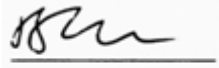


Appendix A7.6 2016 Flare Emissions Monitoring Report



Report Title	Air Emissions Compliance Monitoring Emissions Report
Company address	Air Scientific Ltd., 32 DeGranville Court, Dublin road, Trim, Co. Meath
Stack Emissions Testing Report Commissioned by	Kildare County Council
Facility Name	Kerdiffstown Landfill
Contact Person	Ms. Claire McLoughlin
EPA Licence Number	WL0047-02
Licence Holder	Kerdiffstown Landfill, F1
Stack Reference Number	F1
Dates of the Monitoring Campaign	28/07/2016
Job Reference Number	KELATL1280716 / 2016390
Report Written By	Dr. John Casey
Report Approved by	Dr. Brian Sheridan
Stack Testing Team	Dr. John Casey
Report Date	13/09/2016
Report Type	Test Report Compliance Monitoring
Version	1
Signature of Approver	 Brian Sheridan Technical Manager

Contents

1. Executive Summary.....	4
I. Monitoring Objectives	4
Overall Aim of the monitoring Campaign	4
Special Requirements	4
Target Parameters	4
Emission Limit Values.....	4
Reference Conditions.....	4
Overall Results	5
Accreditation details	5
Monitoring Dates & Times.....	6
Process details	7
Monitoring, Equipment & Analytical Methods.....	8
Sampling Deviations.....	10
Reference Documents.....	10
Suitability of sampling location.....	11
Stack diagram.....	12
2. APPENDICES	13
II. Appendix I - Monitoring Personnel & Equipment.....	13
Stack Emissions Monitoring Personnel.....	13
III. Appendix II - Stack Details & flow characteristics.....	14
Preliminary stack survey calculations	14
IV. Appendix III - Individual parameter sampling details and results	21
Carbon Monoxide Quality Assurance	21
Carbon Monoxide Results & Sampling details.....	22
Carbon Monoxide Trend	23
Carbon Monoxide Measurement Uncertainty.....	24
Oxides of Nitrogen Quality Assurance	25
Oxides of Nitrogen Results & Sampling details.....	26
Oxides of Nitrogen Trend.....	27
Oxides of Nitrogen Measurement Uncertainty	28
Total Volatile Organic Carbon Quality Assurance	29
Total Volatile Organic Carbon Results and Sampling Details.....	30
Total Volatile Organic Carbon Trend.....	31
Total Volatile Organic Carbon Measurement Uncertainty	32
Hydrogen Chloride Sampling Details & Results	33
Hydrogen Chloride Quality Assurance	34
Hydrogen Chloride Results & Measurement Uncertainty	35
Hydrogen Fluoride Sampling Details & Results.....	36
Hydrogen fluoride Quality Assurance	37
Hydrogen Fluoride Results & Measurement Uncertainty	38
Sulphur Dioxide Quality Assurance.....	39
Sulphur Dioxide Results & Sampling details	40
Sulphur Dioxide Trend	41
Sulphur Dioxide Measurement Uncertainty.....	42

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1. Executive Summary

I. Monitoring Objectives

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.

Special Requirements

There were no special requirements.

Target Parameters

Carbon Monoxide (CO)
Oxides of Nitrogen (NOx) as NO ₂
Total Volatile Organic Carbon (TOC)
Hydrogen Chloride (HCL)
Hydrogen Fluoride (HF)
Sulphur Dioxide (SO ₂)
Stack Gas Temperature
Volume (m ³ .h ⁻¹)

Emission Limit Values

Emission Limit Values / Mass Emissions Limit Values	mg.m ⁻³	kg.h ⁻¹
CO	-	-
NOx as NO ₂	-	-
TOC	-	-
HCL	-	-
HF	-	-
SO ₂	-	-
Stack Gas Temperature	-	-
Volume (m ³ .h ⁻¹)	-	-

Reference Conditions

Reference Conditions	Value
Oxygen Reference %	3
Temperature °C	273.15
Total Pressure kPa	101.3
Moisture %	Yes

Executive Summary

Overall Results

	Concentration				
Parameter	Units	Result	MU +/-	Limit	Compliant
Carbon Monoxide (CO)	mg.m ⁻³	19.13	2.99	-	N/A
Oxides of Nitrogen (NOx) as NO ₂	mg.m ⁻³	17.74	2.39	-	N/A
Total Volatile Organic Carbon (VOC)	mgC.m ⁻³	4.23	0.60	-	N/A
Hydrogen Chloride (HCL)	mg.m ⁻³	0.82	0.003	-	N/A
Hydrogen Fluoride (HF)	mg.m ⁻³	<0.28	0.01	-	N/A
Sulphur Dioxide (SO ₂)	mg.m ⁻³	929.98	58.76	-	N/A
Oxygen (%)	% v/v	8.13	0.15	-	N/A
Stack Gas Temperature	K	1288.15	-	-	N/A

Accreditation details

Air Scientific Limited	INAB319T
External Analytical Laboratory	UKAS1549
Other	-

Executive Summary

Monitoring Dates & Times

Parameter	Run	Location ID	Sampling Dates	Sampling Time On	Sampling Time Off	Duration (mins.)
Carbon Monoxide (CO)	Run 1	F1	28/07/2016	10:33:00	11:04:00	00:31:00
	Run 2	-	-	-	-	-
	Run 3	-	-	-	-	-
Oxides of Nitrogen (NOx) as NO ₂	Run 1	F1	28/07/2016	10:33:00	11:04:00	00:31:00
	Run 2	-	-	-	-	-
	Run 3	-	-	-	-	-
Total Volatile Organic Carbon (VOC)	Run 1	F1	28/07/2016	10:36:08	11:04:08	00:30:00
	Run 2	-	-	-	-	-
	Run 3	-	-	-	-	-
Hydrogen Chloride (HCL)	Run 1	F1	28/07/2016	09:05:00	09:37:00	00:32:00
	Run 2	-	-	-	-	-
	Run 3	-	-	-	-	-
Hydrogen Fluoride (HF)	Run 1	F1	28/07/2016	09:50:00	10:21:00	00:31:00
	Run 2	-	-	-	-	-
	Run 3	-	-	-	-	-
Sulphur Dioxide (SO ₂)	Run 1	F1	28/07/2016	10:33:00	11:04:00	00:31:00
	Run 2	-	-	-	-	-
	Run 3	-	-	-	-	-
Oxygen (%)		F1	28/07/2016	10:33:00	11:04:00	00:31:00

