No 1181

Report for the Periodic Monitoring of Emissions to Air

IPPC Permit Number: EP3935UC
Aleris Recycling Ltd
Swansea Plant
28 - 29 May 2014

Contract Reference:	Aleris-02302
Client:	Aleris Recycling Ltd
Address:	Waunarlwydd Works Waunarlwydd, Swansea, SA5 4YG
Site Contact:	Clive Edwards
Monitoring Organisation:	NWSS 40 Court Road Industrial Estate Cwmbran, Torfean. NP44 3AS Tel: 01633 862950 www.nw-ss.co.uk

This report relates to tested items only
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

Report written by	Craig Harley	Date	12-Jun-14
Designation	Air Quality Test Engineer		
Report Approved by	Darren Price	Date	12-Jun-14
Designation	Air Quality Senior Project Manager		
MCERTS Registration Number	MM 03 176		
MCERTS Certification	Level 2	TE's Held	1, 2, 3 & 4

CONTENTS

1.1 Monitoring Objectives

The scope of work of the monitoring as shown in the following table was required to demonstrate emission concentrations.

Emission Point Number	Determinands to be Measured	Sampling Time	Number of Samples
A4	Volatile Organic Compounds (VOCs)	4 hours	Continuous Monitoring
	Sulphur Dioxide	4 hours	Continuous Monitoring
	Oxygen	4 hours	Continuous Monitoring
	Hydrogen Chloride	4 hours	1 & Field Blank
	Particulates	4 hours	1 & Field Blank

1.2 Monitoring Results

Job Type Monitoring Emissions to Atmosphere
Company Aleris Recycling Ltd
Site Swansea
Location A4
Process Status During Monitoring Operating as Normal
Reference Conditions 273k, 101.3kPa, without correction for moisture and oxygen

Determinand	Run	Units	Emission Limit Value	Date of Sampling	Start and End Times	Periodic Monitoring Result	Uncertainty (mg/Nm^3)	Vol. Flow (Nm^3/min)	Mass Emission Rate (kg/hr)	Moisture (%H_2O)	Monitoring Method Reference	Accreditation for use of Method
VOC's as Carbon	1	mg/Nm^3	50	29-May-14	09:10-12:10	18.2	7.5	-	2.4	-	BS EN 12619	MCERTS
Sulphur Dioxide	1	mg/Nm^3	50	28-May-14	15:00-19:00	28.6	26.6	-	3.8	-	EA TGN M21	
Oxygen	1	%	NA	28-May-14	15:00-19:00	20.5	-	-	-	-	BS EN 14789	MCERTS
Hydrogen Chloride	1	mg/Nm^3	10	28-May-14	09:40-13:40	1.4	0.18	2120	0.17	2.4	BS EN 1911	MCERTS
	Blank				09:25	<0.16	0.06	-	-	-		
Particulates	1	mg/Nm^3	5	29-May-14	9:35-13:50	1.1	0.23	2351	0.15	1.8	BS EN 1911	MCERTS
	Blank				09:20	<0.5	0.21	-	-	-		

Note 1 Uncertainties expressed at 95% confidence level

Note 2 Where the value is "<", the uncertainty of measurement has been calculated at the limit of detection.

1.3 Operating Information

Emission Point Reference	Date	Continuous or Batch Process	Fuel	Feedstock	Abatement	Load	Comparison of Operator CEMS and Periodic Monitoring Results			
							Substance	CEMS Results	Periodic Monitoring Results	Units
A4	28-29 May 2014	Cyclic Batch (Furnaces are not synchronised)	Natural Gas / Oxygen	Oily and Coated Aluminium Scrap. Dross	Gases pass through a lime/charcoal mixture and then through bag house filters.	Two furnaces were in operation during the monitoring period	No Relevant CEMS Installed			

1.4 Monitoring Deviations

Emission Point Number	Substance Deviations	Monitoring Deviations	Other Relevant Issues
A4	None	None	None

APPENDIX 1: General Information

Monitoring organisation staff details

Monitoring organisation method details

Monitoring organisation equipment check list references

Manual monitoring method results calculations

2.1.1 Monitoring organisation staff details

Name	Position	MCERTS Level	TE1	TE2	TE3	TE4	MCERTS registration No.
Sampling Team							
Dale Padfield	Air Quality Air Technician	I	✔				MM13 1224
Craig Harley	Air Quality Test Engineer	II	✔	✔	✔	✔	MM05 670
Report Writing							
Craig Harley	Air Quality Test Engineer	II	✔	✔	✔	✔	MM05 670
Report Authorisation							
Darren Price	Air Quality Senior Project Manager	II	✔	✔	✔	✔	MM03 176

2.1.2 Monitoring organisation method details

Determinand	In House Method ID	Referance Standard	Analytical Laboratory
VOCs	A57	BS EN 12619	N/A
SO_2	A44	EA TGN M21	N/A
Oxygen	A44	BS EN 14789	N/A
HCl	A48	BS EN 1911	NWSS
Particulates	A55	BS EN 13284	NWSS

