Site Visit Report

The site visit process is a sample on a particular day of an installation's compliance with some of its licence conditions. Where non-compliance against a particular condition has not been reported, this should not be construed to mean that there is full compliance with that condition of the licence.

Instructions and actions arising from the visit shall be addressed, or where applicable noted, by the licensee in order to ensure compliance, to improve the environmental performance of the installation and to provide clarification on certain issues.

The licensee shall take the actions specified to close out the non-compliances and observations raised in this Site Visit Report.

The licensee may also be requested to provide a response to the Environmental Protection Agency (hereafter referred to as the Agency) in relation to the site visit report findings.

Licensee

Name of Installation	Arran Chemical Company Limited
Licensee	Arran Chemical Company Limited
Licence Register No.	P0110-03
CRO Number	94943
Site Address	Units 1-3, Monksland Industrial Estate, Athlone, Roscommon, N37DN24
Site Visit Reference No.	SV26265

Report Detail

Issue Date	17/10/2023
Prepared By	Pauline Gillard

Site Visit Detail

Date Of Inspection	12/04/2023		
Time In	09:00	**Time Out**	17:30
EPA Inspector(s)			
Additional Visitors	Element		
Licensee Personnel and Role	Cyril Fury		

Summary

This site visit was conducted as part of the Agency’s routine air emissions monitoring programme. The monitoring report is attached. The licensee was found to be in compliance with its Licence in relation to the areas inspected during this site visit.

Site Areas Inspected

See Report.

Documents Inspected

See Report.

EPA AIR EMISSIONS COMPLIANCE MONITORING EMISSIONS REPORT

(Prepared on behalf of the EPA by Element Ireland - EPA Contract No. OEE23-AEMP)

Element Ireland, Unit D8 North City Business Park, North Road, Finglas, Dublin 11
Your Element Ireland Contact: Dónal Ó Faogáin (+353 861 746 367)
E: donal.ofaogain@element.com

Stack Emissions Testing Report Commissioned by
EPA Office of Environmental Enforcement

Installation Name & Address
Arran Chemical Company Limited
Unit 1-3 Monksland Industrial Estate
Athlone
Co. Westmeath

Industrial Emissions Licence: P0110-03

Stack Reference
A-2-2 CAU Scrubber

Dates of the Monitoring Campaign
13h - 14th April 2023

Job Reference Number
P0110-03CAR23-01A

Report Written by
Donal O Faogain Senior Team Leader MCERTS Level 2 MM13 1259 TE1 TE2 TE3 TE4

Report Checked by	Report Approved by
Darragh Long Team Leader MCERTS Level 2 MM18 1494 TE1 TE2 TE3 TE4	Neil Kelly Team Leader MCERTS Level 2 MM16 1390 TE1 TE2 TE3 TE4

Report Date
15th May 2023

Version
Version 1

Signature of Report Checker	Signature of Report Approver
	

CONTENTS

Opinions and interpretations expressed herein are outside the scope of Element Ireland's ISO 17025 accreditation.

The testing performed fully meets the technical requirements in Irish EPA Guidance Note, AG2.

MONITORING OBJECTIVES

Arran Chemical Company Limited, Athlone
A-2-2 CAU Scrubber
13h - 14th April 2023

Overall Aim of the Monitoring Campaign

Element Ireland were commissioned by the EPA Office of Environmental Enforcement to carry out stack emissions testing at Arran Chemical Company Limited on the A-2-2 CAU Scrubber at Athlone.

The aim of the monitoring campaign was to perform testing, as requested by the customer, for a number of prescribed pollutants. There are no emission limits set for any of the pollutants at this time.

Special Requirements

There were no special requirements.

Target Parameters

Dioxins & Furans, Hydrogen Chloride, Sum of individual halogenated VOCs (hazard statements E341 and H351) , Class I Organics , Class II Organics , Total VOCs (as Carbon), Oxides of Nitrogen (as NO_2)

Executive Summary

MONITORING RESULTS

Arran Chemical Company Limited, Athlone
A-2-2 CAU Scrubber
13h - 14th April 2023

where MU = Measurement Uncertainty associated with the Result

			Concentration				Mass Emission			
Parameter			**Units**	**Result**	**MU +/-**	**Limit**	**Units**	**Result**	**MU +/-**	**Limit**
Hydrogen Chloride		[1]	mg/m³	< 0.06	0.003	30	g/hr	< 0.047	0.008	150
Sum of individual halogenated VOCs (hazard statements E341 and H351)		[1]	mg/m³	< 1.70	0.34	2	g/hr	< 1.3	0.3	-
Class I Organics		[1]	mg/m³	>0.000 and <2.461	0.49	20	kg/hr	>0.00 and <0.0019	0.0005	0.1
Class II Organics		[1]	mg/m³	>0.33 and <2.37	0.57	100	kg/hr	>0.0 and <0.002	0.0005	2
Total VOCs (as Carbon)		[1]	mg/m³	1.87	0.43	20	g/hr	1.5	0.4	-
Total VOCs (as Carbon) 1Hr	R1	[1 2]	mg/m³	2.34	0.44	30	g/hr	1.85	0.5	-
Total VOCs (as Carbon) 1Hr	R2	[1 2]	mg/m³	1.64	0.43	30	g/hr	1.29	0.4	-
Water Vapour			% v/v	0.6	0.1					
Stack Gas Temperature			°C	9.2						
Stack Gas Velocity			m/s	2.7	0.44					
Volumetric Flow Rate (ACTUAL)			m³/hr	844	141	**Limit**				
Volumetric Flow Rate (REF)		[1]	m³/hr	790	132	1000				

NOTE: VOLUMETRIC FLOW RATE & VELOCITY DATA TAKEN FROM THE PRELIMINARY VELOCITY TRAVERSE.

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

MONITORING DATE(S) & TIMES

Arran Chemical Company Limited, Athlone
A-2-2 CAU Scrubber
13h - 14th April 2023

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Hydrogen Chloride	R1	mg/m³	< 0.1	g/hr	< 0.0	14/04/2023	09:30 - 10:00	30
Sum of individual halogenated VOCs (hazard statements E341 and H351)	R1	mg/m³	< 1.70	g/hr	< 1.3	14/04/2023	09:00 - 09:30	30
Class I Organics	R1	mg/m³	>0.000 and <2.461	kg/hr	>0.00 and <0.0019	14/04/2023	09:00 - 09:30	30
Class II Organics	R1	mg/m³	>0.33 and <2.37	kg/hr	>0.0 and <0.002	14/04/2023	09:00 - 09:30	30
Total VOCs (as Carbon)	R1	mg/m³	2.35	g/hr	1.85	14/04/2023	08:30 - 09:00	30
Total VOCs (as Carbon)	R2	mg/m³	2.33	g/hr	1.84	14/04/2023	09:00 - 09:30	30
Total VOCs (as Carbon)	R3	mg/m³	0.94	g/hr	0.74	14/04/2023	09:30 - 10:00	30
Total VOCs (as Carbon) 1Hr Average	R1	mg/m³	2.34	g/hr	1.85	14/04/2023	08:30 - 09:30	60
Total VOCs (as Carbon) 1Hr Average	R2	mg/m³	1.64	g/hr	1.29	14/04/2023	09:00 - 10:00	60
Velocity Traverse	R1					14/04/2023	07:50 - 07:55	

All results are expressed at the respective reference conditions.

PROCESS DETAILS

Arran Chemical Company Limited, Athlone
A-2-2 CAU Scrubber
13h - 14th April 2023

Standard Operating Conditions

Parameter	Value
Process Status	Chemical Manufacturing
Capacity (of 100%) and Tonnes / Hour	1200 - 1800m3/hr
Continuous or Batch Process	Batch
Feedstock (if applicable)	Solvents
Abatement System	Thermal Oxidiser
Abatement System Running Status	On
Fuel	Natural Gas
Plume Appearance	None

Executive Summary

MONITORING & ANALYTICAL METHODS

Arran Chemical Company Limited, Athlone
A-2-2 CAU Scrubber
13h - 14th April 2023

	Monitoring				Analysis					
Parameter	**Standard**	**Technical Procedure**	**Sampling Status**	**Testing Lab**	**Analytical Procedure**	**Analytical Technique**	**Analysis Status**	**Analysis Lab**	**Overall Status**	**LOD (Average)**
Hydrogen Chloride	EN 1911	CAT-TP-11	MCERTS	EET	CAT-AP-01	IC	MCERTS	EET	MCERTS	0.07 mg/m³
Sum of individual halogenated VOCs (hazard statements E341 and H351)	CEN/TS 13649	CAT-TP-16	MCERTS	EET	GC/MS	GC/MS	None	MAR	None	1.697 mg/m³
Class I Organics	CEN/TS 13649	CAT-TP-16	MCERTS	EET	GC/MS	GC/MS	None	MAR	None	2.461 mg/m³
Class II Organics	CEN/TS 13649	CAT-TP-16	MCERTS	EET	WI 3042 & 3048	GC/MS	None	MAR	None	2.121 mg/m³
Water Vapour	EN 14790	CAT-TP-05	MCERTS	EET	CAT-TP-05	Gravimetric	MCERTS	EET	MCERTS	0.10 % v/v
Total VOCs (as Carbon)	EN 12619:2013	CAT-TP-20	MCERTS	EET	Flame Ionisation Detection by Sick 3006				MCERTS	0.32 mg/m³
Velocity & Vol. Flow Rate	EN 16911-1 (MID)	CAT-TP-41	MCERTS	EET	Pitot Tube and Thermocouple				MCERTS	1.2 m/s

ANALYSIS LABORATORIES

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

Element (Stockport Lab - EET)	ISO 17025 Accreditation Number: 4279
Marchwood Scientific Services Ltd (MAR)	ISO 17025 Accreditation Number: 1668

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	0.33
Width	m	-
Area	m²	0.09
Port Depth	cm	34
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

Irish EPA Technical Guidance Note AG1 / 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 Irish EPA Guidance Note AG1 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)

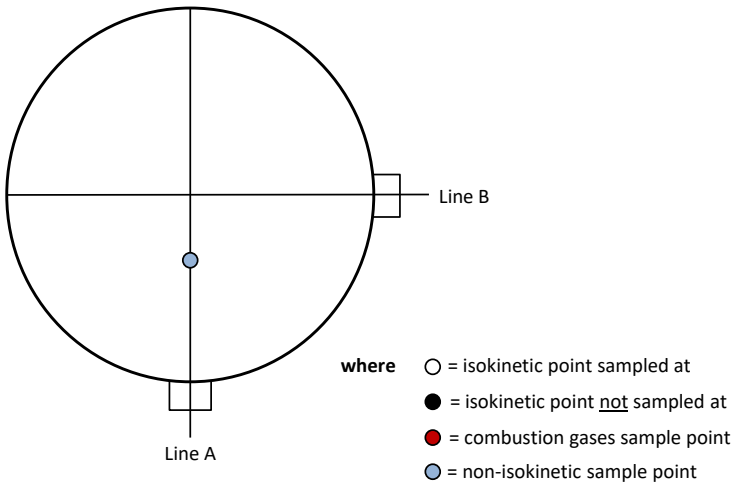
Criteria in EN 15259	Units	Traverse 1	Required	Compliant
Lowest Differential Pressure	Pa	6.5	> 5 Pa	Yes
Mean Velocity	m/s	2.74	-	-
Lowest Gas Velocity	m/s	2.74	-	-
Highest Gas Velocity	m/s	2.74	-	-
Ratio of Above	: 1	1.00	< 3 : 1	Yes
Maximum Angle of Swirl	°	3.00	< 15°	Yes
No Local Negative Flow	-	Yes	-	Yes

PLANT PHOTOS

Photo 1

Photo 2

SAMPLE POINTS



APPENDIX CONTENTS

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Donal O Faogain	MCERTS Level 2	MM13 1259	TE1 TE2 TE3 TE4
Technician	James O'Connor	MCERTS Trainee	MM22 1720	TE1

LIST OF EQUIPMENT

Extractive Sampling	
Equipment Type	**Equipment I.D.**
Control Box DGM (1)	CAT 7.166
Control Box DGM (2)	-
Box Thermocouples (1)	-
Box Thermocouples (2)	-
Umbilical (1)	CAT 3.555
Umbilical (2)	-
Oven Box (1)	-
Oven Box (2)	-
Heated Probe (1)	CAT 5.143
Heated Probe (2)	-
Heated Probe (3)	-
S-Pitot (1)	CAT 21p.92
S-Pitot (2)	CAT 21p.189
L-Pitot	-
Site Balance	CAT 17.68
500g / 1Kg Check Weights	CAT 17.68
Last Impinger Arm	-
Callipers	-
Tubes Kit Thermocouple	-

Instrumental Analysers	
Equipment Type	**Equipment I.D.**
Horiba PG-350E	CAT 39.9
SELECT Horiba Model (2)	-
SELECT Servomex Model	-
SELECT NOX Analyser/Convertor	-
ABB AO2020-URAS26	-
Testo 350 XL	-
JCT JCC P1 Cooler	CAT 4.1122
SELECT FTIR	-
Gasmet Sampling System	-
Sick 3006	CAT 8.15
M&C PSS	CAT 12.83
Mass Flow Controller (1)	CAT 6.81
Mass Flow Controller (2)	CAT 6.45
Mass View (1)	CAT 25.37
Mass View (2)	-
SELECT Logger 1	-
SELECT Logger 2	-
Bioaerosols Temperature Logger	-
Electronic Refrigerator	-

Miscellaneous Items	
Equipment Type	**Equipment I.D.**
Digital Manometer (1)	CAT 3.117
Digital Manometer (2)	-
Digital Temperature Meter	CAT 3.117
Stopwatch	CAT 14.53
Barometer	CAT 13.22
Stack Thermocouple (1)	CAT 4.1490
Stack Thermocouple (2)	-
Stack Thermocouple (3)	-
1m Heated Line (1)	-
1m Heated Line (2)	-
1m Heated Line (3)	-
5m Heated Line (1)	-
15m Heated Line (1)	-
20m Heated Line (1)	-
20m Heated Line (2)	CAT 20.1020
Dual Channel Heater Controller	CAT 20.1020
Single Channel Heater Controller	-
Laboratory Balance	
Tape Measure	CAT 16.94

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Hydrogen Chloride	EN 1911	CAT-TP-11
Sum of individual halogenated VOCs (hazard statements E341 and H351)	CEN/TS 13649	CAT-TP-16
Class I Organics	CEN/TS 13649	CAT-TP-16
Class II Organics	CEN/TS 13649	CAT-TP-16
Water Vapour	EN 14790	CAT-TP-05
Total VOCs (as Carbon)	EN 12619:2013	CAT-TP-20
Velocity & Vol. Flow Rate	EN 16911-1 (MID)	CAT-TP-41

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.33
Stack Width, W	m	-
Stack Area, A	m²	0.09
Average Stack Gas Temperature, T_a	°C	9.2
Average Stack Gas Pressure	Pa	6.5
Average Stack Static Pressure, P_{static}	kPa	0.072
Average Barometric Pressure, P_b	kPa	98.5
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/m³ p	Conc kg/m³ p_i
CO_2	-	0.06	0.06	0.0006	44.01	1.9635	0.00118
O_2	-	20.80	20.68	0.2080	32.00	1.4277	0.29696
N_2	-	79.14	78.68	0.7914	28.01	1.2498	0.98913
Moisture (H_2O)	-	-	0.58	0.0058	18.02	0.8037	0.00464

Where: p = M / 22.41

p_i = r x p

Calculation of Stack Gas Densities

Determinand	Units	Result
Dry Density (STP), P_{STD}	kg/m³	1.287
Wet Density (STP), P_{STW}	kg/m³	1.284
Dry Density (Actual), P_{Actual}	kg/m³	1.212
Average Wet Density (Actual), $P_{ActualW}$	kg/m³	1.209

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	9.2	0.0
Total Pressure	kPa	98.6	101.3
Moisture	%	0.58	0.00

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m³/hr	844
Gas Volumetric Flowrate (STP, Wet)	m³/hr	795
Gas Volumetric Flowrate (STP, Dry)	m³/hr	790
Gas Volumetric Flowrate REF [1]	m³/hr	790

APPENDIX 2

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

(1 of 1)

Parameter	Units	Value
Date of Survey	-	14/04/2023
Time of Survey	-	07:50 - 07:55
Atmospheric Pressure	kPa	98.5
Average Stack Static Pressure	Pa	72
Result of Pitot Stagnation Test	-	Pass
Are Water Droplets Present?	-	Yes
Device Used	S-Type Pitot with KIMO MP 210 (500Pa)	

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	-	1
Number of Lines Used	-	1

Sampling Line A

Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m³	Velocity m/s	Swirl °
STATIC (Units: Pa)		*72.0*				
Mean		**6.5**	**9.2**	**1.209**	**2.74**	
1	0.17	6.5	9.2	1.209	2.74	3.0

APPENDIX 2

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(Δpi)	1.046	Pa
- Resolution	u(res)	0.00087	
- Calibration	u(cal)	0.004	
- Drift	u(drift)	0.083	
- Lack of Fit	u(fit)	0.005	
- Overall corrections to dynamic measurements	u(Cf)	0.094	
Standard uncertainty associated with the molar mass of the gas	u(M)	0.00003	-
- $\varphi O_2,w$	-	20.680	
- $\varphi CO_2,w$	-	0.060	
- Oxygen, dry	u(ϕO_2,d)	0.637	
- Carbon Dioxide, dry	u(ϕCO_2,d)	0.002	
- Water Vapour	u(ϕH_2O)	0.029	
- Oxygen, wet	u(ϕO_2,w)	0.633	
- Carbon Dioxide, wet	u(ϕCO_2,w)	0.002	
Standard uncertainty associated with the stack temperature	u(Tc)	1.440	K
Standard uncertainty associated with the absolute pressure in the duct	u(pc)	175.695	Pa
- Atmospheric Pressure	u(patm)	175.692	
- Static Pressure	u(pstat)	1.046	
Standard uncertainty associated with the density in the duct	u(ρ)	0.00653	-
Standard uncertainty associated with the local velocities	u(vi)	0.225	Pa
Standard uncertainty associated with the mean velocity	u(v)	0.225	m/s
Standard uncertainty associated with the mean velocity (95% Confidence)	Uc(v)	0.441	m/s
Standard uncertainty associated with the mean velocity (95% Confidence), relative	Uc,rel(v)	16.07	%
Standard uncertainty associated with the volume flow rate (95% Confidence)	Uc(qV,w)	141.0	m^3/hr
- $u^2(a)/a^2$	-	0.00053	
- $u^2(qV,w)/q^2V,w$	-	0.00725	
- $u^2(qV,w)$	-	5173	
- $u(qV,w)$	-	71.9	
Standard uncertainty associated with the volume flow rate (95% Confidence), relative	Uc,rel(qV,w)	16.69	%

APPENDIX 2

HYDROGEN CHLORIDE: RESULTS SUMMARY

Arran Chemical Company Limited, Athlone

A-2-2 CAU Scrubber

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	< 0.06		< 0.06
Uncertainty	±mg/m³	0.00		0.00
Mass Emission	g/hr	< 0.0		< 0.0
Uncertainty	±g/hr	0.0		0.0

NOTE: Where the maximum Blank concentration is higher than the Sample concentration, the Blank concentration has been reported.

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	0.58		0.58
Uncertainty	±% v/v	0.06		0.06

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m³	< 0.06		< 0.06

General Sampling Information

Parameter	Value	
Standard	EN 1911	
Technical Procedure	CAT-TP-11	
Name of Analytical Laboratory	EET	
Analytical Laboratory's Procedure	CAT-AP-01	
ISO 17025 Accredited Analysis?	MCERTS	
Date of Sample Analysis	28/04/2023	
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 Quartz Fibre	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

Reference Conditions

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

HYDROGEN CHLORIDE: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1
Sampling Times	-	09:30 - 10:00
Sampling Dates	-	14/04/2023
Sampling Device	-	MFC / MV
Duration	mins	30
Volume Sampled (STP, Dry)	m^3	0.2790
Volume Sampled (STP, Wet)	m^3	0.2806
Volume Sampled (REF)	m^3	0.2790
Sample Flow Rate	l/min	9.29
Laboratory Result for Front Impingers	µg/ml	< 0.00
Laboratory Result for Back Impinger	µg/ml	< 0.10
Volume in Front Impingers	ml	260.8
Volume in Back Impinger	ml	129.2
Mass in Front Impingers	µg	< 0.0
Mass in Back Impinger	µg	< 12.9
Total Mass Collected	µg	< 12.9
Calculated Concentration	mg/m^3	< 0.05
Liquid Trap Start Mass	g	1230.9
Liquid Trap End Mass	g	1229.7
Silica Trap Start Mass	g	1493.4
Silica Trap End Mass	g	1495.9
Total Mass Of Water Vapour	g	1.3
Calculated Water Vapour	% v/v	0.58

Where: MFC stands for Mass Flow Controller, MV stands for Mass View Flowmeter

Blank Runs

Parameter	Units	Blank 1
Blank Dates	-	13/04/2023
Average Volume Sampled (REF)	m^3	0.2790
Laboratory Result for Impingers	µg/ml	< 0.05
Volume in Impingers	ml	333.7
Total Mass Collected	µg	< 16.7
Calculated Concentration	mg/m^3	< 0.06

HYDROGEN CHLORIDE: QUALITY ASSURANCE

Sample Runs

Leak Test Results	Units	Run 1
Mean Sampling Rate	l/min	9.3
Pre-Sampling Leak Rate	l/min	0.05
Post-Sampling Leak Rate	l/min	0.05
Allowable Leak Rate	l/min	0.19
Leak Test Acceptable	-	Yes

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

[1] The concentration in the last absorber was less than 5 times the analytical detection limit.