Executive Summary

Process details

Parameter	
Process status	Normal
Capacity (per/hour) (if applicable)	69m3/hr
Continuous or Batch Process	Continuous
Feedstock	LFG
Abatement System	No
Abatement Systems Running Status	N/A
Fuel	LFG
Plume Appearance	Yes
Other information	None

Executive Summary

Monitoring, Equipment & Analytical Methods

	Monitoring				Analysis	
Parameter	Standard	Technical Procedure	Accredited Testing	Testing Lab	Analytical Technique	Analysis Lab
Carbon Monoxide (CO)	EN15058:2006	SOP 2004	Yes	AirSci	NCIR By Horiba PG-250	AirSci
Oxides of Nitrogen (NOx)	EN14792:2006	SOP 2002	Yes	AirSci	Chemiluminescence	AirSci
Total Volatile Organic Carbon (TOC)	EN12619:2013	SOP 2009	Yes	AirSci	Flame Ionisation Detection	AirSci
Hydrogen Chloride (HCL)	EN1911:2010	SOP 2014	Yes	AirSci	Ion Chromatography	SAL
Hydrogen Fluoride (HF)	EN15713:2006	SOP 2024	No	AirSci	Ion Chromatography	SAL
Sulphur Dioxide (SO2)	TGN 21	SOP 2012	Yes	AirSci	NDIR Absorption	AirSci
Oxygen (%)	EN14789:2005	SOP 2008	Yes	AirSci	Paramagnetic	AirSci
Stack Gas Temperature	EN16911:2013	SOP 2005	No	AirSci	Thermocouple	AirSci

List of Equipment

ID	Item of Equipment	Manufacturer	Serial No.
ASLTM12EQ509	3010 MinfiFID	Signal Instruments	16764
ASLTM12EQ517	Testo 400 Gas Pressure Vacuum and Flow	Testo	00828828/305
ASLTM12EQ520	Buhler Sample Gas Cooler	Buhler Technologies	100063602044367-001
ASLTM13EQ504	Horiba PG2500 Portable Flue Gas Analyser	Horiba	41432840053
ASLTM13EQ509	10 metre industrial heated sample line (Temp controller box 1 & 2)	Neptech	13B088
ASLTM15EQ505	Mass flow meter	Siargo	A1K05286

Sampling Deviations

Parameter	Deviation
Standard ID	EN1911 & EN15713 - absorption efficiency <95%
Standard ID	-
Standard ID	-
Standard ID	-

Reference Documents

Risk Assessment (RA)	SOP1011
Site Review (SR)	SOP1015
Site Specific Protocol (SSP)	SOP1015

Executive Summary

Suitability of sampling location

General Information	Value
Permanent/Temporary	Temporary
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	No	-
Safe Access Available	Yes	-
Easy Access Available	Yes	-

Sampling Location / Platform Improvement Recommendations
None

BSEN 15259 Homogeneity Test Requirements
1: There is no requirement to perform a BSEN15259 Homogeneity Test on this stack
E.g. 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: Other: Enter Description

Executive Summary

Stack diagram



APPENDICES

II. *Appendix I Monitoring Personnel & Equipment*

Stack Emissions Monitoring Personnel

Team Leader	Name	John Casey
	Qualifications	PhD. (Eng.), MSc. (Agr.), B. Agr. Sc.
	System approval	Air Scientific Limited Approved
		-

III. Appendix II Stack Details & flow characteristics

Preliminary stack survey calculations

General Stack Details		
Stack details	Units	Value
Date of survey		28/07/2016
Time of survey		-
Type		Circular
Stack Diameter / Depth, D	m	-
Stack Width, W	m	-
Average Stack Gas Temp., Ta	C	1015
Average Static Pressure, P static	kPa	-
Average Barometric Pressure, Pb	kPa	-
Type of Pitot		-
Are Water Droplets Present ?		-
Average Pitot Tube Calibration Coeff, Cp		-
Negative flow		-
Highly homogeneous flow stream/gas velocity		Yes

Sample Port Size	mm	-
Initial Pitot Leak Check	Pa	-
Final Pitot Leak Check	Pa	-
Orientation of Duct		Vertical
Pitot Tube Cp		0.998
Number of Lines Available		1
Number of Lines Used		1

Sampling Line A						
Point	Distance to duct (m)	Pa	Temp °C	Velocity (m/s)	Oxygen (%)	Angle of Swirl
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	-	-	-	-	-	-
Average	-	-	-	-	-	-
Min	-	-	-	-	-	-
Max	-	-	-	-	-	-

Sampling Line B						
Point	Distance to duct (m)	Pa	Temp °C	Velocity (m/s)	Oxygen (%)	Angle of Swirl
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	-	-	-	-	-	-
Average	-	-	-	-	-	-
Min	-	-	-	-	-	-
Max	-	-	-	-	-	-

Document No.: KELATL1280716 / 2016390
 Visit No: 1
 Year: 2016
 Office: Trim

IPPC Licence No.: WL0047-02
 Licence Holder: Kerdiffstown Landfill, F1
 Facility Location: Kerdiffstown Landfill
 Rev.No: 1

Component	Conc. ppm	Conc. Dry % v/v	Conc. Wet % v/v	Molar Mass
Carbon Dioxide CO ₂	-	10.31	-	44.01
Oxygen O ₂	-	8.12	-	32
Nitrogen N ₂	-	81.57	-	28.1
Moisture (H ₂ O)	-	-	9	18.02
Reference Conditions	Units	Numbers		
Temperature	°C	273.15		
Total Pressure	kPa	101.3		
Moisture	%	-		
Oxygen (Dry)	%	3		