2.1.3 Monitoring organisation equipment check list references

Equipment Checklist Ref: Aleris-02302 Q2 May 2014

2.1.4 Calculation of Stack Gas Velocities, Volumetric Flow, Emission Concentrations and Mass Emission Rates

Total pressure (mm Hg) =	Atmospheric pressure(mm Hg) + static pressure (mm Hg)
Dry Gas volume sampled @ ntp (Nm3) =	$\frac{\text{Dry gas volume sampled(l)} * 273 * \text{Atmospheric pressure(mm Hg)}}{1000 * \text{average ambient temp(K)} * 760}$
Bws =	$\frac{\text{mass H2O collected (g)} * 0.00124}{\text{Dry gas volume sampled@ntp(Nm/s)} + (\text{mass H2O collected(g)} * 0.00124)}$
% Moisture =	100* Bws
Wet Gas volume sampled @ ntp (Nm3) - dry gas meter measurements =	Dry gas volume sampled@ntp(Nm/s)*(100/100-% moisture)
Wet Gas volume sampled @ ntp (Nm3) - sorbent tubes =	$\frac{\text{Average rotameter reading (l/min)} * \text{sampling time (mins)} * 273 * \text{Atmospheric pressure (mm Hg)}}{1000 * \text{ambient temperature (K)} * 760}$
Mol. Wt. of 22-24 July & 28 August 2013	Mol. Wt. dry gas * (1-Bws) + 18*Bws Default value for wt. of dry gas = 28.84 (Non-comb. Process)
Actual mean gas velocity (m/s) =	$\frac{34.97 * \text{Pitot Coefficient} * \text{root delta P (mm H2O)} * (\text{Stack temp.(K)}^{0.5})}{(\text{Mol wt of wet gas} * \text{total pressure(mm Hg)})^{0.5}}$
Actual mean gas velocity @ ntp (m/s) =	$\frac{\text{Actual gas velocity(m/s)} * \text{total pressure(mm Hg)} * 273}{\text{stack temperature(K)} * 760}$
Stack cross section area (m2) =	3.14 * (stack diameter(m)/2)^2
Actual volume flow (m^3/min) =	60* c.s.a.(m2)* actual gas velocity (sampling) (m/s)
Corrected Volume flow @ ntp (Nm^3/min) =	60*stack c.s.a(m2)*mean actual gas velocity (m/s)*ref temp (K)/Duct temp (K)*total pressure (mmHg)/ref. Pressure
Pollutant Concentration @ ntp (mg/Nm3) - wet basis =	$\frac{\text{Mass of Pollutant collected (mg)}}{\text{Wet Gas volume sampled @ ntp(Nm3)}}$
Pollutant Concentration @ ntp (mg/Nm3) - dry basis =	$\frac{\text{Mass of Pollutant collected (mg)}}{\text{Dry Gas volume sampled @ ntp(Nm3)}}$
Pollutant Mass emission rate (kg/hr) =	Pollutant conc (@ ntp wet basis)*Vol. flow (@ ntp wet basis) *60/1000000 **or** Pollutant conc (@ ntp dry basis)*Vol. flow (@ ntp dry basis) *60/1000000

Conversion of ppm to mg/Nm^3 (Direct reading instrument)

Conc of pollutant as mg/Nm^3 =	Conc of pollutant in ppm * (Molecular wt of pollutant / Molar volume)

Correction of pollutant concentration to oxygen reference

Conc of pollutant at ref oxygen level =	Conc of pollutant (@ ntp) * $((21 - O_{2\ ref})/(21 - O_{2\ measured}))$

APPENDIX 2: Stack - A4

Diagrams

Flow criteria measurements

Extractive results sheets

Instrumental gas analyser calibration tables

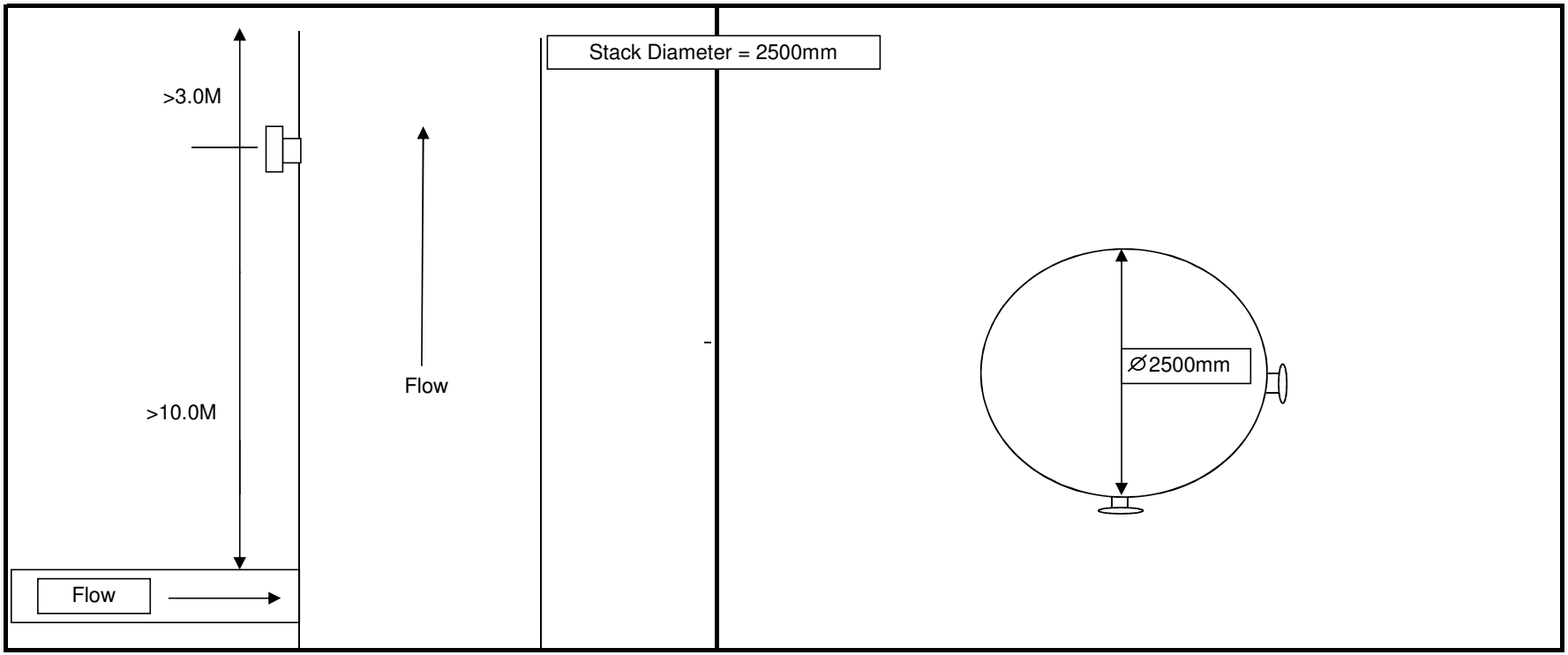
Instrumental gas analyser results tables

Uncertainty of measurement

Analytical results

Permit Number	Operator Name	Installation Name	Installation Address
EP3935UC	Aleris Recycling Ltd	Aleris - Swansea	Waunarlwydd Works, Waunarlwydd, Swansea, SA5 4YG

Stack A4



NWSS

Velocity and Temperature Data **DATE:** 28/05/2014 **JOB REF.:** Aleris-02302

Client:	Aleris Recycling Ltd			**Operators:**	CH/DPd		
Location:	Swansea			**Test For:**	Various		
Stack:	A4			**In-house method:**	Various		
Pitot Type:	S	**Pitot Cp:**	0.81	**Probe ID:**	546	**Meter ID:**	2533
Bar. Pressure:	101.4	**Static:**	4.0	**Duct Shape : Circle (C) or Square (S)**			C
Ambient Temp.:	14			**Stack Diameter (mm):**	2500	by	
Stack O2 (%):	NA			**Port Length (mm):**		210	
Stack CO2 (%):	NA			**Area (m2):**		4.91	
Stack Moisture (%):	NA						

