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**BS EN 14181 QAL2 Report Commissioned by**  
SITA UK Ltd

**Installation Name & Address**

SITA UK Ltd  
Wrexham Industrial Estate  
Malborough Road  
Wrexham  
LL13 9RJ

PPC Permit: AP3538SM

**Stack Reference**

A1 - Main Stack

**Dates of the Monitoring Campaign**

30th October to 2nd November 2012

**Job Reference Number**

CAT-1323

	INITIALS	DATE
OK FOR PUBLIC REGISTER	L.C	18.7.14
COPIED TO PUBLIC REGISTER	JB	EPem

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<b>Signature of Report Approver</b> 

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## Executive Summary (Page 1 of 2)

SITA UK Ltd, Wrexham  
A1 - Main Stack  
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### Overall Aim of the Monitoring Campaign

Catalyst Environmental Ltd were commissioned by SITA UK Ltd to carry out stack emissions testing on the A1 - Main Stack at Wrexham.

The aim of the monitoring campaign was to perform a QAL2 Calibration Exercise on the Continuous Emissions Monitoring System (CEMS), which is installed on the Plant, following the requirements of BS EN 14181.

### Special Requirements

There were no special requirements.

## QAL2 CALIBRATION SUMMARY

Parameter	Calibration Function derived from QAL2?	Source of the Calibration Function Derived	Calibration Function Derived	Result of Variability Test	Valid Calibration Range @ REF Conditions	Range after Surrogate Extension @ REF Conditions	Recommended Calibration Function to Apply to the Data Collection Software (see Conclusion)
Total Particulate Matter	Yes	Parallel Test	$y = 1.4366x + 0.671$	Fail	N/A	N/A	Re-test Required
Total VOCs	Yes	Parallel Test	$y = 0.885x + 0$	Pass	0 to 2.8 mg/m <sup>3</sup>	N/A	$y = x$
Oxides of Nitrogen (as NO <sub>2</sub> )	Yes	Parallel Test	$y = 1.0864x + 1.9716$	Pass	0 to 189.3 mg/m <sup>3</sup>	N/A	$y = x$
Sulphur Dioxide	No	Not Derived	N/A	N/A	N/A	N/A	$y = x$
Carbon Monoxide	No	Not Derived	N/A	N/A	N/A	N/A	$y = x$
Hydrogen Chloride	Yes	Parallel Test	$y = 0.4253x + 0.0222$	Pass	0 to 4.9 mg/m <sup>3</sup>	N/A	$y = 0.4253x + 0.0222$
Water Vapour	Yes	Parallel Test	$y = 1.0373x + 0.5712$	Pass	0 to 11.7 % v/v	N/A	$y = x$
Oxygen	Yes	Parallel Test	$y = 1.1186x + 0$	Pass	0 to 16.2 % v/v	N/A	$y = 1.1186x + 0$
Carbon Dioxide	Yes	Parallel Test	$y = 0.9968x + 0$	Pass	0 to 6.2 % v/v	N/A	$y = x$

These calibration functions remain valid so long as no adjustments (small, manual adjustments) are made to the CEMS, unless permitted through QAL3.

## LINEARITY SUMMARY

Parameter	Linearity Performed?	Linearity Calibration Function	R <sup>2</sup> Value	Maximum ABS %, d <sub>c,rel</sub>	Allowable ABS %, d <sub>c,rel</sub>	Result of Residuals Test	Range Linearity Performed Over
Total Particulate Matter	Yes	$y = 1.0049x - 0.4267$	0.9997	0.67	5	Pass	0 to 40mg/m <sup>3</sup>
Total VOCs	Yes	$y = 1.1836x + 0.6579$	0.9969	3.09	5	Pass	0 to 20 mg/m <sup>3</sup>
Nitrogen Monoxide (as NO <sub>2</sub> )	Yes	$y = 0.9814x - 0.9064$	0.9999	0.67	5	Pass	0 to 500 mg/m <sup>3</sup>
Nitrogen Dioxide	Yes	$y = 1.5922x + 0.6059$	0.9934	4.98	5	Pass	0 to 16 mg/m <sup>3</sup>
Sulphur Dioxide	Yes	$y = 1.1912x - 1.0485$	0.9969	3.25	5	Pass	0 to 66 mg/m <sup>3</sup>
Carbon Monoxide	Yes	$y = 0.8679x - 1.1006$	0.9975	2.49	5	Pass	0 to 91 mg/m <sup>3</sup>
Hydrogen Chloride	Yes	$y = 1.0443x + 0.2509$	0.9983	2.89	5	Pass	0 to 19 mg/m <sup>3</sup>
Oxygen	No (See Conclusion)						

## Executive Summary (Page 2 of 2)

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### SUMMARY OF STANDARD REFERENCE METHOD & BS EN 14181 DEVIATIONS

Parameter	Run	Deviation
CEMS		The functional tests for Total Particulate Matter and Hydrogen Chloride had been performed several weeks after the QAL2 exercise had been completed. MID 14181 requires the functional tests be done within 30 days of the QAL2 exercise being performed.

### CONCLUSIONS, DISCUSSIONS & ACTIONS FROM THE SAMPLING EXERCISE

#### Total Particulate Matter

A calibration function has been derived, however it does not pass the variability test, which indicates that there could be a problem with the CEMS system. Further investigations are required to ascertain why a valid calibration function could not be derived and a repeat of the QAL2 exercise may be required once the CEMS has been checked and / or fixed.

#### Hydrogen Chloride & Oxygen

A valid calibration function has been derived which passes the variability test. This calibration function should be used and entered into the Data Collection Software (DCS). It should however be noted that the calibration function derived for Oxygen is quite a bit higher than would be expected. The functional tests performed by CBISS did not include a check of the Oxygen cell on the analyser and therefore the CEMS results for Oxygen could be construed as being "questionable".

#### Total VOCs, Oxides of Nitrogen (as NO<sub>2</sub>), Water Vapour, Carbon Dioxide

A valid calibration function has been derived which passes the variability test. As the gradient of the calibration function is less than half of the 95% Confidence Interval [CI] and the SRM and CEMS data are therefore deemed to be extremely close in agreement with one another, MID 14181 Version 2.4 suggests that the calibration function derived may not be used and the calibration function in the Data Collection Software (DCS) could be left at 1.0000 (i.e.  $y = x$ ). Agreement from the Environment Agency must be sought before applying this guidance.

#### Sulphur Dioxide & Carbon Monoxide

As the emissions are of an extremely low order (<10% of the Daily ELV) and the spread of data is poor, a valid calibration function has not been derived. The graphical representation of the data can be seen in Section 4A at the back of this test report. Environment Agency guidance for these situations suggests that where emissions are extremely low and a linearity test was not / or could not be performed, it is acceptable to leave the calibration function in the Data Collection Software (DCS) as 1.0000 (i.e.  $y = x$ ), and take the CEMS readings as being indicative readings only.

#### Linearity Conclusion

The CEMS was found to give a linear response to all the test gases supplied to the analyser, passing the BS EN 14181 test of residuals requirement.

## REGULATORY INFORMATION

SITA UK Ltd, Wrexham  
A1 - Main Stack  
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Parameter	Value
Name of the Operator	SITA UK Ltd
Name of the Installation	Wrexham
Address of the Installation	See Title Page
Full Stack Reference Number & Name	A1 - Main Stack
Sector of the Installation	Incineration
Permit Number	AP3538SM
Date of the Last QAL2 Campaign	N/A

### Regulated Determinands and Emission Limit Values (ELVs)

Determinand	Short-Term ELV (mg/m <sup>3</sup> )	Daily or 48hr Average ELV (mg/m <sup>3</sup> )	Uncertainty Requirement (%)
Total Particulate Matter	30	10	30
Total VOCs	20	10	30
Oxides of Nitrogen (as NO <sub>2</sub> )	400	400	20
Nitrogen Monoxide	-	-	20
Nitrogen Dioxide	-	-	20
Sulphur Dioxide	200	50	20
Carbon Monoxide	100	50	20
Hydrogen Chloride	80	10	40

## OPERATIONAL INFORMATION AND SITE MONITORING PROVISIONS

SITA UK Ltd, Wrexham  
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### Process Type and Variations in Emissions

Parameter	Value
Continuous or batch process	Continuous
Were there any variations in emissions during the BS EN 14181 test (e.g. Load changes)	No
Will these variations affect the representative nature of the collected data?	N/A
Are there any factors that may affect the collected data (e.g. auto-calibrations, plant start up and shut down)	Yes - Auto-zero of analyser
Reviewing historical Plant data, were low emissions expected for any determinands?	Yes - VOCs, SO <sub>2</sub> & CO
Was the CEMS reading zero for any determinands, if so, was this investigated to ensure it was working?	All determinands reading a non-zero figure
What product was being processed during the tests?	Clinical Waste

### Type of Fuel

Parameter	Value
Fuel type used during the BS EN 14181 test (Include proportions for co-incineration)	Natural Gas
Are multiple calibration functions required if the emissions vary due to different fuel types being used?	No

### Abatement

Parameter	Value
Type of Abatement System	Bag Filter, Carbon & Lime Addition
Running Status	On



## MONITORING PROVISIONS AT THE INSTALLATION - PERIODIC MONITORING

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### Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.63
Width	m	-
Area	m <sup>2</sup>	0.31
Port Depth	cm	32
Orientation of Duct	-	Vertical
Sample Port Size	-	4" Tube

### Location of Sampling Platform

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

### Platform Details

EA Technical Guidance Note M1 / BS EN 15259 Platform Requirements	Value
Sufficient working area to manipulate probe and operate the measuring instruments	Yes
Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	Yes
Platform has vertical base boards (approx. 0.25m high)	Yes
Platform has chains / self closing gates at top of ladders	Yes
Access to sample ports unhindered by obstructions	Yes
Safe access available	Yes
Easy access available	Yes

### Sampling Location / Platform Improvement Recommendations

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

### BS EN 15259 Homogeneity Test Requirements

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

### Sampling Plane Validation Criteria (from EA Technical Guidance Document (Monitoring) TGN M1 / BS EN 15259)

Criteria in M1	Units	Traverse 1	Required	Compliant
Lowest Differential Pressure	Pa	82.0	> 5 Pa	Yes
Mean Velocity	m/s	13.8	-	-
Lowest Gas Velocity	m/s	12.3	-	-
Highest Gas Velocity	m/s	15.3	-	-
Ratio of Above	: 1	1.25	< 3 : 1	Yes
Maximum Angle of Swirl	°	5	< 15°	Yes
No Local Negative Flow	-	Yes	-	Yes

## MONITORING PROVISIONS AT THE INSTALLATION - PERIODIC MONITORING

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SITA UK Ltd, Wrexham

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### Pro-forma for Site Provisions for Monitoring

Requirement	Compliant	Notes
A safe and clean working environment with sufficient space and weather protection.	Yes	CEM is inside and within it's own casing
Easy and safe access to the CEMS.	Yes	CEM is at ground level
Adequate supplies of reference materials, tools and spare parts.	Yes	Site has a service contract that includes 24 hour response
Facilities to introduce the reference materials for gaseous-monitoring systems, both at the inlet of the sampling line (where present), and at the inlet of the CEMS.	Yes	
Compliance with MID 15259	Yes	See the Sampling Plane Validation Criteria table on the previous page.

### Plant Photos

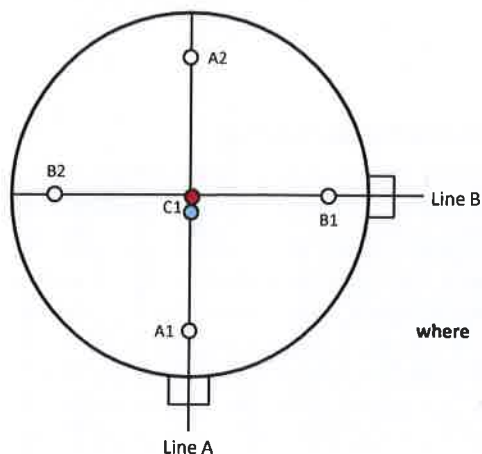
Photo 1



Photo 2



### Sample Points



where

- = isokinetic point sampled at
- = isokinetic point not sampled at
- = combustion gases sample point
- = non-isokinetic sample point



Section 2: Information about the Regulated Installation

**CONTINUOUS EMISSION MONITORING SYSTEMS (CEMS) AT THE INSTALLATION**

SITA UK Ltd, Wrexham

A1 - Main Stack

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Main Determinand	Type	Instrument Name	Instrument Serial Number	Measurement Principle	Certified Range (mg/m <sup>3</sup> )	QAL1 Compliant	MCERTS Number
Total Particulate Matter	In-Situ	PCME DT 991	24958	Charge Induction	0 - 15	Yes	MC 050066/05
Total VOCs	Extractive	Environnement SA Graphite 52M	496	FID	0 - 15	Yes	MC 060082/07
Oxides of Nitrogen (as NO <sub>2</sub> )	Extractive	Environnement SA MIR 9000	1785	GFC-IR	0 - 100	Yes	MC 020010/09
Nitrogen Monoxide	Extractive	Environnement SA MIR 9000	1785	GFC-IR	0 - 100	Yes	MC 020010/09
Nitrogen Dioxide	Extractive	Environnement SA MIR 9000	1785	GFC-IR	-	No	-
Sulphur Dioxide	Extractive	Environnement SA MIR 9000	1785	GFC-IR	0 - 75	Yes	MC 020010/09
Carbon Monoxide	Extractive	Environnement SA MIR 9000	1785	GFC-IR	0 - 75	Yes	MC 020010/09
Hydrogen Chloride	Extractive	Environnement SA MIR 9000	1785	GFC-IR	0 - 15	Yes	MC 020010/09
Oxygen (Dry)	Extractive	Environnement SA MIR 9000	1785	Paramagnetism	0 - 25%	Yes	MC 020010/09
Oxygen (Wet)	In-Situ	Setnag	-	Zirconia Cell	-	No	-
Carbon Dioxide	Extractive	Environnement SA MIR 9000	1785	NDIR	0 - 25%	Yes	MC 020010/05

Peripheral Determinand	Recorded	Instrument Name
Temperature	Yes	K-Type Thermocouple
Pressure	Yes	MIR 9000

### TEST LABORATORY STAFF

Position	Name	MCERTS Accreditation	MCERTS Number & Expiry Date	Technical Endorsements
Team Leader	Brian Jacob	MCERTS Level 2	MM 06 693	TE1 TE2 TE3 TE4
Technician	Antony Ward	MCERTS Level 1	MM 10 1096	None

### STANDARD REFERENCE METHODS (SRMs)

Catalyst Environmental hold UKAS and MCERTS Accreditation for performing QAL2 and ASTs, to BS EN 14181.

Determinand	Instrument Name	Measurement Principle	Instrumental Ranges		MCERTS Number	Reference Method	MU (%)
			Certified (mg/m <sup>3</sup> )	Operational (mg/m <sup>3</sup> )			
Total Particulate Matter	MST	Gravimetric	0 - 5	0 - 50	N/A	BS EN 13284-1	21
Total VOCs	Sick Maihak 3006	FID	0 - 15	0 - 160	MC 040036	BS EN 12619	41
Oxides of Nitrogen (as NO <sub>2</sub> )	Gasmet DX4000	FTIR	0 - 200	0 - 200	MC 030014	TGN M22	7.0
Nitrogen Monoxide	Gasmet DX4000	FTIR	0 - 200	0 - 200	MC 030014	TGN M22	4.0
Nitrogen Dioxide	Gasmet DX4000	FTIR	0 - 200	0 - 200	MC 030014	TGN M22	9.0
Sulphur Dioxide	MST	Ion Chromatography	N/A - SRM	N/A - SRM	N/A	BS EN 14791	15
Carbon Monoxide	Gasmet DX4000	FTIR	0 - 75	0 - 75	MC 030014	TGN M22	23
Hydrogen Chloride	MST	Ion Chromatography	N/A - SRM	N/A - SRM	N/A	BS EN 1911	15
Water Vapour	Gasmet DX4000	FTIR	0 - 30%	0 - 30%	MC 030014	TGN M22	6.0
Oxygen (Dry)	Horiba PG-250	Zirconia Cell	0 - 25%	0 - 25%	MC 050056	BS EN 14789	2.1
Carbon Dioxide	Gasmet DX4000	FTIR	0 - 25%	0 - 25%	MC 030014	TGN M22	5.0

NOTE: Catalyst Environmental hold UKAS and MCERTS Accreditation for all Standard Reference Method Tests performed.

where: MST stands for Manual Sampling Train

### LIST OF EQUIPMENT

Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
Control Box DGM	CAT 7.6	Horiba PG-250	CAT 9.9	Digital Manometer (1)	CAT 3.15
Box Thermocouples	CAT 7.6	Servomex 4900	-	Digital Manometer (2)	-
Umbilical	CAT 3.10	Servomex 5200 MP	-	Digital Temperature Meter	CAT 3.15
Oven Box	CAT 12.3	ECO PHYSICS CLD 822 M h	-	Stopwatch	CAT 14.41
Probe	CAT 5.64	Testo 350 XL	-	Barometer	CAT 13.9
S-Pitot (1)	CAT 21s.19	JCT JCC P-1 Cooler	CAT 4.135	Stack Thermocouple (1)	CAT 4.353
S-Pitot (2)	CAT 21p.23	Gasmet DX-4000 FTIR	CAT 19.7	Stack Thermocouple (2)	CAT 4.173
L-Pitot	-	Gasmet FTIR Sampling System	CAT 10.4	1m Heated Line (1)	-
500g Check Weight	CAT 17.13	Bernath 3006 FID	CAT 8.7	1m Heated Line (2)	-
1Kg Check Weight	CAT 17.13	Heated Head Filter	CAT 12.92	1m Heated Line (3)	-
Last Impinger Arm	CAT 4.17	Mass Flow Controller (1)	CAT 6.3	5m Heated Line (1)	-
Callipers	CAT 23.10	Mass Flow Controller (2)	CAT 6.4	15m Heated Line (1)	-
Tubes Kit Thermocouple	-	Mass View (1)	CAT 25.15	15m Heated Line (2)	-
Laboratory Balance	CAT 1.18 / 1.18a	Mass View (2)	CAT 15.16	20m Heated Line (1)	CAT 20.29
Tape Measure	CAT 16.14	Easylogger EN-EL-12 Bit	CAT 11.17		
		Dual Channel Heater Controller	-		

Section 4A - Data and Calculations - QAL2

**TOTAL PARTICULATE MATTER: QAL2 CALCULATIONS**

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SITA UK Ltd, Wrexham

A1 - Main Stack

**Calibration Data**

Pair	Date	Time	x, CEMS (ACTUAL) mg/m <sup>3</sup>	y, SRM (ACTUAL) mg/m <sup>3</sup>	SRM (STP, DRY, 11% O <sub>2</sub> ) mg/m <sup>3</sup>	x - x <sub>av</sub> (A)	y - y <sub>av</sub> (B)	(A) x (B)	(x - x <sub>av</sub> ) <sup>2</sup>	CAL CEMS (ACTUAL) mg/m <sup>3</sup>
1	30/10/2012	11:58 - 12:42	0.77	2.11	5.08	0.41	0.92	0.38	0.17	1.78
2	30/10/2012	14:11 - 14:58	0.81	1.13	2.65	0.45	-0.06	-0.03	0.20	1.83
3	30/10/2012	15:39 - 16:23	0.62	0.68	1.54	0.26	-0.51	-0.13	0.07	1.56
4	31/10/2012	08:10 - 08:54	0.44	1.10	3.37	0.08	-0.09	-0.01	0.01	1.30
5	31/10/2012	09:13 - 09:57	0.78	1.65	4.39	0.42	0.46	0.19	0.18	1.79
6	31/10/2012	13:11 - 13:55	0.39	0.05	0.14	0.03	-1.14	-0.03	0.00	1.23
7	31/10/2012	14:22 - 15:05	0.39	3.21	8.91	0.03	2.02	0.06	0.00	1.23
8	31/10/2012	15:50 - 16:34	0.39	1.05	2.68	0.03	-0.14	0.00	0.00	1.23
9	01/11/2012	15:19 - 16:00	0.27	1.25	3.00	-0.09	0.06	-0.01	0.01	1.06
10	01/11/2012	16:14 - 17:00	0.27	0.35	0.84	-0.09	-0.84	0.08	0.01	1.06
11	01/11/2012	17:15 - 18:00	0.27	1.11	2.78	-0.09	-0.08	0.01	0.01	1.06
12	02/11/2012	10:20 - 11:13	0.27	4.02	10.13	-0.09	2.83	-0.26	0.01	1.06
13	02/11/2012	11:46 - 12:33	0.27	2.15	5.39	-0.09	0.96	-0.09	0.01	1.06
14	02/11/2012	12:55 - 13:42	0.27	0.07	0.18	-0.09	-1.12	0.10	0.01	1.06
15	02/11/2012	14:14 - 14:59	0.30	1.50	3.94	-0.06	0.31	-0.02	0.00	1.10
16	30/10/2012	SURROGATE	0.00	0.00	0.00	-0.36	-1.19	0.43	0.13	0.67
17	31/10/2012	SURROGATE	0.00	0.00	0.00	-0.36	-1.19	0.43	0.13	0.67
18	01/11/2012	SURROGATE	0.00	0.00	0.00	-0.36	-1.19	0.43	0.13	0.67

NOTE: Any values sitting outside 2 x  
Standard Deviations have been removed as  
Outliers, as per EA's Quick Guide, RM-QG14.

