Report Title	Air Emissions Compliance Monitoring Emissions Report
Company address	Air Scientific Ltd., Unit 3 Westlink Business Park, Clondrinagh, Limerick, V94 K6XK
Contact Details	Phone: 061 324587
Stack Emissions Testing Report Commissioned by	Dawn Meats Ireland
Facility Name	Western Proteins
Contact Person	Brian Cloonan & Patrick Flynn
EPA Licence Number	P0048-03
Licence Holder	Dawn Meats Ireland
Stack Reference Number	A1-1, A2-1 & A2-2
Dates of the Monitoring Campaign	23/05/2023 & 09/06/2023
Job Reference Number	WEPRTL15230523
Report Written By	Mr. Michael Healy
Report Approved by	Claire Boylan
Stack Testing Team	Mr. Michael Healy & Mr. Stephen Finn
Report Date	12/07/2023
Report Type	Test Report Compliance Monitoring
Version	1
Signature of Approver	Claire Boylan. Senior Quality Technician

Contents

1.0 Executive Summary

1.1 Overall aim of the monitoring campaign

The aim of the monitoring campaign was to demonstrate compliance with a set of emission limit values as specified in the site licence.

1.2 Summary of substances to be monitored at each emission point:

Stack Name:	**A1-1**
Total Particulate Matter	
Oxygen	
Nitrogen Oxides (as NO_2)	
Sulphur Dioxide	
Carbon Dioxide	
Volumetric Flow Rate (Ref)	

Stack Name:	**A2-1**
Hydrogen Sulphide	
Mercaptans	
Amines	
Ammonia	

Stack Name:	**A2-2**
Hydrogen Sulphide	
Mercaptans	
Amines	
Ammonia	

1.3 Special Requirements

There were no special requirements.

1.4 Summary of Results

Emission Point Number: A1-1

Parameter	Method	Units	Result	MU +/-	Limit	O_2 Ref. (%)	Moisture Ref. (%)	Blanks	Date	Time on	Time off	Accreditation	
												Sampling	Analysis
Total Particulate Matter (TPM)	EN13284	$mg.m^{-3}$	8.78	0.53	50	3	Dry	<1.08	23/05/2023	12:10	12:44	Yes	Yes
Volumetric Flow Rate (Ref)	EN 16911	$m^3.hr^{-1}$	6,120	1,596	25,000	3	Dry	N/a	23/05/2023	12:10	12:44	Yes	N/a
Nitrogen Oxides	EN 14792	$mg.m^{-3}$	351.7	21.1	450	3	Dry	N/a	23/05/2023	11:06	11:36	Yes	N/a
Sulphur Dioxide	EN/TS 17021	$mg.m^{-3}$	3.5	1.9	1700	3	Dry	N/a	23/05/2023	11:06	11:36	Yes	N/a
Carbon Monoxide	EN 15058	$mg.m^{-3}$	3.5	2.1	80	3	Dry	N/a	23/05/2023	11:06	11:36	Yes	N/a
Carbon Dioxide	EN/TS 17045	vol%	10.70	0.3	N/a	N/a	Dry	N/a	23/05/2023	11:06	11:36	Yes	N/a
Oxygen	EN 14789	vol%	4.42	0.3	N/a	N/a	Dry	N/a	23/05/2023	11:06	11:36	Yes	N/a

Note 1: All results are normalised to standard temperature and pressure ($0^{O}C$ and 101.3kPa)
Note 2: All results are reported in the format as defined by the EPA in guidance note AG2:2021.

Emission Point Number: A2-1

Parameter	Method	Units	Result	MU +/-	Limit	O_2 Ref. (%)	Moisture Ref. (%)	Blanks	Date	Time on	Time off	Accreditation	
												Sampling	Analysis
Ammonia	EN 13649	ppm	3.06	0.16	50	N/a	N/a	<0.1	23/05/2023	13:00	13:30	No	Yes
Hydrogen Sulphide	Drager	ppm	0	N/a	5	N/a	N/a	N/a	23/05/2023	13:00	13:30	No	No
Mercaptans	Drager	ppm	0	N/a	5	N/a	N/a	N/a	23/05/2023	13:00	13:30	No	No
Amines	Drager	ppm	0	N/a	5	N/a	N/a	N/a	23/05/2023	13:00	13:30	No	No

Note 1: All results are normalised to standard temperature and pressure (0^{O}C and 101.3kPa)
Note 2: All results are reported in the format as defined by the EPA in guidance note AG2:2021.

Emission Point Number: A2-2

Parameter	Method	Units	Result	MU +/-	Limit	O_2 Ref. (%)	Moisture Ref. (%)	Blanks	Date	Time on	Time off	Accreditation	
												Sampling	Analysis
Ammonia	EN 13649	ppm	0.06	0.003	50	N/a	N/a	<0.1	23/05/2023	14:30	15:00	No	Yes
Hydrogen Sulphide	Drager	ppm	0	N/a	5	N/a	N/a	N/a	23/05/2023	14:30	15:00	No	No
Mercaptans	Drager	ppm	0	N/a	5	N/a	N/a	N/a	23/05/2023	14:30	15:00	No	No
Amines	Drager	ppm	0	N/a	5	N/a	N/a	N/a	23/05/2023	14:30	15:00	No	No

Note 1: All results are normalised to standard temperature and pressure (0^{O}C and 101.3kPa)
Note 2: All results are reported in the format as defined by the EPA in guidance note AG2:2021.

1.5 Operating Information

Please reference Process Details as per Appendix III attached.

1.6 Monitoring Deviations

Stack Name: A1-1	
Parameter	Deviation
Total Particulate Matter	Differential Pressure <5Pa, constant flow testing carried out.
Oxygen	None
Nitrogen Oxides (as NO_2)	None
Sulphur Dioxide	None
Carbon Dioxide	None
Volumetric Flow Rate (Ref)	EN 16911 - in accordance with MID 16911-1

Stack Name: A2-1	
Parameter	Deviation
H2S	None
Mercaptans	None
Amines	None
Ammonia	None

Stack Name: A2-2	
Parameter	Deviation
H2S	None
Mercaptans	None
Amines	None
Ammonia	None

1.7 Reference Documents

Risk Assessment (RA)	SOP 1011
Site Review (SR)	SOP 1015
Site Specific Protocol (SSP)	SOP 1015

1.8 Revision History

Revision Number	Changes to the report
1	Original version of the report

Part 2: Supporting Information	
Report Title	Air Emissions Compliance Monitoring Emissions Report
Company address	Air Scientific Ltd., Unit 3 Westlink Business Park, Clondrinagh, Limerick, V94 K6XK
Stack Emissions Testing Report Commissioned by	Dawn Meats Ireland
Facility Name	Western Proteins
Contact Person	Brian Cloonan & Patrick Flynn
EPA Licence Number	P0048-03
Licence Holder	Dawn Meats Ireland
Stack Reference Number	A1-1, A2-1 & A2-2
Dates of the Monitoring Campaign	23/05/2023 & 09/06/2023
Job Reference Number	WEPRTL15230523
Report Written By	Mr. Michael Healy
Report Approved by	Claire Boylan
Stack Testing Team	Mr. Michael Healy & Mr. Stephen Finn
Report Date	12/07/2023
Report Type	Test Report Compliance Monitoring
Version	1
Signature of Approver	Claire Boylan. Senior Quality Technician

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.319T

Air Scientific

Appendix I

1.1 Monitoring Personnel

Team Leader	Name	Michael Healy
	System approval	ASL Team Leader Approved
Technician	Name	Stephen Finn
	System approval	ASL Technician Approved

1.2 Equipment Inventory

ID	Item of Equipment	Used	ID	Item of Equipment	Used	ID	Item of Equipment	Used
ASLLK12EQ500	Pump		ASLLK12EQ525	Horiba (PG-250) X		ASLLK13EQ501	Vernier Calipers	
ASLLK12EQ532	Pump		ASLLK16EQ508	Horiba- PG250z		ASLLK14EQ503	Vernier Calipers	x
ASLLK12EQ536	Pump		ASLLK14EQ501	Horiba-PG 350	X	ASLLK14EQ507	Vernier Calipers	
ASLLK12EQ537	Pump		ASLLK17EQ515	Horiba 350		ASLLK17EQ533	Vernier Calipers	
ASLLK12EQ538	Pump		ASLLK20EQ506	Horiba 350		ASLLK18EQ506	Vernier Calipers	
ASLLK12EQ542	Pump		ASLLK21EQ503	Horiba 350		ASLLK20EQ516	Vernier Calipers	
ASLLK12EQ543	Pump		ASLLK21EQ522	Horiba 350				
ASLLK13EQ514	Pump							
ASLLK16EQ518	Pump					ASLLK13EQ503	1kg weight	
ASLLK16EQ519	Pump		ASLLK12EQ526	Chiller		ASLLK13EQ508	500g Hafner weight	
ASLLK17EQ509	Pump		ASLLK14EQ513	Chiller	X	ASLLK13EQ509	500g Hafner weight	
ASLLK17EQ510	Pump		ASLLK16EQ509	Chiller		ASLLK14EQ515	500g Weight	
ASLLK17EQ522	Pump		ASLLK18EQ505	Chiller		ASLLK15EQ511	1kg Weight	
ASLLK17EQ523	Pump		ASLLK21EQ504	Chiller		ASLLK15EQ512	1kg weight	
ASLLK17EQ524	Pump		ASLLK22EQ509	Chiller		ASLLK16EQ511	1kg weight	X
ASLLK17EQ525	Pump					ASLLK16EQ512	500g weight	X
ASLLK17EQ526	Pump					ASLLK17EQ529	500g weight	
ASLLK18EQ517	Pump		ASLLK14EQ518	Velocity Meter		ASLLK17EQ530	1kg weight	
ASLLK18EQ518	Pump		ASLLK16EQ501	Velocity Meter		ASLLK19EQ513	500g weight	
ASLLK21EQ507	Pump		ASLLK17EQ508	Velocity Meter		ASLLK19EQ514	1kg Weight	
ASLLK21EQ508	Pump		ASLLK17EQ514	Velocity Meter		ASLLK19EQ519	1kg weight	
ASLLK21EQ509	Pump		ASLLK18EQ504	Velocity Meter		ASLLK19EQ520	500g weight	
ASLLK21EQ510	Pump		ASLLK19EQ502	Velocity Meter				
ASLLK21EQ511	Pump		ASLLK20EQ504	Velocity Meter				
ASLLK22EQ500	Pump					ASLLK17EQ534	ST5	
ASLLK22EQ501	Pump		ASLLK20EQ513	Anemometer (Hotwire)		ASLLK18EQ503	ST5	
ASLLK22EQ502	Pump		ASLLK21EQ528	TSI (Vane)		ASLLK18EQ513	ST5	
ASLLK22EQ503	Pump					ASLLK19EQ509	ST5	x
ASLLK22EQ504	Pump	X				ASLLK20EQ500	ST5	
ASLLK22EQ505	Pump		ASLLK16EQ502	FID		ASLLK21EQ519	ST5	
			ASLLK17EQ517	FID		ASLLK22EQ508	ST5	
			ASLLK19EQ508	FID				
ASLLK21EQ500	MF Meter		ASLLK20EQ507	FID				
ASLLK21EQ501	MF Meter		ASLLK20EQ508	FID		ASLLK14EQ510	Digital Protractor	x
ASLLK21EQ502	MF Meter		ASLLK17EQ535	Signal Cutter		ASLLK14EQ511	Digital Protractor	
ASLLK21EQ526	MF Meter					ASLLK17EQ528	Digital Protractor	
ASLLK21EQ530	MF Meter					ASLLK18EQ507	Digital Protractor	
ASLLK21EQ531	MF Meter		ASLLK16EQ510	Measuring Tape	X	ASLLK20EQ514	Digital Protractor	
ASLLK22EQ515	MF Meter	x	ASLLK17EQ527	Measuring Tape		ASLLK20EQ515	Digital Protractor	
			ASLLK18EQ508	Measuring Tape				
ASLLK14EQ514	Heated Line		ASLLK19EQ516	Measuring Tape				
ASLLK17EQ502	Heated Line		ASLLK20EQ509	Measuring Tape		ASLLK12EQ522	Balance	
ASLLK17EQ503	Heated Line		ASLLK21EQ521	Measuring Tape		ASLLK15EQ509	Balance	
ASLLK17EQ539	Heated Line (5m)					ASLLK15EQ510	Balance	
ASLLK19EQ523	Heated Line					ASLLK17EQ537	Balance	
ASLLK20EQ520	Heated Line	X	ASLLK20EQ519	PCDD Thermometer		ASLLK19EQ515	Balance	
ASLLK20EQ521	Heated Line					ASLLK21EQ505	Balance	
ASLLK21EQ523	Heated Line (5m)		ASLLK16EQ515	Thermocouple K type		ASLLK21EQ506	Balance	x
ASLLK21EQ524	Heated Line (5m)		ASLLK16EQ516	Thermocouple K type		ASLLK21EQ525	Balance	
ASLLK22EQ510	Heated Line (40m)		ASLLK21EQ513	K type Thermocouple	X	ASLLK21EQ529	Balance	
ASLLK22EQ512	Heated Line (5m)		ASLLK21EQ514	K type Thermocouple				
ASLLK22EQ513	Heated Line (5m)		ASLLK21EQ515	K type Thermocouple				
			ASLLK21EQ516	K type Thermocouple				
ASLLK12EQ518	S type Pitot Tube		ASLLK21EQ517	K type Thermocouple				
ASLLK12EQ520	L Type Pitot tube		ASLLK21EQ518	K type Thermocouple				
ASLLK13EQ506	S type Pitot Tube		ASLLK21EQ520	K type Thermocouple				
ASLLK14EQ506	1m S type & K type							
ASLLK16EQ506	S type Pitot Tube							
ASLLK16EQ517	S type Pitot Tube Long		ASLLK17EQ519	Stopwatch	X			
ASLLK17EQ507	1m S type & K type		ASLLK17EQ520	Stopwatch				
ASLLK17EQ536	S type Pitot Tube		ASLLK17EQ521	Stopwatch				
ASLLK18EQ514	S type Pitot Tube		ASLLK18EQ509	Stopwatch				
ASLLK18EQ515	S type Pitot Tube		ASLLK19EQ518	Stopwatch				
ASLLK19EQ510	S type pitot tube		ASLLK21EQ512	Stopwatch				
ASLLK19EQ511	S type pitot tube							
ASLLK19EQ521	1m S type & K type							
ASLLK19EQ522	Pitot							
ASLLK22EQ506	S type pitot tube	x						
ASLLK22EQ507	S type pitot tube							
ASLLK22EQ511	S type pitot tube							