Stack Gas Composition & Molecular Weights								
Component	Molar Mass M	Density Kg/m ³ p	Conc. Dry % v/v	Dry Volume Fraction r	Dry Conc. kg/m ³ pi	Conc. wet % v/v	Wet Volume Fraction r	Wet Conc. kg/m ³ pi
Carbon Dioxide CO ₂	44.01	1.96	10.31	0.1031	0.20	9.38	0.09	0.18
Oxygen O ₂	32	1.43	8.12	0.0812	0.12	7.39	0.07	0.11
Nitrogen N ₂	28.1	1.25	81.57	0.8157	1.02	74.23	0.74	0.93
Moisture (H ₂ O)	18.02	0.80	-	-	-	9	0.09	0.07
	-	-	-	-	-	-	-	-
where p=M/22.41	-	-	-	-	-	-	-	-
pi = r x p	-	-	-	-	-	-	-	-

Calculation of Stack Gas Densities		
Determinand	Units	Result
Dry Density (STP), P STD	kg.m ⁻³	1.341
Wet Density (STP), P STW	kg.m ⁻³	1.297
Dry Density (Actual), P Actual	kg.m ⁻³	-
Average wet Density (Actual), P ActualW	kg.m ⁻³	-
Where		
P STD = sum of component concentrations, kg/m ³ (excluding water vapour)	-	-
$P_{STW} = (P_{STD} + p_{i \text{ of } H_2O}) / (1 + (p_{i \text{ of } H_2O} / 0.8036))$	-	-
$P_{actual} = P_{STD} \times (T_{STP} / (P_{STP})) \times (P_a / T_a)$	-	-
$P_{actual \ W} \text{ (at each sampling point)} = P_{STW} \times (T_s / P_s) \times (P_a / T_a)$	-	-

Sampling Plane Validation Criteria	Value	Units	Requirement	Compliance	Method
Lowest Differential Pressure	-	Pa	>5 Pa	N/A	EN16911:2013
Lowest Gas Velocity	-	m/s	-	N/A	-
Highest Gas Velocity	-	m/s	-	N/A	-
Ratio of Above	-	:1	<3:1	N/A	EN16911:2013
Mean Velocity	-	m/s	-	N/A	-
Angle of flow with regard to duct axis	-	degrees	< 15	N/A	EN16911:2013
No local negative flow	-	-	-	N/A	-
Homogeneous flow stream/gas velocity	-	-	-	N/A	-

Calculation of stack Gas Velocity, V	
Velocity at Traverse Point, $V = K_{cp} \cdot \sqrt{(2 \cdot DP) / \text{Density}}$	-
Where	
K_{pt} = Pitot tube calibration coefficient	-
Compressibility correction factor, assumed at a constant 0.998	0.998

Gas Volumetric Flowrate	Units	Result
Gas Volumetric Flow Rate (Actual)	$m^3 \cdot h^{-1}$	-
Gas Volumetric Flow Rate (STP, Wet)	$m^3 \cdot h^{-1}$	-
Gas Volumetric Flowrate (STP, Dry)	$m^3 \cdot h^{-1}$	-
Gas Volumetric Flowrate REF to Oxygen	$m^3 \cdot h^{-1}$	-

IV. Appendix III Individual parameter sampling details and results

Carbon Monoxide Quality Assurance

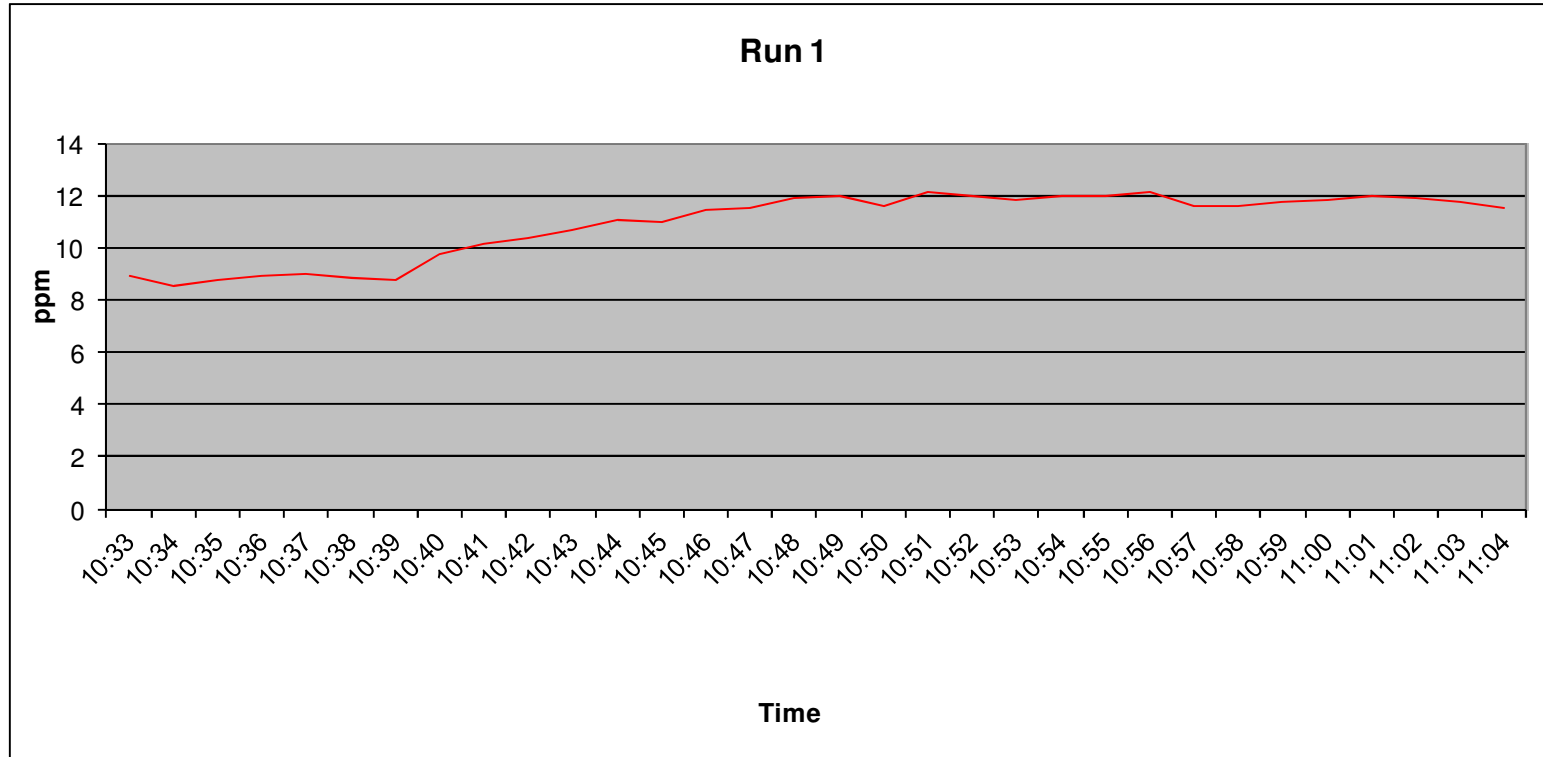
Sampling Details		
Stack ID	F1	-
	Units	Run 1
<i>Parameter</i>		
Sampling Times	-	10:32
Sampling Dates	-	28/07/2016
Instrument Range	ppm	200
Span Gas Value	ppm	149
Acceptable Gas Range	-	Yes
<i>Quality Assurance</i>	Units	Run 1
Conditioning Unit Temperature	C	2
Average Temperature	< C	2
Allowable Temperature	-	4
Temperature Acceptable	-	Yes
Pump flow rate	l/min.	0.5
<i>Zero Drift</i>	Units	Run 1
Zero Down Sampling Line (Pre)	ppm	0.2
Zero Down Sampling Line (Post)	ppm	0.4
Zero drift	ppm	0.2
Allowable Zero Drift	ppm	2.97
Zero Drift Acceptable	-	Yes
<i>Span Drift</i>	Units	Run 1
Span Down Sampling Line (Pre)	ppm	148.8
Span Down Sampling Line (Post)	ppm	150.4
Span Drift	ppm	1.6
Allowable Span Drift	ppm	2.97
Span Drift Acceptable (Y/N)	-	Yes
<i>Leak Check</i>		
Span Gas Conc.	ppm	149
Recorded Conc. down Line	ppm	148.8
Leak check acceptable (< 2%)	(Y/N)	Yes
Test Conditions	Units	Run 1
Run Ambient Temperature Range	C	15