Water Droplets	Units	Run 1
Are Water Droplets Present	-	No

MU (Concurrent Water Vapour)	Units	Run 1
Measurement Uncertainty (MU)	%	9.9
Allowable MU	%	20.0
MU Acceptable	%	Yes

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

Test Conditions	Units	Run 1
Ambient Temperature Recorded?	-	Yes

Blank Runs

Leak Test Results	Units	Blank 1
Expected Sampling Rate	l/min	9.5
Pre-Sampling Leak Rate	l/min	0.05
Post-Sampling Leak Rate	l/min	0.11
Allowable Leak Rate	l/min	0.19
Leak Test Acceptable	-	Yes

Validity of Blank vs ELV	Units	Blank 1
Allowable Blank	mg/m³	3.0
Blank Acceptable	-	Yes

Method Deviations

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

HYDROGEN CHLORIDE: MEASUREMENT UNCERTAINTY CALCULATIONS

	Value			Standard uncertainty			
Measured Quantities	**Symbol**	**Run 1**		**Symbol**	**Units**	**Run 1**	
Sampled Volume (STP)	V_m	0.2790		uV_m	m³	0.0056	
Leak	L	0.54		uL	%	-	
Laboratory Result	L_r	1.05		uL_r	%	-	

	Uncertainty as a Percentage			
Measured Quantities	**Units**	**Run 1**		**Requirement of Standard**
Sampled Volume (STP)	%	2.00		≤2%
Leak	%	0.54		≤2%
Laboratory Result	%	1.05		No Requirement

	Uncertainty in Measurement Units				Sensitivity Coefficient
Measured Quantities	**Symbol**	**Units**	**Run 1**		**Run 1**
Sampled Volume (STP)	V_m	m³	0.2790		0.21
Leak	L	mg/m³	0.000		1.00
Laboratory Result	L_r	mg/m³	0.001		1.00

	Uncertainty in Result		
Measured Quantities	**Units**	**Run 1**	
Sampled Volume (STP)	mg/m³	0.001	
Leak	mg/m³	0.0002	
Laboratory Result	mg/m³	0.0006	

	Oxygen Correction Part of MU Budget		
Measured Quantities	**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	mg/m³	0.0014
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m³	0.0027
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m³	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m³	0.0027
Reported Uncertainty	mg/m³	0.0027
Expanded uncertainty (95% confidence), without Oxygen Correction	%	4.5
Expanded uncertainty (95% confidence), with Oxygen Correction	%	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	4.5
Reported Uncertainty	%	4.5

APPENDIX 2

SUM OF INDIVIDUAL HALOGENATED VOCS (HAZARD STATEMENTS E341 AND H351) : RESULTS SUMMARY

Arran Chemical Company Limited, Athlone

A-2-2 CAU Scrubber

Sample Runs

Parameter	Units	Run 1					Mean
Dichloromethane	mg/m³	< 1.70					< 1.70
Total	**mg/m³**	**< 1.70**					**< 1.70**

General Sampling Information

Parameter	Value	
Standard	CEN/TS 13649	
Technical Procedure	CAT-TP-16	
Name of Analytical Laboratory	MAR	
Analytical Laboratory's Procedure	GC/MS	
ISO 17025 Accredited Analysis?	See Executive Summary	
Date of Sample Analysis	15/05/2023	
Probe Material	Stainless Steel	
Sample Tube Type	Coconut Shell Charcoal	
Dynamic Dilution Employed	No	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	B1	

Reference Conditions

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

APPENDIX 2

SUM OF INDIVIDUAL HALOGENATED VOCS (HAZARD STATEMENTS E341 AND H351) : SAMPLING DETAILS

RUN 1

Parameter	Units	Value
Sampling Times	-	09:00 - 09:30
Sampling Dates	-	14/04/2023
Sampling Device	-	MV
Duration	mins	30
N_2 to Stack Gas Dilution Ratio	: 1	0
Volume Sampled (REF)	m^3	0.0118

Where: MV stands for Mass View (Mass Flow Controller Technology)

Parameter	Lab Result (Front) µg	Lab Result (Back) µg	Lab Result (Total) µg	LOD (Front) µg	LOD (Back) µg	LOD (Total) µg	Concentration mg/m³	Reported Concentration (Blank Reviewed) mg/m³	Reported LOD mg/m³	Adsorption Efficiency %
Dichloromethane	< 10.0	< 10.0	20.0	10.0	10.0	20.0	< 1.697	< 1.697	1.697	100.0
Total			**20.0**			**20.0**	**< 1.697**	**< 1.697**	**1.697**	**-**

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

Tube Lot Number and Unique ID: Lot:2000 0136644671

AG2 Reporting Format	ELV (mg/m³)	Results (mg/m³)	Breakdown of Results	Mass Emission (kg/h)
Sum of individual halogenated VOCs (hazard statements E341 and	2	> 0 and < 1.7	> (sum of) and < (sum of 1)	>0.00000 and <0.00134

SUM OF INDIVIDUAL HALOGENATED VOCS (HAZARD STATEMENTS E341 AND H351) : SAMPLING DETAILS

BLANK 1

Parameter	Units	Value
Sampling Dates	-	14/04/2023
Sampling Device	-	MV
Average Volume Sampled (REF)	m^3	0.0118

Where: MV stands for Mass View (Mass Flow Controller Technology)

Parameter	Lab Result (Front) µg	Lab Result (Back) µg	Lab Result (Total) µg	Concentration mg/m^3
Dichloromethane	< 10.0	< 10.0	20.0	< 1.697
TOTAL			**20.0**	**< 1.697**

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

Tube Lot Number and Unique ID: Lot:2000, 0136644649

SUM OF INDIVIDUAL HALOGENATED VOCS (HAZARD STATEMENTS E341 AND H351) : QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1
Mean Sampling Rate	l/min	0.4
Pre-Sampling Leak Rate	l/min	0.00
Post-Sampling Leak Rate	l/min	0.00
Allowable Leak Rate	l/min	0.02
Leak Test Acceptable	-	Yes

Adsorption Efficiency	Units	Run 1
Dichloromethane	%	100.0
Allowable Adsorption Efficiency	%	95.0
Adsorption Efficiency Acceptable	-	Yes

Temperature at Sample Tubes	Units	Run 1
Temperature	°C	32
Allowable Temperature	°C	40
Temperature Acceptable	-	Yes

Test Conditions	Units	Run 1
Ambient Temperature Recorded?	-	Yes

SUM OF INDIVIDUAL HALOGENATED VOCS (HAZARD STATEMENTS E341 AND H351) : QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1
Expected Sampling Rate	l/min	0.4
Sampling Leak Rate	l/min	0.01
Allowable Leak Rate	l/min	0.02
Leak Test Acceptable	-	Yes

Validity of Blank vs ELV	Units	Blank 1	Allowed
Allowable for Dichloromethane	mg/m³	1.7	0.2
Allowable for TOTAL	mg/m³	1.7	0.2

Method Deviations

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

F INDIVIDUAL HALOGENATED VOCS (HAZARD STATEMENTS E341 AND H351) : MEASUREMENT UNCERTAINTY CALCULA

	Value		Standard uncertainty		
Measured Quantities	**Symbol**	**Run 1**	**Symbol**	**Units**	**Run 1**
Sampled Volume (STP)	V_m	0.0118	uV_m	m³	0.0002
Leak	L	0.00	uL	%	-
Laboratory Result	L_r	10.00	uL_r	%	-

	Uncertainty as a Percentage		
Measured Quantities	**Units**	**Run 1**	**Requirement of Standard**
Sampled Volume (STP)	%	2.00	≤2%
Leak	%	0.00	≤5%
Laboratory Result	%	10.00	No Requirement

	Uncertainty in Measurement Units			Sensitivity Coefficient
Measured Quantities	**Symbol**	**Units**	**Run 1**	**Run 1**
Sampled Volume (STP)	V_m	m³	0.0118	143.93
Leak	L	mg/m³	0.000	1.00
Laboratory Result	L_r	mg/m³	0.170	1.00

	Uncertainty in Result	
Measured Quantities	**Units**	**Run 1**
Sampled Volume (STP)	mg/m³	0.034
Leak	mg/m³	0.0000
Laboratory Result	mg/m³	0.1697

	Oxygen Correction Part of MU Budget	
Measured Quantities	**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	mg/m³	0.173
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m³	0.339
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m³	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m³	0.339
Reported Uncertainty	mg/m³	0.339
Expanded uncertainty (95% confidence), without Oxygen Correction	%	20.0
Expanded uncertainty (95% confidence), with Oxygen Correction	%	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	20.0
Reported Uncertainty	%	20.0

NOTE: Uncertainties reported in mg/m ³ are based upon the summation of all Speciated VOCs Measured.

APPENDIX 2

CLASS I ORGANICS : RESULTS SUMMARY

Arran Chemical Company Limited, Athlone

A-2-2 CAU Scrubber

Sample Runs

Parameter	Units	Run 1					Mean
Benzene	mg/m³	< 0.08					< 0.08
Carbon Tetrachloride	mg/m³	< 0.17					< 0.17
Chloroform	mg/m³	< 0.17					< 0.17
Dichloromethane	mg/m³	< 1.70					< 1.70
Tetrachloroethylene	mg/m³	< 0.17					< 0.17
Trichloroethylene	mg/m³	< 0.17					< 0.17
Total	**mg/m³**	**< 2.46**					**< 2.46**

General Sampling Information

Parameter	Value	
Standard	CEN/TS 13649	
Technical Procedure	CAT-TP-16	
Name of Analytical Laboratory	MAR	
Analytical Laboratory's Procedure	GC/MS	
ISO 17025 Accredited Analysis?	See Executive Summary	
Date of Sample Analysis	15/05/2023	
Probe Material	Stainless Steel	
Sample Tube Type	Silica Gel	
Dynamic Dilution Employed	No	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A2	

Reference Conditions

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

APPENDIX 2

CLASS I ORGANICS : SAMPLING DETAILS

RUN 1

Parameter	Units	Value
Sampling Times	-	09:00 - 09:30
Sampling Dates	-	14/04/2023
Sampling Device	-	MV
Duration	mins	30
N_2 to Stack Gas Dilution Ratio	: 1	0
Volume Sampled (REF)	m^3	0.0118

Where: MV stands for Mass View (Mass Flow Controller Technology)

Parameter	Lab Result (Front) µg	Lab Result (Back) µg	Lab Result (Total) µg	LOD (Front) µg	LOD (Back) µg	LOD (Total) µg	Concentration mg/m³	Reported Concentration (Blank Reviewed) mg/m³	Reported LOD mg/m³	Adsorption Efficiency %
Benzene	< 0.5	< 0.5	1.0	0.5	0.5	1.0	< 0.085	< 0.085	0.085	100.0
Carbon Tetrachloride	< 1.0	< 1.0	2.0	1.0	1.0	2.0	< 0.170	< 0.170	0.170	100.0
Chloroform	< 1.0	< 1.0	2.0	1.0	1.0	2.0	< 0.170	< 0.170	0.170	100.0
Dichloromethane	< 10.0	< 10.0	20.0	10.0	10.0	20.0	< 1.697	< 1.697	1.697	100.0
Tetrachloroethylene	< 1.0	< 1.0	2.0	1.0	1.0	2.0	< 0.170	< 0.170	0.170	100.0
Trichloroethylene	< 1.0	< 1.0	2.0	1.0	1.0	2.0	< 0.170	< 0.170	0.170	100.0
Total			**29.0**			**29.0**	**< 2.461**	**< 2.461**	**2.461**	**-**

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

Tube Lot Number and Unique ID: lot 13902, 0189708330

AG2 Reporting Format	ELV (mg/m³)	Results (mg/m³)	Breakdown of Results	Mass Emission (kg/h)
Class I Organics	20	> 0 and < 2.46	> (sum of) and < (sum of 1+2+3+4+5+6)	>0.00 and <0.0019

APPENDIX 2

CLASS I ORGANICS : SAMPLING DETAILS

BLANK 1

Parameter	Units	Value
Sampling Dates	-	14/04/2023
Sampling Device	-	MV
Average Volume Sampled (REF)	m^3	0.0118

Where: MV stands for Mass View (Mass Flow Controller Technology)

Parameter	Lab Result (Front) µg	Lab Result (Back) µg	Lab Result (Total) µg	Concentration mg/m^3
Benzene	< 0.5	< 0.5	1.0	< 0.085
Carbon Tetrachloride	< 1.0	< 1.0	2.0	< 0.170
Chloroform	< 1.0	< 1.0	2.0	< 0.170
Dichloromethane	< 10.0	< 10.0	20.0	< 1.697
Tetrachloroethylene	< 1.0	< 1.0	2.0	< 0.170
Trichloroethylene	< 1.0	< 1.0	2.0	< 0.170
TOTAL			**29.0**	**< 2.461**

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

Tube Lot Number and Unique ID: lot 13902, 0189708328

APPENDIX 2

CLASS I ORGANICS : QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1
Mean Sampling Rate	l/min	0.4
Pre-Sampling Leak Rate	l/min	0.00
Post-Sampling Leak Rate	l/min	0.00
Allowable Leak Rate	l/min	0.02
Leak Test Acceptable	-	Yes

Adsorption Efficiency	Units	Run 1
Benzene	%	100.0
Carbon Tetrachloride	%	100.0
Chloroform	%	100.0
Dichloromethane	%	100.0
Tetrachloroethylene	%	100.0
Trichloroethylene	%	100.0
Allowable Adsorption Efficiency	%	95.0
Adsorption Efficiency Acceptable	-	Yes

Temperature at Sample Tubes	Units	Run 1
Temperature	°C	28
Allowable Temperature	°C	40
Temperature Acceptable	-	Yes

Test Conditions	Units	Run 1
Ambient Temperature Recorded?	-	Yes

APPENDIX 2

CLASS I ORGANICS : QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1
Expected Sampling Rate	l/min	0.4
Sampling Leak Rate	l/min	0.00
Allowable Leak Rate	l/min	0.02
Leak Test Acceptable	-	Yes

Validity of Blank vs ELV	Units	Blank 1	Allowed
Allowable for Benzene	mg/m³	0.1	N/A
Allowable for Carbon Tetrachloride	mg/m³	0.2	N/A
Allowable for Chloroform	mg/m³	0.2	N/A
Allowable for Dichloromethane	mg/m³	1.7	N/A
Allowable for Tetrachloroethylene	mg/m³	0.2	N/A
Allowable for Trichloroethylene	mg/m³	0.2	N/A
Allowable for TOTAL	mg/m³	2.5	2.0

Method Deviations

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

CLASS I ORGANICS : MEASUREMENT UNCERTAINTY CALCULATIONS

	Value			Standard uncertainty		
Measured Quantities	**Symbol**	**Run 1**		**Symbol**	**Units**	**Run 1**
Sampled Volume (STP)	V_m	0.0118		uV_m	m³	0.0002
Leak	L	0.00		uL	%	-
Laboratory Result	L_r	10.00		uL_r	%	-

	Uncertainty as a Percentage		
Measured Quantities	**Units**	**Run 1**	**Requirement of Standard**
Sampled Volume (STP)	%	2.00	≤2%
Leak	%	0.00	≤5%
Laboratory Result	%	10.00	No Requirement

	Uncertainty in Measurement Units			Sensitivity Coefficient
Measured Quantities	**Symbol**	**Units**	**Run 1**	**Run 1**
Sampled Volume (STP)	V_m	m³	0.0118	208.79
Leak	L	mg/m³	0.000	1.00
Laboratory Result	L_r	mg/m³	0.246	1.00

	Uncertainty in Result	
Measured Quantities	**Units**	**Run 1**
Sampled Volume (STP)	mg/m³	0.049
Leak	mg/m³	0.0000
Laboratory Result	mg/m³	0.2461

	Oxygen Correction Part of MU Budget	
Measured Quantities	**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	mg/m³	0.251
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m³	0.492
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m³	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m³	0.492
Reported Uncertainty	mg/m³	0.492
Expanded uncertainty (95% confidence), without Oxygen Correction	%	20.0
Expanded uncertainty (95% confidence), with Oxygen Correction	%	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	20.0
Reported Uncertainty	%	20.0

NOTE: Uncertainties reported in mg/m ³ are based upon the summation of all Speciated VOCs Measured.

APPENDIX 2

CLASS II ORGANICS : RESULTS SUMMARY

Arran Chemical Company Limited, Athlone

A-2-2 CAU Scrubber

Sample Runs

Parameter	Units	Run 1					Mean
2-Propanol	mg/m³	< 0.34					< 0.34
Acetone	mg/m³	0.33					0.33
Cyclohexane	mg/m³	< 0.17					< 0.17
Cyclohexanone	mg/m³	< 0.17					< 0.17
Ethanol	mg/m³	< 0.34					< 0.34
Ethyl Acetate	mg/m³	< 0.08					< 0.08
Heptane	mg/m³	< 0.17					< 0.17
Hexane	mg/m³	< 0.08					< 0.08
M + P – Xylene	mg/m³	< 0.17					< 0.17
Methyl Ethyl Ketone	mg/m³	< 0.08					< 0.08
Methyl-iso-butyl	mg/m³	< 0.08					< 0.08
o-Xylene	mg/m³	< 0.08					< 0.08
Tetrahydrofuran	mg/m³	< 0.17					< 0.17
Toluene	mg/m³	< 0.08					< 0.08
Total	**mg/m³**	**< 2.37**					**< 2.37**

General Sampling Information

Parameter	Value	
Standard	CEN/TS 13649	
Technical Procedure	CAT-TP-16	
Name of Analytical Laboratory	MAR	
Analytical Laboratory's Procedure	WI 3042 & 3048	
ISO 17025 Accredited Analysis?	See Executive Summary	
Date of Sample Analysis	15/05/2023	
Probe Material	Stainless Steel	
Sample Tube Type	Coconut Shell Charcoal	
Dynamic Dilution Employed	No	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	B1	

Reference Conditions

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

APPENDIX 2

CLASS II ORGANICS : SAMPLING DETAILS

RUN 1

Parameter	Units	Value
Sampling Times	-	09:00 - 09:30
Sampling Dates	-	14/04/2023
Sampling Device	-	MV
Duration	mins	30
N_2 to Stack Gas Dilution Ratio	: 1	0
Volume Sampled (REF)	m^3	0.0118

Where: MV stands for Mass View (Mass Flow Controller Technology)

Parameter	Lab Result (Front) µg	Lab Result (Back) µg	Lab Result (Total) µg	LOD (Front) µg	LOD (Back) µg	LOD (Total) µg	Concentration mg/m³	Reported Concentration (Blank Reviewed) mg/m³	Reported LOD mg/m³	Adsorption Efficiency %
2-Propanol	< 2.0	< 2.0	4.0	2.0	2.0	4.0	< 0.339	< 0.339	0.339	100.0
Acetone	0.9	3.0	3.9	0.5	0.5	1.0	0.331	0.331	0.085	23.1
Cyclohexane	< 1.0	< 1.0	2.0	1.0	1.0	2.0	< 0.170	< 0.170	0.170	100.0
Cyclohexanone	< 1.0	< 1.0	2.0	1.0	1.0	2.0	< 0.170	< 0.170	0.170	100.0
Ethanol	< 2.0	< 2.0	4.0	2.0	2.0	4.0	< 0.339	< 0.339	0.339	100.0
Ethyl Acetate	< 0.5	< 0.5	1.0	0.5	0.5	1.0	< 0.085	< 0.085	0.085	100.0
Heptane	< 1.0	< 1.0	2.0	1.0	1.0	2.0	< 0.170	< 0.170	0.170	100.0
Hexane	< 0.5	< 0.5	1.0	0.5	0.5	1.0	< 0.085	< 0.085	0.085	100.0
M + P – Xylene	< 1.0	< 1.0	2.0	1.0	1.0	2.0	< 0.170	< 0.170	0.170	100.0
Methyl Ethyl Ketone	< 0.5	< 0.5	1.0	0.5	0.5	1.0	< 0.085	< 0.085	0.085	100.0
Methyl-iso-butyl Ketone	< 0.5	< 0.5	1.0	0.5	0.5	1.0	< 0.085	< 0.085	0.085	100.0
o-Xylene	< 0.5	< 0.5	1.0	0.5	0.5	1.0	< 0.085	< 0.085	0.085	100.0
Tetrahydrofuran	< 1.0	< 1.0	2.0	1.0	1.0	2.0	< 0.170	< 0.170	0.170	100.0
Toluene	< 0.5	< 0.5	1.0	0.5	0.5	1.0	< 0.085	< 0.085	0.085	100.0
Total			**27.9**			**25.0**	**< 2.367**	**< 2.367**	**2.121**	**-**

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

Tube Lot Number and Unique ID: lot 2000, 0136644652

AG2 Reporting Format	ELV (mg/m³)	Results (mg/m³)	Breakdown of Results	Mass Emission (Kg/h)
Class II Organics	100	> 0.33 and < 2.37	> (sum of 2) and < (sum of 1+2+3+4+5+6+7+8+9+10+11+12+13+14)	>0.0 and <0.002

APPENDIX 2

CLASS II ORGANICS : SAMPLING DETAILS

BLANK 1

Parameter	Units	Value
Sampling Dates	-	14/04/2023
Sampling Device	-	MV
Average Volume Sampled (REF)	m^3	0.0118

Where: MV stands for Mass View (Mass Flow Controller Technology)

Parameter	Lab Result (Front) µg	Lab Result (Back) µg	Lab Result (Total) µg	Concentration mg/m^3
2-Propanol	< 2.0	< 2.0	4.0	< 0.339
Acetone	3.1	< 0.5	3.6	0.305
Cyclohexane	< 1.0	< 1.0	2.0	< 0.170
Cyclohexanone	< 1.0	< 1.0	2.0	< 0.170
Ethanol	< 2.0	< 2.0	4.0	< 0.339
Ethyl Acetate	< 0.5	< 0.5	1.0	< 0.085
Heptane	< 1.0	< 1.0	2.0	< 0.170
Hexane	< 0.5	< 0.5	1.0	< 0.085
M + P – Xylene	< 1.0	< 1.0	2.0	< 0.170
Methyl Ethyl Ketone	< 0.5	< 0.5	1.0	< 0.085
Methyl-iso-butyl Ketone	< 0.5	< 0.5	1.0	< 0.085
o-Xylene	< 0.5	< 0.5	1.0	< 0.085
Tetrahydrofuran	< 1.0	< 1.0	2.0	< 0.170
Toluene	< 0.5	< 0.5	1.0	< 0.085
TOTAL			**27.6**	**< 2.341**

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

Tube Lot Number and Unique ID: Lot:2000, 0136631835

APPENDIX 2

CLASS II ORGANICS : QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1
Mean Sampling Rate	l/min	0.4
Pre-Sampling Leak Rate	l/min	0.00
Post-Sampling Leak Rate	l/min	0.00
Allowable Leak Rate	l/min	0.02
Leak Test Acceptable	-	Yes

Adsorption Efficiency	Units	Run 1
2-Propanol	%	100.0
Acetone	%	23.1
Cyclohexane	%	100.0
Cyclohexanone	%	100.0
Ethanol	%	100.0
Ethyl Acetate	%	100.0
Heptane	%	100.0
Hexane	%	100.0
M + P – Xylene	%	100.0
Methyl Ethyl Ketone	%	100.0
Methyl-iso-butyl Ketone	%	100.0
o-Xylene	%	100.0
Tetrahydrofuran	%	100.0
Toluene	%	100.0
Allowable Adsorption Efficiency	%	95.0
Adsorption Efficiency Acceptable	-	No

Temperature at Sample Tubes	Units	Run 1
Temperature	°C	32
Allowable Temperature	°C	40
Temperature Acceptable	-	Yes

Test Conditions	Units	Run 1
Ambient Temperature Recorded?	-	Yes

APPENDIX 2

CLASS II ORGANICS : QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1
Expected Sampling Rate	l/min	0.4
Sampling Leak Rate	l/min	0.01
Allowable Leak Rate	l/min	0.02
Leak Test Acceptable	-	Yes

Validity of Blank vs ELV	Units	Blank 1	Allowed
Allowable for 2-Propanol	mg/m³	0.3	N/A
Allowable for Acetone	mg/m³	0.3	N/A
Allowable for Cyclohexane	mg/m³	0.2	N/A
Allowable for Cyclohexanone	mg/m³	0.2	N/A
Allowable for Ethanol	mg/m³	0.3	N/A
Allowable for Ethyl Acetate	mg/m³	0.1	N/A
Allowable for Heptane	mg/m³	0.2	N/A
Allowable for Hexane	mg/m³	0.1	N/A
Allowable for M + P – Xylene	mg/m³	0.2	N/A
Allowable for Methyl Ethyl Ketone	mg/m³	0.1	N/A
Allowable for Methyl-iso-butyl Ketone	mg/m³	0.1	N/A
Allowable for o-Xylene	mg/m³	0.1	N/A
Allowable for Tetrahydrofuran	mg/m³	0.2	N/A
Allowable for Toluene	mg/m³	0.1	N/A
Allowable for TOTAL	mg/m³	2.3	10.0

Method Deviations

Nature of Deviation	Run Number
(x = deviation applies to the associated run)	1
The absorption efficiency for all of the individual Parameters was not met (acetone), however it should be noted the results were of an extremely low order.	x

CLASS II ORGANICS : MEASUREMENT UNCERTAINTY CALCULATIONS

	Value			Standard uncertainty			
Measured Quantities	**Symbol**	**Run 1**		**Symbol**	**Units**	**Run 1**	
Sampled Volume (STP)	V_m	0.0118		uV_m	m³	0.0002	
Leak	L	0.00		uL	%	-	
Laboratory Result	L_r	10.00		uL_r	%	-	

	Uncertainty as a Percentage			
Measured Quantities	**Units**	**Run 1**		**Requirement of Standard**
Sampled Volume (STP)	%	2.00		≤2%
Leak	%	0.00		≤5%
Laboratory Result	%	10.00		No Requirement

	Uncertainty in Measurement Units				Sensitivity Coefficient	
Measured Quantities	**Symbol**	**Units**	**Run 1**		**Run 1**	
Sampled Volume (STP)	V_m	m³	0.0118		200.79	
Leak	L	mg/m³	0.000		1.00	
Laboratory Result	L_r	mg/m³	0.237		1.00	

	Uncertainty in Result		
Measured Quantities	**Units**	**Run 1**	
Sampled Volume (STP)	mg/m³	0.047	
Leak	mg/m³	0.0000	
Laboratory Result	mg/m³	0.2367	

	Oxygen Correction Part of MU Budget		
Measured Quantities	**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	mg/m³	0.241
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m³	0.473
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m³	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m³	0.568
Reported Uncertainty	mg/m³	0.568
Expanded uncertainty (95% confidence), without Oxygen Correction	%	20.0
Expanded uncertainty (95% confidence), with Oxygen Correction	%	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	24.0
Reported Uncertainty	%	24.0

NOTE: Uncertainties reported in mg/m ³ are based upon the summation of all Speciated VOCs Measured.