SPREAD OF DATA	9.99
DAILY ELV (mg/m <sup>3</sup> )	10
MU (%)	30
15% of ELV	1.50
METHOD USED (A or B)	A

SUM	1.53	1.06
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**Derivation of Calibration Function**

b =	1.4366	a =	0.6710
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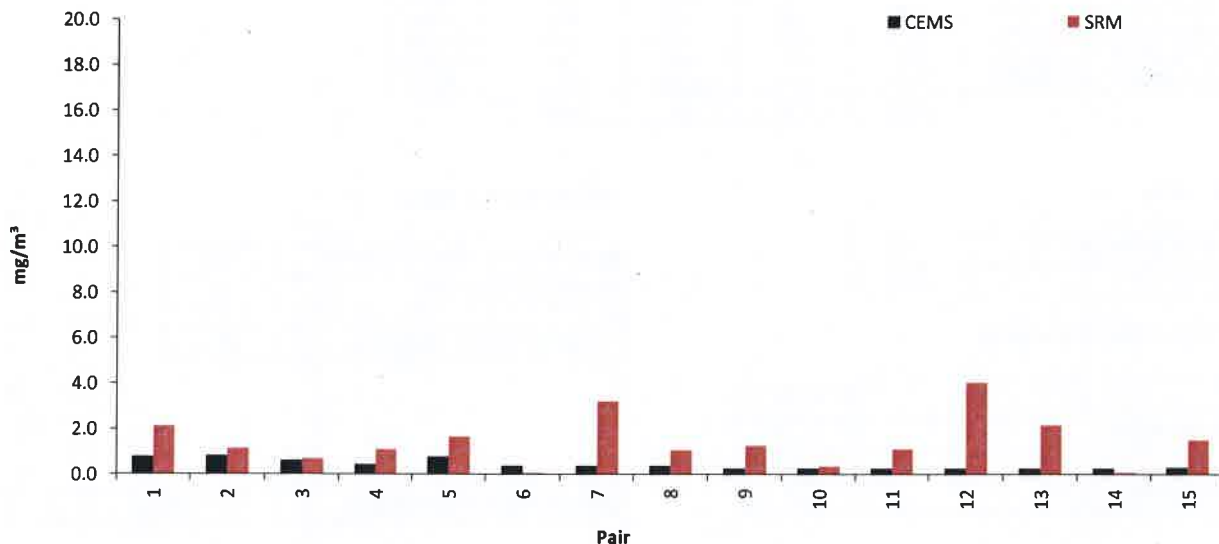
CALIBRATION FUNCTION =	y = 1.4366x + 0.671
------------------------	---------------------

where

For Method A  $b = [(x - x_{av}) \times (y - y_{av})] / (x - x_{av})^2$  and  $a = \text{MEAN}(y) - [\text{MEAN}(x) \times b]$

Method B  $b = \text{MEAN}(y) / [\text{MEAN}(x) - \text{OFFSET}]$  and  $a = -b \times \text{OFFSET}$

**PLOT 1: BAR CHART OF DATA**



Section 4A - Data and Calculations - QAL2

**TOTAL PARTICULATE MATTER: QAL2 CALCULATIONS**

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SITA UK Ltd, Wrexham

A1 - Main Stack

**Variability Test Data**

Pair	Date	Time	CEMS Temp °C	SRM Temp °C	CEMS Pressure kPa	SRM Pressure kPa	CEMS Water Vapour % v/v	SRM Water Vapour % v/v	CEMS Oxygen (DRY) % v/v	SRM Oxygen (DRY) % v/v
1	30/10/2012	11:58 - 12:42	379.6	156.3	99.2	99.9	0.62	4.08	14.94	14.10
2	30/10/2012	14:11 - 14:58	287.3	148.1	99.3	99.9	0.19	4.72	15.20	14.00
3	30/10/2012	15:39 - 16:23	230.9	145.3	99.6	99.9	0.16	3.32	15.30	13.90
4	31/10/2012	08:10 - 08:54	234.1	179.6	99.4	100.0	9.91	10.08	12.88	14.90
5	31/10/2012	09:13 - 09:57	201.6	182.3	99.5	100.0	9.67	9.37	12.53	14.00
6	31/10/2012	13:11 - 13:55	199.3	188.3	99.6	100.0	8.50	9.76	12.55	14.20
7	31/10/2012	14:22 - 15:05	195.3	188.6	99.5	100.0	9.34	9.27	12.50	14.20
8	31/10/2012	15:50 - 16:34	199.2	186.5	99.5	100.0	9.65	7.12	12.34	13.80
9	01/11/2012	15:19 - 16:00	248.2	159.0	99.3	100.0	5.78	7.17	12.39	13.80
10	01/11/2012	16:14 - 17:00	290.6	156.8	99.5	100.0	7.80	6.21	12.56	13.90
11	01/11/2012	17:15 - 18:00	348.9	159.8	99.5	100.0	5.71	8.48	12.57	14.00
12	02/11/2012	10:20 - 11:13	306.1	156.5	99.0	99.9	6.81	6.94	12.54	14.20
13	02/11/2012	11:46 - 12:33	293.8	163.9	99.4	99.9	5.96	7.54	12.04	14.00
14	02/11/2012	12:55 - 13:42	319.5	166.3	99.5	99.9	7.78	7.66	12.81	14.20
15	02/11/2012	14:14 - 14:59	329.5	175.1	99.5	99.8	9.93	5.40	13.05	14.30
16	30/10/2012	SURROGATE	0.0	0.0	101.3	101.3	0.00	0.00	20.80	20.80
17	31/10/2012	SURROGATE	0.0	0.0	101.3	101.3	0.00	0.00	20.80	20.80
18	01/11/2012	SURROGATE	0.0	0.0	101.3	101.3	0.00	0.00	20.80	20.80

Pair	Date	Time	CAL CEMS (ACTUAL) mg/m³	CAL CEMS (STP, DRY, 11% O₂) mg/m³	SRM (STP, DRY, 11% O₂) mg/m³	ys, SRM - CAL CEMS	Filter ID Number (47-XXXX)
1	30/10/2012	11:58 - 12:42	1.78	7.20	5.08	-2.12	47-11111
2	30/10/2012	14:11 - 14:58	1.83	6.64	2.65	-3.99	47-11095
3	30/10/2012	15:39 - 16:23	1.56	5.15	1.54	-3.61	47-11057
4	31/10/2012	08:10 - 08:54	1.30	3.37	3.37	0.00	47-11118
5	31/10/2012	09:13 - 09:57	1.79	4.14	4.39	0.25	47-11058
6	31/10/2012	13:11 - 13:55	1.23	2.80	0.14	-2.66	47-11106
7	31/10/2012	14:22 - 15:05	1.23	2.79	8.91	6.12	47-11061
8	31/10/2012	15:50 - 16:34	1.23	2.77	2.68	-0.09	47-11113
9	01/11/2012	15:19 - 16:00	1.06	2.54	3.00	0.46	47-11067
10	01/11/2012	16:14 - 17:00	1.06	2.86	0.84	-2.02	47-11119
11	01/11/2012	17:15 - 18:00	1.06	3.09	2.78	-0.31	47-11066
12	02/11/2012	10:20 - 11:13	1.06	2.92	10.13	7.22	47-11110
13	02/11/2012	11:46 - 12:33	1.06	2.66	5.39	2.73	47-11094
14	02/11/2012	12:55 - 13:42	1.06	3.10	0.18	-2.92	47-10780
15	02/11/2012	14:14 - 14:59	1.10	3.46	3.94	0.48	47-10908
16	30/10/2012	SURROGATE	0.67	0.00	0.00	0.00	47-11093
17	31/10/2012	SURROGATE	0.67	0.00	0.00	0.00	47-11062
18	01/11/2012	SURROGATE	0.67	0.00	0.00	0.00	47-10929
MAX				7.20	S <sub>d</sub>	2.98	

**Test of Variability**

$Q_0 = ELV \times (MU / 100) / 1.96$	1.53
$K_v$ for 15 Pairs of Data	0.9803

The variability is accepted if  $S_d \leq Q_0 \times K_v$

Parameter	Value
Standard Deviation (S <sub>d</sub> )	2.98
$Q_0 \times K_v$	1.50
Outcome of Variability Test	Fail

**Valid Calibration Range**

Maximum CAL CEMS Value (mg/m³)	7.2
Allowable Extension (%)	10
Surrogate Extension Applied?	No

Valid Calibration Range (mg/m³)	0 to 14
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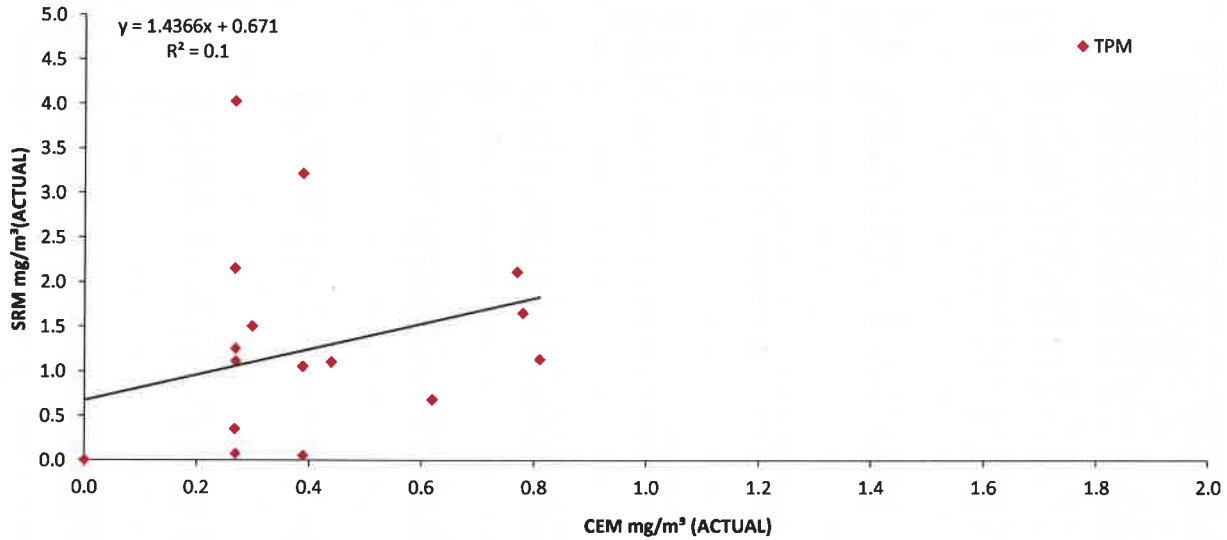
Section 4A - Data and Calculations - QAL2

**TOTAL PARTICULATE MATTER: QAL2 CALCULATIONS**

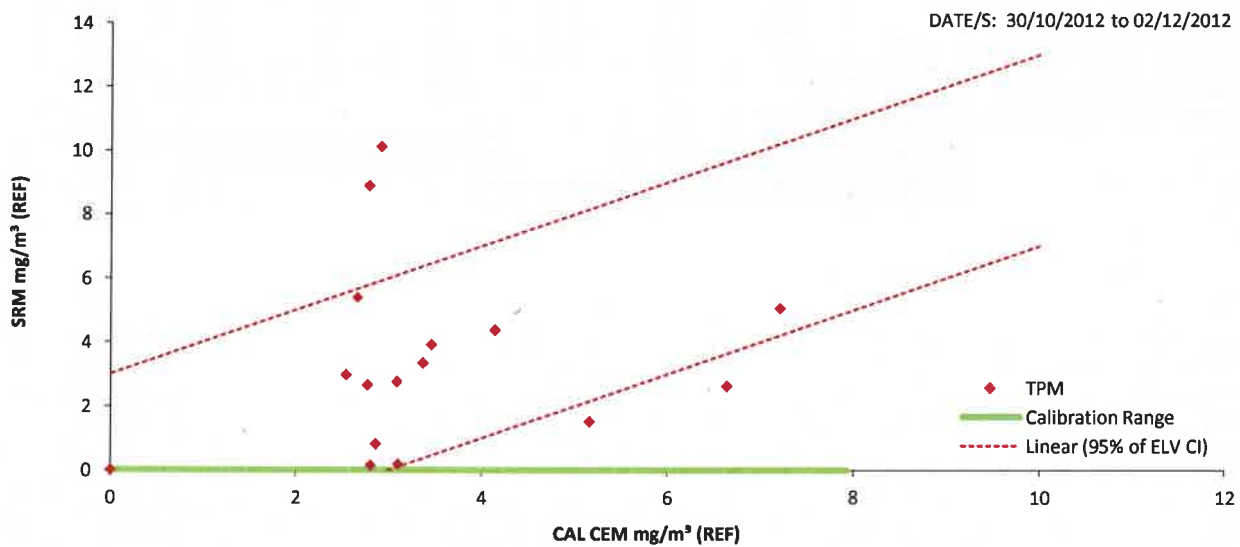
(Page 3 of 3)

SITA UK Ltd, Wrexham  
A1 - Main Stack

**PLOT 2: Calibration Graph for Method A**



**PLOT 3: X-Y Plot - REF CAL CEMS vs REF SRM Values**





Section 4A - Data and Calculations - QAL2

**VOLATILE ORGANIC COMPOUNDS: QAL2 CALCULATIONS**

(Page 1 of 4)

SITA UK Ltd, Wrexham

A1 - Main Stack

**Calibration Data**

Pair	Date	Time (30-minute Average)	x, CEMS (STP, WET) mg/m <sup>3</sup>	y, SRM (STP, WET) mg/m <sup>3</sup>	SRM (STP, DRY, 11% O <sub>2</sub> ) mg/m <sup>3</sup>	x - x <sub>av</sub> (A)	y - y <sub>av</sub> (B)	(A) x (B)	(x - x <sub>av</sub> ) <sup>2</sup>	CAL CEMS (STP, WET) mg/m <sup>3</sup>
1	30/10/2012	18:35 - 19:05	2.16	2.70	4.19	1.32	1.95	2.58	1.74	1.91
2	30/10/2012	19:35 - 20:05	2.25	2.54	3.90	1.40	1.79	2.52	1.97	1.99
3	30/10/2012	21:35 - 22:05	1.39	1.65	2.66	0.55	0.90	0.50	0.30	1.23
4	30/10/2012	22:35 - 23:05	0.36	0.73	1.15	-0.48	-0.01	0.01	0.23	0.32
5	31/10/2012	00:35 - 01:05	0.04	0.30	0.47	-0.80	-0.44	0.36	0.65	0.03
6	31/10/2012	01:35 - 02:05	0.53	0.16	0.25	-0.31	-0.59	0.18	0.10	0.47
7	31/10/2012	04:35 - 05:05	1.60	0.16	0.25	0.76	-0.59	-0.45	0.58	1.42
8	31/10/2012	06:35 - 07:05	0.22	0.16	0.25	-0.62	-0.59	0.36	0.39	0.19
9	31/10/2012	07:35 - 08:05	0.64	0.07	0.05	-0.20	-0.67	0.14	0.04	0.57
10	31/10/2012	10:31 - 11:01	0.63	0.35	0.54	-0.21	-0.40	0.08	0.05	0.56
11	31/10/2012	13:31 - 14:01	0.04	1.44	2.36	-0.80	0.70	-0.56	0.64	0.04
12	31/10/2012	15:31 - 16:01	0.62	1.10	1.65	-0.22	0.36	-0.08	0.05	0.55
13	31/10/2012	16:31 - 17:01	2.15	1.60	2.52	1.30	0.86	1.12	1.70	1.90
14	31/10/2012	18:31 - 19:01	0.91	0.28	0.43	0.06	-0.47	-0.03	0.00	0.80
15	31/10/2012	19:31 - 20:01	0.63	0.27	0.48	-0.21	-0.47	0.10	0.05	0.56
16	31/10/2012	21:31 - 22:01	1.33	0.27	0.41	0.49	-0.47	-0.23	0.24	1.18
17	01/11/2012	00:31 - 01:01	1.37	0.42	0.64	0.53	-0.32	-0.17	0.28	1.21
18	01/11/2012	01:31 - 02:01	-0.35	0.42	0.62	-1.20	-0.33	0.39	1.43	-0.31
19	01/11/2012	02:31 - 03:01	-0.30	0.41	0.62	-1.14	-0.34	0.38	1.30	-0.27
20	01/11/2012	03:31 - 04:01	1.47	0.40	0.60	0.63	-0.35	-0.22	0.39	1.30
21	01/11/2012	04:31 - 05:01	-0.09	0.39	0.61	-0.93	-0.36	0.33	0.87	-0.08
22	01/11/2012	05:31 - 06:01	-0.17	0.38	0.60	-1.02	-0.36	0.37	1.04	-0.15
23	01/11/2012	06:31 - 07:01	-0.34	0.37	0.62	-1.19	-0.37	0.44	1.41	-0.31
24	02/11/2012	10:28 - 10:58	1.86	1.35	2.09	1.02	0.60	0.61	1.04	1.65
25	02/11/2012	11:28 - 11:58	2.21	1.35	2.06	1.37	0.61	0.83	1.87	1.96
26	02/11/2012	12:28 - 12:58	0.81	0.61	0.94	-0.03	-0.13	0.00	0.00	0.72
27	02/11/2012	13:28 - 13:58	0.78	0.23	0.38	-0.06	-0.51	0.03	0.00	0.69

NOTE: Any values sitting outside 2 x

Standard Deviations have been removed as  
Outliers, as per EA's Quick Guide, RM-QG14.

SPREAD OF DATA	4.13
DAILY ELV (mg/m <sup>3</sup> )	10
MU (%)	30
15% of ELV	1.50
METHOD USED (A or B)	B

[If spread of data (excluding zero points) is > 15% of the ELV,  
use Method A, otherwise use Method B]

WHERE OFFSET = 0



Section 4A - Data and Calculations - QAL2

**VOLATILE ORGANIC COMPOUNDS: QAL2 CALCULATIONS**

(Page 2 of 4)

SITA UK Ltd, Wrexham  
A1 - Main Stack

**Derivation of Calibration Function**

b =	0.8850	a =	0.0000
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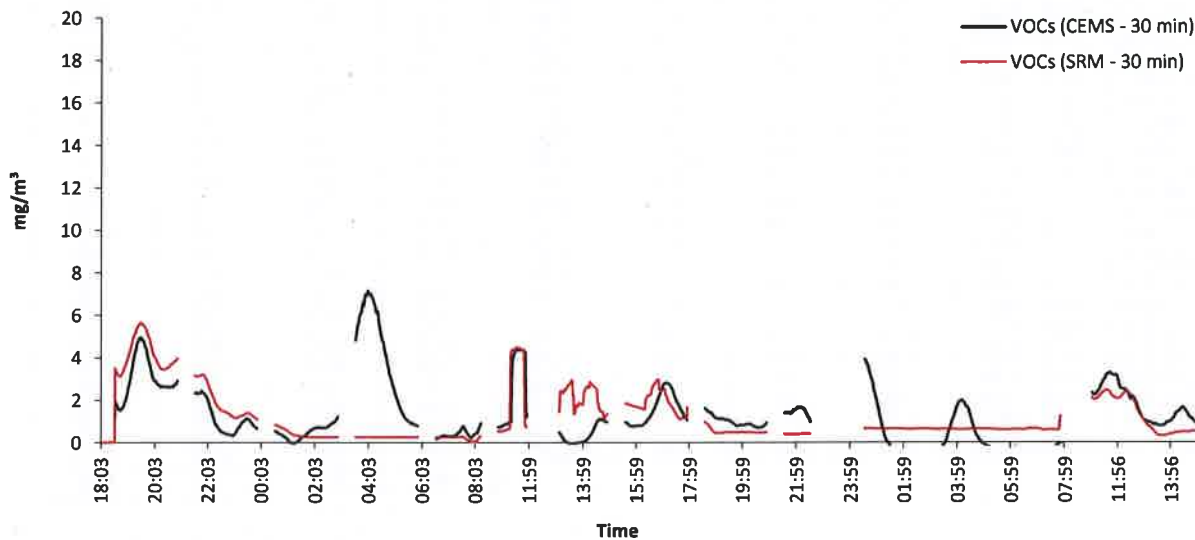
CALIBRATION FUNCTION =	$y = 0.885x + 0$
------------------------	------------------

where

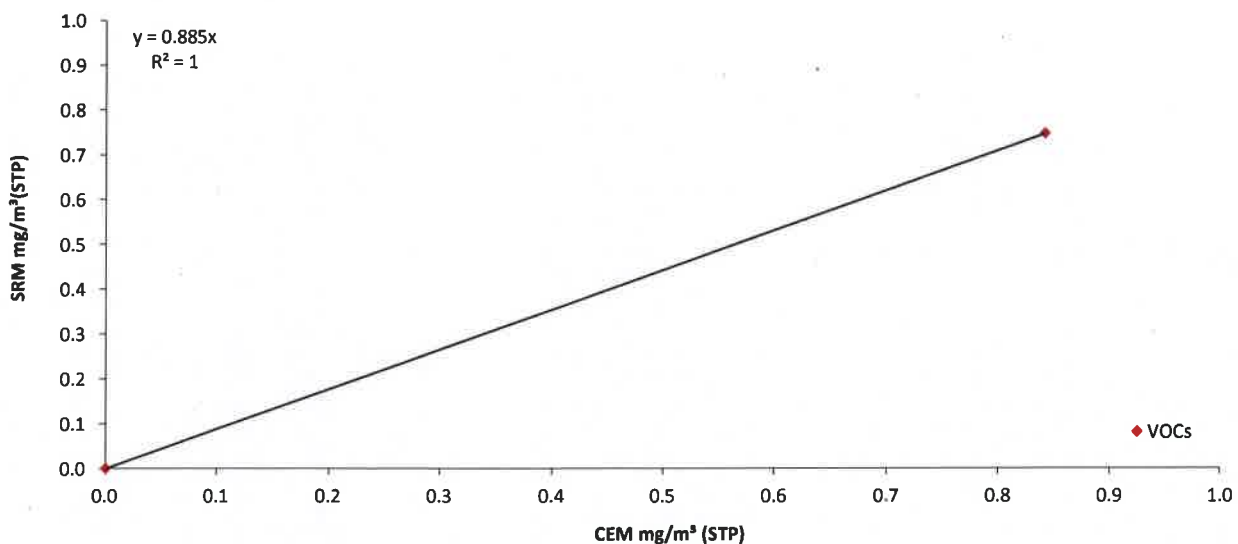
For Method A  $b = [(x - x_{av}) \times (y - y_{av})] / (x - x_{av})^2$  and  $a = \text{MEAN}(y) - [\text{MEAN}(x) \times b]$

