.25	0.000001	0.000000000002
Pressure	Std	1% of value	10.2	1.0	L	0.10	0.0000006	0.00000000000003
							Total	0.00000000001

Metal	Analysis		Analysis Unc. U (mg)	Analysis u2	Sampling u2	Total sqrt(u2)	Measurement Uncertainty (95% Confidence) (mg/Nm3)	Expanded Total Uncertainty as a percentage of (95% Confidence)	
	(µg)	Unc (%)						Emissions Concentration	Emission Limit Value
Mercury	0.38	15.3	0.00006	0.000000003	0.00000000001	0.00006	0.0001	20.4	0.23

Uncertainty of Mercury - Run 3

Parameter	Value	Unit
Mean Sampling Rate	22.3	L/min
Leak Rate	0.13	L/min
Barometric Pressure	1016	mbar
Average Stack Temperature	97.3	°C
Sampled Stack Gas Volume	687	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		Envirocare Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u²
		Uncertainty Criteria	Max. Value					
Leak Rate	Rect	<2% of sampling rate	0.45	0.13	L/min	0.56	0.000002	0.000000000004
Time	Std	1sec in 1hour = 0.028%	2.0	0.53	sec	0.03	0.0000002	0.00000000000003
Gasmeter Volume	Std	<2%	13.7	2.5	L	0.37	0.000002	0.000000000005
Temperature	Std	1% of value	1.0	0.24	°C	0.25	0.000001	0.000000000002
Pressure	Std	1% of value	10.2	1.0	mbar	0.10	0.0000006	0.00000000000003
							Total	0.00000000001

Metal	Analysis		Analysis Unc. U (mg)	Analysis u2	Sampling u2	Total sqrt(u2)	Measurement Uncertainty (95% Confidence) (mg/Nm3)	Expanded Total Uncertainty as a percentage of (95% Confidence)	
	(µg)	Unc (%)						Emissions Concentration	Emission Limit Value
Mercury	0.38	15.3	0.00006	0.000000003	0.00000000001	0.00006	0.0001	18.9	-

Uncertainty of Dioxins & Furans - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	0.03	ng/m³
Mean Sampling Rate	10.2	L/min
Leak Rate	0.27	L/min
Barometric Pressure	1019	mbar
Average StackTemperature	99.0	°C
Sampled Stack Gas Volume	3526	L

Parameter	Value	Unit
Mean Emission Concentration	0.023	ng/m³
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		Envirocare Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u²
		Uncertainty Criteria	Max. Value					
Leak Rate	Rect	<2% of sampling rate	0.20	0.27	L/min	2.6	0.0004	0.0000001
Time	Std	1sec in 1hour = 0.028%	2.0	6.0	sec	0.03	0.000006	0.00000000004
Gasmeter Volume	Std	<2%	70.5	13.0	L	0.37	0.00009	0.000000007
Temperature	Std	1% of value	1.0	0.24	°C	0.24	0.00006	0.000000003
Pressure	Std	1% of value	10.2	1.0	mbar	0.10	0.00002	0.0000000005

Measured Concentration	0.023	**Total**	0.000003
Analysis Uncertainty %	7.4	**Combined Standard Uncertainty [(sum u²)$^{0.5}$]**	0.002
Analysis Uncertainty u ng	0.002	**Expanded Total Uncertainty as a % of emission conc. (95% confidence)**	14.8
Analysis Total u^2	0.000003	**Expanded Total Uncertainty (ng/m³) (95% confidence)**	0.003
		Expanded Total Uncertainty as a % of emission limit value (95% confidence)	11.5

Uncertainty of PCB's - Run 1

Parameter	Value	Unit
Emission Limit Value (ELV)	-	ng/m³
Mean Sampling Rate	10.2	L/min
Leak Rate	0.27	L/min
Barometric Pressure	1019	mbar
Average StackTemperature	99.0	°C
Sampled Stack Gas Volume	3526	L

Parameter	Value	Unit
Mean Emission Concentration	0.0013	ng/m³
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		Envirocare Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u²
		Uncertainty Criteria	Max. Value					
Leak Rate	Rect	<2% of sampling rate	0.20	0.27	L/min	2.6	0.00002	0.0000000004
Time	Std	1sec in 1hour = 0.028%	2.0	6.0	sec	0.03	0.0000004	0.0000000000001
Gasmeter Volume	Std	<2%	70.5	13.0	L	0.37	0.000005	0.00000000002
Temperature	Std	1% of value	1.0	0.24	°C	0.24	0.000003	0.00000000001
Pressure	Std	1% of value	10.2	1.0	mbar	0.10	0.000001	0.000000000002

Measured Concentration	0.0013	**Total**	0.000000004
Analysis Uncertainty %	4.6	**Combined Standard Uncertainty [(sum u²)0.5]**	0.00006
Analysis Uncertainty u ng	0.00006	**Expanded Total Uncertainty as a % of emission conc. (95% confidence)**	9.5
Analysis Total u2	0.000000004	**Expanded Total Uncertainty (ng/m³) (95% confidence)**	0.0001
		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/m³
Mean Sampling Rate	14.6	L/min
Leak Rate	0.16	L/min
Barometric Pressure	1016	mbar
Average StackTemperature	98.2	°C
Sampled Stack Gas Volume	842	L

Parameter	Value	Unit
Mean Emission Concentration	1.8	ug/m³
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		Envirocare Certified Value	Units	% Actual Value	Source Uncertainty u	Combined Uncertainty u²
		Uncertainty Criteria	Max. Value					
Leak Rate	Rect	<2% of sampling rate	0.29	0.16	L/min	1.1	0.01	0.0001
Time	Std	1sec in 1hour = 0.028%	2.0	1.0	sec	0.03	0.0005	0.0000002
Gasmeter Volume	Std	<2%	17	3.1	L	0.37	0.007	0.00004
Temperature	Std	1% of value	1.0	0.24	°C	0.24	0.004	0.00002
Pressure	Std	1% of value	10.2	1.0	mbar	0.10	0.002	0.000003

Measured Concentration	1.8	**Total**	0.05
Analysis Uncertainty %	12.2	**Combined Standard Uncertainty [(sum u²)$^{0.5}$]**	0.22
Analysis Uncertainty u ug	0.22	**Expanded Total Uncertainty as a % of emission conc. (95% confidence)**	24.0
Analysis Total u2	0.05	**Expanded Total Uncertainty (ug/m³) (95% confidence)**	0.43
		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	33650	L/min

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	0.13	m/s
Expanded Uncertainty Mean Velocity (95% confidence)	0.25	m/s
Expanded Uncertainty Mean Velocity (95% Confidence), Relative	1.4	%
Standard Uncertainty - Volumetric Flow Rate	811	-
Standard Uncertainty - Volumetric Flow Rate (95% Confidence)	1590	m³/hr
Standard Uncertainty - Volumetric Flow Rate (95% Confidence), Relative	4.7	%

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.