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

Arran Chemical Company Limited, Athlone
A-2-2 CAU Scrubber

Sample Runs

Parameter	Units	Run 1	Run 2	Run 3	Mean
Raw Concentration	ppm	1.50	1.54	0.89	1.31
Concentration	mg/m³	2.35	2.33	0.94	1.87
Uncertainty	±mg/m³	0.44	0.44	0.43	0.43
Mass Emission	g/hr	1.9	1.8	0.7	1.5
Uncertainty	±g/hr	0.5	0.5	0.4	0.4

General Sampling Information

Parameter	Value	
Standard	EN 12619:2013	
Technical Procedure	CAT-TP-20	
Probe Material	Stainless Steel	
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	1.0552	
Span Gas Expiry Date	20/01/2028	
Span Gas Start Pressure (bar)	120	
Gas Cylinder Concentration (ppm)	79.39	
Span Gas Set Point (ppm)	79.39	
Span Gas Uncertainty (%)	2	
Zero Gas Type	Synthetic Air (5 Grade)	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

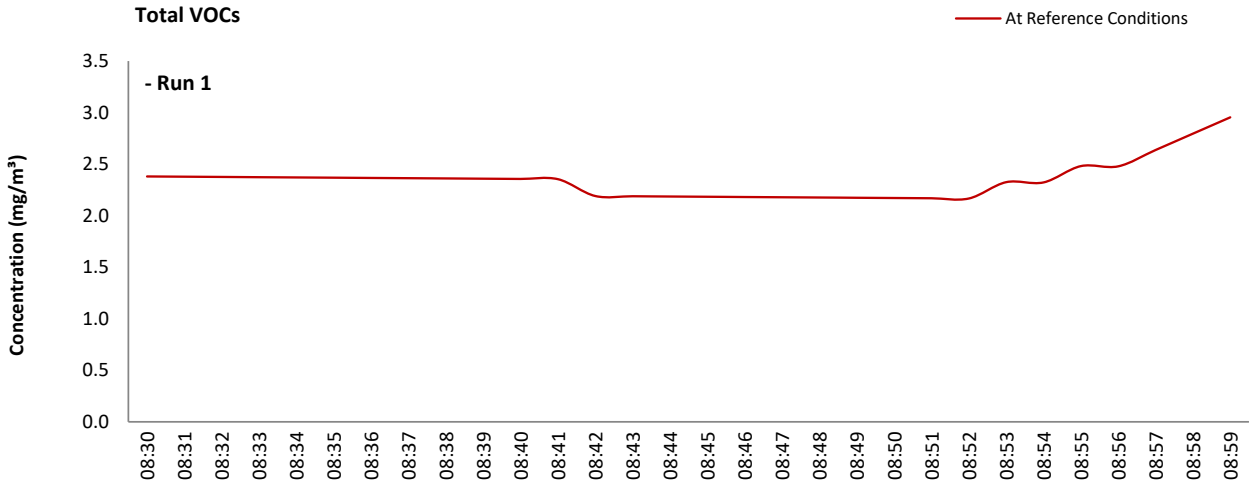
Reference Conditions

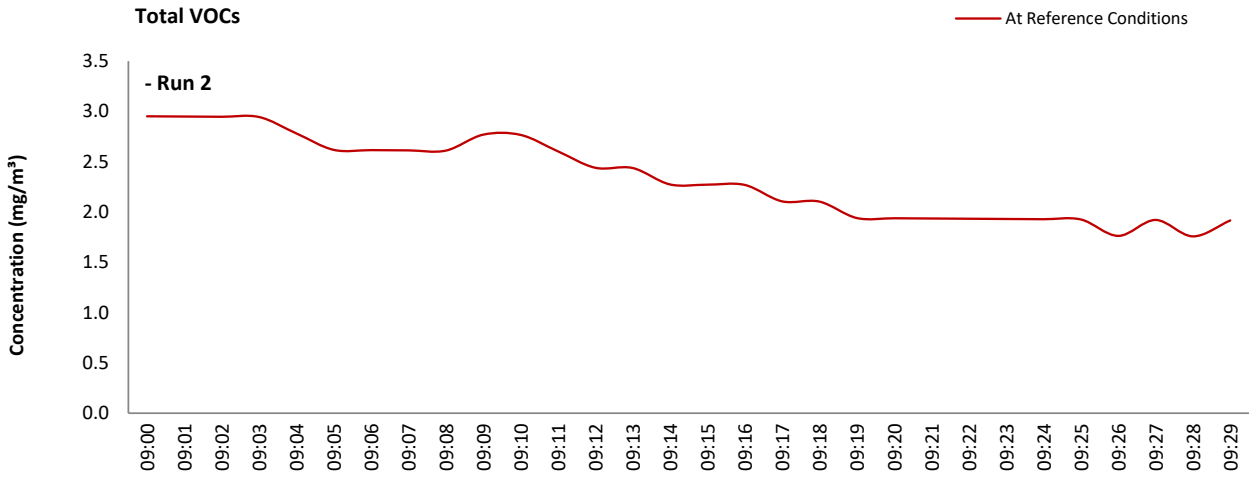
Reference Conditions are: 273K, 101.3kPa, dry gas.

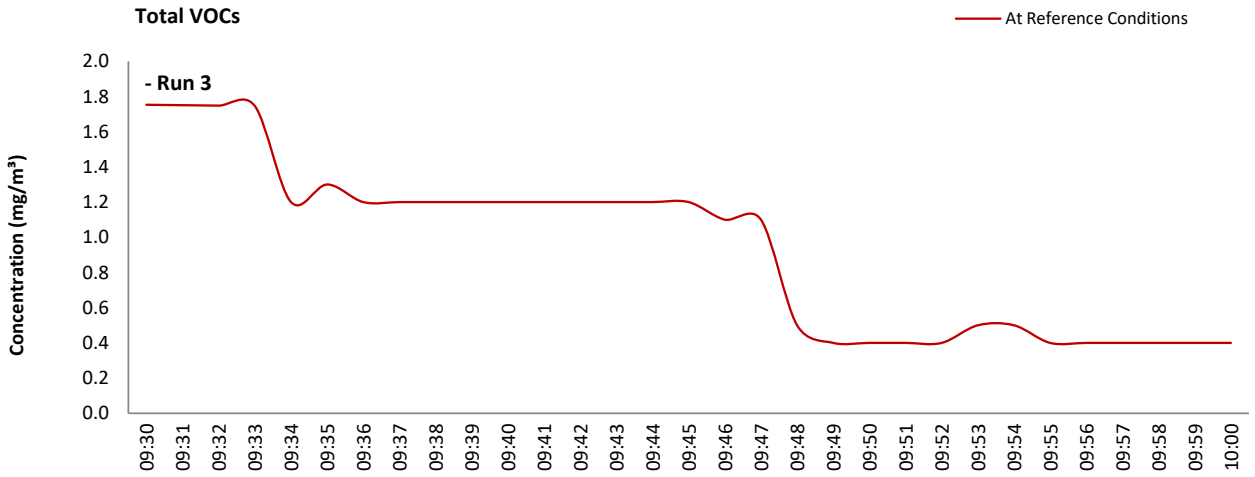
APPENDIX 2

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data







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

Sampling Details

Parameter	Units	Run 1	Run 2	Run 3
Sampling Times	-	08:30 - 09:00	09:00 - 09:30	09:30 - 10:00
Sampling Dates	-	14/04/2023	14/04/2023	14/04/2023
Instrument Range	ppm	100	100	100
Span Gas Value	ppm	79.4	79.4	79.4

Quality Assurance

	Zero Drift	Units	Run 1	Run 2	Run 3
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.00	0.00	0.00
	Zero Down Sampling Line (Post)	ppm	0.20	0.20	0.20
	Zero Drift	ppm	0.20	0.20	0.20
	Zero Drift	%	0.25	0.25	0.25
	Drift Correction Applied	2-5%	No	No	No
	Allowable Zero Drift	± ppm	3.97	3.97	3.97
	Zero Drift Acceptable	-	Yes	Yes	Yes

	Span Drift	Units	Run 1	Run 2	Run 3
CAL 1	Span Down Sampling Line (Pre)	ppm	79.30	79.30	79.30
	Span Down Sampling Line (Post)	ppm	79.40	79.40	79.40
	Span Drift	ppm	0.10	0.10	0.10
	Span Drift	%	0.13	0.13	0.13
	Drift Correction Applied	2-5%	No	No	No
	Allowable Span Drift	± ppm	3.97	3.97	3.97
	Span Drift Acceptable	-	Yes	Yes	Yes

Test Conditions	Units	Run 1	Run 2	Run 3
Run Ambient Temperature Range	°C	4 - 5	5	5

Method Deviations

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

APPENDIX 2

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1	RUN 2	RUN 3	Units
Limit value	20.0	20.0	20.0	mg/m³ (REF)
Allowable MU	15.0	15.0	15.0	%
Measured concentration	2.35	2.33	0.94	mg/m³ (STP, dry)
Range Used	100.0	100.0	100.0	ppm
Range Used [A]	160.6	160.6	160.6	mg/m³
Cal gas conc.	79.4	79.4	79.4	ppm
Conversion	1.61	1.61	1.61	ppm to mg/m³
MCERTS Range [B]	15.0	15.0	15.0	mg/m³
Lower of [A] or [B]	15.0	15.0	15.0	mg/m³
Cal gas conc.	127.5	127.5	127.5	mg/m³

Performance characteristics	RUN 1	RUN 2	RUN 3	Units
Response time	45	45	45	seconds
Number of readings in measurement	30	30	30	-
Repeatability at zero	2.00	2.00	2.00	% full scale
Repeatability at span level	0.00	0.00	0.00	% full scale
Deviation from linearity	0.42	0.42	0.42	% of value
Zero drift	0.25	0.25	0.25	% full scale
Span drift	0.13	0.13	0.13	% full scale
Volume or pressure flow dependence	1.60	1.60	1.60	% of full scale
Atmospheric pressure dependence	0.30	0.30	0.30	% of value/kPa
Ambient temperature dependence	1.40	1.40	1.40	% full scale/10K
Combined interference	0.45	0.45	0.45	% range
Dependence on voltage	0.50	0.50	0.50	% full scale/10V
Losses in the line (leak)	0.13	0.13	0.13	% of value
Uncertainty of calibration gas	2.00	2.00	2.00	% of value

Performance characteristic	RUN 1	RUN 2	RUN 3	Units
Standard deviation of repeatability at zero	use rep at span	use rep at span	use rep at span	mg/m³
Standard deviation of repeatability at span level	0.00	0.00	0.00	mg/m³
Lack of fit	0.04	0.04	0.04	mg/m³
Drift	0.00	0.00	0.00	mg/m³
Volume or pressure flow dependence	0.00	0.00	0.00	mg/m³
Atmospheric pressure dependence	0.01	0.01	0.01	mg/m³
Ambient temperature dependence	0.20	0.20	0.20	mg/m³
Combined interference (from MCERTS Certificate)	0.04	0.04	0.04	mg/m³
Dependence on voltage	0.06	0.06	0.06	mg/m³
Losses in the line (leak)	0.00	0.00	0.00	mg/m³
Uncertainty of calibration gas	0.03	0.03	0.01	mg/m³

			RUN 1	RUN 2	RUN 3	Units
Measurement uncertainty		**Result**	2.35	2.33	0.94	mg/m³
Combined uncertainty			0.22	0.22	0.22	mg/m³
Expanded uncertainty	k =	1.96	0.44	0.44	0.43	mg/m³
Uncertainty corrected to std conds. (O_2)			0.44	0.44	0.43	mg/m³ (REF)

	RUN 1	RUN 2	RUN 3	Units
Expanded uncertainty (no O_2) - at 95% Confidence	18.58	18.69	45.98	% of Value
Expanded uncertainty (no O_2) - at 95% Confidence	2.18	2.18	2.17	% at ELV
Overall Allowable uncertainty (no O_2) - at 95% Confidence	15.0	15.0	15.0	% at ELV
Result of Compliance with Uncertainty Requirement	**COMPLIANT**	**COMPLIANT**	**COMPLIANT**	-

	RUN 1	RUN 2	RUN 3	Units
Expanded uncertainty (with O_2) - at 95% Confidence	N/A	N/A	N/A	% of Value
Expanded uncertainty (with O_2) - at 95% Confidence	N/A	N/A	N/A	% at ELV
Overall Allowable uncertainty (with O_2) - at 95% Confidence	N/A	N/A	N/A	% at ELV
Result of Compliance with Uncertainty Requirement	**N/A**	**N/A**	**N/A**	-

Requirement for SRM is that Uncertainty should be <15% of the value at the ELV, on a dry gas basis, or if O_2 correction is applied less than 15% + the uncertainty associated with the O_2 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

EPA AIR EMISSIONS COMPLIANCE MONITORING EMISSIONS REPORT

(Prepared on behalf of the EPA by Element Ireland - EPA Contract No. OEE23-AEMP)

Element Ireland, Unit D8 North City Business Park, North Road, Finglas, Dublin 11
Your Element Ireland Contact: Dónal Ó Faogáin (+353 861 746 367)
E: donal.ofaogain@element.com

Stack Emissions Testing Report Commissioned by
EPA Office of Environmental Enforcement

Installation Name & Address
Arran Chemical Company Limited
Unit 1-3 Monksland Industrial Estate
Athlone
Co. Westmeath

Industrial Emissions Licence: P0110-03

Stack Reference
A2-3 RTO

Dates of the Monitoring Campaign
13h - 14th April 2023

Job Reference Number
P0110-03CAR23-01B

Report Written by
Donal O Faogain Senior Team Leader MCERTS Level 2 MM13 1259 TE1 TE2 TE3 TE4

Report Checked by	Report Approved by
Darragh Long Team Leader MCERTS Level 2 MM18 1494 TE1 TE2 TE3 TE4	Neil Kelly Team Leader MCERTS Level 2 MM16 1390 TE1 TE2 TE3 TE4

Report Date
16th October 2023

Version
Version 2

Signature of Report Checker	Signature of Report Approver
	

CONTENTS

Opinions and interpretations expressed herein are outside the scope of Element Ireland's ISO 17025 accreditation.

The testing performed fully meets the technical requirements in Irish EPA Guidance Note, AG2.

This version of the test report supersedes the previous version of the test report. Please destroy all previous versions to ensure no confusion arises from having multiple test reports in existence.

MONITORING OBJECTIVES

Arran Chemical Company Limited, Athlone
A2-3 RTO
13h - 14th April 2023

Overall Aim of the Monitoring Campaign

Element Ireland were commissioned by the EPA Office of Environmental Enforcement to carry out stack emissions testing at Arran Chemical Company Limited on the A2-3 RTO at Athlone.

The aim of the monitoring campaign was to perform testing, as requested by the customer, for a number of prescribed pollutants. There are no emission limits set for any of the pollutants at this time.

Special Requirements

There were no special requirements.

Target Parameters

Dioxins & Furans, Hydrogen Chloride, Sum of individual VOCs (hazard statements H340, H350, H350i9 H360D or H360F) , Process Solvents , Total VOCs (as Carbon), Oxides of Nitrogen (as NO_2)

Executive Summary

MONITORING RESULTS

Arran Chemical Company Limited, Athlone
A2-3 RTO
13h - 14th April 2023

where MU = Measurement Uncertainty associated with the Result

			Concentration				Mass Emission			
Parameter		**Units**	**Result**	**MU +/-**	**Limit**		**Units**	**Result**	**MU +/-**	**Limit**
Dioxins & Furans Upper Limit (worst case where <LOD = LOD)										
Dioxins & Furans (NATO I-TEQ) - R1	[1]	ng/m³	0.0005	0.0001	0.1		µg/hr	0.00	0.000	-
Hydrogen Chloride	[1]	mg/m³	0.33	0.01	30		g/hr	0.6	0.044	150
Sum of individual VOCs (hazard statements H340, H350, H350i9 H360D or H360F)	[1]	mg/m³	< 1.69	0.34	2		g/hr	< 2.9	0.607	-
Sum of individual VOCs (hazard statements H341 and H351)	[1]	mg/m³	< 1.70	0.34	-		g/hr	< 2.9		-
Toluene	[1]	mg/m³	0.13	0.03	-		g/hr	0.2	0.046	-
Methanol	[1]	mg/m³	< 1.69	0.34	-		g/hr	< 2.9	0.614	-
isopropanol	[1]	mg/m³	< 0.34	0.07	-		g/hr	< 0.6	0.123	-
Methyl tert butyl ether	[1]	mg/m³	1.65	0.33	-		g/hr	2.8	0.599	-
Acetonitrile	[1]	mg/m³	< 1.69	0.34	-		g/hr	< 2.9	0.614	-
Heptane	[1]	mg/m³	< 0.17	0.03	-		g/hr	< 0.3	0.061	-
Ethanol	[1]	mg/m³	< 0.34	0.07	-		g/hr	< 0.6	0.123	-
2 Methyltetraydofuran	[1]	mg/m³	< 0.17	0.03	-		g/hr	< 0.3	0.061	-
Total VOCs (as Carbon)	[1]	mg/m³	8.29	0.47	20		g/hr	14.22	1.208	-
Total VOCs (as Carbon) 1Hr R1	[1 2]	mg/m³	8.62	0.48	30		g/hr	14.79	1.239	-
Total VOCs (as Carbon) 1Hr R2	[1 2]	mg/m³	8.87	0.48	30		g/hr	15.23	1.261	-
Oxides of Nitrogen (as NO_2)	[1]	mg/m³	63.00	2.92	250		g/hr	108.1	8.410	-
Carbon Dioxide		% v/v	**Dry** 0.52	0.23						
Oxygen		% v/v	**Dry** 20.11	0.47						
Water Vapour		% v/v	7.6	0.4						
Stack Gas Temperature		°C	50.0							
Stack Gas Velocity		m/s	6.9	0.30						
Volumetric Flow Rate (ACTUAL)		m³/hr	2250	141	**Limit**					
Volumetric Flow Rate (REF)	[1]	m³/hr	1716	107	5000					

NOTE: VOLUMETRIC FLOW RATE & VELOCITY DATA TAKEN FROM THE PRELIMINARY VELOCITY TRAVERSE.

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

[2] 1.5 times the ELV = 30mg/m³

MONITORING DATE(S) & TIMES

Arran Chemical Company Limited, Athlone
A2-3 RTO
13h - 14th April 2023

Parameter		Units	Concentration	Units	Mass Emission	Sampling Date(s)	Sampling Times	Duration mins
Dioxins & Furans (NATO)	R1	ng/m³	0.0005	µg/hr	0.0009	13/04/2023	11:00 - 17:00	360
Water Vapour (dioxins)	R1	% v/v	8.93			13/04/2023	11:00 - 17:00	360
Hydrogen Chloride	R1	mg/m³	0.3	g/hr	0.57	13/04/2023	10:15 - 10:45	30
Water Vapour (HCl)	R1	% v/v	6.23			13/04/2023	10:15 - 10:45	30
Sum of individual VOCs (hazard statements H340, H350, H350i9 H360D or H360F)	R1	mg/m³	< 1.69	g/hr	< 2.90	13/04/2023	13:00 - 13:30	30
Sum of individual VOCs (hazard statements H341 and H351)	R1	mg/m³	< 1.70	g/hr	< 2.92	13/04/2023	13:50 - 14:20	30
Toluene	R1	mg/m³	0.13	g/hr	0.22	13/04/2023	13:00 - 13:30	30
Methanol	R1	mg/m³	< 1.69	g/hr	< 2.90	13/04/2023	13:00 - 13:30	30
isopropanol	R1	mg/m³	< 0.34	g/hr	< 0.58	13/04/2023	13:00 - 13:30	30
Methyl tert butyl ether	R1	mg/m³	1.65	g/hr	2.83	13/04/2023	13:00 - 13:30	30
Acetonitrile	R1	mg/m³	< 1.69	g/hr	< 2.90	13/04/2023	13:00 - 13:30	30
Heptane	R1	mg/m³	< 0.17	g/hr	< 0.29	13/04/2023	13:00 - 13:30	30
Ethanol	R1	mg/m³	< 0.34	g/hr	< 0.58	13/04/2023	13:00 - 13:30	30
2 Methyltetraydofuran	R1	mg/m³	< 0.17	g/hr	< 0.29	13/04/2023	13:00 - 13:30	30
Total VOCs (as Carbon)	R1	mg/m³	7.12	g/hr	12.21	13/04/2023	12:50 - 13:20	30
Total VOCs (as Carbon)	R2	mg/m³	10.12	g/hr	17.37	13/04/2023	13:20 - 13:50	30
Total VOCs (as Carbon)	R3	mg/m³	7.62	g/hr	13.08	13/04/2023	13:50 - 14:20	30
Total VOCs (as Carbon) 1Hr Average	R1	mg/m³	8.62	g/hr	14.79	13/04/2023	12:50 - 13:50	60
Total VOCs (as Carbon) 1Hr Average	R2	mg/m³	8.87	g/hr	15.23	13/04/2023	13:20 - 14:20	60
Oxides of Nitrogen (as NO_2)	R1	mg/m³	63.0	g/hr	108.1	13/04/2023	12:50 - 13:20	30
Carbon Dioxide	R1	% v/v	0.52			13/04/2023	12:50 - 13:20	30
Oxygen	R1	% v/v	20.11			13/04/2023	12:50 - 13:20	30
Velocity Traverse	R1					13/04/2023	10:50 - 10:55	

All results are expressed at the respective reference conditions.