Method B  $b = \text{MEAN}(y) / [\text{MEAN}(x) - \text{OFFSET}]$  and  $a = -b \times \text{OFFSET}$

**PLOT 1: GRAPH FOR REF (STANDARDISED) SRM vs REF (STANDARDISED) CEMS (30 minute rolling averages)**



**PLOT 2: Calibration Graph for Method B**



Section 4A - Data and Calculations - QAL2

**VOLATILE ORGANIC COMPOUNDS: QAL2 CALCULATIONS**

(Page 3 of 4)

SITA UK Ltd, Wrexham

A1 - Main Stack

**Variability Test Data**

Pair	Date	Time (30-minute Average)	CAL CEMS (STP, WET) mg/m <sup>3</sup>	CEMS Water Vapour % v/v	SRM Water Vapour % v/v	CEMS Oxygen (DRY) % v/v	SRM Oxygen (DRY) % v/v	CAL CEMS (STP, DRY, 11% O <sub>2</sub> ) mg/m <sup>3</sup>	SRM (STP, DRY, 11% O <sub>2</sub> ) mg/m <sup>3</sup>	ys, SRM - CAL CEMS
1	30/10/2012	18:35 - 19:05	1.91	8.09	8.72	12.56	13.93	2.47	4.19	1.72
2	30/10/2012	19:35 - 20:05	1.99	7.65	7.94	12.52	13.94	2.54	3.90	1.36
3	30/10/2012	21:35 - 22:05	1.23	9.17	9.46	12.79	14.15	1.65	2.66	1.01
4	30/10/2012	22:35 - 23:05	0.32	8.17	9.36	12.55	13.94	0.41	1.15	0.74
5	31/10/2012	00:35 - 01:05	0.03	9.69	9.95	12.64	13.96	0.05	0.47	0.43
6	31/10/2012	01:35 - 02:05	0.47	7.82	8.38	12.59	13.89	0.61	0.25	-0.36
7	31/10/2012	04:35 - 05:05	1.42	7.39	7.72	12.77	14.17	1.86	0.25	-1.61
8	31/10/2012	06:35 - 07:05	0.19	7.94	8.11	12.67	14.06	0.25	0.25	0.00
9	31/10/2012	07:35 - 08:05	0.57	3.71	4.25	5.74	6.48	0.38	0.05	-0.33
10	31/10/2012	10:31 - 11:01	0.56	8.96	8.64	12.51	13.98	0.72	0.54	-0.18
11	31/10/2012	13:31 - 14:01	0.04	8.39	9.56	12.56	14.24	0.05	2.36	2.31
12	31/10/2012	15:31 - 16:01	0.55	9.74	8.67	12.25	13.66	0.70	1.65	0.95
13	31/10/2012	16:31 - 17:01	1.90	8.31	9.56	12.57	13.97	2.46	2.52	0.06
14	31/10/2012	18:31 - 19:01	0.80	7.83	7.48	12.50	14.14	1.02	0.43	-0.59
15	31/10/2012	19:31 - 20:01	0.56	4.99	6.58	13.07	14.97	0.74	0.48	-0.26
16	31/10/2012	21:31 - 22:01	1.18	6.58	8.27	12.20	13.80	1.43	0.41	-1.02
17	01/11/2012	00:31 - 01:01	1.21	6.68	8.23	12.23	13.73	1.48	0.64	-0.85
18	01/11/2012	01:31 - 02:01	-0.31	6.70	8.19	12.16	13.71	-0.38	0.62	1.00
19	01/11/2012	02:31 - 03:01	-0.27	7.45	8.51	12.26	13.76	-0.33	0.62	0.95
20	01/11/2012	03:31 - 04:01	1.30	6.77	7.88	12.33	13.85	1.61	0.60	-1.00
21	01/11/2012	04:31 - 05:01	-0.08	5.71	7.19	12.51	14.15	-0.10	0.61	0.71
22	01/11/2012	05:31 - 06:01	-0.15	4.56	6.86	12.39	14.13	-0.19	0.60	0.79
23	01/11/2012	06:31 - 07:01	-0.31	4.75	7.18	12.78	14.59	-0.39	0.62	1.01
24	02/11/2012	10:28 - 10:58	1.65	7.31	8.64	12.40	13.94	2.07	2.09	0.02
25	02/11/2012	11:28 - 11:58	1.96	7.57	8.17	12.45	13.84	2.47	2.06	-0.42
26	02/11/2012	12:28 - 12:58	0.72	6.73	7.38	12.53	13.98	0.91	0.94	0.03
27	02/11/2012	13:28 - 13:58	0.69	7.62	8.06	12.90	14.33	0.93	0.38	-0.54
MAX								2.54	Sd	0.92

Section 4A - Data and Calculations - QAL2

**VOLATILE ORGANIC COMPOUNDS: QAL2 CALCULATIONS**

(Page 4 of 4)

SITA UK Ltd, Wrexham

A1 - Main Stack

**Test of Variability**

$Q_0 = ELV \times (MU / 100) / 1.96$	1.53
Kv for 27 Pairs of Data	0.9861

The variability is accepted if  $Sd \leq Q_0 \times Kv$

Parameter	Value
Standard Deviation (Sd)	0.92
$Q_0 \times Kv$	1.51
Outcome of Variability Test	Pass

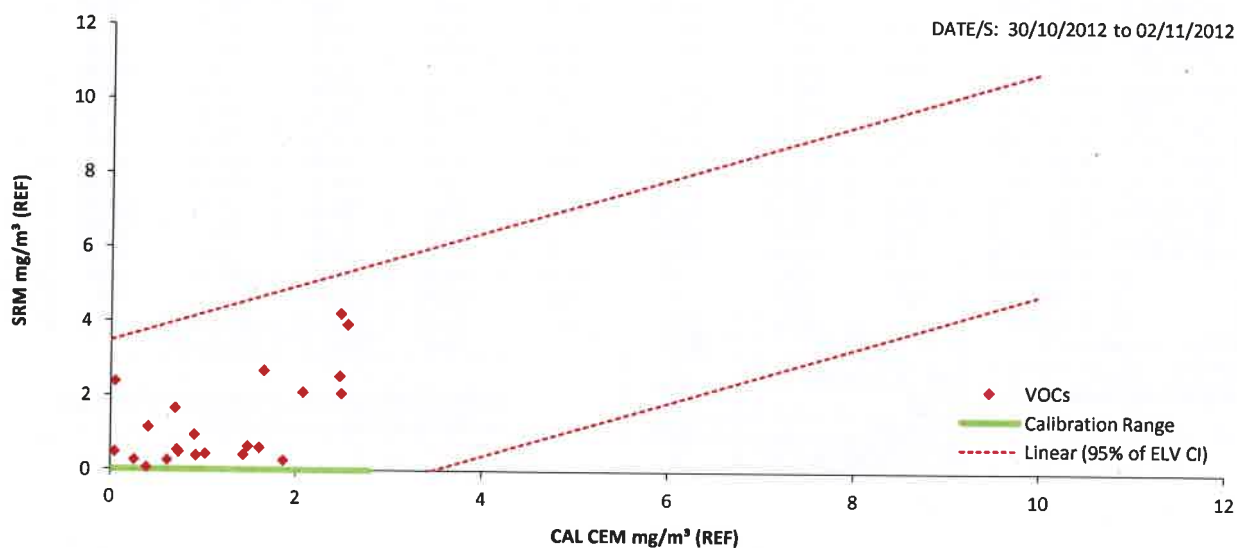
**Valid Calibration Range**

Maximum CAL CEMS Value (mg/m <sup>3</sup> )	2.5
Allowable Extension (%)	10

Surrogate Extension Applied?	No
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Valid Calibration Range (mg/m <sup>3</sup> )	0 to 2.8
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**PLOT 3: X-Y Plot - REF CAL CEMS vs REF SRM Values**



Section 4A - Data and Calculations - QAL2

OXIDES OF NITROGEN (as NO<sub>2</sub>): QAL2 CALCULATIONS

(Page 1 of 4)

SITA UK Ltd, Wrexham

A1 - Main Stack

Calibration Data

Pair	Date	Time (30-minute Average)	x, CEMS (STP, DRY) mg/m <sup>3</sup>	y, SRM (STP, DRY) mg/m <sup>3</sup>	SRM (STP, DRY, 11% O <sub>2</sub> ) mg/m <sup>3</sup>	x - x <sub>av</sub> (A)	y - y <sub>av</sub> (B)	(A) x (B)	(x - x <sub>av</sub> ) <sup>2</sup>	CAL CEMS (STP, DRY) mg/m <sup>3</sup>
1	01/11/2012	03:43 - 04:13	136.36	136.98	192.21	39.75	30.06	1194.82	1580.22	150.11
2	30/10/2012	18:35 - 19:05	113.02	132.23	187.05	16.41	25.31	415.33	269.34	124.76
3	30/10/2012	19:35 - 20:05	84.62	97.93	138.62	-11.98	-9.00	107.82	143.63	93.91
4	30/10/2012	21:35 - 22:05	96.41	114.65	167.39	-0.20	7.73	-1.51	0.04	106.71
5	30/10/2012	22:35 - 23:05	95.95	113.78	161.05	-0.66	6.85	-4.53	0.44	106.21
6	31/10/2012	00:35 - 01:05	111.32	136.19	193.54	14.71	29.26	430.37	216.34	122.91
7	31/10/2012	01:35 - 02:05	109.44	131.49	185.05	12.83	24.56	315.08	164.55	120.86
8	31/10/2012	03:35 - 04:05	104.78	119.06	172.52	8.17	12.13	99.09	66.75	115.80
9	31/10/2012	04:35 - 05:05	112.47	123.66	181.04	15.86	16.74	265.52	251.69	124.16
10	31/10/2012	06:35 - 07:05	104.83	121.62	175.21	8.23	14.69	120.82	67.65	115.86
11	31/10/2012	10:31 - 11:01	105.76	133.60	190.43	9.15	26.68	244.18	83.79	116.87
12	31/10/2012	13:31 - 14:01	103.76	121.96	180.43	7.15	15.03	107.50	51.13	114.70
13	31/10/2012	15:31 - 16:01	102.63	128.61	175.13	6.02	21.68	130.59	36.28	113.47
14	31/10/2012	16:31 - 17:01	126.08	147.50	209.81	29.47	40.57	1195.83	868.67	138.95
15	31/10/2012	18:31 - 19:01	93.24	103.73	151.17	-3.37	-3.19	10.75	11.33	103.27
16	31/10/2012	19:31 - 20:01	84.93	78.21	129.74	-11.68	-28.72	335.35	136.35	94.24
17	31/10/2012	21:31 - 22:01	99.00	112.00	155.61	2.39	5.07	12.14	5.72	109.53
18	01/11/2012	00:31 - 01:01	123.54	132.73	182.66	26.93	25.80	694.84	725.09	136.18
19	01/11/2012	01:31 - 02:01	124.85	131.75	180.74	28.24	24.82	700.99	797.48	137.61
20	01/11/2012	02:31 - 03:01	132.18	139.65	192.78	35.57	32.72	1163.65	1264.98	145.57
21	01/11/2012	06:31 - 07:01	111.50	101.70	158.59	14.89	-5.23	-77.85	221.78	123.11
22	02/11/2012	10:28 - 10:58	123.22	122.37	173.20	26.61	15.44	410.86	708.30	135.84
23	02/11/2012	11:28 - 11:58	109.45	115.05	160.78	12.85	8.12	104.33	165.00	120.88
24	02/11/2012	12:28 - 12:58	93.09	94.66	134.82	-3.52	-12.26	43.19	12.40	103.10
25	02/11/2012	13:28 - 13:58	102.60	102.86	154.14	5.99	-4.07	-24.39	35.93	113.44
26	-	SURROGATE	0.00	0.00	0.00	-96.61	-106.93	10330.13	9333.23	1.97
27	-	SURROGATE	0.00	0.00	0.00	-96.61	-106.93	10330.13	9333.23	1.97
28	-	SURROGATE	0.00	0.00	0.00	-96.61	-106.93	10330.13	9333.23	1.97

NOTE: Any values sitting outside 2 x

Standard Deviations have been removed as  
Outliers, as per EA's Quick Guide, RM-QG14.

SPREAD OF DATA	209.81
DAILY ELV (mg/m <sup>3</sup> )	400
MU (%)	20
15% of ELV	60.00
METHOD USED (A or B)	A

[If spread of data (excluding zero points) is > 15% of the ELV,  
use Method A, otherwise use Method B]

SUM	38985.13	35884.59
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Section 4A - Data and Calculations - QAL2

**OXIDES OF NITROGEN (as NO<sub>2</sub>): QAL2 CALCULATIONS**

(Page 2 of 4)

SITA UK Ltd, Wrexham

A1 - Main Stack

**Derivation of Calibration Function**

b =	1.0864	a =	1.9716
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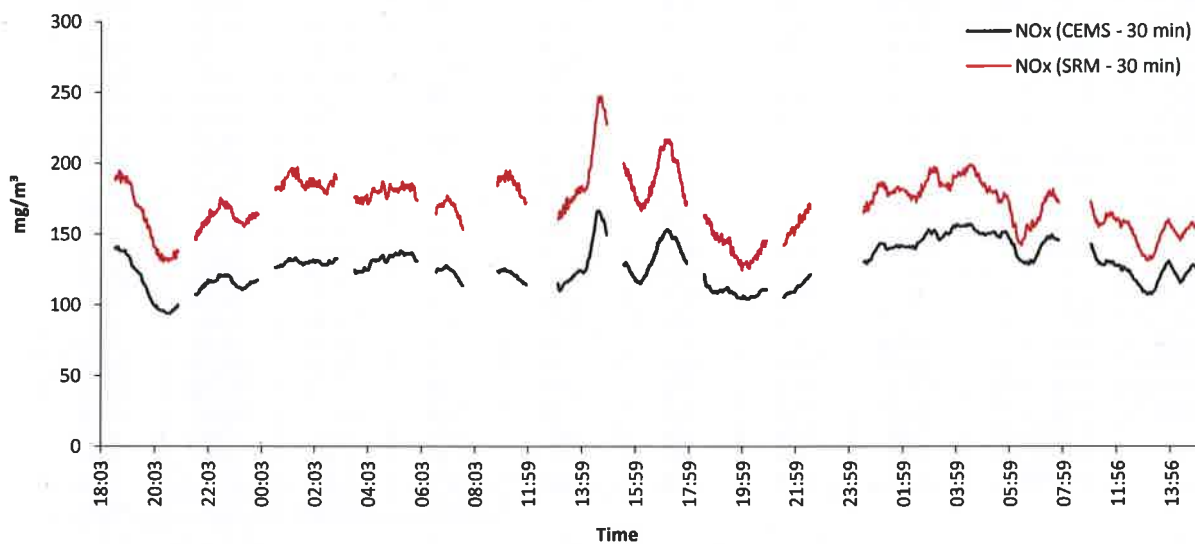
CALIBRATION FUNCTION =	$y = 1.0864x + 1.9716$
------------------------	------------------------

where

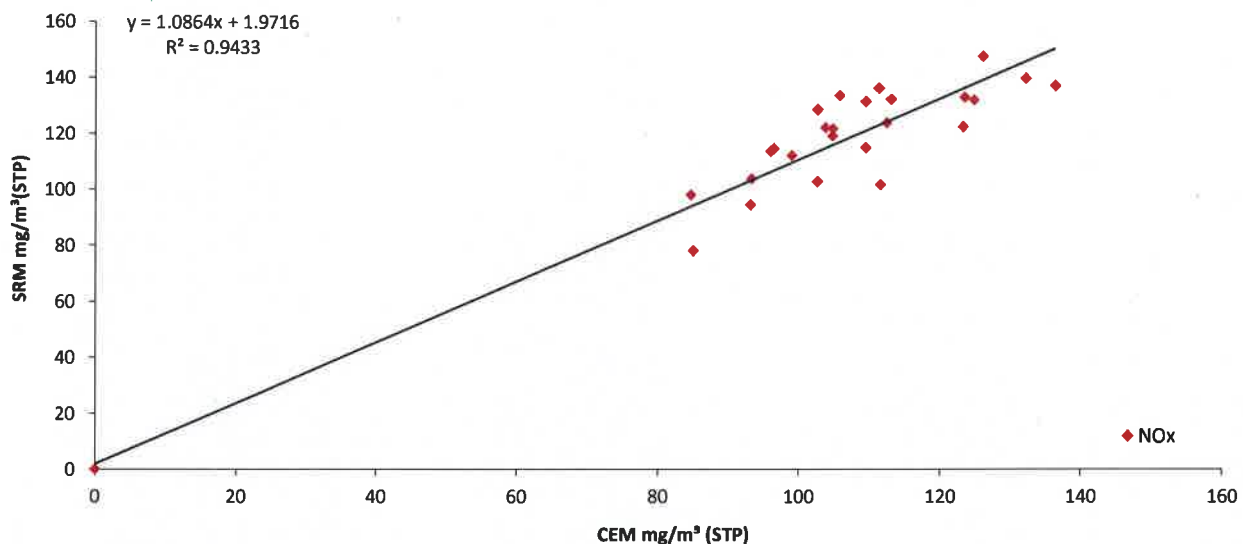
For Method A  $b = [(x - x_{av}) \times (y - y_{av})] / (x - x_{av})^2$  and  $a = \text{MEAN}(y) - [\text{MEAN}(x) \times b]$

Method B  $b = \text{MEAN}(y) / [\text{MEAN}(x) - \text{OFFSET}]$  and  $a = -b \times \text{OFFSET}$

**PLOT 1: GRAPH FOR REF (STANDARDISED) SRM vs REF (STANDARDISED) CEMS (30 minute rolling averages)**



**PLOT 2: Calibration Graph for Method A**



Section 4A - Data and Calculations - QAL2

**OXIDES OF NITROGEN (as NO<sub>2</sub>): QAL2 CALCULATIONS**

(Page 3 of 4)