Traverse Point Number	Distance (mm)	Sample Port 1 Temp. °C	Sample Port 1 ΔP cm H2O	Sample Port 1 Sq.root ΔP	Sample Port 2 Temp. °C	Sample Port 2 ΔP cm H2O	Sample Port 2 Sq.root ΔP
1	65	100	0.75	0.87	0.98	0.85	0.92
2	205	100	0.75	0.87	0.98	0.85	0.92
3	365	100	0.80	0.89	100	0.90	0.95
4	565	100	0.80	0.89	100	0.90	0.95
5	855	100	0.85	0.92	101	0.90	0.95
6	1645	100	0.85	0.92	100	0.90	0.95
7	1935	101	0.85	0.92	100	0.85	0.92
8	2135	101	0.85	0.92	100	0.85	0.92
9	2295	101	0.85	0.92	100	0.85	0.92
10	2435	101	0.85	0.92	100	0.80	0.89
Total	TA=2500	1004	8.2	9.1	803.0	8.7	9.3
Average		100	0.82	0.9	80.3	0.87	0.9

Flow-stability criteria for periodic sampling of particulates

Criteria	Requirement	Actual
Angle of gas flow	<±15° from stack longitudinal axis	<±15°
Flow direction	No local negative flow	Positive flow
Minimum velocity	5 Pa for pitot tubes	73.5 Pa
Gas velocity variations	Ratio of highest to lowest less than 3:1 (9:1 Pitot)	1.2 :1
Temperature variation	≤ ±5% of mean temperature in Kelvin	24.6 %

CLIENT:	**Aleris Recycling**	**SAMPLE DATE:**	**28-May-14**
		PRE BLANK DATE:	**28-May-14**
LOCATION:	**Swansea**		
		TIME OF SAMPLING:	**09:40-13:40**
STACK:	**A4 - Main Stack**	**TIME OF PRE BLANK:**	**09:25**

SAMPLING DATA			**Cen HCl 1**
Run Time (min)			**240**
Total mass H_2O collected (g)			**12.4**
Pitot tube constant,Cp			**0.81**
Dry gas meter (DGM) volume (litres)			**666.89**
Temperature DGM (°C)			**17**
Temperature stack (°C)			**101**
Mean pitot tube pressure drop (traverse), delta P(cm H_2O)			**0.8**
Mean pitot tube pressure drop at sample point (traverse), delta P(cm H_2O)			**0.7**
Mean pitot tube pressure drop(sample run) , delta P(cm H_2O)			**0.7**
Barometric Pressure (kPa)			**101.4**
X-sectional area of stack (m^2)			**4.9**
Efficiency of the 1st Impinger (%)			**100**
Field Blank as a percentage of ELV (%)			**< 1.64**
Reference Conditions			
Temperature (K)			**273**
Pressure (kPa)			**101.3**
As a wet gas			
Emission Limit Value (mg/Nm^3)			**10**
Flow Data			
Velocity, actual (m/s)			**10**
Velocity, ntp (m/s)			**7**
Vol.Flow, actual (m^3/min)			**2888**
Vol.Flow, ntp wet gas			**2120**
Volume sampled, ntp, dry gas (Nm^3)			**0.63**
Volume sampled, ntp, wet gas (Nm^3)			**0.64**
Analytical Data (max µg collected)	**Sample Run**		**Pre Blank**
Chloride	**861**	**<**	**103**
Concentration Data (mg/Nm3 unless otherwise stated)			**wet gas**
H_2O (% vol)			**2.4**
Hydrogen Chloride Pre Blank		**<**	**0.2**
Hydrogen Chloride			**1.4**
Mass Emissions Data (Kg/Hr unless otherwise stated)			
Hydrogen Chloride			**0.17**

CLIENT: Aleris Recycling

LOCATION: Swansea

STACK: A4 - Main Stack

Hydrogen Chloride Uncertainty Calculations		Cen HCl 1		Pre Blank
Sampling Uncertainty (@ 95% confidence level)	%	10		10
Sample Volume @ Reference Conditions	m3	0.644		0.644
Volume Impinger 1	ml	100		102
Volume Impinger 2	ml	102		104
Concentration @ Reference Conditions	mg/Nm3	1.4	<	0.2

NWSS have calculated total sampling uncertainty at a 95 % confidence level for different sampling conditions.
The results were between 6 and 9 %.
NWSS have decided to quote a 'worst case' sampling uncertainty of 10% to cover all sampling procedures.

	Unit	Source	Value	Value
Analytical Uncertainty	%	From AQC data	9	9
Impinger 1 1/2 LOD	mg/l	From AQC data	0.25	0.25
Impinger 2 1/2 LOD	mg/l	From AQC data	0.25	0.25
mass Chloride collected in Impinger 1	mg	Lab result	0.8	0.0
mass Chloride collected in Impinger 2	mg	Lab result	0.0	0.0
Maximum Chloride Collected	mg	Calculation	0.86	0.10
Impinger 1 Analytical Uncertainty as Chloride	mg	Calculation	0.07	0.03
Impinger 2 Analytical Uncertainty as Chloride	mg	Calculation	0.03	0.03
Total Analytical Uncertainty as Chloride	mg	Calculation	0.07	0.04
Sampling Uncertainty as Chloride	mg	Calculation	0.09	0.01
Total Uncertainty as Hydrogen Chloride	mg	Calculation	0.116	0.039
Total Uncertainty as Hydrogen Chloride	mg/Nm3	Calculation	0.18	0.06
Total Uncertainty as Hydrogen Chloride	%	Calculation	13	37

RESULTS TABLES

CLIENT:	**Aleris Recycling**	**SAMPLE DATE:**	**29-May-14**
		BLANK DATE:	**29-May-14**
LOCATION:	**Swansea**		
		TIME OF SAMPLING:	**9:35-13:50**
STACK:	**A4 Main Stack**	**TIME OF BLANK:**	**09:20**