Appendix II

2.1 Stack Emission Point Reference: A1-1

2.1.1 Suitability of Sample Location:

General Information	A1-1
Permanent/Temporary	Permanent
Inside/ Outside	Outside

Platform Details		
Irish EPA Technical Guidance Note AG1 / BS EN 15259 Platform Requirements	Value	Comment
Sufficient Working area to manipulate probe and measuring instruments	Yes	-
Platform has 2 handrails (approx. 0.5m & 1.0 m high)	Yes	-
Platform has vertical base boards (approx. 0.25 m 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		
None		
EN 15259 Homogeneity Test Requirements		
1		
Select Option: 1: There is no requirement to perform a BSEN15259 Homogeneity Test on this stack 2: Test results were obtained from previous Homogeneity test carried out by ASL 3: Test results were obtained from previous Homogeneity test carried out by Alternative contractor 4: Homogeneity Test is required on this stack and the client has been informed of this requirement		

2.1.2 Stack Diagram

Figure 1: A1-1

2.1.3 Stack Raw Data

Title:	**Determination of Total Particulates**				
Method:	EN 13284-1				
Client:	Western Proteins				
Test Date:	23/05/2023		**Air Volume at Pump**	0.7967	m^3
Test Time	12:10		**Temperature at Pump**	17.43	Deg C
Laboratory Used:	RPS		**Pressure at Pump**	80.02	kPa
Stack Name	A1-1		**Humidity at Pumps**	0	%
Run I.D.	1		**Filter Weight**	3.38	mg
Filter I.D.	253220		**Front End Weight**	1	mg
Moisture Content	8.82	%			
Reference Oxygen	3	%	**Flow Uncertainty**	1,596	m^3/hr
Measured Oxygen	5.81	%	**Flow Uncertainty**	26.1	%
Stack Flow Rate	7962	Nm^3/hr			
Adjusted Stack Flow Rate	6120.09	Nm^3/hr, dry @ % Oxygen			
Volume of Air Sampled	0.5915	Nm^3			

Leak Check Results	**Result**		**% Leak**	
Before Sample 1	0	l/min	0.0	
Average Flow Rate	20.00	l/min	0.0	
Standard Maximum	0.4	l/min	2%	
Back Pressure	69.95	kPa		
Standard Criteria to be Met	**Result**	**Std. Requirement**		
Angle of Flow	Yes	<15 Degrees	**Probe material**	Stainless Steel
Negative Flow in the Stack	Yes	None	**Filter housing**	Stainless Steel
Pitot Pressure Difference	No	>5Pa	**Positioning of filter**	In Stack
Ratio of Flow Measurement	Yes	<3:1	**Filter Size & Material**	47mm Quartz
Stagnation Test	Yes	<10Pa		
Pitot Tube Leak Check	**Result**			
Positive Pressure	Pass	-		
Negative Pressure	Pass	-		
Number of Ports	2	2		
Straight length before sample point	Yes	> 5 Hydraulic Diameters		
Straight length after sample point	Yes	> 5 Hydraulic Diameters to Stack Outlet or 2HD to Fan/ Bend		
Sample Calculations				
Blank (Filter and Front Wash Combined)	0.54	mg		
Sample 1 (Filter and Front Combined)	4.38	mg		
Volume of Air Sampled	0.5915	Nm^3		
Blank Result	0.91	$mg/Nm^{3,}$ dry	1.08	$mg/Nm^{3,}$ dry @ Ref O_2
Sample Result	7.40	$mg/Nm^{3,}$ dry	8.78	$mg/Nm^{3,}$ dry @ Ref O_2
Uncertainty of Measurement	0.53	mg/Nm^3		
Emission Limit Value	50	mg/Nm^3		
Blank as Percentage of ELV	1.8	%	**Requirement <10% ELV or <0.5 mg/m³**	

Isokinetic Criterion Compliance		
Isokinetic Variation	-	%
Allowable Isokinetic Range	-5 to + 15%	%
Isokinetic Acceptable	-	

Balance Calibration	**Weight**	**0**		
0	0	g	Eccentric load indication carried out - Balance Ok	Yes
500	500	g		
1000	1000	g		
Impinger Weights	**Initial**	**Final**	**Difference**	
Total Impinger Weight	2195.8	2241.8	46	
Volume of Air Sampled	0.5915	Nm3	46	
Moisture Content (EN 14790)	8.82	%		

DUCT AND GAS SPECIFICATION			
Name			a1-1
Section			Circular
Diameter		[m]	1.27
Area		[m2]	1.266769
Ports		[#]	2
Points	P	[#]	6
Density	ρn	[kg/Nm3]	1.333
Carbon Dioxide	CO2	[%]	10.7
Oxygen	O2	[%]	4.42
Water Vapor Ratio	rw	[0;1]	0.1
Nozzle	nz	[mm]	15
Turbolence factor	ft	[sec]	1
Wall Adjustment Factor	waf		
PITOT DATA SPECIFICATION			
Name			
Velocity	[m/sec]	5	0.83
Velocity	[m/sec]	10	0.83
Velocity	[m/sec]	20	0.83
Velocity	[m/sec]	30	0.83
Velocity	[m/sec]	40	0.83
NORMALIZATION FACTOR			
Tnorm		[K]	273
Pnorm		[kPa]	101.3
DUCT FLOW RATE			
Dry actual	QVa	[m3/h]	13465
Moist actual	Q'Va	[m3/h]	14962
Moist norm. [Tnorm Pnorm]	Q'Vn	[Nm3/h]	7962
Dry norm. [Tnorm Pnorm]	QVn	[Nm3/h]	7165
AVERAGE VALUES			
Total Points		[#]	2
Velocity	v'a	[m/sec]	3.3
Stack temperature	tstack	[°C]	244.58
Stack Pressure	Pa	[kPa]	102.2
Isokinetic Rate	DI	[%]	-
Velocity at nozzle	v'N	[m/sec]	3.924
Probe temperature	tprobe	[°C]	20.3
Filter temperature	tfilter	[°C]	29.1
Outlet temperature	toutlet	[°C]	50.1
Aux temperature	taux	[°C]	28.7
Ambient Pressure	Pamb	[kPa]	102.29
GAS METER SAMPLED VOLUMES			
Elapsed time	et		00:30:00
Norm. Volume [Tnorm Pnorm]	Vgn		0.5915
Moist Volume at stack conditions	V'ga		1.2351
Volume at dgm conditions	Vdgm		0.7967
Gas meter temperature	tdgm		17.43
Gas Meter Pressure	Pdgm		80.02

start ts [timestamp]	port [###]	point [###]	Probe pos [cm]	tstack avg [°C]	Pa avg [kPa]	dP Pitot avg [Pa]	velocity avg [m/sec]
23/05/2023	1	1	5.6	244.8	102.22	5.67	3.39
11:54:06	-	-	-	-	-	-	-
23/05/2023	1	2	18.6	245.16	102.22	6.11	3.52
11:54:40	-	-	-	-	-	-	-
23/05/2023	1	3	37.6	249.21	102.22	4.52	3.04
11:55:35	-	-	-	-	-	-	-
23/05/2023	1	4	89.5	244.72	102.22	5.54	3.35
11:56:12	-	-	-	-	-	-	-
23/05/2023	1	5	108.5	245	102.22	4.75	3.1
11:56:45	-	-	-	-	-	-	-
23/05/2023	1	6	121.5	245.98	102.21	4.22	2.93
11:57:20	-	-	-	-	-	-	-
23/05/2023	2	1	5.6	240.62	102.22	4.5	3.01
12:00:27	-	-	-	-	-	-	-
23/05/2023	2	2	18.6	241.9	102.22	3.81	2.77
12:00:59	-	-	-	-	-	-	-
23/05/2023	2	3	37.6	240.74	102.21	4	2.84
12:01:31	-	-	-	-	-	-	-
23/05/2023	2	4	89.5	238.4	102.21	4.53	3.01
12:02:16	-	-	-	-	-	-	-
23/05/2023	2	5	108.5	242.3	102.21	9.1	4.28
12:02:52	-	-	-	-	-	-	-
23/05/2023	2	6	121.5	252.36	102.21	8.8	4.25
12:03:30	-	-	-	-	-	-	-
23/05/2023	3	1	5.6	248.56	102.21	5.68	3.4
12:04:07	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