SITA UK Ltd, Wrexham

A1 - Main Stack

**Variability Test Data**

Pair	Date	Time (30-minute Average)	CAL CEMS (STP, DRY) mg/m <sup>3</sup>	CEMS Water Vapour % v/v	SRM Water Vapour % v/v	CEMS Oxygen (DRY) % v/v	SRM Oxygen (DRY) % v/v	CAL CEMS (STP, DRY, 11% O <sub>2</sub> ) mg/m <sup>3</sup>	SRM (STP, DRY, 11% O <sub>2</sub> ) mg/m <sup>3</sup>	ys, SRM - CAL CEMS
1	01/11/2012	03:43 - 04:13	150.11	5.99	7.80	12.28	13.87	172.09	192.21	20.12
2	30/10/2012	18:35 - 19:05	124.76	8.09	8.72	12.56	13.93	147.78	187.05	39.27
3	30/10/2012	19:35 - 20:05	93.91	7.65	7.94	12.52	13.94	110.75	138.62	27.87
4	30/10/2012	21:35 - 22:05	106.71	9.17	9.46	12.79	14.15	129.97	167.39	37.42
5	30/10/2012	22:35 - 23:05	106.21	8.17	9.36	12.55	13.94	125.65	161.05	35.40
6	31/10/2012	00:35 - 01:05	122.91	9.69	9.95	12.64	13.96	146.97	193.54	46.57
7	31/10/2012	01:35 - 02:05	120.86	7.82	8.38	12.59	13.89	143.69	185.05	41.36
8	31/10/2012	03:35 - 04:05	115.80	7.01	7.90	12.69	14.10	139.28	172.52	33.24
9	31/10/2012	04:35 - 05:05	124.16	7.39	7.72	12.77	14.17	150.86	181.04	30.18
10	31/10/2012	06:35 - 07:05	115.86	7.94	8.11	12.67	14.06	139.02	175.21	36.19
11	31/10/2012	10:31 - 11:01	116.87	8.96	8.64	12.51	13.98	137.68	190.43	52.75
12	31/10/2012	13:31 - 14:01	114.70	8.39	9.56	12.56	14.24	135.83	180.43	44.60
13	31/10/2012	15:31 - 16:01	113.47	9.74	8.67	12.25	13.66	129.73	175.13	45.40
14	31/10/2012	16:31 - 17:01	138.95	8.31	9.56	12.57	13.97	164.80	209.81	45.01
15	31/10/2012	18:31 - 19:01	103.27	7.83	7.48	12.50	14.14	121.56	151.17	29.61
16	31/10/2012	19:31 - 20:01	94.24	4.99	6.58	13.07	14.97	118.86	129.74	10.87
17	31/10/2012	21:31 - 22:01	109.53	6.58	8.27	12.20	13.80	124.48	155.61	31.13
18	01/11/2012	00:31 - 01:01	136.18	6.68	8.23	12.23	13.73	155.26	182.66	27.39
19	01/11/2012	01:31 - 02:01	137.61	6.70	8.19	12.16	13.71	155.73	180.74	25.02
20	01/11/2012	02:31 - 03:01	145.57	7.45	8.51	12.26	13.76	166.49	192.78	26.29
21	01/11/2012	06:31 - 07:01	123.11	4.75	7.18	12.78	14.59	149.69	158.59	8.89
22	02/11/2012	10:28 - 10:58	135.84	7.31	8.64	12.40	13.94	158.03	173.20	15.18
23	02/11/2012	11:28 - 11:58	120.88	7.57	8.17	12.45	13.84	141.39	160.78	19.39
24	02/11/2012	12:28 - 12:58	103.10	6.73	7.38	12.53	13.98	121.78	134.82	13.04
25	02/11/2012	13:28 - 13:58	113.44	7.62	8.06	12.90	14.33	140.10	154.14	14.03
26	-	SURROGATE	1.97	N/A	N/A	N/A	N/A	1.97	0.00	-1.97
27	-	SURROGATE	1.97	N/A	N/A	N/A	N/A	1.97	0.00	-1.97
28	-	SURROGATE	1.97	N/A	N/A	N/A	N/A	1.97	0.00	-1.97
MAX								172.09	Sd	15.43



Section 4A - Data and Calculations - QAL2

OXIDES OF NITROGEN (as NO<sub>2</sub>): QAL2 CALCULATIONS

(Page 4 of 4)

SITA UK Ltd, Wrexham

A1 - Main Stack

Test of Variability

$Q_0 = ELV \times (MU / 100) / 1.96$	40.82
Kv for 28 Pairs of Data	0.9861

The variability is accepted if  $Sd \leq Q_0 \times Kv$

Parameter	Value
Standard Deviation (Sd)	15.43
$Q_0 \times Kv$	40.25
Outcome of Variability Test	Pass

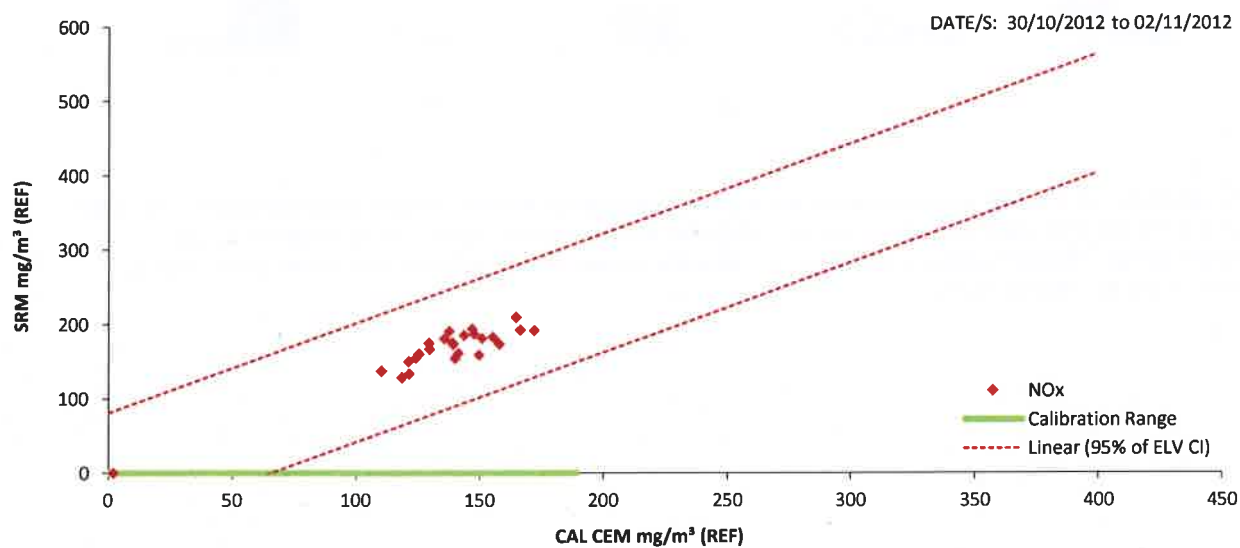
Valid Calibration Range

Maximum CAL CEMS Value (mg/m <sup>3</sup> )	172.1
Allowable Extension (%)	10

Surrogate Extension Applied?	No
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Valid Calibration Range (mg/m <sup>3</sup> )	0 to 189.3
--	------------

PLOT 3: X-Y Plot - REF CAL CEMS vs REF SRM Values



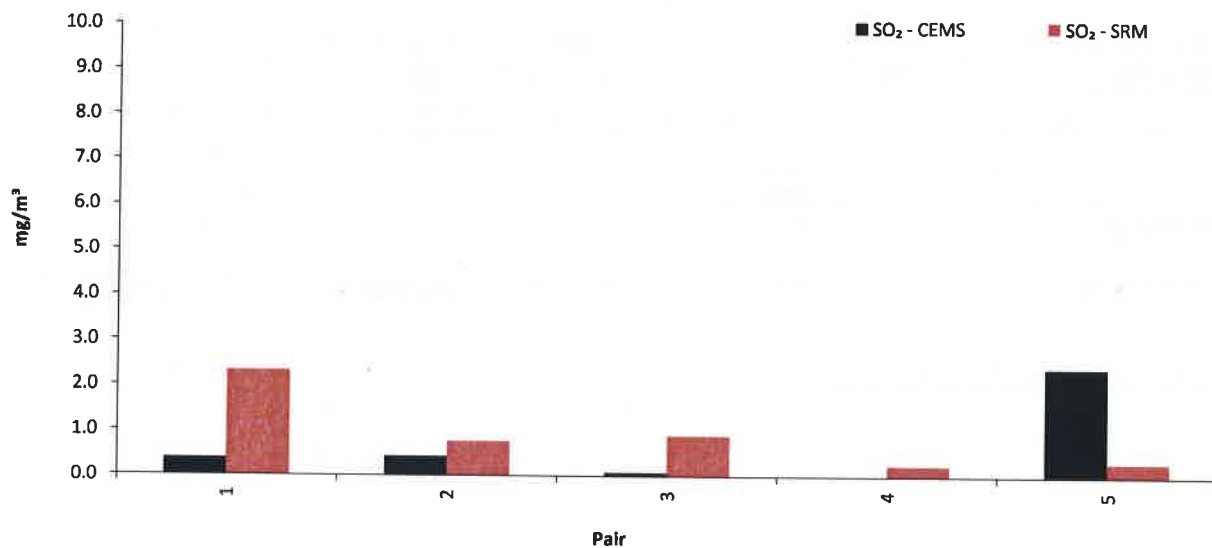
Section 4A - Data and Calculations - QAL2

**SULPHUR DIOXIDE: QAL2 CALCULATIONS**

SITA UK Ltd, Wrexham

A1 - Main Stack

**PLOT 1: BAR CHART FOR REF (STANDARDISED) SRM vs REF (STANDARDISED) CEMS**



It can be seen from PLOT 1 (above) that the emissions are of a low order (less than the 95% Confidence Interval, which is 20% of the Daily ELV) and the spread of data is poor. Subsequently, a valid calibration function has not been derived from the parallel measurement exercise, however in these circumstances it is allowable to leave the calibration function as  $y = x$  so the CEMS is effectively acting as an indicative monitor.

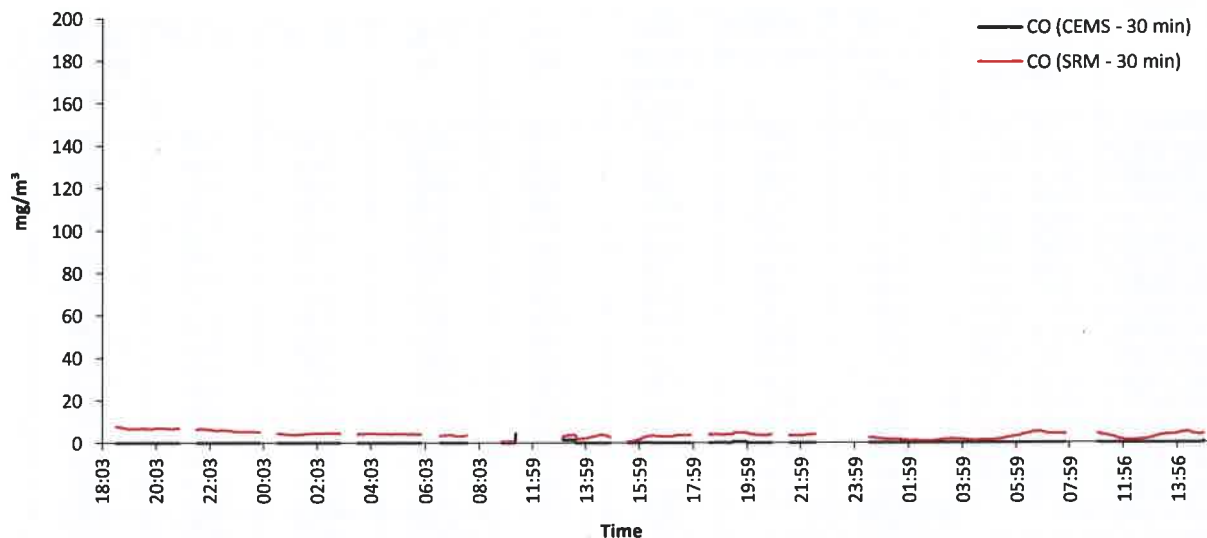
Section 4A - Data and Calculations - QAL2

**CARBON MONOXIDE: QAL2 CALCULATIONS**

SITA UK Ltd, Wrexham

A1 - Main Stack

**PLOT 1: GRAPH FOR REF (STANDARDISED) SRM vs REF (STANDARDISED) CEMS (30 minute rolling averages)**



It can be seen from PLOT 1 (above) that the emissions are of a low order (less than the 95% Confidence Interval, which is 20% of the Daily ELV) and the spread of data is poor. Subsequently, a valid calibration function has not been derived from the parallel measurement exercise, however in these circumstances it is allowable to leave the calibration function as  $y = x$  so the CEMS is effectively acting as an indicative monitor.

Section 4A - Data and Calculations - QAL2

**HYDROGEN CHLORIDE: QAL2 CALCULATIONS**

(Page 1 of 4)

SITA UK Ltd, Wrexham

A1 - Main Stack

**Calibration Data**

Pair	Date	Time (30-minute Average)	x, CEMS (STP, DRY) mg/m <sup>3</sup>	y, SRM (STP, DRY) mg/m <sup>3</sup>	SRM (STP, DRY, 11% O <sub>2</sub> ) mg/m <sup>3</sup>	x - x <sub>av</sub> (A)	y - y <sub>av</sub> (B)	(A) x (B)	(x - x <sub>av</sub> ) <sup>2</sup>	CAL CEMS (STP, DRY) mg/m <sup>3</sup>
1	30/10/2012	11:58 - 12:42	4.01	1.67	2.42	-1.01	-0.49	0.50	1.03	1.73
2	30/10/2012	14:11 - 14:58	2.80	0.81	1.16	-2.22	-1.35	3.00	4.95	1.21
3	30/10/2012	15:39 - 16:23	2.72	1.90	2.68	-2.30	-0.26	0.60	5.31	1.18
4	30/10/2012	17:10 - 17:53	6.75	4.15	6.01	1.73	1.99	3.44	2.98	2.89
5	31/10/2012	08:10 - 08:54	6.79	3.29	5.39	1.77	1.13	2.00	3.12	2.91
6	31/10/2012	09:13 - 09:57	7.09	3.66	5.23	2.07	1.50	3.10	4.27	3.04
7	31/10/2012	10:18 - 11:00	6.96	3.68	5.18	1.94	1.52	2.94	3.75	2.98
8	31/10/2012	11:27 - 12:10	6.08	3.86	5.59	1.06	1.70	1.80	1.11	2.61
9	31/10/2012	14:22 - 15:05	5.96	4.39	6.46	0.94	2.23	2.09	0.88	2.56
10	31/10/2012	15:50 - 16:34	7.05	0.64	0.89	2.03	-1.52	-3.08	4.10	3.02
11	01/11/2012	17:15 - 18:00	8.76	3.07	4.39	3.74	0.91	3.40	13.96	3.75
12	02/11/2012	10:20 - 11:13	5.29	1.28	1.88	0.27	-0.88	-0.23	0.07	2.27
13	02/11/2012	11:46 - 12:33	5.01	0.95	1.36	-0.01	-1.21	0.02	0.00	2.15
14	02/11/2012	12:55 - 13:42	4.95	1.72	2.53	-0.07	-0.44	0.03	0.01	2.13
15	02/11/2012	14:14 - 14:59	5.19	1.56	2.33	0.17	-0.60	-0.10	0.03	2.23
16	30/10/2012	SURROGATE	0.00	0.04	0.04	-5.02	-2.12	10.65	25.24	0.02
17	31/10/2012	SURROGATE	0.00	0.03	0.03	-5.02	-2.13	10.70	25.24	0.02
SPREAD OF DATA					6.43	SUM		40.84	96.04	
DAILY ELV (mg/m <sup>3</sup> )					10					
MU (%)					40					
15% of ELV					1.50					
METHOD USED (A or B)					A					

NOTE: Any values sitting outside 2 x  
Standard Deviations have been removed as  
Outliers, as per EA's Quick Guide, RM-QG14.

[If spread of data (excluding zero points) is > 15% of the ELV,  
use Method A, otherwise use Method B]

Section 4A - Data and Calculations - QAL2

HYDROGEN CHLORIDE: QAL2 CALCULATIONS

(Page 2 of 4)

SITA UK Ltd, Wrexham

A1 - Main Stack

Derivation of Calibration Function

b =	0.4253	a =	0.0222
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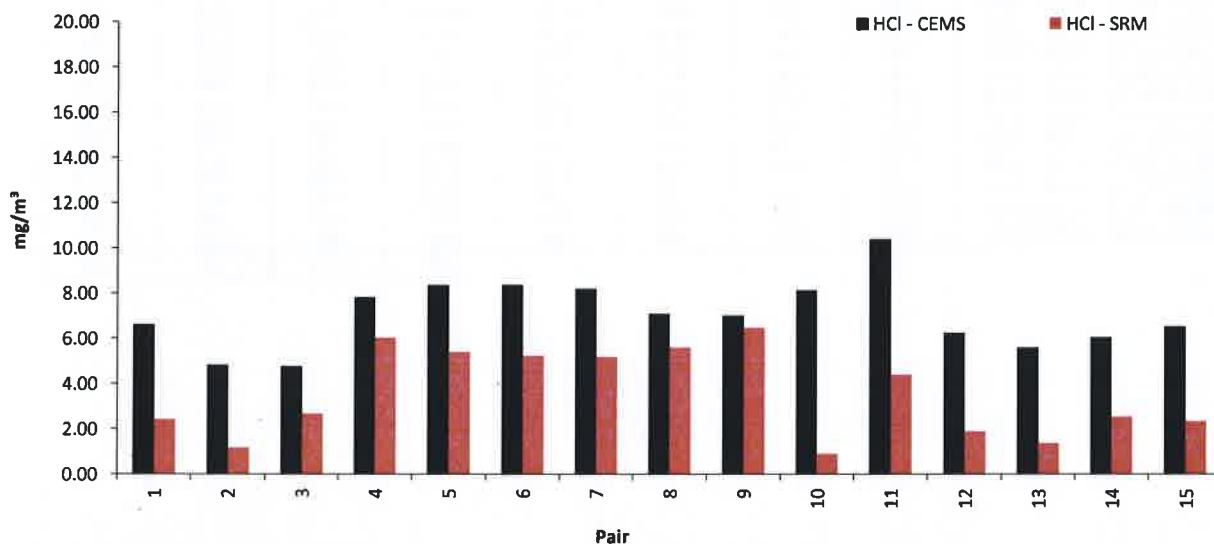
CALIBRATION FUNCTION =	$y = 0.4253x + 0.0222$
------------------------	------------------------

where

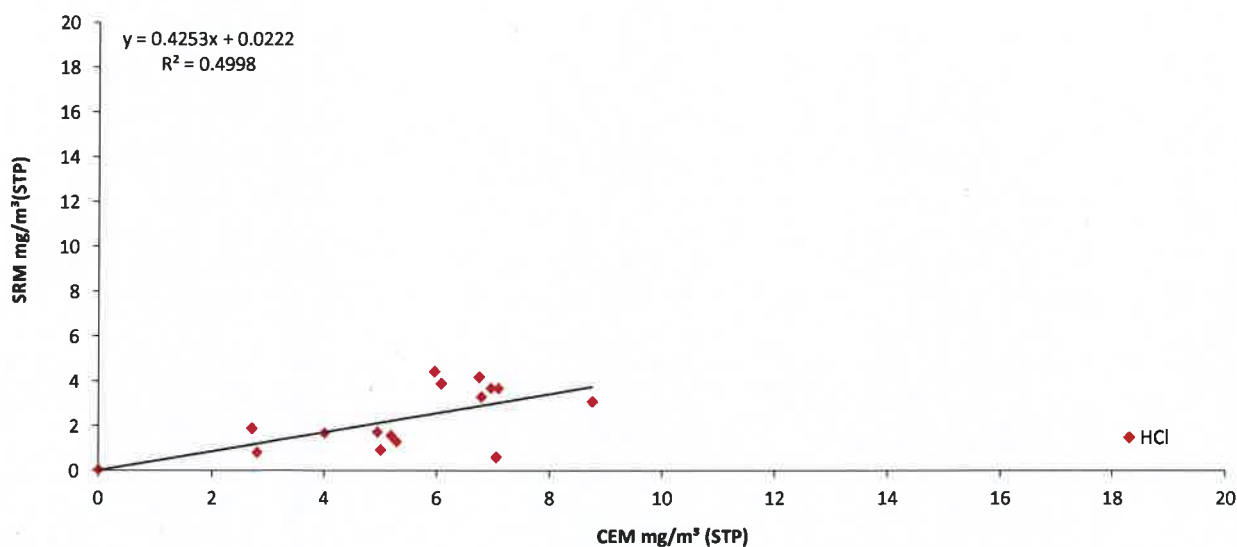
For Method A  $b = [(x - x_{av}) \times (y - y_{av})] / (x - x_{av})^2$  and  $a = \text{MEAN}(y) - [\text{MEAN}(x) \times b]$

Method B  $b = \text{MEAN}(y) / [\text{MEAN}(x) - \text{OFFSET}]$  and  $a = -b \times \text{OFFSET}$

PLOT 1: BAR CHART FOR REF (STANDARDISED) SRM vs REF (STANDARDISED) CEMS



PLOT 2: Calibration Graph for Method A



Section 4A - Data and Calculations - QAL2

**HYDROGEN CHLORIDE: QAL2 CALCULATIONS**

(Page 3 of 4)

