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Stack Emissions Testing Report Commissioned by
Avon Metals Ltd

Installation Name & Address
Avon Metals Ltd
Ashville Road
Gloucester
GL2 5DA

PPC Permit: EP/A2/001, VARIATION GC/16/00001/A2/V1

Stack Reference
A1 New GT

Dates of the Monitoring Campaign
25th - 26th March 2025

Job Reference Number
EMT-12598

Report Written by
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Report Date
18th April 2025

Version
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Signature of Report Approver


TITLE PAGE

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Executive Summary

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MONITORING OBJECTIVES

Avon Metals Ltd, Gloucester

A1 New GT

25th - 26th March 2025

Overall Aim of the Monitoring Campaign

Element were commissioned by Avon Metals Ltd to carry out stack emissions testing on the A1 New GT at Gloucester.

The aim of the monitoring campaign was to demonstrate compliance with a set of emission limit values (ELVs) as specified in the Site's Permit.

Special Requirements

There were no special requirements.

Target Parameters

Total Particulate Matter, Hydrogen Chloride, Dioxins & Furans, Hydrogen Fluoride, Total VOCs (as Carbon)

Executive Summary

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MONITORING RESULTS

Avon Metals Ltd, Gloucester

A1 New GT

25th - 26th March 2025

where MU = Measurement Uncertainty associated with the Result

Parameter	Concentration				Mass Emission			
	Units	Result	MU +/-	Limit	Units	Result	MU +/-	Limit
Total Particulate Matter ¹	mg/m ³	0.46	0.37	5	g/hr	19.7	16.1	-
Hydrogen Chloride ¹	mg/m ³	0.07	0.00	5	g/hr	3.0	0.3	-
Dioxins & Furans Upper Limit (worst case where <LOD = LOD)								
Dioxins & Furans (NATO I-TEQ)	ng/m ³	0.0212	0.0043	0.1	µg/hr	0.91	0.20	-
Dioxins & Furans (WHO TEQ Humans / Mammals)	ng/m ³	0.0212	0.0043	-	µg/hr	0.91	0.20	-
Dioxins & Furans (WHO TEQ Fish)	ng/m ³	0.0235	0.0048	-	µg/hr	1.01	0.22	-
Dioxins & Furans (WHO TEQ Birds)	ng/m ³	0.0374	0.0076	-	µg/hr	1.61	0.35	-
Dioxins & Furans Lower Limit (best case where <LOD = 0)								
Dioxins & Furans (NATO I-TEQ)	ng/m ³	0.0202	0.0041	-	µg/hr	0.87	0.19	-
Dioxins & Furans (WHO TEQ Humans / Mammals)	ng/m ³	0.0203	0.0041	-	µg/hr	0.87	0.19	-
Dioxins & Furans (WHO TEQ Fish)	ng/m ³	0.0225	0.0046	-	µg/hr	0.97	0.21	-
Dioxins & Furans (WHO TEQ Birds)	ng/m ³	0.0365	0.0074	-	µg/hr	1.56	0.34	-
Hydrogen Fluoride ¹	mg/m ³	0.13	0.02	1	g/hr	5.7	0.9	-
Total VOCs (as Carbon) ¹	mg/m ³	1.25	1.01	10	g/hr	53.5	43.4	-
Water Vapour	% v/v	1.2	0.1					
Stack Gas Temperature	°C	51.4						
Stack Gas Velocity	m/s	11.7	0.79					
Volumetric Flow Rate (ACTUAL)	m ³ /hr	51704	4186					
Volumetric Flow Rate (REF) ¹	m ³ /hr	42896	3473					

NOTE: VOLUMETRIC FLOW RATE & VELOCITY DATA TAKEN FROM AN AVERAGE OF ALL OF THE ISOKINETIC RUNS.

¹ Reference Conditions (REF) are: 273K, 101.3kPa, dry gas.

Executive Summary

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MONITORING DATE(S) & TIMES

Avon Metals Ltd, Gloucester

A1 New GT

25th - 26th March 2025

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Total Particulate Matter	R1	mg/m ³	0.57	g/hr	24.3	25/03/2025	10:50 - 11:20, 11:21 - 11:51	60
Total Particulate Matter	R2	mg/m ³	0.42	g/hr	18.0	25/03/2025	12:10 - 12:40, 12:41 - 13:11	60
Total Particulate Matter	R3	mg/m ³	0.39	g/hr	16.7	25/03/2025	13:17 - 13:47, 13:48 - 14:18	60
Hydrogen Chloride	R1	mg/m ³	0.08	g/hr	3.2	25/03/2025	10:50 - 11:20, 11:21 - 11:51	60
Hydrogen Chloride	R2	mg/m ³	0.11	g/hr	4.6	25/03/2025	12:10 - 12:40, 12:41 - 13:11	60
Hydrogen Chloride	R3	mg/m ³	0.02	g/hr	1.0	25/03/2025	13:17 - 13:47, 13:48 - 14:18	60
Dioxins & Furans (NATO)	R1	ng/m ³	0.021	µg/hr	0.9	25/03/2025	09:28 - 12:28, 12:30 - 15:30	360
Hydrogen Fluoride	R1	mg/m ³	< 0.015	g/hr	< 0.7	25/03/2025	10:50 - 11:20, 11:21 - 11:51	60
Hydrogen Fluoride	R2	mg/m ³	0.18	g/hr	7.7	25/03/2025	12:10 - 12:40, 12:41 - 13:11	60
Hydrogen Fluoride	R3	mg/m ³	0.20	g/hr	8.7	25/03/2025	13:17 - 13:47, 13:48 - 14:18	60
Total VOCs (as Carbon)	R1	mg/m ³	1.25	g/hr	53.5	25/03/2025	13:25 - 14:25	60
Velocity Traverse	R1					25/03/2025	10:20 - 10:35	

All results are expressed at the respective reference conditions.

Executive Summary

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PROCESS DETAILS

Avon Metals Ltd, Gloucester
A1 New GT
25th - 26th March 2025

Standard Operating Conditions

Parameter	Value
Process Status	Metal Casting
Capacity (of 100%) and Tonnes / Hour	N/A
Continuous or Batch Process	Continuous
Feedstock (if applicable)	Aluminium alloy
Abatement System	Bag filter
Abatement System Running Status	Running
Fuel	Aluminium alloy
Plume Appearance	N/A

Executive Summary

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MONITORING & ANALYTICAL METHODS

Avon Metals Ltd, Gloucester
A1 New GT
25th - 26th March 2025

Parameter	Monitoring				Analysis				Overall Status	LOD (Average)
	Standard	Technical Procedure	Sampling Status	Testing Lab	Analytical Procedure	Analytical Technique	Analysis Status	Analysis Lab		
Total Particulate Matter	EN 13284-1	MD 001	MCERTS	EET	MD 103	Gravimetric	MCERTS	EET	MCERTS	0.17 mg/m ³
Hydrogen Chloride	ISO 15713	MD 010	MCERTS	EET	MD-101	IC	MCERTS	EET	MCERTS	0.014 mg/m ³
Dioxins & Furans	EN 1948	MD 007	MCERTS	EET	PM137, TM201	GC-HRMS	MCERTS	EET	MCERTS	0.0055 ng/m ³
Hydrogen Fluoride	CEN/TS 17340	MD 010	MCERTS	EET	MD-101	IC	MCERTS	EET	MCERTS	0.014 mg/m ³
Water Vapour	EN 14790	MD 005	MCERTS	EET	MD 005	Gravimetric	MCERTS	EET	MCERTS	0.10 % v/v
Total VOCs (as Carbon)	EN 12619:2013	MD 020	MCERTS	EET	Flame Ionisation Detection by Sick 3006				MCERTS	0.32 mg/m ³
Velocity & Vol. Flow Rate	EN 16911-1 (MID)	MD 041	MCERTS	EET	Pitot Tube and Thermocouple				MCERTS	1.8 m/s

ANALYSIS LABORATORIES

(with short name reference as appears in the table above)

Element (Stockport Lab - EET)	ISO 17025 Accreditation Number: UKAS 4279
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SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
All	All	There are no deviations associated with the sampling employed.

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	1.25
Width	m	-
Area	m ²	1.23
Port Depth	cm	10
Orientation of Duct	-	Vertical
Number of Ports	-	2
Sample Port Size	-	4" BSP

Location of Sampling Platform

General Platform Information	Value
Permanent / Temporary Platform	Permanent
Inside / Outside	Outside

Platform Details

EA Technical Guidance Note M1 / EN 15259 Platform Requirements	Value
Sufficient working area to manipulate probe and operate the measuring instruments	Yes
Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	Yes
Platform has vertical base boards (approx. 0.25m high)	Yes
Platform has chains / self closing gates at top of ladders	Yes
There are no obstructions present which hamper insertion of sampling equipment	Yes
Safe Access Available	Yes
Easy Access Available	Yes

Sampling Location / Platform Improvement Recommendations

The sampling location meets all the requirements specified in EA Guidance Note M1 and EN 15259, and therefore there are no improvement recommendations.

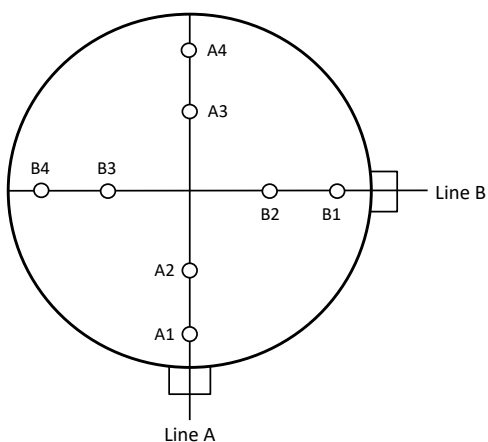
EN 15259 Homogeneity Test Requirements

There is no requirement to perform a EN 15259 Homogeneity Test on this Stack.