Uncertainty calculation for EN 13284					
	Symbol	**Unit**	**Values**	**UOM as %**	**Std Requirement**
Sampled Volume	V_m	m^3	0.001	0.13	<=5%
Sampled gas Temperature	T_m	k	2.00	0.69	<=2%
Sampled gas Pressure	ρ_m	kPa	1.00	1.25	<=2%
Sampled gas Humidity	H_m	% by volume	1.00	1.00	<=1%
Oxygen content	$O_{2,m}$	% by volume	0.10	-	<=5%
Mass particulate	m	mg	0.102	2.34	<5% of limit value
Leak	L		-	0.00	<=2%
Uncollected Mass	UCM		-	0.00	<10% of limit value
Corrected Volume (STP)	V	m^3	0.59	1.75	-
Mass	m	mg	4.38	2.34	-
Factor for O2 Correction	fc		1.18	0.66	-
Leak	L	$mg.m^{-3}$	0.00	0.00	-
Uncollected mass	UCM	mg	0.00	0.00	-
Combined measurement uncertainty			**0.26**	-	-
Expanded uncertainty as percentage of measured value				**5.99**	% measured of value
Expanded uncertainty in units of measurement				**0.53**	mg.m-3
Expanded uncertainty as percentage of limit value				**1.05**	% ELV

Uncertainty calculation for Velocity and Volume Flow Rate Measurement by Pitot tube EN ISO 16911-1					
	Unit	**Values**	**as %**	**Std Requirement**	
Range of Delta P transducer	Pa	2500	-		-
Resolution of Delta P transducer	Pa	10	-		-
Repeatability of Delta P transducer	% of value	0.01	-		-
Drift of Delta P transducer	% of range	0.32	-		-
Lack of fit of measurement system	% of range	0.25	-		-
Uncertainty in Delta P transducer	Pa	2.5	-		-
Uncertainty of pitor coefficient		0.03	-		-
Enter uncertainties as (95%,k=2) where relevant					
Uncertainty in temperature readout system	°C	1	-		-
Uncertainty in atmospheric pressure transducer	Pa	160.5	-		-
Uncertainty in duct area measurement	%	1.0	-		-
Uncertainty of Molar Mass	kg/mol	0.00001	0.05		-
Uncertainty of Temperature	K	0.5	0.10		-
Uncertainty of Stack Static Pressure	Pa	10.22	0.01		-
Uncertainty of Stack Pressure	Pa	160.8	0.08		-
Uncertainty of Gas Density	kg/m3	0.0017	0.13		-
Uncertainty in velocity	m/sec	0.43	13.0		-
Expanded Uncertainty in velocity	m/sec	0.86	26.0		-
Uncertainty of Volumetric Flow Rate	m^3/hour	798	-		-
Expanded Uncertainty of Volumetric Flow Rate	m^3/hour	**1596**	**26.1**	<10% of ELV	

Title:	***Determination of Flue Gases***					
Method:	EN 14792 / TS 17021 / EN 15058 / TS 17045 / EN 14789					
Test Date:	23/05/2023					
Stack Name:	A1-1		**Quality Assurance**			
Test Start Time:	11:06		Probe Material		Stainless Steel	
Reference Conditions			Filtration Type/size		Stainless Steel	
Measured Oxygen	4.42	%	Heated Filter used		Yes	
Reference Oxygen	3	%	No. of sampling lines		1	
Reference Moisture	0		No. of Sampling points		1	
			Sampling point I.D.s		1	
Parameter		**NO**	**SO2**	**CO**	**CO_2**	**O_2**
Emission Limit Values	$mg.m^{-3}$ ref	450	1700	80	-	-
Instrument Range	ppm	500	200	200	30%	25.00%
Span Gas Value	ppm	434	154	151	16.15%	20.90%
Acceptable Gas Range	-	Yes	Yes	Yes	Yes	Yes
Calibration Gas Reference No.	-	22ING244	22ING219	21ING603	19ING559	-
Calibration Gas Uncertainty	%	1.2	1.2	1.5	0.9	0.35
Calibration Gas Start Bar	Bar	55	30	45	25	-
Expiry Date	-	Oct-23	Jun-24	Jul-24	Jul-23	-
Quality Assurance	Units	**NO**	**SO2**	**CO**	**CO2**	**O2**
Conditioning Unit Temperature	C	2	2	2	2	2
Average Temperature	< C	2	2	2	2	2
Allowable Temperature	-	4	4	4	4	4
Temperature Acceptable	-	Yes	Yes	Yes	Yes	Yes
Pump flow rate	l/min.	0.5	0.5	0.5	0.5	0.5
Instrument Zero Drift	Units	**NO**	**SO2**	**CO**	**CO2**	**O2**
Instrument Zero (Ambient air or Nitrogen)		Nitrogen	Nitrogen	Nitrogen	Nitrogen	Nitrogen
Instrument Zero (Pre)	ppm	0	0	0	0.00%	0.00%
Instrument Zero (Check)	ppm	0	2	0	0.02%	0.06%
Compliance Statement	Pass / Fail	Pass	Pass	Pass	Pass	Pass
Instrument Zero (Post)	ppm	0	0.9	2	0.03%	0.11%
Zero Drift	ppm	0	0.9	2	0.03%	0.11%
Allowable Zero Drift (Less than 2%)	ppm equiv.	8.7	3.1	3.0	-	0.42%
Adjustable Zero Drift (2 - 5%) / 5% CO_2	ppm equiv.	21.7	7.7	7.6	0.81%	1.05%
Zero Drift Failure (<5% / >5% CO_2)	ppm equiv.	21.7	7.7	7.6	0.81%	1.05%
Zero Drift Acceptable	-	Yes	Yes	Yes	Yes	Yes
Adjust for Zero Drift	-	No	No	No	No	No
Reject results	-	No	No	No	No	No
Calculated Drift	%	0.0%	0.6%	1.3%	0.2%	0.5%
Instrument Span Drift	Units	**NO**	**SO2**	**CO**	**CO2**	**O2**
Instrument Span Down (Pre)	ppm	434	154	151	16.15%	20.90%
Instrument Check Span (Post)	ppm	436	155	151	16.02%	20.99%
Span Drift	ppm	2	1	0	-0.13%	0.09%
Allowable Span Drift (less than 2%)	ppm equiv.	8.68	3.08	3.02	0.32%	0.42%
Adjustable Span Drift (2 - 5%)	ppm equiv.	21.7	7.7	7.55	0.81%	1.05%
Span Drift Failure (Greater than 5%)	ppm equiv.	21.7	7.7	7.55	0.81%	1.05%
Span Drift Acceptable (Y/N)	-	Yes	Yes	Yes	Yes	Yes
Adjust for Span Drift	-	No	No	No	No	No
Reject results	-	No	No	No	No	No
Calculated Drift	%	0.5%	0.6%	0.0%	-0.8%	0.4%
Heated Line Check Including Leak Check		**NO**	**SO2**	**CO**	**CO2**	**O2**
Span Gas Conc.	ppm	434	154	151	16.15%	20.90%
Zero Check Acceptable Limit (+/-)	ppm	8.68	3.08	3.02	0.32%	0.42%
Heated Line Check Zero Gas	ppm	0	1	1	0.01%	0.28%
Compliance Statement	Pass / Fail	Pass	Pass	Pass	Pass	Pass
Heated Line Check Span Gas	ppm or %	433	152	149	16.00%	20.92%
Span Gas Leak Detected	ppm or %	-1	-2	-2	-0.15%	0.02%
Leak check acceptable (< 2%)	ppm or %	8.68	3.08	3.02	0.32%	0.42%
Compliance Statement	Pass / Fail	Pass	Pass	Pass	Pass	Pass
Response Time (<200 seconds)		Yes	Yes	Yes	Yes	Yes

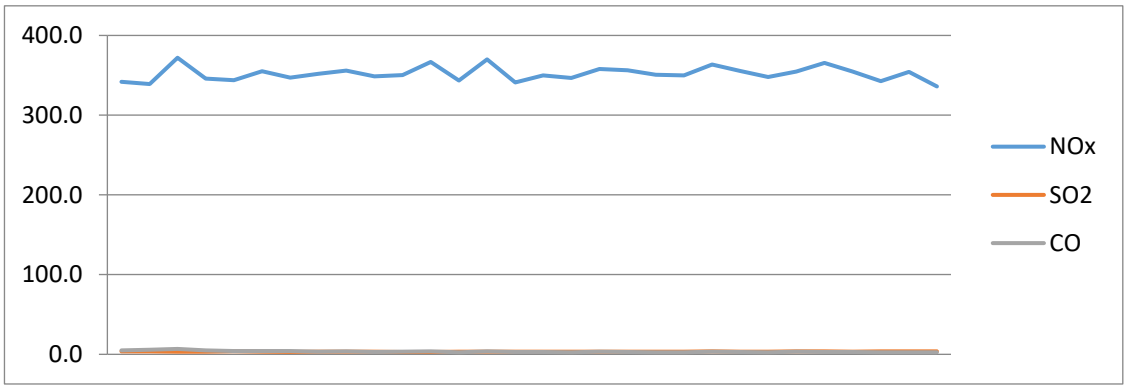
Test Conditions	Units	
Run Ambient Temperature Range	C	12

Raw Data

Date/Time	*NOx*	*SO_2*	*CO*	*CO_2*	*O_2*
	ppm	*ppm*	*ppm*	*vol%*	*vol%*
23/05/2023 11:06	153.275	1.150	3.625	10.518	4.972
23/05/2023 11:07	152.125	1.175	4.250	10.527	4.813
23/05/2023 11:08	166.850	1.083	5.000	10.863	4.239
23/05/2023 11:09	155.058	1.100	3.583	10.610	4.547
23/05/2023 11:10	154.233	1.267	3.167	10.620	4.574
23/05/2023 11:11	159.242	1.017	2.917	10.726	4.448
23/05/2023 11:12	155.725	0.975	2.917	10.648	4.514
23/05/2023 11:13	157.875	1.042	2.583	10.679	4.439
23/05/2023 11:14	159.650	1.083	2.750	10.741	4.377
23/05/2023 11:15	156.442	1.017	2.250	10.717	4.403
23/05/2023 11:16	157.083	1.008	2.333	10.658	4.482
23/05/2023 11:17	164.533	1.008	2.750	10.828	4.251
23/05/2023 11:18	154.025	1.058	2.000	10.599	4.552
23/05/2023 11:19	165.975	1.042	2.750	10.893	4.137
23/05/2023 11:20	152.875	1.075	2.083	10.551	4.571
23/05/2023 11:21	156.958	1.125	2.083	10.694	4.462
23/05/2023 11:22	155.492	1.133	2.000	10.637	4.451
23/05/2023 11:23	160.442	1.050	2.417	10.791	4.322
23/05/2023 11:24	159.858	1.092	2.250	10.743	4.252
23/05/2023 11:25	157.342	1.125	2.000	10.708	4.382
23/05/2023 11:26	156.950	1.108	2.000	10.721	4.374
23/05/2023 11:27	163.025	1.242	2.583	10.824	4.219
23/05/2023 11:28	159.525	1.125	2.250	10.768	4.229
23/05/2023 11:29	156.050	1.117	2.000	10.695	4.422
23/05/2023 11:30	159.092	1.167	2.417	10.693	4.298
23/05/2023 11:31	163.892	1.167	2.083	10.874	4.164
23/05/2023 11:32	159.025	1.125	2.167	10.734	4.248
23/05/2023 11:33	153.750	1.158	2.000	10.655	4.458
23/05/2023 11:34	158.825	1.175	2.000	10.783	4.294
23/05/2023 11:35	150.700	1.258	1.917	10.485	4.573
23/05/2023 11:36	153.942	1.300	2.083	10.679	4.496
Average	**157.7**	**1.1**	**2.6**	**10.70**	**4.42**