Carbon Monoxide Results & Sampling details

Parameter	Units	Run 1
Concentration	mg.m ⁻³	13.65
Uncertainty	mg.m ⁻³	2.99
Mass Emission	kg.h	-

General Sampling Information	
Parameter	Value
Standard	EN15058
Technical Procedure	SOP2004
Probe material	SS
Filtration Type/Size	PTFE
Heated Head Filter Used	Yes
Heated Line Temperature	190
Span Gas Reference Number	ASLTM15ING508
Span Gas Expiry Date	Nov-17
Span Gas Start Pressure (bar)	20
Gas Cylinder Concentration (ppm)	149
Span Gas Uncertainty (%)	<2
Zero Gas Type	Nitrogen
Number of Sampling Lines Used	1
Number of Sampling Points Used	1
Sample Point I.D's	F1
Reference Conditions	
Temperature (K)	273.15
Pressure (kPa)	101.3
Gas (Wet or Dry)	Dry
Oxygen	3

Carbon Monoxide Trend



Carbon Monoxide Measurement Uncertainty

	Units	Run 1
Measured Quantities		
Certified Range of Analyser	ppm	1.36 to 1000
Operational Range of Analyser	ppm	200
Measured Reading	ppm	10.92
Measured Quantities	Units	Run 1
Nonlinearity	%	0.9
Temperature Dependent Zero drift	%	0.14
Temperature Dependent Span drift	%	-0.12
Cross-sensitivity	%	0.08
Leak	%	0
Calibration Gas Uncertainty	%	<2
Parameter	Units	Run 1
Combined uncertainty	mg.m ⁻³	0.99
Expanded uncertainty	mg.m ⁻³	1.98
Uncertainty corrected to std conds.	mg.m ⁻³	2.99
Expanded uncertainty expressed with a level of confidence of 95%	% of ELV	-
Expanded uncertainty expressed with a level of confidence of 95%	mg.m ⁻³	2.99
Expanded uncertainty expressed with a level of confidence of 95%	% of value	21.90
Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions		