PROCESS DETAILS

Arran Chemical Company Limited, Athlone
A2-3 RTO
13h - 14th April 2023

Standard Operating Conditions

Parameter	Value
Process Status	Chemical Manufacturing
Capacity (of 100%) and Tonnes / Hour	1200 - 1800m3/hr
Continuous or Batch Process	Batch
Feedstock (if applicable)	Solvents
Abatement System	Thermal Oxidiser
Abatement System Running Status	On
Fuel	Natural Gas
Plume Appearance	None

Executive Summary

(Page 5 of 7)

MONITORING & ANALYTICAL METHODS

Arran Chemical Company Limited, Athlone
A2-3 RTO
13h - 14th April 2023

	Monitoring				Analysis					
Parameter	**Standard**	**Technical Procedure**	**Sampling Status**	**Testing Lab**	**Analytical Procedure**	**Analytical Technique**	**Analysis Status**	**Analysis Lab**	**Overall Status**	**LOD (Average)**
Dioxins & Furans	EN 1948	CAT-TP-07	MCERTS	EET	PM137, TM201	GC-HRMS	MCERTS	EET	MCERTS	0.0005 ng/m³
Hydrogen Chloride	EN 1911	CAT-TP-11	MCERTS	EET	CAT-AP-01	IC	MCERTS	EET	MCERTS	0.073 mg/m³
Sum of individual VOCs (hazard statements H340, H350, H350i9 H360D or H360F)	CEN/TS 13649	CAT-TP-16	MCERTS	EET	GC/MS	GC/MS	None	MAR	None	1.688 mg/m³
Sum of individual VOCs (hazard statements H341 and H351)	CEN/TS 13649	CAT-TP-16	MCERTS	EET	GC/MS	GC/MS	None	MAR	None	1.701 mg/m³
Toluene	CEN/TS 13649	CAT-TP-16	MCERTS	EET	WI3042	GC/MS	MCERTS	MAR	MCERTS	0.084 mg/m³
Methanol	CEN/TS 13649	CAT-TP-16	MCERTS	EET	WI3042	GC/MS	None	MAR	None	1.688 mg/m³
isopropanol	CEN/TS 13649	CAT-TP-16	MCERTS	EET	WI3042	GC/MS	17025	MAR	17025	0.338 mg/m³
Methyl tert butyl ether	CEN/TS 13649	CAT-TP-16	MCERTS	EET	WI3042	GC/MS	MCERTS	MAR	MCERTS	0.084 mg/m³
Acetonitrile	CEN/TS 13649	CAT-TP-16	MCERTS	EET	WI3042	GC/MS	None	MAR	None	1.688 mg/m³
Heptane	CEN/TS 13649	CAT-TP-16	MCERTS	EET	WI3042	GC/MS	None	MAR	None	0.169 mg/m³
Ethanol	CEN/TS 13649	CAT-TP-16	MCERTS	EET	WI3042	GC/MS	17025	MAR	17025	0.338 mg/m³
2 Methyltetraydofuran	CEN/TS 13649	CAT-TP-16	MCERTS	EET	WI3042	GC/MS	None	MAR	None	0.169 mg/m³
Water Vapour	EN 14790	CAT-TP-05	MCERTS	EET	CAT-TP-05	Gravimetric	MCERTS	EET	MCERTS	0.10 % v/v
Total VOCs (as Carbon)	EN 12619:2013	CAT-TP-20	MCERTS	EET	Flame Ionisation Detection by Sick 3006				MCERTS	0.32 mg/m³
Oxides of Nitrogen (as NO_2)	EN 14792	CAT-TP-39	MCERTS	EET	Chemiluminescence by Horiba PG-350E				MCERTS	0.41 mg/m³
Carbon Dioxide	CEN/TS 17405	CAT-TP-39	MCERTS	EET	NDIR by Horiba PG-350E				MCERTS	0.1 %
Oxygen	EN 14789	CAT-TP-39	MCERTS	EET	Dry Paramagnetic Cell by Horiba PG-350E				MCERTS	0.1 %
Velocity & Vol. Flow Rate	EN 16911-1 (MID)	CAT-TP-41	MCERTS	EET	Pitot Tube and Thermocouple				MCERTS	1.2 m/s

ANALYSIS LABORATORIES

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

Element (Stockport Lab - EET)	ISO 17025 Accreditation Number: 4279

Marchwood Scientific Services Ltd (MAR)	ISO 17025 Accreditation Number: 1668

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	0.34
Width	m	-
Area	m²	0.09
Port Depth	cm	34
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

Irish EPA Technical Guidance Note AG1 / 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 Irish EPA Guidance Note AG1 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	35.2	> 5 Pa	Yes
Mean Velocity	m/s	6.88	-	-
Lowest Gas Velocity	m/s	6.88	-	-
Highest Gas Velocity	m/s	6.88	-	-
Ratio of Above	: 1	1.00	< 3 : 1	Yes
Maximum Angle of Swirl	°	3.00	< 15°	Yes
No Local Negative Flow	-	Yes	-	Yes

PLANT PHOTOS

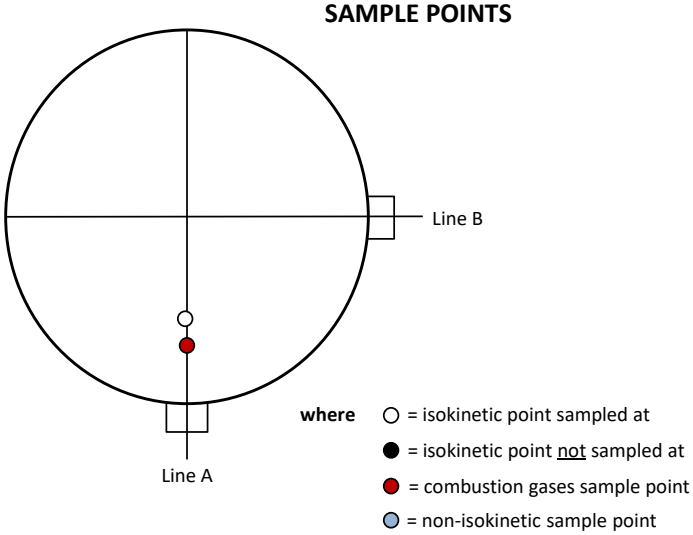
Photo 1

Photo 2

Photo 3

Photo 4

SAMPLE POINTS



APPENDIX CONTENTS

APPENDIX 1

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Donal O Faogain	MCERTS Level 2	MM13 1259	TE1 TE2 TE3 TE4
Technician	James O'Connor	MCERTS Trainee	MM22 1720	TE1

LIST OF EQUIPMENT

Extractive Sampling	
Equipment Type	**Equipment I.D.**
Control Box DGM (1)	CAT 7.166
Control Box DGM (2)	-
Box Thermocouples (1)	-
Box Thermocouples (2)	-
Umbilical (1)	CAT 3.555
Umbilical (2)	-
Oven Box (1)	-
Oven Box (2)	-
Heated Probe (1)	CAT 5.143
Heated Probe (2)	-
Heated Probe (3)	-
S-Pitot (1)	CAT 21p.92
S-Pitot (2)	CAT 21p.189
L-Pitot	-
Site Balance	CAT 17.68
500g / 1Kg Check Weights	CAT 17.68
Last Impinger Arm	CAT 4.0001
Callipers	CAT 23.11
Tubes Kit Thermocouple	CAT 4.440

Instrumental Analysers	
Equipment Type	**Equipment I.D.**
Horiba PG-350E	CAT 39.9
SELECT Horiba Model (2)	-
SELECT Servomex Model	-
SELECT NOX Analyser/Convertor	-
ABB AO2020-URAS26	-
Testo 350 XL	-
JCT JCC P1 Cooler	CAT 4.1122
SELECT FTIR	-
Gasmet Sampling System	-
Sick 3006	CAT 8.15
M&C PSS	CAT 12.83
Mass Flow Controller (1)	CAT 6.81
Mass Flow Controller (2)	CAT 6.45
Mass View (1)	CAT 25.37
Mass View (2)	-
SELECT Logger 1	-
SELECT Logger 2	-
Bioaerosols Temperature Logger	-
Electronic Refrigerator	-

Miscellaneous Items	
Equipment Type	**Equipment I.D.**
Digital Manometer (1)	CAT 3.117
Digital Manometer (2)	-
Digital Temperature Meter	CAT 3.117
Stopwatch	CAT 14.53
Barometer	CAT 13.22
Stack Thermocouple (1)	CAT 4.1490
Stack Thermocouple (2)	-
Stack Thermocouple (3)	-
1m Heated Line (1)	-
1m Heated Line (2)	-
1m Heated Line (3)	-
5m Heated Line (1)	-
15m Heated Line (1)	-
20m Heated Line (1)	-
20m Heated Line (2)	CAT 20.1020
Dual Channel Heater Controller	CAT 20.1020
Single Channel Heater Controller	-
Laboratory Balance	
Tape Measure	CAT 16.94

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Dioxins & Furans	EN 1948	CAT-TP-07
Hydrogen Chloride	EN 1911	CAT-TP-11
Sum of individual VOCs (hazard statements H340, H350, H350i9 H360D or H360F)	CEN/TS 13649	CAT-TP-16
Tetrahydrofuran	CEN/TS 13649	CAT-TP-16
Toluene	CEN/TS 13649	CAT-TP-16
Methanol	CEN/TS 13649	CAT-TP-16
isopropanol	CEN/TS 13649	CAT-TP-16
Methyl tert butyl ether	CEN/TS 13649	CAT-TP-16
Acetonitrile	CEN/TS 13649	CAT-TP-16
Heptane	CEN/TS 13649	CAT-TP-16
Ethanol	CEN/TS 13649	CAT-TP-16
2 Methyltetraydofuran	CEN/TS 13649	CAT-TP-16
Water Vapour	EN 14790	CAT-TP-05
Total VOCs (as Carbon)	EN 12619:2013	CAT-TP-20
Oxides of Nitrogen (as NO_2)	EN 14792	CAT-TP-39
Carbon Dioxide	CEN/TS 17405	CAT-TP-39
Oxygen	EN 14789	CAT-TP-39
Velocity & Vol. Flow Rate	EN 16911-1 (MID)	CAT-TP-41

PRELIMINARY STACK SURVEY: CALCULATIONS

General Stack Details

Stack Details (from Traverse)	Units	Value
Stack Diameter / Depth, D	m	0.34
Stack Width, W	m	-
Stack Area, A	m²	0.09
Average Stack Gas Temperature, T_a	°C	50.0
Average Stack Gas Pressure	Pa	35.2
Average Stack Static Pressure, P_{static}	kPa	0.017
Average Barometric Pressure, P_b	kPa	98.9
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/m³ p	Conc kg/m³ p_i
CO_2	-	0.52	0.49	0.0052	44.01	1.9635	0.01016
O_2	-	20.11	18.85	0.2011	32.00	1.4277	0.28705
N_2	-	79.38	74.43	0.7938	28.01	1.2498	0.99208
Moisture (H_2O)	-	-	6.23	0.0623	18.02	0.8037	0.05005

Where: $p = M / 22.41$

$p_i = r \times p$

Calculation of Stack Gas Densities

Determinand	Units	Result
Dry Density (STP), P_{STD}	kg/m³	1.289
Wet Density (STP), P_{STW}	kg/m³	1.259
Dry Density (Actual), P_{Actual}	kg/m³	1.064
Average Wet Density (Actual), $P_{ActualW}$	kg/m³	1.039

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	50.0	0.0
Total Pressure	kPa	98.9	101.3
Moisture	%	7.58	0.00

Gas Volumetric Flowrate (from Traverse)	Units	Result
Gas Volumetric Flowrate (Actual)	m³/hr	2250
Gas Volumetric Flowrate (STP, Wet)	m³/hr	1857
Gas Volumetric Flowrate (STP, Dry)	m³/hr	1716
Gas Volumetric Flowrate REF [1]	m³/hr	1716

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

(1 of 1)

Parameter	Units	Value
Date of Survey	-	13/04/2023
Time of Survey	-	10:50 - 10:55
Atmospheric Pressure	kPa	98.9
Average Stack Static Pressure	Pa	17
Result of Pitot Stagnation Test	-	Pass
Are Water Droplets Present?	-	Yes
Device Used	S-Type Pitot with KIMO MP 210 (500Pa)	

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	-	1
Number of Lines Used	-	1

Sampling Line A

Traverse Point	Depth m	ΔP Pa	Temp °C	Wet Density kg/m³	Velocity m/s	Swirl °
STATIC (Units: Pa)		*17.0*				
Mean		**35.2**	**50.0**	**1.039**	**6.88**	
1	0.17	35.2	50.0	1.039	6.88	3.0

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(Δpi)	1.115	Pa
- Resolution	u(res)	0.00087	
- Calibration	u(cal)	0.129	
- Drift	u(drift)	0.083	
- Lack of Fit	u(fit)	0.029	
- Overall corrections to dynamic measurements	u(Cf)	0.242	
Standard uncertainty associated with the molar mass of the gas	u(M)	0.00004	-
- $\varphi O_2,w$	-	18.854	
- $\varphi CO_2,w$	-	0.485	
- Oxygen, dry	u(ϕO_2,d)	0.615	
- Carbon Dioxide, dry	u(ϕCO_2,d)	0.016	
- Water Vapour	u(ϕH_2O)	0.318	
- Oxygen, wet	u(ϕO_2,w)	0.581	
- Carbon Dioxide, wet	u(ϕCO_2,w)	0.015	
Standard uncertainty associated with the stack temperature	u(Tc)	1.648	K
Standard uncertainty associated with the absolute pressure in the duct	u(pc)	175.696	Pa
- Atmospheric Pressure	u(patm)	175.692	
- Static Pressure	u(pstat)	1.115	
Standard uncertainty associated with the density in the duct	u(ρ)	0.00561	-
Standard uncertainty associated with the local velocities	u(vi)	0.151	Pa
Standard uncertainty associated with the mean velocity	u(v)	0.151	m/s
Standard uncertainty associated with the mean velocity (95% Confidence)	Uc(v)	0.297	m/s
Standard uncertainty associated with the mean velocity (95% Confidence), relative	Uc,rel(v)	4.31	%
Standard uncertainty associated with the volume flow rate (95% Confidence)	Uc(qV,w)	140.6	m^3/hr
- $u^2(a)/a^2$	-	0.00053	
- $u^2(qV,w)/q^2V,w$	-	0.00102	
- $u^2(qV,w)$	-	5147	
- $u(qV,w)$	-	71.7	
Standard uncertainty associated with the volume flow rate (95% Confidence), relative	Uc,rel(qV,w)	6.25	%

APPENDIX 2

DIOXINS & FURANS: RESULTS SUMMARY

(PAGE 1 OF 4)

Arran Chemical Company Limited, Athlone
A2-3 RTO

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

Sample Runs (UPPER NATO I-TEQ)

Parameter	Units	Run 1		Mean
Concentration	ng/m³	0.00055		0.00055
Uncertainty	±ng/m³	0.00011		0.00011
Mass Emission	µg/hr	0.00094		0.00094
Uncertainty	±µg/hr	0.00020		0.00020

Sample Runs (UPPER WHO TEQ Humans / Mammals)

Parameter	Units	Run 1		Mean
Concentration	ng/m³	0.00065		0.00065
Uncertainty	±ng/m³	0.00013		0.00013
Mass Emission	µg/hr	0.00111		0.00111
Uncertainty	±µg/hr	0.00024		0.00024

Sample Runs (UPPER WHO TEQ Fish)

Parameter	Units	Run 1		Mean
Concentration	ng/m³	0.001		0.001
Uncertainty	±ng/m³	0.00014		0.00014
Mass Emission	µg/hr	0.00123		0.00123
Uncertainty	±µg/hr	0.00026		0.00026

Sample Runs (UPPER WHO TEQ Birds)

Parameter	Units	Run 1		Mean
Concentration	ng/m³	0.001		0.001
Uncertainty	±ng/m³	0.00020		0.00020
Mass Emission	µg/hr	0.00168		0.00168
Uncertainty	±µg/hr	0.00036		0.00036

APPENDIX 2

DIOXINS & FURANS: RESULTS SUMMARY

(PAGE 2 OF 4)

Arran Chemical Company Limited, Athlone
A2-3 RTO

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

Sample Runs (LOWER NATO I-TEQ)

Parameter	Units	Run 1		Mean
Concentration	ng/m³	0.000025		0.000025
Uncertainty	±ng/m³	0.000005		0.000005
Mass Emission	µg/hr	0.000042		0.000042
Uncertainty	±µg/hr	0.000009		0.000009

Sample Runs (LOWER WHO TEQ Humans / Mammals)

Parameter	Units	Run 1		Mean
Concentration	ng/m³	0.000022		0.000022
Uncertainty	±ng/m³	0.000004		0.000004
Mass Emission	µg/hr	0.000037		0.000037
Uncertainty	±µg/hr	0.000008		0.000008

Sample Runs (LOWER WHO TEQ Fish)

Parameter	Units	Run 1		Mean
Concentration	ng/m³	0.000011		0.000011
Uncertainty	±ng/m³	0.000002		0.000002
Mass Emission	µg/hr	0.000020		0.000020
Uncertainty	±µg/hr	0.000004		0.000004

Sample Runs (LOWER WHO TEQ Birds)

Parameter	Units	Run 1		Mean
Concentration	ng/m³	0.000011		0.000011
Uncertainty	±ng/m³	0.000002		0.000002
Mass Emission	µg/hr	0.000020		0.000020
Uncertainty	±µg/hr	0.000004		0.000004

APPENDIX 2

DIOXINS & FURANS: RESULTS SUMMARY

(PAGE 3 OF 4)

Arran Chemical Company Limited, Athlone
A2-3 RTO

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

Blank Runs (UPPER NATO I-TEQ)

Parameter	Units	Blank 1		Maximum
Concentration	ng/m³	0.0004		0.0004

Blank Runs (UPPER WHO TEQ Humans / Mammals)

Parameter	Units	Blank 1		Maximum
Concentration	ng/m³	0.0005		0.0005

Blank Runs (UPPER WHO TEQ Fish)

Parameter	Units	Blank 1		Maximum
Concentration	ng/m³	0.0005		0.0005

Blank Runs (UPPER WHO TEQ Birds)

Parameter	Units	Blank 1		Maximum
Concentration	ng/m³	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/m³	0.000014		0.000014

Blank Runs (LOWER WHO TEQ Humans / Mammals)

Parameter	Units	Blank 1		Maximum
Concentration	ng/m³	0.000011		0.000011

Blank Runs (LOWER WHO TEQ Fish)

Parameter	Units	Blank 1		Maximum
Concentration	ng/m³	0.000004		0.000004

Blank Runs (LOWER WHO TEQ Birds)

Parameter	Units	Blank 1		Maximum
Concentration	ng/m³	0.000004		0.000004

APPENDIX 2

DIOXINS & FURANS: RESULTS SUMMARY

(PAGE 4 OF 4)

Arran Chemical Company Limited, Athlone
A2-3 RTO

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	8.93		8.93
Uncertainty	±% v/v	0.45		0.45

General Sampling Information

Parameter	Value	
Standard	EN 1948	
Technical Procedure	CAT-TP-07	
Name of Analytical Laboratory	EET	
Analytical Laboratory's Procedure	PM137, TM201	
ISO 17025 Accredited Analysis?	MCERTS	
Date of Sample Analysis	15/05/2023	
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	90mm Quartz Fibre	
Number of Sampling Lines Used	1 /	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

Reference Conditions

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

APPENDIX 2

DIOXINS & FURANS: ISOKINETIC SAMPLING CALCULATIONS

Test	Units	Run 1	
Absolute pressure of stack gas, P_s			
Barometric pressure, P_b	mmHg	737.3	
Stack static pressure, P_{static}	mmH_2O	1.8	
$P_s = (P_b + (P_{static} / 13.6)$	mmHg	737.4	
Volume of water vapour collected, V_{wstd}			
Total mass collected in impingers (liquid trap)	g	-146.4	
Total mass collected in impingers (silica trap)	g	608.2	
Total mass of liquid collected, V_{lc}	g	461.8	
$V_{wstd} = (0.001246)(V_{lc})$	m^3	0.5754	
Volume of gas metered dry, V_{mstd}			
Volume of gas sample through gas meter, V_m	m^3	6.3840	
Gas meter correction factor, Y_d	-	1.0040	
Average dry gas meter temperature, T_m	°C	17.2	
Average pressure drop across orifice, ΔH	mmH_2O	33.2	
$V_{mstd} = ((0.3592)(V_m)(P_b + (\Delta H/13.6))(Y_d)) / (T_m + 273)$	m^3	5.8687	
Moisture content, B_{wo} & R_{wv}			
$B_{wo} = V_{wstd} / (V_{mstd} + V_{wstd})$	m^3	0.0893	
B_{wo} as a percentage	% v/v	8.93	
Reported Water Vapour, checked with Tables in EN 14790, Rwv	% v/v	8.93	
Volume of gas metered wet, V_{mstw}			
$V_{mstw} = (V_{mstd})(100/(100 - R_{wv}))$	m^3	6.4441	
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	% v/v	0.40	
O_2	% v/v	20.00	
Total	% v/v	20.40	
N_2	% v/v	79.60	
$M_d = 0.44(\%CO_2)+0.32(\%O_2)+0.28(\%N_2)$	g/gmol	28.86	
Molecular weight of stack gas (wet), M_s			
$M_s = M_d(1 - (R_{wv}/100)) + 18(R_{wv}/100)$	g/gmol	27.89	
Velocity of stack gas, V_s			
Pitot tube velocity constant, K_p	-	34.97	
Velocity pressure coefficient, C_p	-	0.88	
Average of velocity heads, ΔP_{avg}	mmH_2O	4.85	
Average square root of velocity heads, √ΔP	$\sqrt{mmH_2O}$	2.20	
Average stack gas temperature, T_s	°C	48.8	
$V_s = ((K_p)(C_p)(\sqrt{\Delta P})(\sqrt{T_s} + 273)) / (\sqrt{(M_s)(P_s)})$	m/s	8.43	
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	0.09	
$Q_a = (60)(A_s)(V_s)$	m^3/min	45.9	
Conversion factor (K/mm.Hg), C_f	-	0.3592	
$Q_{stw} = ((Q_a)(P_{sj})(C_f)) / ((T_s) + 273)$	m^3/min	37.8	
$Q_{std} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273)$	m^3/min	34.4	
$Q_{stwO_2} = ((Q_a)(P_s)(C_f)) / ((T_s) + 273) / (O_{2REFw})$	m^3/min	N/A	
$Q_{stdO_2} = ((Q_a)(P_s)(C_f)(1 - (R_{wv}/100))) / ((T_s) + 273) / (O_{2REFd})$	m^3/min	N/A	
Percent isokinetic, %I			
Nozzle diameter, D_n	mm	7.01	
Nozzle area, A_n	mm^2	38.56	
Total sampling time, q	min	360	
$\%I = (4.6398E^{6})(T_s+273)(V_{mstd}) / (P_s)(V_s)(A_n)(q)(1 - (R_{wv}/100))$	%	111.4	

APPENDIX 2

DIOXINS & FURANS: SAMPLING DETAILS

RUN 1

Parameter	Units	Value
Sampling Times	-	11:00 - 17:00
Sampling Dates	-	13/04/2023
Sampling Device	-	ISO
Volume Sampled (REF)	m^3	5.8687