Referenced Data

	NOx mg/Nm³	SO_2 mg/Nm³	CO mg/Nm³	CO_2 vol%	O_2 vol%
23/05/2023 11:06	341.7	3.6	4.9	10.52	4.97
23/05/2023 11:07	339.2	3.6	5.8	10.53	4.81
23/05/2023 11:08	372.0	3.4	6.8	10.86	4.24
23/05/2023 11:09	345.7	3.4	4.9	10.61	4.55
23/05/2023 11:10	343.9	3.9	4.3	10.62	4.57
23/05/2023 11:11	355.1	3.2	4.0	10.73	4.45
23/05/2023 11:12	347.2	3.0	4.0	10.65	4.51
23/05/2023 11:13	352.0	3.2	3.5	10.68	4.44
23/05/2023 11:14	356.0	3.4	3.7	10.74	4.38
23/05/2023 11:15	348.8	3.2	3.1	10.72	4.40
23/05/2023 11:16	350.2	3.1	3.2	10.66	4.48
23/05/2023 11:17	366.9	3.1	3.7	10.83	4.25
23/05/2023 11:18	343.4	3.3	2.7	10.60	4.55
23/05/2023 11:19	370.1	3.2	3.7	10.89	4.14
23/05/2023 11:20	340.9	3.3	2.8	10.55	4.57
23/05/2023 11:21	350.0	3.5	2.8	10.69	4.46
23/05/2023 11:22	346.7	3.5	2.7	10.64	4.45
23/05/2023 11:23	357.7	3.3	3.3	10.79	4.32
23/05/2023 11:24	356.4	3.4	3.1	10.74	4.25
23/05/2023 11:25	350.8	3.5	2.7	10.71	4.38
23/05/2023 11:26	349.9	3.4	2.7	10.72	4.37
23/05/2023 11:27	363.5	3.9	3.5	10.82	4.22
23/05/2023 11:28	355.7	3.5	3.1	10.77	4.23
23/05/2023 11:29	347.9	3.5	2.7	10.70	4.42
23/05/2023 11:30	354.7	3.6	3.3	10.69	4.30
23/05/2023 11:31	365.4	3.6	2.8	10.87	4.16
23/05/2023 11:32	354.6	3.5	2.9	10.73	4.25
23/05/2023 11:33	342.8	3.6	2.7	10.66	4.46
23/05/2023 11:34	354.1	3.6	2.7	10.78	4.29
23/05/2023 11:35	336.0	3.9	2.6	10.48	4.57
23/05/2023 11:36	343.2	4.0	2.8	10.68	4.50
Average	**351.7**	**3.5**	**3.5**	**10.70**	**4.42**
Uncertainty of Measurement	**21.1**	**1.9**	**2.1**	**0.28**	**0.35**
Uncertainty as % of ELV	**4.70**	**0.11**	**2.60**	-	-
Standard Requirement	**<10%**	**<15%**	**<6%**	**<25%**	**<6%**



QGU-010-2013 Uncertainty calculation for Gaseous Measurement EN 14792 Nox

v4

Limit value	450	**mg.m^{-3} (corrected) NO2**	**Gas**	NO	
			Full Scale	500	**ppm**
Measured concentration	157.74	**ppm**	**Cal gas conc**	434	**ppm**
Measured concentration	323.83	**mg.m^{-3} (corrected) NO2**	**Conversion**	2.053	
Ratio NO/NO2	100.00		**Full Scale**	1026.5	**mg.m^{-3} (NO2)**
			Cal gas conc	891.002	**mg.m^{-3} (NO2)**

Correction for reference conditions

		O2, %	Moisture, %	Pressure, KPa	Temperature, K
	ref	3.00	0.00	101.30	**273.00**
	measured	4.42	0.00	101.30	**273.00**
Factors		1.09	1.00	1.00	1.00
Correction Factor		**1.09**			

Performance characteristics	**Value**				**specification**
Response time		30	seconds		180.000
Number of readings in measurement		30			
Repeatability at zero		0.03	% full scale		0.200
Repeatability at span level		0.06	% full scale		2.000
Deviation from linearity		0.2	% of value		2.000
Zero drift		0	% full scale		2.000
Span drift		0.4	% full scale		2.000
volume or pressure flow dependence		0	% of full scale/kPa		0.033
atmospheric pressure dependence		0	% of value/kPa		0.750
ambient temperature dependence		0.3	% full scale/10K		0.300
NH3 (20 mg/m3)		0	mg/m3		
CO2 (15%)		0.209	% by vol		
H2O (30%)		0.0	% by vol		4.000
dependence on voltage		0.1	% full scale/10V		2%fs/10V
converter efficiency		95	%		95%
losses in the line (leak)		0.230414747	% of value		2% of value
Uncertainty of calibration gas		1.2	% of value		

Effect of drift

1.30	mg/m3	0.14538
0.40	% value	

	ranges min	ranges max	value at calib
flow	95	105	100
pressure	101.30	101.3	101.3
temp	289	289	283
NH3 range	0	0	0
CO2 range	0	15	0
H2O range	0	0	0
Instrument Voltage Rating			110
Voltage	93	121	110

Measurement performance related to stationary conditions

Performance characteristic			**Uncertainty**		**Value of uncertainty quantity**		
Standard deviation of repeatability at zero			U_{zero}		for mean		use rep at span
Standard deviation of repeatability at span level			U_{drift}		for mean		0.01
Lack of fit			U_{fit}				1.19
Drift			U_{drift}				0.75
volume or pressure flow dependence			U_{dpress}				0.00
atmopsheric pressure dependence			U_{dpress}				0.00
ambient temperature dependence			U_{dtemp}				0.18
NH3 (20 mg/m3)			U_{dresef}				0.00
CO2 (15%)							0.12
H2O (30%)							0.00
Dependence on voltage			U_{dvolt}				0.09
Converter efficiency			U_{deff}				9.35
losses in the line (leak)			U_{leak}				0.43
Uncertainty of calibration gas			U_{calib}				2.24

Use largest negative or positive interferent effect

0	0.00
0	0.12
0	0.00
0	0.12
Interference uncertainty	0.12

Measurement uncertainty		Result	323.83	mg/m^3
Combined uncertainty			9.73	mg/m^3
Expanded uncertainty	k =	2	19.46	mg/m^3
Uncertainty corrected to std conds			21.13	mg.m-3 (corrected)
Expanded uncertainty	**expressed with a level of confidence of 95%**		**4.70**	**% ELV**
Expanded uncertainty	**expressed with a level of confidence of 95%**		**21.13**	**mg.m^{-3} at ELV**

QGU-008-2013 Uncertainty calculation for Gaseous Measurement SO2 EN TS 17021

V2 Jul-08

Limit value	1700	**mg/m³ (corrected) SO2**	**Cal gas conc**	440.44	**mg.m⁻³**
Measured concentration	3.19	**mg/m3**	**Full Scale**	572	**mg/m³**
Measured concentration	3.46	**mg/m³ (Corrected)**			

Correction for reference conditions

		O2, %	Moisture, %	Pressure, KPa	Temperature, K
	ref	3.00	0.00	101.30	**273.00**
	measured	4.42	0.00	101.30	**273.00**
	Uncert	0.35	1.00	0.00	**1.00**
Factors		1.09	1.00	1.00	1.00
Uncertainty in factor		0.02	0.01	0.00	0.00
Correction Factor		**1.09**	uf	**0.03**	

Performance characteristics	**Value**				**specification**
Response time		160	seconds		180.000
Logger sampling interval		60	seconds		
Measurement period		30	minutes		
Number of readings in measurement		30			
Repeatability at zero		0.25	% full scale		<1 % range
Repeatability at span level		0.15	% full scale		<2 % range
Deviation from linearity		0.2	% of value		<2 % range
Zero drift		0.45	% full scale		<2% range / 24hr
Span drift		0.5	% full scale		<2% range/24hr
volume or pressure flow dependence		0.02	% of full scale/3 kPa		<2 % / 3 kPa
atmospheric pressure dependence		0.8	% of full scale/2 kPa		<3% / 2 kPa
ambient temperature dependence		0.01	% full scale/10K		<3% range / 10 K
N_2O (mg/m3)	20	0.2	mg/m3		
CO_2 (% vol)	15	0.2	mg/m3		
CH_4 (mg/m3)	40	0.7	mg/m3		
H2O (% vol)	20	0.2	mg/m3		
dependence on voltage		0.1	% full scale/10V		<2% range
losses in the line (leak)		1.298701299	% of value		< 0.1%vol /10 volt
Uncertainty of calibration gas		1.2	% of value		< 2% of value

Effect of drift

0.45	mg/m3
13.11	% value
CORRECT FOR DRIFT	

		ranges min	max	value at calib	
flow		0.3	0.5	0.4	l/hr
pressure		100.76	100.92	100.88	kPa
temp		287	288.5	287.5	K
N2O range		0	0	0	mg/m3
CO2 range		0	40	0	%vol
CH4 range		0	57	0	mg/m3
H2O range		0	1	0	%vol
Voltage		93	121	110	V

Performance characteristic			**Uncertainty**		**Value of uncertainty quantity**		
Standard deviation of repeatability at zero			U_{zc}		for mean		use rep at span
Standard deviation of repeatability at span level			U_{rs}		for mean		0.03
Lack of fit			U_{fit}				0.66
Drift			U_{drift}				0.26
volume or pressure flow dependence			U_{vpres}				0.00
atmopsheric pressure dependence			U_{apres}				0.14
ambient temperature dependence			U_{temp}				0.00
N2O (mg/m3)			U_{interf}				0.00
CO2 (% vol)			U_{interf}				0.31
CH4 (mg/m3)			U_{interf}				0.58
H2O (% vol)			U_{interf}				0.01
Dependence on voltage			U_{volt}				0.49
losses in the line (leak)			U_{leak}				0.03
Uncertainty of calibration gas			U_{calib}				0.02
Uncertianty in factor			uf				0.08

Use largest of sum of all positive or all negative influences

0.89	all +ves	Criteria
0	all -ves	sum <4% range
0.89	largest	0.063781076

Value to use for intereference uncertainty

U_{int} 0.89

Measurement uncertainty			3.46	mg/m^3
Combined uncertainty			0.88	mg/m^3
Expanded uncertainty	k =	2	1.76	mg/m^3
Uncertainty corrected to std conds			1.91	mg/m^3
Expanded uncertainty	**expressed with a level of confidence of 95%**		**0.11**	**% ELV**
Expanded uncertainty	**expressed with a level of confidence of 95%**		**1.91**	**$mg.m^{-3}$**
Expanded uncertainty	**expressed with a level of confidence of 95%**		**55.23**	**% value**

Uncertainty calculation for Gaseous Measurement CO

Limit value	80	**mg/m³ (corrected)**	**Cal gas conc**	188.75	**mg.m⁻³**
Measured concentration	3.19	**mg/m3**	**Full Scale**	250	**mg/m³**
Measured concentration	2.08	**mg/m³ (Corrected)**			