SAMPLING DATA					**Cen Pm 1**
Run Time (min)					240
Total mass H_2O collected (g)					58.2
Pitot tube constant,Cp					0.83
Dry gas meter (DGM) volume (litres)					4235.68
Temperature DGM (°C)					19
Temperature stack (°C)					117
Mean pitot tube pressure drop (traverse), delta P(cm H_2O)					0.9
Mean pitot tube pressure drop at sample point (traverse), delta P(cm H_2O)					0.7
Mean pitot tube pressure drop(sample run) , delta P(cm H_2O)					0.7
Mean orifice pressure drop,delta H(cm H_2O)					2.8
Barometric Pressure (kPa)					101.2
X-sectional area of stack (m^2)					4.91
Nozzle Size (cm)					0.7
% Isokinetic					104
Field Blank as a percentage of ELV (%)					< 9.4
Reference Conditions					
Temperature (K)					273
Pressure (kPa)					101.3
Oxygen (%)					
As a wet gas					
Emission Limit Value (mg/Nm^3)					5
Flow Data					
Velocity, actual (m/s)					11.4
Velocity, ntp (m/s)					8.0
Vol.Flow, actual (m^3/min)					3346.1
Vol.Flow, ntp wet gas					2350.5
Vol.Flow, ntp dry gas ref. oxygen (m^3/min)					N/A
Volume sampled, ntp, dry gas (Nm^3)					4.0
Volume sampled, ntp, wet gas (Nm^3)					4.0
Analytical Data (mg collected)		**Minimum**			**maximum**
Particulates Sample Run		2.68			4.3
Particulates Field Blank					< 1.9
Acetone Analytical Blank Value (%)					0.0005
Concentration Data (mg/Nm3 unless otherwise stated)	**wet gas**				
H_2O (% vol)					1.8
Particulates Blank					< 0.47
Particulates		0.66	to	1.06	0.23
Mass Emissions Data (Kg/Hr unless otherwise stated)					
Particulates					0.15

UNCERTAINTY TABLES

CLIENT: Aleris Recycling

LOCATION: Swansea

STACK: A4 Main Stack

Dust Uncertainty Calculations		Cen Pm 1		Blank
Sampling Uncertainty (@ 95% confidence level)	%	10		10
Sample Volume @ Reference Conditions	m3	4.03		4.03
Dust Concentration @ Reference Conditions	mg/Nm3	1.1	<	0.5

NWSS have calculated total sampling uncertainty at a 95 % confidence level for different sampling conditions.
The results were between 6 and 9 %.

NWSS have decided to quote a 'worst case' sampling uncertainty of 10% to cover all sampling procedures.

All uncertainties are quoted at a 95% confidence level

	Unit	Source	Value	Value
Analytical Uncertainty - Filter	%	From AQC data	7.0	7.0
1/2 LOD Filter	g	From AQC data	0.00015	0.00015
Analytical Uncertainty - Washings	%	From AQC data	7.0	7.0
1/2 LOD Washings	g	From AQC data	0.00080	0.00080
Mass Dust collected Filter	g	Lab Result	0.0027	0.0
Mass Dust collected Washings	g	Lab Result	0.0	0.0
Maximum dust collected	g	Calculation	0.0043	0.0019
Filter Analytical Uncertainty	g	Calculation	0.00019	0.00015
Washings Analytical Uncertainty	g	Calculation	0.00080	0.00080
Total Analytical Uncertainty	g	Calculation	0.00082	0.00081
Sampling Uncertainty	g	Calculation	0.00043	0.00019
Total Uncertainty	g	Calculation	0.00093	0.00084
Total Uncertainty @ Reference Conditions	mg/m3	Calculation	0.2	0.2
Total Uncertainty	%	Calculation	22	44

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Client:	Aleris	Plant:	Swansea	Location:	A4
Operators:	CH DPd	Test For:	Nox/SO2	In-house Method No.:	A44
Laptop ID:	1298	Start:	Temp (℃) 9	Pressure (kPa) 101.2	Flow Rate (l/min) 0.4
Data Logger ID:	1024	End:	9	101.2	0.4

	Action	O2	CO	SO2	NO	NOx	CO2	VOC
Analyser & Cylinder Info.	Analyser ID	5121						
	Gas Divider ID	1001						
	Span Gas Lot Number	VCD116012		VCD116012				
	Span Gas Uncertainty (±%)	1.2		1			1	1
ELVs & Ranges	Half hourly or Daily ELV (mg/m³)	N/A	N/A	50				
	Half hourly or Daily ELV (ppm)	N/A	N/A	18			N/A	
	Ideal Range [150%] to [300%] (ppm)	N/A N/A	N/A N/A	26 53			N/A N/A	
	Range Used	25		200				
Span & Divider Information	Span Range [50%] to [90%] (ppm)	N/A		100 180				
	Span Certified Value of Cylinder (ppm)	15.00		192.00				
	Proposed Span Value (ppm)	15.00		114.10				
	Actual Gas Divider %	100.00		59.43				
	Actual Span value to be used (ppm) (A)	15.0		114.1				
	T_{90} Value (ppm) of (A)	13.5		102.7				
Analyser Calibration	T_{90} Time Analyser (seconds)	20		30				
	3 x T_{90} Time Between Readings	60		90				
	Zero Response	-0.02		0.10				
	Span Response (B)	15.04		114.10				
	Re-Zero Response	-0.02		0.10				
	Analyser Repeatability	0.08		0.28		N/A		
	<2 x Repeatability	PASS		PASS		N/A		
Initial Line Checks	T_{90} Time System (seconds)	30		45				
	3 x T_{90} Time Between Readings	90		135				
	System Check: Zero (C)	0.06		0.10				
	C/B*100 =	0.40		0.09				
	C/B*100 = <2%	PASS		PASS				
	System Check: Span (D)	15.04		111.10				
	(D-B)/B*100 =	0.00		-2.63				
	(D-B)/B*100 =<2% (=<5% SO_2)	PASS		PASS				
Final Line Checks	System Check: Zero (E)	0.01		0.50				
	(E-C)/D*100 =	-0.33		0.3600				
	Drift: (E-C)/D*100 = <5%	PASS		PASS				
	System Check: Span (F)	15.03		108.40				
	(F-D)/B*100 =	-0.07		-2.37				
	Drift: (F-D)/B*100 = <5%	PASS		PASS				