Where: ISO stands for Manual Isokinetic Sampling Train

				NATO I-TEQ		WHO Humans / Mammals		WHO Fish		WHO Birds		
Parameter	**Units**	**Result**	**DL**	**TEQ1**	**TEQ2**	**TEQ1**	**TEQ2**	**TEQ1**	**TEQ2**	**TEQ1**	**TEQ2**	**% Rec**
2378-TCDD	ng	ND	0.00055	0.0006	0.0000	0.0006	0.0000	0.0006	0.0000	0.0006	0.0000	94
12378-PeCDD	ng	ND	0.00178	0.0009	0.0000	0.0018	0.0000	0.0018	0.0000	0.0018	0.0000	78
123478-HxCDD	ng	ND	0.00114	0.0001	0.0000	0.0001	0.0000	0.0006	0.0000	0.0001	0.0000	79
123678-HxCDD	ng	ND	0.00119	0.0001	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	75
123789-HxCDD	ng	ND	0.00122	0.0001	0.0000	0.0001	0.0000	0.0000	0.0000	0.0001	0.0000	-
1234678-HPeCDD	ng	0.00600	0.00073	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	76
OCDD	ng	0.02099	0.00131	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	86
Total Dioxins	ng	0.0000	-	0.0019	0.0001	0.0028	0.0001	0.0029	0.0000	0.0025	0.0000	-
2378-TCDF	ng	ND	0.00136	0.0001	0.0000	0.0001	0.0000	0.0001	0.0000	0.0014	0.0000	69
12378-PeCDF	ng	ND	0.00122	0.0001	0.0000	0.0000	0.0000	0.0001	0.0000	0.0001	0.0000	100
23478-PeCDF	ng	ND	0.00123	0.0006	0.0000	0.0004	0.0000	0.0006	0.0000	0.0012	0.0000	70
123478-HxCDF	ng	ND	0.00089	0.0001	0.0000	0.0001	0.0000	0.0001	0.0000	0.0001	0.0000	80
123678-HxCDF	ng	ND	0.00095	0.0001	0.0000	0.0001	0.0000	0.0001	0.0000	0.0001	0.0000	75
234678-HxCDF	ng	ND	0.00130	0.0001	0.0000	0.0001	0.0000	0.0001	0.0000	0.0001	0.0000	62
123789-HxCDF	ng	ND	0.00143	0.0001	0.0000	0.0001	0.0000	0.0001	0.0000	0.0001	0.0000	101
1234678-HPeCDF	ng	0.00503	0.00042	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	75
1234789-HPeCDF	ng	0.00084	0.00049	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	97
OCDF	ng	0.00474	0.00058	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	77
Total Furans	ng	0.0000	-	0.0013	0.0001	0.0011	0.0001	0.0013	0.0001	0.0032	0.0001	-
Totals	ng	0.0000	-	0.0032	0.0001	0.0038	0.0001	0.0042	0.0001	0.0058	0.0001	-
Total Concentration	ng/m^3	-	-	0.0005	0.0000	0.0006	0.0000	0.0007	0.0000	0.0010	0.0000	-
Limit of Detection	ng/m^3	-	-	0.0005	-	0.0006	-	0.0007	-	0.0010	-	-

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

APPENDIX 2

DIOXINS & FURANS: SAMPLING DETAILS

(Continued)

BLANK 1

Parameter	Units	Value
Sampling Dates	-	13/04/2023
Sampling Device	-	ISO
Average Volume Sampled (REF)	m^3	5.8687

Where: ISO stands for Manual Isokinetic Sampling Train

				NATO I-TEQ		WHO Humans / Mammals		WHO Fish		WHO Birds		
Parameter	**Units**	**Result**	**DL**	**TEQ1**	**TEQ2**	**TEQ1**	**TEQ2**	**TEQ1**	**TEQ2**	**TEQ1**	**TEQ2**	**% Rec**
2378-TCDD	ng	ND	0.00043	0.0004	0.0000	0.0004	0.0000	0.0004	0.0000	0.0004	0.0000	84
12378-PeCDD	ng	ND	0.00128	0.0006	0.0000	0.0013	0.0000	0.0013	0.0000	0.0013	0.0000	74
123478-HxCDD	ng	ND	0.00108	0.0001	0.0000	0.0001	0.0000	0.0005	0.0000	0.0001	0.0000	74
123678-HxCDD	ng	ND	0.00106	0.0001	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	69
123789-HxCDD	ng	ND	0.00109	0.0001	0.0000	0.0001	0.0000	0.0000	0.0000	0.0001	0.0000	-
1234678-HPeCDD	ng	0.00440	0.00070	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	74
OCDD	ng	0.02395	0.00092	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	86
Total Dioxins	ng	0.0000	-	0.0015	0.0001	0.0021	0.0001	0.0023	0.0000	0.0019	0.0000	-
2378-TCDF	ng	ND	0.00119	0.0001	0.0000	0.0001	0.0000	0.0001	0.0000	0.0012	0.0000	Paramete 63
12378-PeCDF	ng	ND	0.00089	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	103
23478-PeCDF	ng	ND	0.00090	0.0005	0.0000	0.0003	0.0000	0.0005	0.0000	0.0009	0.0000	68
123478-HxCDF	ng	ND	0.00055	0.0001	0.0000	0.0001	0.0000	0.0001	0.0000	0.0001	0.0000	81
123678-HxCDF	ng	ND	0.00058	0.0001	0.0000	0.0001	0.0000	0.0001	0.0000	0.0001	0.0000	75
234678-HxCDF	ng	ND	0.00075	0.0001	0.0000	0.0001	0.0000	0.0001	0.0000	0.0001	0.0000	64
123789-HxCDF	ng	ND	0.00082	0.0001	0.0000	0.0001	0.0000	0.0001	0.0000	0.0001	0.0000	101
1234678-HPeCDF	ng	0.00140	0.00038	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	69
1234789-HPeCDF	ng	ND	0.00044	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	106
OCDF	ng	0.00273	0.00057	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	78
Total Furans	ng	0.0000	-	0.0009	0.0000	0.0007	0.0000	0.0008	0.0000	0.0025	0.0000	-
Totals	ng	0.0000	-	0.0024	0.0001	0.0028	0.0001	0.0031	0.0000	0.0044	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

Sample Runs

Leak Test Results	Units	Run 1
Mean Sampling Rate	l/min	17.8
Pre-Sampling Leak Rate	l/min	0.11
Post-Sampling Leak Rate	l/min	0.05
Allowable Leak Rate	l/min	0.89
Leak Test Acceptable	-	Yes

Water Droplets	Units	Run 1
Are Water Droplets Present	-	No

MU (Concurrent Water Vapour)	Units	Run 1
Measurement Uncertainty (MU)	%	5.1
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	%	111.4
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	19
Maximum Allowable Temperature	°C	20
Exit Temperature Acceptable	-	Yes

Test Conditions	Units	Run 1
Ambient Temperature Recorded?	-	Yes

DIOXINS & FURANS: QUALITY ASSURANCE

Blank Runs

Leak Test Results	Units	Blank 1
Expected Sampling Rate	l/min	15.0
Sampling Leak Rate	l/min	0.05
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/m³	0.010
Blank Acceptable	-	Yes

Method Deviations

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

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

	Value		Standard uncertainty		
Measured Quantities	**Symbol**	**Run 1**	**Symbol**	**Units**	**Run 1**
Sampled Volume (Actual)	V_m	6.3840	uV_m	m^3	0.1277
Sampled Gas Temperature	T_m	290.2	uT_m	K	2.00
Sampled Gas Pressure	ρ_m	98.3	$u\rho_m$	kPa	0.50
Sampled Gas Humidity	H_m	0.00	uH_m	% v/v	1.00
Leak	L	0.28	uL	%	-
Laboratory Result	L_r	10.0	uL_r	%	-

	Uncertainty as a Percentage		
Measured Quantities	**Units**	**Run 1**	**Requirement of Standard**
Sampled Volume (Actual)	%	2.00	≤2%
Sampled Gas Temperature	%	0.69	≤1%
Sampled Gas Pressure	%	0.51	≤1%
Sampled Gas Humidity	%	1.00	≤1%
Leak	%	0.28	≤5%
Laboratory Result	%	10.0	No Requirement

	Uncertainty in Measurement Units			Sensitivity Coefficient
Measured Quantities	**Symbol**	**Units**	**Run 1**	**Run 1**
Sampled Volume (STP)	V_m	m^3	5.8687	0.0001
Leak	L	ng/m^3	0.0000	1.00
Laboratory Result	L_r	ng/m^3	0.0001	1.00

	Uncertainty in Result	
Measured Quantities	**Units**	**Run 1**
Sampled Volume (STP)	ng/m^3	0.000014
Leak	ng/m^3	0.000001
Laboratory Result	ng/m^3	0.0001

	Oxygen Correction Part of MU Budget	
Measured Quantities	**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	0.0001
Expanded uncertainty (95% confidence), without Oxygen Correction	ng/m^3	0.0001
Expanded uncertainty (95% confidence), with Oxygen Correction	ng/m^3	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	ng/m^3	0.0001
Reported Uncertainty	ng/m^3	0.0001
Expanded uncertainty (95% confidence), without Oxygen Correction	%	20.2
Expanded uncertainty (95% confidence), with Oxygen Correction	%	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	20.2
Reported Uncertainty	%	20.2

APPENDIX 2

HYDROGEN CHLORIDE: RESULTS SUMMARY

Arran Chemical Company Limited, Athlone

A2-3 RTO

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	mg/m³	0.33		0.33
Uncertainty	±mg/m³	0.01		0.01
Mass Emission	g/hr	0.6		0.6
Uncertainty	±g/hr	0.044		0.044

Parameter	Units	Run 1		Mean
Water Vapour	% v/v	6.23		6.23
Uncertainty	±% v/v	0.26		0.26

Blank Runs

Parameter	Units	Blank 1		Maximum
Concentration	mg/m³	0.06		0.06

General Sampling Information

Parameter	Value	
Standard	EN 1911	
Technical Procedure	CAT-TP-11	
Name of Analytical Laboratory	EET	
Analytical Laboratory's Procedure	CAT-AP-01	
ISO 17025 Accredited Analysis?	MCERTS	
Date of Sample Analysis	28/04/2023	
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 Quartz Fibre	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

Reference Conditions

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

HYDROGEN CHLORIDE: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1
Sampling Times	-	10:15 - 10:45
Sampling Dates	-	13/04/2023
Sampling Device	-	MFC / MV
Duration	mins	30
Volume Sampled (STP, Dry)	m^3	0.2777
Volume Sampled (STP, Wet)	m^3	0.2961
Volume Sampled (REF)	m^3	0.2777
Sample Flow Rate	l/min	9.24
Laboratory Result for Front Impingers	µg/ml	0.18
Laboratory Result for Back Impinger	µg/ml	0.34
Volume in Front Impingers	ml	281.5
Volume in Back Impinger	ml	124.3
Mass in Front Impingers	µg	50.7
Mass in Back Impinger	µg	42.3
Total Mass Collected	µg	92.9
Calculated Concentration	mg/m^3	0.33
Liquid Trap Start Mass	g	1267.8
Liquid Trap End Mass	g	1278.8
Silica Trap Start Mass	g	1489.1
Silica Trap End Mass	g	1492.9
Total Mass Of Water Vapour	g	14.8
Calculated Water Vapour	% v/v	6.23

Where: MFC stands for Mass Flow Controller, MV stands for Mass View Flowmeter

Blank Runs

Parameter	Units	Blank 1
Blank Dates	-	13/04/2023
Average Volume Sampled (REF)	m^3	0.2777
Laboratory Result for Impingers	µg/ml	0.05
Volume in Impingers	ml	330.6
Total Mass Collected	µg	16.5
Calculated Concentration	mg/m^3	0.06

HYDROGEN CHLORIDE: QUALITY ASSURANCE

Sample Runs

Leak Test Results	Units	Run 1
Mean Sampling Rate	l/min	9.2
Pre-Sampling Leak Rate	l/min	0.05
Post-Sampling Leak Rate	l/min	0.05
Allowable Leak Rate	l/min	0.18
Leak Test Acceptable	-	Yes

Absorption Efficiency	Units	Run 1
Absorption Efficiency	%	54.5
Allowable Absorption Efficiency	%	N/A [1]
Absorption Efficiency Acceptable	-	Yes [1]

[1] The concentration in the last absorber was less than 5 times the analytical detection limit.

Water Droplets	Units	Run 1
Are Water Droplets Present	-	No

MU (Concurrent Water Vapour)	Units	Run 1
Measurement Uncertainty (MU)	%	4.2
Allowable MU	%	20.0
MU Acceptable	%	Yes

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

Test Conditions	Units	Run 1
Ambient Temperature Recorded?	-	Yes

Blank Runs

Leak Test Results	Units	Blank 1
Expected Sampling Rate	l/min	9.5
Pre-Sampling Leak Rate	l/min	0.05
Post-Sampling Leak Rate	l/min	0.11
Allowable Leak Rate	l/min	0.19
Leak Test Acceptable	-	Yes

Validity of Blank vs ELV	Units	Blank 1
Allowable Blank	mg/m³	3.0
Blank Acceptable	-	Yes

Method Deviations

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

HYDROGEN CHLORIDE: MEASUREMENT UNCERTAINTY CALCULATIONS

	Value		Standard uncertainty		
Measured Quantities	**Symbol**	**Run 1**	**Symbol**	**Units**	**Run 1**
Sampled Volume (STP)	V_m	0.2777	uV_m	m³	0.0056
Leak	L	0.54	uL	%	-
Laboratory Result	L_r	1.05	uL_r	%	-

	Uncertainty as a Percentage		
Measured Quantities	**Units**	**Run 1**	**Requirement of Standard**
Sampled Volume (STP)	%	2.00	≤2%
Leak	%	0.54	≤2%
Laboratory Result	%	1.05	No Requirement

	Uncertainty in Measurement Units			Sensitivity Coefficient
Measured Quantities	**Symbol**	**Units**	**Run 1**	**Run 1**
Sampled Volume (STP)	V_m	m³	0.2777	1.21
Leak	L	mg/m³	0.001	1.00
Laboratory Result	L_r	mg/m³	0.004	1.00

	Uncertainty in Result	
Measured Quantities	**Units**	**Run 1**
Sampled Volume (STP)	mg/m³	0.007
Leak	mg/m³	0.0010
Laboratory Result	mg/m³	0.0035

	Oxygen Correction Part of MU Budget	
Measured Quantities	**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	mg/m³	0.01
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m³	0.01
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m³	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m³	0.01
Reported Uncertainty	mg/m³	0.01
Expanded uncertainty (95% confidence), without Oxygen Correction	%	4.5
Expanded uncertainty (95% confidence), with Oxygen Correction	%	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	4.5
Reported Uncertainty	%	4.5

SUM OF INDIVIDUAL VOCS (HAZARD STATEMENTS H340, H350, H350I9 H360D OR H360F) : RESULTS SUMMARY

Arran Chemical Company Limited, Athlone

A2-3 RTO

Sample Runs

Parameter	Units	Run 1					Mean
Dimethylformamide	mg/m³	< 1.69					< 1.69
Total	**mg/m³**	**< 1.69**					**< 1.69**

General Sampling Information

Parameter	Value	
Standard	CEN/TS 13649	
Technical Procedure	CAT-TP-16	
Name of Analytical Laboratory	MAR	
Analytical Laboratory's Procedure	GC/MS	
ISO 17025 Accredited Analysis?	See Executive Summary	
Date of Sample Analysis	15/05/2023	
Probe Material	Stainless Steel	
Sample Tube Type	Coconut Shell Charcoal	
Dynamic Dilution Employed	No	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	B1	

Reference Conditions

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

SUM OF INDIVIDUAL VOCS (HAZARD STATEMENTS H340, H350, H350I9 H360D OR H360F) : SAMPLING DETAILS

RUN 1

Parameter	Units	Value
Sampling Times	-	13:00 - 13:30
Sampling Dates	-	13/04/2023
Sampling Device	-	MV
Duration	mins	30
N_2 to Stack Gas Dilution Ratio	: 1	0
Volume Sampled (REF)	m^3	0.0118

Where: MV stands for Mass View (Mass Flow Controller Technology)

Parameter	Lab Result (Front) µg	Lab Result (Back) µg	Lab Result (Total) µg	LOD (Front) µg	LOD (Back) µg	LOD (Total) µg	Concentration mg/m³	Reported Concentration (Blank Reviewed) mg/m³	Reported LOD mg/m³	Adsorption Efficiency %
Dimethylformamide	< 10.0	< 10.0	20.0	10.0	10.0	20.0	< 1.688	< 1.688	1.688	100.0
Total			**20.0**			**20.0**	**< 1.688**	**< 1.688**	**1.688**	**-**

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

Tube Lot Number and Unique ID: lot 2000, 0136644648

AG2 Reporting Format	ELV (mg/m³)	Results (mg/m³)	Breakdown of Results	Mass Emission (kg/h)
Sum of individual VOCs (hazard statements H340, H350, H350i9 H360D or	2	> 0 and < 1.69	> (sum of) and < (sum of 1)	>0.00000 and <0.00290

SUM OF INDIVIDUAL VOCS (HAZARD STATEMENTS H340, H350, H350I9 H360D OR H360F) : SAMPLING DETAILS

BLANK 1

Parameter	Units	Value
Sampling Dates	-	13/04/2023
Sampling Device	-	MV
Average Volume Sampled (REF)	m^3	0.0118

Where: MV stands for Mass View (Mass Flow Controller Technology)

Parameter	Lab Result (Front) µg	Lab Result (Back) µg	Lab Result (Total) µg	Concentration mg/m^3
Dimethylformamide	< 10.0	< 10.0	20.0	< 1.688
TOTAL			**20.0**	**< 1.688**

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

Tube Lot Number and Unique ID: Lot:2000, 0136644651

SUM OF INDIVIDUAL VOCS (HAZARD STATEMENTS H340, H350, H350I9 H360D OR H360F) : QUALITY ASSURANCE

Sample Runs

Leak Test Results	Units	Run 1
Mean Sampling Rate	l/min	0.4
Pre-Sampling Leak Rate	l/min	0.00
Post-Sampling Leak Rate	l/min	0.00
Allowable Leak Rate	l/min	0.02
Leak Test Acceptable	-	Yes

Adsorption Efficiency	Units	Run 1
Dimethylformamide	%	100.0
Allowable Adsorption Efficiency	%	95.0
Adsorption Efficiency Acceptable	-	Yes

Temperature at Sample Tubes	Units	Run 1
Temperature	°C	32
Allowable Temperature	°C	40
Temperature Acceptable	-	Yes

Test Conditions	Units	Run 1
Ambient Temperature Recorded?	-	Yes

SUM OF INDIVIDUAL VOCS (HAZARD STATEMENTS H340, H350, H350I9 H360D OR H360F) : QUALITY ASSURANCE

Blank Runs

Leak Test Results	Units	Blank 1
Expected Sampling Rate	l/min	0.4
Sampling Leak Rate	l/min	0.01
Allowable Leak Rate	l/min	0.02
Leak Test Acceptable	-	Yes

Validity of Blank vs ELV	Units	Blank 1	Allowed
Allowable for Dimethylformamide	mg/m³	1.7	0.2
Allowable for TOTAL	mg/m³	1.7	0.2

Method Deviations

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

NDIVIDUAL VOCS (HAZARD STATEMENTS H340, H350, H350I9 H360D OR H360F) : MEASUREMENT UNCERTAINTY CALCI

	Value		Standard uncertainty		
Measured Quantities	**Symbol**	**Run 1**	**Symbol**	**Units**	**Run 1**
Sampled Volume (STP)	V_m	0.0118	uV_m	m³	0.0002
Leak	L	0.00	uL	%	-
Laboratory Result	L_r	10.00	uL_r	%	-

	Uncertainty as a Percentage		
Measured Quantities	**Units**	**Run 1**	**Requirement of Standard**
Sampled Volume (STP)	%	2.00	≤2%
Leak	%	0.00	≤5%
Laboratory Result	%	10.00	No Requirement

	Uncertainty in Measurement Units			Sensitivity Coefficient
Measured Quantities	**Symbol**	**Units**	**Run 1**	**Run 1**
Sampled Volume (STP)	V_m	m³	0.0118	142.51
Leak	L	mg/m³	0.000	1.00
Laboratory Result	L_r	mg/m³	0.169	1.00

	Uncertainty in Result	
Measured Quantities	**Units**	**Run 1**
Sampled Volume (STP)	mg/m³	0.034
Leak	mg/m³	0.0000
Laboratory Result	mg/m³	0.1688

	Oxygen Correction Part of MU Budget	
Measured Quantities	**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	mg/m³	0.172
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m³	0.337
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m³	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m³	0.337
Reported Uncertainty	mg/m³	0.337
Expanded uncertainty (95% confidence), without Oxygen Correction	%	20.0
Expanded uncertainty (95% confidence), with Oxygen Correction	%	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	20.0
Reported Uncertainty	%	20.0

NOTE: Uncertainties reported in mg/m ³ are based upon the summation of all Speciated VOCs Measured.

SUM OF INDIVIDUAL VOCS (HAZARD STATEMENTS H341 AND H351) : RESULTS SUMMARY

Arran Chemical Company Limited, Athlone

A2-3 RTO

Sample Runs

Parameter	Units	Run 1		Mean
Tetrahydrofuran	mg/m³	< 1.70		< 1.70

General Sampling Information

Parameter	Value	
Standard	CEN/TS 13649	
Technical Procedure	CAT-TP-16	
Name of Analytical Laboratory	MAR	
Analytical Laboratory's Procedure	GC/MS	
ISO 17025 Accredited Analysis?	See Executive Summary	
Date of Sample Analysis	15/05/2023	
Probe Material	Stainless Steel	
Sample Tube Type	Silica Gel	
Dynamic Dilution Employed	No	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A2	

Reference Conditions

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

SUM OF INDIVIDUAL VOCS (HAZARD STATEMENTS H341 AND H351) : SAMPLING DETAILS

RUN 1

Parameter	Units	Value
Sampling Times	-	13:50 - 14:20
Sampling Dates	-	13/04/2023
Sampling Device	-	MV
Duration	mins	30
N_2 to Stack Gas Dilution Ratio	: 1	0
Volume Sampled (REF)	m^3	0.0118

Where: MV stands for Mass View (Mass Flow Controller Technology)

Parameter	Lab Result (Front) µg	Lab Result (Back) µg	Lab Result (Total) µg	LOD (Front) µg	LOD (Back) µg	LOD (Total) µg	Concentration mg/m^3	Reported Concentration (Blank Reviewed) mg/m^3	Reported LOD mg/m^3	Adsorption Efficiency %
Tetrahydrofuran	< 10.0	< 10.0	20.0	10.0	10.0	20.0	< 1.701	< 1.701	1.701	100.0

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

Tube Lot Number and Unique ID: lot 13902, 0189708330

AG2 Reporting Format	ELV (mg/m^3)	Results (mg/m^3)	Breakdown of Results	Mass Emission (kg/h)
(hazard statements H341 and H351)	SELECT	> 0 and < 1.7	> (sum of) and < (sum of 1)	>0.00000 and <0.00292

SUM OF INDIVIDUAL VOCS (HAZARD STATEMENTS H341 AND H351) : SAMPLING DETAILS

BLANK 1

Parameter	Units	Value
Sampling Dates	-	13/04/2023
Sampling Device	-	MV
Average Volume Sampled (REF)	m^3	0.0118

Where: MV stands for Mass View (Mass Flow Controller Technology)

Parameter	Lab Result (Front) µg	Lab Result (Back) µg	Lab Result (Total) µg	Concentration mg/m^3
Tetrahydrofuran	< 10.0	< 10.0	20.0	< 1.701

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

Tube Lot Number and Unique ID: lot 13902, 0189708328

SUM OF INDIVIDUAL VOCS (HAZARD STATEMENTS H341 AND H351) : QUALITY ASSURANCE

Sample Runs

Leak Test Results	Units	Run 1
Mean Sampling Rate	l/min	0.4
Pre-Sampling Leak Rate	l/min	0.00
Post-Sampling Leak Rate	l/min	0.00
Allowable Leak Rate	l/min	0.02
Leak Test Acceptable	-	Yes

Adsorption Efficiency	Units	Run 1
Tetrahydrofuran	%	100.0
Allowable Adsorption Efficiency	%	95.0
Adsorption Efficiency Acceptable	-	Yes

Temperature at Sample Tubes	Units	Run 1
Temperature	°C	28
Allowable Temperature	°C	40
Temperature Acceptable	-	Yes

Test Conditions	Units	Run 1
Ambient Temperature Recorded?	-	Yes

SUM OF INDIVIDUAL VOCS (HAZARD STATEMENTS H341 AND H351) : QUALITY ASSURANCE

(PAGE 2 OF 2)

Blank Runs

Leak Test Results	Units	Blank 1
Expected Sampling Rate	l/min	0.4
Sampling Leak Rate	l/min	0.00
Allowable Leak Rate	l/min	0.02
Leak Test Acceptable	-	Yes

Validity of Blank vs ELV	Units	Blank 1	Allowed
Allowable for Tetrahydrofuran	mg/m³	1.7	N/A
Allowable for TOTAL	mg/m³	1.7	-

Method Deviations

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

SUM OF INDIVIDUAL VOCS (HAZARD STATEMENTS H341 AND H351) : MEASUREMENT UNCERTAINTY CALCULATIONS

	Value			Standard uncertainty		
Measured Quantities	**Symbol**	**Run 1**		**Symbol**	**Units**	**Run 1**
Sampled Volume (STP)	V_m	0.0118		uV_m	m³	0.0002
Leak	L	0.00		uL	%	-
Laboratory Result	L_r	10.00		uL_r	%	-

	Uncertainty as a Percentage		
Measured Quantities	**Units**	**Run 1**	**Requirement of Standard**
Sampled Volume (STP)	%	2.00	≤2%
Leak	%	0.00	≤5%
Laboratory Result	%	10.00	No Requirement

	Uncertainty in Measurement Units			Sensitivity Coefficient
Measured Quantities	**Symbol**	**Units**	**Run 1**	**Run 1**
Sampled Volume (STP)	V_m	m³	0.0118	144.71
Leak	L	mg/m³	0.000	1.00
Laboratory Result	L_r	mg/m³	0.170	1.00

	Uncertainty in Result	
Measured Quantities	**Units**	**Run 1**
Sampled Volume (STP)	mg/m³	0.034
Leak	mg/m³	0.0000
Laboratory Result	mg/m³	0.1701

	Oxygen Correction Part of MU Budget	
Measured Quantities	**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	mg/m³	0.173
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m³	0.340
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m³	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m³	0.340
Reported Uncertainty	mg/m³	0.340
Expanded uncertainty (95% confidence), without Oxygen Correction	%	20.0
Expanded uncertainty (95% confidence), with Oxygen Correction	%	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	20.0
Reported Uncertainty	%	20.0

NOTE: Uncertainties reported in mg/m ³ are based upon the summation of all Speciated VOCs Measured.