Sampling Plane Validation Criteria (from EN 15259)

Criteria in EN 15259	Units	Traverse 1	Required	Compliant
Lowest Differential Pressure	Pa	143.2	> 5 Pa	Yes
Mean Velocity	m/s	13.70	-	-
Lowest Gas Velocity	m/s	13.58	-	-
Highest Gas Velocity	m/s	13.79	-	-
Ratio of Above	: 1	1.02	< 3 : 1	Yes
Maximum Angle of Swirl	°	5.00	< 15°	Yes
No Local Negative Flow	-	Yes	-	Yes

SAMPLE POINTS



where ○ = isokinetic point sampled at
 ● = isokinetic point not sampled at
 ● = combustion gases sample point
 ● = non-isokinetic sample point

APPENDIX CONTENTS

APPENDIX 1 - Stack Emissions Monitoring Personnel, List of Equipment & Methods and Technical Procedures Used

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Craig Harley	MCERTS Level 2	MM 05 670	TE1 TE2 TE3 TE4
Technician	Samuel Summers	MCERTS Level 1	MM 23 1795	TE1, TE2 and TE3

LIST OF EQUIPMENT

Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM (1) Yd	CAT 7.18	Horiba PG-350E	-	Digital Manometer (1)	CAT 3.228
Control Box DGM (2)	-	Horiba PG-250 SRM	-	Digital Manometer (2)	CAT 3.177
Box Thermocouples (1)	CAT 3.38	Servomex 5200 MP	-	Digital Temperature Meter	CAT 3.228
Box Thermocouples (2)	-	Eco Physics CLD 822Mh	-	Stopwatch	-
Umbilical (1)	CAT 3.38	ABB AO2020-URAS26	-	Barometer	CAT 13.46
Umbilical (2)	-	Testo 350 XL	-	Stack Thermocouple (1)	CAT 4.1661
Oven Box (1)	CAT 12.79	JCT JCC P1 Cooler	-	Stack Thermocouple (2)	CAT 4.1707
Oven Box (2)	-	Gasmet DX4000	-	Stack Thermocouple (3)	CAT 4.00139
Heated Probe (1)	-	Gasmet Sampling System	-	1m Heated Line (1)	-
Heated Probe (2)	CAT 5.176	Sick 3006	CAT 8.2	1m Heated Line (2)	-
Heated Probe (3)	CAT 5.177	M&C PSS	-	1m Heated Line (3)	-
S-Pitot (1) - CP 0.877	-	Mass Flow Controller (1)	CAT 6.34	5m Heated Line (1)	-
S-Pitot (2) - CP 0.831	CAT 21P.157	Mass Flow Controller (2)	CAT 6.35	15m Heated Line (1)	CAT 20.83
S-Pitot (3) - CP 0.838	CAT 21P.243	Mass View (1)	CAT 25.13	20m Heated Line (1)	-
Site Balance	CAT 17.111	Mass View (2)	CAT 25.14	20m Heated Line (2)	-
500g / 1Kg Check Weights	CAT 17.111	Hioki 5043 (V)	CAT 11.99	Dual Channel Heater Controller	-
Last Impinger Arm	CAT 4.1130	Hioki 5043 (V)	-	Single Channel Heater Controller	-
Callipers	CAT 23.50	Bioaerosols Temperature Logger	-	Laboratory Balance	CAT 1.18, 1.18a, 1.18b
Tubes Kit Thermocouple	-	Electronic Refrigerator	-	Tape Measure	CAT 16.22

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Total Particulate Matter	EN 13284-1	MD 001
Hydrogen Chloride	ISO 15713	MD 010
Dioxins & Furans	EN 1948	MD 007
Hydrogen Fluoride	CEN/TS 17340	MD 010
Water Vapour	EN 14790	MD 005
Total VOCs (as Carbon)	EN 12619:2013	MD 020
Velocity & Vol. Flow Rate	EN 16911-1 (MID)	MD 041

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	1.25
Stack Width, W	m	-
Stack Area, A	m ²	1.23
Average Stack Gas Temperature, T _a	°C	49.4
Average Stack Gas Pressure	mmH ₂ O	14.8
Average Stack Static Pressure, P _{static}	kPa	0.015
Average Barometric Pressure, P _b	kPa	101.2
Average Pitot Tube Calibration Coefficient, C _p	-	0.84

Stack Gas Composition & Molecular Weights

Component	Conc ppm	Conc Dry % v/v	Conc Wet % v/v	Volume Fraction r	Molar Mass M	Density kg/m ³ p	Conc kg/m ³ p _i
CO ₂ (Estimated)	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O ₂ (Estimated)	-	20.80	20.55	0.2080	32.00	1.4277	0.29696
N ₂	-	79.14	78.17	0.7914	28.01	1.2498	0.98913
Moisture (H ₂ O)	-	-	1.22	0.0122	18.02	0.8037	0.00983

Where: $p = M / 22.41$

$p_i = r \times p$

Calculation of Stack Gas Densities

Determinand	Units	Result
Dry Density (STP), P _{STD}	kg/m ³	1.287
Wet Density (STP), P _{STW}	kg/m ³	1.281
Dry Density (Actual), P _{Actual}	kg/m ³	1.089
Average Wet Density (Actual), P _{ActualW}	kg/m ³	1.084

Where: P_{STD} = sum of component concentrations, kg/m³ (not including water vapour)

P_{STW} = sum of all wet concentrations / 100 x density, kg/m³ (including water vapour)

$P_{Actual} = P_{STD} \times (T_{STP} / (P_{STP})) \times ((P_{static} + P_b) / T_a)$

$P_{ActualW}$ (at each sampling point) = $P_{STW} \times (T_s / P_s) \times (P_a / T_a)$

Calculation of Stack Gas Volumetric Flowrate, Q

Duct gas flow conditions	Units	Actual	REF ¹
Temperature	°C	49.4	0.0
Total Pressure	kPa	101.2	101.3
Moisture	%	1.22	0.00

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m ³ /hr	60514
Gas Volumetric Flowrate (STP, Wet)	m ³ /hr	51203
Gas Volumetric Flowrate (STP, Dry)	m ³ /hr	50577
Gas Volumetric Flowrate REF ¹	m ³ /hr	50577

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE TO EN 16911-1 (MID)

(1 of 1)

Parameter	Units	Value
Date of Survey	-	25/03/2025
Time of Survey	-	10:20 - 10:35
Atmospheric Pressure	kPa	101.2
Average Stack Static Pressure	Pa	15
Result of Pitot Stagnation Test	-	Pass
Are Water Droplets Present?	-	Yes
Device Used	S-Type Pitot with Liquid Incline Manometer	

Parameter	Units	Value
Initial Pitot Leak Check	-	Pass
Final Pitot Leak Check	-	Pass
Orientation of Duct	-	Vertical
Pitot Tube, C _p	-	0.84
Number of Lines Available	-	2
Number of Lines Used	-	2

Sampling Line A							Sampling Line B				
Traverse Point	Depth m	ΔP mmH ₂ O	Temp °C	Wet Density kg/m ³	Velocity m/s	Swirl °	ΔP mmH ₂ O	Temp °C	Wet Density kg/m ³	Velocity m/s	Swirl °
STATIC (Units: Pa)		15.0					15.0				
Mean		14.9	49.3	1.085	13.73		14.8	49.5	1.084	13.66	
1	0.08	14.8	49.0	1.085	13.68	2.0	14.6	49.0	1.085	13.58	5.0
2	0.31	14.8	49.0	1.085	13.68	4.0	14.6	49.0	1.085	13.58	4.0
3	0.94	15.0	50.0	1.082	13.79	5.0	14.8	50.0	1.082	13.70	2.0
4	1.17	15.0	49.0	1.085	13.77	4.0	15.0	50.0	1.082	13.79	4.0

PRELIMINARY STACK SURVEY: VELOCITY TRAVERSE TO EN 16911-1 (MID) - MEASUREMENT UNCERTAINTY

(1 of 1)

Performance characteristics (Uncertainty Components)	Uncertainty	Value	Units
Standard Uncertainty on the coefficient of the Pitot Tube	$u(k)$	0.005	-
Standard Uncertainty associated with the mean local dynamic pressures	$u(\Delta p_i)$	2.842	Pa
- Resolution	$u(res)$	0.52154	
- Calibration	$u(cal)$	2.201	
- Drift	$u(drift)$	1.096	
- Lack of Fit	$u(fit)$	3.257	
- Overall corrections to dynamic measurements	$u(C_f)$	7.076	
Standard uncertainty associated with the molar mass of the gas	$u(M)$	0.00003	-
- $\phi_{O_2,w}$	-	20.546	
- $\phi_{CO_2,w}$	-	0.059	
- Oxygen, dry	$u(\phi_{O_2,d})$	0.637	
- Carbon Dioxide, dry	$u(\phi_{CO_2,d})$	0.002	
- Water Vapour	$u(\phi_{H_2O})$	0.062	
- Oxygen, wet	$u(\phi_{O_2,w})$	0.629	
- Carbon Dioxide, wet	$u(\phi_{CO_2,w})$	0.002	
Standard uncertainty associated with the stack temperature	$u(T_c)$	1.645	K
Standard uncertainty associated with the absolute pressure in the duct	$u(p_c)$	175.704	Pa
- Atmospheric Pressure	$u(p_{atm})$	175.692	
- Static Pressure	$u(p_{stat})$	2.009	
Standard uncertainty associated with the density in the duct	$u(\rho)$	0.00592	-
Standard uncertainty associated with the local velocities	$u(v_i)$	1.314	Pa
Standard uncertainty associated with the mean velocity	$u(\bar{v})$	0.469	m/s
Standard uncertainty associated with the mean velocity (95% Confidence)	$U_c(v)$	0.919	m/s
Standard uncertainty associated with the mean velocity (95% Confidence), relative	$U_{c,rel}(v)$	6.71	%
Standard uncertainty associated with the volume flow rate (95% Confidence)	$U_c(qV,w)$	4898.8	m ³ /hr
- $u^2(a)/a^2$	-	0.00053	
- $u^2(qV,w)/q^2V,w$	-	0.00171	
- $u^2(qV,w)$	-	6246878	
- $u(qV,w)$	-	2499.4	
Standard uncertainty associated with the volume flow rate (95% Confidence), relative	$U_{c,rel}(qV,w)$	8.10	%

TOTAL PARTICULATE MATTER: RESULTS SUMMARY

Avon Metals Ltd, Gloucester
A1 New GT

Sample Runs

Parameter	Units	Run 1	Run 2	Run 3		Mean
Concentration	mg/m ³	0.57	0.42	0.39		0.46
Uncertainty	±mg/m ³	0.38	0.38	0.36		0.37
Mass Emission	g/hr	24.3	18.0	16.7		19.7
Uncertainty	±g/hr	16.5	16.4	15.3		16.1

Parameter	Units	Run 1	Run 2	Run 3		Mean
Water Vapour	% v/v	1.06	1.14	1.05		1.08
Uncertainty	±% v/v	0.06	0.06	0.06		0.06

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m ³	0.17		0.17

NOTE: Where the Balance Uncertainty / Limit of Detection is higher than the Blank concentration, the Balance Uncertainty / Limit of Detection concentration has been reported.