SITA UK Ltd, Wrexham

A1 - Main Stack

**Variability Test Data**

Pair	Date	Time (30-minute Average)	CAL CEMS (STP, DRY) mg/m <sup>3</sup>	CEMS Water Vapour % v/v	SRM Water Vapour % v/v	CEMS Oxygen (DRY) % v/v	SRM Oxygen (DRY) % v/v	CAL CEMS (STP, DRY, 11% O <sub>2</sub> ) mg/m <sup>3</sup>	SRM (STP, DRY, 11% O <sub>2</sub> ) mg/m <sup>3</sup>	ys, SRM - CAL CEMS
1	30/10/2012	11:58 - 12:42	1.73	0.62	4.08	14.94	14.10	2.85	2.42	-0.43
2	30/10/2012	14:11 - 14:58	1.21	0.19	4.72	15.20	14.00	2.09	1.16	-0.93
3	30/10/2012	15:39 - 16:23	1.18	0.16	3.32	15.30	13.90	2.07	2.68	0.61
4	30/10/2012	17:10 - 17:53	2.89	6.73	8.08	12.38	14.10	3.36	6.01	2.66
5	31/10/2012	08:10 - 08:54	2.91	9.91	10.08	12.88	14.90	3.58	5.39	1.81
6	31/10/2012	09:13 - 09:57	3.04	9.67	9.37	12.53	14.00	3.59	5.23	1.64
7	31/10/2012	10:18 - 11:00	2.98	9.32	9.87	12.52	13.90	3.52	5.18	1.67
8	31/10/2012	11:27 - 12:10	2.61	8.01	9.19	12.45	14.10	3.05	5.59	2.54
9	31/10/2012	14:22 - 15:05	2.56	9.34	9.27	12.50	14.20	3.01	6.46	3.45
10	31/10/2012	15:50 - 16:34	3.02	9.65	7.12	12.34	13.80	3.49	0.89	-2.60
11	01/11/2012	17:15 - 18:00	3.75	5.71	8.48	12.57	14.00	4.45	4.39	-0.06
12	02/11/2012	10:20 - 11:13	2.27	6.81	6.94	12.54	14.20	2.69	1.88	-0.80
13	02/11/2012	11:46 - 12:33	2.15	5.96	7.54	12.04	14.00	2.40	1.36	-1.05
14	02/11/2012	12:55 - 13:42	2.13	7.78	7.66	12.81	14.20	2.60	2.53	-0.07
15	02/11/2012	14:14 - 14:59	2.23	9.93	5.40	13.05	14.30	2.80	2.33	-0.48
16	30/10/2012	SURROGATE	0.02	N/A	N/A	N/A	N/A	0.02	0.04	0.02
17	31/10/2012	SURROGATE	0.02	N/A	N/A	N/A	N/A	0.02	0.03	0.01
MAX								4.45	Sd	1.59



Section 4A - Data and Calculations - QAL2

**HYDROGEN CHLORIDE: QAL2 CALCULATIONS**

(Page 4 of 4)

SITA UK Ltd, Wrexham

A1 - Main Stack

**Test of Variability**

$Q_0 = ELV \times (MU / 100) / 1.96$	2.04
Kv for 17 Pairs of Data	0.9791

The variability is accepted if  $Sd \leq Q_0 \times Kv$

Parameter	Value
Standard Deviation (Sd)	1.59
$Q_0 \times Kv$	2.00
Outcome of Variability Test	Pass

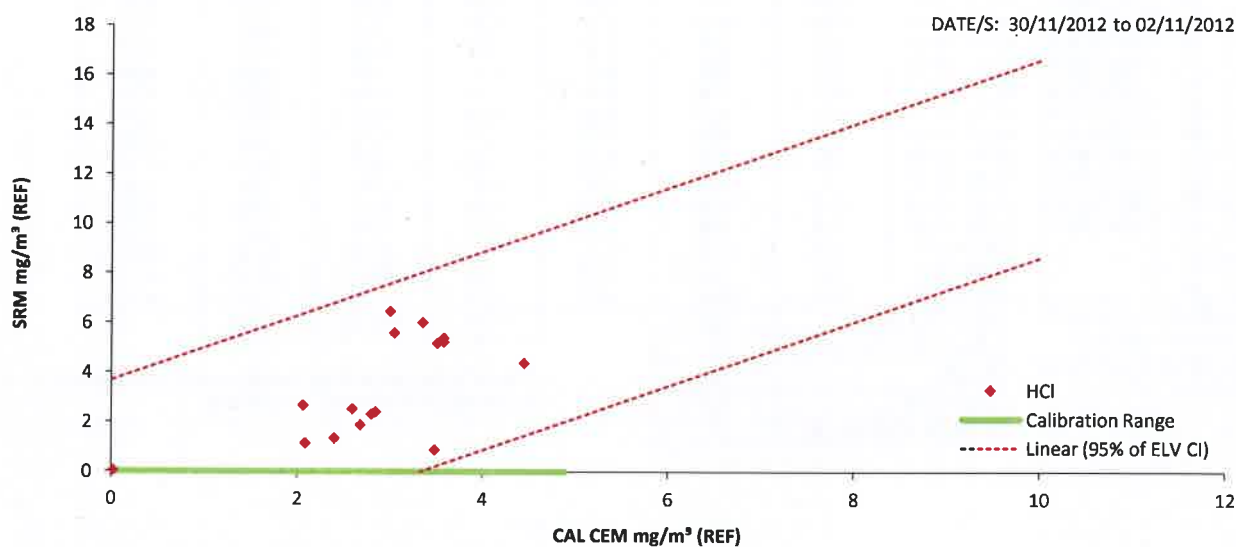
**Valid Calibration Range**

Maximum CAL CEMS Value (mg/m <sup>3</sup> )	4.4
Allowable Extension (%)	10

Surrogate Extension Applied?	No
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Valid Calibration Range (mg/m <sup>3</sup> )	0 to 4.9
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**PLOT 3: X-Y Plot - REF CAL CEMS vs REF SRM Values**



Section 4A - Data and Calculations - QAL2

**WATER VAPOUR: QAL2 CALCULATIONS**

(Page 1 of 4)

SITA UK Ltd, Wrexham

A1 - Main Stack

**Calibration Data**

Pair	Date	Time (30-minute Average)	x, CEMS (ACTUAL) % v/v	y, SRM (ACTUAL) % v/v	$x - x_{av}$ (A)	$y - y_{av}$ (B)	(A) x (B)	$(x - x_{av})^2$	CAL CEMS (ACTUAL) % v/v
1	30/10/2012	18:35 - 19:05	8.09	8.72	1.57	1.39	2.17	2.45	8.96
2	30/10/2012	19:35 - 20:05	7.65	7.94	1.13	0.61	0.68	1.27	8.51
3	30/10/2012	21:35 - 22:05	9.17	9.46	2.65	2.12	5.63	7.03	10.09
4	30/10/2012	22:35 - 23:05	8.17	9.36	1.65	2.03	3.34	2.72	9.05
5	31/10/2012	00:35 - 01:05	9.69	9.95	3.17	2.61	8.27	10.03	10.62
6	31/10/2012	01:35 - 02:05	7.82	8.38	1.30	1.04	1.35	1.68	8.68
7	31/10/2012	03:35 - 04:05	7.01	7.90	0.49	0.57	0.28	0.24	7.85
8	31/10/2012	04:35 - 05:05	7.39	7.72	0.87	0.38	0.33	0.75	8.24
9	31/10/2012	06:35 - 07:05	7.94	8.11	1.42	0.78	1.10	2.00	8.81
10	31/10/2012	13:31 - 14:01	8.39	9.56	1.87	2.23	4.15	3.48	9.27
11	31/10/2012	16:31 - 17:01	8.31	9.56	1.79	2.22	3.97	3.20	9.19
12	31/10/2012	18:31 - 19:01	7.83	7.48	1.30	0.15	0.19	1.70	8.69
13	31/10/2012	19:31 - 20:01	4.99	6.58	-1.54	-0.76	1.17	2.36	5.74
14	31/10/2012	21:31 - 22:01	6.58	8.27	0.06	0.94	0.06	0.00	7.40
15	01/11/2012	00:31 - 01:01	6.68	8.23	0.16	0.89	0.14	0.02	7.50
16	01/11/2012	01:31 - 02:01	6.70	8.19	0.18	0.85	0.15	0.03	7.52
17	01/11/2012	02:31 - 03:01	7.45	8.51	0.92	1.17	1.08	0.85	8.30
18	01/11/2012	03:31 - 04:01	6.77	7.88	0.24	0.54	0.13	0.06	7.59
19	01/11/2012	04:31 - 05:01	5.71	7.19	-0.81	-0.14	0.12	0.66	6.50
20	01/11/2012	05:31 - 06:01	4.56	6.86	-1.96	-0.47	0.93	3.85	5.30
21	02/11/2012	10:28 - 10:58	7.31	8.64	0.78	1.30	1.02	0.62	8.15
22	02/11/2012	11:28 - 11:58	7.57	8.17	1.04	0.83	0.87	1.09	8.42
23	02/11/2012	12:28 - 12:58	6.73	7.38	0.21	0.04	0.01	0.04	7.55
24	02/11/2012	13:28 - 13:58	7.62	8.06	1.10	0.72	0.79	1.21	8.48
25	-	SURROGATE	0.00	0.00	-6.52	-7.34	47.87	42.56	0.57
26	-	SURROGATE	0.00	0.00	-6.52	-7.34	47.87	42.56	0.57
27	-	SURROGATE	0.00	0.00	-6.52	-7.34	47.87	42.56	0.57

NOTE: Any values sitting outside 2 x Standard Deviations have been removed as Outliers, as per EA's Quick Guide, RM-QG14.

SPREAD OF DATA	9.95
EFFECTIVE ELV (% v/v)	30
MU (%)	30
15% of ELV	4.50
METHOD USED (A or B)	A

[If spread of data (excluding zero points) is > 15% of the Effective ELV, use Method A, otherwise use Method B]

Section 4A - Data and Calculations - QAL2

WATER VAPOUR: QAL2 CALCULATIONS

(Page 2 of 4)

SITA UK Ltd, Wrexham

A1 - Main Stack

Derivation of Calibration Function

b =	1.0373	a =	0.5712
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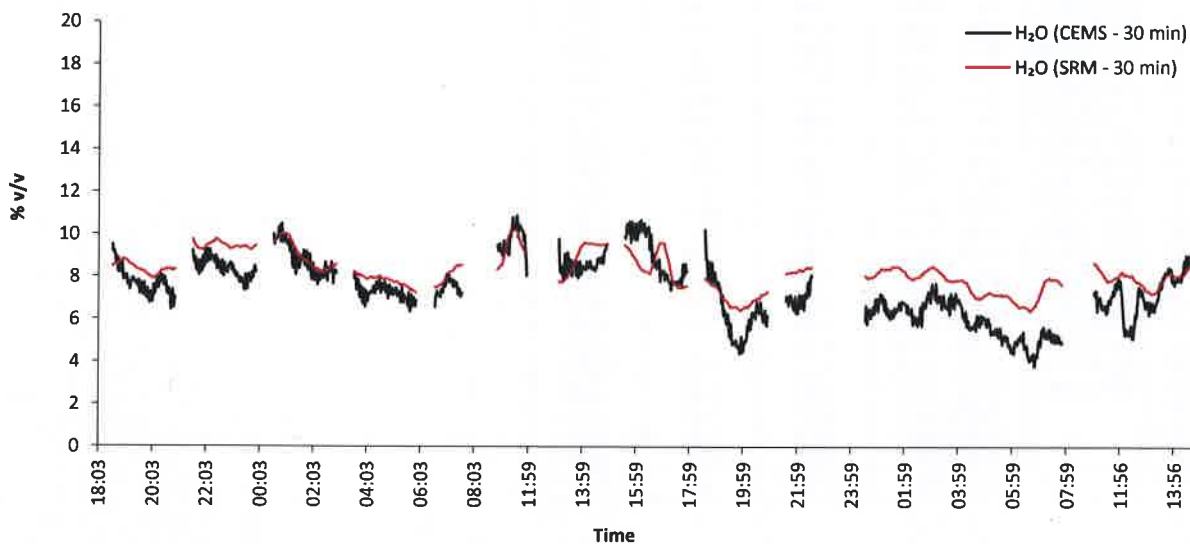
CALIBRATION FUNCTION =	$y = 1.0373x + 0.5712$
------------------------	------------------------

where

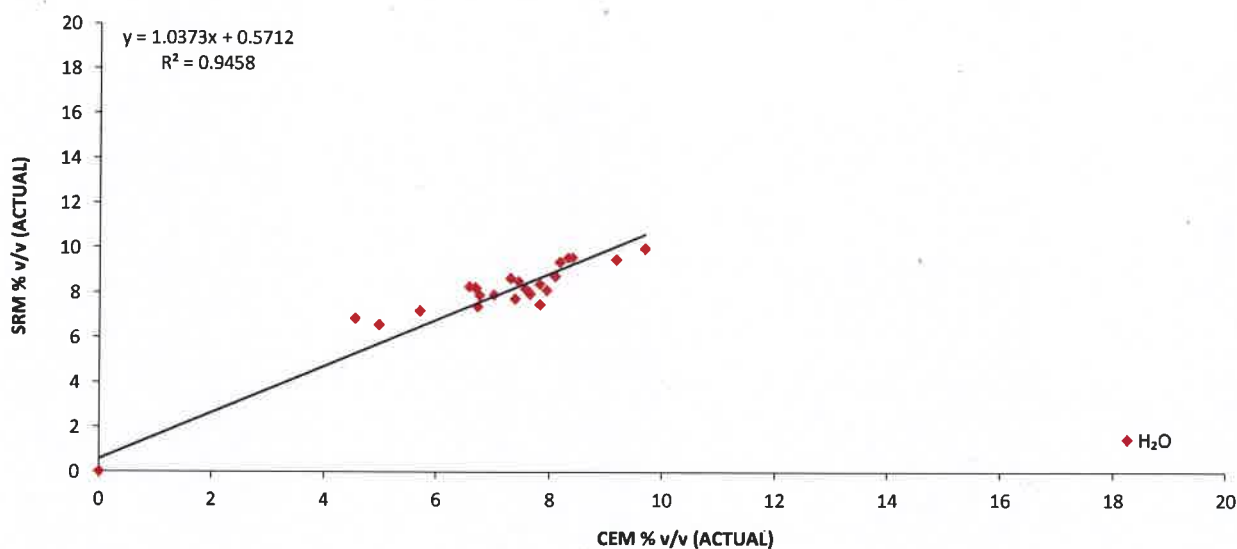
For Method A  $b = [(x - x_{av}) \times (y - y_{av})] / (x - x_{av})^2$  and  $a = \text{MEAN}(y) - [\text{MEAN}(x) \times b]$

Method B  $b = \text{MEAN}(y) / [\text{MEAN}(x) - \text{OFFSET}]$  and  $a = -b \times \text{OFFSET}$

PLOT 1: GRAPH FOR STP SRM vs STP CEMS (30 minute rolling averages)



PLOT 2: Calibration Graph for Method A



Section 4A - Data and Calculations - QAL2

**WATER VAPOUR: QAL2 CALCULATIONS**

(Page 3 of 4)

SITA UK Ltd, Wrexham

A1 - Main Stack

**Variability Test Data**

Pair	Date	Time (30-minute Average)	CAL CEMS (ACTUAL) % v/v	ys, SRM (ACTUAL) % v/v	ys, SRM - CAL CEMS
1	30/10/2012	18:35 - 19:05	8.96	8.72	-0.24
2	30/10/2012	19:35 - 20:05	8.51	7.94	-0.56
3	30/10/2012	21:35 - 22:05	10.09	9.46	-0.63
4	30/10/2012	22:35 - 23:05	9.05	9.36	0.32
5	31/10/2012	00:35 - 01:05	10.62	9.95	-0.67
6	31/10/2012	01:35 - 02:05	8.68	8.38	-0.30
7	31/10/2012	03:35 - 04:05	7.85	7.90	0.06
8	31/10/2012	04:35 - 05:05	8.24	7.72	-0.52
9	31/10/2012	06:35 - 07:05	8.81	8.11	-0.69
10	31/10/2012	13:31 - 14:01	9.27	9.56	0.29
11	31/10/2012	16:31 - 17:01	9.19	9.56	0.36
12	31/10/2012	18:31 - 19:01	8.69	7.48	-1.21
13	31/10/2012	19:31 - 20:01	5.74	6.58	0.83
14	31/10/2012	21:31 - 22:01	7.40	8.27	0.87
15	01/11/2012	00:31 - 01:01	7.50	8.23	0.73
16	01/11/2012	01:31 - 02:01	7.52	8.19	0.67
17	01/11/2012	02:31 - 03:01	8.30	8.51	0.21
18	01/11/2012	03:31 - 04:01	7.59	7.88	0.29
19	01/11/2012	04:31 - 05:01	6.50	7.19	0.70
20	01/11/2012	05:31 - 06:01	5.30	6.86	1.56
21	02/11/2012	10:28 - 10:58	8.15	8.64	0.49
22	02/11/2012	11:28 - 11:58	8.42	8.17	-0.25
23	02/11/2012	12:28 - 12:58	7.55	7.38	-0.17
24	02/11/2012	13:28 - 13:58	8.48	8.06	-0.42
25	-	SURROGATE	0.57	0.00	-0.57
26	-	SURROGATE	0.57	0.00	-0.57
27	-	SURROGATE	0.57	0.00	-0.57
MAX			10.62	Sd	0.64

Section 4A - Data and Calculations - QAL2

**WATER VAPOUR: QAL2 CALCULATIONS**

(Page 4 of 4)

SITA UK Ltd, Wrexham

A1 - Main Stack

**Test of Variability**

$Q_0 = ELV \times (MU / 100) / 1.96$	4.59
Kv for 27 Pairs of Data	0.9861

The variability is accepted if  $Sd \leq Q_0 \times Kv$

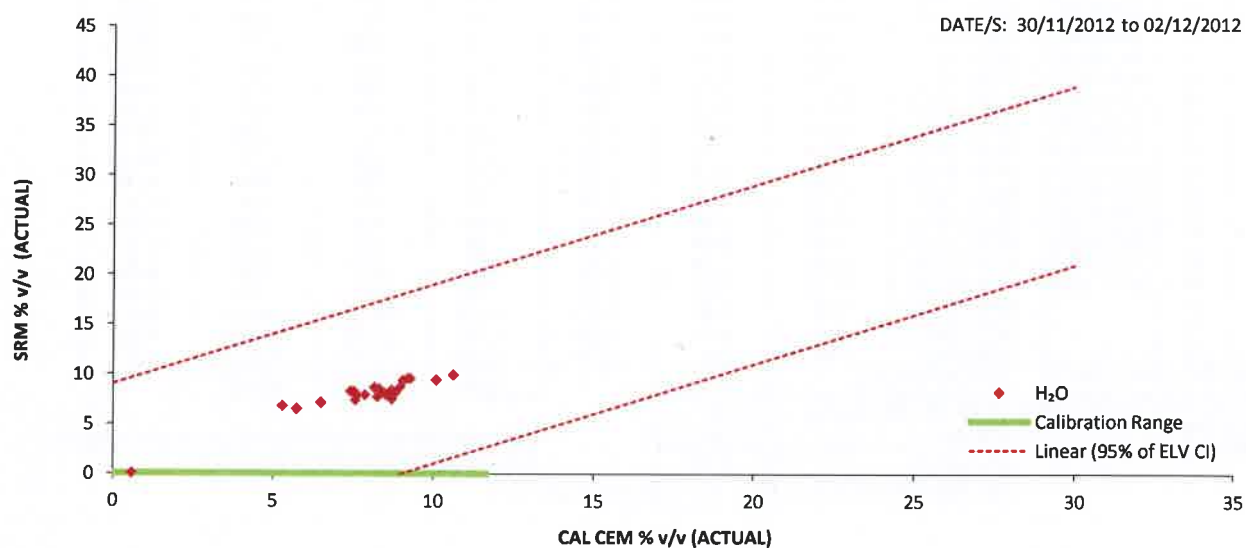
Parameter	Value
Standard Deviation (Sd)	0.64
$Q_0 \times Kv$	4.53
Outcome of Variability Test	Pass

**Valid Calibration Range**

Maximum CAL CEMS Value (% v/v)	10.6
Allowable Extension (%)	10

Valid Calibration Range (% v/v)	0 to 11.7
---------------------------------	-----------

**PLOT 3: X-Y Plot - ACTUAL CAL CEMS vs ACTUAL SRM Values**



Section 4A - Data and Calculations - QAL2

**OXYGEN: QAL2 CALCULATIONS**

(Page 1 of 4)

SITA UK Ltd, Wrexham

A1 - Main Stack

**Calibration Data**

Pair	Date	Time (30-minute Average)	x, CEMS (DRY) % v/v	y, SRM (DRY) % v/v	$x - x_{av}$ (A)	$y - y_{av}$ (B)	(A) x (B)	$(x - x_{av})^2$	CAL CEMS (DRY) % v/v
1	02/11/2012	13:49 - 14:19	13.17	14.58	1.94	2.03	3.93	3.77	14.73
2	30/10/2012	18:35 - 19:05	12.56	13.93	1.33	1.37	1.83	1.77	14.05
3	30/10/2012	19:35 - 20:05	12.52	13.94	1.29	1.38	1.78	1.68	14.01
4	30/10/2012	21:35 - 22:05	12.79	14.15	1.56	1.59	2.49	2.44	14.31
5	30/10/2012	22:35 - 23:05	12.55	13.94	1.32	1.38	1.82	1.74	14.04
6	31/10/2012	00:35 - 01:05	12.64	13.96	1.41	1.41	1.98	1.99	14.14
7	31/10/2012	01:35 - 02:05	12.59	13.89	1.36	1.34	1.82	1.86	14.08
8	31/10/2012	03:35 - 04:05	12.69	14.10	1.46	1.54	2.25	2.13	14.19
9	31/10/2012	04:35 - 05:05	12.77	14.17	1.54	1.61	2.49	2.38	14.28
10	31/10/2012	06:35 - 07:05	12.67	14.06	1.44	1.50	2.16	2.07	14.17
11	31/10/2012	10:31 - 11:01	12.51	13.98	1.28	1.43	1.83	1.65	14.00
12	31/10/2012	13:31 - 14:01	12.56	14.24	1.33	1.68	2.24	1.77	14.05
13	31/10/2012	15:31 - 16:01	12.25	13.66	1.03	1.10	1.13	1.05	13.71
14	31/10/2012	16:31 - 17:01	12.57	13.97	1.34	1.41	1.89	1.80	14.06
15	31/10/2012	18:31 - 19:01	12.50	14.14	1.28	1.58	2.02	1.63	13.99
16	31/10/2012	21:31 - 22:01	12.20	13.80	0.97	1.24	1.21	0.95	13.65
17	01/11/2012	00:31 - 01:01	12.23	13.73	1.00	1.18	1.18	1.01	13.68
18	01/11/2012	01:31 - 02:01	12.16	13.71	0.94	1.15	1.08	0.88	13.61
19	01/11/2012	02:31 - 03:01	12.26	13.76	1.03	1.20	1.23	1.06	13.71
20	01/11/2012	03:31 - 04:01	12.33	13.85	1.10	1.29	1.42	1.21	13.79
21	01/11/2012	04:31 - 05:01	12.51	14.15	1.28	1.59	2.04	1.64	13.99
22	01/11/2012	05:31 - 06:01	12.39	14.13	1.17	1.57	1.83	1.36	13.86
23	01/11/2012	06:31 - 07:01	12.78	14.59	1.55	2.03	3.14	2.40	14.29
24	02/11/2012	10:28 - 10:58	12.40	13.94	1.18	1.38	1.62	1.39	13.88
25	02/11/2012	11:28 - 11:58	12.45	13.84	1.22	1.29	1.57	1.50	13.93
26	02/11/2012	12:28 - 12:58	12.53	13.98	1.31	1.42	1.86	1.71	14.02
27	-	SURROGATE	0.00	0.00	-11.23	-12.56	140.98	126.03	0.00
28	-	SURROGATE	0.00	0.00	-11.23	-12.56	140.98	126.03	0.00
29	-	SURROGATE	0.00	0.00	-11.23	-12.56	140.98	126.03	0.00
					SUM		472.81	422.95	

NOTE: Any values sitting outside 2 x Standard Deviations have been removed as Outliers, as per EA's Quick Guide, RM-QG14.