APPENDIX 2

PROCESS SOLVENTS : RESULTS SUMMARY

Arran Chemical Company Limited, Athlone

A2-3 RTO

Sample Runs

Parameter	Units	Run 1					Mean
Toluene	mg/m³	0.13					0.13
Methanol	mg/m³	< 1.69					< 1.69
isopropanol	mg/m³	< 0.34					< 0.34
Methyl tert butyl	mg/m³	1.65					1.65
Acetonitrile	mg/m³	< 1.69					< 1.69
Heptane	mg/m³	< 0.17					< 0.17
Ethanol	mg/m³	< 0.34					< 0.34
2 Methyltetraydofuran	mg/m³	< 0.17					< 0.17
Total	**mg/m³**	**< 6.16**					**< 6.16**

General Sampling Information

Parameter	Value	
Standard	CEN/TS 13649	
Technical Procedure	CAT-TP-16	
Name of Analytical Laboratory	MAR	
Analytical Laboratory's Procedure	WI3042	
ISO 17025 Accredited Analysis?	See Executive Summary	
Date of Sample Analysis	15/05/2023	
Probe Material	Stainless Steel	
Sample Tube Type	Coconut Shell Charcoal	
Dynamic Dilution Employed	No	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	B1	

Reference Conditions

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

APPENDIX 2

PROCESS SOLVENTS : SAMPLING DETAILS

RUN 1

Parameter	Units	Value
Sampling Times	-	13:00 - 13:30
Sampling Dates	-	13/04/2023
Sampling Device	-	MV
Duration	mins	30
N_2 to Stack Gas Dilution Ratio	: 1	0
Volume Sampled (REF)	m^3	0.0118

Where: MV stands for Mass View (Mass Flow Controller Technology)

Parameter	Lab Result (Front) µg	Lab Result (Back) µg	Lab Result (Total) µg	LOD (Front) µg	LOD (Back) µg	LOD (Total) µg	Concentration mg/m³	Reported Concentration (Blank Reviewed) mg/m³	Reported LOD mg/m³	Adsorption Efficiency %
Toluene	1.0	< 0.5	1.5	0.5	0.5	1.0	0.127	0.127	0.084	100.0
Methanol	< 10.0	< 10.0	20.0	10.0	10.0	20.0	< 1.688	< 1.688	1.688	100.0
isopropanol	< 2.0	< 2.0	4.0	2.0	2.0	4.0	< 0.338	< 0.338	0.338	100.0
Methyl tert butyl ether	19.0	< 0.5	19.5	0.5	0.5	1.0	1.646	1.646	0.084	100.0
Acetonitrile	< 10.0	< 10.0	20.0	10.0	10.0	20.0	< 1.688	< 1.688	1.688	100.0
Heptane	< 1.0	< 1.0	2.0	1.0	1.0	2.0	< 0.169	< 0.169	0.169	100.0
Ethanol	< 2.0	< 2.0	4.0	2.0	2.0	4.0	< 0.338	< 0.338	0.338	100.0
2 Methyltetraydofuran	< 1.0	< 1.0	2.0	1.0	1.0	2.0	< 0.169	< 0.169	0.169	100.0
Total			**73.0**			**54.0**	**< 6.162**	**< 6.162**	**4.558**	**-**

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

Tube Lot Number and Unique ID: lot 2000, 0136644652

AG2 Reporting Format	ELV (mg/m³)	Results (mg/m³)	Breakdown of Results	Mass Emission (Kg/h)
Process Solvents	-	> 1.77 and < 6.16	> (sum of 1+4) and < (sum of 1+2+3+4+5+6+7+8)	>0.00304 and <0.01058

APPENDIX 2

PROCESS SOLVENTS : SAMPLING DETAILS

BLANK 1

Parameter	Units	Value
Sampling Dates	-	13/04/2023
Sampling Device	-	MV
Average Volume Sampled (REF)	m^3	0.0118

Where: MV stands for Mass View (Mass Flow Controller Technology)

Parameter	Lab Result (Front) µg	Lab Result (Back) µg	Lab Result (Total) µg	Concentration mg/m^3
Toluene	< 0.5	< 0.5	1.0	< 0.084
Methanol	< 10.0	< 10.0	20.0	< 1.688
isopropanol	< 2.0	< 2.0	4.0	< 0.338
Methyl tert butyl ether	< 0.5	< 0.5	1.0	< 0.084
Acetonitrile	< 10.0	< 10.0	20.0	< 1.688
Heptane	< 1.0	< 1.0	2.0	< 0.169
Ethanol	< 2.0	< 2.0	4.0	< 0.338
2 Methyltetraydofuran	< 1.0	< 1.0	2.0	< 0.169
TOTAL			**54.0**	**< 4.558**

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

Tube Lot Number and Unique ID: Lot:2000, 0136631835

PROCESS SOLVENTS : QUALITY ASSURANCE

(PAGE 1 OF 2)

Sample Runs

Leak Test Results	Units	Run 1
Mean Sampling Rate	l/min	0.4
Pre-Sampling Leak Rate	l/min	0.00
Post-Sampling Leak Rate	l/min	0.00
Allowable Leak Rate	l/min	0.02
Leak Test Acceptable	-	Yes

Adsorption Efficiency	Units	Run 1
Toluene	%	100.0
Methanol	%	100.0
isopropanol	%	100.0
Methyl tert butyl ether	%	100.0
Acetonitrile	%	100.0
Heptane	%	100.0
Ethanol	%	100.0
2 Methyltetraydofuran	%	100.0
Allowable Adsorption Efficiency	%	95.0
Adsorption Efficiency Acceptable	-	Yes

Temperature at Sample Tubes	Units	Run 1
Temperature	°C	32
Allowable Temperature	°C	40
Temperature Acceptable	-	Yes

Test Conditions	Units	Run 1
Ambient Temperature Recorded?	-	Yes

PROCESS SOLVENTS : QUALITY ASSURANCE

Blank Runs

Leak Test Results	Units	Blank 1
Expected Sampling Rate	l/min	0.4
Sampling Leak Rate	l/min	0.01
Allowable Leak Rate	l/min	0.02
Leak Test Acceptable	-	Yes

Validity of Blank vs ELV	Units	Blank 1	Allowed
Allowable for Toluene	mg/m³	0.1	N/A
Allowable for Methanol	mg/m³	1.7	N/A
Allowable for isopropanol	mg/m³	0.3	N/A
Allowable for Methyl tert butyl ether	mg/m³	0.1	N/A
Allowable for Acetonitrile	mg/m³	1.7	N/A
Allowable for Heptane	mg/m³	0.2	N/A
Allowable for Ethanol	mg/m³	0.3	N/A
Allowable for 2 Methyltetraydofuran	mg/m³	0.2	N/A
Allowable for TOTAL	mg/m³	4.6	N/A

Method Deviations

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

PROCESS SOLVENTS : MEASUREMENT UNCERTAINTY CALCULATIONS

	Value			Standard uncertainty			
Measured Quantities	**Symbol**	**Run 1**		**Symbol**	**Units**	**Run 1**	
Sampled Volume (STP)	V_m	0.0118		uV_m	m³	0.0002	
Leak	L	0.00		uL	%	-	
Laboratory Result	L_r	10.14		uL_r	%	-	

	Uncertainty as a Percentage			
Measured Quantities	**Units**	**Run 1**		**Requirement of Standard**
Sampled Volume (STP)	%	2.00		≤2%
Leak	%	0.00		≤5%
Laboratory Result	%	10.14		No Requirement

	Uncertainty in Measurement Units				Sensitivity Coefficient	
Measured Quantities	**Symbol**	**Units**	**Run 1**		**Run 1**	
Sampled Volume (STP)	V_m	m³	0.0118		520.16	
Leak	L	mg/m³	0.000		1.00	
Laboratory Result	L_r	mg/m³	0.625		1.00	

	Uncertainty in Result		
Measured Quantities	**Units**	**Run 1**	
Sampled Volume (STP)	mg/m³	0.123	
Leak	mg/m³	0.0000	
Laboratory Result	mg/m³	0.6247	

	Oxygen Correction Part of MU Budget		
Measured Quantities	**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	mg/m³	0.637
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m³	1.248
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m³	N/A
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m³	1.248
Reported Uncertainty	mg/m³	1.248
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

NOTE: Uncertainties reported in mg/m ³ are based upon the summation of all Speciated VOCs Measured.

APPENDIX 2

TOTAL VOCs (as CARBON): RESULTS SUMMARY

Arran Chemical Company Limited, Athlone
A2-3 RTO

Sample Runs

Parameter	Units	Run 1	Run 2	Run 3	Mean
Raw Concentration	ppm	4.37	6.31	5.06	5.25
Concentration	mg/m³	7.12	10.12	7.62	8.29
Uncertainty	±mg/m³	0.46	0.49	0.47	0.47
Mass Emission	g/hr	12.2	17.4	13.1	14.2
Uncertainty	±g/hr	1.1	1.4	1.1	1.2

General Sampling Information

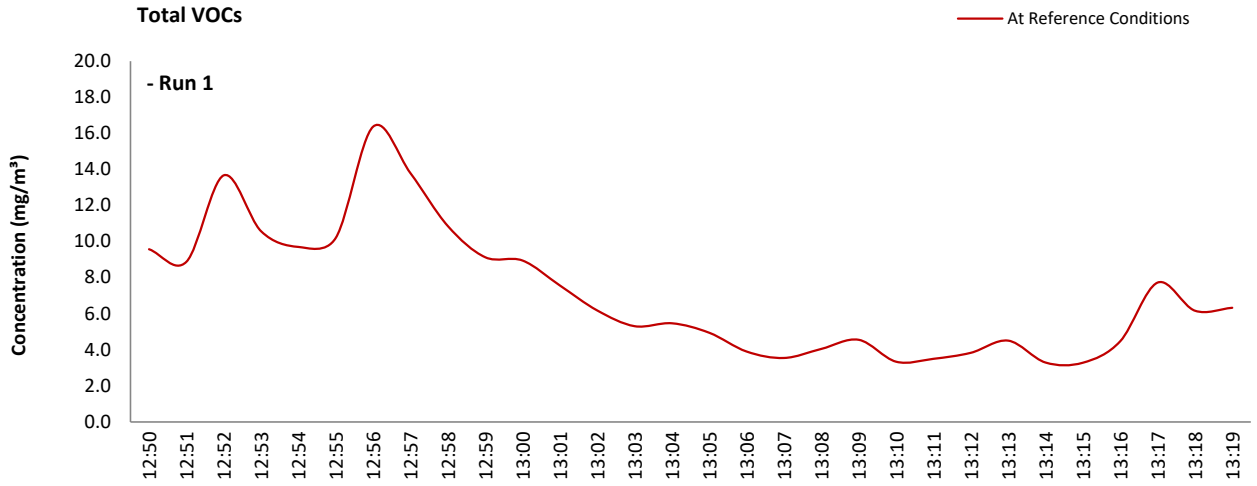
Parameter	Value	
Standard	EN 12619:2013	
Technical Procedure	CAT-TP-20	
Probe Material	Stainless Steel	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Propane In Synthetic Air (5 Grade)	
Span Gas Reference Number	1.0552	
Span Gas Expiry Date	20/01/2028	
Span Gas Start Pressure (bar)	120	
Gas Cylinder Concentration (ppm)	79.39	
Span Gas Set Point (ppm)	79.39	
Span Gas Uncertainty (%)	2	
Zero Gas Type	Synthetic Air (5 Grade)	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

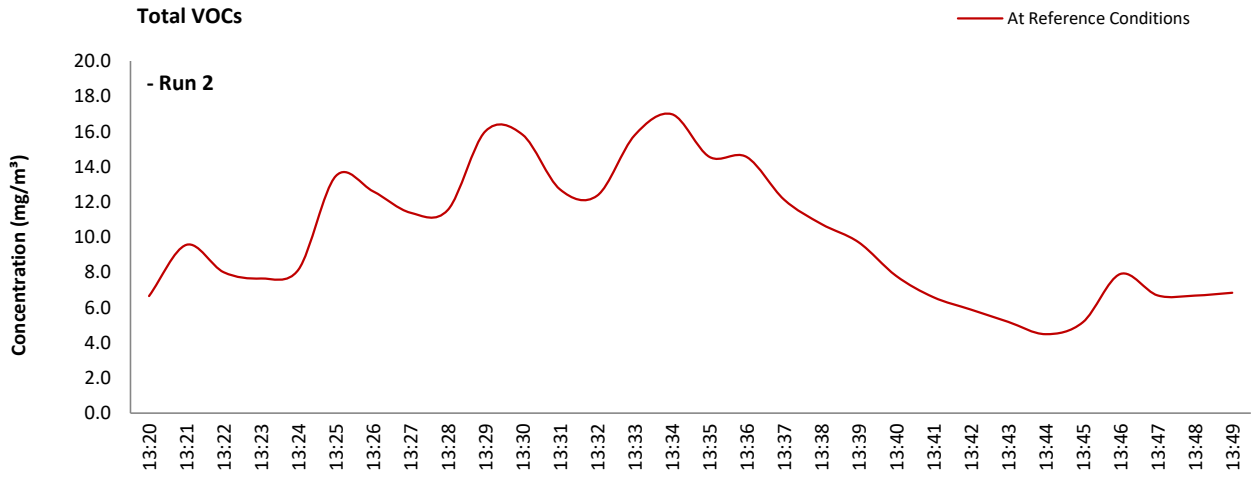
Reference Conditions

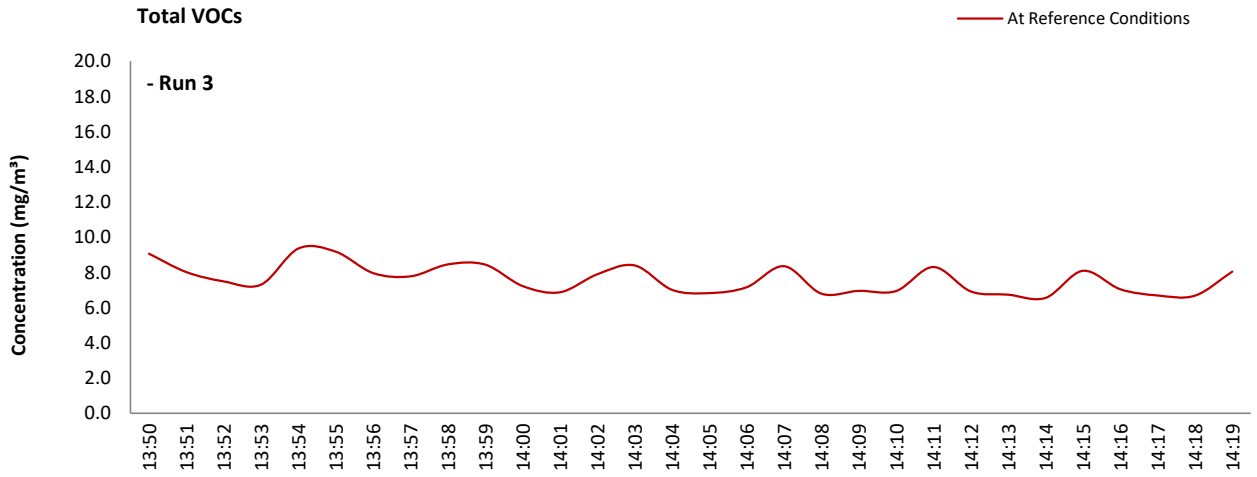
Reference Conditions are: 273K, 101.3kPa, dry gas.

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data







APPENDIX 2

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

Sampling Details

Parameter	Units	Run 1	Run 2	Run 3
Sampling Times	-	12:50 - 13:20	13:20 - 13:50	13:50 - 14:20
Sampling Dates	-	13/04/2023	13/04/2023	13/04/2023
Instrument Range	ppm	100	100	100
Span Gas Value	ppm	79.4	79.4	79.4

Quality Assurance

	Zero Drift	Units	Run 1	Run 2	Run 3
CAL 1	Zero Down Sampling Line (Pre)	ppm	0.00	0.00	0.00
	Zero Down Sampling Line (Post)	ppm	1.30	1.30	1.30
	Zero Drift	ppm	1.30	1.30	1.30
	Zero Drift	%	1.65	1.65	1.65
	Drift Correction Applied	2-5%	No	No	No
	Allowable Zero Drift	± ppm	3.97	3.97	3.97
	Zero Drift Acceptable	-	Yes	Yes	Yes

	Span Drift	Units	Run 1	Run 2	Run 3
CAL 1	Span Down Sampling Line (Pre)	ppm	79.00	79.00	79.00
	Span Down Sampling Line (Post)	ppm	79.60	79.60	79.60
	Span Drift	ppm	0.60	0.60	0.60
	Span Drift	%	0.76	0.76	0.76
	Drift Correction Applied	2-5%	No	No	No
	Allowable Span Drift	± ppm	3.97	3.97	3.97
	Span Drift Acceptable	-	Yes	Yes	Yes

Test Conditions	Units	Run 1	Run 2	Run 3
Run Ambient Temperature Range	°C	11 - 12	12	12

Method Deviations

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

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1	RUN 2	RUN 3	Units
Limit value	20.0	20.0	20.0	mg/m³ (REF)
Allowable MU	15.0	15.0	15.0	%
Measured concentration	7.12	10.12	7.62	mg/m³ (STP, dry)
Range Used	100.0	100.0	100.0	ppm
Range Used [A]	160.6	160.6	160.6	mg/m³
Cal gas conc.	79.4	79.4	79.4	ppm
Conversion	1.61	1.61	1.61	ppm to mg/m³
MCERTS Range [B]	15.0	15.0	15.0	mg/m³
Lower of [A] or [B]	15.0	15.0	15.0	mg/m³
Cal gas conc.	127.5	127.5	127.5	mg/m³

Performance characteristics	RUN 1	RUN 2	RUN 3	Units
Response time	45	45	45	seconds
Number of readings in measurement	30	30	30	-
Repeatability at zero	2.00	2.00	2.00	% full scale
Repeatability at span level	0.00	0.00	0.00	% full scale
Deviation from linearity	0.42	0.42	0.42	% of value
Zero drift	1.65	1.65	1.65	% full scale
Span drift	0.76	0.76	0.76	% full scale
Volume or pressure flow dependence	1.60	1.60	1.60	% of full scale
Atmospheric pressure dependence	0.30	0.30	0.30	% of value/kPa
Ambient temperature dependence	1.40	1.40	1.40	% full scale/10K
Combined interference	0.45	0.45	0.45	% range
Dependence on voltage	0.50	0.50	0.50	% full scale/10V
Losses in the line (leak)	0.50	0.50	0.50	% of value
Uncertainty of calibration gas	2.00	2.00	2.00	% of value

Performance characteristic	RUN 1	RUN 2	RUN 3	Units
Standard deviation of repeatability at zero	use rep at span	use rep at span	use rep at span	mg/m³
Standard deviation of repeatability at span level	0.00	0.00	0.00	mg/m³
Lack of fit	0.04	0.04	0.04	mg/m³
Drift	0.00	0.00	0.00	mg/m³
Volume or pressure flow dependence	0.00	0.00	0.00	mg/m³
Atmospheric pressure dependence	0.01	0.01	0.01	mg/m³
Ambient temperature dependence	0.20	0.20	0.20	mg/m³
Combined interference (from MCERTS Certificate)	0.04	0.04	0.04	mg/m³
Dependence on voltage	0.06	0.06	0.06	mg/m³
Losses in the line (leak)	0.02	0.03	0.02	mg/m³
Uncertainty of calibration gas	0.08	0.12	0.09	mg/m³

			RUN 1	RUN 2	RUN 3	Units
Measurement uncertainty		**Result**	7.12	10.12	7.62	mg/m³
Combined uncertainty			0.24	0.25	0.24	mg/m³
Expanded uncertainty	k =	1.96	0.46	0.49	0.47	mg/m³
Uncertainty corrected to std conds. (O_2)			0.46	0.49	0.47	mg/m³ (REF)

	RUN 1	RUN 2	RUN 3	Units
Expanded uncertainty (no O_2) - at 95% Confidence	6.51	4.87	6.14	% of Value
Expanded uncertainty (no O_2) - at 95% Confidence	2.32	2.46	2.34	% at ELV
Overall Allowable uncertainty (no O_2) - at 95% Confidence	15.0	15.0	15.0	% at ELV
Result of Compliance with Uncertainty Requirement	**COMPLIANT**	**COMPLIANT**	**COMPLIANT**	-

	RUN 1	RUN 2	RUN 3	Units
Expanded uncertainty (with O_2) - at 95% Confidence	N/A	N/A	N/A	% of Value
Expanded uncertainty (with O_2) - at 95% Confidence	N/A	N/A	N/A	% at ELV
Overall Allowable uncertainty (with O_2) - at 95% Confidence	N/A	N/A	N/A	% at ELV
Result of Compliance with Uncertainty Requirement	**N/A**	**N/A**	**N/A**	-

Requirement for SRM is that Uncertainty should be <15% of the value at the ELV, on a dry gas basis, or if O_2 correction is applied less than 15% + the uncertainty associated with the O_2 correction (using sqrt of sum squares to add uncertainty components).