General Sampling Information

Parameter	Value	
Standard	EN 13284-1	
Technical Procedure	MD 001	
Probe Material	Titanium	
Filter Housing Material	Titanium	
Positioning of Filter	In Stack	
Filter Size and Material	47mm Glass Fibre	
Number of Sampling Lines Used	2/2	FORMAT: Number Used / Number Required
Number of Sampling Points Used	8/8	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1 - A4, B1 - B4	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas.

TOTAL PARTICULATE MATTER: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	Run 2	Run 3	
Absolute pressure of stack gas, P_s					
Barometric pressure, P_b	mmHg	759.1	759.1	759.1	
Stack static pressure, P_{static}	mmH ₂ O	0.0	0.0	0.0	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	759.1	759.1	759.1	
Volume of water vapour collected, V_{wstd}					
Total mass collected in impingers (liquid trap)	g	-5.1	-4.2	-5.8	
Total mass collected in impingers (silica trap)	g	16.2	16.1	17.5	
Total mass of liquid collected, V_{lc}	g	11.1	11.9	11.7	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0138	0.0148	0.0146	
Volume of gas metered dry, V_{mstd}					
Volume of gas sample through gas meter, V_m	m ³	1.4350	1.4840	1.6020	
Gas meter correction factor, Y_d	-	0.9540	0.9540	0.9540	
Average dry gas meter temperature, T_m	°C	18.9	29.3	31.6	
Average pressure drop across orifice, ΔH	mmH ₂ O	62.0	62.5	65.9	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	1.2862	1.2844	1.3767	
Moisture content, B_{wo} & R_{ww}					
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0106	0.0114	0.0105	
B_{wo} as a percentage	% v/v	1.06	1.14	1.05	
Reported Water Vapour, checked with Tables in EN 14790, R_{ww}	% v/v	1.06	1.14	1.05	
Volume of gas metered wet, V_{mstw}					
$V_{mstw} = (V_{mstd})(100/(100 - R_{ww}))$	m ³	1.3001	1.2993	1.3912	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$					
IED & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	No	No	
% wet oxygen measured in gas stream, $ACT\%O_{2w}$	% v/v	N/A	N/A	N/A	
% dry oxygen measured in gas stream, $ACT\%O_{2d}$	% v/v	N/A	N/A	N/A	
% oxygen reference condition, $REF\%O_2$	% v/v	N/A	N/A	N/A	
O ₂ Reference Factor wet ($O_{2REFw} = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$)	-	N/A	N/A	N/A	
O ₂ Reference Factor dry ($O_{2REFd} = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$)	-	N/A	N/A	N/A	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m ³	N/A	N/A	N/A	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m ³	N/A	N/A	N/A	
Molecular weight of dry gas stream, M_d					
CO ₂ (Estimated)	% v/v	0.06	0.06	0.06	
O ₂ (Estimated)	% v/v	20.80	20.80	20.80	
Total	% v/v	20.86	20.86	20.86	
N ₂	% v/v	79.14	79.14	79.14	
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$	g/gmol	28.84	28.84	28.84	
Molecular weight of stack gas (wet), M_s					
$M_s = M_d(1 - (R_{ww}/100)) + 18(R_{ww}/100)$	g/gmol	28.73	28.72	28.73	
Velocity of stack gas, V_s					
Pitot tube velocity constant, K_p	-	34.97	34.97	34.97	
Velocity pressure coefficient, C_p	-	0.84	0.84	0.84	
Average of velocity heads, ΔP_{avg}	mmH ₂ O	10.08	9.79	10.24	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	3.17	3.13	3.20	
Average stack gas temperature, T_s	°C	50.2	49.8	49.4	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(T_s + 273)) / (V(M_s)(P_s))$	m/s	11.32	11.16	11.40	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} (Q_{stwO_2}), Dry@O_{2REF} (Q_{stdO_2})					
Area of stack, A_s	m ²	1.23	1.23	1.23	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	833.9	821.5	839.6	
Conversion factor (K/mm.Hg), C_f	-	0.3592	0.3592	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	703.5	694.0	710.0	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{ww}/100))) / ((T_s) + 273)$	m ³ /min	696.1	686.1	702.6	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273) / (O_{2REFw})$	m ³ /min	N/A	N/A	N/A	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{ww}/100))) / ((T_s) + 273) / (O_{2REFd})$	m ³ /min	N/A	N/A	N/A	
Percent isokinetic, %I					
Nozzle diameter, D_n	mm	6.96	6.96	6.96	
Nozzle area, A_n	mm ²	38.01	38.01	38.01	
Total sampling time, q	min	60	60	60	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{ww}/100))$	%	99.4	100.8	105.5	

TOTAL PARTICULATE MATTER: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	Run 2	Run 3
Sampling Times	-	10:50 - 11:20, 11:21 - 11:51	12:10 - 12:40, 12:41 - 13:11	13:17 - 13:47, 13:48 - 14:18
Sampling Dates	-	25/03/2025	25/03/2025	25/03/2025
Sampling Device	-	ISO	ISO	ISO
Volume Sampled (REF)	m ³	1.2862	1.2844	1.3767
Filter I.D. Number	-	47-118436	47-118393	47-118455
Start Filter Mass	g	0.15090	0.15007	0.14589
End Filter Mass	g	0.15117	0.15033	0.14621
Total Mass on Filter	g	0.00027	0.00026	0.00032
Probe Rinse I.D. Number	-	PR-47-118436	PR-47-118393	PR-47-118455
Start Probe Rinse Mass	g	2.97355	2.96937	2.74961
End Probe Rinse Mass	g	2.97401	2.96965	2.74983
Total Mass in Probe Rinse	g	0.00046	0.00028	0.00021
Total Mass Collected	mg	0.73	0.54	0.54
Calculated Concentration	mg/m ³	0.57	0.42	0.39
Balance Uncertainty / LOD	mg/m ³	0.18	0.18	0.17

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1
Blank Dates	-	25/03/2025
Average Volume Sampled (REF)	m ³	1.3158
Filter I.D. Number	-	47-118438
Start Filter Mass	g	0.15016
End Filter Mass	g	0.15020
Total Mass on Filter	g	0.00004
Probe Rinse I.D. Number	-	PR-47-118438
Start Probe Rinse Mass	g	2.89959
End Probe Rinse Mass	g	2.89972
Total Mass in Probe Rinse	g	0.00013
Total Mass Collected	mg	0.17
Calculated Concentration	mg/m ³	0.13
Balance Uncertainty / LOD	mg/m ³	0.17

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	Run 2	Run 3	
Mean Sampling Rate	l/min	22.8	23.6	25.5	
Pre-Sampling Leak Rate	l/min	0.10	0.10	0.10	
Post-Sampling Leak Rate	l/min				
Allowable Leak Rate	l/min	0.30	0.30	0.30	
Leak Test Acceptable	-	Yes	Yes	Yes	
Water Droplets	Units	Run 1	Run 2	Run 3	
Are Water Droplets Present	-	No	No	No	
MU (Concurrent Water Vapour)	Units	Run 1	Run 2	Run 3	
Measurement Uncertainty (MU)	%	5.3	5.4	5.4	
Allowable MU	%	20.0	20.0	20.0	
MU Acceptable	%	Yes	Yes	Yes	
Silica Gel (Concurrent Water Vapour)	Units	Run 1	Run 2	Run 3	
Less than 50% Faded	%	Yes	Yes	Yes	
Isokinetic Criterion Compliance	Units	Run 1	Run 2	Run 3	
Isokinetic Variation	%	99.4	100.8	105.5	
Allowable Isokinetic Range	%	95 - 115	95 - 115	95 - 115	
Isokineticity Acceptable	-	Yes	Yes	Yes	
Weighing Uncertainty Criteria	Units	Run 1	Run 2	Run 3	
Overall Weighing Uncertainty	± mg	0.33	0.33	0.33	
Overall Weighing Uncertainty	± mg/m ³	0.25	0.25	0.24	
ELV [Daily ELV for IED]	mg/m ³	5.00	5.00	5.00	
Allowable Weighing Uncertainty	mg/m ³	0.25	0.25	0.25	
Weighing Uncertainty Acceptable	-	N/A	N/A	N/A	
Filter Temperatures	Units	Run 1	Run 2	Run 3	
Pre-Conditioning Temperature	°C	180	180	180	
Post-Conditioning Temperature	°C	160	160	160	
Maximum Filter Temperature	°C	51	50	50	
Test Conditions	Units	Run 1	Run 2	Run 3	
Ambient Temperature Recorded?	-	Yes	Yes	Yes	

TOTAL PARTICULATE MATTER: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	15.0	
Pre-Sampling Leak Rate	l/min	0.10	
Post-Sampling Leak Rate	l/min		
Allowable Leak Rate	l/min	N/A	
Leak Test Acceptable	-	Yes	

Validity of Blank vs ELV	Units	Blank 1	
Allowable Blank	mg/m ³	0.5	
Blank Acceptable	-	Yes	

Acetone / Water Rinse Blank	Units	Blank
Acetone / Water Rinse Value	mg/l	2.7
Allowable Blank	mg/l	10
Blank Acceptable	-	Yes

Method Deviations

Nature of Deviation	Run Number			
	1	2	3	
(x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)				
There are no deviations associated with the sampling employed.	x	x	x	

TOTAL PARTICULATE MATTER: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value				Symbol	Standard uncertainty			
	Symbol	Run 1	Run 2	Run 3		Units	Run 1	Run 2	Run 3
Sampled Volume (Actual)	V _m	1.4350	1.4840	1.6020	uV _m	m ³	0.0287	0.0297	0.0320
Sampled Gas Temperature	T _m	291.9	302.3	304.6	uT _m	K	2.00	2.00	2.00
Sampled Gas Pressure	p _m	101.2	101.2	101.2	up _m	kPa	0.50	0.50	0.50
Sampled Gas Humidity	H _m	0.00	0.00	0.00	uH _m	% v/v	1.00	1.00	1.00
Leak	L	0.44	0.42	0.39	uL	%	-	-	-
Mass of Particulate	m	0.73	0.54	0.54	um	mg	0.23	0.23	0.23
Uncollected Mass	UCM	0.17	0.17	0.17	uUCM	mg	-	-	-