A		NA	

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Client:	Aleris	Plant:	Swansea	Location:	A4
Operators:	CH DPd	Test For:	VOCs	In-house Method No.:	A57
Laptop ID:	1298	Start:	Temp (℃) 9	Pressure (kPa) 103.2	Flow Rate (l/min) -
Data Logger ID:	1024	End:	9	103.2	-

	Action	O2	CO	SO2	NO	NOx	CO2	VOC
Analyser & Cylinder Info.	Analyser ID							1230
	Gas Divider ID				1137			
	Span Gas Lot Number							VC4843PA
	Span Gas Uncertainty (±%)						1	1
ELVs & Ranges	Half hourly or Daily ELV (mg/m³)							50
	Half hourly or Daily ELV (ppm)							31
	Ideal Range [150%] to [300%] (ppm)							47 93
	Range Used							100
Span & Divider Information	Span Range [50%] to [90%] (ppm)	N/A						40
	Span Certified Value of Cylinder (ppm)							106.86
	Proposed Span Value (ppm)							63.40
	Actual Gas Divider %							59.34
	Actual Span value to be used (ppm) (A)							63.4
	T_{90} Value (ppm) of (A)							57.1
Analyser Calibration	T_{90} Time Analyser (seconds)							5
	3 x T_{90} Time Between Readings							15
	Zero Response							0.20
	Span Response (B)							64.10
	Re-Zero Response							-0.10
	Analyser Repeatability					N/A		0.20
	<2 x Repeatability					N/A		PASS
Initial Line Checks	T_{90} Time System (seconds)							15
	3 x T_{90} Time Between Readings							45
	System Check: Zero (C)							0.20
	C/B*100 =							0.3120
	C/B*100 = <2%							PASS
	System Check: Span (D)							64.10
	(D-B)/B*100 =							0.00
	(D-B)/B*100 =<2% (=<5% SO_2)							PASS
Final Line Checks	System Check: Zero (E)							0.00
	(E-C)/D*100 =							-0.3120
	Drift: (E-C)/D*100 = <5%							PASS
	System Check: Span (F)							63.20
	(F-D)/B*100 =							-1.40
	Drift: (F-D)/B*100 = <5%							PASS

A		NA	

Combustion Gas Emission Data from	A4 - Main Stack	
Time	Drift Corrected @ Reference Conditions	
	Oxygen	Sulphur Dioxide
28-May-14	(%)	(mg/Nm^3)
15:00	21.1	21.6
15:01	21.2	21.9
15:02	21.2	17.3
15:03	21.0	43.5
15:04	21.1	14.4
15:05	21.1	9.5
15:06	20.9	25.3
15:07	20.5	13.5
15:08	20.7	8.6
15:09	20.5	16.7
15:10	19.9	12.9
15:11	20.0	6.9
15:12	20.0	5.7
15:13	20.0	5.7
15:14	20.0	5.7
15:15	20.3	6.0
15:16	20.6	5.4
15:17	20.6	7.1
15:18	20.6	11.2
15:19	20.6	15.8
15:20	20.6	19.5
15:21	20.6	21.3
15:22	20.6	23.3
15:23	20.6	25.6
15:24	20.6	27.9
15:25	20.7	28.7
15:26	20.7	30.5
15:27	20.6	30.5
15:28	20.7	29.9
15:29	20.7	29.3
15:30	20.7	27.0
15:31	20.7	26.4
15:32	20.7	26.7
15:33	20.7	26.1
15:34	20.2	26.7
15:35	20.1	28.4
15:36	20.1	28.7
15:37	20.0	29.9
15:38	20.1	30.2
15:39	20.0	29.6
15:40	20.0	29.0
15:41	20.4	26.7
15:42	20.1	25.5
15:43	20.2	23.8
15:44	20.1	22.6
15:45	20.1	22.3
15:46	20.4	21.5
15:47	20.6	19.7

Combustion Gas Emission Data from	A4 - Main Stack	
Time	Drift Corrected @ Reference Conditions	
	Oxygen	Sulphur Dioxide
28-May-14	(%)	(mg/Nm^3)
15:48	20.6	18.3
15:49	20.6	17.4
15:50	20.8	15.4
15:51	21.0	13.4
15:52	21.3	11.0
15:53	21.3	9.9
15:54	21.3	7.9
15:55	21.3	6.4
15:56	21.3	5.8
15:57	21.3	5.0
15:58	21.3	4.9
15:59	21.3	4.9
16:00	21.3	5.5
16:01	21.3	5.8
16:02	21.3	6.1
16:03	21.3	6.1
16:04	21.3	5.8
16:05	21.3	5.2
16:06	21.2	5.2
16:07	20.9	5.5
16:08	21.0	6.4
16:09	21.1	7.5
16:10	20.6	8.7
16:11	20.3	21.4
16:12	20.3	27.2
16:13	20.3	28.9
16:14	20.3	31.0
16:15	20.3	31.8
16:16	20.3	31.8
16:17	20.3	30.7
16:18	20.3	31.8
16:19	20.3	31.8
16:20	20.3	32.1
16:21	20.4	31.5
16:22	20.7	33.3
16:23	20.7	39.1
16:24	20.5	80.6
16:25	20.3	28.3
16:26	20.4	24.0
16:27	20.3	22.2
16:28	20.3	18.2
16:29	20.3	15.8
16:30	20.3	15.0
16:31	20.5	15.3
16:32	20.6	14.1
16:33	20.3	14.1
16:34	20.7	16.4
16:35	20.7	13.2

Combustion Gas Emission Data from	A4 - Main Stack	
Time	Drift Corrected @ Reference Conditions	
	Oxygen	Sulphur Dioxide
28-May-14	(%)	(mg/Nm^3)
16:36	20.8	17.3
16:37	20.9	20.2
16:38	21.3	24.5
16:39	21.4	14.7
16:40	21.3	32.1
16:41	21.2	33.0
16:42	21.3	18.4
16:43	21.1	17.6
16:44	20.9	11.1
16:45	21.3	11.4
16:46	21.1	9.1
16:47	20.9	9.1
16:48	20.8	8.8
16:49	20.8	10.0
16:50	20.2	82.4
16:51	20.5	33.5
16:52	20.5	54.5
16:53	20.5	25.7
16:54	20.9	36.4
16:55	20.8	34.7
16:56	20.5	21.6
16:57	20.4	8.2
16:58	20.0	24.8
16:59	19.8	16.6
17:00	20.0	11.1
17:01	19.9	9.0
17:02	20.0	7.9
17:03	20.0	7.0
17:04	20.1	8.5
17:05	20.0	7.9
17:06	20.0	6.4
17:07	20.2	4.4
17:08	20.5	4.9
17:09	20.5	4.9
17:10	20.2	4.3
17:11	20.1	5.2
17:12	20.0	5.8
17:13	20.1	6.1
17:14	19.8	6.7
17:15	19.6	15.7
17:16	20.0	23.3
17:17	20.1	29.1
17:18	20.5	23.6
17:19	20.9	24.2
17:20	20.8	26.2
17:21	20.4	30.3
17:22	20.4	36.4
17:23	20.7	42.5