Correction for reference conditions

		O2, %	Moisture, %	Pressure, KPa	Temperature, K
	ref	3.00	0.00	101.30	**273.00**
	measured	4.42	0.00	101.30	**273.00**
	Uncert	0.35	1.00	0.00	**1.00**
Factors		1.09	1.00	1.00	1.00
Uncertainty in factor		0.02	0.01	0.00	0.00
Correction Factor		**1.09**	uf	**0.03**	

Performance characteristics	**Value**				**specification**
Response time		30	seconds		180.000
Logger sampling interval		60	seconds		
Measurement period		30	minutes		
Number of readings in measurement		30			
Repeatability at zero		0.25	% full scale		<1 % range
Repeatability at span level		0.15	% full scale		<2 % range
Deviation from linearity(lack of fit)		0.7	% of value		<2 % range
Zero drift		2.5	mg/m3		<2% range / 24hr
Span drift		0	mg/m3		<2% range/24hr
volume or pressure flow dependence		0.02	% of full scale/3 kPa		<2 % / 3 kPa
atmospheric pressure dependence		0.8	% of full scale/2 kPa		<3% / 2 kPa
ambient temperature dependence		0.01	% full scale/10K		<3% range / 10 K
N_2O (mg/m3)	20	0.2	mg/m3		
CO_2 (% vol)	15	0.2	mg/m3		
CH_4 (mg/m3)	40	0.7	mg/m3		
H2O (% vol)	20	0.2	mg/m3		
dependence on voltage		0.1	% full scale/10V		<2% range
losses in the line (leak)		-1.32	% of value		< 0.1%vol /10 volt
Uncertainty of calibration gas		1.5	% of value		< 2% of value

Effect of drift

0.04	mg/m3
0.02	% full scale

	ranges min	max	value at calib	
flow	95.00	105	100	kPa
pressure	100.76	100.92	100.88	kPa
temp	287	288.5	287.5	K
N2O range	0	40	0	mg/m3
CO2 range	0	15	0	%vol
CH4 range	0	57	0	mg/m3
H2O range	0	1	0	%vol
Voltage	93	121	110	V

Performance characteristic			**Uncertainty**		**Value of uncertainty quantity**		**mg/m3**
Standard deviation of repeatability at zero			U_{sd}		for mean		use rep at span
Standard deviation of repeatability at span level			U_{rs}		for mean		0.07
Lack of fit			U_{fit}				0.01
Drift			U_{drift}				0.02
volume or pressure flow dependence			U_{dpress}				0.05
atmopsheric pressure dependence			U_{dpress}				0.06
ambient temperature dependence			U_{dtemp}				0.00
N2O (mg/m3)			U_{interf}				0.23
CO2 (% vol)			U_{interf}				0.12
CH4 (mg/m3)			U_{interf}				0.58
H2O (% vol)			U_{interf}				0.01
Dependence on voltage			U_{volt}				0.22
losses in the line (leak)			U_{leak}				-0.02
Uncertainty of calibration gas			U_{calib}				0.03

Use largest of sum of all positive or all negative influences

0.93	all +ves	Criteria	
0	all -ves	sum <4% range	
0.93	largest		0.063877688

Value to use for intereference uncertainty

U_{int} 0.93

Measurement uncertainty				
Combined uncertainty			0.96	mg/m³
Expanded uncertainty	k =	2	1.92	mg/m³
Uncertainty corrected to std conds			**2.08**	**mg/m³**
Expanded uncertainty	**expressed with a level of confidence of 95%**		**2.60**	**% ELV**
Expanded uncertainty	**expressed with a level of confidence of 95%**		**2.08**	**mg.m⁻³**

QGU-007-2013 Uncertainty calculation for Gaseous Measurement Carbon Dioxide

V2.2 Jul-08

Limit value	n/a	**%vol**	**Calibration gas**	**0.162**	**%vol**
Measured concentration	10.70	**%vol**	**Full Scale**	**25**	**%vol**

Performance characteristics	**Value**				**specification**
Response time		30	seconds		< 200 s
Logger sampling interval		60	seconds		
Measurement period		30	minutes		
Number of readings in measurement		30	Assuming 1 minute collected over 1 hour		
Repeatability at zero		0.015	% by volume	stdev	<0.2 % range
Repeatability at span level		0.014	% by volume	stdev	<0.4 % range
Deviation from linearity		0.13	% vol	+/-	<0.3 % volume
Zero drift (during measurement period)		0	% vol at zero level	+/-	<2% of volume / 24hr
Span drift (during measurement period)		0	% vol at span level	+/-	<2% volume/24hr
volume or pressure flow dependence		0	% of fs / 10l/h	+- 5 l/h	<1% range
atmospheric pressure dependence		0.3	% of fs/kPa	+- 2kPa	< 1.5 % range
ambient temperature dependence		-0.07	% by volume /10K	+- 15K	<0.3% volume 10 K
CO_2 (% vol)	15	0.07	% by volume per	15	
NO (mg/m3)	300	0.02	% by volume per	300	
NO_2 (mg/m3)	30	0	% by volume per	30	
Combined interference		0.56	% range		<2% range
Dependence on voltage		0.1	% by volume /10V	+- 5%	< 0.1%vol /10 volt
Losses in the line (leak)		0.92879257	% of value		< 2% of value
Uncertainty of calibration gas		0.9	% of value		

Effect of drift	
0.00	% vol
0.00	% value

	range of variation from conditions at calibration			
	min	max	value at calib	
flow	5	15	10	l/h
pressure	99.00	101	100	kPa
temp	280	285	285	K
CO_2 range	8	15	0	% vol
NO range	100	150	0	mg/m3
NO_2 range	5	7.5	0	mg/m3
Voltage	105	115	110	V

Performance characteristic			**Uncertainty**		**Value of uncertainty quantity**		**% vol**
Standard deviation of repeatability at zero			U_{zc}		for mean		Only use rep at span
Standard deviation of repeatability at span level			U_{rs}		for mean		0.00
Lack of fit			U_{fit}				0.08
Drift			U_{zse}				0.00
volume or pressure flow dependence			U_{dpress}				0.00
atmospheric pressure dependence			U_{dpress}				0.04
ambient temperature dependence			U_{temp}				-0.02
CO_2							0.05
NO							0.01
NO_2							0.00
Combined interference (from mcerts)							0.08
dependence on voltage			U_{volt}				0.03
losses in the line (leak)			U_{leak}				0.06
Uncertainty of calibration gas			U_{calib}				0.06

Use largest of sum of all positive or all negative influences

0.06	all +ves	Criteria
0	all -ves	sum <2% value
0.06	largest	0.213974732

Value to use for intereference uncertainty

U_{int} 0.06

Measurement uncertainty			10.70	%vol
Combined uncertainty			0.14	%vol
% of value			1.29	%
Coverage factor k =	2			
Expanded uncertainty	**expressed with a level of confidence of 95%**		**2.58**	**% of value**
Expanded uncertainty	**expressed with a level of confidence of 95%**		**0.28**	**% vol**

QGU-007-2013 Uncertainty calculation for Gaseous Measurement Oxygen EN14789

V2.2 Jul-08

Limit value	n/a	**%vol**	**Calibration gas**	**0.209**	**%vol**
Measured concentration	4.42	**%vol**	**Full Scale**	**0.25**	**%vol**

Performance characteristics	**Value**				**specification**
Response time		30	seconds		< 200 s
Logger sampling interval		60	seconds		
Measurement period		30	minutes		
Number of readings in measurement		30	Assuming 1 minute collected over 1 hour		
Repeatability at zero		0.015	% by volume	stdev	<0.2 % range
Repeatability at span level		0.014	% by volume	stdev	<0.4 % range
Deviation from linearity		0	% vol	+/-	<0.3 % volume
Zero drift (during measurement period)		0.0011	% vol at zero level	+/-	<2% of volume / 24hr
Span drift (during measurement period)		0.0009	% vol at span level	+/-	<2% volume/24hr
volume or pressure flow dependence		0	% of fs / 10l/h	+- 5 l/h	<1% range
atmospheric pressure dependence		0.3	% of fs/kPa	+- 2kPa	< 1.5 % range
ambient temperature dependence		-0.07	% by volume /10K	+- 15K	<0.3% volume 10 K
CO_2 (% vol)	15	0.07	% by volume per	15	
NO (mg/m3)	300	0.02	% by volume per	300	
NO_2 (mg/m3)	30	0	% by volume per	30	
Combined interference		0.56	% range		<2% range
Dependence on voltage		0.1	% by volume /10V	+- 5%	< 0.1%vol /10 volt
Losses in the line (leak)		-0.09569378	% of value		< 2% of value
Uncertainty of calibration gas		0.35	% of value		

Effect of drift	
0.00	% vol
0.00	% value

	range of variation from conditions at calibration			
	min	max	value at calib	
flow	5	15	10	l/h
pressure	99.00	101	100	kPa
temp	280	285	285	K
CO_2 range	8	15	0	% vol
NO range	100	150	0	mg/m3
NO_2 range	5	7.5	0	mg/m3
Voltage	105	115	110	V

Performance characteristic			**Uncertainty**		**Value of uncertainty quantity**		**% vol**
Standard deviation of repeatability at zero			U_{zc}		for mean		Only use rep at span
Standard deviation of repeatability at span level			U_{rs}		for mean		0.00
Lack of fit			U_{fit}				0.08
Drift			U_{dzs}				0.00
volume or pressure flow dependence			U_{dpres}				0.00
atmospheric pressure dependence			U_{dpres}				0.04
ambient temperature dependence			U_{dtemp}				-0.02
CO_2							0.05
NO							0.01
NO_2							0.00
Combined interference (from mcerts)							0.08
dependence on voltage			U_{dvolt}				0.03
losses in the line (leak)			U_{leak}				0.13
Uncertainty of calibration gas			U_{calib}				0.03

Use largest of sum of all positive or all negative influences

0.06	all +ves	Criteria	
0	all -ves	sum <2% value	
0.06	largest		0.22

Value to use for intereference uncertainty

U_{int} 0.06

Measurement uncertainty			4.42	%vol
Combined uncertainty			0.17	%vol
% of value			3.91	%
Coverage factor k =	2			
Expanded uncertainty	**expressed with a level of confidence of 95%**		**7.82**	**% of value**
Expanded uncertainty	**expressed with a level of confidence of 95%**		**0.35**	**% vol**

2.2 Stack Emission Point Reference: A2-1

2.2.1 Suitability of Sample Location:

General Information	A2-1
Permanent/Temporary	Permanent
Inside/ Outside	Outside

Platform Details		
Irish EPA Technical Guidance Note AG1 / BS EN 15259 Platform Requirements	Value	Comment
Sufficient Working area to manipulate probe and measuring instruments	N/a	-
Platform has 2 handrails (approx. 0.5m & 1.0 m high)	N/a	-
Platform has vertical base boards (approx. 0.25 m high)	N/a	-
Platform has chains / self-closing gates at top of ladders	N/a	-
There are no obstructions present which hamper insertion of sampling equipment	N/a	-
Safe Access Available	Yes	-
Easy Access Available	Yes	-
Sampling Location / Platform Improvement Recommendations		
None.		
EN 15259 Homogeneity Test Requirements		
1.		
Select Option: 1: There is no requirement to perform a BSEN15259 Homogeneity Test on this stack 2: Test results were obtained from previous Homogeneity test carried out by ASL 3: Test results were obtained from previous Homogeneity test carried out by Alternative contractor 4: Homogeneity Test is required on this stack and the client has been informed of this requirement		