Measured Quantities	Uncertainty as a Percentage				Requirement of Standard
	Units	Run 1	Run 2	Run 3	
Sampled Volume (Actual)	%	2.00	2.00	2.00	≤2%
Sampled Gas Temperature	%	0.69	0.66	0.66	≤1%
Sampled Gas Pressure	%	0.49	0.49	0.49	≤1%
Sampled Gas Humidity	%	1.00	1.00	1.00	≤1%
Leak	%	0.44	0.42	0.39	≤2%
Mass of Particulate	%	3.58	3.58	3.34	-
Uncollected Mass	%	-	-	-	-

Measured Quantities	Uncertainty in Measurement Units					Sensitivity Coefficient		
	Symbol	Units	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
Sampled Volume (STP)	V _m	m ³	1.2862	1.2844	1.3767	0.44	0.33	0.28
Leak	L	mg/m ³	0.001	0.001	0.001	1.00	1.00	1.00
Mass of Particulate	L _r	mg	0.730	0.540	0.537	0.78	0.78	0.73
Uncollected Mass	UCM	mg	0.10	0.10	0.10	0.78	0.78	0.73

Measured Quantities	Uncertainty in Result			
	Units	Run 1	Run 2	Run 3
Sampled Volume (STP)	mg/m ³	0.015	0.011	0.010
Leak	mg/m ³	0.0014	0.0010	0.0009
Mass of Particulate	mg/m ³	0.1788	0.1791	0.1671
Uncollected Mass	mg/m ³	0.0748	0.0749	0.0699

Measured Quantities	Oxygen Correction Part of MU Budget			
	Units	Run 1	Run 2	Run 3
O ₂ Correction Factor	-	N/A	N/A	N/A
Stack Gas O ₂ Content	% v/v	N/A	N/A	N/A
MU for O ₂ Correction	-	N/A	N/A	N/A
Overall MU For O ₂ Measurement	%	N/A	N/A	N/A

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	mg/m ³	0.19	0.19	0.18
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m ³	0.38	0.38	0.36
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m ³	N/A	N/A	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.38	0.38	0.36
Reported Uncertainty	mg/m ³	0.38	0.38	0.36
Expanded uncertainty (95% confidence), without Oxygen Correction	%	67.1	90.6	91.2
Expanded uncertainty (95% confidence), with Oxygen Correction	%	N/A	N/A	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	67.1	90.6	91.2
Reported Uncertainty	%	67.1	90.6	91.2
Reported Uncertainty as % of ELV	%	7.6	7.6	7.1

HYDROGEN CHLORIDE: RESULTS SUMMARY

Avon Metals Ltd, Gloucester
A1 New GT

Sample Runs

Parameter	Units	Run 1	Run 2	Run 3	Mean
Concentration	mg/m ³	0.08	0.11	0.02	0.07
Uncertainty	±mg/m ³	0.004	0.01	0.001	0.004
Mass Emission	g/hr	3.2	4.6	1.0	3.0
Uncertainty	±g/hr	0.3	0.5	0.1	0.3

Parameter	Units	Run 1	Run 2	Run 3	Mean
Water Vapour	% v/v	1.06	1.14	1.05	1.08
Uncertainty	±% v/v	0.06	0.06	0.06	0.06

Blank Runs

Parameter	Units	Blank 1	Maximum
Concentration	mg/m ³	< 0.01	< 0.01

General Sampling Information

Parameter	Value
Standard	ISO 15713
Technical Procedure	MD 010
Name of Analytical Laboratory	EET
Analytical Laboratory's Procedure	MD-101
ISO 17025 Accredited Analysis?	MCERTS
Date of Sample Analysis	02/04/2025
Probe Material	Titanium
Filter Housing Material	Titanium
Impinger Material	Polyethylene
Absorption Solution	HPLC Grade Water
Positioning of Filter	In Stack
Filter Size and Material	47mm Glass Fibre
Number of Sampling Lines Used	2/2
Number of Sampling Points Used	8/8
Sample Point I.D.'s	A1 - A4, B1 - B4

FORMAT: Number Used / Number Required

FORMAT: Number Used / Number Required

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas.

HYDROGEN CHLORIDE: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	Run 2	Run 3	
Absolute pressure of stack gas, P_s					
Barometric pressure, P_b	mmHg	759.1	759.1	759.1	
Stack static pressure, P_{static}	mmH ₂ O	0.0	0.0	0.0	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	759.1	759.1	759.1	
Volume of water vapour collected, V_{wstd}					
Total mass collected in impingers (liquid trap)	g	-5.1	-4.2	-5.8	
Total mass collected in impingers (silica trap)	g	16.2	16.1	17.5	
Total mass of liquid collected, V_{lc}	g	11.1	11.9	11.7	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.0138	0.0148	0.0146	
Volume of gas metered dry, V_{mstd}					
Volume of gas sample through gas meter, V_m	m ³	1.4350	1.4840	1.6020	
Gas meter correction factor, Y_d	-	0.9540	0.9540	0.9540	
Average dry gas meter temperature, T_m	°C	18.9	29.3	31.6	
Average pressure drop across orifice, ΔH	mmH ₂ O	62.0	62.5	65.9	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	1.2862	1.2844	1.3767	
Moisture content, B_{wo} & R_{ww}					
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0106	0.0114	0.0105	
B_{wo} as a percentage	% v/v	1.06	1.14	1.05	
Reported Water Vapour, checked with Tables in EN 14790, R_{ww}	% v/v	1.06	1.14	1.05	
Volume of gas metered wet, V_{mstw}					
$V_{mstw} = (V_{mstd})(100/(100 - R_{ww}))$	m ³	1.3001	1.2993	1.3912	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$					
IED & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	No	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	N/A	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	N/A	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	N/A	N/A	
O ₂ Reference Factor wet ($O_{2REFw} = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$)	-	N/A	N/A	N/A	
O ₂ Reference Factor dry ($O_{2REFd} = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$)	-	N/A	N/A	N/A	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m ³	N/A	N/A	N/A	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m ³	N/A	N/A	N/A	
Molecular weight of dry gas stream, M_d					
CO ₂ (Estimated)	% v/v	0.06	0.06	0.06	
O ₂ (Estimated)	% v/v	20.80	20.80	20.80	
Total	% v/v	20.86	20.86	20.86	
N ₂	% v/v	79.14	79.14	79.14	
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$	g/gmol	28.84	28.84	28.84	
Molecular weight of stack gas (wet), M_s					
$M_s = M_d(1 - (R_{ww}/100)) + 18(R_{ww}/100)$	g/gmol	28.73	28.72	28.73	
Velocity of stack gas, V_s					
Pitot tube velocity constant, K_p	-	34.97	34.97	34.97	
Velocity pressure coefficient, C_p	-	0.84	0.84	0.84	
Average of velocity heads, ΔP_{avg}	mmH ₂ O	10.08	9.79	10.24	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	3.17	3.13	3.20	
Average stack gas temperature, T_s	°C	50.2	49.8	49.4	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(T_s + 273)) / (V(M_s)(P_s))$	m/s	11.32	11.16	11.40	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} (Q_{stwO_2}), Dry@O_{2REF} (Q_{stdO_2})					
Area of stack, A_s	m ²	1.23	1.23	1.23	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	833.9	821.5	839.6	
Conversion factor (K/mm.Hg), C_f	-	0.3592	0.3592	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	703.5	694.0	710.0	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{ww}/100))) / ((T_s) + 273)$	m ³ /min	696.1	686.1	702.6	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273) / (O_{2REFw})$	m ³ /min	N/A	N/A	N/A	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{ww}/100))) / ((T_s) + 273) / (O_{2REFd})$	m ³ /min	N/A	N/A	N/A	
Percent isokinetic, %I					
Nozzle diameter, D_n	mm	6.96	6.96	6.96	
Nozzle area, A_n	mm ²	38.01	38.01	38.01	
Total sampling time, q	min	60	60	60	
$\%I = (4.6398E^6)(T_s + 273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{ww}/100))$	%	99.4	100.8	105.5	

HYDROGEN CHLORIDE: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	Run 2	Run 3
Sampling Times	-	10:50 - 11:20, 11:21 - 11:51	12:10 - 12:40, 12:41 - 13:11	13:17 - 13:47, 13:48 - 14:18
Sampling Dates	-	25/03/2025	25/03/2025	25/03/2025
Sampling Device	-	ISO	ISO	ISO
Volume Sampled (REF)	m ³	1.2862	1.2844	1.3767
Laboratory Result for Front Impingers	µg/ml	0.34	0.34	0.10
Laboratory Result for Back Impinger	µg/ml	< 0.05		
Volume in Front Impingers	ml	266.0	403.4	336.5
Volume in Back Impinger	ml	129.7		
Mass in Front Impingers	µg	90.4	137.2	33.7
Mass in Back Impinger	µg	< 6.5		
Total Mass Collected	µg	96.9	137.2	33.7
Calculated Concentration	mg/m ³	0.08	0.11	0.02

Where: ISO stands for Manual Isokinetic Sampling Train

Blank Runs

Parameter	Units	Blank 1
Blank Dates	-	25/03/2025
Average Volume Sampled (REF)	m ³	1.3158
Laboratory Result for Impingers	µg/ml	< 0.05
Volume in Impingers	ml	312.1
Total Mass Collected	µg	< 15.6
Calculated Concentration	mg/m ³	< 0.01

HYDROGEN CHLORIDE: QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1	Run 2	Run 3	
Mean Sampling Rate	l/min	22.8	23.6	25.5	
Pre-Sampling Leak Rate	l/min	0.10	0.10	0.10	
Post-Sampling Leak Rate	l/min	N/A	N/A	N/A	
Allowable Leak Rate	l/min	0.30	0.30	0.30	
Leak Test Acceptable	-	Yes	Yes	Yes	
Absorption Efficiency	Units	Run 1			
Absorption Efficiency	%	100.0			
Allowable Absorption Efficiency	%	N/A			
Absorption Efficiency Acceptable	-	N/A			
Water Droplets	Units	Run 1	Run 2	Run 3	
Are Water Droplets Present	-	No	No	No	
MU (Concurrent Water Vapour)	Units	Run 1	Run 2	Run 3	
Measurement Uncertainty (MU)	%	5.3	5.4	5.4	
Allowable MU	%	20.0	20.0	20.0	
MU Acceptable	%	Yes	Yes	Yes	
Silica Gel (Concurrent Water Vapour)	Units	Run 1	Run 2	Run 3	
Less than 50% Faded	%	Yes	Yes	Yes	
Isokinetic Criterion Compliance	Units	Run 1	Run 2	Run 3	
Isokinetic Variation	%	99.4	100.8	105.5	
Allowable Isokinetic Range	%	95 - 115	95 - 115	95 - 115	
Isokineticity Acceptable	-	Yes	Yes	Yes	
Filter Temperatures	Units	Run 1	Run 2	Run 3	
Maximum Filter Temperature	°C	51	50	50	
Test Conditions	Units	Run 1	Run 2	Run 3	
Ambient Temperature Recorded?	-	Yes	Yes	Yes	