Combustion Gas Emission Data from	A4 - Main Stack	
Time	Drift Corrected @ Reference Conditions	
	Oxygen	Sulphur Dioxide
28-May-14	(%)	(mg/Nm^3)
17:24	20.4	42.2
17:25	20.1	54.5
17:26	20.8	46.0
17:27	20.4	47.2
17:28	20.0	58.3
17:29	20.0	63.0
17:30	20.2	53.9
17:31	20.1	41.7
17:32	20.0	36.1
17:33	20.1	34.1
17:34	20.0	32.0
17:35	20.1	34.3
17:36	19.9	35.2
17:37	20.4	35.5
17:38	20.6	29.7
17:39	20.3	29.4
17:40	20.3	33.2
17:41	20.3	30.5
17:42	19.9	28.5
17:43	20.0	30.8
17:44	20.1	32.0
17:45	20.1	33.7
17:46	19.9	34.3
17:47	20.0	33.2
17:48	20.1	27.9
17:49	20.2	22.3
17:50	20.6	19.4
17:51	21.1	16.2
17:52	20.8	14.4
17:53	20.8	12.9
17:54	20.9	12.1
17:55	21.3	10.0
17:56	21.4	8.8
17:57	21.4	8.0
17:58	21.5	7.1
17:59	21.5	6.5
18:00	21.5	6.2
18:01	21.5	5.9
18:02	21.5	5.3
18:03	21.5	5.0
18:04	21.3	10.0
18:05	21.4	41.9
18:06	20.9	63.6

Combustion Gas Emission Data from	A4 - Main Stack	
Time	Drift Corrected @ Reference Conditions	
	Oxygen	Sulphur Dioxide
28-May-14	(%)	(mg/Nm^3)
18:07	20.5	79.8
18:08	21.0	76.8
18:09	20.6	77.7
18:10	19.9	92.4
18:11	20.3	64.8
18:12	20.3	43.7
18:13	20.8	40.2
18:14	20.7	33.1
18:15	19.9	30.2
18:16	20.2	36.3
18:17	20.7	30.8
18:18	21.1	21.4
18:19	21.2	22.5
18:20	20.4	23.7
18:21	20.2	19.9
18:22	20.0	22.8
18:23	20.0	45.7
18:24	20.2	52.5
18:25	20.3	71.9
18:26	20.5	58.7
18:27	20.9	68.4
18:28	20.2	49.9
18:29	20.2	43.1
18:30	21.0	42.5
18:31	21.0	34.9
18:32	20.8	36.6
18:33	21.1	36.9
18:34	20.8	32.5
18:35	20.3	44.9
18:36	20.5	66.3
18:37	20.5	85.7
18:38	19.9	144.0
18:39	19.7	81.3
18:40	19.7	63.4
18:41	18.8	87.5
18:42	18.4	101.6
18:43	19.1	91.6
18:44	20.0	63.4
18:45	20.3	59.0
18:46	20.3	45.1
18:47	20.1	40.4
18:48	19.6	41.6
18:49	19.8	41.0

Combustion Gas Emission Data from	A4 - Main Stack	
Time	Drift Corrected @ Reference Conditions	
	Oxygen	Sulphur Dioxide
28-May-14	(%)	(mg/Nm^3)
18:50	19.9	39.3
18:51	19.8	42.5
18:52	19.7	47.2
18:53	19.7	50.4
18:54	19.6	53.4
18:55	19.6	52.8
18:56	19.7	45.4
18:57	19.7	44.8
18:58	19.7	43.4
18:59	19.7	41.3
19:00	19.7	41.0
Average	**20.5**	**28.6**

Combustion Gas Emission Data	A4 - Main Stack
Time 29-May-14	VOC as Carbon (mg/Nm^3)
09:10	4.0
09:11	11.2
09:12	< 0.2
09:13	13.1
09:14	5.1
09:15	27.4
09:16	58.5
09:17	11.8
09:18	7.2
09:19	1.9
09:20	1.9
09:21	14.2
09:22	21.1
09:23	10.1
09:24	32.3
09:25	48.7
09:26	20.1
09:27	5.6
09:28	34.5
09:29	54.6
09:30	73.1
09:31	79.7
09:32	55.1
09:33	23.0
09:34	4.8
09:35	37.4
09:36	31.0
09:37	13.1
09:38	50.0
09:39	67.6
09:40	86.6
09:41	64.3
09:42	77.4
09:43	51.6
09:44	44.8
09:45	19.7
09:46	58.2
09:47	85.7
09:48	24.3
09:49	10.0
09:50	9.2
09:51	20.7
09:52	35.7
09:53	38.3
09:54	61.4
09:55	146.8
09:56	95.2
09:57	67.5
09:58	63.5
09:59	30.9
10:00	26.6
10:01	25.0
10:02	40.9
10:03	93.6

Combustion Gas Emission Data	A4 - Main Stack
Time 29-May-14	VOC as Carbon (mg/Nm^3)
10:04	28.9
10:05	17.8
10:06	15.3
10:07	39.6
10:08	34.2
10:09	31.8
10:10	25.8
10:11	26.8
10:12	54.8
10:13	31.3
10:14	30.5
10:15	12.4
10:16	16.6
10:17	20.1
10:18	55.8
10:19	126.7
10:20	110.1
10:21	113.0
10:22	100.2
10:23	51.5
10:24	24.0
10:25	9.2
10:26	5.9
10:27	4.3
10:28	3.3
10:29	2.3
10:30	1.2
10:31	0.3
10:32	< 0.2
10:33	< 0.2
10:34	< 0.2
10:35	< 0.2
10:36	< 0.2
10:37	< 0.2
10:38	< 0.2
10:39	< 0.2
10:40	< 0.2
10:41	< 0.2
10:42	< 0.2
10:43	< 0.2
10:44	< 0.2
10:45	< 0.2
10:46	3.2
10:47	11.7
10:48	8.3
10:49	9.9
10:50	45.8
10:51	91.2
10:52	107.8
10:53	61.3
10:54	25.6
10:55	15.1
10:56	8.6
10:57	5.1