APPENDIX 2

OXIDES OF NITROGEN (as NO_2): RESULTS SUMMARY

Arran Chemical Company Limited, Athlone
A2-3 RTO

Sample Runs

Parameter	Units	Run 1		Mean
Raw Concentration	ppm	30.70		30.70
Concentration	mg/m³	63.00		63.00
Uncertainty	±mg/m³	2.92		2.92
Mass Emission	g/hr	108.1		108.1
Uncertainty	±g/hr	8.4		8.4

General Sampling Information

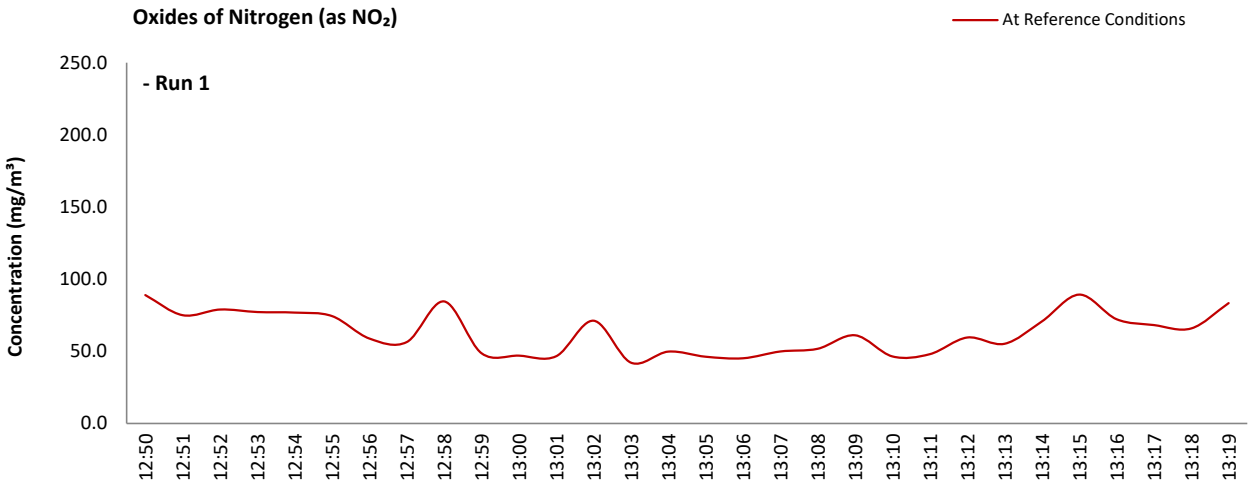
Parameter	Value	
Standard	EN 14792	
Technical Procedure	CAT-TP-39	
Probe Material	Stainless Steel	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Date & Result of Last Converter Check	21/02/2023 - 96.7%	
Span Gas Type	Nitrogen Monoxide	
Span Gas Reference Number	12.0519	
Span Gas Expiry Date	24/03/2025	
Span Gas Start Pressure (bar)	150	
Gas Cylinder Concentration (ppm)	412.8	NOTE: Dilution performed to achieve correct span value
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

Reference Conditions

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

OXIDES OF NITROGEN (as NO_2): DATA TREND

Graphical Trend of Data



OXIDES OF NITROGEN (as NO_2): SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	12:50 - 13:20
Sampling Dates	-	13/04/2023
Instrument Range	ppm	250
Span Gas Value	ppm	121.8

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	N/A
Allowable Temperature	< °C	N/A
Temperature Acceptable	-	N/A

	Zero Drift	Units	Run 1
CAL 1	Zero at Analyser (Pre)	ppm	0.00
CAL 1	Zero at Analyser (Post)	ppm	0.10
CAL 1	Zero Drift	ppm	0.10
CAL 1	Zero Drift	%	0.08
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Zero Drift	± %	5.00
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span at Analyser (Pre)	ppm	121.82
CAL 1	Span at Analyser (Post)	ppm	123.20
CAL 1	Span Drift	ppm	1.38
CAL 1	Zero Adj. Span Drift	%	1.05
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Span Drift	± %	5.00
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	11 - 12

Method Deviations

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

APPENDIX 2

OXIDES OF NITROGEN (as NO_2): MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	250.0		mg/m³ (REF)
Allowable MU	10.0		%
Measured concentration	63.00		mg/m³ (STP, dry)
Ratio NO / NO_2	5		%
Range Used	250.0		ppm
Range Used [A]	513.1		mg/m³
Cal gas conc.	121.8		ppm
Conversion	2.05		ppm to mg/m³
MCERTS Range [B]	205.0		mg/m³
Lower of [A] or [B]	205.0		mg/m³
Cal gas conc.	250.0		mg/m³

Performance characteristics	RUN 1		Units
Response time	31		seconds
Number of readings in measurement	30		-
Repeatability at zero	0.00		% full scale
Repeatability at span level	0.10		% full scale
Deviation from linearity	0.39		% of value
Zero drift	0.08		% full scale
Span drift	1.05		% full scale
Volume or pressure flow dependence	0.10		% of full scale
Atmospheric pressure dependence	0.10		% of value/kPa
Ambient temperature dependence	0.04		% full scale/10K
Combined interference	0.63		% range
Dependence on voltage	-0.23		% full scale/10V
Converter efficiency	96.7		%
Losses in the line (leak)	0.84		% of value
Uncertainty of calibration gas blending	1.40		% 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/m³
Standard deviation of repeatability at span level	0.02		mg/m³
Lack of fit	0.46		mg/m³
Drift	0.00		mg/m³
Volume or pressure flow dependence	0.00		mg/m³
Atmospheric pressure dependence	0.06		mg/m³
Ambient temperature dependence	0.01		mg/m³
Combined interference (from MCERTS Certificate)	0.75		mg/m³
Dependence on voltage	-0.03		mg/m³
Converter efficiency	0.06		mg/m³
Losses in the line (leak)	0.30		mg/m³
Uncertainty of calibration gas blending	0.51		mg/m³
Uncertainty of calibration gas	0.73		mg/m³

			RUN 1		Units
Measurement uncertainty		**Result**	63.00		mg/m³
Combined uncertainty			1.49		mg/m³
Expanded uncertainty	k =	1.96	2.92		mg/m³
Uncertainty corrected to std conds. (O_2)			2.92		mg/m³ (REF)

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	4.63		% of Value
Expanded uncertainty (no O_2) - at 95% Confidence	1.17		% at ELV
Overall Allowable uncertainty (no O_2) - at 95% Confidence	10.0		% 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 <10% of the value at the ELV, on a dry gas basis, or if O_2 correction is applied less than 10% + the uncertainty associated with the O_2 correction (using sqrt of sum squares to add uncertainty components).

APPENDIX 2

CARBON DIOXIDE: RESULTS SUMMARY

Arran Chemical Company Limited, Athlone
A2-3 RTO

Sample Runs

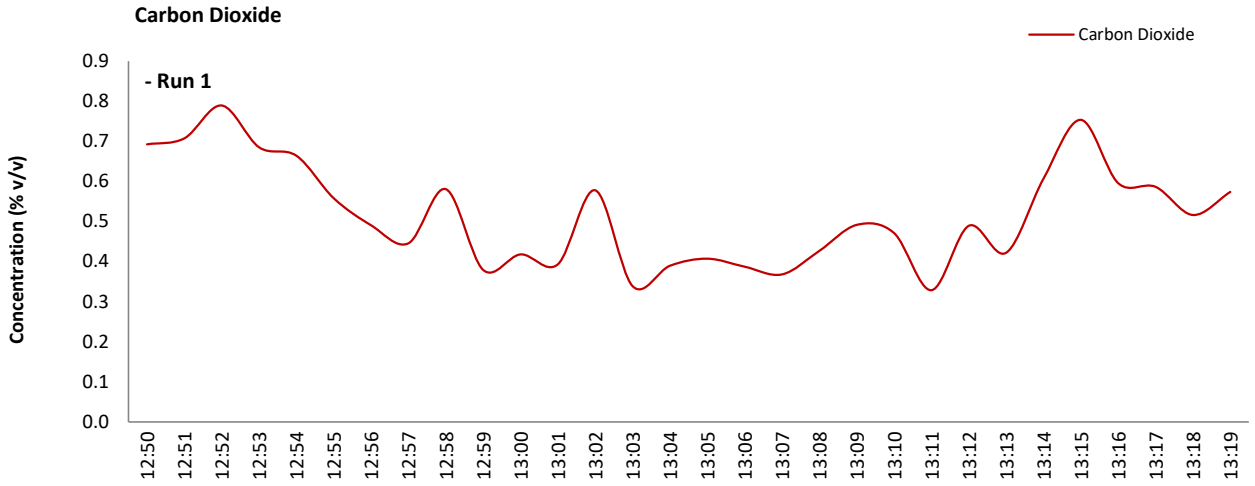
Parameter	Units	Run 1		Mean
Concentration	% v/v	0.52		0.52
Uncertainty	±% v/v	0.23		0.23

General Sampling Information

Parameter	Value	
Standard	CEN/TS 17405	
Technical Procedure	CAT-TP-39	
Probe Material	Stainless Steel	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Carbon Dioxide	
Span Gas Reference Number	6.0067	
Span Gas Expiry Date	19/05/2026	
Span Gas Start Pressure (bar)	100	
Gas Cylinder Concentration (% v/v)	16.25	
Span Gas Uncertainty (%)	2.00	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

CARBON DIOXIDE: DATA TREND

Graphical Trend of Data



APPENDIX 2

CARBON DIOXIDE: SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	12:50 - 13:20
Sampling Dates	-	13/04/2023
Instrument Range	% v/v	20
Span Gas Value	% v/v	16.3

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	N/A
Allowable Temperature	< °C	N/A
Temperature Acceptable	-	N/A

	Zero Drift	Units	Run 1
CAL 1	Zero Down Sampling Line (Pre)	% v/v	0.00
CAL 1	Zero Down Sampling Line (Post)	% v/v	0.02
CAL 1	Zero Drift	% v/v	0.02
CAL 1	Zero Drift	%	0.12
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Zero Drift	± %	5.00
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span Down Sampling Line (Pre)	% v/v	16.15
CAL 1	Span Down Sampling Line (Post)	% v/v	16.21
CAL 1	Span Drift	% v/v	0.06
CAL 1	Zero Adj. Span Drift	%	0.25
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Span Drift	± %	5.00
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	11 - 12

Method Deviations

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

APPENDIX 2

CARBON DIOXIDE: MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	N/A		%vol
Allowable MU	25.0		%
Measured concentration	0.52		%vol
Range Used	20.0		%vol
Cal gas conc.	16.3		%vol

Performance characteristics	RUN 1		Units
Response time	29		seconds
Number of readings in measurement	30		-
Repeatability at zero	0.00		% full scale
Repeatability at span level	0.10		% full scale
Deviation from linearity	0.85		% of value
Zero drift	0.12		% full scale
Span drift	0.25		% full scale
Volume or pressure flow dependence	0.10		% of full scale
Atmospheric pressure dependence	0.30		% of value/kPa
Ambient temperature dependence	-0.20		% full scale/10K
Combined interference	0.00		% range
Dependence on voltage	0.40		% full scale/10V
Losses in the line (leak)	0.62		% 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		%vol
Standard deviation of repeatability at span level	0.02		%vol
Lack of fit	0.10		%vol
Drift	0.00		%vol
Volume or pressure flow dependence	0.00		%vol
Atmospheric pressure dependence	0.02		%vol
Ambient temperature dependence	-0.03		%vol
Combined interference (from MCERTS Certificate)	0.00		%vol
Dependence on voltage	0.05		%vol
Losses in the line (leak)	0.00		%vol
Uncertainty of calibration gas	0.01		%vol

			RUN 1		Units
Measurement uncertainty		**Result**	0.52		%vol
Combined uncertainty			0.12		%vol
Expanded uncertainty	k =	1.96	0.23		%vol

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	43.63		% of Value

APPENDIX 2

OXYGEN: RESULTS SUMMARY

Arran Chemical Company Limited, Athlone
A2-3 RTO

Sample Runs

Parameter	Units	Run 1		Mean
Concentration	% v/v	20.11		20.11
Uncertainty	±% v/v	0.47		0.47

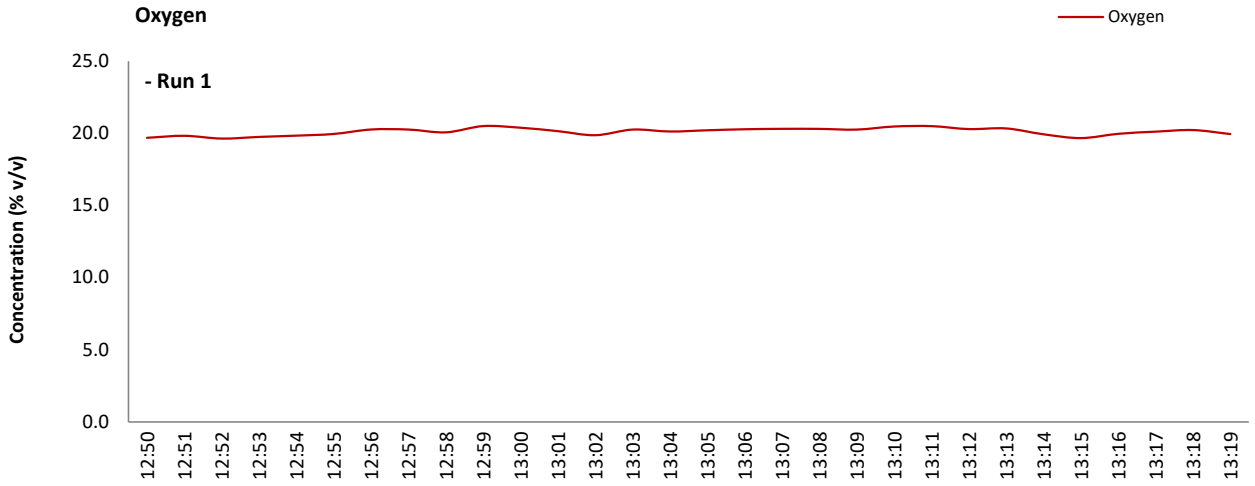
General Sampling Information

Parameter	Value	
Standard	EN 14789	
Technical Procedure	CAT-TP-39	
Probe Material	Stainless Steel	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Synthetic Air (5 Grade)	
Span Gas Reference Number	11.0533	
Span Gas Expiry Date	10/06/2027	
Span Gas Start Pressure (bar)	150	
Gas Cylinder Concentration (% v/v)	21.09	NOTE: Dilution performed to achieve correct span value
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1 / 1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1 / 1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

APPENDIX 2

OXYGEN: DATA TREND

Graphical Trend of Data



APPENDIX 2

OXYGEN: SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	12:50 - 13:20
Sampling Dates	-	13/04/2023
Instrument Range	% v/v	25.0
Span Gas Value	% v/v	21.1

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	N/A
Allowable Temperature	< °C	N/A
Temperature Acceptable	-	N/A

	Zero Drift	Units	Run 1
CAL 1	Zero at Analyser (Pre)	% v/v	0.00
CAL 1	Zero at Analyser (Post)	% v/v	-0.08
CAL 1	Zero Drift	% v/v	-0.08
CAL 1	Zero Drift	%	0.38
CAL 1	Drift Correction Applied	2-5%	No
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span at Analyser (Pre)	% v/v	21.09
CAL 1	Span at Analyser (Post)	% v/v	20.92
CAL 1	Span Drift	% v/v	-0.17
CAL 1	Zero Adj. Span Drift	%	0.43
CAL 1	Drift Correction Applied	2-5%	No
	Allowable Span Drift	± %	5.00
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	11 - 12

Method Deviations

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

APPENDIX 2

OXYGEN: MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	N/A		%vol
Allowable MU	6.0		%
Measured concentration	20.11		%vol
Range Used	25.0		%vol
Cal gas conc.	21.1		%vol

Performance characteristics	RUN 1		Units
Response time	41		seconds
Number of readings in measurement	30		-
Repeatability at zero	0.02		% full scale
Repeatability at span level	0.02		% full scale
Deviation from linearity	0.04		% of value
Zero drift	-0.38		% full scale
Span drift	-0.43		% full scale
Volume or pressure flow dependence	0.10		% of full scale
Atmospheric pressure dependence	0.19		% of value/kPa
Ambient temperature dependence	-0.21		% full scale/10K
Combined interference	0.00		% range
Dependence on voltage	0.02		% full scale/10V
Losses in the line (leak)	0.43		% 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		%vol
Standard deviation of repeatability at span level	0.00		%vol
Lack of fit	0.01		%vol
Drift	0.00		%vol
Volume or pressure flow dependence	0.00		%vol
Atmospheric pressure dependence	0.01		%vol
Ambient temperature dependence	-0.03		%vol
Combined interference (from MCERTS Certificate)	0.00		%vol
Dependence on voltage	0.00		%vol
Losses in the line (leak)	0.05		%vol
Uncertainty of calibration gas	0.23		%vol

			RUN 1		Units
Measurement uncertainty		**Result**	20.11		%vol
Combined uncertainty			0.24		%vol
Expanded uncertainty	k =	1.96	0.47		%vol

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	2.34		% of Value
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be 0.3% vol absolute or 6% relative whichever is the lower, on a dry gas basis. Source, EN 14789.

VERSION HISTORY

Version Number	Record of changes made within this version of the document
V1	The original document issued to the client
V2	Removed Blank pages from the report

Element Materials Technology
Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

P: +44 (0) 1244 833780
F: +44 (0) 1244 833781
W: www.element.com

Element
Unit D8, North City Business Park
North Road
Finglas
Dublin 11
Ireland
D02 EK8

Attention :	Dónal Ó Faogáin
Date :	15th May, 2023
Your reference :	EMT05627
Our reference :	Test Report 23/6655 Batch 1
Location :	Dublin
Date samples received :	28th April, 2023
Status :	Final Report
Issue :	1

Two samples were received for analysis on 28th April, 2023 of which two were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Phil Sommerton BSc
Senior Project Manager

Element Materials Technology

Client Name:	**Element**		
Reference:	**EMT05627**	**Sample Date:**	**13 Apr 2023**
Location:	**Dublin**	**Date of Receipt:**	**28 Apr 2023**
Contact:	**Dónal Ó Faogáin**	**Date Analysed:**	**15 May 2023**

Sample ID: **1.1 EMT05627-B|A2-3**
Depth:
EMT Job No: **23/6655**
EMT Sample No: **1**
Matrix: **Stack**
Method: **TM201/PM137 Dioxins, Furans and PCBs in Stationary Source Emissions**

ANALYSIS OF PCDDs and PCDFs

Q : Qualifiers

SV Indicates surrogate recovery outside performance criteria
>> Indicates value exceeds calibration range

Key

LOD Limit of Detection
ISO 17025 (UKAS)
M MCERTS accredited

CAS No		Compound	Q	Result ng/sample	LOD	I-TEFs	TEQ Lower Bound	TEQ Upper Bound	% Recovery
1746-01-6	#M	2378-TCDD		<0.00043	0.00043	1	0.00000	0.00043	84
40321-76-4	#M	12378-PCDD		<0.00128	0.00128	1	0.00000	0.00128	74
39227-28-6	#M	123478-HxCDD		<0.00108	0.00108	0.1	0.00000	0.00011	74
57653-85-7	#M	123678-HxCDD		<0.00106	0.00106	0.1	0.00000	0.00011	69
19408-74-3	#M	123789-HxCDD		<0.00109	0.00109	0.1	0.00000	0.00011	
35822-46-9	#M	1234678-HpCDD		0.00440	0.00070	0.01	0.00004	0.00004	74
3268-87-9	#M	OCDD		0.02395	0.00092	0.0003	0.00001	0.00001	86
51207-31-9	#M	2378-TCDF		<0.00119	0.00119	0.1	0.00000	0.00012	63
57117-41-6	#M	12378-PCDF		<0.00089	0.00089	0.03	0.00000	0.00003	103
57117-31-4	#M	23478-PCDF		<0.00090	0.00090	0.3	0.00000	0.00027	68
70648-26-9	#M	123478-HxCDF		<0.00055	0.00055	0.1	0.00000	0.00006	81
57117-44-9	#M	123678-HxCDF		<0.00058	0.00058	0.1	0.00000	0.00006	75
60851-34-5	#M	234678-HxCDF		<0.00075	0.00075	0.1	0.00000	0.00007	64
72918-21-9	#M	123789-HxCDF		<0.00082	0.00082	0.1	0.00000	0.00008	101
67562-39-4	#M	1234678-HpCDF		0.00140	0.00038	0.01	0.00001	0.00001	69
55673-89-7	#M	1234789-HpCDF		<0.00044	0.00044	0.01	0.00000	0.00000	106
39001-02-0	#M	OCDF		0.00273	0.00057	0.0003	0.00000	0.00000	78
		Sum - TEQ					0.00006	0.00279	

Upper-Bound: 'Upper-bound' means the concept which requires using the limit of quantification for the contribution of each non-quantified congener
Lower-Bound: 'Lower-bound' means the concept which requires using zero for the contribution of each non-quantified congener
TEQ: Toxic Equivalent Value
TEF: Toxic Equivalent Factor

Element Materials Technology

Client Name:	**Element**		
Reference:	**EMT05627**	**Sample Date:**	**13 Apr 2023**
Location:	**Dublin**	**Date of Receipt:**	**28 Apr 2023**
Contact:	**Dónal Ó Faogáin**	**Date Analysed:**	**15 May 2023**

Sample ID: **1.2 EMT05627-R1|A2-3**
Depth:
EMT Job No: **23/6655**
EMT Sample No: **2**
Matrix: **Stack**
Method: **TM201/PM137 Dioxins, Furans and PCBs in Stationary Source Emissions**

ANALYSIS OF PCDDs and PCDFs

Q : Qualifiers

SV Indicates surrogate recovery outside performance criteria
>> Indicates value exceeds calibration range

Key

LOD Limit of Detection
ISO 17025 (UKAS)
M MCERTS accredited

CAS No		Compound	Q	Result ng/sample	LOD	I-TEFs	TEQ Lower Bound	TEQ Upper Bound	% Recovery
1746-01-6	#M	2378-TCDD		<0.00055	0.00055	1	0.00000	0.00055	94
40321-76-4	#M	12378-PCDD		<0.00178	0.00178	1	0.00000	0.00178	78
39227-28-6	#M	123478-HxCDD		<0.00114	0.00114	0.1	0.00000	0.00011	79
57653-85-7	#M	123678-HxCDD		<0.00119	0.00119	0.1	0.00000	0.00012	75
19408-74-3	#M	123789-HxCDD		<0.00122	0.00122	0.1	0.00000	0.00012	
35822-46-9	#M	1234678-HpCDD		0.00600	0.00073	0.01	0.00006	0.00006	76
3268-87-9	#M	OCDD		0.02099	0.00131	0.0003	0.00001	0.00001	86
51207-31-9	#M	2378-TCDF		<0.00136	0.00136	0.1	0.00000	0.00014	69
57117-41-6	#M	12378-PCDF		<0.00122	0.00122	0.03	0.00000	0.00004	100
57117-31-4	#M	23478-PCDF		<0.00123	0.00123	0.3	0.00000	0.00037	70
70648-26-9	#M	123478-HxCDF		<0.00089	0.00089	0.1	0.00000	0.00009	80
57117-44-9	#M	123678-HxCDF		<0.00095	0.00095	0.1	0.00000	0.00010	75
60851-34-5	#M	234678-HxCDF		<0.00130	0.00130	0.1	0.00000	0.00013	62
72918-21-9	#M	123789-HxCDF		<0.00143	0.00143	0.1	0.00000	0.00014	101
67562-39-4	#M	1234678-HpCDF		0.00503	0.00042	0.01	0.00005	0.00005	75
55673-89-7	#M	1234789-HpCDF		0.00084	0.00049	0.01	0.00001	0.00001	97
39001-02-0	#M	OCDF		0.00474	0.00058	0.0003	0.00000	0.00000	77
		Sum - TEQ					0.00013	0.00382	