Oxides of Nitrogen Quality Assurance

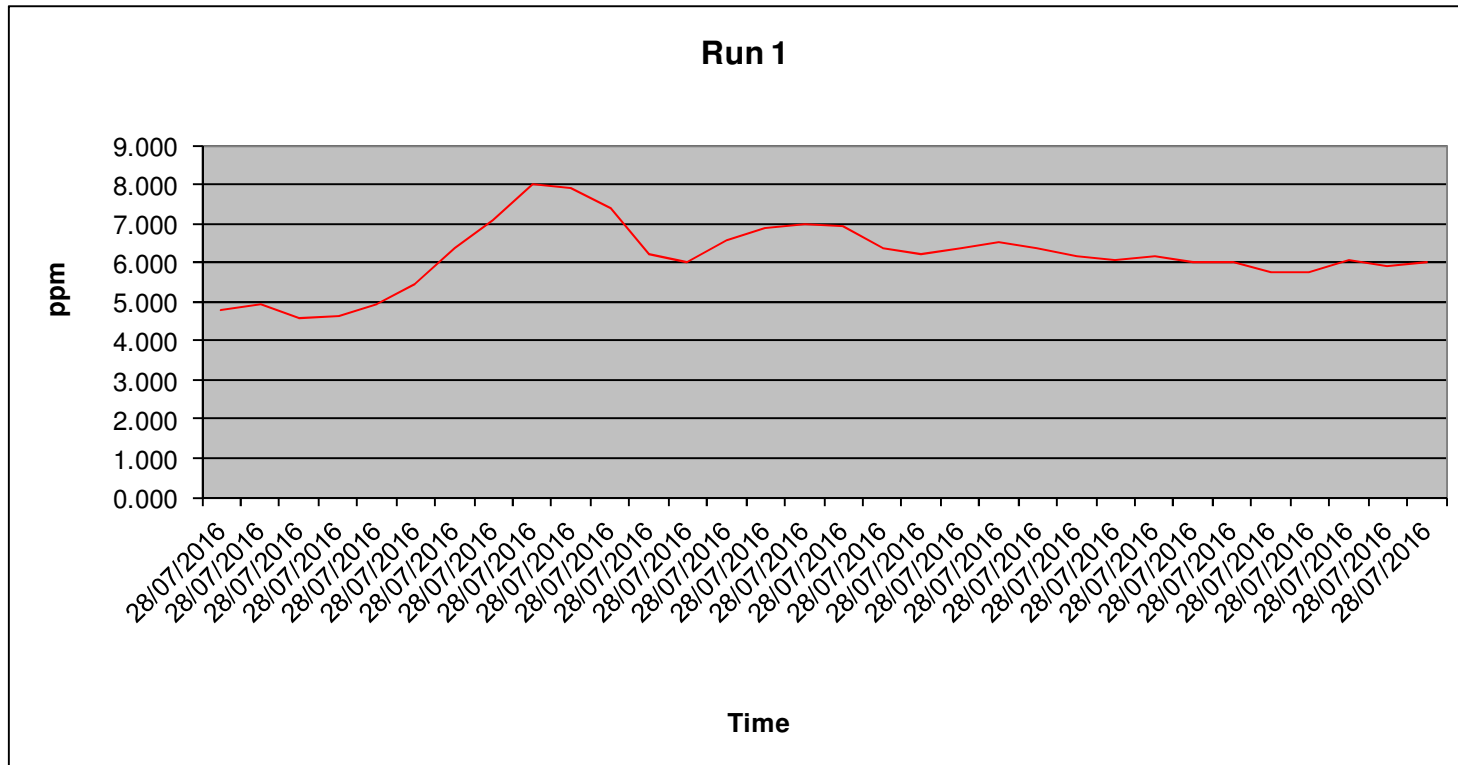
Sampling Details		
Stack ID	F1	-
	Units	Run 1
<i>Parameter</i>		
Sampling Times	-	10:32
Sampling Dates	-	28/07/2016
Instrument Range	ppm	250
Span Gas Value	ppm	158
Acceptable Gas Range	-	Yes
<i>Quality Assurance</i>	Units	Run 1
Conditioning Unit Temperature	C	2
Average Temperature	< C	2
Allowable Temperature	-	4
Temperature Acceptable	-	Yes
Pump flow rate	l/min.	0.5
<i>Zero Drift</i>	Units	Run 1
Zero Down Sampling Line (Pre)	ppm	0.1
Zero Down Sampling Line (Post)	ppm	0
Zero drift	ppm	0.1
Allowable Zero Drift	ppm	3.16
Zero Drift Acceptable	-	Yes
<i>Span Drift</i>	Units	Run 1
Span Down Sampling Line (Pre)	ppm	158.4
Span Down Sampling Line (Post)	ppm	156.3
Span Drift	ppm	2.1
Allowable Span Drift	ppm	3.16
Span Drift Acceptable (Y/N)	-	Yes
<i>Leak Check</i>		
Span Gas Conc.	ppm	158
Recorded Conc. down Line	ppm	158.4
Leak check acceptable (< 2%)	(Y/N)	Yes
<i>Test Conditions</i>	Units	Run 1
Run Ambient Temperature Range	C	15
NOx Converter Efficiency	%	95.3

Oxides of Nitrogen Results & Sampling details

Parameter	Units	Run 1
Concentration	mg.m ⁻³	12.66
Uncertainty	mg.m ⁻³	2.39
Mass Emission	kg.h ⁻¹	-

General Sampling Information	
Parameter	Value
Standard	EN14792
Technical Procedure	SOP2002
Probe material	SS
Filtration Type/Size	PTFE
Heated Head Filter Used	Yes
Heated Line Temperature	190
Date & Result of last converter check	95.3 18/12/2015
Span Gas Reference Number	ASLTM15ING533
Span Gas Expiry Date	Dec-16
Span Gas Start Pressure (bar)	40
Gas Cylinder Concentration (ppm)	158
Span Gas Uncertainty (%)	<2
Zero Gas Type	Nitrogen
Number of Sampling Lines Used	1
Number of Sampling Points Used	1
Sample Point I.D's	F1
Reference Conditions	
Temperature (K)	273.15
Pressure (kPa)	101.3
Gas (Wet or Dry)	Dry
Oxygen	3

Oxides of Nitrogen Trend



Oxides of Nitrogen Measurement Uncertainty

Measured Quantities	Units	Run 1
Nonlinearity	%	1.4
Temperature Dependent Zero drift	%	-0.04
Temperature Dependent Span drift	%	-0.25
Cross-sensitivity	%	0.5
Leak	%	0
Calibration Gas Uncertainty	%	<2
Mass Flow Controllers (Dilution) Uncertainty	%	<1
NOx Converter Efficiency	%	95.3
Parameter	Units	Run 1
Combined uncertainty	mg.m ⁻³	0.77
Expanded uncertainty	mg.m ⁻³	1.55
Uncertainty corrected to std conds.	mg.m ⁻³	2.39
Expanded uncertainty expressed with a level of confidence of 95%	% of ELV	-
Expanded uncertainty expressed with a level of confidence of 95%	mg.m ⁻³	2.39
Expanded uncertainty expressed with a level of confidence of 95%	% of value	18.84
Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions		