HYDROGEN CHLORIDE: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	15.0	
Pre-Sampling Leak Rate	l/min	0.10	
Post-Sampling Leak Rate	l/min		
Allowable Leak Rate	l/min	N/A	
Leak Test Acceptable	-	Yes	

Validity of Blank vs ELV	Units	Blank 1	
Allowable Blank	mg/m ³	0.5	
Blank Acceptable	-	Yes	

Method Deviations

Nature of Deviation	Run Number			
	1	2	3	
(x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)				
There are no deviations associated with the sampling employed.	x	x	x	

HYDROGEN CHLORIDE: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value				Symbol	Standard uncertainty			
	Symbol	Run 1	Run 2	Run 3		Units	Run 1	Run 2	Run 3
Sampled Volume (Actual)	V_m	1.4350	1.4840	1.6020	uV_m	m ³	0.0287	0.0297	0.0320
Sampled Gas Temperature	T_m	291.9	302.3	304.6	uT_m	K	2.00	2.00	2.00
Sampled Gas Pressure	p_m	101.2	101.2	101.2	up_m	kPa	0.50	0.50	0.50
Sampled Gas Humidity	H_m	0.00	0.00	0.00	uH_m	% v/v	1.00	1.00	1.00
Leak	L	0.44	0.42	0.39	uL	%	-	-	-
Laboratory Result	L_r	1.05	1.05	1.05	uL_r	%	-	-	-

Measured Quantities	Uncertainty as a Percentage				Requirement of Standard
	Units	Run 1	Run 2	Run 3	
Sampled Volume (Actual)	%	2.00	2.00	2.00	≤2%
Sampled Gas Temperature	%	0.69	0.66	0.66	≤1%
Sampled Gas Pressure	%	0.49	0.49	0.49	≤1%
Sampled Gas Humidity	%	1.00	1.00	1.00	≤1%
Leak	%	0.44	0.42	0.39	≤2%
Laboratory Result	%	1.05	1.05	1.05	No Requirement

Measured Quantities	Uncertainty in Measurement Units					Sensitivity Coefficient		
	Symbol	Units	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
Sampled Volume (STP)	V_m	m ³	1.2862	1.2844	1.3767	0.06	0.08	0.02
Leak	L	mg/m ³	0.0002	0.0003	0.0001	1.00	1.00	1.00
Laboratory Result	L_r	mg/m ³	0.001	0.001	0.000	1.00	1.00	1.00

Measured Quantities	Uncertainty in Result			
	Units	Run 1	Run 2	Run 3
Sampled Volume (STP)	mg/m ³	0.002	0.003	0.001
Leak	mg/m ³	0.0002	0.0003	0.0001
Laboratory Result	mg/m ³	0.0008	0.0011	0.0003

Measured Quantities	Oxygen Correction Part of MU Budget			
	Units	Run 1	Run 2	Run 3
O ₂ Correction Factor	-	N/A	N/A	N/A
Stack Gas O ₂ Content	% v/v	N/A	N/A	N/A
MU for O ₂ Correction	-	N/A	N/A	N/A
Overall MU For O ₂ Measurement	%	N/A	N/A	N/A

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	mg/m ³	0.0021	0.0031	0.0007
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m ³	0.0041	0.0060	0.0014
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m ³	N/A	N/A	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.0041	0.0060	0.0014
Reported Uncertainty	mg/m ³	0.0041	0.0060	0.0014
Expanded uncertainty (95% confidence), without Oxygen Correction	%	5.5	5.6	5.6
Expanded uncertainty (95% confidence), with Oxygen Correction	%	N/A	N/A	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	5.5	5.6	5.6
Reported Uncertainty	%	5.5	5.6	5.6
Reported Uncertainty as % of ELV	%	0.1	0.1	0.0

DIOXINS & FURANS: RESULTS SUMMARY

(PAGE 1 OF 4)

Avon Metals Ltd, Gloucester
A1 New GT

TEQ1 - UPPER LIMITS (worst case where <LOD = LOD)

Sample Runs (UPPER NATO I-TEQ)

Parameter	Units	Run 1	Mean
Concentration	ng/m ³	0.021	0.021
Uncertainty	±ng/m ³	0.004	0.004
Mass Emission	µg/hr	0.91	0.91
Uncertainty	±µg/hr	0.20	0.20

Sample Runs (UPPER WHO TEQ Humans / Mammals)

Parameter	Units	Run 1	Mean
Concentration	ng/m ³	0.021	0.021
Uncertainty	±ng/m ³	0.004	0.004
Mass Emission	µg/hr	0.91	0.91
Uncertainty	±µg/hr	0.20	0.20

Sample Runs (UPPER WHO TEQ Fish)

Parameter	Units	Run 1	Mean
Concentration	ng/m ³	0.023	0.023
Uncertainty	±ng/m ³	0.005	0.005
Mass Emission	µg/hr	1.01	1.01
Uncertainty	±µg/hr	0.22	0.22

Sample Runs (UPPER WHO TEQ Birds)

Parameter	Units	Run 1	Mean
Concentration	ng/m ³	0.037	0.037
Uncertainty	±ng/m ³	0.008	0.008
Mass Emission	µg/hr	1.61	1.61
Uncertainty	±µg/hr	0.35	0.35

DIOXINS & FURANS: RESULTS SUMMARY

(PAGE 2 OF 4)

Avon Metals Ltd, Gloucester
A1 New GT

TEQ2 - LOWER LIMITS (best case where <LOD = 0)

Sample Runs (LOWER NATO I-TEQ)

Parameter	Units	Run 1	Mean
Concentration	ng/m ³	0.020	0.020
Uncertainty	±ng/m ³	0.004	0.004
Mass Emission	µg/hr	0.87	0.87
Uncertainty	±µg/hr	0.19	0.19

Sample Runs (LOWER WHO TEQ Humans / Mammals)

Parameter	Units	Run 1	Mean
Concentration	ng/m ³	0.020	0.020
Uncertainty	±ng/m ³	0.004	0.004
Mass Emission	µg/hr	0.87	0.87
Uncertainty	±µg/hr	0.19	0.19

Sample Runs (LOWER WHO TEQ Fish)

Parameter	Units	Run 1	Mean
Concentration	ng/m ³	0.023	0.023
Uncertainty	±ng/m ³	0.005	0.005
Mass Emission	µg/hr	0.97	0.97
Uncertainty	±µg/hr	0.21	0.21

Sample Runs (LOWER WHO TEQ Birds)

Parameter	Units	Run 1	Mean
Concentration	ng/m ³	0.036	0.036
Uncertainty	±ng/m ³	0.007	0.007
Mass Emission	µg/hr	1.56	1.56
Uncertainty	±µg/hr	0.34	0.34

DIOXINS & FURANS: RESULTS SUMMARY

(PAGE 3 OF 4)

Avon Metals Ltd, Gloucester
A1 New GT

TEQ1 - UPPER LIMITS (worst case where <LOD = LOD)

Blank Runs (UPPER NATO I-TEQ)

Parameter	Units	Blank 1	Maximum
Concentration	ng/m ³	0.0004	0.0004

Blank Runs (UPPER WHO TEQ Humans / Mammals)

Parameter	Units	Blank 1	Maximum
Concentration	ng/m ³	0.0005	0.0005

Blank Runs (UPPER WHO TEQ Fish)

Parameter	Units	Blank 1	Maximum
Concentration	ng/m ³	0.0005	0.0005

Blank Runs (UPPER WHO TEQ Birds)

Parameter	Units	Blank 1	Maximum
Concentration	ng/m ³	0.0007	0.0007

TEQ2 - LOWER LIMITS (best case where <LOD = 0)

Blank Runs (LOWER NATO I-TEQ)

Parameter	Units	Blank 1	Maximum
Concentration	ng/m ³	0.0000002	0.0000002

Blank Runs (LOWER WHO TEQ Humans / Mammals)

Parameter	Units	Blank 1	Maximum
Concentration	ng/m ³	0.0000001	0.0000001

Blank Runs (LOWER WHO TEQ Fish)

Parameter	Units	Blank 1	Maximum
Concentration	ng/m ³	0.00000002	0.00000002

Blank Runs (LOWER WHO TEQ Birds)

Parameter	Units	Blank 1	Maximum
Concentration	ng/m ³	0.00000002	0.00000002

DIOXINS & FURANS: RESULTS SUMMARY

(PAGE 4 OF 4)

Avon Metals Ltd, Gloucester

A1 New GT

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	1.50		1.50
Uncertainty	±% v/v	0.08		0.08

General Sampling Information

Parameter	Value	
Standard	EN 1948	
Technical Procedure	MD 007	
Name of Analytical Laboratory	EET	
Analytical Laboratory's Procedure	PM137, TM201	
ISO 17025 Accredited Analysis?	MCERTS	
Date of Sample Analysis	07/04/2025	
Probe Material	Titanium	
Filter Housing Material	Borosilicate Glass	
Glassware Material	Borosilicate Glass	
Absorption Material	XAD-2	
Positioning of Filter	Out Stack	
Filter Size and Material	47mm Quartz Fibre	
Number of Sampling Lines Used	2 / 2	FORMAT: Number Used / Number Required
Number of Sampling Points Used	8 / 8	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1 - A4, B1 - B4	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas.