SPREAD OF DATA	0.93
EFFECTIVE ELV (% v/v)	21
MU (%)	10
15% of ELV	3.15
METHOD USED (A or B)	B

[If spread of data (excluding zero points) is > 15% of the Effective ELV, use Method A, otherwise use Method B]

WHERE OFFSET = 0



Section 4A - Data and Calculations - QAL2

OXYGEN: QAL2 CALCULATIONS

(Page 2 of 4)

SITA UK Ltd, Wrexham

A1 - Main Stack

Derivation of Calibration Function

b =	1.1186	a =	0.0000
-----	--------	-----	--------

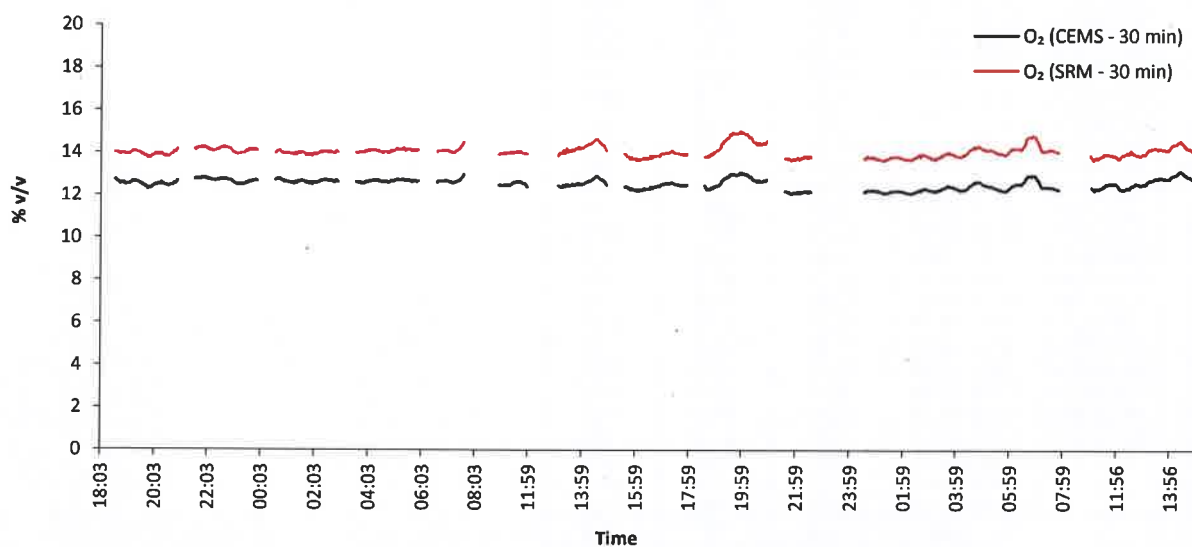
CALIBRATION FUNCTION =	$y = 1.1186x + 0$
------------------------	-------------------

where

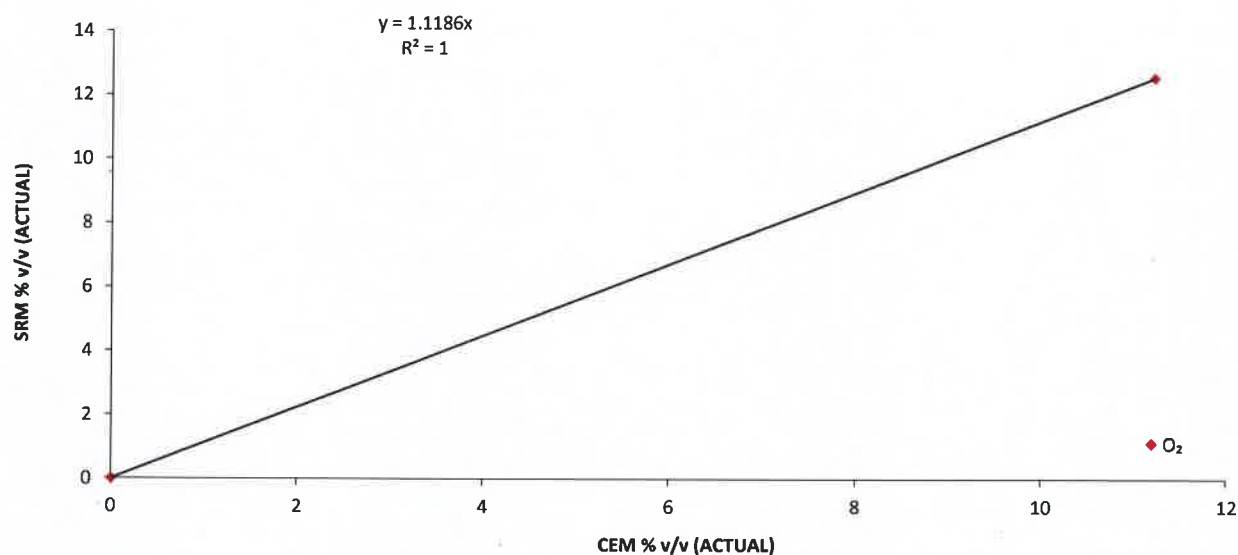
For Method A  $b = [(x - x_{av}) \times (y - y_{av})] / (x - x_{av})^2$  and  $a = \text{MEAN}(y) - [\text{MEAN}(x) \times b]$

Method B  $b = \text{MEAN}(y) / [\text{MEAN}(x) - \text{OFFSET}]$  and  $a = -b \times \text{OFFSET}$

PLOT 1: GRAPH FOR STP SRM vs STP CEMS (30 minute rolling averages)



PLOT 2: Calibration Graph for Method B



Section 4A - Data and Calculations - QAL2

**OXYGEN: QAL2 CALCULATIONS**

(Page 3 of 4)

SITA UK Ltd, Wrexham

A1 - Main Stack

**Variability Test Data**

Pair	Date	Time (30-minute Average)	CAL CEMS (DRY) % v/v	ys, SRM (DRY) % v/v	ys, SRM - CAL CEMS
1	02/11/2012	13:49 - 14:19	14.73	14.58	-0.15
2	30/10/2012	18:35 - 19:05	14.05	13.93	-0.12
3	30/10/2012	19:35 - 20:05	14.01	13.94	-0.07
4	30/10/2012	21:35 - 22:05	14.31	14.15	-0.16
5	30/10/2012	22:35 - 23:05	14.04	13.94	-0.10
6	31/10/2012	00:35 - 01:05	14.14	13.96	-0.17
7	31/10/2012	01:35 - 02:05	14.08	13.89	-0.19
8	31/10/2012	03:35 - 04:05	14.19	14.10	-0.09
9	31/10/2012	04:35 - 05:05	14.28	14.17	-0.12
10	31/10/2012	06:35 - 07:05	14.17	14.06	-0.11
11	31/10/2012	10:31 - 11:01	14.00	13.98	-0.01
12	31/10/2012	13:31 - 14:01	14.05	14.24	0.20
13	31/10/2012	15:31 - 16:01	13.71	13.66	-0.05
14	31/10/2012	16:31 - 17:01	14.06	13.97	-0.09
15	31/10/2012	18:31 - 19:01	13.99	14.14	0.15
16	31/10/2012	21:31 - 22:01	13.65	13.80	0.15
17	01/11/2012	00:31 - 01:01	13.68	13.73	0.05
18	01/11/2012	01:31 - 02:01	13.61	13.71	0.10
19	01/11/2012	02:31 - 03:01	13.71	13.76	0.05
20	01/11/2012	03:31 - 04:01	13.79	13.85	0.06
21	01/11/2012	04:31 - 05:01	13.99	14.15	0.16
22	01/11/2012	05:31 - 06:01	13.86	14.13	0.26
23	01/11/2012	06:31 - 07:01	14.29	14.59	0.30
24	02/11/2012	10:28 - 10:58	13.88	13.94	0.06
25	02/11/2012	11:28 - 11:58	13.93	13.84	-0.08
26	02/11/2012	12:28 - 12:58	14.02	13.98	-0.04
27	-	SURROGATE	0.00	0.00	0.00
28	-	SURROGATE	0.00	0.00	0.00
29	-	SURROGATE	0.00	0.00	0.00
MAX			14.73	Sd	0.13

Section 4A - Data and Calculations - QAL2

OXYGEN: QAL2 CALCULATIONS

(Page 4 of 4)

SITA UK Ltd, Wrexham

A1 - Main Stack

Test of Variability

$Q_0 = ELV \times (MU / 100) / 1.96$	1.07
Kv for 29 Pairs of Data	0.9861

The variability is accepted if  $Sd \leq Q_0 \times Kv$

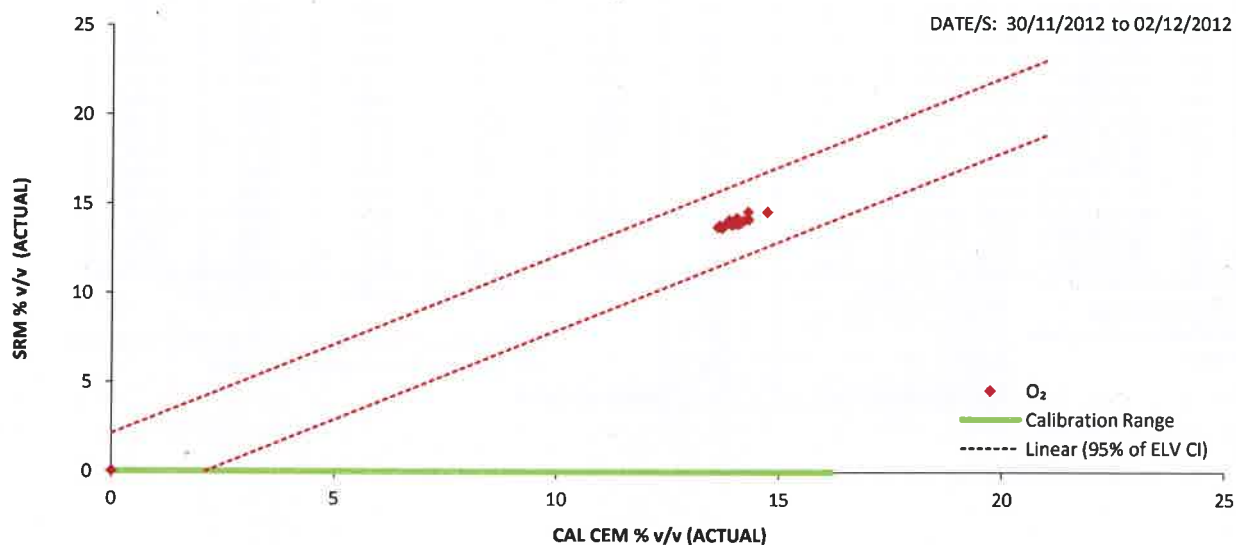
Parameter	Value
Standard Deviation (Sd)	0.13
$Q_0 \times Kv$	1.06
Outcome of Variability Test	Pass

Valid Calibration Range

Maximum CAL CEMS Value (% v/v)	14.7
Allowable Extension (%)	10

Valid Calibration Range (% v/v)	0 to 16.2
---------------------------------	-----------

PLOT 3: X-Y Plot - ACTUAL CAL CEMS vs ACTUAL SRM Values



Section 4A - Data and Calculations - QAL2

**CARBON DIOXIDE: QAL2 CALCULATIONS**

(Page 1 of 4)

SITA UK Ltd, Wrexham

A1 - Main Stack

**Calibration Data**

Pair	Date	Time (30-minute Average)	x, CEMS (DRY) % v/v	y, SRM (DRY) % v/v	$x - x_{av}$ (A)	$y - y_{av}$ (B)	(A) x (B)	$(x - x_{av})^2$	CAL CEMS (DRY) % v/v
1	02/11/2012	10:34 - 11:04	5.65	5.68	0.42	0.47	0.20	0.17	5.63
2	30/10/2012	18:35 - 19:05	5.22	5.15	-0.01	-0.06	0.00	0.00	5.20
3	30/10/2012	19:35 - 20:05	5.36	5.31	0.13	0.10	0.01	0.02	5.35
4	30/10/2012	21:35 - 22:05	5.12	5.12	-0.11	-0.09	0.01	0.01	5.10
5	30/10/2012	22:35 - 23:05	5.37	5.28	0.14	0.07	0.01	0.02	5.35
6	31/10/2012	00:35 - 01:05	5.31	5.27	0.08	0.05	0.00	0.01	5.29
7	31/10/2012	01:35 - 02:05	5.27	5.28	0.04	0.06	0.00	0.00	5.26
8	31/10/2012	03:35 - 04:05	5.10	5.15	-0.13	-0.07	0.01	0.02	5.08
9	31/10/2012	04:35 - 05:05	5.05	5.10	-0.18	-0.11	0.02	0.03	5.04
10	31/10/2012	06:35 - 07:05	5.16	5.10	-0.07	-0.12	0.01	0.00	5.14
11	31/10/2012	06:35 - 07:05	5.16	5.10	-0.07	-0.12	0.01	0.00	5.14
12	31/10/2012	10:31 - 11:01	5.29	5.36	0.06	0.15	0.01	0.00	5.27
13	31/10/2012	13:31 - 14:01	5.01	4.95	-0.22	-0.26	0.06	0.05	5.00
14	31/10/2012	15:31 - 16:01	5.37	5.52	0.14	0.31	0.04	0.02	5.35
15	31/10/2012	18:31 - 19:01	5.21	5.14	-0.02	-0.07	0.00	0.00	5.19
16	31/10/2012	19:31 - 20:01	4.63	4.55	-0.60	-0.66	0.40	0.36	4.61
17	31/10/2012	21:31 - 22:01	5.49	5.42	0.26	0.21	0.05	0.07	5.47
18	01/11/2012	00:31 - 01:01	5.45	5.44	0.22	0.23	0.05	0.05	5.44
19	01/11/2012	01:31 - 02:01	5.48	5.42	0.25	0.20	0.05	0.06	5.46
20	01/11/2012	02:31 - 03:01	5.31	5.42	0.08	0.21	0.02	0.01	5.29
21	01/11/2012	03:31 - 04:01	5.35	5.34	0.12	0.13	0.02	0.01	5.33
22	01/11/2012	04:31 - 05:01	5.10	5.05	-0.13	-0.16	0.02	0.02	5.08
23	01/11/2012	05:31 - 06:01	5.15	5.06	-0.08	-0.16	0.01	0.01	5.14
24	01/11/2012	06:31 - 07:01	4.88	4.73	-0.35	-0.48	0.17	0.12	4.86
25	02/11/2012	12:28 - 12:58	5.26	5.39	0.03	0.18	0.01	0.00	5.24

NOTE: Any values sitting outside 2 x Standard Deviations have been removed as Outliers, as per EA's Quick Guide, RM-QG14.

SPREAD OF DATA	1.13
EFFECTIVE ELV (% v/v)	20
MU (%)	10
15% of ELV	3.00
METHOD USED (A or B)	B

WHERE OFFSET = 0

[If spread of data (excluding zero points) is > 15% of the Effective ELV, use Method A, otherwise use Method B]

Section 4A - Data and Calculations - QAL2

**CARBON DIOXIDE: QAL2 CALCULATIONS**

(Page 2 of 4)

SITA UK Ltd, Wrexham

A1 - Main Stack

**Derivation of Calibration Function**

b =	0.9968	a =	0.0000
-----	--------	-----	--------

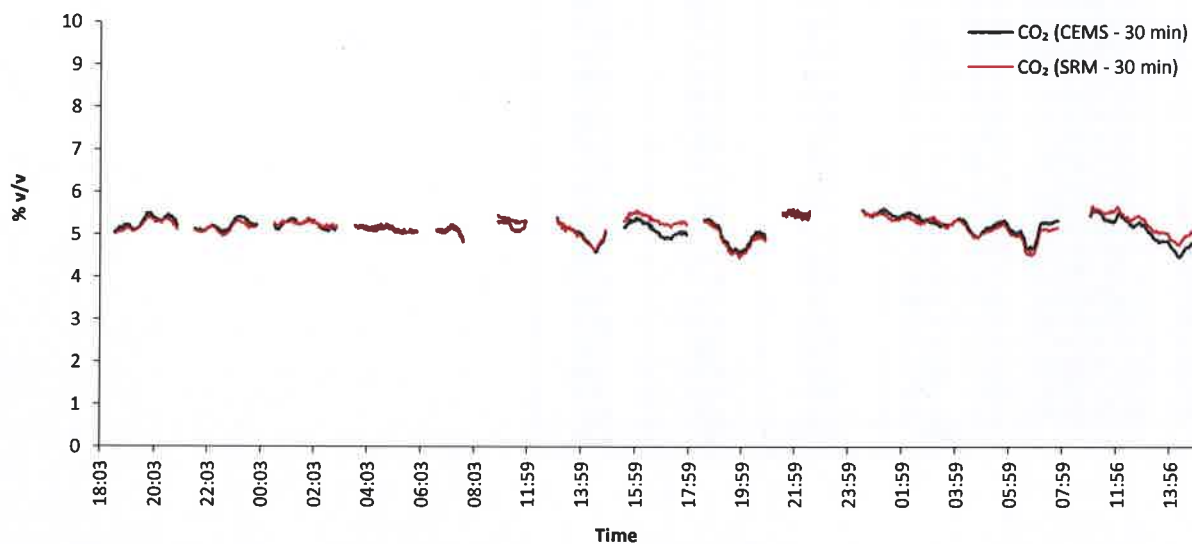
CALIBRATION FUNCTION =	$y = 0.9968x + 0$
------------------------	-------------------

where

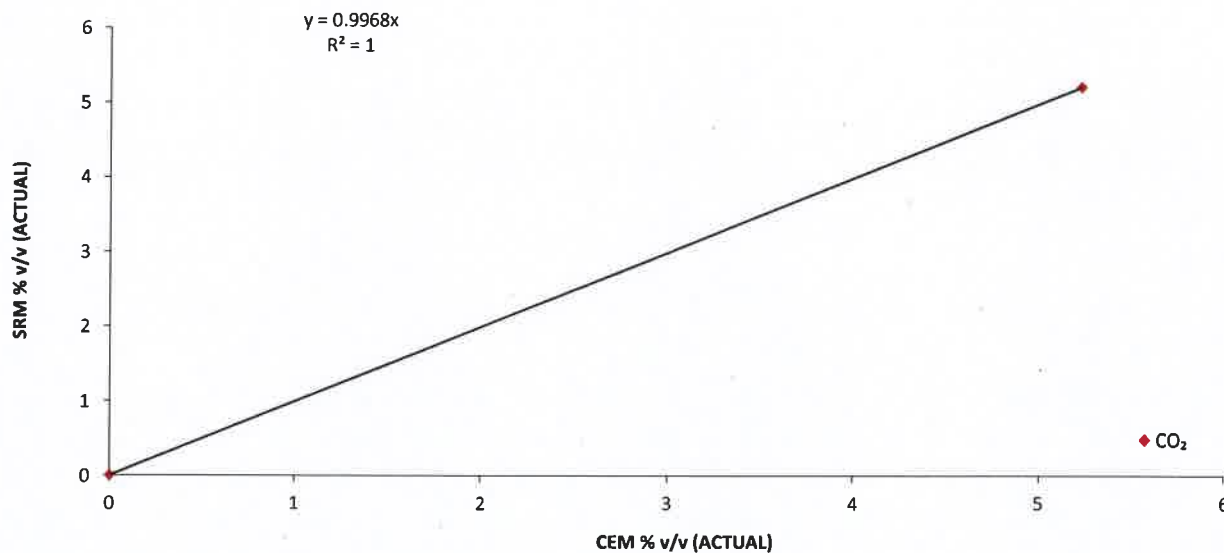
For Method A  $b = [(x - x_{av}) \times (y - y_{av})] / (x - x_{av})^2$  and  $a = \text{MEAN}(y) - [\text{MEAN}(x) \times b]$