Combustion Gas Emission Data	A4 - Main Stack
Time 29-May-14	VOC as Carbon (mg/Nm^3)
10:58	3.5
10:59	1.6
11:00	1.3
11:01	1.6
11:02	0.1
11:03	< 0.2
11:04	< 0.2
11:05	< 0.2
11:06	< 0.2
11:07	< 0.2
11:08	< 0.2
11:09	< 0.2
11:10	< 0.2
11:11	< 0.2
11:12	< 0.2
11:13	< 0.2
11:14	< 0.2
11:15	< 0.2
11:16	< 0.2
11:17	< 0.2
11:18	< 0.2
11:19	< 0.2
11:20	< 0.2
11:21	< 0.2
11:22	< 0.2
11:23	< 0.2
11:24	< 0.2
11:25	< 0.2
11:26	< 0.2
11:27	< 0.2
11:28	< 0.2
11:29	< 0.2
11:30	0.8
11:31	60.6
11:32	33.3
11:33	30.6
11:34	11.8
11:35	7.9
11:36	1.0
11:37	< 0.2
11:38	< 0.2
11:39	< 0.2
11:40	< 0.2
11:41	< 0.2
11:42	< 0.2
11:43	< 0.2
11:44	< 0.2
11:45	< 0.2
11:46	< 0.2
11:47	< 0.2
11:48	8.9

Combustion Gas Emission Data	A4 - Main Stack
Time 29-May-14	VOC as Carbon (mg/Nm^3)
11:49	1.8
11:50	50.3
11:51	81.5
11:52	50.1
11:53	36.6
11:54	7.0
11:55	1.8
11:56	0.7
11:57	< 0.2
11:58	< 0.2
11:59	< 0.2
12:00	< 0.2
12:01	< 0.2
12:02	< 0.2
12:03	23.1
12:04	13.6
12:05	2.0
12:06	0.6
12:07	0.2
12:08	< 0.2
12:09	< 0.2
12:10	< 0.2
12:11	< 0.2
12:12	< 0.2
12:13	< 0.2
12:14	< 0.2
12:15	< 0.2
12:16	< 0.2
12:17	< 0.2
12:18	1.2
12:19	27.0
12:20	4.0
12:21	1.2
12:22	0.3
12:23	0.4
12:24	< 0.2
12:25	< 0.2
12:26	< 0.2
12:27	< 0.2
12:28	< 0.2
12:29	< 0.2
12:30	< 0.2
12:31	< 0.2
12:32	0.3
12:33	19.8
12:34	35.3
12:35	0.8
12:36	< 0.2

Combustion Gas Emission Data	A4 - Main Stack
Time 29-May-14	VOC as Carbon (mg/Nm^3)
12:37	< 0.2
12:38	< 0.2
12:39	< 0.2
12:40	< 0.2
12:41	< 0.2
12:42	35.0
12:43	1.6
12:44	28.7
12:45	69.6
12:46	9.7
12:47	21.9
12:48	75.7
12:49	10.3
12:50	12.4
12:51	67.8
12:52	16.3
12:53	1.1
12:54	< 0.2
12:55	< 0.2
12:56	< 0.2
12:57	< 0.2
12:58	< 0.2
12:59	< 0.2
13:00	< 0.2
13:01	< 0.2
13:02	< 0.2
13:03	< 0.2
13:04	< 0.2
13:05	< 0.2
13:06	< 0.2
13:07	< 0.2
13:08	< 0.2
13:09	< 0.2
13:10	< 0.2
Average	**18.2**

SO2 Uncertainty Calculations **A4 - Main Stack**

Range 0 - ? ppm	SO2	
200	571	mg/m³

studied concentration SO2 (VLE)	29	mg/m³
measuring time	240	minutes

Conditions of operation		
Measurement are performed in an environment where		
fluctuations of ambient temperature (in °C)		298 to 318 K
fluctuations of sample pressure are within (in kPa)		100 +/- 5
fluctuations of voltage (in V)		200-220
atmospheric pressure variations (in kPa)		99-100
frequency of adjustment (in hours)		10
O2 concentration measured		NA
NH3 range : unknown	Default values :	0-20 mg/m3
CO2 range		8-15 %
H2O range		10-20%
O2 reference concentration		NA

Performance characteristics	Value		*	specification	
Response time	L	60	seconds	1 minute	
Repeatability at zero	L	1.0	% of the full scale	0,2% of the full scale	
Repeatability at span level	L	1.0	% of the full scale	2% of the full scale	
Deviation from linearity	L	0.50	% of value	+/-5% of elv	
Zero drift ***	L	0.0	% of fs/24h	+/-5% of fs/24h	
Span drift ***	L	0.0	% of fs/24h	+/-5% of fs/24h	
volume or pressure flow dependence	L	0.020	% of fs/kPa	1% of fs/30kPa	
atmospheric pressure dependence	L	0.80	% of value/kPa	3% of value/4kPa	
ambient temperature dependence	L	3.0	%fs/10K	3%fs/10K	
dependence on voltage	L	1.0	%fs/10V	2%fs/10V	
losses in the line (leak)	F	2.0	% of value	2% of value	
Uncertainty of calibration gas	F	2.0	% of value		

L=laboratory F=Field

Measurement performance related to dynamic conditions	
Requirement for response time	120 sec
Measured response time	2 minutes
Conclusion	**requirement met**

Measurement performance related to stationary conditions					
Performance characteristic		**Uncertainty**		**Value of uncertainty quantity**	
Standard deviation of repeatability at zero		ur0		0.0015*410	5.7
Standard deviation of repeatability at span level		urs		0.008*410	5.7
Lack of fit		ufit		0.007*410/30.5	1.6
Zero drift		u0dr		0.0001*410/30.5	0.0
Span drift		usdr		0.01*410/30.5	0.0
volume or pressure flow dependence		uspres		(0.0002*410)*5/30,5	0.33
atmospheric pressure dependence		uapres		(0.008*200/1)*0,5/30,5	0.066
ambient temperature dependence		utemp		(0.003*410/10)*10/30,5	9.9
dependence on voltage		uvolt		0.0012/10*410*10/30.5	3.3
losses in the line (leak)		uleak		0.02*200/30.5	0.33
Uncertainty of calibration gas		ucalib		0.02*200/30.5	0.33