DIOXINS & FURANS: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P_b	mmHg	756.1	
Stack static pressure, P_{static}	mmH ₂ O	0.0	
$P_s = (P_b + (P_{static} / 13.6))$	mmHg	756.1	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	48.5	
Total mass collected in impingers (silica trap)	g	41.1	
Total mass of liquid collected, V_{lc}	g	89.6	
$V_{wstd} = (0.001246)(V_{lc})$	m ³	0.1116	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m ³	8.5300	
Gas meter correction factor, Y_d	-	0.9540	
Average dry gas meter temperature, T_m	°C	29.0	
Average pressure drop across orifice, ΔH	mmH ₂ O	53.7	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m ³	7.3556	
Moisture content, B_{wo} & R_{ww}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m ³	0.0150	
B_{wo} as a percentage	% v/v	1.50	
Reported Water Vapour, checked with Tables in EN 14790, R_{ww}	% v/v	1.50	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{ww}))$	m ³	7.4672	
Volume of gas metered at Oxygen Reference Conditions, $V_{mstd@X\%O_2}$ & $V_{mstw@X\%O_2}$			
IED & Incinerates Hazardous Material? (Yes = no positive O ₂ correction)	-	No	
% wet oxygen measured in gas stream, ACT%O _{2w}	% v/v	N/A	
% dry oxygen measured in gas stream, ACT%O _{2d}	% v/v	N/A	
% oxygen reference condition, REF%O ₂	% v/v	N/A	
O ₂ Reference Factor wet ($O_{2REFw} = (21 - REF\%O_2) / (21 - ACT\%O_{2w})$)	-	N/A	
O ₂ Reference Factor dry ($O_{2REFd} = (21 - REF\%O_2) / (21 - ACT\%O_{2d})$)	-	N/A	
$V_{mstw@X\%oxygen} = (V_{mstw}) / (O_{2REFw})$	m ³	N/A	
$V_{mstd@X\%oxygen} = (V_{mstd}) / (O_{2REFd})$	m ³	N/A	
Molecular weight of dry gas stream, M_d			
CO ₂ (Estimated)	% v/v	0.06	
O ₂ (Estimated)	% v/v	20.80	
Total	% v/v	20.86	
N ₂	% v/v	79.14	
$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$	g/gmol	28.84	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{ww}/100)) + 18(R_{ww}/100)$	g/gmol	28.68	
Velocity of stack gas, V_s			
Pitot tube velocity constant, K_p	-	34.97	
Velocity pressure coefficient, C_p	-	0.84	
Average of velocity heads, ΔP_{avg}	mmH ₂ O	15.15	
Average square root of velocity heads, $\sqrt{\Delta P}$	√mmH ₂ O	3.89	
Average stack gas temperature, T_s	°C	60.8	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(T_s + 273)) / (V(M_s)(P_s))$	m/s	14.15	
Total flow of stack gas: Actual (Q_a), Wet (Q_{stw}), Dry (Q_{std}), Wet@O_{2REF} (Q_{stwO_2}), Dry@O_{2REF} (Q_{stdO_2})			
Area of stack, A_s	m ²	1.23	
$Q_a = (60)(A_s)(V_s)$	m ³ /min	1042.0	
Conversion factor ($K/mm.Hg$), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273)$	m ³ /min	847.8	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{ww}/100))) / ((T_s) + 273)$	m ³ /min	835.1	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273) / (O_{2REFw})$	m ³ /min	N/A	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{ww}/100))) / ((T_s) + 273) / (O_{2REFd})$	m ³ /min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	6.03	
Nozzle area, A_n	mm ²	28.59	
Total sampling time, q	min	360	
$\%I = (4.6398E^6)(T_s+273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{ww}/100))$	%	105.0	

DIOXINS & FURANS: SAMPLING DETAILS

RUN 1

Parameter	Units	Value
Sampling Times	-	09:28 - 12:28, 12:30 - 15:30
Sampling Dates	-	25/03/2025
Sampling Device	-	ISO
Volume Sampled (REF)	m ³	7.3556

Where: ISO stands for Manual Isokinetic Sampling Train

Parameter	Units	Result	DL	NATO I-TEQ		WHO Humans / Mammals		WHO Fish		WHO Birds		% Rec
				TEQ1	TEQ2	TEQ1	TEQ2	TEQ1	TEQ2	TEQ1	TEQ2	
2378-TCDD	ng	ND	0.00713	0.0071	0.0000	0.0071	0.0000	0.0071	0.0000	0.0071	0.0000	79
12378-PeCDD	ng	0.04435	0.01348	0.0222	0.0222	0.0444	0.0444	0.0444	0.0444	0.0444	0.0444	77
123478-HxCDD	ng	0.02352	0.01439	0.0024	0.0024	0.0024	0.0024	0.0118	0.0118	0.0012	0.0012	86
123678-HxCDD	ng	0.06145	0.01567	0.0061	0.0061	0.0061	0.0061	0.0006	0.0006	0.0006	0.0006	81
123789-HxCDD	ng	0.03596	0.01562	0.0036	0.0036	0.0036	0.0036	0.0004	0.0004	0.0036	0.0036	-
1234678-HPeCDD	ng	0.29302	0.00334	0.0029	0.0029	0.0029	0.0029	0.0003	0.0003	0.0003	0.0003	78
OCDD	ng	0.25019	0.00346	0.0003	0.0003	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	80
Total Dioxins	ng	0.0000	-	0.0446	0.0374	0.0666	0.0594	0.0645	0.0574	0.0572	0.0501	-
2378-TCDF	ng	0.05904	0.01046	0.0059	0.0059	0.0059	0.0059	0.0030	0.0030	0.0590	0.0590	80
12378-PeCDF	ng	0.05604	0.02293	0.0028	0.0028	0.0017	0.0017	0.0028	0.0028	0.0056	0.0056	102
23478-PeCDF	ng	0.10216	0.02200	0.0511	0.0511	0.0306	0.0306	0.0511	0.0511	0.1022	0.1022	79
123478-HxCDF	ng	0.07555	0.01735	0.0076	0.0076	0.0076	0.0076	0.0076	0.0076	0.0076	0.0076	80
123678-HxCDF	ng	0.11599	0.01911	0.0116	0.0116	0.0116	0.0116	0.0116	0.0116	0.0116	0.0116	77
234678-HxCDF	ng	0.19171	0.02153	0.0192	0.0192	0.0192	0.0192	0.0192	0.0192	0.0192	0.0192	71
123789-HxCDF	ng	0.08408	0.02608	0.0084	0.0084	0.0084	0.0084	0.0084	0.0084	0.0084	0.0084	108
1234678-HPeCDF	ng	0.37387	0.00749	0.0037	0.0037	0.0037	0.0037	0.0037	0.0037	0.0037	0.0037	74
1234789-HPeCDF	ng	0.07825	0.00923	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	96
OCDF	ng	0.13438	0.00247	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	83
Total Furans	ng	0.0000	-	0.1112	0.1112	0.0895	0.0895	0.1081	0.1081	0.2181	0.2181	-
Totals	ng	0.0000	-	0.1558	0.1486	0.1561	0.1490	0.1726	0.1655	0.2753	0.2681	-
Total Concentration	ng/m ³	-	-	0.0212	0.0202	0.0212	0.0203	0.0235	0.0225	0.0374	0.0365	-
Limit of Detection	ng/m ³	-	-	0.0055	-	0.0057	-	0.0067	-	0.0090	-	-

Where: ND stands for Non Detected
DL stands for Analytical Detection Limit
TEQ1 refers to Non Detected Congeners at the Detection Limit
TEQ2 refers to Non Detected Congeners at Zero
% Rec stands for the Recovery Percentage of the Sample

DIOXINS & FURANS: SAMPLING DETAILS

(Continued)

BLANK 1

Parameter	Units	Value
Sampling Dates	-	25/03/2025
Sampling Device	-	ISO
Average Volume Sampled (REF)	m ³	7.3556

Where: ISO stands for Manual Isokinetic Sampling Train

Parameter	Units	Result	DL	NATO I-TEQ		WHO Humans / Mammals		WHO Fish		WHO Birds		% Rec
				TEQ1	TEQ2	TEQ1	TEQ2	TEQ1	TEQ2	TEQ1	TEQ2	
2378-TCDD	ng	ND	0.00059	0.0006	0.0000	0.0006	0.0000	0.0006	0.0000	0.0006	0.0000	88
12378-PeCDD	ng	ND	0.00150	0.0008	0.0000	0.0015	0.0000	0.0015	0.0000	0.0015	0.0000	85
123478-HxCDD	ng	ND	0.00113	0.0001	0.0000	0.0001	0.0000	0.0006	0.0000	0.0001	0.0000	89
123678-HxCDD	ng	ND	0.00114	0.0001	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	84
123789-HxCDD	ng	ND	0.00114	0.0001	0.0000	0.0001	0.0000	0.0000	0.0000	0.0001	0.0000	-
1234678-HPeCDD	ng	ND	0.00056	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	83
OCDD	ng	ND	0.00100	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	86
Total Dioxins	ng	0.0000	-	0.0017	0.0000	0.0024	0.0000	0.0027	0.0000	0.0023	0.0000	-
2378-TCDF	ng	ND	0.00095	0.0001	0.0000	0.0001	0.0000	0.0000	0.0000	0.0010	0.0000	77
12378-PeCDF	ng	ND	0.00144	0.0001	0.0000	0.0000	0.0000	0.0001	0.0000	0.0001	0.0000	118
23478-PeCDF	ng	ND	0.00138	0.0007	0.0000	0.0004	0.0000	0.0007	0.0000	0.0014	0.0000	79
123478-HxCDF	ng	ND	0.00088	0.0001	0.0000	0.0001	0.0000	0.0001	0.0000	0.0001	0.0000	83
123678-HxCDF	ng	ND	0.00093	0.0001	0.0000	0.0001	0.0000	0.0001	0.0000	0.0001	0.0000	81
234678-HxCDF	ng	ND	0.00107	0.0001	0.0000	0.0001	0.0000	0.0001	0.0000	0.0001	0.0000	70
123789-HxCDF	ng	ND	0.00129	0.0001	0.0000	0.0001	0.0000	0.0001	0.0000	0.0001	0.0000	124
1234678-HPeCDF	ng	ND	0.00059	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	78
1234789-HPeCDF	ng	ND	0.00073	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	104
OCDF	ng	0.00180	0.00056	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	85
Total Furans	ng	0.0000	-	0.0013	0.0000	0.0010	0.0000	0.0012	0.0000	0.0029	0.0000	-
Totals	ng	0.0000	-	0.0030	0.0000	0.0034	0.0000	0.0039	0.0000	0.0052	0.0000	-
Total Concentration	ng/m ³	-	-	0.0004	0.0000	0.0005	0.0000	0.0005	0.0000	0.0007	0.0000	-

Where: ND stands for Non Detected
DL stands for Analytical Detection Limit
TEQ1 refers to Non Detected Congeners at the Detection Limit
TEQ2 refers to Non Detected Congeners at Zero
% Rec stands for the Recovery Percentage of the Sample