Method B  $b = \text{MEAN}(y) / [\text{MEAN}(x) - \text{OFFSET}]$  and  $a = -b \times \text{OFFSET}$

**PLOT 1: GRAPH FOR STP SRM vs STP CEMS (30 minute rolling averages)**



**PLOT 2: Calibration Graph for Method B**



Section 4A - Data and Calculations - QAL2

**CARBON DIOXIDE: QAL2 CALCULATIONS**

(Page 3 of 4)

SITA UK Ltd, Wrexham

A1 - Main Stack

**Variability Test Data**

Pair	Date	Time (30-minute Average)	CAL CEMS (DRY) % v/v	ys, SRM (DRY) % v/v	ys, SRM - CAL CEMS
1	02/11/2012	10:34 - 11:04	5.63	5.68	0.05
2	30/10/2012	18:35 - 19:05	5.20	5.15	-0.05
3	30/10/2012	19:35 - 20:05	5.35	5.31	-0.03
4	30/10/2012	21:35 - 22:05	5.10	5.12	0.02
5	30/10/2012	22:35 - 23:05	5.35	5.28	-0.07
6	31/10/2012	00:35 - 01:05	5.29	5.27	-0.02
7	31/10/2012	01:35 - 02:05	5.26	5.28	0.02
8	31/10/2012	03:35 - 04:05	5.08	5.15	0.07
9	31/10/2012	04:35 - 05:05	5.04	5.10	0.06
10	31/10/2012	06:35 - 07:05	5.14	5.10	-0.05
11	31/10/2012	06:35 - 07:05	5.14	5.10	-0.05
12	31/10/2012	10:31 - 11:01	5.27	5.36	0.09
13	31/10/2012	13:31 - 14:01	5.00	4.95	-0.05
14	31/10/2012	15:31 - 16:01	5.35	5.52	0.17
15	31/10/2012	18:31 - 19:01	5.19	5.14	-0.05
16	31/10/2012	19:31 - 20:01	4.61	4.55	-0.06
17	31/10/2012	21:31 - 22:01	5.47	5.42	-0.05
18	01/11/2012	00:31 - 01:01	5.44	5.44	0.00
19	01/11/2012	01:31 - 02:01	5.46	5.42	-0.05
20	01/11/2012	02:31 - 03:01	5.29	5.42	0.12
21	01/11/2012	03:31 - 04:01	5.33	5.34	0.01
22	01/11/2012	04:31 - 05:01	5.08	5.05	-0.03
23	01/11/2012	05:31 - 06:01	5.14	5.06	-0.08
24	01/11/2012	06:31 - 07:01	4.86	4.73	-0.13
25	02/11/2012	12:28 - 12:58	5.24	5.39	0.15
		MAX	5.63	Sd	0.08



Section 4A - Data and Calculations - QAL2

**CARBON DIOXIDE: QAL2 CALCULATIONS**

(Page 4 of 4)

SITA UK Ltd, Wrexham

A1 - Main Stack

**Test of Variability**

$Q_0 = ELV \times (MU / 100) / 1.96$	1.02
Kv for 25 Pairs of Data	0.9861

The variability is accepted if  $Sd \leq Q_0 \times Kv$

Parameter	Value
Standard Deviation (Sd)	0.08
$Q_0 \times Kv$	1.01
Outcome of Variability Test	Pass

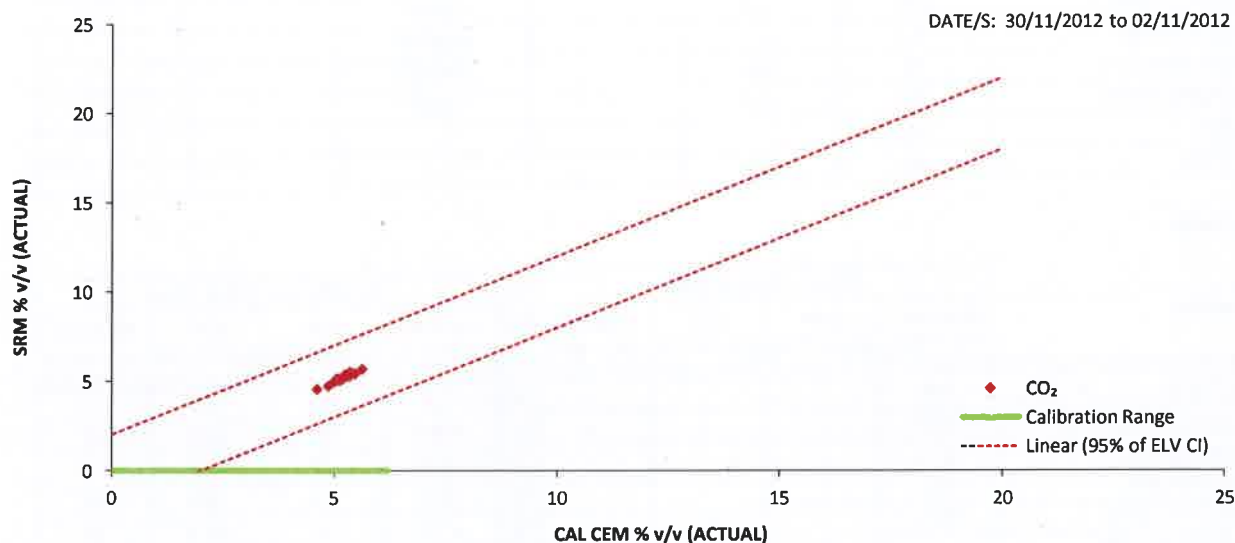
**Valid Calibration Range**

Maximum CAL CEMS Value (% v/v)	5.6
Allowable Extension (%)	10

Surrogate Extension Applied?	No
------------------------------	----

Valid Calibration Range (% v/v)	0 to 6.2
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**PLOT 3: X-Y Plot - ACTUAL CAL CEMS vs ACTUAL SRM Values**



## FUNCTIONAL CHECKS OF CEMS

SITA UK Ltd, Wrexham  
A1 - Main Stack

### Description of Functional Checks / Equipment Used for Linearity of Total Particulate Matter CEMS

Before performing the parallel measurements, Catalyst's Engineer checked the DCS PC and noted that the readings looked "sensible" and no flatlining or repeating zeros were being output, giving an added confidence that the analyser was working correctly.

### Reference Materials Available on Site

Parameter	QAL3 Check Gas	Concentration (mg/m <sup>3</sup> / %)	QAL3 Check Gas Supplier	Cylinder Number	Cylinder Expiry Date	Certified Accuracy
Total VOCs	C <sub>3</sub> H <sub>8</sub>	29.5	-	400485	-	-
Nitrogen Monoxide	NO	399.7	-	4088459	-	-
Nitrogen Dioxide	NO <sub>2</sub>	31.3	-	45302	-	-
Sulphur Dioxide	SO <sub>2</sub>	99.9	-	4088459	-	-
Carbon Monoxide	CO	100.0	-	4088459	-	-
Hydrogen Chloride	HCl	15.7	-	51085	-	-
Oxygen	O <sub>2</sub>	-	-	-	-	-
Zero Gas	N <sub>2</sub>	N/A	-	-	-	-

### CEMS Checks

Parameter	Analyser System Check				Sampling Line System Check			
	Gas Conc. (mg/m <sup>3</sup> / %)	Zero (mg/m <sup>3</sup> / %)	Span (mg/m <sup>3</sup> / %)	Response (T <sub>90</sub> - secs)	Gas Conc. (mg/m <sup>3</sup> / %)	Zero (mg/m <sup>3</sup> / %)	Span (mg/m <sup>3</sup> / %)	Response (T <sub>90</sub> - secs)
Total VOCs	N/A	-	-	-	0.0	-0.2	26.0	-
Nitrogen Monoxide	399.7	-	-	-	399.7	0.0	394.1	40
Nitrogen Dioxide	31.3	-	-	-	31.3	0.0	21.4	-
Sulphur Dioxide	99.9	-	-	-	99.9	1.5	78.0	40
Carbon Monoxide	100.0	-	-	-	100.0	0.0	104.1	40
Hydrogen Chloride	-	-	-	-	-	-	-	-
Oxygen	-	-	-	-	-	-	-	-

**PRO-FORMA FOR ASSESSING AND REPORTING THE RESULTS OF THE FUNCTIONAL TESTS**

(Page 1 of 4)

Functional Checks Performed By	Dave Gratton, Cbiss, Engineer
Date/s Functional Checks Performed	24 - 25/10/2012

**1. Alignment and Cleanliness (Non-Extractive CEMS Only)**

Requirement	Performed	Notes
A visual inspection, with reference to the CEMS manuals, shall be carried out on the following when applicable:		
Internal check of the CEMS.	Yes	
Cleanliness of the optical components.	Yes	
Flushing air supply.	Yes	
Optical path free from obstructions.	Yes	
After re-assembly at the measurement location, at least the following shall be checked:		
Alignment of the measuring system.	Yes	
Contamination control (internal check of optical surfaces).	Yes	

**2. Sampling System (Extractive CEMS Only)**

Requirement	Performed	Notes
A visual inspection of the sampling system shall be performed, noting the condition of the following components, when fitted:		
Sampling probe.	Yes	
Gas conditioning systems.	Yes	
Pumps.	Yes	
All connections.	Yes	
Sample lines.	Yes	
Power supplies.	Yes	
Filters.	Yes	
NOx converters – if the sampling system contains a NOx converter, then the test laboratory shall record when the last efficiency-test was performed, and the result of this test.	N/A	
The sampling system shall be in good condition and free of any visible faults, which may decrease the quality of the data.	Yes	

**3. Leak testing**

Requirement	Performed	Notes
Leak Testing shall be performed according to the CEMS manuals. The test shall cover the entire sampling system.	Yes	See Section 5 of the Test Report - "CEMS Checks" for the results of the leak check.

**4. Zero and Span Check**

Requirement	Performed	Notes
Reference zero and span materials shall be used to verify the corresponding readings of the CEMS. Ensure the reading on the DCS Computer reflects the reading on the screen of the CEMS Analyser/s.	Yes	See Section 5 of the Test Report - "CEMS Checks" for the results of the zero and span checks. The reading on the DCS was cross-referenced with the CEMS' screen to ensure the logged reading was correct.

**PRO-FORMA FOR ASSESSING AND REPORTING THE RESULTS OF THE FUNCTIONAL TESTS**

(Page 2 of 4)

4. Zero and Span Check (continued)		
Requirement	Performed	Notes
In case of non-extractive CEMS, zero and span checks shall be performed using a reference-path free of flue gas before and after readjustment and after re-assembly of the CEMS at the measurement location.	Yes	See Section 5 of the Test Report - "CEMS Checks" for the results of the zero and span checks. The reading on the DCS was cross-referenced with the CEMS' screen to ensure the logged reading was correct.

5. Linearity		
Requirement	Performed	Notes
During the calibration / linearity tests the applied concentrations should be logged onto the DCS to prove the complete system. i.e. Concentration applied to the instrument is represented by the instrument output and identical to the value logged on the DCS. DCS logged values should be included in the instrument service report.	Yes	
The linearity of the CEMS response shall be checked using five different reference materials, including a zero concentration.	Yes	See Section 5 of the Test Report for the results of the linearity tests.
The reference material with zero concentration, as well as the reference materials with four different concentrations, shall have a verifiable quantity and quality.	Yes	See Section 5 of the Test Report - "Reference Materials Used for CEMS Linearity Checks" for the results of the linearity tests.
In case of gaseous reference materials, these four reference materials can be obtained from different gas cylinders or can be prepared by means of a calibrated dilution system from one single gas concentration.	Yes	
The reference material concentrations shall be selected such that the measured values are at approximately 20%, 40%, 60% and 80% of the range of two times the emission limit (either Daily or Short Term ELV). It is necessary to know the values of the ratios of their concentrations precisely enough so that an incorrect failure of the linearity test does not occur. The dry test reference material shall be applied to the inlet of the CEMS. (i.e. not down the line)	Yes	See Section 5 of the Test Report for the results of the linearity tests.
The individual CEMS are tested using the following concentrations applied in a randomised sequence:		
Reference material with zero concentration	Yes	
Reference material concentration approximately 20% of 2 x the ELV	Yes	
Reference material concentration approximately 40% of 2 x the ELV	Yes	
Reference material concentration approximately 60% of 2 x the ELV	Yes	
Reference material concentration approximately 80% of 2 x the ELV	Yes	
Reference material with zero concentration	Yes	

6. Interferences		
Requirement	Performed	Notes
A test shall be undertaken if the process gases to be monitored contain components that are known interferences, as identified during QAL1 and there is a failure of the QAL2 or AST which could be due to interferences.	Yes	See Section 5 of the Test Report - "Interferences (at Analyser) Taken at the Same Time as the CEMS Checks" for the results of the interference tests.



**PRO-FORMA FOR ASSESSING AND REPORTING THE RESULTS OF THE FUNCTIONAL TESTS**

(Page 3 of 4)

7. Zero and Span Drift Audit		
Requirement	Performed	Notes
The test laboratory shall assess whether the operator has a QAL3 procedure in place, and whether the operator has applied this procedure. The evidence would comprise (i) a documented procedure, (ii) zero and span data, (iii) control charts.	Yes	

8. Response Time		
Requirement	Performed	Notes
The response time of the CEMS shall be checked. This can be performed, if appropriate, by feeding of the reference material at the end of the sampling probe. The response time shall not exceed the performance requirement applied during the QAL1 tests. (i.e. 200 seconds)	Yes	Parameter specific response times can be found in the Zero and Span Gas Functional Test Table (above).

9. Service Report (THIS IS AN AUDIT OF THE SERVICE REPORT, STATE IF THE REQUIRED INFO IS PRESENT OR NOT IN THE SERVICE REPORT)		
Requirement	Performed	Notes
As a minimum requirement the service report should include the following:		
Document reference for work instruction for the type of work being undertaken.	No	No document reference for the work being undertaken is listed within the service report
Instrument manufacturer.	Yes	Service report produced by the instrument manufacturer
Instrument type.	Yes	Instruments listed as Environnement SA MIR 9000 and Environnement SA Graphite 52M
Instrument model.	Yes	Instruments listed as Environnement SA MIR 9000 and Environnement SA Graphite 52M
Instrument serial no.	Yes	Environnement SA MIR 9000 serial number listed as 1206 and Environnement SA Graphite 52M serial number listed as 496
Operating principle.	No	No information regarding the operating principle of the analysers is included in the service report
Operating range.	No	No information regarding the operating range of the analysers is included in the service report
Certification details.	No	No information regarding the certification details of the analysers is included in the service report
Compliance with MCERTS. (including certificate no.)	No	No information regarding the compliance with MCERTS of the analysers is included in the service report
Location.	No	No information regarding the location of the CEMS is included in the service report
Date and time work was undertaken.	Yes	The date and time the work was undertaken is included in the service report
Equipment used - type, serial no's, calibration dates.	Yes	The gas divider serial number is included in the service report
Gases used - certificate no's, expiry dates, binary or mixture.	Yes	The gas cylinder reference numbers are included in the service report. The expiry dates of the gas cylinders and their accuracy are included in the service report
Calibration and linearity data as required by EN14181.	Yes	
Logged data for the period of calibration and linearity. NOTE: There may be gaps in the data, for example, if the CEMS are removed from the stack for the linearity test. In such cases, the test laboratory shall state why there are gaps in the data.	Yes	
Name and signature of the service engineer present on the service report?	Yes	

**PRO-FORMA FOR ASSESSING AND REPORTING THE RESULTS OF THE FUNCTIONAL TESTS**

(Page 4 of 4)

<b>10. Documentation and Records</b>		
<b>Requirement</b>	<b>Available</b>	<b>Notes</b>
A plan of the CEM.	Yes	
All manuals (maintenance, users, etc).	Yes	
Log books to document possible malfunctions and action taken.	Yes	
Service reports.	Yes	
QAL3 documentation including actions taken as a result of out of control situations.	Yes	
Management system procedures for maintenance, calibration and training.	Yes	
Training records.	Yes	
Maintenance schedules.	Yes	
Auditing plans and records - evidence that the operator includes the procedures for the management of the CEMS within the auditing cycle of the management system.	Yes	
Existing instrument calibration functions / gain factors.	Yes	
Documentation and records audit completed and validated prior to commencing SRM testing.	Yes	



## TOTAL PARTICULATE MATTER: LINEARITY CHECK CALCULATIONS

SITA UK Ltd, Wrexham

A1 - Main Stack

24/10/2012

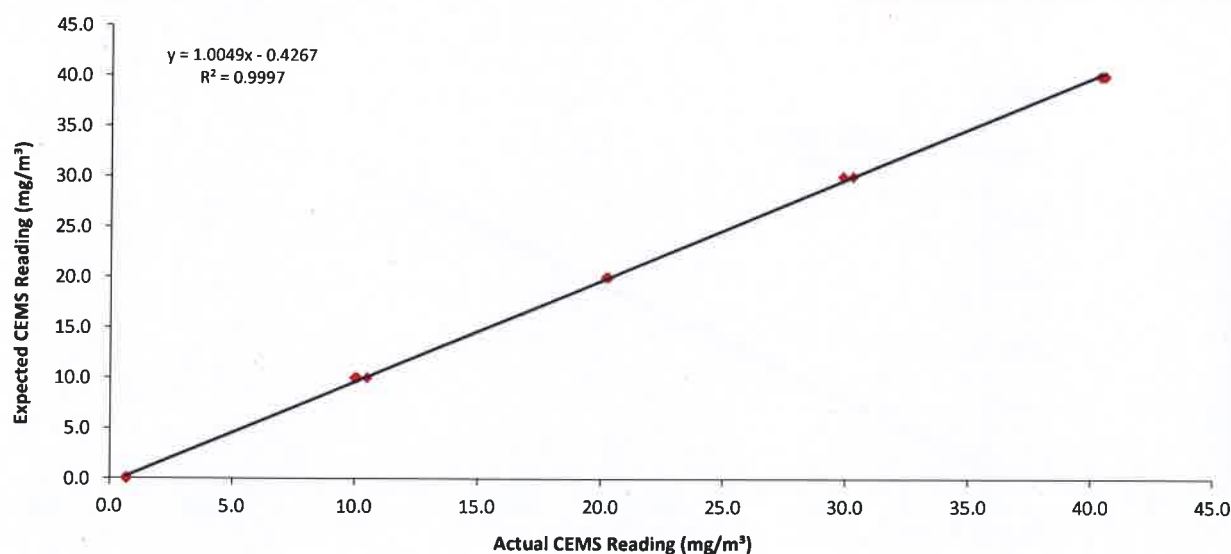
### Linearity Readings on CEMS

Linearity Point	Time of Readings	Linearity % Point	Expected Reading (mg/m³)	Reading 1 (mg/m³)	Reading 2 (mg/m³)	Reading 3 (mg/m³)	Average CEMS Reading (mg/m³)
1	11:00	0.00	0.00	0.68	0.71	0.64	0.68
2	11:24	80.00	40.00	40.40	40.60	40.50	40.50
3	11:16	40.00	20.00	20.30	20.20	20.20	20.23
5	11:30	20.00	10.00	10.50	10.10	9.99	10.20
6	11:36	60.00	30.00	29.90	29.90	30.30	30.03

### Test of Residuals

Linearity Point	Average $x_c$	$d_c$	% $d_{c,rel}$	ABS % $d_{c,rel}$	MAX ABS % $d_{c,rel}$	Limit	Outcome
1	0.68	-0.25	-0.63	0.63	0.67	5	Pass
2	40.50	-0.27	-0.67	0.67			
3	20.23	0.10	0.24	0.24			
5	10.20	0.18	0.45	0.45			
6	30.03	0.25	0.62	0.62			