Total Volatile Organic Carbon Quality Assurance

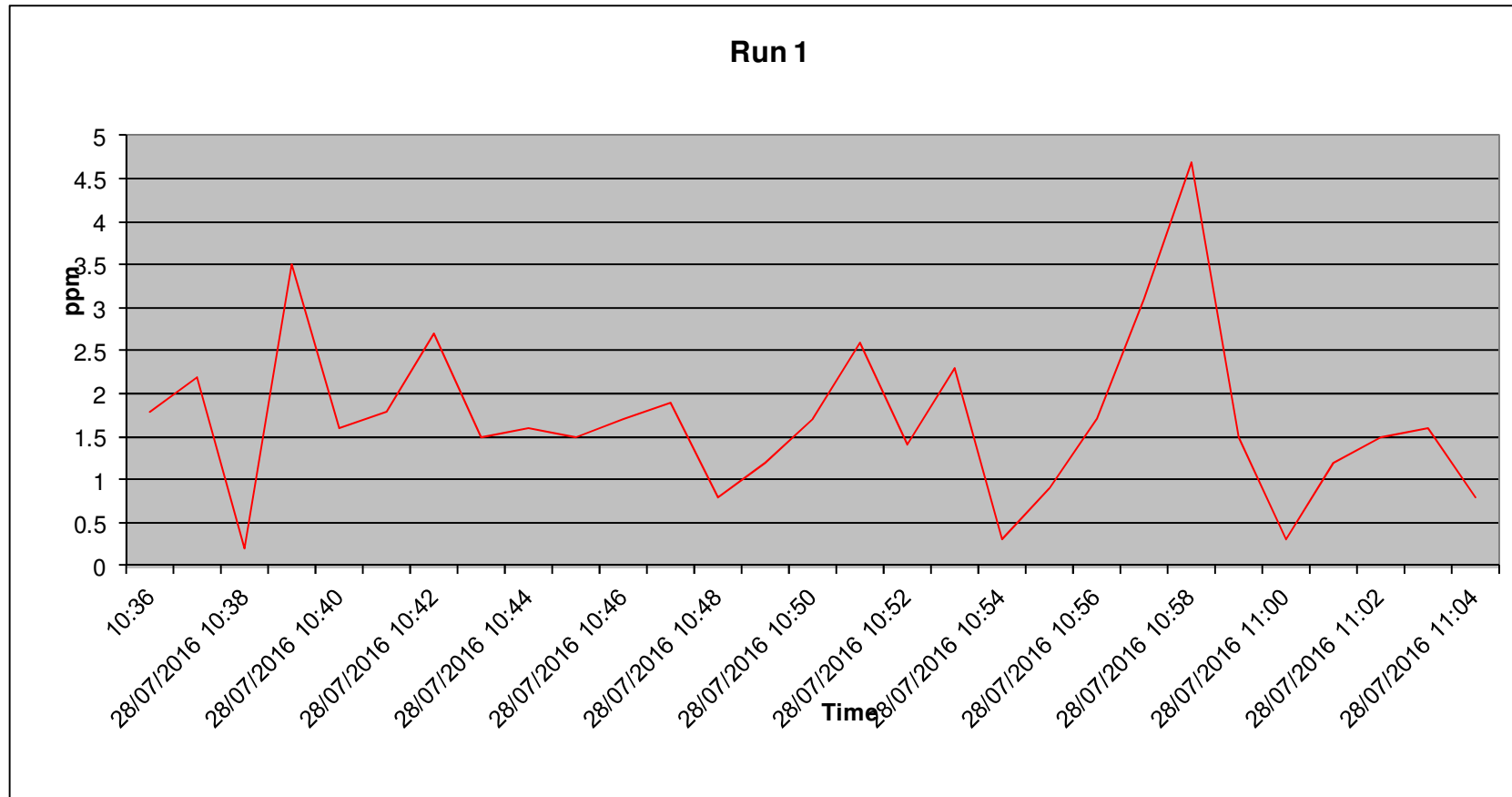
Sampling Details		
Stack ID	F1	-
	Units	Run 1
<i>Parameter</i>		
Sampling Times	-	10:36
Sampling Dates	-	28/07/2016
Instrument Range	ppm	100
Span Gas Value	ppm	79
Acceptable Gas Range	-	Yes
Quality Assurance	Units	Run 1
Oven Temperature	C	193
Average Temperature	< C	193
Temperature Acceptable	-	Yes
Sample line temperature	C	190
Zero Drift	Units	Run 1
Zero Down Sampling Line (Pre)	ppm	0.1
Zero Down Sampling Line (Post)	ppm	0.4
Zero drift	ppm	0.3
Allowable Zero Drift	ppm	1.5
Zero Drift Acceptable	-	Yes
Span Drift	Units	Run 1
Span Down Sampling Line (Pre)	ppm	78.9
Span Down Sampling Line (Post)	ppm	77.8
Span Drift	ppm	1.1
Allowable Span Drift	ppm	1.5
Span Drift Acceptable (Y/N)	-	Yes
Leak Check		
Span Gas Conc.	ppm	79
Recorded Conc. down Line	ppm	78.9
Leak check acceptable (< 2%)	(Y/N)	Yes

Total Volatile Organic Carbon Results and Sampling Details

Parameter	Units	Run 1
Concentration	mgC.m ⁻³	3.02
Uncertainty	mgC.m ⁻³	0.60
Mass Emission	kg.h ⁻¹	-

General Sampling Information	
Parameter	Value
Standard	EN12619
Technical Procedure	SOP2009
Probe material	SS
Filtration Type/Size	PTFE
Heated Head Filter Used	Yes
Heated Line Temperature	190
Span Gas Reference Number	ASLTM15ING532
Span Gas Expiry Date	01/12/2018
Span Gas Start Pressure (bar)	30
Gas Cylinder Concentration (ppm)	79
Span Gas Uncertainty (%)	<2
Zero Gas Type	Ambient
Number of Sampling Lines Used	1
Number of Sampling Points Used	1
Sample Point I.D's	F1
Reference Conditions	-
Temperature (K)	273.15
Pressure (kPa)	101.3
Gas (Wet or Dry)	Dry
Oxygen	3

Total Volatile Organic Carbon Trend



Total Volatile Organic Carbon Measurement Uncertainty

	Units	Run 1
Measured Quantities		
Certified Range of Analyser	ppm	0.5 to 1000
Operational Range of Analyser	ppm	100
Measured Reading	ppm	1.71
Measured Quantities	Units	Run 1
Nonlinearity	%	0.068
Temperature Dependent Zero drift	%	0.3
Temperature Dependent Span drift	%	0.3
Cross-sensitivity	%	-
Leak	%	<2
Calibration Gas uncertainty	%	<2
Parameter	Units	Run 1
Combined uncertainty	mg.m ⁻³	0.30
Expanded uncertainty	mg.m ⁻³	0.60
Expanded uncertainty expressed with a level of confidence of 95%	% of ELV	-
Expanded uncertainty expressed with a level of confidence of 95%	% of value	19.75
Expanded uncertainty expressed with a level of confidence of 95%	mg.m ⁻³	0.60
Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions		