DIOXINS & FURANS: QUALITY ASSURANCE

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Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	22.6	
Pre-Sampling Leak Rate	l/min	0.10	
Post-Sampling Leak Rate	l/min	0.10	
Allowable Leak Rate	l/min	1.13	
Leak Test Acceptable	-	Yes	
Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	
MU (Concurrent Water Vapour)	Units	Run 1	
Measurement Uncertainty (MU)	%	5.3	
Allowable MU	%	20.0	
MU Acceptable	%	Yes	
Silica Gel (Concurrent Water Vapour)	Units	Run 1	
Less than 50% Faded	%	Yes	
Isokinetic Criterion Compliance	Units	Run 1	
Isokinetic Variation	%	105.0	
Allowable Isokinetic Range	%	95 - 115	
Isokineticity Acceptable	-	Yes	
Filter Temperatures	Units	Run 1	
Maximum Filter Temperature	°C	120	
Maximum Allowable Temperature	°C	125	
Temperature Acceptable	-	Yes	
Condenser Exit Temperature	Units	Run 1	
Maximum Temperature Recorded	°C	15	
Maximum Allowable Temperature	°C	20	
Exit Temperature Acceptable	-	Yes	
Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	

DIOXINS & FURANS: QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	15.0	
Sampling Leak Rate	l/min	0.10	
Allowable Leak Rate	l/min	0.75	
Leak Test Acceptable	-	Yes	

Validity of NATO I-TEQ Blank vs ELV	Units	Blank 1	
Allowable Blank	ng/m ³	0.010	
Blank Acceptable	-	Yes	

Method Deviations

Nature of Deviation	Run Number	
(x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)	1	
There are no deviations associated with the sampling employed.	wx	

DIOXINS & FURANS (NATO I-TEQ): MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value		Standard uncertainty		
	Symbol	Run 1	Symbol	Units	Run 1
Sampled Volume (Actual)	V_m	8.5300	uV_m	m ³	0.1706
Sampled Gas Temperature	T_m	302.0	uT_m	K	2.00
Sampled Gas Pressure	p_m	100.8	up_m	kPa	0.50
Sampled Gas Humidity	H_m	0.00	uH_m	% v/v	1.00
Leak	L	0.44	uL	%	-
Laboratory Result	L_r	10.0	uL_r	%	-

Measured Quantities	Uncertainty as a Percentage		Requirement of Standard
	Units	Run 1	
Sampled Volume (Actual)	%	2.00	≤2%
Sampled Gas Temperature	%	0.66	≤1%
Sampled Gas Pressure	%	0.50	≤1%
Sampled Gas Humidity	%	1.00	≤1%
Leak	%	0.44	≤5%
Laboratory Result	%	10.0	No Requirement

Measured Quantities	Uncertainty in Measurement Units			Sensitivity Coefficient	
	Symbol	Units	Run 1	Run 1	
Sampled Volume (STP)	V_m	m ³	7.3556	0.003	
Leak	L	ng/m ³	0.0001	1.00	
Laboratory Result	L_r	ng/m ³	0.0021	1.00	

Measured Quantities	Uncertainty in Result	
	Units	Run 1
Sampled Volume (STP)	ng/m ³	0.0006
Leak	ng/m ³	0.0001
Laboratory Result	ng/m ³	0.0021

Measured Quantities	Oxygen Correction Part of MU Budget	
	Units	Run 1
O ₂ Correction Factor	-	N/A
Stack Gas O ₂ Content	% v/v	N/A
MU for O ₂ Correction	-	N/A
Overall MU For O ₂ Measurement	%	N/A

Parameter	Units	Run 1
Combined uncertainty	ng/m ³	0.0022
Expanded uncertainty (95% confidence), without Oxygen Correction	ng/m ³	0.0043
Expanded uncertainty (95% confidence), with Oxygen Correction	ng/m ³	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	ng/m ³	0.0043
Reported Uncertainty	ng/m ³	0.0043
Expanded uncertainty (95% confidence), without Oxygen Correction	%	20.3
Expanded uncertainty (95% confidence), with Oxygen Correction	%	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	20.3
Reported Uncertainty	%	20.3
Reported Uncertainty as % of ELV	%	4.3

HYDROGEN FLUORIDE: RESULTS SUMMARY

Avon Metals Ltd, Gloucester
A1 New GT

Sample Runs

Parameter	Units	Run 1	Run 2	Run 3	Mean
Concentration	mg/m ³	< 0.02	0.18	0.20	0.13
Uncertainty	±mg/m ³	0.002	0.02	0.03	0.02
Mass Emission	g/hr	< 0.7	7.7	8.7	5.7
Uncertainty	±g/hr	0.1	1.2	1.3	0.9

Parameter	Units	Run 1	Run 2	Run 3	Mean
Water Vapour	% v/v	1.07	1.15	1.05	1.09
Uncertainty	±% v/v	0.06	0.06	0.06	0.06

Blank Runs

Parameter	Units	Blank 1	Maximum
Concentration	mg/m ³	< 0.01	< 0.01

General Sampling Information

Parameter	Value
Standard	CEN/TS 17340
Technical Procedure	MD 010
Name of Analytical Laboratory	EET
Analytical Laboratory's Procedure	MD-101
ISO 17025 Accredited Analysis?	MCERTS
Date of Sample Analysis	02/04/2025
Probe Material	Titanium
Filter Housing Material	Titanium
Impinger Material	Polyethylene
Absorption Solution	HPLC Grade Water
Positioning of Filter	In Stack
Filter Size and Material	47mm Glass Fibre
Number of Sampling Lines Used	2 / 2
Number of Sampling Points Used	8 / 8
Sample Point I.D.'s	A1 - A4, B1 - B4

FORMAT: Number Used / Number Required
FORMAT: Number Used / Number Required

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas.

HYDROGEN FLUORIDE: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1	Run 2	Run 3
Sampling Times	-	10:50 - 11:20, 11:21 - 11:51	12:10 - 12:40, 12:41 - 13:11	13:17 - 13:47, 13:48 - 14:18
Sampling Dates	-	25/03/2025	25/03/2025	25/03/2025
Sampling Device	-	DGM	DGM	DGM
Duration	mins	60	60	60
DGM Start Volume	m ³	3.8380	5.2860	6.7850
DGM End Volume	m ³	5.2730	6.7700	8.3870
DGM Start Temperature	°C	18.9	29.3	29.0
DGM End Temperature	°C	18.0	29.3	33.0
Start ΔH	mmH ₂ O	10.20	10.20	10.20
End ΔH	mmH ₂ O	10.20	10.20	10.20
DGM Y _d	-	0.9540	0.9540	0.9540
Barometric Pressure	kPa	101.2	101.2	101.2
Volume Sampled (STP, Dry)	m ³	1.2819	1.2781	1.3720
Volume Sampled (STP, Wet)	m ³	1.2957	1.2929	1.3865
Volume Sampled (REF)	m ³	1.2819	1.2781	1.3720
Sample Flow Rate	l/min	22.82	23.60	25.47
Laboratory Result for Front Impingers	µg/ml	< 0.05	0.57	0.83
Laboratory Result for Back Impinger	µg/ml	< 0.05		
Volume in Front Impingers	ml	266.0	403.4	336.5
Volume in Back Impinger	ml	129.7		
Mass in Front Impingers	µg	< 13.3	229.9	279.3
Mass in Back Impinger	µg	< 6.5		
Total Mass Collected	µg	< 19.8	229.9	279.3
Calculated Concentration	mg/m ³	< 0.02	0.18	0.20
Liquid Trap Start Mass	g	1549.2	1545.8	1545.2
Liquid Trap End Mass	g	1544.1	1541.6	1539.4
Silica Trap Start Mass	g	1562.0	1475.8	1578.2
Silica Trap End Mass	g	1578.2	1491.9	1595.7
Total Mass Of Water Vapour	g	11.1	11.9	11.7
Calculated Water Vapour	% v/v	1.07	1.15	1.05

Where: DGM stands for Dry Gas Meter

Blank Runs

Parameter	Units	Blank 1
Blank Dates	-	25/03/2025
Average Volume Sampled (REF)	m ³	1.3106
Laboratory Result for Impingers	µg/ml	< 0.05
Volume in Impingers	ml	312.1
Total Mass Collected	µg	< 15.6
Calculated Concentration	mg/m ³	< 0.01

HYDROGEN FLUORIDE: QUALITY ASSURANCE

Sample Runs

Leak Test Results	Units	Run 1	Run 2	Run 3	
Mean Sampling Rate	l/min	22.8	23.6	25.5	
Pre-Sampling Leak Rate	l/min	0.10	0.10	0.10	
Post-Sampling Leak Rate	l/min	0.10	0.10	0.10	
Allowable Leak Rate	l/min	0.46	0.47	0.51	
Leak Test Acceptable	-	Yes	Yes	Yes	

Absorption Efficiency	Units	Run 1	
Absorption Efficiency	%	100.0	
Allowable Absorption Efficiency	%	N/A ²	
Absorption Efficiency Acceptable	-	Yes ²	

² The concentration is less than 30% of the ELV, therefore no assessment against an allowable efficiency is required.

Water Droplets	Units	Run 1	Run 2	Run 3	
Are Water Droplets Present	-	No	No	No	

MU (Concurrent Water Vapour)	Units	Run 1	Run 2	Run 3	
Measurement Uncertainty (MU)	%	5.3	5.4	5.4	
Allowable MU	%	20.0	20.0	20.0	
MU Acceptable	%	Yes	Yes	Yes	

Silica Gel (Concurrent Water Vapour)	Units	Run 1	Run 2	Run 3	
Less than 50% Faded	%	Yes	Yes	Yes	

Test Conditions	Units	Run 1	Run 2	Run 3	
Ambient Temperature Recorded?	-	Yes	Yes	Yes	

Blank Runs

Leak Test Results	Units	Blank 1	
Expected Sampling Rate	l/min	15.0	
Pre-Sampling Leak Rate	l/min	0.10	
Post-Sampling Leak Rate	l/min	0.00	
Allowable Leak Rate	l/min	0.30	
Leak Test Acceptable	-	Yes	

Validity of Blank vs ELV	Units	Blank 1	
Allowable Blank	mg/m ³	0.1	
Blank Acceptable	-	Yes	

Method Deviations

Nature of Deviation	Run Number			
(x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)	1	2	3	
There are no deviations associated with the sampling employed.	wx	wx	wx	