### Graphical Representation of Linearity Data



# VOLATILE ORGANIC COMPOUNDS: LINEARITY CHECK CALCULATIONS

SITA UK Ltd, Wrexham

A1 - Main Stack

24/10/2012

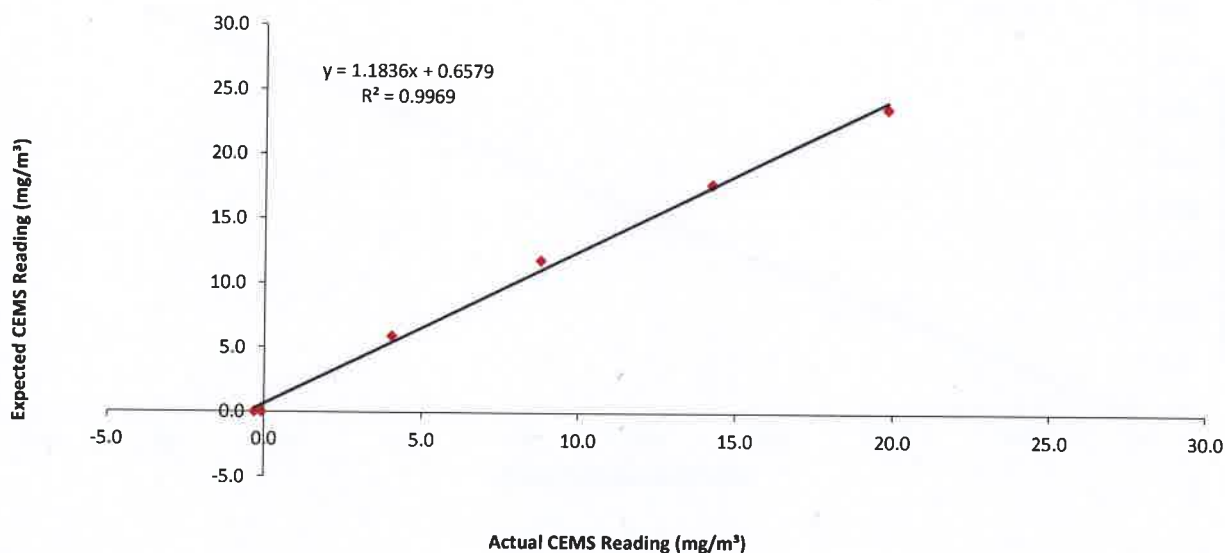
## Linearity Readings on CEMS

Linearity Point	Time of Readings	Linearity % Point	Expected Reading (mg/m <sup>3</sup> )	Reading 1 4 x Response (mg/m <sup>3</sup> )	Reading 2 1 x Response (mg/m <sup>3</sup> )	Reading 3 1 x Response (mg/m <sup>3</sup> )	Average CEMS Reading (mg/m <sup>3</sup> )
1	12:50	0.00	0.00	-0.33	-0.32	-0.32	-0.32
2	13:59	60.00	17.67	14.22	14.23	14.25	14.23
3	14:07	20.00	5.89	4.02	4.02	4.03	4.02
4	13:48	80.00	23.56	19.82	19.81	19.80	19.81
5	14:14	0.00	0.00	-0.10	-0.10	-0.10	-0.10
6	13:54	40.00	11.78	8.78	8.78	8.78	8.78

## Test of Residuals

Linearity Point	Average $x_c$	$d_c$	% $d_{c,rel}$	ABS % $d_{c,rel}$	MAX ABS % $d_{c,rel}$	Limit	Outcome
1	-0.32	-0.27	-1.16	1.16	3.09	5	Pass
2	14.23	0.17	0.70	0.70			
3	4.02	0.47	2.00	2.00			
4	19.81	-0.54	-2.31	2.31			
5	-0.10	-0.55	-2.31	2.31			
6	8.78	0.73	3.09	3.09			

## Graphical Representation of Linearity Data



**NITROGEN MONOXIDE: LINEARITY CHECK CALCULATIONS**

SITA UK Ltd, Wrexham

A1 - Main Stack

24/10/2012

**Linearity Readings on CEMS [As Read on Analyser] (as NO)**

Linearity Point	Time of Readings	Linearity % Point	Expected Reading (mg/m <sup>3</sup> )	Reading 1 4 x Response (mg/m <sup>3</sup> )	Reading 2 1 x Response (mg/m <sup>3</sup> )	Reading 3 1 x Response (mg/m <sup>3</sup> )	Average CEMS Reading (mg/m <sup>3</sup> )
1	15:10	0.00	0.00	0.00	0.00	0.00	0.00
2	15:35	60.00	239.84	245.00	245.00	245.50	245.17
3	15:18	20.00	79.95	84.20	84.20	84.30	84.23
4	15:45	80.00	319.78	326.50	326.10	326.20	326.27
5	16:10	0.00	0.00	0.10	0.10	0.00	0.07
6	15:23	40.00	159.89	162.60	162.70	162.20	162.50

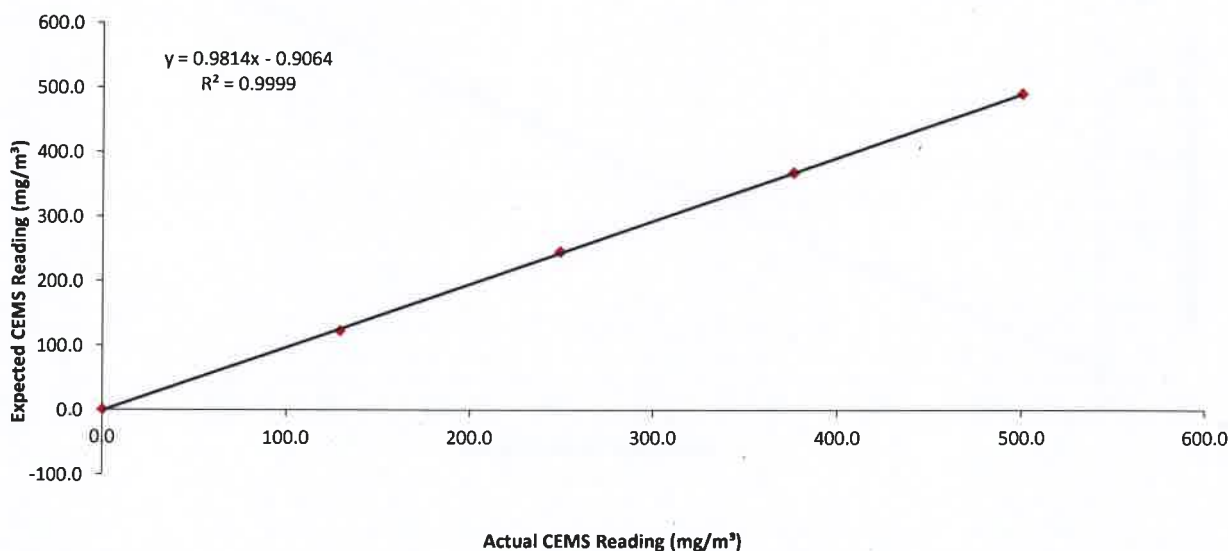
**Linearity Readings on CEMS (as NO<sub>2</sub>)**

Linearity Point	Time of Readings	Linearity % Point	Expected Reading (mg/m <sup>3</sup> )	Reading 1 4 x Response (mg/m <sup>3</sup> )	Reading 2 1 x Response (mg/m <sup>3</sup> )	Reading 3 1 x Response (mg/m <sup>3</sup> )	Average CEMS Reading (mg/m <sup>3</sup> )
1	15:10	0.00	0.00	0.00	0.00	0.00	0.00
2	15:35	60.00	367.75	375.67	375.67	376.43	375.92
3	15:18	20.00	122.58	129.11	129.11	129.26	129.16
4	15:45	80.00	490.34	500.63	500.02	500.17	500.28
5	16:10	0.00	0.00	0.15	0.15	0.00	0.10
6	15:23	40.00	245.17	249.32	249.47	248.71	249.17

**Test of Residuals (as NO<sub>2</sub>)**

Linearity Point	Average x <sub>c</sub>	d <sub>c</sub>	% d <sub>c,rel</sub>	ABS % d <sub>c,rel</sub>	MAX ABS % d <sub>c,rel</sub>	Limit	Outcome
1	0.00	0.91	0.18	0.18	0.67	5	Pass
2	375.92	-0.27	-0.05	0.05			
3	129.16	-3.26	-0.67	0.67			
4	500.28	0.28	0.06	0.06			
5	0.10	0.81	0.16	0.16			
6	249.17	1.54	0.31	0.31			

**Graphical Representation of Linearity Data (as NO<sub>2</sub>)**



## NITROGEN DIOXIDE: LINEARITY CHECK CALCULATIONS

SITA UK Ltd, Wrexham

A1 - Main Stack

24/10/2012

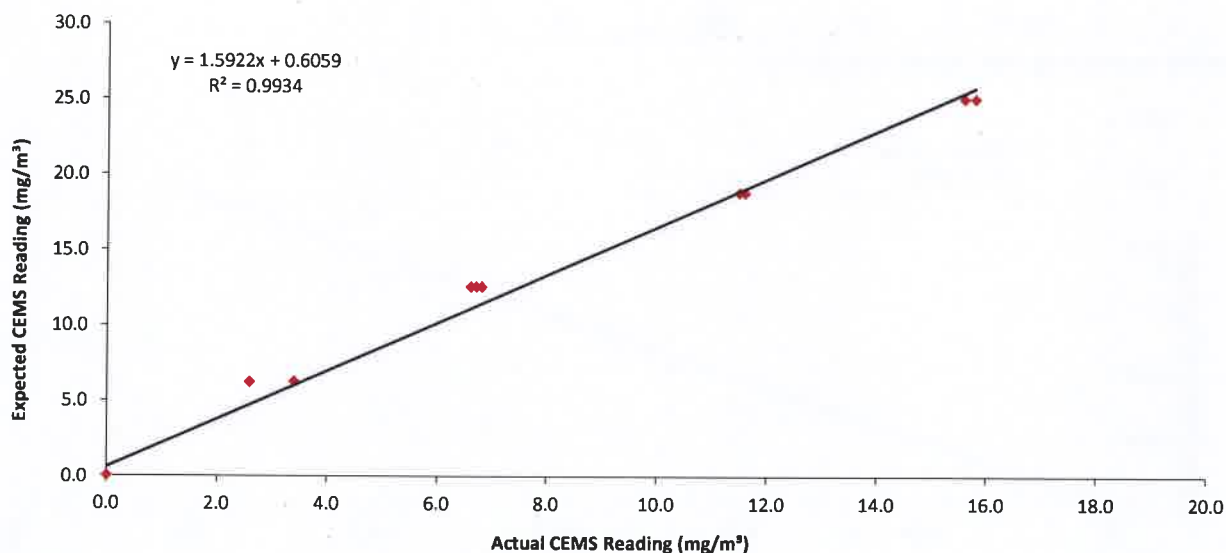
### Linearity Readings on CEMS

Linearity Point	Time of Readings	Linearity % Point	Expected Reading (mg/m <sup>3</sup> )	Reading 1 4 x Response (mg/m <sup>3</sup> )	Reading 2 1 x Response (mg/m <sup>3</sup> )	Reading 3 1 x Response (mg/m <sup>3</sup> )	Average CEMS Reading (mg/m <sup>3</sup> )
1	10:40	0.00	0.00	0.00	0.00	0.00	0.00
2	11:10	60.00	18.78	11.50	11.50	11.60	11.53
3	11:17	20.00	6.26	3.40	3.40	2.60	3.13
4	10:54	80.00	25.04	15.60	15.80	15.60	15.67
5	11:30	0.00	0.00	0.00	0.00	0.00	0.00
6	11:02	40.00	12.52	6.70	6.80	6.60	6.70

### Test of Residuals

Linearity Point	Average $x_c$	$d_c$	% $d_{c,rel}$	ABS % $d_{c,rel}$	MAX ABS % $d_{c,rel}$	Limit	Outcome
1	0.00	-0.61	-2.42	2.42	4.98	5	Pass
2	11.53	-0.19	-0.76	0.76			
3	3.13	0.67	2.66	2.66			
4	15.67	-0.51	-2.04	2.04			
5	0.00	-0.61	-2.42	2.42			
6	6.70	1.25	4.98	4.98			

### Graphical Representation of Linearity Data



Section 5 - Results of the Functional Tests

**SULPHUR DIOXIDE: LINEARITY CHECK CALCULATIONS**

SITA UK Ltd, Wrexham

A1 - Main Stack

24/10/2012

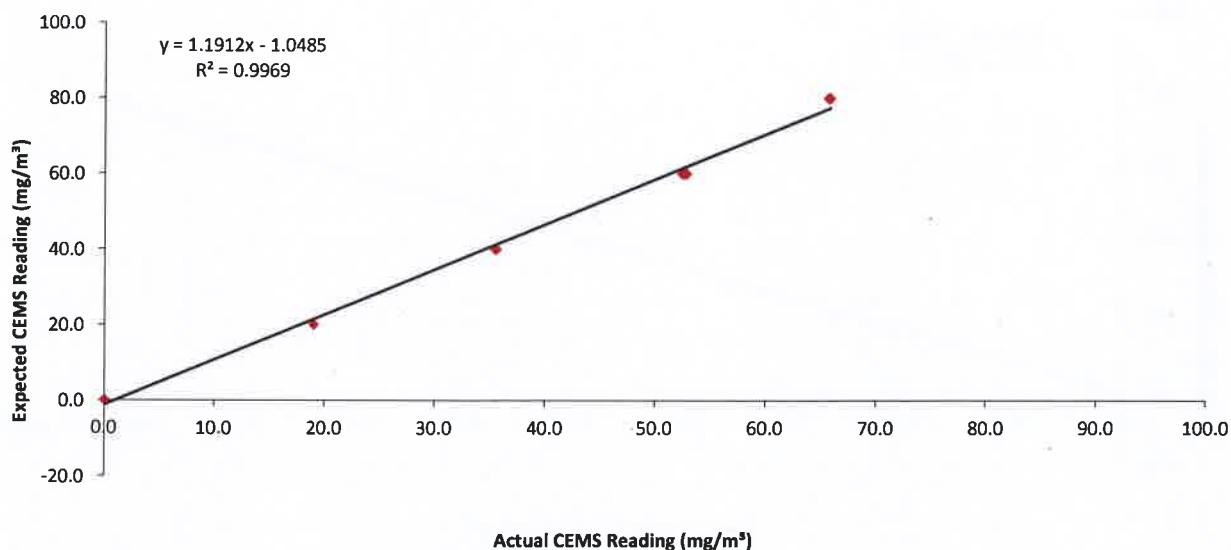
**Linearity Readings on CEMS**

Linearity Point	Time of Readings	Linearity % Point	Expected Reading (mg/m <sup>3</sup> )	Reading 1 4 x Response (mg/m <sup>3</sup> )	Reading 2 1 x Response (mg/m <sup>3</sup> )	Reading 3 1 x Response (mg/m <sup>3</sup> )	Average CEMS Reading (mg/m <sup>3</sup> )
1	15:10	0.00	0.00	0.00	0.00	0.00	0.00
2	15:35	60.00	59.95	52.70	52.90	52.50	52.70
3	15:18	20.00	19.98	19.00	19.00	19.00	19.00
4	15:45	80.00	79.93	65.80	65.70	65.90	65.80
5	16:10	0.00	0.00	0.00	0.00	0.00	0.00
6	15:23	40.00	39.96	35.50	35.50	35.60	35.53

**Test of Residuals**

Linearity Point	Average $x_c$	$d_c$	%, $d_{c,rel}$	ABS %, $d_{c,rel}$	MAX ABS %, $d_{c,rel}$	Limit	Outcome
1	0.00	1.05	1.31	1.31	3.25	5	Pass
2	52.70	-1.78	-2.23	2.23			
3	19.00	-1.60	-2.00	2.00			
4	65.80	2.60	3.25	3.25			
5	0.00	1.05	1.31	1.31			
6	35.53	-1.31	-1.64	1.64			

**Graphical Representation of Linearity Data**



Section 5 - Results of the Functional Tests

**CARBON MONOXIDE: LINEARITY CHECK CALCULATIONS**

SITA UK Ltd, Wrexham  
A1 - Main Stack  
24/10/2012

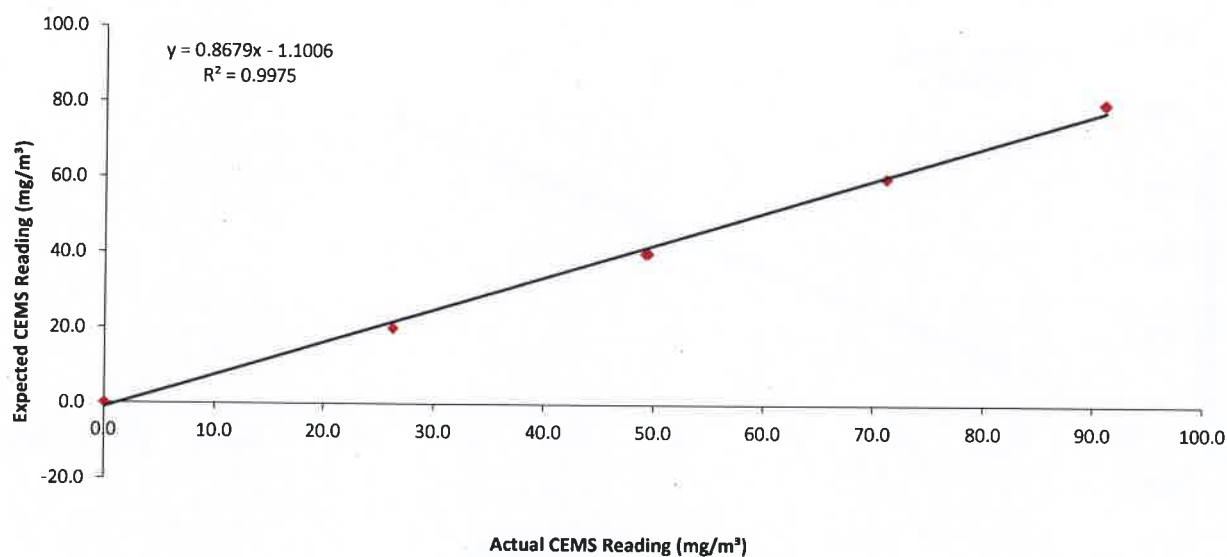
**Linearity Readings on CEMS**

Linearity Point	Time of Readings	Linearity % Point	Expected Reading (mg/m <sup>3</sup> )	Reading 1 4 x Response (mg/m <sup>3</sup> )	Reading 2 1 x Response (mg/m <sup>3</sup> )	Reading 3 1 x Response (mg/m <sup>3</sup> )	Average CEMS Reading (mg/m <sup>3</sup> )
1	15:10	0.00	0.00	0.00	0.00	0.00	0.00
2	15:35	60.00	59.97	71.20	71.10	71.10	71.13
3	15:18	20.00	19.99	26.30	26.30	26.30	26.30
4	15:45	80.00	79.96	91.00	91.20	91.10	91.10
5	16:10	0.00	0.00	0.00	0.00	0.00	0.00
6	15:23	40.00	39.98	49.20	49.50	49.50	49.40

**Test of Residuals**

Linearity Point	Average $x_c$	$d_c$	$\%, d_{c,rel}$	ABS $\%, d_{c,rel}$	MAX ABS $\%, d_{c,rel}$	Limit	Outcome
1	0.00	1.10	1.38	1.38	2.49	5	Pass
2	71.13	-0.67	-0.83	0.83			
3	26.30	-1.74	-2.17	2.17			
4	91.10	1.99	2.49	2.49			
5	0.00	1.10	1.38	1.38			
6	49.40	-1.79	-2.24	2.24			

**Graphical Representation of Linearity Data**





Section 5 - Results of the Functional Tests

**HYDROGEN CHLORIDE: LINEARITY CHECK CALCULATIONS**

SITA UK Ltd, Wrexham  
A1 - Main Stack  
16/01/2013

**Linearity Readings on CEMS**

Linearity Point	Time of Readings	Linearity % Point	Expected Reading (mg/m <sup>3</sup> )	Reading 1 4 x Response (mg/m <sup>3</sup> )	Reading 2 1 x Response (mg/m <sup>3</sup> )	Reading 3 1 x Response (mg/m <sup>3</sup> )	Average CEMS Reading (mg/m <sup>3</sup> )
1	13:20	0.00	0.00	0.00	0.00	0.00	0.00
2	13:41	60.00	15.66	14.50	14.60	14.70	14.60
3	13:48	20.00	4.89	3.90	3.90	3.90	3.90
4	13:31	80.00	19.55	18.70	18.70	18.80	18.73
5	13:20	0.00	0.00	0.00	0.00	0.00	0.00
6	13:36	40.00	10.00	9.30	9.30	9.30	9.30

**Test of Residuals**

Linearity Point	Average $x_c$	$d_c$	% $d_{c,rel}$	ABS % $d_{c,rel}$	MAX ABS % $d_{c,rel}$	Limit	Outcome
1	0.00	-0.25	-1.28	1.28	2.89	5	Pass
2	14.60	0.16	0.83	0.83			
3	3.90	0.56	2.89	2.89			
4	18.73	-0.26	-1.34	1.34			
5	0.00	-0.25	-1.28	1.28			
6	9.30	0.04	0.19	0.19			

**Graphical Representation of Linearity Data**