Upper-Bound: 'Upper-bound' means the concept which requires using the limit of quantification for the contribution of each non-quantified congener
Lower-Bound: 'Lower-bound' means the concept which requires using zero for the contribution of each non-quantified congener
TEQ: Toxic Equivalent Value
TEF: Toxic Equivalent Factor

Element Materials Technology

Notification of Deviating Samples

Client Name: Element
Reference: EMT05627
Location: Dublin
Contact: Dónal Ó Faogáin

Matrix : Stack

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
23/6655	1	1.1 EMT05627-B|A2-3		1	DIOXIN_FURAN	Sample holding time exceeded
23/6655	1	1.2 EMT05627-R1|A2-3		2	DIOXIN_FURAN	Sample holding time exceeded

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.
Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 23/6655

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 37°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.
Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above quantitative calibration range. The result should be considered the minimum value and is indicative only. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

EMT Job No: 23/6655

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM201	Dioxins, Furans and PCBs in Stationary Source Emissions	PM137	Extraction and clean-up of Dioxins (PCDDs), Furans (PCDFs) and dioxin-like PCBs using accelerator solvent extractor and clean up system			AR	
TM201	Dioxins, Furans and PCBs in Stationary Source Emissions	PM137	Extraction and clean-up of Dioxins (PCDDs), Furans (PCDFs) and dioxin-like PCBs using accelerator solvent extractor and clean up system	Yes	Yes	AR	

Job Number:	ET05627
Date:	13/04/2023
Completed By:	Donal O Faogain

Location / Site:	EPA Arran Chemicals	**Stack / Work Area:**	RTO/CAU
Fire Alarm	Yes	Platform Inspection? (details)	
Chemical Alarm	No	Stack Pressure (+ve/-ve)	Pos
Intrinsically Safe Area	Yes	Stack Gas Composition	Combustion Gas
Hygiene Regulations	Yes	Emergency Procedure	Follow site rules

Who / what is at risk: W = Worker, P = Passers by / visitors, A = Assets, E = Environment

Activity	Hazard	Who is at risk?	Risk severity as found			Control measures	Risk severity after controls		
			L	S	R		L	S	R
General Site Hazards	Van Access	W, P, A	2	3	6	• Follow site routes • No mobile phone use whilst driving • Follow site speed limits • Hazard perception training completed	1	3	3
General Site Hazards	Pedestrian Access	W	2	2	4	• Follow site access routes - obey signage • No mobile phone use whilst walking • High Viz vest • Safety Boots	1	2	2
General Site Hazards	Noise	W	2	4	8	• Ear defenders available as required • Limit time in noisy area as far as possible	1	4	4
General Site Hazards	Site Traffic	W, A	2	3	6	• High viz vests • Stick to Walkways • Don't use mobile phones whilst walking	2	3	6
Unloading Vehicle	Manual handling	W, A	2	3	6	• Sensible packing of vans • Gloves worn during all manual handling • Steel toe cap boots worn at all times • Trolley for carrying on unobstructed routes	2	3	6
Work Location Assessment	Permanent platform	W, P, A	2	3	6	• Platform inspection record available • Acceptable and safe platform size • Pre-use check • Boots and Gloves worn • Consideration of weather - wind and rain	2	3	6
Work Location Assessment	Ground Level	W, P	2	2	4	• Consideration to passers by - barrier area off	1	2	2
Work Location Assessment	Outdoors	W, P, A	2	2	4	• Consideration to passers by - barrier area off	1	2	2
Work at Height	Falling Objects	W, P, A	2	3	6	• Tool Lanyards used • Tool Mats used • Area under stack cordoned off with signage • Hard Hats worn	1	3	3

Activity	Hazard	Who is at risk?	Risk severity as found			Control measures	Risk severity after controls		
			L	S	R		L	S	R
Access Provision	Stairs	P	2	3	6	• Handrails used • Safety Boots and Gloves worn	1	3	3
Access Provision	Rope Lifts	W	2	2	4	• SSW for Lifting followed • Area Cordoned off • Warning Signs out • Gloves worn	2	2	4
Breaking into ducts	Positive pressure	W, P, A	2	2	4	• Establish pressure and temperature of stack • Open from side • Seal at all possible times • Safety Glasses and Gloves worn	2	2	4
Breaking into ducts	High Temperature	W	2	2	4	• Ensure enough space to work safely • Long Sleaves worn • Temperature resistant gloves worn	2	2	4
Manual Sampling	Electrical Power	W	1	3	3	• All equipment PAT tested • 110v used • Cables routed to avoid trip hazards	2	3	6
Analyser Sampling	Use of compressed gases	W	2	5	10	• Regulators inspected and in date • Gases tied up or in racks • Safety Glasses worn during use	2	3	6
Analyser Sampling	Use of Fuel Gas	w	2	4	8	• Regulator inspected and in date • Gas tied up or in rack • Safety Glasses worn during use	2	3	6
Analyser Sampling	Electrical Power	w	1	3	3	• All equipment PAT tested • 110v used • Cables routed to avoid trip hazards	2	3	6
Sample train preparation and recovery	In van	w	1	3	3	• Sufficient space to work safely • Doors opened suffiently for ventilation • Spill kit available	2	3	6

Point of Work Hazards Identified & Additional Controls

Who / what is at risk: W = Worker, P = Passers by / visitors, A = Assets, E = Environment

Activity	Hazard	Who is at risk?	Risk severity as found			Control measures	Risk severity after		
			L	S	R		L	S	R

Name/s of Persons at Risk:	Position	Date:13/04/2023 (sign below)	Date:14/04/2023 (sign below)	Date: (sign below)	Date: (sign below)	Date: (sign below)	Date: (sign below)	Date: (sign below)
Donal O Faogain	TL							
James O'Connor	Tech							

		Hazard Severity				
		Negligible (N) - 1	Slight (S) - 2	Moderate (M) - 3	High (H) - 4	Very High (VH) - 5
	Effects on people >	Negligible injury, no absence from work.	Minor injury requiring first aid treatment or headache, nausea, dizziness, mild rashes.	Injury leading to a lost time accident. Early stages of HAVs, Noise, Respiratory, Skin diseases	Involving a serious / life changing injury. Advanced stages of HAVs, Noise, Respiratory, Skin diseases.	Death or Multiple Deaths.
	Effect on Production, Process, Assets, or Reputation >	Negligible loss of function or production with no damage to equipment.	Loss of production or minor damage to equipment requiring minor repair.	Localised damage to equipment requiring extensive repair, significant loss of function/production. Reputation of company may be affected in certain	Damage to equipment resulting in production shutdown and significant loss of process. Significant impact on reputation of company.	Extensive damage to equipment resulting in total loss and total loss of production or process. Reputation of company impacted within business community.
	Effect on the environment >	Negligible impact to the environment.	Impact to the environment.	Moderate pollution incurring some restitution costs.	Severe pollution with short term localised implications incurring significant restitution costs.	Major pollution with long term implication and very high restitution costs
Likelihood of Occurrence	**Very Unlikely (VU) - 1** A freak combination of factors would be required for an accident or incident to result.	1	2	3	4	5
	Unlikely (U) - 2 A rare combination of factors would be required for an accident or incident to result.	2	4	6	8	10
	Possible (P) - 3 Could happen when additional factors are present but otherwise unlikely to occur.	3	6	9	12	15
	Likely (L) - 4 Not certain to happen but an additional factor may result in an accident or incident.	4	8	12	16	20
	Very Likely (VL) - 5 Almost inevitable that an accident or incident would result.	5	10	15	20	25

LOW RISK	MEDIUM RISK	HIGH RISK
May be acceptable, however, review task to see if the risk can be reduced further.	Task should only proceed with appropriate management authorisation after consultation with Safety Representative. Where possible the job should be redefined to take account of the hazards involved or the risk should be reduced further with additional control measures.	Task must not proceed. It should be redefined or further control measures put in place to reduce the risks. The controls should be re-assessed for adequacy prior to commencing with the work.

CERTIFICATE OF ANALYSIS

MSSL reference: 23-53619

Report date: 15-05-2023

Customer: Element MTE UK Ltd Dublin
Unit D8
North City Business Park
North Road
Ireland

Customer contact(s): donal.ofaogain@element.com
dublin.samples@element.com

Customer reference: EMT05627
Customer PO: -
Customer sampling date: 13, 14-04-2023
Date received: 03-05-2023

Analysis started: 04-05-2023
Analysis complete: 15-05-2023
Conforming: Yes

Results only relate to the items tested. Results apply to the samples as received.

Conformance is contingent upon accurate information being provided by the customer and customer compliance with relevant sample handling and storage conditions prior to receipt at the laboratory.

All opinions and interpretations expressed within this report are outside Marchwood's scope of accreditation.

Accreditation Key:

Y : ISO 17025 UKAS M : MCERTS
N : Non Accredited (S) : Subcontracted

Notes:

Reported by: Sing Liem
Position: Senior Analytical Chemist

Approved by: Sebastian Dahl
Position: Laboratory Manager
For/on behalf of Marchwood Scientific Services Ltd

1668

t: 0161 703 9170 w: www.cawood.co.uk/marchwood
Marchwood, Unit 5, 60 Smithfold Lane, Worsley, Gr Manchester M28 0GP
www.cawood.co.uk

Analysis of target VOC(s) from charcoal tube(s) (226-01) by GC/MS (solvent desorption) (WI 3042) - front sections

MSSL sample ref:	23-53619-001	23-53619-002
Customer sample ref:	1.1 EMT05627-B | Blank Tube | Target ed Organics | A2-3	1.2 EMT05627-R1 | Tube | Target ed Organics | A2-3

Determinand	Units	LOD	Acc.		
Ethanol	µg	2.0	Y	<2.0	<2.0
Isopropanol	µg	2.0	Y	<2.0	<2.0
Methyl tert butyl ether	µg	0.5	M	<0.5	**19**
Toluene	µg	0.5	M	<0.5	**1.0**
Acetonitrile	µg	10	N	<10	<10
Tetrahydrofuran	µg	1.0	N	<1.0	<1.0
2-Methyltetrahydrofuran	µg	1.0	N	<1.0	<1.0
Heptane	µg	1.0	N	<1.0	**5.9**

Analysis of target VOC(s) from charcoal tube(s) (226-01) by GC/MS (solvent desorption) (WI 3042) - back section

MSSL sample ref:	23-53619-002
Customer sample ref:	1.2 EMT05627-R1 | Tube | Target ed Organics | A2-3

Determinand	Units	LOD	Acc.	
Ethanol	µg	2.0	Y	<2.0
Isopropanol	µg	2.0	Y	<2.0
Methyl tert butyl ether	µg	0.5	M	<0.5
Toluene	µg	0.5	M	<0.5
Acetonitrile	µg	10	N	<10
Tetrahydrofuran	µg	1.0	N	<1.0
2-Methyltetrahydrofuran	µg	1.0	N	<1.0
Heptane	µg	1.0	N	<1.0

Analysis of target VOC(s) from silica gel tube(s) (226-10) by GC/MS (solvent desorption) - front sections

MSSL sample ref:	23-53619-003	23-53619-004
Customer sample ref:	1.3 EMT05627-B | Blank Tube | Methanol | A2-3	1.4 EMT05627-R1 | Tube | Methanol | A2-3

Determinand	Units	LOD	Acc.		
Methanol	µg	10	N	<10	<10

Analysis of target VOC(s) from silica gel tube(s) (226-10) by GC/MS (solvent desorption) - back section

MSSL sample ref:	23-53619-004
Customer sample ref:	1.4 EMT05627-R1 | Tube | Methanol | A2-3

Determinand	Units	LOD	Acc.	
Methanol	µg	10	N	<10

Analysis of target VOC(s) from charcoal tube(s) (226-01) by GC/MS (solvent desorption) - front sections

MSSL sample ref:	23-53619-005	23-53619-006
Customer sample ref:	1.5 EMT05627-B | Blank Tube | DMF | A2-3	1.6 EMT05627-R1 | Tube | DMF | A2-3

Determinand	Units	LOD	Acc.		
Dimethylformamide	µg	10	N	<10	<10

Analysis of target VOC(s) from charcoal tube(s) (226-01) by GC/MS (solvent desorption) - back section

MSSL sample ref:	23-53619-006
Customer sample ref:	1.6 EMT05627-R1 | Tube | DMF | A2-3

Determinand	Units	LOD	Acc.	
Dimethylformamide	µg	10	N	<10

Analysis of target VOC(s) from charcoal tube(s) (226-01) by GC/MS (solvent desorption) (WI 3042 & 3048) - front sections

MSSL sample ref:	23-53619-007	23-53619-008
Customer sample ref:	1.7 EMT05627-B | Blank Tube | Charcoal (Specific) | A2-2	1.8 EMT05627-R1 | Tube | Charcoal (Specific) | A2-2

Determinand	Units	LOD	Acc.		
Ethanol	µg	2.0	Y	<2.0	<2.0
Acetone	µg	0.5	Y	**3.1**	**0.9**
Isopropanol	µg	2.0	Y	<2.0	<2.0
Hexane	µg	0.5	M	<0.5	<0.5
Methyl ethyl ketone	µg	0.5	M	<0.5	<0.5
Ethyl acetate	µg	0.5	M	<0.5	<0.5
Benzene	µg	0.5	M	<0.5	<0.5
Methyl isobutyl ketone	µg	0.5	M	<0.5	<0.5
Toluene	µg	0.5	M	<0.5	<0.5
m/p-Xylene	µg	1.0	M	<1.0	<1.0
o-Xylene	µg	0.5	M	<0.5	<0.5
Dichloromethane	µg	10	Y	<10	<10
Chloroform	µg	1.0	M	<1.0	<1.0
Carbon tetrachloride	µg	1.0	M	<1.0	<1.0
Trichloroethylene [(1)]	µg	1.0	N	<1.0	<1.0
Tetrachloroethylene	µg	1.0	N	<1.0	<1.0
Tetrahydrofuran	µg	1.0	N	<1.0	<1.0
Heptane	µg	1.0	N	<1.0	<1.0
Cyclohexane	µg	1.0	N	<1.0	<1.0
Cyclohexanone	µg	1.0	N	<1.0	<1.0

[(1)] This is a known breakdown product of 1,1,2,2-tetrachloroethane.

Analysis of target VOC(s) from charcoal tube(s) (226-01) by GC/MS (solvent desorption) (WI 3042 & 3048) - back section

MSSL sample ref:	**23-53619-008**
Customer sample ref:	**1.8 EMT05627-R1 | Tube | Charcoal (Specific) | A2-2**

Determinand	Units	LOD	Acc.	
Ethanol	µg	2.0	Y	<2.0
Acetone	µg	0.5	Y	**3.0**
Isopropanol	µg	2.0	Y	<2.0
Hexane	µg	0.5	M	<0.5
Methyl ethyl ketone	µg	0.5	M	<0.5
Ethyl acetate	µg	0.5	M	<0.5
Benzene	µg	0.5	M	<0.5
Methyl isobutyl ketone	µg	0.5	M	<0.5
Toluene	µg	0.5	M	<0.5
m/p-Xylene	µg	1.0	M	<1.0
o-Xylene	µg	0.5	M	<0.5
Dichloromethane	µg	10	Y	<10
Chloroform	µg	1.0	M	<1.0
Carbon tetrachloride	µg	1.0	M	<1.0
Trichloroethylene [(1)]	µg	1.0	N	<1.0
Tetrachloroethylene	µg	1.0	N	<1.0
Tetrahydrofuran	µg	1.0	N	<1.0
Heptane	µg	1.0	N	<1.0
Cyclohexane	µg	1.0	N	<1.0
Cyclohexanone	µg	1.0	N	<1.0

[(1)] This is a known breakdown product of 1,1,2,2-tetrachloroethane.

WI 001 - Heavy metals

		Expanded Uncertainties (%)		
Determinand	**Matrix**	**Imp (HNO_3/H_2O_2)**	**Filter**	**Probe wash**
Beryllium		**7.4**	**9.0**	**9.0**
Titanium		**5.7**	**6.1**	**6.2**
Vanadium		**4.9**	**5.7**	**5.4**
Chromium		**5.1**	**11.3**	**5.5**
Manganese		**5.3**	**8.8**	**5.7**
Cobalt		**5.0**	**7.5**	**5.2**
Nickel		**6.3**	**13.1**	**5.7**
Copper		**6.1**	**5.5**	**5.4**
Zinc		**9.1**	**9.2**	**7.4**
Arsenic		**5.2**	**8.4**	**6.4**
Selenium		**5.5**	**7.9**	**5.9**
Cadmium		**5.0**	**5.0**	**3.8**
Tin		**5.5**	**7.2**	**5.8**
Antimony		**5.1**	**5.5**	**6.3**
Thallium		**6.5**	**7.2**	**6.9**
Lead		**5.3**	**6.5**	**5.7**

WI 002 - Ammonia

		Expanded Uncertainties (%)
Determinand	**Matrix**	**Imp (0.05M H_2SO_4)**
Ammonia		**7.2**

WI 003 - Anions

		Expanded Uncertainties (%)		
Determinand	**Matrix**	**Imp (D/I Water)**	**Imp (0.1M NaOH)**	**Imp (0.05M H_2SO_4)**
Hydrogen Fluoride		**6.3**	-	-
Hydrogen Chloride		**5.4**	-	-
Hydrogen Bromide		-	-	**6.0**
Chlorine		-	**9.2**	-
Bromine		-	**8.5**	-

WI 004 - Mercury

		Expanded Uncertainties (%)			
Determinand	**Matrix**	**Imp ($KMnO_4$)**	**Imp ($K_2Cr_2O_7$)**	**Filter**	**Probe wash**
Mercury		**8.5**	**7.0**	**13.8**	**9.3**

WI 005 - Particulates

		Expanded Uncertainties (mg)				
Determinand	**Matrix**	**47mm GFA**	**47mm QMA**	**110mm GFA**	**110mm QMA**	**Probe wash**
Particulates		**0.427**	**0.434**	**0.475**	**1.98**	**0.589**
Determinand	**Matrix**	**37mm GFA**	**37mm QMA**	-	-	-
Particulates		**0.207**	**0.203**	-	-	-

Conditioning temperatures for method WI005 are 180°C for preweight and 160°C for reweight

WI 007 - SO_2

		Expanded Uncertainties (%)
Determinand	**Matrix**	**Imp (0.3% H_2O_2)**
SO_2		**3.7**

WI 3048 - VOCs (SD)

		Expanded Uncertainties (%)
Determinand	**Matrix**	**Charcoal Tube**
Hexane		**21.8**
Methyl ethyl ketone		**24.8**
Ethyl acetate		**18.4**
Benzene		**17.8**
Methyl iso butyl ketone		**15.7**
Toluene		**11.1**
m/p-Xylene		**10.8**
o-Xylene		**15.1**
Chloroform		**17.7**
Carbon tetrachloride		**22.8**
Tetrachloroethylene		**18.6**

Process Details Form

List of solvents used per process (to be added to the solvent suite)

Emission point as per Licence		
A2-3	A2-2	
Toluene	DCM	
THF		
IPA		
MTBE		
Methanol		
Acetonitrile		
Heptane		
DMF		
Ethanol		
2 Methyl THF		

Process Details Form

Licensee	ARRAN CHEMICAL	Contractor	
Reg. Number	P0110-03		
Site Contact	SHANE NAUGHTON	Contractor's Contact	
Role	ENV SUPERVISOR	Role	
Signature	Shane Naughton	Signature	

Emission Point as per License	A2-3	A2-2	
Type of process	O Rotogravure printing	O Rotogravure printing	O Rotogravure printing
	O Cement plant	O Cement plant	O Cement plant
	O Electrical generation	O Electrical generation	O Electrical generation
	O Steam boiler	O Steam boiler	O Steam boiler
	~~O~~ Other: CHEMICAL MANUFACTURING	~~O~~ Other: CHEMICAL MANUFACTURING	O Other:
Load of Process (Rotogravure printing: the solvent type and content of the ink, the ink delivery rate, the press temperature, the status of abatement plant, printing rate (m/s), etc.; Cement plant: Clinker source and loading rate, fuel source and load rate; Power plant: Electrical generation (MW) and fuel; Cement, chemical or pharmaceutical plants: Rate of material processed (tons/ hour); General manufacturing processes: Rate of items processed per hour; Steam boilers: Percentage with regards maximum capacity where appropriate)			
Abatement system	O Bag filter	O Bag filter	O Bag filter
	O Electrostatic precipitator	O Electrostatic precipitator	O Electrostatic precipitator
	O Cyclone	O Cyclone	O Cyclone
	~~O~~ Thermal oxidiser	O Thermal oxidiser	O Thermal oxidiser
	O Active carbon bed	~~O~~ Active carbon bed	O Active carbon bed
	O NSCR	O NSCR	O NSCR
	O SCR	O SCR	O SCR
	O Dry scrubber	O Dry scrubber	O Dry scrubber
	~~O~~ Wet scrubber	~~O~~ Wet scrubber	O Wet scrubber
	O Lime injection	O Lime injection	O Lime injection
	O Biofilter	O Biofilter	O Biofilter
	O None	O None	O None
	O Other:	O Other:	O Other:

FOLLOW-UP ACTIONS

The licensee is required to complete the actions outlined in this site visit report within the specified timeframes. Where required, the licensee shall also respond to actions specified in Compliance Investigations and/or submit a response to this site visit report via the EDEN system. The licensee shall maintain a documentary evidence, for review by the Agency, that the prescribed actions were completed within the required timeframe.

(i) Compliance Investigations

The Agency may generate a Compliance Investigation through the EDEN system and issue instructions and actions to the licensee. The licensee will receive notification when an instruction or action is issued and the licensee must respond to the actions within the Compliance Investigation within the specified timeframe.

(ii) Response to Site Visit Report

Where the licensee is requested to (or wishes to) respond to the Agency in relation to this site visit report, the licensee may select the 'Make a Response' link on the Site Visits page in EDEN where a .pdf document containing the response can be attached and submitted. The response should include details of the actions taken by the licensee to address the issues raised in this site visit report and the target completion dates. This Licensee Public Response provides the licensee with an opportunity to inform both the Agency and the public about the implementing of actions set out in the Agency site visit report. The response must be submitted **within 21 calendar days** of the issue date of this site visit report.

(iii) Publication of Reports

This site visit report will be published on the EPA's website, www.epa.ie, 30 calendar days after the site visit report issue date.

Any licensee response to this site visit report will be published on the EPA's website simultaneously (i.e. 30 calendar days after the site visit report issue date).

Please note that licensees are required to comply with the conditions of the licence at all times, and where non-compliance occurs, compliance must be restored within the shortest possible time. These actions will be verified during subsequent Agency visits. Please quote the above Inspection Reference Number in any correspondence in relation this Report.