Measurement uncertainty at	29	mg/m3
utot	13	mg/m3
utot/clim	47	%
Utot,rel	93	%

VOC Uncertainty Calculations **A4 - Main Stack**

Range 0 - ? ppm	VOC	
100	161	mg/m˘

studied concentration VOC (VLE)	18	mg/m³
measuring time	240	minutes

Conditions of operation		
Measurement are performed in an environment where		
fluctuations of ambient temperature (in °C)		298 to 318 K
fluctuations of sample pressure are within (in kPa)		100 +/- 5
fluctuations of voltage (in V)		200-220
atmospheric pressure variations (in kPa)		99-100
frequency of adjustment (in hours)		10
O2 concentration measured		NA
NH3 range : unknown	Default values :	0-20 mg/m3
CO2 range		8-15 %
H2O range		10-20%
O2 reference concentration		NA

Performance characteristics	Value		*	specification	
Response time	L	5.0	seconds	1 minute	
Repeatability at zero	L	1.0	% of the full scale	0,2% of the full scale	
Repeatability at span level	L	1.0	% of the full scale	2% of the full scale	
Deviation from linearity	L	0.50	% of value	+/-5% of elv	
Zero drift ***	L	0.0	% of fs/24h	+/-5% of fs/24h	
Span drift ***	L	0.0	% of fs/24h	+/-5% of fs/24h	
volume or pressure flow dependence	L	0.020	% of fs/kPa	1% of fs/30kPa	
atmospheric pressure dependence	L	0.80	% of value/kPa	3% of value/4kPa	
ambient temperature dependence	L	3.0	%fs/10K	3%fs/10K	
dependence on voltage	L	1.0	%fs/10V	2%fs/10V	
losses in the line (leak)	F	2.0	% of value	2% of value	
Uncertainty of calibration gas	F	2.0	% of value		

L=laboratory F=Field

Measurement performance related to dynamic conditions	
Requirement for response time	120 sec
Measured response time	2 minutes
Conclusion	**requirement met**

Measurement performance related to stationary conditions					
Performance characteristic		**Uncertainty**		**Value of uncertainty quantity**	
Standard deviation of repeatability at zero		ur0		0.0015*410	1.6
Standard deviation of repeatability at span level		urs		0.008*410	1.6
Lack of fit		ufit		0.007*410/30.5	0.46
Zero drift		u0dr		0.0001*410/30.5	0.0
Span drift		usdr		0.01*410/30.5	0.0
volume or pressure flow dependence		uspres		(0.0002*410)*5/30,5	0.093
atmospheric pressure dependence		uapres		(0.008*200/1)*0,5/30,5	0.042
ambient temperature dependence		utemp		(0.003*410/10)*10/30,5	2.8
dependence on voltage		uvolt		0.0012/10*410*10/30.5	0.93
losses in the line (leak)		uleak		0.02*200/30.5	0.21
Uncertainty of calibration gas		ucalib		0.02*200/30.5	0.21

Measurement uncertainty at	18	mg/m3
utot	3.8	mg/m3
utot/clim	21	%
Utot,rel	41	%

NORTHUMBRIAN WATER Scientific Services

Analytical Report

1181

Client: ALERIS RECYCLING (UK) LTD

Contract: ALERIS-02302

Air Monitoring

Clive Edwards
Waunarlwydd Works

Waunarlwydd
Swansea

Northumbrian Water Scientific Services
Northumberland Dock Road
Wallsend
Tyne & Wear
NE28 0QD
Tel. 0191 2968366 Fax. 0191 2968535

						Method	H174
Sample ID Number	Description		Date Taken	Time Taken	Date Received	Date Started	particulates (CEN) g
785834	A4 MAIN STACK - RUN 1	FILTER13LD517	29/05/14	09:35	02/06/14	02/06/14	0.00268
785835	A4 MAIN STACK - BLANK	FILTER14LD071	29/05/14	09:35	02/06/14	02/06/14	<0.00030
785836	A4 MAIN STACK - RUN 1 - IMP 1	ACETONE + H2O	29/05/14	09:20	02/06/14	02/06/14	<0.00160
785837	A4 MAIN STACK - BLANK - IMP 1	ACETONE + H2O	29/05/14	09:20	02/06/14	02/06/14	<0.00160

Authorised by:  Ian Barnabas - Scientific Support Laboratory Manager

Tests marked "*" in this report are NOT included in the UKAS accreditation schedule for this laboratory.

Printed 09/06/2014

19/05/2014 00:00:00

09/06/2014 23:59:59

This report was compiled by Customer Department

In the event of a query please contact them on the above number

Opinions and interpretations expressed herein are out side the scope of UKAS accreditation

Results relate only to the items tested

NORTHUMBRIAN WATER Scientific Services

Analytical Report

1181

Client: ALERIS RECYCLING (UK) LTD

Contract: ALERIS-02302

Air Monitoring

Clive Edwards
Waunarlwydd Works

Waunarlwydd
Swansea

Northumbrian Water Scientific Services
Northumberland Dock Road
Wallsend
Tyne & Wear
NE28 0QD
Tel. 0191 2968366 Fax. 0191 2968535

							Method	H090	H163
Sample ID Number	Description		Date Taken	Time Taken	Date Received	Date Started		chloride mg/l	volume of sample ml
785830	A4 MAIN STACK - RUN 1 - IMP 1	DI H2O	28/05/14	09:40	02/06/14	03/06/14		8.1	100.00
785831	A4 MAIN STACK - RUN 1 - IMP 2	DI H2O	28/05/14	09:40	02/06/14	03/06/14		<0.50	102.00
785832	A4 MAIN STACK - BLANK - IMP 1	DI H2O	28/05/14	09:25	02/06/14	03/06/14		<0.50	104.00
785833	A4 MAIN STACK - BLANK - IMP 2	DI H2O	28/05/14	09:25	02/06/14	03/06/14		<0.50	102.00

Authorised by: I Barnabas

Ian Barnabas - Scientific Support Laboratory Manager

Tests marked "*" in this report are NOT included in the UKAS accreditation schedule for this laboratory.

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This report was compiled by Customer Department

In the event of a query please contact them on the above number

Opinions and interpretations expressed herein are out side the scope of UKAS accreditation

Results relate only to the items tested