2.2.2 Stack Diagram

2.2.3 Stack Raw Data

Title:	***Determination of Speciated Organic Compounds***	
Method:	EN 13649	
Client:	Western Proteins	
Test Date:	23/05/2023	
Test Time:	13:00	
Laboratory Used:	RPS	
Stack Reference:	A2-1	

Leak Check Results	**Ammonia**	
Prior to test:	0	l/min
Post Test:	0	l/min
Sample Volume Flow Rate:	0.35	l/min
Standard Requirement:	<5	%
Test Result:	0.0	%
Test Status	Yes	

Calibration Details	**Ammonia**	
Pump Number:	21EQ511	
Calibration Unit:	22EQ515	
Calibration Unit Uncertainty:	<2	%
Calibration Rate Before Test:	0.35	l/min
Calibration Rate After Test:	0.35	l/min
Maximum allowed flow	0.5	l/min
Average sample Volume:	0.35	l/min
Sample Test Time:	30	minutes
Pump Gas Temperature:	14	^{O}C
Pump Sample Pressure:	101.3	kPa
Normalised Gas Volume:	0.00978	Nm^3

Tube Details	**Ammonia**	
Tube Type:	226-10-06	
Tube Identification Number:	8745704210	
Blank Identification Number:	8745704218	
Main Adsorbent Layer	400	mg
Backup Adsorbent Layer	200	mg
Containment Material	Glass	
Breakthrough Occurred	No	
Tubes in Lab in <7 days	Yes	
Tubes >7 days were stored	<4	Deg C
Tubes >7 days were stored	Dark	-
Transport Container Airtight	Yes	
Exposed to Sunlight	No	
Transport Temp <20 Deg C	Yes	
Field Blank <10% Analyte Value	Yes	
Field Blank <10% ELV	Yes	

Test Details		
Adsorption Tube Temperature:	14	^{O}C

Speciated Organic Results

Class I	***ug/tube***	***mg.Nm^{-3}***
Ammonia	20.8	2.13

Speciated Organic Results - Blanks

Class I	***ug/tube***	***mg.Nm^{-3}***
Ammonia	0.7	0.07

Uncertainty calculation		**A2-1**	**TA Luft Class 1**			Measurement Equation $c = \frac{m}{V} f_c$			
Limit value (ELV)	-	**mg.m^{-3}**	**Reference oxygen**		**% by volume**				
Measured concentration	2.13	**mg.m^{-3} (at reference conditions)**							

Measured Quantities	**Symbol**	**Value**	**Standard uncertainty**		**Units**		**Uncertainty as percentage**	**Uncertainty at lv**	**Requirement of std**
Sampled Volume Gas	V_m	0.009783276	uV_m	0.0001	**m^3**		1.02		<=2%
Sampled gas Temperature	T_m	287	uTm	2	k		2.00		<2.5 k
Sampled gas Pressure	ρ_m	101.3	up_m	1	**kPa**		0.99		<=1%
Sampled gas Humidity	H_m	0	uH_m	1	**% by volume**		1.00		<=1%
Oxygen content	$O_{2,m}$		$uO_{2,m}$	0.1	**% by volume**		#DIV/0!		<=5%
Note - Sampled gas humidity, temperature and pressure are values at the gas meter									
Leak	L	0.5			**%**		0.50		<=2%
Intermediate calculations									
Factor for std conds	fs	0.95							
uncertainty components	symbol	**sensitivity coeff**		**u (in units of fs)**					
	ρ_m	0.009		0.009					
	H_m	0.010		0.010		$f_s = \frac{(100 - H_m)}{100} \frac{273}{T_m} \frac{\rho_m}{101.3}$			
	T_m	0.003		0.007					
	ufs			0.015			1.57		
Corrected volume	V	0.01	uV	0.000	**m^3**	$V = V_m f_s$	1.90		
Factor for O2 correction	fc	1.00							
uncertainty components	symbol	**sensitivity coeff**		**u**		$f_c = \frac{21 - O_{2,ref}}{21 - O_{2,m}}$			
	$O_{2,m}$	0.05		0.005					
Factor for O2 Correction	ufc	1.00		0.005			0.48		

Parameter		**Value**	**Units**	**Sensitivity coeff**	**Uncertainty contribution**		**Uncertainty as %**	
Corrected Volume (standard condition	V	0.01	m^3	228.46	0.04	mg.m^{-3}	1.90	%
Factor for O2 Correction	fc	1.00		2.13	0.01	mg.m^{-3}	0.48	%
Leak	L	0.01	mg.m^{-3}	1.00	0.01	mg.m^{-3}	0.29	%
Combined uncertainty					**0.04**	mg.m^{-3}		
Expanded uncertainty as percentage of measured value			**3.96**	**% measured of value**		**expressed with a level of confidence of 95%**		
						(Using a coverage factor k=2)		
Expanded uncertainty in units of measurement			**0.0842**	**mg.m^{-3}**				

2.3 Stack Emission Point Reference: A2-2

2.3.1 Suitability of Sample Location:

General Information	A2-2
Permanent/Temporary	Permanent
Inside/ Outside	Outside

Platform Details		
Irish EPA Technical Guidance Note AG1 / BS EN 15259 Platform Requirements	Value	Comment
Sufficient Working area to manipulate probe and measuring instruments	N/a	-
Platform has 2 handrails (approx. 0.5m & 1.0 m high)	N/a	-
Platform has vertical base boards (approx. 0.25 m high)	N/a	-
Platform has chains / self-closing gates at top of ladders	N/a	-
There are no obstructions present which hamper insertion of sampling equipment	N/a	-
Safe Access Available	Yes	-
Easy Access Available	Yes	-
Sampling Location / Platform Improvement Recommendations		
None		
EN 15259 Homogeneity Test Requirements		
1.		
Select Option: 1: There is no requirement to perform a BSEN15259 Homogeneity Test on this stack 2: Test results were obtained from previous Homogeneity test carried out by ASL 3: Test results were obtained from previous Homogeneity test carried out by Alternative contractor 4: Homogeneity Test is required on this stack and the client has been informed of this requirement		

2.3.2 Stack Diagram

2.3.3 Stack Raw Data

Title:	***Determination of Speciated Organic Compounds***	
Method:	EN 13649	
Client:	Western Proteins	
Test Date:	23/05/2023	
Test Time:	14:30	
Laboratory Used:	RPS	
Stack Reference:	A2-2	

Leak Check Results	**VOCs**	
Prior to test:	0	l/min
Post Test:	0	l/min
Sample Volume Flow Rate:	0.35	l/min
Standard Requirement:	<5	%
Test Result:	0.0	%
Test Status	Yes	

Calibration Details	**VOCs**	
Pump Number:	21EQ511	
Calibration Unit:	22EQ515	
Calibration Unit Uncertainty:	<2	%
Calibration Rate Before Test:	0.35	l/min
Calibration Rate After Test:	0.35	l/min
Maximum allowed flow	0.5	l/min
Average sample Volume:	0.35	l/min
Sample Test Time:	30	minutes
Pump Gas Temperature:	14	^{O}C
Pump Sample Pressure:	101.3	kPa
Normalised Gas Volume:	0.00978	Nm^3

Tube Details	**VOCs**	
Tube Type:	226-10-06	
Tube Identification Number:	8745704211	
Blank Identification Number:	8745704218	
Main Adsorbent Layer	400	mg
Backup Adsorbent Layer	200	mg
Containment Material	Glass	
Breakthrough Occurred	No	
Tubes in Lab in <7 days	Yes	
Tubes >7 days were stored	<4	Deg C
Tubes >7 days were stored	Dark	-
Transport Container Airtight	Yes	
Exposed to Sunlight	No	
Transport Temp <20 Deg C	Yes	
Field Blank <10% Analyte Value	Yes	
Field Blank <10% ELV	Yes	

Test Details		
Adsorption Tube Temperature:	14	^{O}C

Speciated Organic Results

Class I	***ug/tube***	***mg.Nm^{-3}***
Ammonia	0.4	0.04

Speciated Organic Results - Blanks

Class I	***ug/tube***	***mg.Nm^{-3}***
Ammonia	0.7	0.07

Uncertainty calculation		**A2-2**	**TA Luft Class 1**			Measurement Equation $c = \frac{m}{V} f_c$			
Limit value (ELV)	-	**mg.m^{-3}**	**Reference oxygen**		**% by volume**				
Measured concentration	0.04	**mg.m^{-3} (at reference conditions)**							

Measured Quantities	**Symbol**	**Value**	**Standard uncertainty**		**Units**		**Uncertainty as percentage**	**Uncertainty at Iv**	**Requirement of std**
Sampled Volume Gas	V_m	0.009783276	uV_m	0.0001	**m^3**		1.02		<=2%
Sampled gas Temperature	T_m	287	uTm	2	k		2.00		<2.5 k
Sampled gas Pressure	ρ_m	101.3	$u\rho_m$	1	**kPa**		0.99		<=1%
Sampled gas Humidity	H_m	0	uH_m	1	**% by volume**		1.00		<=1%
Oxygen content	$O_{2,m}$		$uO_{2,m}$	0.1	**% by volume**		#DIV/0!		<=5%
Note - Sampled gas humidity, temperature and pressure are values at the gas meter									
Leak	L	0.5			**%**		0.50		<=2%
Intermediate calculations									
Factor for std conds	fs	0.95							
uncertainty components	symbol	**sensitivity coeff**		**u (in units of fs)**					
	ρ_m	0.009		0.009		$f_c = \frac{(100 - H_m)}{100} \frac{273}{T_m} \frac{\rho_m}{101.3}$			
	H_m	0.010		0.010					
	T_m	0.003		0.007					
	ufs			0.015			1.57		
Corrected volume	V	0.01	uV	0.000	**m^3**	$V = V_m f_s$	1.90		
Factor for O2 correction	fc	1.00							
uncertainty components	symbol	**sensitivity coeff**		**u**		$f_c = \frac{21 - O_{2,ref}}{21 - O_{2,m}}$			
	$O_{2,m}$	0.05		0.005					
Factor for O2 Correction	ufc	1.00		0.005			0.48		

Parameter		**Value**	**Units**	**Sensitivity coeff**	**Uncertainty contribution**		**Uncertainty as %**	
Corrected Volume (standard condition	V	0.01	m^3	4.39	0.00	mg.m^{-3}	1.90	%
Factor for O2 Correction	fc	1.00		0.04	0.00	mg.m^{-3}	0.48	%
Leak	L	0.00	mg.m^{-3}	1.00	0.00	mg.m^{-3}	0.29	%
Combined uncertainty					**0.00**	mg.m^{-3}		
Expanded uncertainty as percentage of measured value			**3.96**	**% measured of value**	**expressed with a level of confidence of 95%**			
					(Using a coverage factor k=2)			
Expanded uncertainty in units of measurement			**0.0016**	**mg.m^{-3}**				

Appendix III: Certificates and Process Detail Form

Process details form information not made available from Licensee at time of reporting. Details can be obtained direct from the client.