HYDROGEN FLUORIDE: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value				Symbol	Standard uncertainty			
	Symbol	Run 1	Run 2	Run 3		Units	Run 1	Run 2	Run 3
Sampled Volume (Actual)	V_m	1.4350	1.4840	1.6020	uV_m	m ³	0.0287	0.0297	0.0320
Sampled Gas Temperature	T_m	291.5	302.3	304.0	uT_m	K	2.00	2.00	2.00
Sampled Gas Pressure	p_m	101.2	101.2	101.2	up_m	kPa	0.50	0.50	0.50
Sampled Gas Humidity	H_m	0.00	0.00	0.00	uH_m	% v/v	1.00	1.00	1.00
Leak	L	0.44	0.42	0.39	uL	%	-	-	-
Laboratory Result	L_r	5.85	5.85	5.85	uL_r	%	-	-	-

Measured Quantities	Uncertainty as a Percentage				Requirement of Standard
	Units	Run 1	Run 2	Run 3	
Sampled Volume (Actual)	%	2.00	2.00	2.00	≤2%
Sampled Gas Temperature	%	0.69	0.66	0.66	≤1%
Sampled Gas Pressure	%	0.49	0.49	0.49	≤1%
Sampled Gas Humidity	%	1.00	1.00	1.00	≤1%
Leak	%	0.44	0.42	0.39	≤2%
Laboratory Result	%	5.85	5.85	5.85	No Requirement

Measured Quantities	Uncertainty in Measurement Units					Sensitivity Coefficient		
	Symbol	Units	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
Sampled Volume (STP)	V_m	m ³	1.2819	1.2781	1.3720	0.01	0.14	0.15
Leak	L	mg/m ³	0.00004	0.00044	0.00046	1.00	1.00	1.00
Laboratory Result	L_r	mg/m ³	0.001	0.011	0.012	1.00	1.00	1.00

Measured Quantities	Uncertainty in Result			
	Units	Run 1	Run 2	Run 3
Sampled Volume (STP)	mg/m ³	0.000	0.005	0.005
Leak	mg/m ³	0.0000	0.0004	0.0005
Laboratory Result	mg/m ³	0.0009	0.0105	0.0119

Measured Quantities	Oxygen Correction Part of MU Budget			
	Units	Run 1	Run 2	Run 3
O ₂ Correction Factor	-	N/A	N/A	N/A
Stack Gas O ₂ Content	% v/v	N/A	N/A	N/A
MU for O ₂ Correction	-	N/A	N/A	N/A
Overall MU For O ₂ Measurement	%	N/A	N/A	N/A

Parameter	Units	Run 1	Run 2	Run 3
Combined uncertainty	mg/m ³	0.001	0.01	0.01
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m ³	0.002	0.02	0.03
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m ³	N/A	N/A	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m ³	0.002	0.02	0.03
Reported Uncertainty	mg/m ³	0.002	0.02	0.03
Expanded uncertainty (95% confidence), without Oxygen Correction	%	12.6	12.6	12.6
Expanded uncertainty (95% confidence), with Oxygen Correction	%	N/A	N/A	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	12.6	12.6	12.6
Reported Uncertainty	%	12.6	12.6	12.6
Reported Uncertainty as % of ELV	%	0.2	2.3	2.6

TOTAL VOCs (as CARBON): RESULTS SUMMARY

Avon Metals Ltd, Gloucester
A1 New GT

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	mg/m ³	1.25	1.25
Uncertainty	±mg/m ³	1.01	1.01
Mass Emission	g/hr	53.5	53.5
Uncertainty	±g/hr	43.4	43.4

General Sampling Information

Parameter	Value
Standard	EN 12619:2013
Technical Procedure	MD 020
Probe Material	Titanium
Filtration Type / Size	0.1µm Glass Fibre
Heated Head Filter Used	Yes
Heated Line Temperature	180°C
Span Gas Type	Propane In Synthetic Air (5 Grade)
Span Gas Reference Number	1.0611
Span Gas Expiry Date	24/06/2029
Span Gas Start Pressure (bar)	190
Gas Cylinder Concentration (ppm)	80.22
Span Gas Set Point (ppm)	80.22
Span Gas Uncertainty (%)	2
Zero Gas Type	Synthetic Air (5 Grade)
Number of Sampling Lines Used	1/1
Number of Sampling Points Used	1/1
Sample Point I.D.'s	B2

FORMAT: Number Used / Number Required

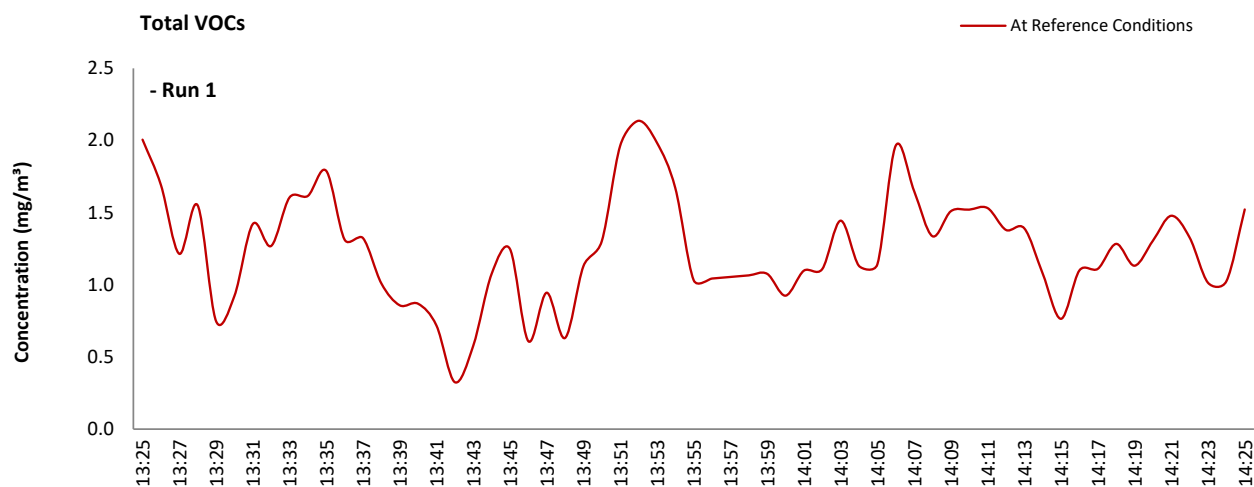
FORMAT: Number Used / Number Required

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas.

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



TOTAL VOCs (as CARBON): SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1	
Sampling Times	-	13:25 - 14:25	
Sampling Dates	-	25/03/2025	
Instrument Range	ppm	100	
Span Gas Value	ppm	80.2	

Quality Assurance

Zero Drift		Units	Run 1	
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.00	
	Zero Down Sampling Line (Post)	ppm	-0.50	
	Zero Drift	ppm	-0.50	
	Zero Drift	%	-0.62	
	Drift Correction Applied	2-5%	No	
	Allowable Zero Drift	± ppm	4.01	
	Zero Drift Acceptable	-	Yes	
Span Drift		Units	Run 1	
CAL 1	Span Down Sampling Line (Pre)	ppm	80.20	
	Span Down Sampling Line (Post)	ppm	80.00	
	Span Drift	ppm	-0.20	
	Span Drift	%	-0.25	
	Drift Correction Applied	2-5%	No	
	Allowable Span Drift	± ppm	4.01	
	Span Drift Acceptable	-	Yes	
Test Conditions		Units	Run 1	
Run Ambient Temperature Range		°C	15 / 12	

Method Deviations

Nature of Deviation	Run Number
(x = deviation applies to the associated run)	1

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1	Units
Limit value	10.0	mg/m ³ (REF)
Allowable MU	15.0	%
Measured concentration	1.25	mg/m ³ (STP, dry)
Range Used	100.0	ppm
Range Used [A]	160.6	mg/m ³
Cal gas conc.	80.2	ppm
Conversion	1.61	ppm to mg/m ³
MCERTS Range [B]	15.0	mg/m ³
Lower of [A] or [B]	15.0	mg/m ³
Cal gas conc.	128.8	mg/m ³

Performance characteristics	RUN 1	Units
Response time	45	seconds
Number of readings in measurement	60	-
Repeatability at zero	2.00	% full scale
Repeatability at span level	0.00	% full scale
Deviation from linearity	0.34	% of value
Zero drift	-0.62	% full scale
Span drift	-0.25	% full scale
Volume or pressure flow dependence	1.60	% of full scale
Atmospheric pressure dependence	0.30	% of value/kPa
Ambient temperature dependence	1.40	% full scale/10K
Combined interference	0.45	% range
Dependence on voltage	0.50	% full scale/10V
Losses in the line (leak)	0.00	% of value
Uncertainty of calibration gas	2.00	% of value

Performance characteristic	RUN 1	Units
Standard deviation of repeatability at zero	use rep at span	mg/m ³
Standard deviation of repeatability at span level	0.00	mg/m ³
Lack of fit	0.03	mg/m ³
Drift	-0.47	mg/m ³
Volume or pressure flow dependence	0.00	mg/m ³
Atmospheric pressure dependence	0.01	mg/m ³
Ambient temperature dependence	0.20	mg/m ³
Combined interference (from MCERTS Certificate)	0.04	mg/m ³
Dependence on voltage	0.06	mg/m ³
Losses in the line (leak)	0.00	mg/m ³
Uncertainty of calibration gas	0.01	mg/m ³

Measurement uncertainty	Result	RUN 1	Units
Combined uncertainty		1.25	mg/m ³
Expanded uncertainty		0.51	mg/m ³
Expanded uncertainty	k = 1.96	1.01	mg/m ³
Uncertainty corrected to std conds. (O ₂)		1.01	mg/m ³ (REF)

	RUN 1	Units
Expanded uncertainty (no O ₂) - at 95% Confidence	80.70	% of Value
Expanded uncertainty (no O ₂) - at 95% Confidence	10.06	% at ELV
Overall Allowable uncertainty (no O ₂) - at 95% Confidence	15.0	% at ELV
Result of Compliance with Uncertainty Requirement	COMPLIANT	-

	RUN 1	Units
Expanded uncertainty (with O ₂) - at 95% Confidence	N/A	% of Value
Expanded uncertainty (with O ₂) - at 95% Confidence	N/A	% at ELV
Overall Allowable uncertainty (with O ₂) - at 95% Confidence	N/A	% at ELV
Result of Compliance with Uncertainty Requirement	N/A	-

Requirement for SRM is that Uncertainty should be <15% of the value at the ELV, on a dry gas basis, or if O₂ correction is applied less than 15% + the uncertainty associated with the O₂ correction (using sqrt of sum squares to add uncertainty components).

VERSION HISTORY

Version Number	Record of changes made within this version of the document
V1	The original document issued to the client