Hydrogen Chloride Sampling Details & Results

Stack ID	F1	Run 1
Sample ID	F1HCL1	mls
Impinger 1 ID	F1HCL1+2	130
Impinger 2 ID	-	-
Impinger 3 ID	F1HCL3	130
Time on	09:05	
Time off	09:37	
Leak Check Results		
Prior to test:	0.03	l/min
Post Test:	0.02	l/min
Sample Volume Flow Rate:	1.8	l/min
Standard Requirement:	<2	%
Test Result:	0	%
Test Status	Pass	
Calibration Details		
Pump Number:	-	
Calibration Unit:	ASLTM15EQ505	
Calibration Rate Before Test:	1.8	litres per minute
Calibration Rate After Test:	1.900	litres per minute
Average sample Volume:	1.8	litres per minute
Sample Test Time:	32	minutes
Pump Gas Temperature:	0	°C
Pump Sample Pressure:	101.3	kPa
Actual Sample Volume:	0.05760	m ³
Normalised Gas Volume:	0.05760	Nm ³

Hydrogen Chloride Quality Assurance

Stack ID	F1	-
Date	28/07/2016	-
Start time	-	09:05:00
Finish Time	-	09:37:00
	Units	Run 1
Leak test results		
Mean Sampling Rate	l/min	1.8
Pre-sampling leak rate	l/min	0.03
Post-sampling leak rate	l/min	0.02
Leak rate	l/min	0
Acceptable leak rate (<2%)	Y/N	Yes
Filtration		
Filter Material	-	N/A
Filter Size	mm	N/A
Max. Filter Temp	degrees	N/A
Absorbers Type	Glass/PTFE/ Other	PTFE
Absorption Solution	-	Di H2O
Absorption Efficiency		
Total Imp1 + Imp 2 + Imp 3	ug	33.8
Impinger 3	ug	6.5
Absorption efficiency	%	81
Acceptable Absorption Eff.	>95% (Y/N)	N
Blank sample		
Blank sample ID	-	F1HCLB
Blank result	mg/m ³	<0.11
Acceptable Blank	<10% ELV (Y/N)	Y
Testing laboratory		
Laboratory Name	-	UKAS1549
Test certificate Number	-	589741

Hydrogen Chloride Results & Measurement Uncertainty

Stack ID	F1	Run 1
Date	-	
Start time	09:05	
Finish Time	09:37	
Results		
Laboratory Result	33.8	$\mu\text{g/ml}$
Impinger final Volume	260	ml
Concentration	0.03	mg
Sample Volume	0.058	Nm^3
Emissions Concentration	0.59	mg.m^{-3}
Mass Emissions	-	kg.h^{-1}

	Units	Run 1
	Units	Run 1
Parameter		
Combined Uncertainty	mg.m^{-3}	0.001
Expanded uncertainty as percentage of measured value	% of measured value	4.80
Expanded uncertainty in units of measurement	mg.m^{-3}	0.003
Expanded uncertainty as percentage of limit value	% Of ELV	-

Hydrogen Fluoride Sampling Details & Results

Sampling Details		Run 1
Stack ID	F1	
Start time	09:50	
Finish Time	10:21	
Leak Check Results		
Prior to test:	0.02	l/min
Post Test:	0.02	l/min
Sample Volume Flow Rate:	1.9	l/min
Standard Requirement:	<2	%
Test Result:	0	%
Test Status	Pass	
Calibration Details		
Pump Number:	-	
Calibration Unit:	ASLTM15EQ505	
Calibration Rate Before Test:	1.9	l/min
Calibration Rate After Test:	1.9	l/min
Average sample Volume:	1.9	l/min
Sample Test Time:	31	min
Pump Gas Temperature:	0	°C
Pump Sample Pressure:	101.3	kPa
Actual Sample Volume:	0.05890	m ³
Normalised Gas Volume:	0.06473	Nm ³

Hydrogen fluoride Quality Assurance

Start time	-	09:50:00
Finish Time	-	10:21:00
	Units	Run 1
Leak test results		
Mean Sampling Rate	l/min	1.9
Pre-sampling leak rate	l/min	0.02
Post-sampling leak rate	l/min	0.02
Leak rate	l/min	0.00
Acceptable leak rate (<2%)	Y/N	Yes
Filtration		
Filter Material	-	N/A
Filter Size	mm	N/A
Max. Filter Temp	degrees	N/A
Absorbers Type	Glass/PTFE/ Other	Glass
Absorption Solution	-	0.1m NaOH
Absorption Efficiency		
Total Imp 1 + Imp2 + Imp3	ug	13
Impinger 3	ug	6.5
Absorption efficiency	%	50
Acceptable Absorption Eff.	>95% (Y/N)	N
Blank sample		
Blank sample ID	-	F1HFB
Blank result	mg/m ³	<0.08
Acceptable Blank	<10% ELV (Y/N)	Y

Hydrogen Fluoride Results & Measurement Uncertainty

Sampling Details		Run 1
Stack ID	F1	
Date	-	
Start time	09:50:00	
Finish Time	10:21:00	
Results		
Laboratory Result	13	µg/ml
Impinger final Volume	260	ml
Concentration	0.01	mg
Sample Volume	0.06	Nm ³
Emissions Concentration	<0.20	mg.m ⁻³
Mass Emissions	-	kg.h ⁻¹

	Units	Run 1
	Units	Run 1
Parameter		
Combined Uncertainty	mg.m ⁻³	0.005
Expanded uncertainty as percentage of measured value	% of measured value	4.742
Expanded uncertainty in units of measurement	mg.m ⁻³	0.010
Expanded uncertainty as percentage of limit value	% Of ELV	-