Certificate of Analysis

Report No.: **23-06428-1**

Issue No.: **1**
Date of Issue **05/07/2023**

Customer Details:	Axis Environmental Services Ltd, Unit 3, Westlink Business Park, Clondrinagh, Limerick, V94 K6XK, Ireland
Customer Contact:	Michael Healy
Customer Order No.:	WEPRTL15230523
Customer Reference:	Not Supplied
Quotation Reference:	Q23-05037
Description:	3 gas samples, 1 liquid sample, 1 solid sample
Date Received:	09/06/2023
Date Started:	09/06/2023
Date Completed:	05/07/2023
Test Methods:	Details available on request (refer to SOP code against relevant result/s)
Notes:	None

Approved By: **Joanne Dewhurst, Operational Manager**

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service.
This certificate shall not be reproduced except in full without the prior written approval of the laboratory.
Observations and interpretations are outside of the scope of UKAS accreditation.
Results reported herein relate only to the items supplied to the laboratory for testing.
Results on an Interim Report are not dry-weight corrected.
Where the laboratory is not responsible for the sampling, results apply to the sample(s) as they were received.
The laboratory shall not be responsible for any information that is supplied by the customer that may affect the validity of results.

UKAS TESTING 0605

mCERTS THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

Results Summary

Report No.: 23-06428-1

Customer Reference: Not Supplied

Customer Order No: WEPRTL15230523

Customer Sample No	253220	A1-1 Wash	8745704218	8745704211	8745704210
RPS Sample No	185199	185200	185201	185202	185203
Sample Matrix	FILTER	SOLUTION	TUBE	TUBE	TUBE
Sampling Date	23/05/2023	23/05/2023	23/05/2023	23/05/2023	23/05/2023

Determinand	CAS No	Codes	SOP	RL	Units					
particulates		UM	D9	0.04	mg	3.38				
particulates		UM	D9	0.5	mg		1.0			
ammonia	7664-41-7	U	A6	0.2	ug			0.7	0.4	20.8

Deviating Samples

Report No.: 23-06428-1

Customer Reference: Not Supplied

Customer Order No: WEPRTL15230523

Our policy on Deviating Samples has been implemented in accordance with UKAS Policy on Deviating Samples (TPS63).
RPS is not responsible for the integrity of samples as received, unless RPS personnel performed the sampling. Samples submitted may be declared to be deviating.
Where applicable the analysis method remains UKAS accredited, however results reported for a deviating sample may be compromised.
Where no sampling date was supplied, samples have been declared to be deviating. If the date can be supplied, results may be reissued if assessed not deviating.
Where the sample container used was unsuitable or broken, the sample is flagged as deviating and re-sampling/re-submisson may be required.

RPS No.	Customer No.	Customer ID	Date Sampled	Containers Received	Deviating	Reason for Deviation
185199	253220		23/05/2023	Container	No	
185200	A1-1 Wash		23/05/2023	Container	No	
185201	8745704218		23/05/2023	Container	No	
185202	8745704211		23/05/2023	Container	No	
185203	8745704210		23/05/2023	Container	No	

Report No.: 23-06428-1

Key Code	Description
N	Not Accredited Test
U	UKAS Accredited Test - UKAS accreditation is only implied if the report carries the UKAS logo
UF	UKAS Flexible Scope Test
M	MCERTS Accredited Test - MCERTS accreditation is only implied if the report carries the MCERTS logo
O	Marine Management Organisation (MMO) Validated
SN	Subcontracted to approved laboratory not accredited for the test
SU	Subcontracted to approved laboratory UKAS Accredited for the test
SM	Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test
SIN	Subcontracted to internal RPS Group laboratory not accredited for the test
SIU	Subcontracted to internal RPS Group laboratory UKAS Accredited for the test
SIM	Subcontracted to internal RPS Group laboratory MCERTS/UKAS Accredited for the test
I/S (in results)	Insufficient Sample
U/S (in results)	Unsuitable Sample
S/C (in results)	See Comments
ND (in results)	Not Detected
L (in results)	Result is outside normal limits

Please note that all samples will be destroyed 4 WEEKS after the report has been issued, with the exception of asbestos samples.

Note: Sample retention may be subject to agreement with the customer for particular projects

Certificate Notes	Description
Note 1	This test report shall not be reproduced except in full, without written approval of the Laboratory.
Note 2	Unless otherwise stated, results are not corrected for analytical recoveries.
Note 3	Samples were taken by the customer and, unless otherwise stated, sampling locations were not supplied.
Note 4	Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.
Note 5	Unless otherwise stated, method D9 conditioning temperatures are 180°C for pre-weigh and 160°C for re-weigh.
Note 6	The PDF version of the certificate is the definitive copy and the Excel version is uncontrolled and provided for information only.
Note 7	For asbestos analysis, all records, communications and reports pertaining to the analysis are retained for five years from the date of issue of the report. The sample analysed is retained for six months.
Note 8	For asbestos analysis, method of analysis used is stereo microscopy, polarised light microscopy and dispersion staining.

Note: Where the following information is included in this certificate, it has usually been supplied by the customer: Customer Sample ID, Sample Location, Sampling Date and Sample Air Volumes. The laboratory shall not be responsible for any information that is supplied by the customer that may affect the validity of results.

Report No.: 23-06428-1

Determinand	CAS No	Media	SOP	% Recovery	% Uncertainty
acetaldehyde	75-07-0	tube	A40	98	16.2
benzaldehyde	100-52-7	tube	A40	100	19.4
butyraldehyde	123-72-8	tube	A40	92	11.5
formaldehyde	50-00-0	tube	A40	97	12.8
hexanal	66-25-1	tube	A40	89	11
propionaldehyde	123-38-6	tube	A40	96	12.6
valeraldehyde	110-62-3	tube	A40	93	12.3
ammonia	7664-41-7	sulphuric scid solution	A6	n/a	8.9
chlorine	7782-50-5	sodium hydroxide solution	C27	n/a	15.2
hydrogen bromide	10035-10-6	sulphuric acid solution	C27	n/a	10.9
hydrogen chloride	7647-01-0	deionised water	C27	n/a	7.9
hydrogen chloride	7647-01-0	sulphuric acid solution	C27	n/a	13.3
hydrogen fluoride	7664-3-3	sodium hydroxide solution	C27	n/a	7.9
sulphur dioxide	7446-09-5	hydrogen peroxide solution	C27	n/a	7.7
nitrogen oxide	10102-43-9	potassium permanganate solution	C27	n/a	11.7
particulates	n/a	filter	D9	n/a	12.2
particulates	n/a	wash solution	D9	n/a	14.8
formaldehyde	50-00-0	deionised water	M103	n/a	23.7
2,4- & 2,6-toluene diisocyanate (TDI)	n/a	filter	M119	n/a	8.6
hexamethylene diisocyanate (HDI)	822-06-0	filter	M119	n/a	5.6
methylene diphenyl diisocyanate (MDI)	101-68-8	filter	M119	n/a	11.8
hydrogen sulphide	7783-06-4	zinc acetate solution	M120	n/a	4.2
antimony	7440-36-0	filter	M31	n/a	10.3
arsenic	7440-38-2	filter	M31	n/a	17.1
cadmium	7440-43.9	filter	M31	n/a	12.1
chromium	7440-47-3	filter	M31	n/a	17.1
cobalt	7440-48-4	filter	M31	n/a	13.1
copper	7440-50-8	filter	M31	n/a	14
lead	7439-92-1	filter	M31	n/a	9.8
manganese	7439-96-5	filter	M31	n/a	17.5
nickel	7440-02-0	filter	M31	n/a	14.4
thallium	7440-28-0	filter	M31	n/a	15.3
tin	7440-31-5	filter	M31	n/a	18.5
vanadium	7440-62-2	filter	M31	n/a	12.1
zinc	7440-66-6	filter	M31	n/a	15.2
antimony	7440-36-0	nitric acid wash	M31	n/a	10.3
arsenic	7440-38-2	nitric acid wash	M31	n/a	17.1
cadmium	7440-43-9	nitric acid wash	M31	n/a	12.1
chromium	7440-47-3	nitric acid wash	M31	n/a	17.1
cobalt	7440-48-4	nitric acid wash	M31	n/a	13.1
copper	7440-50-8	nitric acid wash	M31	n/a	14
lead	7439-92-1	nitric acid wash	M31	n/a	9.8
manganese	7439-96-5	nitric acid wash	M31	n/a	17.5
nickel	7440-02-0	nitric acid wash	M31	n/a	14.4
selenium	7782-49-2	nitric acid wash	M31	n/a	15.1
thallium	7440-28-0	nitric acid wash	M31	n/a	15.3
tin	7440-31-5	nitric acid wash	M31	n/a	18.5
vanadium	7440-62-2	nitric acid wash	M31	n/a	12.1
zinc	7440-66-6	nitric acid wash	M31	n/a	15.2
antimony	7440-36-0	nitric/peroxide solution	M31	n/a	5.9
arsenic	7440-38-2	nitric/peroxide solution	M31	n/a	6.8
cadmium	7440-43-9	nitric/peroxide solution	M31	n/a	6.3
chromium	7440-47-3	nitric/peroxide solution	M31	n/a	7.2
cobalt	7440-48-4	nitric/peroxide solution	M31	n/a	5.2
copper	7440-50-8	nitric/peroxide solution	M31	n/a	6.8
lead	7439-92-1	nitric/peroxide solution	M31	n/a	8.6
manganese	7439-96-5	nitric/peroxide solution	M31	n/a	9.6
nickel	7440-02-0	nitric/peroxide solution	M31	n/a	5.5
selenium	7782-49-2	nitric/peroxide solution	M31	n/a	8.7
thallium	7440-28-0	nitric/peroxide solution	M31	n/a	7.7
tin	7440-31-5	nitric/peroxide solution	M31	n/a	5.8
vanadium	7440-62-2	nitric/peroxide solution	M31	n/a	6.7
zinc	7440-66-6	nitric/peroxide solution	M31	n/a	11.9
1,2,4-trimethylbenzene	95-63-6	tube	O8	88	8.1
1,3,5-trimethylbenzene	108-67-8	tube	O8	92	7.7
2-ethyltoluene	611-14-3	tube	O8	91	8.4
3- & 4-ethyltoluene	n/a	tube	O8	91	8.4
benzene	71-43-2	tube	O8	90	13.9
butyl acetate	123-86-4	tube	O8	90	10.3
decane	124-18-5	tube	O8	97	6.7
dichloromethane	75-09-2	tube	O8	88	24
ethyl acetate	141-78-6	tube	O8	n/a	n/a
ethyl benzene	100-41-4	tube	O8	92	9.8
heptane	142-82-5	tube	O8	94	10.5
hexane	110-54-3	tube	O8	n/a	n/a
limonene	138-86-3	tube	O8	93	13
m- & p-xylene	n/a	tube	O8	90	9.3
methyl isobutyl ketone (MIBK)	108-10-1	tube	O8	86	10
methyl tert-butyl ether (MTBE)	1634-04-4	tube	O8	92	15
o-xylene	95-47-6	tube	O8	86	9.9
propylbenzene	103-65-1	tube	O8	92	7.5
tetrachloroethylene	127-18-4	tube	O8	91	9.3
tetrahydrofuran (THF)	109-99-9	tube	O8	87	14.7
toluene	108-88-3	tube	O8	89	10.7
trichloroethylene	79-01-6	tube	O8	91	10.6
m- & p-cresol	n/a	tube	P1	n/a	11
m- & p-xylenol	n/a	tube	P1	n/a	11.9
o-cresol	95-48-7	tube	P1	n/a	10.8
o-xylenol	526-75-0	tube	P1	n/a	12
phenol	108-95-2	tube	P1	n/a	10.4

Certificate of Analysis

Report No.: **23-06426-1**

Issue No.: **1**
Date of Issue **22/06/2023**

Customer Details:	Axis Environmental Services Ltd, Unit 3, Westlink Business Park, Clondrinagh, Limerick, V94 K6XK, Ireland
Customer Contact:	Michael Healy
Customer Order No.:	WEPRTL15230523
Customer Reference:	Not Supplied
Quotation Reference:	Q23-05037
Description:	1 liquid sample, 1 solid sample
Date Received:	09/06/2023
Date Started:	09/06/2023
Date Completed:	22/06/2023
Test Methods:	Details available on request (refer to SOP code against relevant result/s)
Notes:	None

Approved By: **Joanne Dewhurst, Operational Manager**

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service.
This certificate shall not be reproduced except in full without the prior written approval of the laboratory.
Observations and interpretations are outside of the scope of UKAS accreditation.
Results reported herein relate only to the items supplied to the laboratory for testing.
Results on an Interim Report are not dry-weight corrected.
Where the laboratory is not responsible for the sampling, results apply to the sample(s) as they were received.
The laboratory shall not be responsible for any information that is supplied by the customer that may affect the validity of results.

UKAS TESTING 0605

mCERTS THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

RPS Environmental Management Limited trading as RPS Laboratories. Registered in England No. 01756175.
Unit 12, Waters Edge Business Park, Modwen Road, Salford, M5 3EZ. T +44 161 872 2443
A member of the RPS Group plc. Terms and conditions apply - copy on request

Results Summary

Report No.: 23-06426-1

Customer Reference: Not Supplied

Customer Order No: WEPRTL15230523

Customer Sample No	253937	Blank Wash
RPS Sample No	185191	185192
Sample Matrix	FILTER	SOLUTION
Sampling Date	23/05/2023	23/05/2023

Determinand	CAS No	Codes	SOP	RL	Units		
particulates		UM	D9	0.04	mg	< 0.04	
particulates		UM	D9	0.5	mg		< 0.5

Deviating Samples

Report No.: 23-06426-1

Customer Reference: Not Supplied

Customer Order No: WEPRTL15230523

Our policy on Deviating Samples has been implemented in accordance with UKAS Policy on Deviating Samples (TPS63).
RPS is not responsible for the integrity of samples as received, unless RPS personnel performed the sampling. Samples submitted may be declared to be deviating.
Where applicable the analysis method remains UKAS accredited, however results reported for a deviating sample may be compromised.
Where no sampling date was supplied, samples have been declared to be deviating. If the date can be supplied, results may be reissued if assessed not deviating.
Where the sample container used was unsuitable or broken, the sample is flagged as deviating and re-sampling/re-submisson may be required.

RPS No.	Customer No.	Customer ID	Date Sampled	Containers Received	Deviating	Reason for Deviation
185191	253937		23/05/2023	Container	No	
185192	Blank Wash		23/05/2023	Container	No	

Report No.: 23-06426-1

Key Code	Description
N	Not Accredited Test
U	UKAS Accredited Test - UKAS accreditation is only implied if the report carries the UKAS logo
UF	UKAS Flexible Scope Test
M	MCERTS Accredited Test - MCERTS accreditation is only implied if the report carries the MCERTS logo
O	Marine Management Organisation (MMO) Validated
SN	Subcontracted to approved laboratory not accredited for the test
SU	Subcontracted to approved laboratory UKAS Accredited for the test
SM	Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test
SIN	Subcontracted to internal RPS Group laboratory not accredited for the test
SIU	Subcontracted to internal RPS Group laboratory UKAS Accredited for the test
SIM	Subcontracted to internal RPS Group laboratory MCERTS/UKAS Accredited for the test
I/S (in results)	Insufficient Sample
U/S (in results)	Unsuitable Sample
S/C (in results)	See Comments
ND (in results)	Not Detected
L (in results)	Result is outside normal limits

Please note that all samples will be destroyed 4 WEEKS after the report has been issued, with the exception of asbestos samples.

Note: Sample retention may be subject to agreement with the customer for particular projects

Certificate Notes	Description
Note 1	This test report shall not be reproduced except in full, without written approval of the Laboratory.
Note 2	Unless otherwise stated, results are not corrected for analytical recoveries.
Note 3	Samples were taken by the customer and, unless otherwise stated, sampling locations were not supplied.
Note 4	Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.
Note 5	Unless otherwise stated, method D9 conditioning temperatures are 180°C for pre-weigh and 160°C for re-weigh.
Note 6	The PDF version of the certificate is the definitive copy and the Excel version is uncontrolled and provided for information only.
Note 7	For asbestos analysis, all records, communications and reports pertaining to the analysis are retained for five years from the date of issue of the report. The sample analysed is retained for six months.
Note 8	For asbestos analysis, method of analysis used is stereo microscopy, polarised light microscopy and dispersion staining.

Note: Where the following information is included in this certificate, it has usually been supplied by the customer: Customer Sample ID, Sample Location, Sampling Date and Sample Air Volumes. The laboratory shall not be responsible for any information that is supplied by the customer that may affect the validity of results.

Report No.: 23-06426-1

Determinand	CAS No	Media	SOP	% Recovery	% Uncertainty
acetaldehyde	75-07-0	tube	A40	98	16.2
benzaldehyde	100-52-7	tube	A40	100	19.4
butyraldehyde	123-72-8	tube	A40	92	11.5
formaldehyde	50-00-0	tube	A40	97	12.8
hexanal	66-25-1	tube	A40	89	11
propionaldehyde	123-38-6	tube	A40	96	12.6
valeraldehyde	110-62-3	tube	A40	93	12.3
ammonia	7664-41-7	sulphuric scid solution	A6	n/a	8.9
chlorine	7782-50-5	sodium hydroxide solution	C27	n/a	15.2
hydrogen bromide	10035-10-6	sulphuric acid solution	C27	n/a	10.9
hydrogen chloride	7647-01-0	deionised water	C27	n/a	7.9
hydrogen chloride	7647-01-0	sulphuric acid solution	C27	n/a	13.3
hydrogen fluoride	7664-3-3	sodium hydroxide solution	C27	n/a	7.9
sulphur dioxide	7446-09-5	hydrogen peroxide solution	C27	n/a	7.7
nitrogen oxide	10102-43-9	potassium permanganate solution	C27	n/a	11.7
particulates	n/a	filter	D9	n/a	12.2
particulates	n/a	wash solution	D9	n/a	14.8
formaldehyde	50-00-0	deionised water	M103	n/a	23.7
2,4- & 2,6-toluene diisocyanate (TDI)	n/a	filter	M119	n/a	8.6
hexamethylene diisocyanate (HDI)	822-06-0	filter	M119	n/a	5.6
methylene diphenyl diisocyanate (MDI)	101-68-8	filter	M119	n/a	11.8
hydrogen sulphide	7783-06-4	zinc acetate solution	M120	n/a	4.2
antimony	7440-36-0	filter	M31	n/a	10.3
arsenic	7440-38-2	filter	M31	n/a	17.1
cadmium	7440-43.9	filter	M31	n/a	12.1
chromium	7440-47-3	filter	M31	n/a	17.1
cobalt	7440-48-4	filter	M31	n/a	13.1
copper	7440-50-8	filter	M31	n/a	14
lead	7439-92-1	filter	M31	n/a	9.8
manganese	7439-96-5	filter	M31	n/a	17.5
nickel	7440-02-0	filter	M31	n/a	14.4
thallium	7440-28-0	filter	M31	n/a	15.3
tin	7440-31-5	filter	M31	n/a	18.5
vanadium	7440-62-2	filter	M31	n/a	12.1
zinc	7440-66-6	filter	M31	n/a	15.2
antimony	7440-36-0	nitric acid wash	M31	n/a	10.3
arsenic	7440-38-2	nitric acid wash	M31	n/a	17.1
cadmium	7440-43-9	nitric acid wash	M31	n/a	12.1
chromium	7440-47-3	nitric acid wash	M31	n/a	17.1
cobalt	7440-48-4	nitric acid wash	M31	n/a	13.1
copper	7440-50-8	nitric acid wash	M31	n/a	14
lead	7439-92-1	nitric acid wash	M31	n/a	9.8
manganese	7439-96-5	nitric acid wash	M31	n/a	17.5
nickel	7440-02-0	nitric acid wash	M31	n/a	14.4
selenium	7782-49-2	nitric acid wash	M31	n/a	15.1
thallium	7440-28-0	nitric acid wash	M31	n/a	15.3
tin	7440-31-5	nitric acid wash	M31	n/a	18.5
vanadium	7440-62-2	nitric acid wash	M31	n/a	12.1
zinc	7440-66-6	nitric acid wash	M31	n/a	15.2
antimony	7440-36-0	nitric/peroxide solution	M31	n/a	5.9
arsenic	7440-38-2	nitric/peroxide solution	M31	n/a	6.8
cadmium	7440-43-9	nitric/peroxide solution	M31	n/a	6.3
chromium	7440-47-3	nitric/peroxide solution	M31	n/a	7.2
cobalt	7440-48-4	nitric/peroxide solution	M31	n/a	5.2
copper	7440-50-8	nitric/peroxide solution	M31	n/a	6.8
lead	7439-92-1	nitric/peroxide solution	M31	n/a	8.6
manganese	7439-96-5	nitric/peroxide solution	M31	n/a	9.6
nickel	7440-02-0	nitric/peroxide solution	M31	n/a	5.5
selenium	7782-49-2	nitric/peroxide solution	M31	n/a	8.7
thallium	7440-28-0	nitric/peroxide solution	M31	n/a	7.7
tin	7440-31-5	nitric/peroxide solution	M31	n/a	5.8
vanadium	7440-62-2	nitric/peroxide solution	M31	n/a	6.7
zinc	7440-66-6	nitric/peroxide solution	M31	n/a	11.9
1,2,4-trimethylbenzene	95-63-6	tube	O8	88	8.1
1,3,5-trimethylbenzene	108-67-8	tube	O8	92	7.7
2-ethyltoluene	611-14-3	tube	O8	91	8.4
3- & 4-ethyltoluene	n/a	tube	O8	91	8.4
benzene	71-43-2	tube	O8	90	13.9
butyl acetate	123-86-4	tube	O8	90	10.3
decane	124-18-5	tube	O8	97	6.7
dichloromethane	75-09-2	tube	O8	88	24
ethyl acetate	141-78-6	tube	O8	n/a	n/a
ethyl benzene	100-41-4	tube	O8	92	9.8
heptane	142-82-5	tube	O8	94	10.5
hexane	110-54-3	tube	O8	n/a	n/a
limonene	138-86-3	tube	O8	93	13
m- & p-xylene	n/a	tube	O8	90	9.3
methyl isobutyl ketone (MIBK)	108-10-1	tube	O8	86	10
methyl tert-butyl ether (MTBE)	1634-04-4	tube	O8	92	15
o-xylene	95-47-6	tube	O8	86	9.9
propylbenzene	103-65-1	tube	O8	92	7.5
tetrachloroethylene	127-18-4	tube	O8	91	9.3
tetrahydrofuran (THF)	109-99-9	tube	O8	87	14.7
toluene	108-88-3	tube	O8	89	10.7
trichloroethylene	79-01-6	tube	O8	91	10.6
m- & p-cresol	n/a	tube	P1	n/a	11
m- & p-xylenol	n/a	tube	P1	n/a	11.9
o-cresol	95-48-7	tube	P1	n/a	10.8
o-xylenol	526-75-0	tube	P1	n/a	12
phenol	108-95-2	tube	P1	n/a	10.4