Sulphur Dioxide Quality Assurance

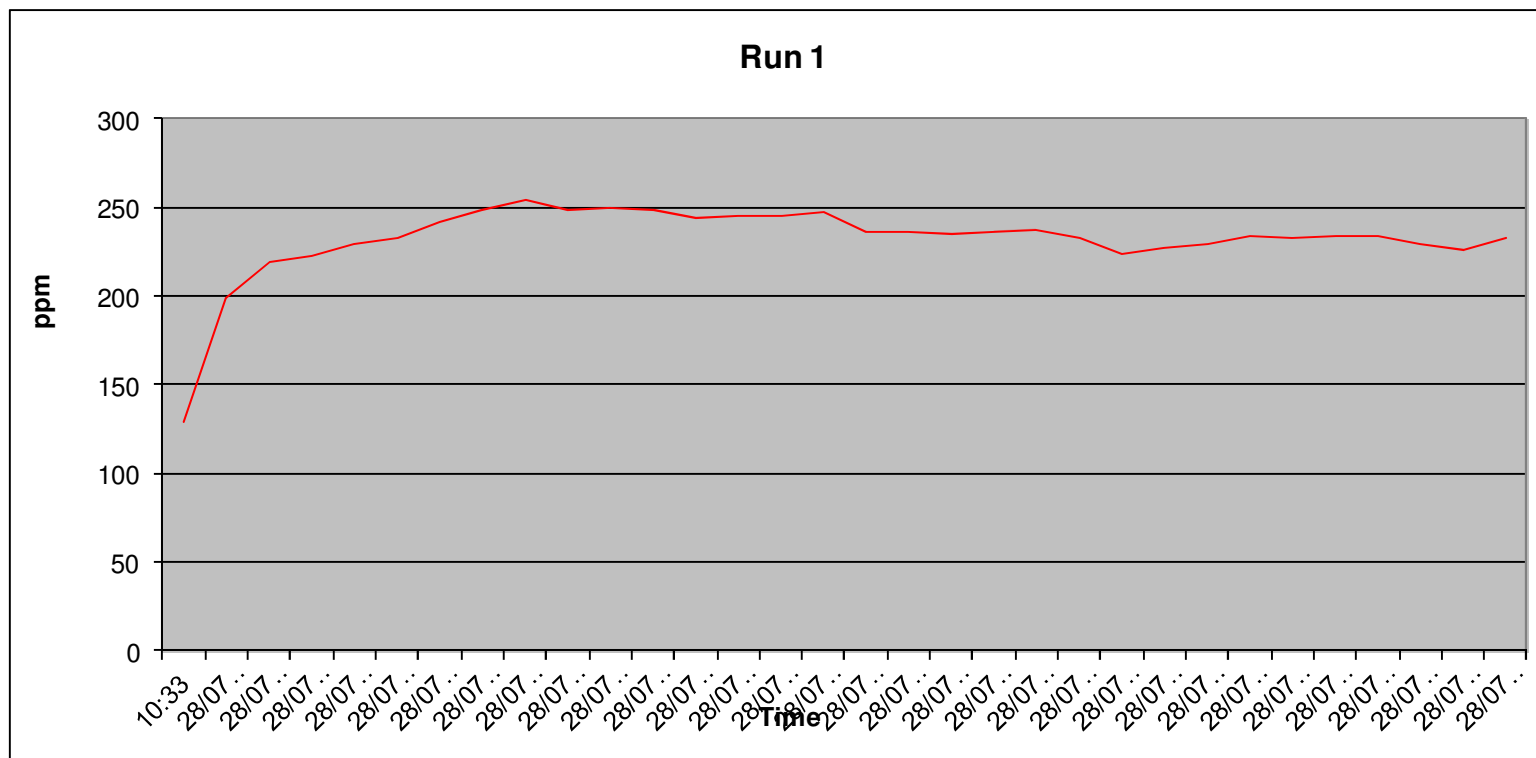
Sampling Details		
Stack ID	F1	-
	Units	Run 1
Parameter		
Sampling Times	-	10:32
Sampling Dates	-	28/07/2016
Instrument Range	ppm	1000
Span Gas Value	ppm	506
Acceptable Gas Range	-	Yes
	-	-
Quality Assurance	Units	Run 1
Conditioning Unit Temperature	C	2
Average Temperature	< C	2
Allowable Temperature	-	4
Temperature Acceptable	-	Yes
Pump flow rate	l/min.	0.5
	-	-
Zero Drift	Units	Run 1
Zero Down Sampling Line (Pre)	ppm	0
Zero Down Sampling Line (Post)	ppm	6
Zero drift	ppm	6
Allowable Zero Drift	ppm	25
Zero Drift Acceptable	-	Yes
	-	-
Span Drift	Units	Run 1
Span Down Sampling Line (Pre)	ppm	510
Span Down Sampling Line (Post)	ppm	488
Span Drift	ppm	22
Allowable Span Drift	ppm	25
Span Drift Acceptable (Y/N)	-	Yes
	-	-
Leak Check		
Span Gas Conc.	ppm	506
Recorded Conc. down Line	ppm	510
Leak check acceptable (< 2%)	(Y/N)	Yes
	-	-
Test Conditions	Units	Run 1
Run Ambient Temperature Range	C	15

Sulphur Dioxide Results & Sampling details

Parameter	Units	Run 1
Concentration	mg.m ⁻³	663.52
Uncertainty	mg.m ⁻³	58.76
Mass Emission	kg.h	-

General Sampling Information	
Parameter	Value
Standard	TGN 21
Technical Procedure	2012
Probe material	SS
Filtration Type/Size	PTFE
Heated Head Filter Used	Yes
Heated Line Temperature	190
Date & Result of last converter check	-
Span Gas Reference Number	ASLTM15ING507
Span Gas Expiry Date	Nov-16
Span Gas Start Pressure (bar)	30
Gas Cylinder Concentration (ppm)	506
Span Gas Uncertainty (%)	<2
Zero Gas Type	N
Number of Sampling Lines Used	1
Number of Sampling Points Used	1
Sample Point I.D's	F1
Reference Conditions	
Temperature (K)	273.15
Pressure (kPa)	101.3
Gas (Wet or Dry)	Dry
Oxygen	3

Run 1



Sulphur Dioxide Measurement Uncertainty

	Units	Run 1
Measured Quantities		
Certified Range of Analyser	ppm	2.14 to 1000
Operational Range of Analyser	ppm	1000
Measured Reading	ppm	232.00
Measured Quantities	Units	Run 1
Nonlinearity	%	0.8
Temperature Dependent Zero drift	%	0.8
Temperature Dependent Span drift	%	2
Cross-sensitivity	%	1.5
Leak	%	0
Calibration Gas Uncertainty	%	<2 %
Parameter	Units	Run 1
Combined uncertainty	mg.m ⁻³	9.43
Expanded uncertainty	mg.m ⁻³	18.86
Uncertainty corrected to std conds.	mg.m ⁻³	58.76
Expanded uncertainty expressed with a level of confidence of 95%	% of ELV	-
Expanded uncertainty expressed with a level of confidence of 95%	mg.m ⁻³	58.76
Expanded uncertainty expressed with a level of confidence of 95%	% of value	8.86
Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions		