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BS EN 14181 AST Report Commissioned by
SITA UK Ltd

Installation Name & Address

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

Primary Site Contact: Alan Gartside

PPC Permit: AP3538SM

Stack Reference

A1 - Main Stack

Dates of the Monitoring Campaign

14th - 15th November 2013

Job Reference Number

CAT-1685

	INITIALS	DATE
OK FOR PUBLIC REGISTER	L.C.	18.2.14
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Signature of Report Approver

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Opinions and interpretations expressed herein are outside the scope of Catalyst Environmental Ltd's UKAS accreditation.

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Executive Summary (Page 1 of 2)

SITA UK Ltd, Wrexham
A1 - Main Stack
14th - 15th November 2013

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 an AST Calibration Check 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.

AST CALIBRATION CHECK SUMMARY

Parameter	Source of the Calibration Function Derived from Previous QAL2	Calibration Function as Derived from the Previous QAL2	Calibration Range from Previous QAL2 @ REF Conditions	Calibration Function that the AST was performed against (See Conclusion)	Result of Variability Test	Result of Calibration Test	Range after AST Extension @ REF Conditions
Total Particulate Matter	Parallel Test	$y = 1.4366x + 0.671$	N/A	$y = 1.4366x + 0.671$	Fail	Fail	N/A
Total VOCs	Parallel Test	$y = 0.885x + 0$	0 to 2.8	$y = x$	Pass	Pass	Existing Range Still Valid
Oxides of Nitrogen (as NO ₂)	Parallel Test	$y = 1.0864x + 1.9716$	0 to 189.3	$y = x$	Pass	Pass	0 to 246.5 mg/m ³
Sulphur Dioxide	Not Derived	N/A	N/A	$y = x$	Pass	Fail	N/A
Carbon Monoxide	Not Derived	N/A	N/A	$y = x$	Pass	Pass	Existing Range Still Valid
Hydrogen Chloride	Parallel Test	$y = 0.4253x + 0.0222$	0 to 4.9	$y = 0.4253x + 0.0222$	Fail	Fail	N/A
Water Vapour	Parallel Test	$y = 1.0373x + 0.5712$	0 to 11.7	$y = 1.0373x + 0.5712$	Pass	Pass	Existing Range Still Valid
Oxygen (Dry)	Parallel Test	$y = 1.1186x + 0$	0 to 16.2	$y = 1.1186x + 0$	Pass	Pass	Existing Range Still Valid
Carbon Dioxide	Parallel Test	$y = 0.9968x + 0$	0 to 6.2	$y = 0.9968x + 0$	Pass	Pass	Existing Range Still Valid

All calibration functions relate to mg/m³, with the exception of Water Vapour, Oxygen & Carbon Dioxide which relate to % v/v.

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 ² Value	Maximum ABS %, d _{c,rel}	Allowable ABS %, d _{c,rel}	Result of Residuals Test	Range Linearity Performed Over
Total Particulate Matter	Yes	$y = 1.0188x + 0.081$	0.9992	2.12	5	Pass	0 to 39 mg/m ³
Total VOCs	Yes	$y = 1.0447x - 0.1413$	0.9977	2.10	5	Pass	0 to 16 mg/m ³
Nitrogen Monoxide (as NO ₂)	Yes	$y = 1.0912x - 0.0834$	0.9992	1.60	5	Pass	0 to 453 mg/m ³
Sulphur Dioxide	Yes	$y = 1.1842x - 2.443$	0.9984	1.94	5	Pass	0 to 71 mg/m ³
Carbon Monoxide	Yes	$y = 0.917x - 1.0814$	0.9952	1.84	5	Pass	0 to 87 mg/m ³
Hydrogen Chloride	Yes	$y = 1.044x - 0.154$	0.9983	1.70	5	Pass	0 to 16 mg/m ³
Oxygen (Dry)	Yes	$y = 0.9641x - 0.0288$	0.9999	0.57	5	Pass	0 to 17 % v/v

All calibration functions relate to mg/m³, with the exception of Water Vapour, Oxygen & Carbon Dioxide which relate to % v/v.

Executive Summary (Page 2 of 2)

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SUMMARY OF STANDARD REFERENCE METHOD & BS EN 14181 DEVIATIONS

Parameter	Run	Deviation
All	All	There are no deviations associated with the sampling employed.

CONCLUSIONS, DISCUSSIONS & ACTIONS FROM THE SAMPLING EXERCISE

Oxides of Nitrogen (as NO₂)

The CEMS data was corrected using the calibration function derived during the most recent QAL2 campaign. The corrected values passed both the variability and calibration tests as required by BS EN 14181 and therefore the calibration function is deemed to be valid within the given tolerances. The calibration range derived in the previous QAL2 has been extended as a larger spread of data was collected during this AST exercise.

Total VOCs, Carbon Monoxide, Water Vapour, Oxygen (Dry), Carbon Dioxide

The CEMS data was corrected using the calibration function derived during the most recent QAL2 campaign. The corrected values passed both the variability and calibration tests as required by BS EN 14181 and therefore the calibration function is deemed to be valid within the given tolerances. The calibration range derived in the previous QAL2 is still valid.

Sulphur Dioxide

No valid calibration function was derived at the previous QAL2 stage as the emissions from the Plant were of a low order (less than the 95% Confidence Interval [CI] of the Daily ELV). A function of $y = x$ was used for the AST calculations, but this resulted in a failure on the test of calibration. This, coupled with the fact that both sets of data (both SRM and CEMS) collected during this AST exercise are of higher concentration throughout the monitoring period it is suggested that a new QAL2 exercise is completed for this parameter.

Hydrogen Chloride

The CEMS data was corrected using the calibration function derived during the most recent QAL2 campaign. The corrected values did not pass either of the variability or calibration tests as required by BS EN 14181 and therefore the calibration function is deemed to be invalid. The correct functionality of the CEMS system had been checked during the pre-AST functional checks, however, it may be worth re-checking. Following this, a new QAL2 will be required to derive a new calibration function. It is worth noting that applying a function of $y = x$ would have led to the CEMS passing both the variability and calibration checks, however it is not permissible to change the function from the QAL2 based on an AST exercise. A repeat QAL2 will still be necessary.

Total Particulate Matter

The CEMS data was corrected using the calibration function derived during the last QAL2 performed in 2012, although it should be noted that this function was deemed invalid due to it failing the test of variability, and a re-test was recommended. The corrected values failed both of the variability and calibration tests as required by BS EN 14181. The correct functionality of the CEMS system had been checked during the pre-AST functional checks, however, it may be worth re-checking. Following this, a new QAL2 will be required to derive a new calibration function.

REGULATORY INFORMATION

SITA UK Ltd, Wrexham
A1 - Main Stack
14th - 15th November 2013

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	30th October - 2nd November 2012
Date CEMS Data Obtained by Catalyst	15th November 2013

Regulated Determinands and Emission Limit Values (ELVs)

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



Section 2: Information about the Regulated Installation



OPERATIONAL INFORMATION AND SITE MONITORING PROVISIONS

SITA UK Ltd, Wrexham
A1 - Main Stack
14th - 15th November 2013

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)	None
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 - Autozero of Analyser
Reviewing historical Plant data, were low emissions expected for any determinands?	Yes - Total VOCs, Carbon Monoxide
Was the CEMS reading zero for any determinands, if so, was this investigated to ensure it was working?	Total Particulate Matter - Investigated by CEMs engineer
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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SITA UK Ltd, Wrexham
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Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.63
Width	m	-
Area	m ²	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	132	> 5 Pa	Yes
Mean Velocity	m/s	16.1	-	-
Lowest Gas Velocity	m/s	14.7	-	-
Highest Gas Velocity	m/s	17.0	-	-
Ratio of Above	: 1	1.16	< 3 : 1	Yes
Maximum Angle of Swirl	°	2	< 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	Inside Plant Building. 240V and 100 Power Nearby (5m).
Easy and safe access to the CEMS.	Yes	Concrete area. CEMs built into a cabinet.
Adequate supplies of reference materials, tools and spare parts.	Yes	SO ₂ 144.1 / VOC 19.94 / CO 126.6 / NO 67 / HCL 19.5 / O ₂ 12.5
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	Line check possible
Compliance with MID 15259	Yes	See the Sampling Plane Validation Criteria table on the previous page.

Plant Photos

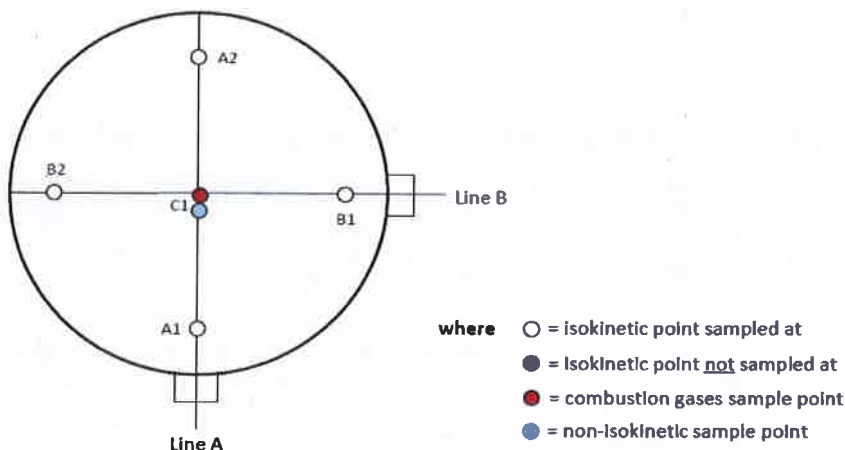
Photo 1



Photo 2



Sample Points



CONTINUOUS EMISSION MONITORING SYSTEMS (CEMS) AT THE INSTALLATION

SITA UK Ltd, Wrexham
A1 - Main Stack
14th - 15th November 2013

Main Determinand	Type	Instrument Name	Instrument Serial Number	Measurement Principle	Certified Range (mg/m ³)	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 ₂)	Extractive	Environnement SA MIR 9000	1785	GFC-IR	0 - 100	Yes	MC 020010/09
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	-	-	-
Carbon Dioxide	Extractive	Environnement SA MIR 9000	1785	NDIR	0 - 25%	Yes	MC 020010/09

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	Robert Haworth	MCERTS Level 2	MM 07 797, Expiry: June 2015	TE1 TE2 TE3 TE4
Technician	Antony Ward	MCERTS Level 1	MM 10 1096, Expiry: September 2015	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 ³)	Operational (mg/m ³)			
Total Particulate Matter	MST	Gravimetric	0 - 5	0 - 50	N/A	BS EN 13284-1	5.4
Total VOCs	Sick Maihak 3006	FID	0 - 15	0 - 160	MC 040036	BS EN 12619	23
Oxides of Nitrogen (as NO ₂)	Gasmet DX4000	FTIR	0 - 200	0 - 200	MC 030014	TGN M22	7.5
Sulphur Dioxide	Gasmet DX4000	FTIR	0 - 75	0 - 57	MC 030014	TGN M22	8.9
Carbon Monoxide	Gasmet DX4000	FTIR	0 - 75	0 - 75	MC 030014	TGN M22	24
Hydrogen Chloride	Gasmet DX4000	FTIR	0 - 15	0 - 81	MC 030014	TGN M22	11.1
Water Vapour	Gasmet DX4000	FTIR	0 - 30%	0 - 30%	MC 030014	TGN M22	6.1
Oxygen (Dry)	Horiba PG-250	Zirconia Cell	0 - 25%	0 - 25%	MC 050056	BS EN 14789	2.2
Carbon Dioxide	Gasmet DX4000	FTIR	0 - 25%	0 - 25%	MC 030014	TGN M22	5.2

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	
Equipment Type	Equipment I.D.
Control Box DGM	CAT 7.12
Box Thermocouples	CAT 3.31
Umbilical	CAT 3.31
Oven Box	CAT 12.27
Probe	CAT 5.39
S-Pitot (1)	CAT 21S.02
S-Pitot (2)	-
L-Pitot	-
500g Check Weight	CAT 17.22
1Kg Check Weight	CAT 17.22
Last Impinger Arm	CAT 4.179 / 4.180
Callipers	CAT 23.13
Tubes Kit Thermocouple	-
Laboratory Balance	CAT 1.18 / 1.18a
Tape Measure	CAT 16.20

Instrumental Analysers	
Equipment Type	Equipment I.D.
Horiba PG-250	CAT 9.11
Servomex 4900	-
Servomex 5200 MP	-
ECO PHYSICS CLD 822 M h	-
Testo 350 XL	-
JCT JCC P-1 Cooler	CAT 4.185
Gasmet DX-4000 FTIR	CAT 19.3
Gasmet FTIR Sampling System	CAT 10.1
Bernath 3006 FID	CAT 8.12
Heated Head Filter	CAT 12.93
Mass Flow Controller (1)	CAT 6.28
Mass Flow Controller (2)	CAT 6.29
Mass View (1)	CAT 25.23
Mass View (2)	CAT 25.24
Easylogger EN-EL-12 Bit	CAT 11.23
Dual Channel Heater Controller	CAT 3.49

Miscellaneous Items	
Equipment Type	Equipment I.D.
Digital Manometer (1)	CAT 3.33
Digital Manometer (2)	-
Digital Temperature Meter	CAT 3.33
Stopwatch	CAT 14.44
Barometer	CAT 13.13
Stack Thermocouple (1)	CAT 4.303
Stack Thermocouple (2)	-
1m Heated Line (1)	CAT 20.14
1m Heated Line (2)	CAT 20.15
1m Heated Line (3)	-
5m Heated Line (1)	CAT 20.33
15m Heated Line (1)	-
15m Heated Line (2)	-
20m Heated Line (1)	CAT 20.30

TOTAL PARTICULATE MATTER: AST CALCULATIONS

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SITA UK Ltd, Wrexham

A1 - Main Stack

Calibration Data

Pair	Date	Time	x, CEMS (STP, ACTUAL) mg/m ³	y, SRM (STP, ACTUAL) mg/m ³	SRM (STP, DRY, 11% O ₂) mg/m ³	x - x _{av} (A)	y - y _{av} (B)	(A) x (B)	(x - x _{av}) ²	CAL CEMS (STP, ACTUAL) mg/m ³
1	15/11/2013	09:20 - 09:54	4.96	54.61	137.71	2.94	-4.78	-14.03	8.63	7.79
2	15/11/2013	10:24 - 10:57	3.02	40.98	108.52	1.00	-18.41	-18.43	1.00	5.01
3	15/11/2013	11:24 - 11:58	3.00	41.34	111.98	0.98	-18.05	-17.71	0.96	4.98
4	15/11/2013	12:24 - 12:58	0.33	77.41	202.94	-1.69	18.02	-30.40	2.85	1.15
5	15/11/2013	13:24 - 13:58	0.43	93.64	241.69	-1.59	34.25	-54.59	2.54	1.28
6	15/11/2013	14:24 - 14:58	0.38	48.35	137.40	-1.64	-11.04	18.09	2.69	1.22

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	133.17
DAILY ELV (mg/m ³)	10
MU (%)	30
15% of ELV	1.50

SUM -117.07 18.66

Existing Calibration Function

$$y = 1.4366x + 0.671$$

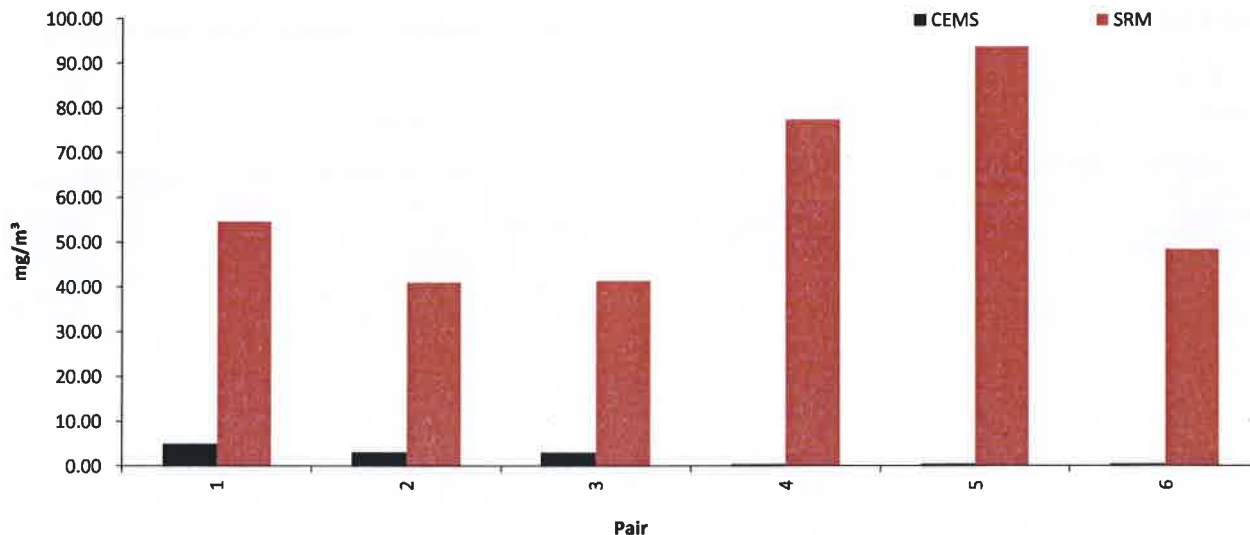
Source of Existing Calibration Function

CAT-1323-14181 SITA Wrexham A1 Main Stack QAL2 Report V1

Existing Calibration Range

N/A

PLOT 1: BAR CHART OF DATA



Section 4B - Data and Calculations - AST

TOTAL PARTICULATE MATTER: AST 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	15/11/2013	09:20 - 09:54	367.3	156.4	-1.0	101.5	2.58	5.68	13.22	14.40
2	15/11/2013	10:24 - 10:57	251.0	157.9	-1.0	101.4	2.59	5.48	13.43	14.70
3	15/11/2013	11:24 - 11:58	216.0	160.1	-1.5	101.4	2.86	5.63	13.33	14.80
4	15/11/2013	12:24 - 12:58	280.8	160.1	-0.9	101.4	3.16	5.54	13.39	14.60
5	15/11/2013	13:24 - 13:58	296.4	166.3	-1.0	101.4	3.53	5.63	13.13	14.40
6	15/11/2013	14:24 - 14:58	296.5	174.0	-1.0	101.4	4.07	7.16	13.42	14.80

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	15/11/2013	09:20 - 09:54	7.79	-2441.59	137.71	2579.30	47-16354
2	15/11/2013	10:24 - 10:57	5.01	-1320.82	108.52	1429.33	47-16353
3	15/11/2013	11:24 - 11:58	4.98	-808.63	111.98	920.61	47-16352
4	15/11/2013	12:24 - 12:58	1.15	-355.67	202.94	558.60	47-16687
5	15/11/2013	13:24 - 13:58	1.28	-356.64	241.69	598.33	47-16626
6	15/11/2013	14:24 - 14:58	1.22	-353.65	137.40	491.05	47-16369
			MAX	-353.65	S _d	805.54	

Test of Variability

$Q_0 = ELV \times (MU / 100) / 1.96$	1.53
Kv for 6 Pairs of Data	0.9329

The variability is accepted if $S_d \leq 1.5 \times Q_0 \times K_v$

Parameter	Value
Standard Deviation (Sd)	805.54
$1.5 \times Q_0 \times K_v$	2.14
Outcome of Variability Test	Fail

Test of Calibration (Acceptance of Calibration Function)

$t_{0.95} (N-1)$	2.015
------------------	-------

where N (number of samples) = 6

The calibration is accepted if $D \leq t_{0.95} (N-1) \times S_d / \text{SQRT} (N) + Q_0$

Parameter	Value
Mean Difference (D)	1096.21
$t_{0.95} (N-1) \times S_d / \text{SQRT} (N) + Q_0$	664.18
Outcome of Calibration Test	Fail

VOLATILE ORGANIC COMPOUNDS: AST CALCULATIONS

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SITA UK Ltd, Wrexham

A1 - Main Stack

Calibration Data

Pair	Date	Time (30-minute Average)	x, CEMS (STP, WET) mg/m ³	y, SRM (STP, WET) mg/m ³	SRM (STP, DRY, 11% O ₂) mg/m ³	x - x _{av} (A)	y - y _{av} (B)	(A) x (B)	(x - x _{av}) ²	CAL CEMS (STP, WET) mg/m ³
1	14/11/2013	16:47 - 17:17	0.94	0.26	0.44	-0.03	0.09	0.00	0.00	0.94
2	14/11/2013	17:47 - 18:17	0.97	0.16	0.25	0.00	-0.01	0.00	0.00	0.97
3	14/11/2013	18:47 - 19:17	0.97	0.16	0.25	0.01	-0.01	0.00	0.00	0.97
4	14/11/2013	19:47 - 20:17	0.98	0.16	0.29	0.01	-0.01	0.00	0.00	0.98
5	14/11/2013	20:47 - 21:17	0.97	0.16	0.26	0.01	-0.01	0.00	0.00	0.97
6	14/11/2013	21:47 - 22:17	0.98	0.16	0.26	0.02	-0.01	0.00	0.00	0.98
7	14/11/2013	22:47 - 23:17	0.83	0.16	0.26	-0.13	-0.01	0.00	0.02	0.83
8	15/11/2013	23:47 - 00:17	0.94	0.16	0.26	-0.02	-0.01	0.00	0.00	0.94
9	15/11/2013	00:47 - 01:17	1.00	0.16	0.27	0.03	-0.01	0.00	0.00	1.00
10	15/11/2013	01:47 - 02:17	1.02	0.16	0.29	0.06	-0.01	0.00	0.00	1.02
11	15/11/2013	02:47 - 03:17	1.07	0.16	0.28	0.11	-0.01	0.00	0.01	1.07
12	15/11/2013	03:47 - 04:17	0.95	0.16	0.27	-0.02	-0.01	0.00	0.00	0.95
13	15/11/2013	04:47 - 05:17	0.97	0.16	0.28	0.00	-0.01	0.00	0.00	0.97
14	15/11/2013	05:47 - 06:17	0.98	0.16	0.29	0.02	-0.01	0.00	0.00	0.98
15	15/11/2013	06:47 - 07:17	0.94	0.16	0.27	-0.03	-0.01	0.00	0.00	0.94
16	15/11/2013	07:47 - 08:17	0.92	0.16	0.27	-0.04	-0.01	0.00	0.00	0.92

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

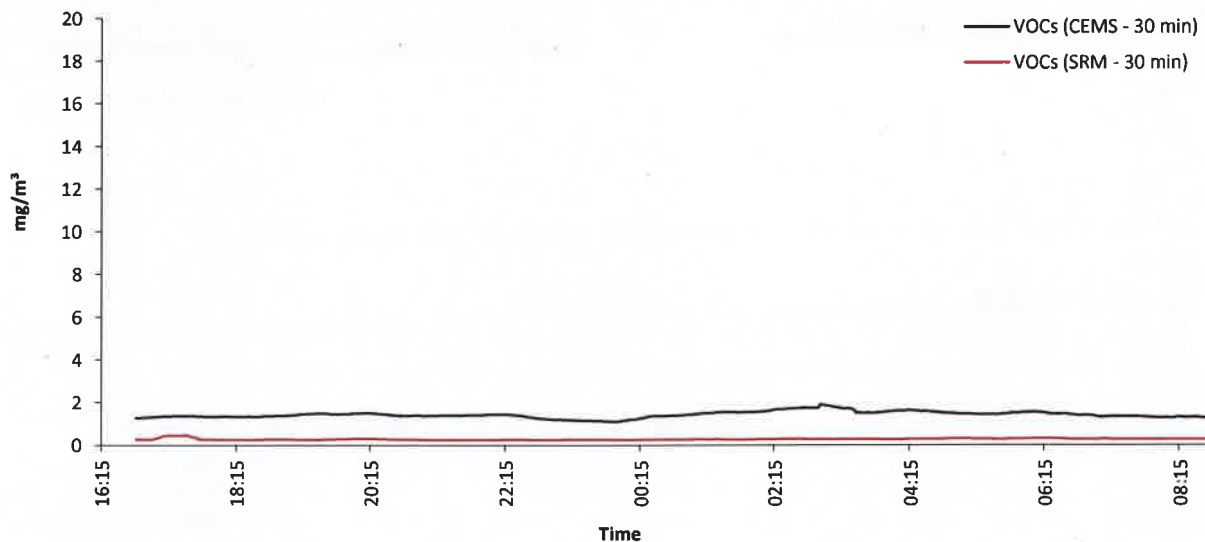
SPREAD OF DATA	0.19
DAILY ELV (mg/m ³)	10
MU (%)	30
15% of ELV	1.50

Existing Calibration Function
$y = 0.885x + 0$

Source of Existing Calibration Function
CAT-1323-14181 SITA Wrexham A1 Main Stack QAL2 Report V1

Existing Calibration Range
0 to 2.8 mg/m ³ at 11% O ₂

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



VOLATILE ORGANIC COMPOUNDS: AST CALCULATIONS

(Page 2 of 2)

SITA UK Ltd, Wrexham

A1 - Main Stack

Variability Test Data

Pair	Date	Time (30-minute Average)	CAL CEMS (STP, WET) mg/m ³	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 ₂) mg/m ³	SRM (STP, DRY, 11% O ₂) mg/m ³	ys, SRM - CAL CEMS
1	14/11/2013	16:47 - 17:17	0.94	5.39	6.54	13.70	14.73	1.36	0.44	-0.91
2	14/11/2013	17:47 - 18:17	0.97	7.77	7.62	13.13	14.00	1.33	0.25	-1.08
3	14/11/2013	18:47 - 19:17	0.97	17.11	6.18	13.03	14.14	1.47	0.25	-1.22
4	14/11/2013	19:47 - 20:17	0.98	5.86	6.43	14.04	15.10	1.49	0.29	-1.20
5	14/11/2013	20:47 - 21:17	0.97	8.84	7.56	13.30	14.20	1.39	0.26	-1.13
6	14/11/2013	21:47 - 22:17	0.98	9.18	7.30	13.44	14.38	1.43	0.26	-1.16
7	14/11/2013	22:47 - 23:17	0.83	5.92	7.06	13.41	14.40	1.17	0.26	-0.90
8	15/11/2013	23:47 - 00:17	0.94	2.47	6.25	13.43	14.42	1.28	0.26	-1.02
9	15/11/2013	00:47 - 01:17	1.00	4.36	6.32	14.05	14.67	1.50	0.27	-1.23
10	15/11/2013	01:47 - 02:17	1.02	5.25	5.47	14.52	15.05	1.67	0.29	-1.38
11	15/11/2013	02:47 - 03:17	1.07	5.82	6.01	14.36	14.84	1.72	0.28	-1.44
12	15/11/2013	03:47 - 04:17	0.95	8.08	5.43	14.66	14.78	1.63	0.27	-1.35
13	15/11/2013	04:47 - 05:17	0.97	4.16	5.71	13.87	14.97	1.41	0.28	-1.13
14	15/11/2013	05:47 - 06:17	0.98	3.27	5.67	14.20	15.08	1.49	0.29	-1.20
15	15/11/2013	06:47 - 07:17	0.94	3.89	5.97	13.75	14.67	1.34	0.27	-1.07
16	15/11/2013	07:47 - 08:17	0.92	3.54	5.69	13.65	14.61	1.30	0.27	-1.03
MAX								1.72	Sd	0.15

Test of Variability

$Q_0 = ELV \times (MU / 100) / 1.96$	1.53
Kv for 16 Pairs of Data	0.9777

The variability is accepted if $Sd \leq 1.5 \times Q_0 \times Kv$

Parameter	Value
Standard Deviation (Sd)	0.15
$1.5 \times Q_0 \times Kv$	2.24
Outcome of Variability Test	Pass

Test of Calibration (Acceptance of Calibration Function)

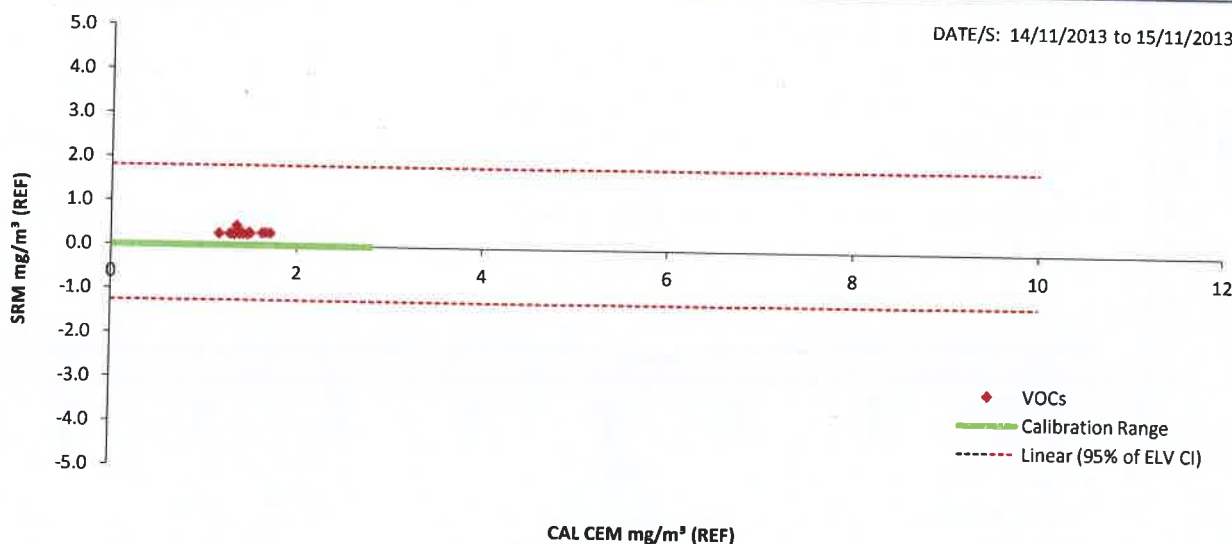
$t_{0.95} (N-1)$	1.746
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where N (number of samples) = 16

The calibration is accepted if $D \leq t_{0.95} (N-1) \times Sd / \sqrt{N} + Q_0$

Parameter	Value
Mean Difference (D)	1.16
$t_{0.95} (N-1) \times Sd / \sqrt{N} + Q_0$	1.60
Outcome of Calibration Test	Pass

PLOT 2: X-Y Plot - REF CAL CEMS vs REF SRM Values



OXIDES OF NITROGEN (as NO₂): AST CALCULATIONS

(Page 1 of 2)

SITA UK Ltd, Wrexham

A1 - Main Stack

Calibration Data

Pair	Date	Time (30-minute Average)	x, CEMS (STP, DRY) mg/m ³	y, SRM (STP, DRY) mg/m ³	SRM (STP, DRY, 11% O ₂) mg/m ³	x - x _{av} (A)	y - y _{av} (B)	(A) x (B)	(x - x _{av}) ²	CAL CEMS (STP, DRY) mg/m ³
1	14/11/2013	22:50 - 23:20	181.16	167.66	253.81	49.43	45.76	2261.98	2443.43	181.16
2	14/11/2013	16:47 - 17:17	111.56	108.50	173.10	-20.17	-13.40	270.31	406.68	111.56
3	14/11/2013	17:47 - 18:17	154.81	153.07	218.65	23.08	31.17	719.40	532.78	154.81
4	14/11/2013	18:47 - 19:17	132.24	121.90	177.69	0.51	0.00	0.00	0.26	132.24
5	14/11/2013	19:47 - 20:17	110.66	101.13	171.44	-21.07	-20.77	437.48	443.74	110.66
6	14/11/2013	20:47 - 21:17	134.80	124.67	183.30	3.07	2.77	8.53	9.45	134.80
7	14/11/2013	21:47 - 22:17	175.72	163.23	246.75	43.99	41.33	1818.06	1935.24	175.72
8	15/11/2013	00:47 - 01:17	171.32	165.59	261.59	39.60	43.69	1730.10	1567.99	171.32
9	15/11/2013	01:47 - 02:17	129.66	120.79	203.08	-2.06	-1.11	2.30	4.26	129.66
10	15/11/2013	02:47 - 03:17	113.56	105.14	170.73	-18.17	-16.77	304.63	330.16	113.56
11	15/11/2013	03:47 - 04:17	96.47	84.15	135.30	-35.26	-37.75	1330.82	1243.08	96.47
12	15/11/2013	04:47 - 05:17	79.21	68.68	113.92	-52.52	-53.22	2795.09	2758.03	79.21
13	15/11/2013	05:47 - 06:17	95.57	84.30	142.41	-36.15	-37.60	1359.31	1306.95	95.57
14	15/11/2013	06:47 - 07:17	149.41	135.42	213.93	17.69	13.52	239.18	312.88	149.41
15	15/11/2013	07:47 - 08:17	139.74	124.28	194.46	8.01	2.37	19.03	64.22	139.74
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	147.67				
					DAILY ELV (mg/m ³)	400				
					MU (%)	20				
					15% of ELV	60.00				
							SUM	13296.22	13359.17	

Existing Calibration Function

$$y = 1.0864x + 1.9716$$

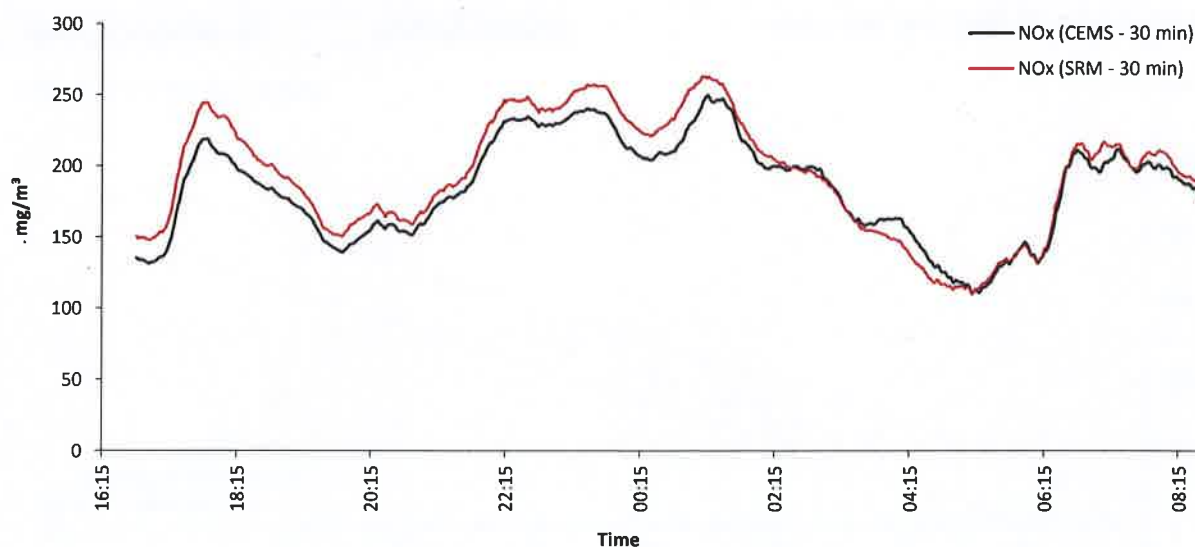
Source of Existing Calibration Function

CAT-1323-14181 SITA Wrexham A1 Main Stack QAL2 Report V1

Existing Calibration Range

0 to 189.3 mg/m³ at 11% O₂

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



OXIDES OF NITROGEN (as NO₂): AST CALCULATIONS

(Page 2 of 2)

SITA UK Ltd, Wrexham

A1 - Main Stack

Variability Test Data

Pair	Date	Time (30-minute Average)	CAL CEMS (STP, DRY) mg/m ³	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 ₂) mg/m ³	SRM (STP, DRY, 11% O ₂) mg/m ³	ys, SRM - CAL CEMS
1	14/11/2013	22:50 - 23:20	181.16	5.76	7.09	13.40	14.39	238.52	253.81	15.29
2	14/11/2013	16:47 - 17:17	111.56	5.39	6.54	13.70	14.73	152.73	173.10	20.37
3	14/11/2013	17:47 - 18:17	154.81	7.77	7.62	13.13	14.00	196.72	218.65	21.93
4	14/11/2013	18:47 - 19:17	132.24	17.11	6.18	13.03	14.14	165.91	177.69	11.78
5	14/11/2013	19:47 - 20:17	110.66	5.86	6.43	14.04	15.10	159.09	171.44	12.35
6	14/11/2013	20:47 - 21:17	134.80	8.84	7.56	13.30	14.20	174.98	183.30	8.32
7	14/11/2013	21:47 - 22:17	175.72	9.18	7.30	13.44	14.38	232.33	246.75	14.42
8	15/11/2013	00:47 - 01:17	171.32	4.36	6.32	14.05	14.67	246.54	261.59	15.04
9	15/11/2013	01:47 - 02:17	129.66	5.25	5.47	14.52	15.05	200.00	203.08	3.08
10	15/11/2013	02:47 - 03:17	113.56	5.82	6.01	14.36	14.84	170.98	170.73	-0.24
11	15/11/2013	03:47 - 04:17	96.47	8.08	5.43	14.66	14.78	152.27	135.30	-16.97
12	15/11/2013	04:47 - 05:17	79.21	4.16	5.71	13.87	14.97	111.06	113.92	2.85
13	15/11/2013	05:47 - 06:17	95.57	3.27	5.67	14.20	15.08	140.58	142.41	1.83
14	15/11/2013	06:47 - 07:17	149.41	3.89	5.97	13.75	14.67	206.12	213.93	7.81
15	15/11/2013	07:47 - 08:17	139.74	3.54	5.69	13.65	14.61	190.04	194.46	4.42
MAX								246.54	Sd	9.70

Test of Variability

$Q_0 = ELV \times (MU / 100) / 1.96$	40.82
Kv for 15 Pairs of Data	0.9761

The variability is accepted if $Sd \leq 1.5 \times Q_0 \times Kv$

Parameter	Value
Standard Deviation (Sd)	9.70
$1.5 \times Q_0 \times Kv$	59.76
Outcome of Variability Test	Pass

Test of Calibration (Acceptance of Calibration Function)

$t_{0.95} (N-1)$	1.753
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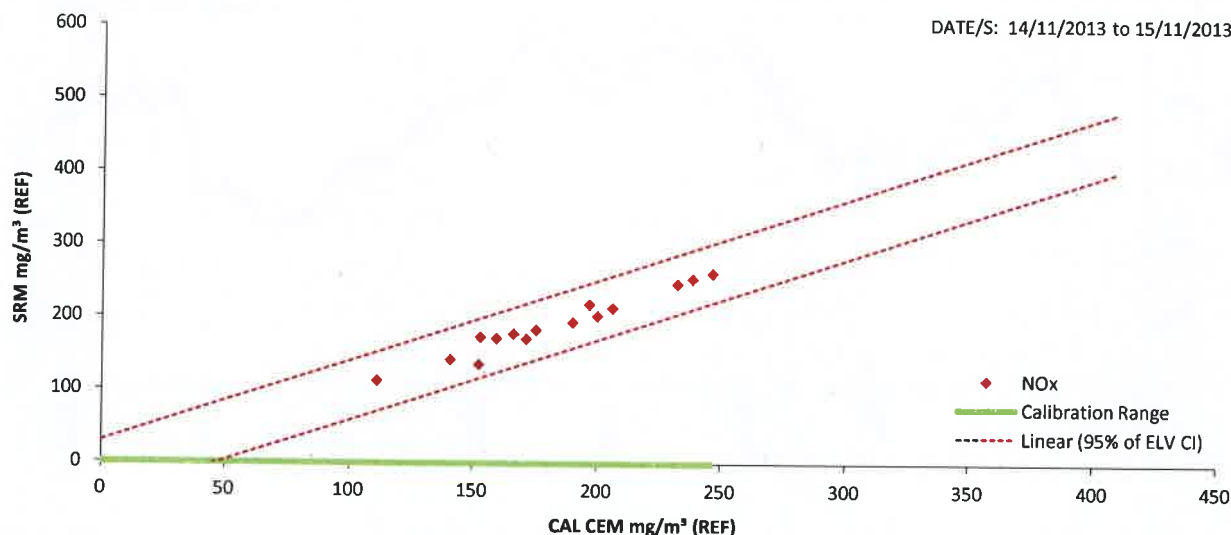
where N (number of samples) = 15

The calibration is accepted if $D \leq t_{0.95} (N-1) \times Sd / \sqrt{N} + Q_0$

Parameter	Value
Mean Difference (D)	8.15
$t_{0.95} (N-1) \times Sd / \sqrt{N} + Q_0$	45.21
Outcome of Calibration Test	Pass

PLOT 2: X-Y Plot - REF CAL CEMS vs REF SRM Values

New Calibration Range	0 to 246.5 mg/m ³ at 11% O ₂
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SULPHUR DIOXIDE: AST CALCULATIONS

(Page 1 of 2)

SITA UK Ltd, Wrexham

A1 - Main Stack

Calibration Data

Pair	Date	Time (30-minute Average)	x, CEMS (STP, DRY) mg/m ³	y, SRM (STP, DRY) mg/m ³	SRM (STP, DRY, 11% O ₂) mg/m ³	x - x _{av} (A)	y - y _{av} (B)	(A) x (B)	(x - x _{av}) ²	CAL CEMS (STP, DRY) mg/m ³
1	14/11/2013	16:47 - 17:17	5.91	10.17	16.23	-9.02	-12.86	115.99	81.37	5.91
2	14/11/2013	17:47 - 18:17	33.27	33.40	47.71	18.34	10.37	190.22	336.36	33.27
3	14/11/2013	18:47 - 19:17	110.03	105.27	153.45	95.10	82.24	7821.20	9043.80	110.03
4	14/11/2013	19:47 - 20:17	25.38	31.49	53.38	10.46	8.46	88.45	109.32	25.38
5	14/11/2013	20:47 - 21:17	9.24	13.81	20.30	-5.69	-9.22	52.47	32.38	9.24
6	14/11/2013	21:47 - 22:17	20.57	23.71	35.84	5.65	0.68	3.82	31.87	20.57
7	14/11/2013	22:47 - 23:17	2.08	12.74	19.31	-12.85	-10.29	132.29	165.13	2.08
8	15/11/2013	23:47 - 00:17	2.29	15.40	23.38	-12.63	-7.63	96.46	159.63	2.29
9	15/11/2013	00:47 - 01:17	-2.04	11.70	18.48	-16.96	-11.33	192.26	287.73	-2.04
10	15/11/2013	01:47 - 02:17	-0.51	12.98	21.82	-15.44	-10.05	155.18	238.43	-0.51
11	15/11/2013	02:47 - 03:17	2.08	13.68	22.22	-12.85	-9.35	120.13	165.08	2.08
12	15/11/2013	03:47 - 04:17	3.39	14.79	23.78	-11.53	-8.24	95.05	133.06	3.39
13	15/11/2013	04:47 - 05:17	2.66	14.46	23.99	-12.26	-8.57	105.10	150.43	2.66
14	15/11/2013	05:47 - 06:17	10.28	20.70	34.97	-4.64	-2.33	10.83	21.57	10.28
15	15/11/2013	06:47 - 07:17	6.00	16.00	25.28	-8.92	-7.03	62.70	79.63	6.00
16	15/11/2013	07:47 - 08:17	8.20	18.19	28.46	-6.72	-4.84	32.56	45.23	8.20

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	137.22
DAILY ELV (mg/m ³)	50
MU (%)	20
15% of ELV	7.50

SUM 9274.72 11081.02

Existing Calibration Function

y = x

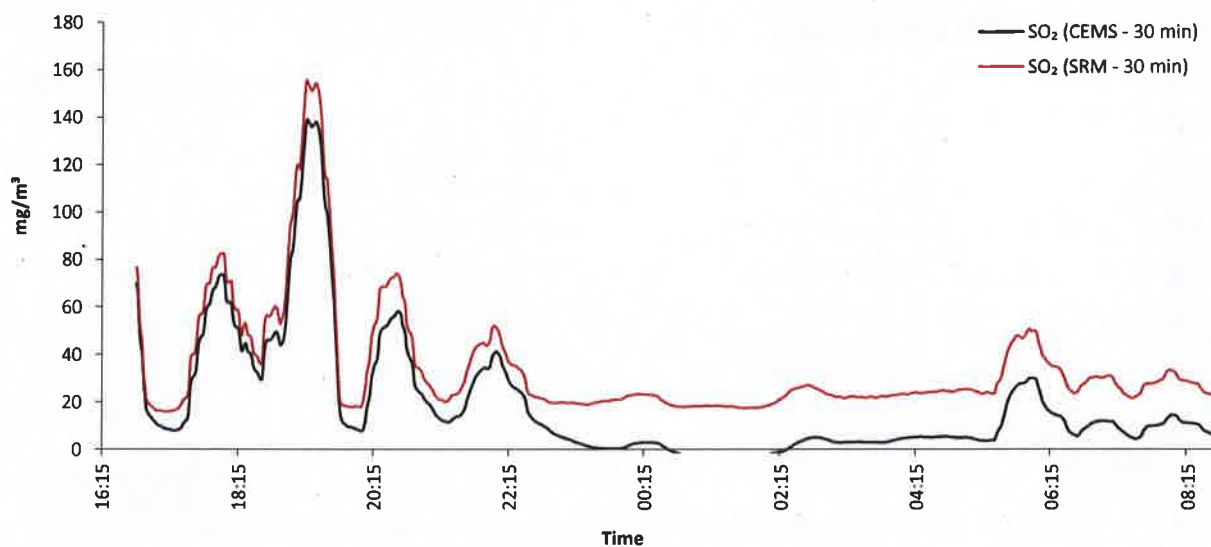
Source of Existing Calibration Function

CAT-1323-14181 SITA Wrexham A1 Main Stack QAL2 Report V1

Existing Calibration Range

N/A

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



SULPHUR DIOXIDE: AST CALCULATIONS

(Page 2 of 2)

SITA UK Ltd, Wrexham

A1 - Main Stack

Variability Test Data

Pair	Date	Time (30-minute Average)	CAL CEMS (STP, DRY) mg/m ³	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 ₂) mg/m ³	SRM (STP, DRY, 11% O ₂) mg/m ³	ys, SRM - CAL CEMS
1	14/11/2013	16:47 - 17:17	5.91	5.39	6.54	13.70	14.73	8.09	16.23	8.14
2	14/11/2013	17:47 - 18:17	33.27	7.77	7.62	13.13	14.00	42.27	47.71	5.44
3	14/11/2013	18:47 - 19:17	110.03	17.11	6.18	13.03	14.14	138.04	153.45	15.41
4	14/11/2013	19:47 - 20:17	25.38	5.86	6.43	14.04	15.10	36.49	53.38	16.89
5	14/11/2013	20:47 - 21:17	9.24	8.84	7.56	13.30	14.20	11.99	20.30	8.31
6	14/11/2013	21:47 - 22:17	20.57	9.18	7.30	13.44	14.38	27.20	35.84	8.64
7	14/11/2013	22:47 - 23:17	2.08	5.92	7.06	13.41	14.40	2.73	19.31	16.57
8	15/11/2013	23:47 - 00:17	2.29	2.47	6.25	13.43	14.42	3.03	23.38	20.36
9	15/11/2013	00:47 - 01:17	-2.04	4.36	6.32	14.05	14.67	-2.93	18.48	21.41
10	15/11/2013	01:47 - 02:17	-0.51	5.25	5.47	14.52	15.05	-0.79	21.82	22.62
11	15/11/2013	02:47 - 03:17	2.08	5.82	6.01	14.36	14.84	3.13	22.22	19.09
12	15/11/2013	03:47 - 04:17	3.39	8.08	5.43	14.66	14.78	5.35	23.78	18.42
13	15/11/2013	04:47 - 05:17	2.66	4.16	5.71	13.87	14.97	3.73	23.99	20.25
14	15/11/2013	05:47 - 06:17	10.28	3.27	5.67	14.20	15.08	15.12	34.97	19.84
15	15/11/2013	06:47 - 07:17	6.00	3.89	5.97	13.75	14.67	8.28	25.28	17.00
16	15/11/2013	07:47 - 08:17	8.20	3.54	5.69	13.65	14.61	11.15	28.46	17.31
MAX								138.04	Sd	5.36

Test of Variability

$Q_d = ELV \times (MU / 100) / 1.96$	5.10
Kv for 16 Pairs of Data	0.9777

The variability is accepted if $Sd \leq 1.5 \times Q_d \times Kv$

Parameter	Value
Standard Deviation (Sd)	5.36
$1.5 \times Q_d \times Kv$	7.48
Outcome of Variability Test	Pass

Test of Calibration (Acceptance of Calibration Function)

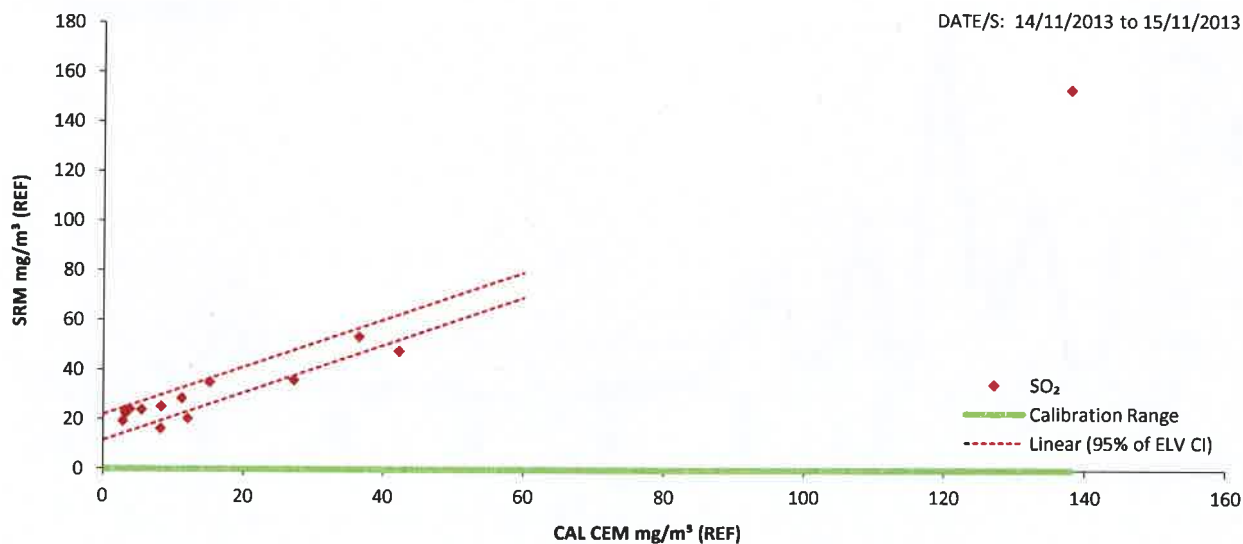
$t_{0.95} (N-1)$	1.746
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where N (number of samples) = 16

The calibration is accepted if $D \leq t_{0.95} (N-1) \times Sd / \sqrt{N} + Q_d$

Parameter	Value
Mean Difference (D)	15.98
$t_{0.95} (N-1) \times Sd / \sqrt{N} + Q_d$	7.44
Outcome of Calibration Test	Fail

PLOT 2: X-Y Plot - REF CAL CEMS vs REF SRM Values



CARBON MONOXIDE: AST CALCULATIONS

(Page 1 of 2)

SITA UK Ltd, Wrexham

A1 - Main Stack

Calibration Data

Pair	Date	Time (30-minute Average)	x, CEMS (STP, WET) mg/m ³	y, SRM (STP, WET) mg/m ³	SRM (STP, DRY, 11% O ₂) mg/m ³	x - x _{av} (A)	y - y _{av} (B)	(A) x (B)	(x - x _{av}) ²	CAL CEMS (STP, WET) mg/m ³
1	14/11/2013	19:43 - 20:13	1.14	2.17	3.99	0.32	1.57	0.50	0.10	1.14
2	14/11/2013	16:47 - 17:17	0.83	1.21	2.06	0.01	0.61	0.01	0.00	0.83
3	14/11/2013	17:47 - 18:17	0.69	0.69	1.07	-0.13	0.10	-0.01	0.02	0.69
4	14/11/2013	20:47 - 21:17	0.75	1.17	1.87	-0.07	0.57	-0.04	0.00	0.75
5	14/11/2013	21:47 - 22:17	0.79	0.33	0.54	-0.03	-0.27	0.01	0.00	0.79
6	14/11/2013	22:47 - 23:17	0.69	0.33	0.54	-0.13	-0.27	0.04	0.02	0.69
7	15/11/2013	23:47 - 00:17	0.60	0.33	0.53	-0.22	-0.27	0.06	0.05	0.60
8	15/11/2013	00:47 - 01:17	0.63	0.38	0.64	-0.19	-0.22	0.04	0.04	0.63
9	15/11/2013	01:47 - 02:17	0.75	0.34	0.61	-0.07	-0.26	0.02	0.01	0.75
10	15/11/2013	02:47 - 03:17	0.87	0.39	0.67	0.05	-0.21	-0.01	0.00	0.87
11	15/11/2013	03:47 - 04:17	0.81	0.33	0.56	-0.01	-0.27	0.00	0.00	0.81
12	15/11/2013	04:47 - 05:17	1.01	0.33	0.58	0.19	-0.27	-0.05	0.04	1.01
13	15/11/2013	05:47 - 06:17	1.07	0.33	0.59	0.25	-0.27	-0.07	0.06	1.07
14	15/11/2013	06:47 - 07:17	0.78	0.33	0.55	-0.04	-0.27	0.01	0.00	0.78
15	15/11/2013	07:47 - 08:17	0.90	0.33	0.55	0.08	-0.27	-0.02	0.01	0.90

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

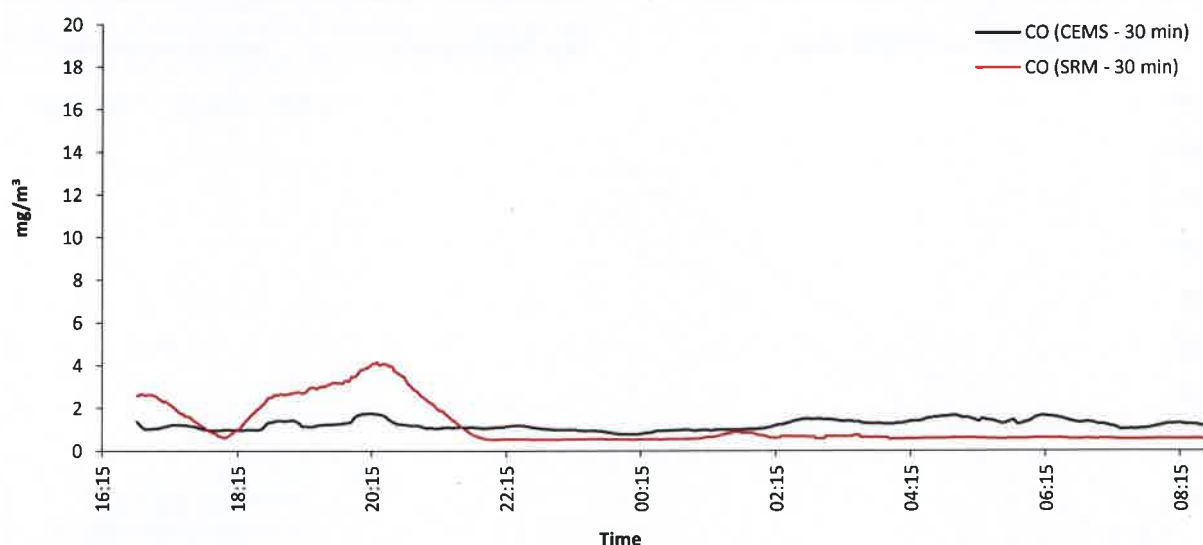
SPREAD OF DATA	3.45
DAILY ELV (mg/m ³)	50
MU (%)	20
15% of ELV	7.50

Existing Calibration Function
y = x

Source of Existing Calibration Function
CAT-1323-14181 SITA Wrexham A1 Main Stack QAL2 Report V1

Existing Calibration Range
0 to 91 mg/m ³ at 11% O ₂

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



CARBON MONOXIDE: AST CALCULATIONS

(Page 2 of 2)

SITA UK Ltd, Wrexham

A1 - Main Stack

Variability Test Data

Pair	Date	Time (30-minute Average)	CAL CEMS (STP, WET) mg/m ³	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 ₂) mg/m ³	SRM (STP, DRY, 11% O ₂) mg/m ³	ys, SRM - CAL CEMS
1	14/11/2013	19:43 - 20:13	1.14	5.89	6.25	14.11	15.20	1.76	3.99	2.23
2	14/11/2013	16:47 - 17:17	0.83	5.39	6.54	13.70	14.73	1.21	2.06	0.86
3	14/11/2013	17:47 - 18:17	0.69	7.77	7.62	13.13	14.00	0.95	1.07	0.12
4	14/11/2013	20:47 - 21:17	0.75	8.84	7.56	13.30	14.20	1.07	1.87	0.79
5	14/11/2013	21:47 - 22:17	0.79	9.18	7.30	13.44	14.38	1.15	0.54	-0.62
6	14/11/2013	22:47 - 23:17	0.69	5.92	7.06	13.41	14.40	0.96	0.54	-0.42
7	15/11/2013	23:47 - 00:17	0.60	2.47	6.25	13.43	14.42	0.82	0.53	-0.28
8	15/11/2013	00:47 - 01:17	0.63	4.36	6.32	14.05	14.67	0.95	0.64	-0.31
9	15/11/2013	01:47 - 02:17	0.75	5.25	5.47	14.52	15.05	1.22	0.61	-0.61
10	15/11/2013	02:47 - 03:17	0.87	5.82	6.01	14.36	14.84	1.39	0.67	-0.72
11	15/11/2013	03:47 - 04:17	0.81	8.08	5.43	14.66	14.78	1.39	0.56	-0.83
12	15/11/2013	04:47 - 05:17	1.01	4.16	5.71	13.87	14.97	1.48	0.58	-0.90
13	15/11/2013	05:47 - 06:17	1.07	3.27	5.67	14.20	15.08	1.63	0.59	-1.03
14	15/11/2013	06:47 - 07:17	0.78	3.89	5.97	13.75	14.67	1.12	0.55	-0.57
15	15/11/2013	07:47 - 08:17	0.90	3.54	5.69	13.65	14.61	1.27	0.55	-0.72
MAX								1.76	Sd	0.88

Test of Variability

$Q_0 = ELV \times (MU / 100) / 1.96$	5.10
Kv for 15 Pairs of Data	0.9761

The variability is accepted if $Sd \leq 1.5 \times Q_0 \times Kv$

Parameter	Value
Standard Deviation (Sd)	0.88
$1.5 \times Q_0 \times Kv$	7.47
Outcome of Variability Test	Pass

Test of Calibration (Acceptance of Calibration Function)

$t_{0.95} (N-1)$	1.753
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where N (number of samples) = 15

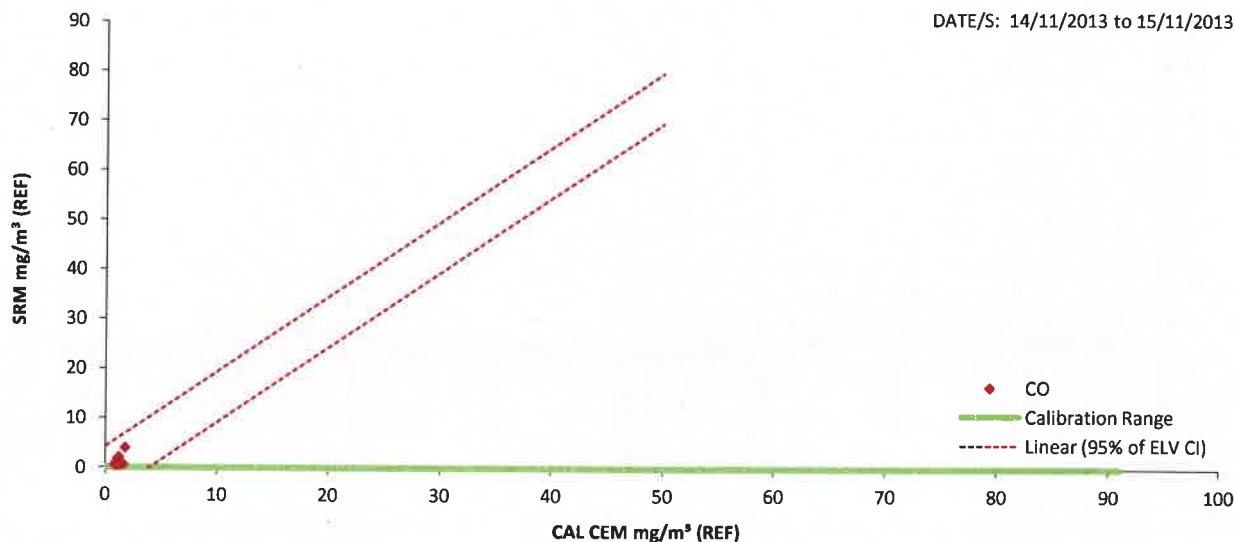
The calibration is accepted if $D \leq t_{0.95} (N-1) \times Sd / \sqrt{N} + Q_0$

Parameter	Value
Mean Difference (D)	0.20
$t_{0.95} (N-1) \times Sd / \sqrt{N} + Q_0$	5.50
Outcome of Calibration Test	Pass

PLOT 2: X-Y Plot - REF CAL CEMS vs REF SRM Values

New Calibration Range	Existing Range Still Valid
-----------------------	----------------------------

DATE/S: 14/11/2013 to 15/11/2013



HYDROGEN CHLORIDE: AST CALCULATIONS

(Page 1 of 2)

SITA UK Ltd, Wrexham

A1 - Main Stack

Calibration Data

Pair	Date	Time (30-minute Average)	x, CEMS (STP, DRY) mg/m³	y, SRM (STP, DRY) mg/m³	SRM (STP, DRY, 11% O₂) mg/m³	$x - x_{av}$ (A)	$y - y_{av}$ (B)	(A) x (B)	$(x - x_{av})^2$	CAL CEMS (STP, DRY) mg/m³
1	14/11/2013	17:39 - 18:09	22.56	20.79	30.14	11.00	11.81	129.95	120.98	9.62
2	14/11/2013	20:39 - 21:09	18.13	16.69	24.43	6.57	7.71	50.67	43.14	7.73
3	14/11/2013	21:39 - 22:09	15.15	14.78	22.03	3.59	5.81	20.85	12.88	6.46
4	14/11/2013	22:39 - 23:09	10.14	10.20	15.33	-1.42	1.23	-1.74	2.01	4.34
5	15/11/2013	23:39 - 00:09	9.49	7.31	10.90	-2.07	-1.66	3.44	4.28	4.06
6	15/11/2013	00:39 - 01:09	8.94	6.68	10.74	-2.61	-2.29	5.98	6.84	3.83
7	15/11/2013	01:39 - 02:09	7.69	4.71	7.74	-3.86	-4.26	16.47	14.93	3.29
8	15/11/2013	02:39 - 03:09	8.90	5.81	9.45	-2.66	-3.16	8.42	7.09	3.81
9	15/11/2013	03:39 - 04:09	8.58	5.10	8.04	-2.98	-3.87	11.56	8.90	3.67
10	15/11/2013	04:39 - 05:09	8.52	5.33	8.99	-3.04	-3.64	11.05	9.22	3.65
11	15/11/2013	05:39 - 06:09	12.75	7.90	13.57	1.19	-1.08	-1.28	1.41	5.44
12	15/11/2013	06:39 - 07:09	9.73	6.22	10.05	-1.83	-2.75	5.04	3.35	4.16
13	15/11/2013	07:39 - 08:09	9.69	5.13	8.07	-1.87	-3.85	7.18	3.48	4.14

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		22.40
DAILY ELV (mg/m³)		10
MU (%)		40
15% of ELV		1.50

SUM

267.58

238.50

Existing Calibration Function

$$y = 0.4253x + 0.0222$$

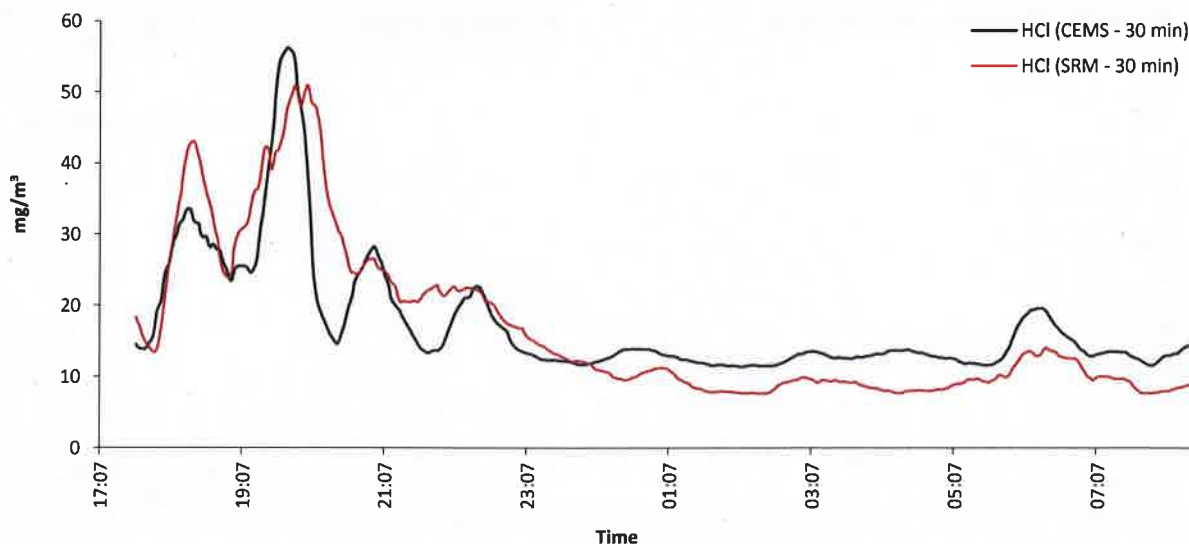
Source of Existing Calibration Function

CAT-1323-14181 SITA Wrexham A1 Main Stack QAL2 Report V1

Existing Calibration Range

0 to 4.9 mg/m³ at 11% O₂

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



HYDROGEN CHLORIDE: AST CALCULATIONS

(Page 2 of 2)

SITA UK Ltd, Wrexham

A1 - Main Stack

Variability Test Data

Pair	Date	Time (30-minute Average)	CAL CEMS (STP, DRY) mg/m ³	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 ₂) mg/m ³	SRM (STP, DRY, 11% O ₂) mg/m ³	ys, SRM - CAL CEMS
1	14/11/2013	17:39 - 18:09	9.62	7.04	7.70	13.24	14.10	12.40	30.14	17.74
2	14/11/2013	20:39 - 21:09	7.73	8.37	7.55	13.27	14.17	10.01	24.43	14.43
3	14/11/2013	21:39 - 22:09	6.46	9.79	7.20	13.33	14.29	8.43	22.03	13.59
4	14/11/2013	22:39 - 23:09	4.34	6.04	7.06	13.35	14.35	5.66	15.33	9.67
5	15/11/2013	23:39 - 00:09	4.06	3.60	6.51	13.27	14.29	5.25	10.90	5.65
6	15/11/2013	00:39 - 01:09	3.83	3.33	6.32	14.08	14.78	5.53	10.74	5.21
7	15/11/2013	01:39 - 02:09	3.29	4.86	5.58	14.29	14.91	4.91	7.74	2.83
8	15/11/2013	02:39 - 03:09	3.81	6.58	5.88	14.46	14.85	5.82	9.45	3.63
9	15/11/2013	03:39 - 04:09	3.67	7.98	5.83	14.58	14.66	5.71	8.04	2.33
10	15/11/2013	04:39 - 05:09	3.65	3.59	5.54	14.15	15.07	5.32	8.99	3.67
11	15/11/2013	05:39 - 06:09	5.44	3.32	5.65	14.29	15.18	8.12	13.57	5.45
12	15/11/2013	06:39 - 07:09	4.16	3.36	5.75	13.67	14.81	5.67	10.05	4.38
13	15/11/2013	07:39 - 08:09	4.14	2.56	5.81	13.59	14.65	5.59	8.07	2.48
MAX								12.40	Sd	5.14

Test of Variability

$Q_0 = ELV \times (MU / 100) / 1.96$	2.04
Kv for 13 Pairs of Data	0.9721

The variability is accepted if $Sd \leq 1.5 \times Q_0 \times Kv$

Parameter	Value
Standard Deviation (Sd)	5.14
$1.5 \times Q_0 \times Kv$	2.98
Outcome of Variability Test	Fail

Test of Calibration (Acceptance of Calibration Function)

$t_{0.95} (N-1)$	1.782
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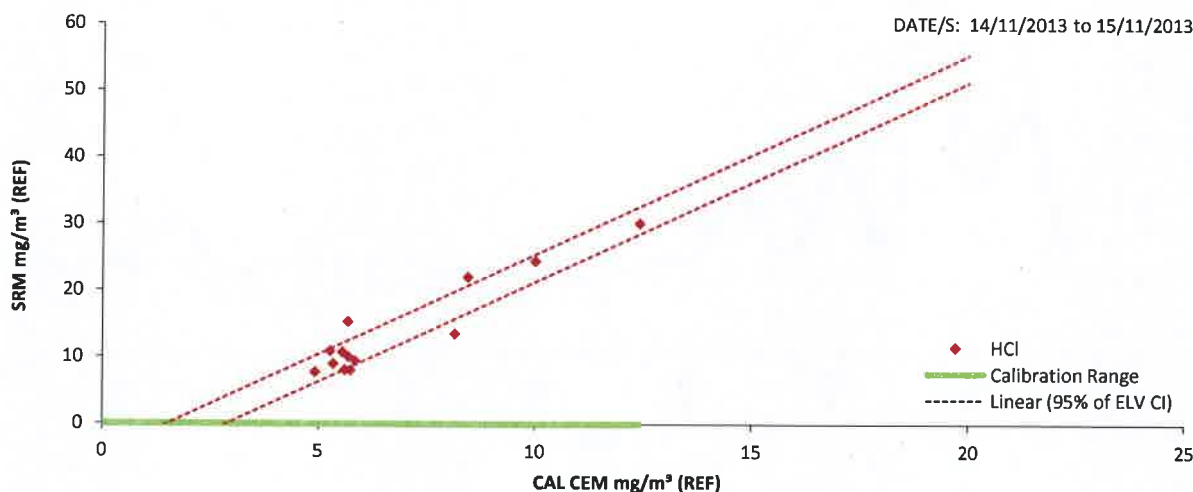
where N (number of samples) = 13

The calibration is accepted if $D \leq t_{0.95} (N-1) \times Sd / \text{SQRT} (N) + Q_0$

Parameter	Value
Mean Difference (D)	7.00
$t_{0.95} (N-1) \times Sd / \text{SQRT} (N) + Q_0$	4.58
Outcome of Calibration Test	Fail

PLOT 2: X-Y Plot - REF CAL CEMS vs REF SRM Values

New Calibration Range	N/A
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Section 4B - Data and Calculations - AST
WATER VAPOUR: AST CALCULATIONS

(Page 1 of 2)

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	14/11/2013	16:29 - 16:59	4.85	6.00	-1.31	-0.31	0.41	1.73	5.60
2	14/11/2013	17:29 - 17:59	4.67	7.57	-1.49	1.26	-1.88	2.23	5.42
3	14/11/2013	18:29 - 18:59	5.87	6.61	-0.29	0.30	-0.09	0.09	6.66
4	14/11/2013	19:29 - 19:59	5.61	5.49	-0.55	-0.82	0.46	0.31	6.39
5	14/11/2013	20:29 - 20:59	5.01	7.52	-1.15	1.21	-1.40	1.33	5.77
6	14/11/2013	22:29 - 22:59	5.33	7.28	-0.83	0.97	-0.81	0.70	6.10
7	14/11/2013	23:29 - 23:59	6.50	6.72	0.34	0.41	0.14	0.11	7.31
8	15/11/2013	00:29 - 00:59	8.75	6.49	2.59	0.18	0.47	6.69	9.65
9	15/11/2013	01:29 - 01:59	6.37	5.82	0.21	-0.49	-0.10	0.04	7.18
10	15/11/2013	02:29 - 02:59	5.41	5.81	-0.75	-0.50	0.38	0.57	6.18
11	15/11/2013	03:29 - 03:59	3.54	6.10	-2.62	-0.21	0.56	6.89	4.24
12	15/11/2013	04:29 - 04:59	7.74	5.27	1.58	-1.04	-1.63	2.48	8.60
13	15/11/2013	05:29 - 05:59	7.61	5.91	1.45	-0.40	-0.58	2.09	8.47
14	15/11/2013	06:29 - 06:59	9.04	5.75	2.88	-0.56	-1.62	8.27	9.95

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	2.30
EFFECTIVE ELV (% v/v)	30
MU (%)	30
15% of ELV	4.50

SUM	-5.71	33.52
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Existing Calibration Function

$$y = 1.0373x + 0.5712$$

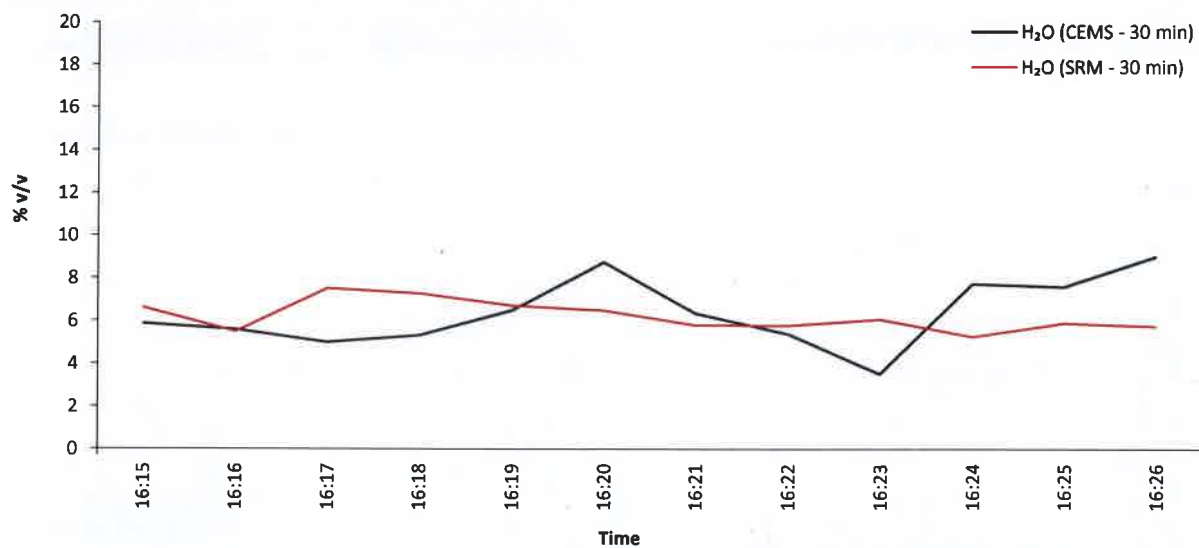
Source of Existing Calibration Function

CAT-1323-14181 SITA Wrexham A1 Main Stack QAL2 Report V1

Existing Calibration Range

0 to 11.7 % v/v

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



WATER VAPOUR: AST CALCULATIONS

(Page 2 of 2)

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	14/11/2013	16:29 - 16:59	5.60	6.00	0.40
2	14/11/2013	17:29 - 17:59	5.42	7.57	2.15
3	14/11/2013	18:29 - 18:59	6.66	6.61	-0.05
4	14/11/2013	19:29 - 19:59	6.39	5.49	-0.90
5	14/11/2013	20:29 - 20:59	5.77	7.52	1.76
6	14/11/2013	22:29 - 22:59	6.10	7.28	1.18
7	14/11/2013	23:29 - 23:59	7.31	6.72	-0.60
8	15/11/2013	00:29 - 00:59	9.65	6.49	-3.16
9	15/11/2013	01:29 - 01:59	7.18	5.82	-1.36
10	15/11/2013	02:29 - 02:59	6.18	5.81	-0.37
11	15/11/2013	03:29 - 03:59	4.24	6.10	1.85
12	15/11/2013	04:29 - 04:59	8.60	5.27	-3.33
13	15/11/2013	05:29 - 05:59	8.47	5.91	-2.56
14	15/11/2013	06:29 - 06:59	9.95	5.75	-4.20
MAX			9.95	Sd	2.06

Test of Variability

$Q_0 = ELV \times (MU / 100) / 1.96$	4.59
Kv for 14 Pairs of Data	0.9742

The variability is accepted if $Sd \leq 1.5 \times Q_0 \times Kv$

Parameter	Value
Standard Deviation (Sd)	2.06
$1.5 \times Q_0 \times Kv$	6.71
Outcome of Variability Test	Pass

Test of Calibration (Acceptance of Calibration Function)

$t_{0.95} (N-1)$	1.771
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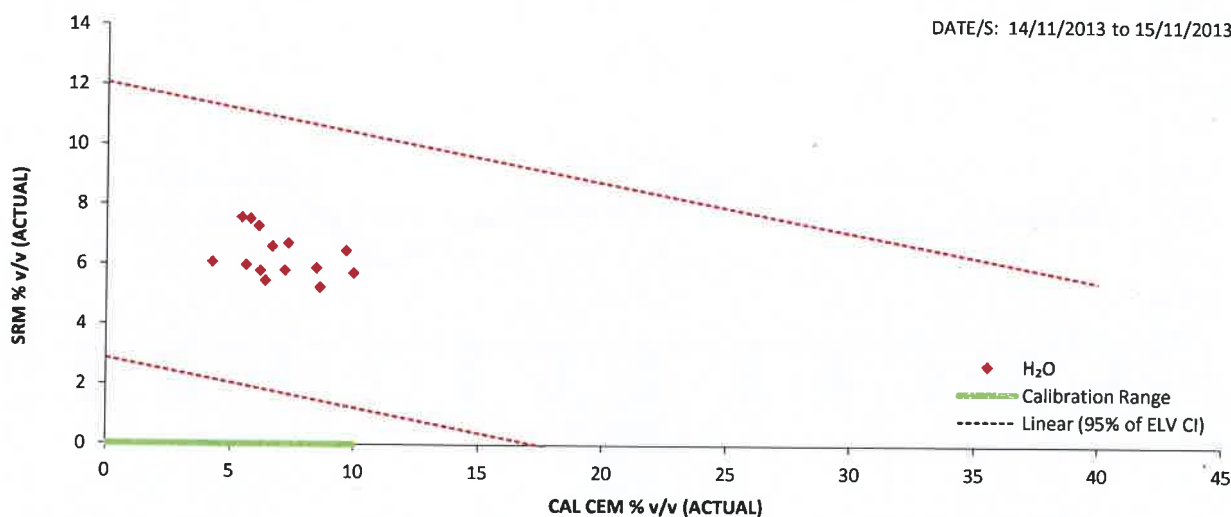
where N (number of samples) = 14

The calibration is accepted if $D \leq t_{0.95} (N-1) \times Sd / \text{SQRT} (N) + Q_0$

Parameter	Value
Mean Difference (D)	0.66
$t_{0.95} (N-1) \times Sd / \text{SQRT} (N) + Q_0$	5.57
Outcome of Calibration Test	Pass

PLOT 2: X-Y Plot - REF CAL CEMS vs REF SRM Values

New Calibration Range	Existing Range Still Valid
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OXYGEN: AST CALCULATIONS

(Page 1 of 2)

SITA UK Ltd, Wrexham

A1 - Main Stack

Calibration Data

Pair	Date	Time (30-minute Average)	x, CEMS (WET) % v/v	y, SRM (WET) % v/v	x - x _{av} (A)	y - y _{av} (B)	(A) x (B)	(x - x _{av}) ²	CAL CEMS (WET) % v/v
1	14/11/2013	18:58 - 19:28	13.14	14.33	-0.57	-0.27	0.15	0.33	14.69
2	14/11/2013	16:47 - 17:17	13.70	14.73	-0.01	0.13	0.00	0.00	15.32
3	14/11/2013	17:47 - 18:17	13.13	14.00	-0.58	-0.60	0.35	0.33	14.69
4	14/11/2013	20:47 - 21:17	13.30	14.20	-0.41	-0.40	0.16	0.17	14.87
5	14/11/2013	21:47 - 22:17	13.44	14.38	-0.27	-0.21	0.06	0.07	15.03
6	14/11/2013	22:47 - 23:17	13.41	14.40	-0.30	-0.19	0.06	0.09	15.00
7	15/11/2013	23:47 - 00:17	13.43	14.42	-0.28	-0.18	0.05	0.08	15.02
8	15/11/2013	00:47 - 01:17	14.05	14.67	0.34	0.07	0.02	0.12	15.72
9	15/11/2013	01:47 - 02:17	14.52	15.05	0.81	0.46	0.37	0.65	16.24
10	15/11/2013	02:47 - 03:17	14.36	14.84	0.65	0.25	0.16	0.42	16.06
11	15/11/2013	04:47 - 05:17	13.87	14.97	0.16	0.37	0.06	0.03	15.51
12	15/11/2013	05:47 - 06:17	14.20	15.08	0.49	0.48	0.24	0.24	15.89
13	15/11/2013	06:47 - 07:17	13.75	14.67	0.04	0.07	0.00	0.00	15.38
14	15/11/2013	07:47 - 08:17	13.65	14.61	-0.06	0.01	0.00	0.00	15.27
					SUM		1.68	2.54	

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

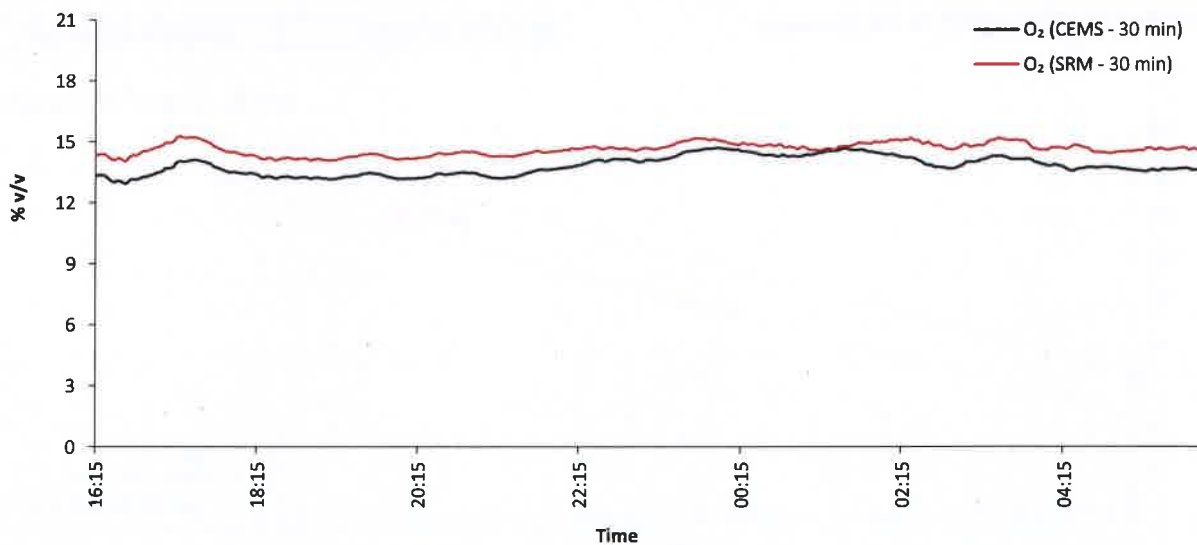
SPREAD OF DATA	1.08
EFFECTIVE ELV (% v/v)	21
MU (%)	10
15% of ELV	3.15

Existing Calibration Function
$y = 1.1186x + 0$

Source of Existing Calibration Function
CAT-1323-14181 SITA Wrexham A1 Main Stack QAL2 Report V1

Existing Calibration Range
0 to 16.2 % v/v

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



OXYGEN: AST CALCULATIONS

(Page 2 of 2)

SITA UK Ltd, Wrexham

A1 - Main Stack

Variability Test Data

Pair	Date	Time (30-minute Average)	CAL CEMS (WET) % v/v	ys, SRM (WET) % v/v	ys, SRM - CAL CEMS
1	14/11/2013	18:58 - 19:28	14.69	14.33	-0.36
2	14/11/2013	16:47 - 17:17	15.32	14.73	-0.59
3	14/11/2013	17:47 - 18:17	14.69	14.00	-0.69
4	14/11/2013	20:47 - 21:17	14.87	14.20	-0.68
5	14/11/2013	21:47 - 22:17	15.03	14.38	-0.65
6	14/11/2013	22:47 - 23:17	15.00	14.40	-0.59
7	15/11/2013	23:47 - 00:17	15.02	14.42	-0.61
8	15/11/2013	00:47 - 01:17	15.72	14.67	-1.05
9	15/11/2013	01:47 - 02:17	16.24	15.05	-1.19
10	15/11/2013	02:47 - 03:17	16.06	14.84	-1.22
11	15/11/2013	04:47 - 05:17	15.51	14.97	-0.54
12	15/11/2013	05:47 - 06:17	15.89	15.08	-0.81
13	15/11/2013	06:47 - 07:17	15.38	14.67	-0.71
14	15/11/2013	07:47 - 08:17	15.27	14.61	-0.66
MAX			16.24	Sd	0.25

Test of Variability

$Q_0 = ELV \times (MU / 100) / 1.96$	1.07
Kv for 14 Pairs of Data	0.9742

The variability is accepted if $Sd \leq 1.5 \times Q_0 \times Kv$

Parameter	Value
Standard Deviation (Sd)	0.25
$1.5 \times Q_0 \times Kv$	1.57
Outcome of Variability Test	Pass

Test of Calibration (Acceptance of Calibration Function)

$t_{0.95} (N-1)$	1.771
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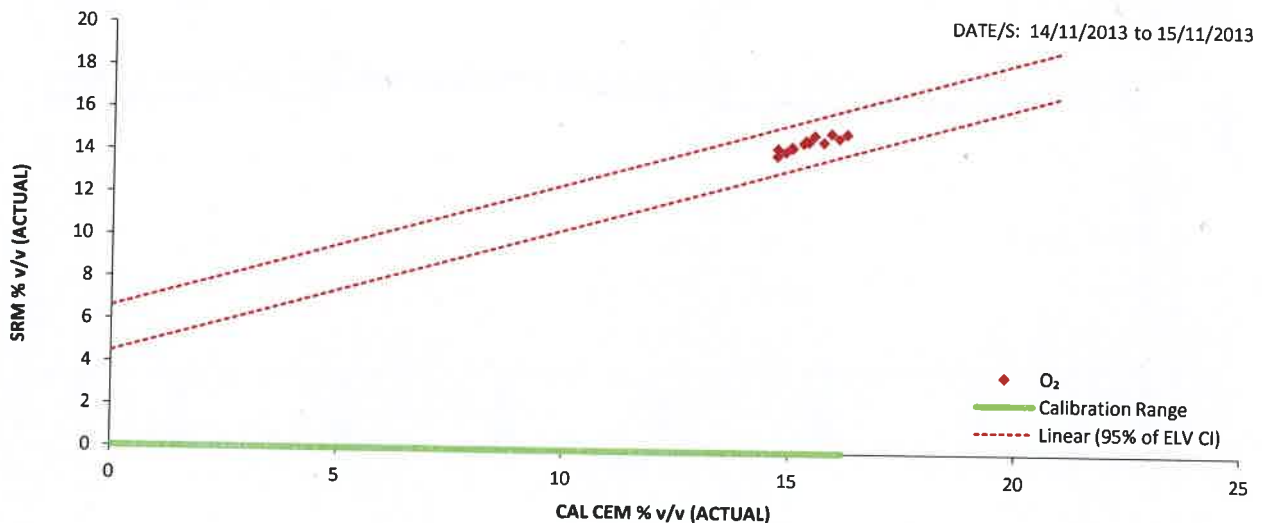
where N (number of samples) = 14

The calibration is accepted if $D \leq t_{0.95} (N-1) \times Sd / \sqrt{N} + Q_0$

Parameter	Value
Mean Difference (D)	0.74
$t_{0.95} (N-1) \times Sd / \sqrt{N} + Q_0$	1.19
Outcome of Calibration Test	Pass

PLOT 2: X-Y Plot - REF CAL CEMS vs REF SRM Values

New Calibration Range	Existing Range Still Valid
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Section 4B - Data and Calculations - AST

CARBON DIOXIDE: AST CALCULATIONS

(Page 1 of 2)

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	15/11/2013	23:38 - 00:08	5.00	4.43	0.40	0.34	0.14	0.16	4.99
2	14/11/2013	17:47 - 18:17	4.95	4.61	0.36	0.52	0.19	0.13	4.94
3	14/11/2013	18:47 - 19:17	4.94	4.56	0.34	0.48	0.16	0.12	4.93
4	14/11/2013	19:47 - 20:17	3.97	3.68	-0.63	-0.41	0.26	0.40	3.96
5	14/11/2013	20:47 - 21:17	4.57	4.26	-0.03	0.17	-0.01	0.00	4.55
6	14/11/2013	21:47 - 22:17	4.55	4.04	-0.05	-0.05	0.00	0.00	4.54
7	14/11/2013	22:47 - 23:17	4.78	4.21	0.18	0.13	0.02	0.03	4.76
8	15/11/2013	23:47 - 00:17	4.91	4.33	0.31	0.24	0.08	0.09	4.89
9	15/11/2013	00:47 - 01:17	4.79	4.20	0.19	0.12	0.02	0.03	4.77
10	15/11/2013	01:47 - 02:17	4.44	3.85	-0.16	-0.23	0.04	0.03	4.42
11	15/11/2013	02:47 - 03:17	4.38	3.81	-0.22	-0.28	0.06	0.05	4.37
12	15/11/2013	03:47 - 04:17	4.55	3.86	-0.05	-0.23	0.01	0.00	4.53
13	15/11/2013	04:47 - 05:17	4.13	3.65	-0.47	-0.44	0.20	0.22	4.12
14	15/11/2013	05:47 - 06:17	4.16	3.65	-0.44	-0.43	0.19	0.19	4.15
15	15/11/2013	06:47 - 07:17	4.70	4.03	0.10	-0.05	-0.01	0.01	4.68
16	15/11/2013	07:47 - 08:17	4.78	4.19	0.18	0.10	0.02	0.03	4.76

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	0.96
EFFECTIVE ELV (% v/v)	10
MU (%)	10
15% of ELV	1.50

SUM 1.38 1.49

Existing Calibration Function

$$y = 0.9968x + 0$$

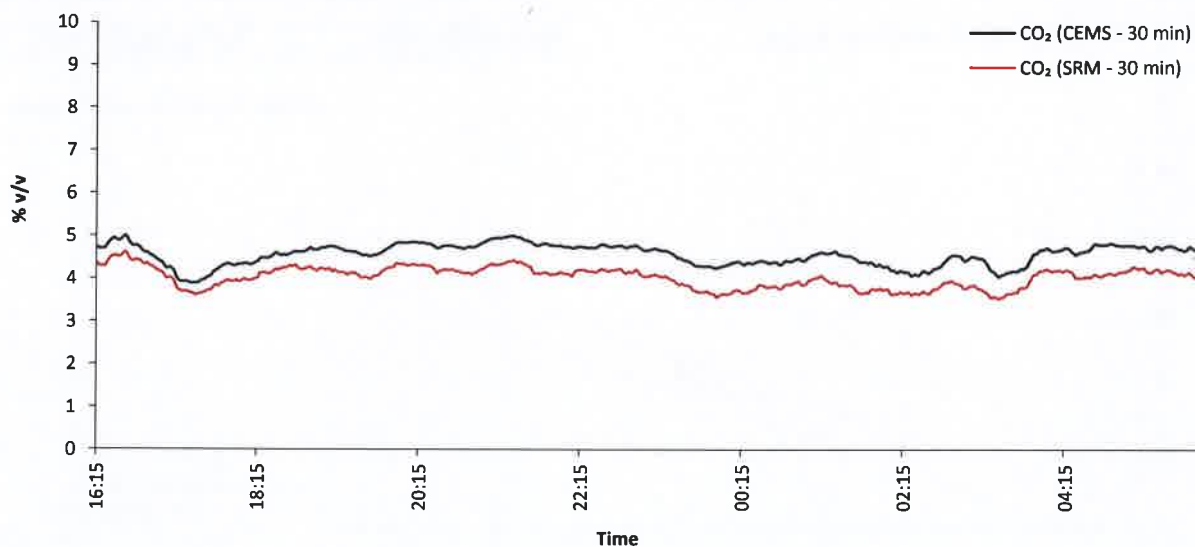
Source of Existing Calibration Function

CAT-1323-14181 SITA Wrexham A1 Main Stack QAL2 Report V1

Existing Calibration Range

0 to 6.2 % v/v

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



Section 4B - Data and Calculations - AST
CARBON DIOXIDE: AST CALCULATIONS
(Page 2 of 2)

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	15/11/2013	23:38 - 00:08	4.99	4.43	-0.56
2	14/11/2013	17:47 - 18:17	4.94	4.61	-0.33
3	14/11/2013	18:47 - 19:17	4.93	4.56	-0.36
4	14/11/2013	19:47 - 20:17	3.96	3.68	-0.28
5	14/11/2013	20:47 - 21:17	4.55	4.26	-0.29
6	14/11/2013	21:47 - 22:17	4.54	4.04	-0.50
7	14/11/2013	22:47 - 23:17	4.76	4.21	-0.55
8	15/11/2013	23:47 - 00:17	4.89	4.33	-0.56
9	15/11/2013	00:47 - 01:17	4.77	4.20	-0.57
10	15/11/2013	01:47 - 02:17	4.42	3.85	-0.57
11	15/11/2013	02:47 - 03:17	4.37	3.81	-0.56
12	15/11/2013	03:47 - 04:17	4.53	3.86	-0.67
13	15/11/2013	04:47 - 05:17	4.12	3.65	-0.47
14	15/11/2013	05:47 - 06:17	4.15	3.65	-0.49
15	15/11/2013	06:47 - 07:17	4.68	4.03	-0.65
16	15/11/2013	07:47 - 08:17	4.76	4.19	-0.58
MAX			4.99	Sd	0.12

Test of Variability

$Q_0 = ELV \times (MU / 100) / 1.96$	0.51
Kv for 16 Pairs of Data	0.9777

The variability is accepted if $Sd \leq 1.5 \times Q_0 \times Kv$

Parameter	Value
Standard Deviation (Sd)	0.12
$1.5 \times Q_0 \times Kv$	0.75
Outcome of Variability Test	Pass

Test of Calibration (Acceptance of Calibration Function)

$t_{0.95} (N-1)$	1.746
------------------	-------

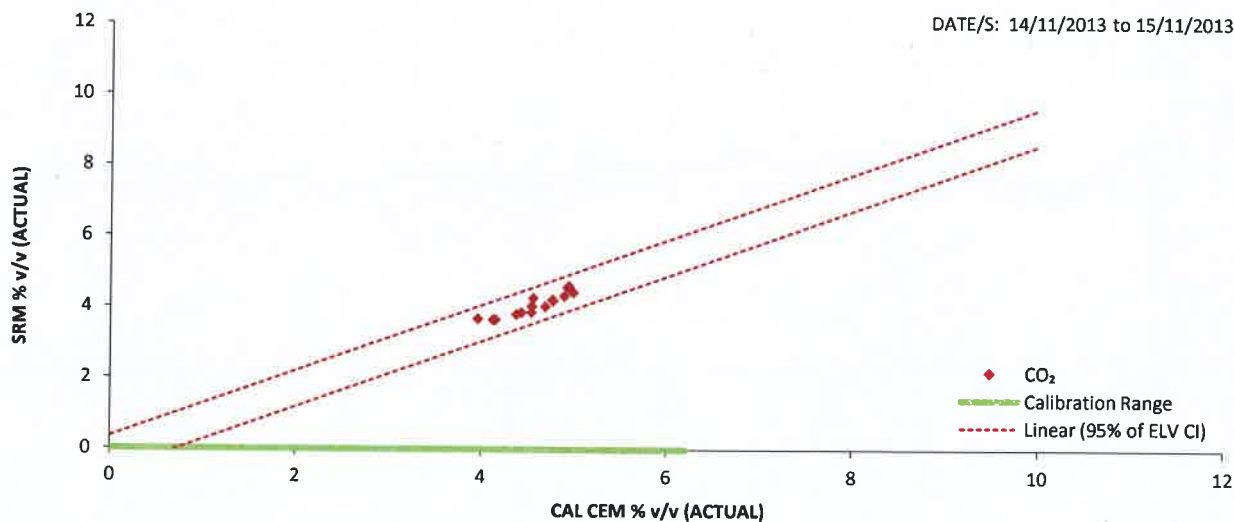
where N (number of samples) = 16

The calibration is accepted if $D \leq t_{0.95} (N-1) \times Sd / \text{SQRT} (N) + Q_0$

Parameter	Value
Mean Difference (D)	0.50
$t_{0.95} (N-1) \times Sd / \text{SQRT} (N) + Q_0$	0.56
Outcome of Calibration Test	Pass

PLOT 2: X-Y Plot - REF CAL CEMS vs REF SRM Values

New Calibration Range	Existing Range Still Valid
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FUNCTIONAL CHECKS OF CEMS

(Page 1 of 2)

SITA UK Ltd, Wrexham

A1 - Main Stack

Reference Materials Available on Site

Parameter	QAL3 Check Gas	Concentration (ppm / %)	QAL3 Check Gas Supplier	Cylinder Number	Cylinder Expiry Date	Certified Accuracy
Total VOCs	C ₃ H ₈	10.0	Air Products	10006202974	June 2018	Not Detailed
Nitrogen Monoxide	NO	50.0	Air Products	10006435798	Sept 2016	Not Detailed
Sulphur Dioxide	SO ₂	50.0	Air Products	100006442882	Sept 2016	Not Detailed
Carbon Monoxide	CO	100.0	Air Products	10005976274	Feb 2018	Not Detailed
Hydrogen Chloride	HCl	12.2	Air Products	BV12587F	None	Not Detailed
Oxygen	O ₂	14%	Air Products	10006453084	June 2023	Not Detailed
Carbon Dioxide	CO ₂	9.91%	Cryoservice	P28022D43158	None	Not Detailed
Zero Gas	N ₂	N/A	Cryoservice	7464841	27/01/2014	5%

CEMS Checks

Parameter	Analyser System Check				Sampling Line System Check			
	Gas Conc. (mg/m ³ / %)	Zero (mg/m ³ / %)	Span (mg/m ³ / %)	Response (T ₉₀ - secs)	Gas Conc. (mg/m ³ / %)	Zero (mg/m ³ / %)	Span (mg/m ³ / %)	Response (T ₉₀ - secs)
Total VOCs					80.0	0.3	77.5	120
Nitrogen Monoxide					406.6	-0.9	403.2	120
Sulphur Dioxide					98.2	2.7	95.3	120
Carbon Monoxide					106.2	0.1	109.6	120
Hydrogen Chloride					20.0	0.2	19.4	360
Oxygen					20.90	0.0	22.1	180

Reference Materials Used for CEMS Linearity Checks

Parameter	Linearity Check Gas	Concentration (mg/m ³ / %)	Linearity Check Gas Supplier	Cylinder Number	Cylinder Expiry Date	Certified Accuracy
Total VOCs	C ₃ H ₈	80.0	Not Detailed	P65859	Not Detailed	Not Detailed
Nitrogen Monoxide	NO	406.6	Not Detailed	139903	Not Detailed	Not Detailed
Sulphur Dioxide	SO ₂	98.2	Not Detailed	139903	Not Detailed	Not Detailed
Carbon Monoxide	CO	106.2	Not Detailed	139903	Not Detailed	Not Detailed
Hydrogen Chloride	HCl	20.0	Not Detailed	D673713	Not Detailed	Not Detailed
Oxygen	O ₂	20.9	Not Detailed	N/A	Not Detailed	Not Detailed
Zero Gas	N ₂ / Inst. Air (FID)	N/A	N/A	N/A	N/A	N/A



Section 5 - Results of the Functional Checks



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

(Page 1 of 4)

Functional Checks Performed By	Danny Price (A1-CBISS)
Date/s Functional Checks Performed	14/11/2013 - 15/11/2013

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	Service Engineer happy with the internal condition
Cleanliness of the optical components.	N/A	Optical Components encased in CEM
Flushing air supply.	Yes	Fine
Optical path free from obstructions.	N/A	N/A
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	Calibrated dilution system used for Total VOCs, NO, CO, SO ₂ , O ₂ . Calibration standards used for HCl and Total Particulate Matter.
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	Randomised sequence not utilised
Reference material concentration approximately 20% of 2 x the ELV	Yes	Randomised sequence not utilised
Reference material concentration approximately 40% of 2 x the ELV	Yes	Randomised sequence not utilised
Reference material concentration approximately 60% of 2 x the ELV	Yes	Randomised sequence not utilised
Reference material concentration approximately 80% of 2 x the ELV	Yes	Randomised sequence not utilised
Reference material with zero concentration	Yes	Randomised sequence not utilised

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.	No	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	QAL3 Procedure and records from June 2013 onwards. Out of control and identified issues noted and actioned e.g. Order of new regulators and CEMS service agent contacted.

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 is 1785 and Environnement SA Graphite 52M serial number is 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 principle of the analysers is included in the service report
Certification details.	No	No information regarding the operating principle of the analysers is included in the service report
Compliance with MCERTS. (including certificate no.)	No	No information regarding the operating principle of the analysers is included in the service report
Location.	Yes	Site address listed on front page
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.
Calibration and linearity data as required by EN14181.	Yes	Included in service report.
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)

10. Documentation and Records		
Requirement	Available	Notes
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

14/11/2013

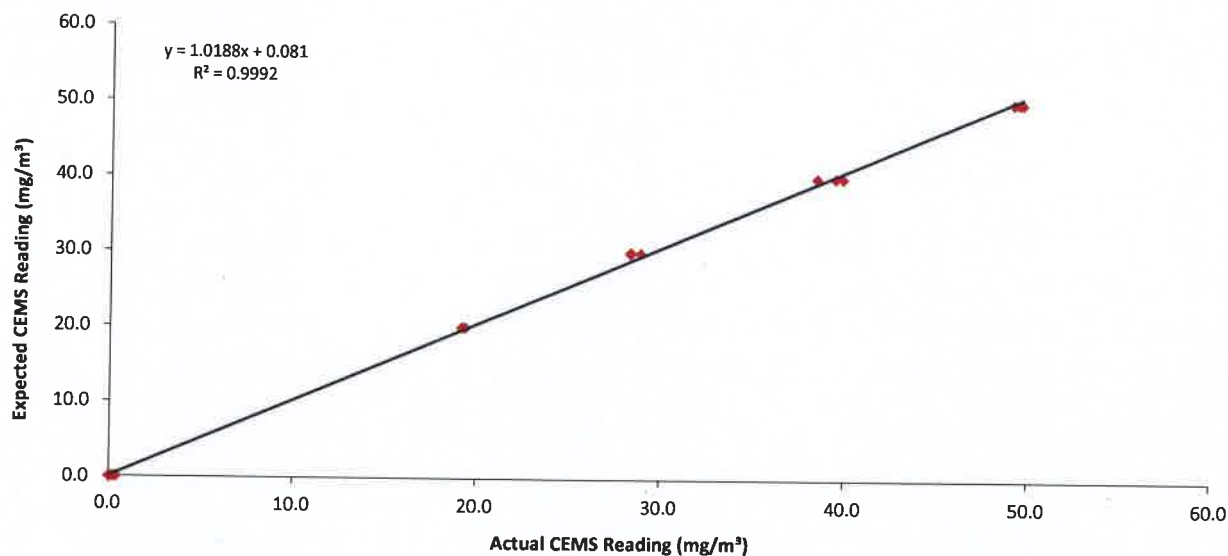
Linearity Readings on CEMS

Linearity Point	Time of Readings	Linearity % Point	Expected Reading (mg/m ³)	Reading 1 (mg/m ³)	Reading 2 (mg/m ³)	Reading 3 (mg/m ³)	Average CEMS Reading (mg/m ³)
1	15:00	0.00	0.00	0.20	0.40	0.10	0.23
2	15:20	30.00	30.00	28.40	28.90	28.30	28.53
3	15:40	50.00	50.00	49.20	49.70	49.50	49.47
4	16:00	40.00	40.00	38.50	39.50	39.90	39.30
5	16:40	0.00	0.00	0.30	0.00	0.00	0.10
6	16:20	20.00	20.00	19.30	19.20	19.40	19.30

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	0.23	-0.32	-0.80	0.80	2.12	5	Pass
2	28.53	0.85	2.12	2.12			
3	49.47	-0.48	-1.20	1.20			
4	39.30	-0.12	-0.30	0.30			
5	0.10	-0.18	-0.46	0.46			
6	19.30	0.26	0.64	0.64			

Graphical Representation of Linearity Data



VOLATILE ORGANIC COMPOUNDS: LINEARITY CHECK CALCULATIONS

SITA UK Ltd, Wrexham

A1 - Main Stack

14/11/2013

Linearity Readings on CEMS

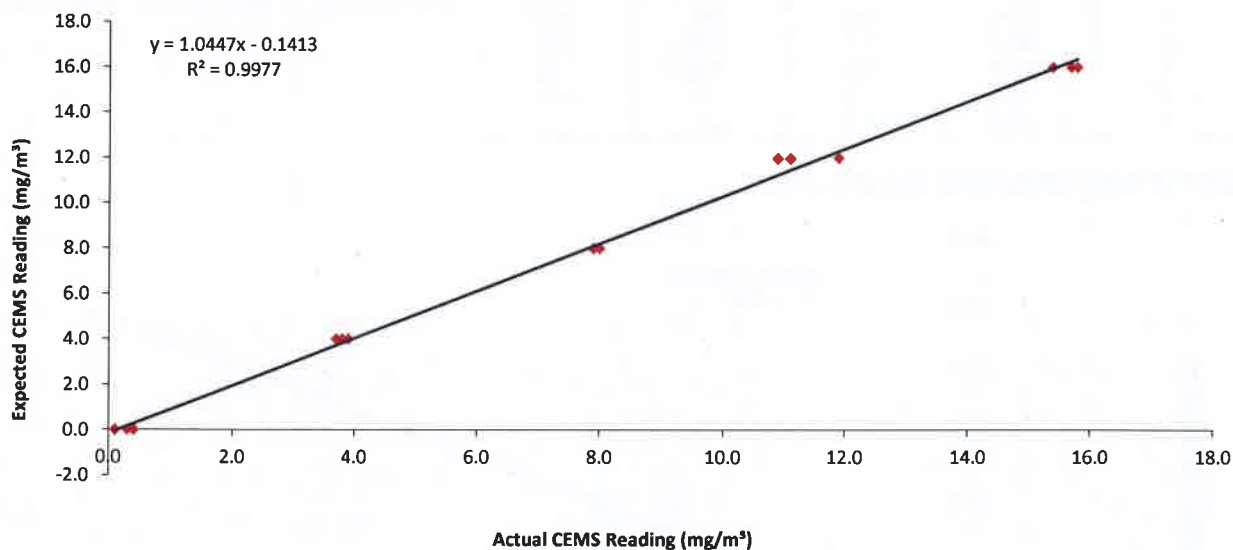
Linearity Point	Time of Readings	Linearity % Point	Expected Reading (mg/m ³)	Reading 1 4 x Response (mg/m ³)	Reading 2 1 x Response (mg/m ³)	Reading 3 1 x Response (mg/m ³)	Average CEMS Reading (mg/m ³)
1	08:00	0.00	0.00	0.30	0.10	0.40	0.27
2	08:20	60.00	12.00	10.90	11.90	11.10	11.30
3	08:40	20.00	4.00	3.80	3.90	3.70	3.80
4	09:00	80.00	16.00	15.80	15.40	15.70	15.63
5	09:20	0.00	0.00	0.10	0.10	0.30	0.17
6	09:40	40.00	8.00	7.90	8.00	7.90	7.93

NOTE: Concentrations obtained using calibrated Mass Flow Controllers (MFCs)

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	0.27	-0.14	-0.86	0.86	2.10	5	Pass
2	11.30	0.34	2.10	2.10			
3	3.80	0.17	1.07	1.07			
4	15.63	-0.19	-1.19	1.19			
5	0.17	-0.03	-0.20	0.20			
6	7.93	-0.15	-0.92	0.92			

Graphical Representation of Linearity Data



NITROGEN MONOXIDE: LINEARITY CHECK CALCULATIONS

SITA UK Ltd, Wrexham

A1 - Main Stack

14/11/2013

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

Linearity Point	Time of Readings	Linearity % Point	Expected Reading (mg/m ³)	Reading 1 4 x Response (mg/m ³)	Reading 2 1 x Response (mg/m ³)	Reading 3 1 x Response (mg/m ³)	Average CEMS Reading (mg/m ³)
1	12:20	0.00	0.00	-0.70	-1.00	-0.90	-0.87
2	12:30	60.00	240.00	216.00	214.90	215.00	215.30
3	12:40	20.00	80.00	80.70	76.50	76.80	78.00
4	12:50	80.00	320.00	295.00	297.00	293.90	295.30
5	13:00	0.00	0.00	-1.10	-1.40	-1.40	-1.30
6	13:10	40.00	160.00	145.70	145.90	149.40	147.00

NOTE: Concentrations obtained using calibrated Mass Flow Controllers (MFCs)

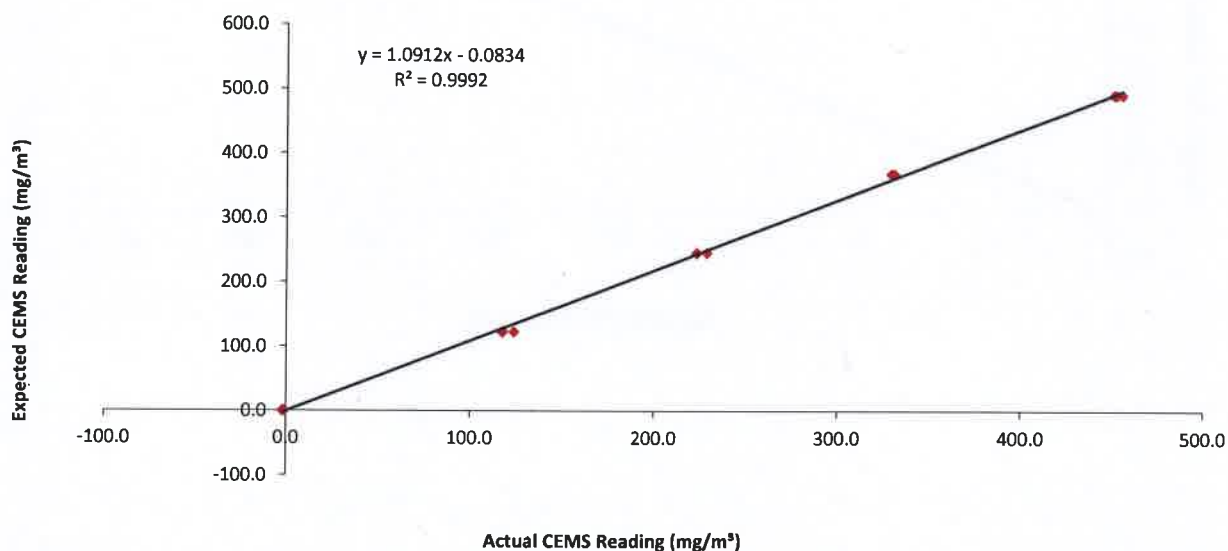
Linearity Readings on CEMS (as NO₂)

Linearity Point	Time of Readings	Linearity % Point	Expected Reading (mg/m ³)	Reading 1 4 x Response (mg/m ³)	Reading 2 1 x Response (mg/m ³)	Reading 3 1 x Response (mg/m ³)	Average CEMS Reading (mg/m ³)
1	12:20	0.00	0.00	-1.07	-1.53	-1.38	-1.33
2	12:30	60.00	368.00	331.20	329.51	329.67	330.13
3	12:40	20.00	122.67	123.74	117.30	117.76	119.60
4	12:50	80.00	490.67	452.33	455.40	450.65	452.79
5	13:00	0.00	0.00	-1.69	-2.15	-2.15	-1.99
6	13:10	40.00	245.33	223.41	223.71	229.08	225.40

Test of Residuals (as NO₂)

Linearity Point	Average x _c	d _c	%, d _{c,rel}	ABS %, d _{c,rel}	MAX ABS %, d _{c,rel}	Limit	Outcome
1	-1.33	1.53	0.31	0.31	1.60	5	Pass
2	330.13	7.85	1.60	1.60			
3	119.60	-7.76	-1.58	1.58			
4	452.79	-3.34	-0.68	0.68			
5	-1.99	2.26	0.46	0.46			
6	225.40	-0.54	-0.11	0.11			

Graphical Representation of Linearity Data (as NO₂)



SULPHUR DIOXIDE: LINEARITY CHECK CALCULATIONS

SITA UK Ltd, Wrexham

A1 - Main Stack

14/11/2013

Linearity Readings on CEMS

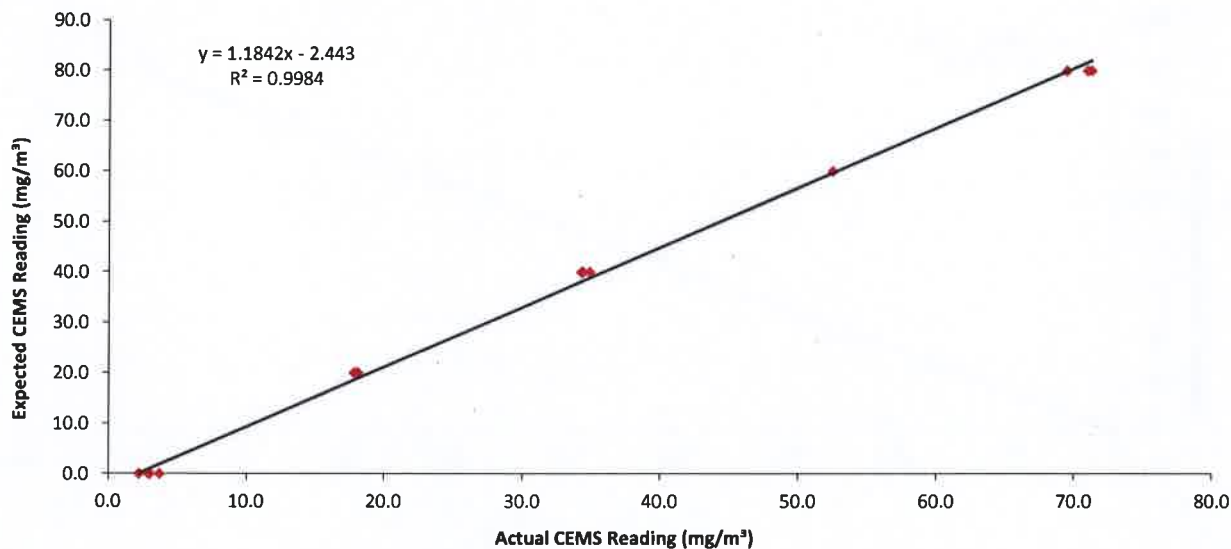
Linearity Point	Time of Readings	Linearity % Point	Expected Reading (mg/m ³)	Reading 1 4 x Response (mg/m ³)	Reading 2 1 x Response (mg/m ³)	Reading 3 1 x Response (mg/m ³)	Average CEMS Reading (mg/m ³)
1	15:00	0.00	0.00	3.70	2.20	2.20	2.70
2	15:20	60.00	60.00	52.50	52.50	52.50	52.50
3	15:40	20.00	20.00	17.80	18.10	18.00	17.97
4	15:50	80.00	80.00	69.50	71.30	71.00	70.60
5	16:10	0.00	0.00	2.90	3.00	3.00	2.97
6	16:30	40.00	40.00	34.30	34.40	34.90	34.53

NOTE: Concentrations obtained using calibrated Mass Flow Controllers (MFCs)

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	2.70	-0.75	-0.94	0.94	1.94	5	Pass
2	52.50	0.27	0.34	0.34			
3	17.97	1.17	1.46	1.46			
4	70.60	-1.16	-1.45	1.45			
5	2.97	-1.07	-1.34	1.34			
6	34.53	1.55	1.94	1.94			

Graphical Representation of Linearity Data



CARBON MONOXIDE: LINEARITY CHECK CALCULATIONS

SITA UK Ltd, Wrexham
A1 - Main Stack
14/11/2013

Linearity Readings on CEMS

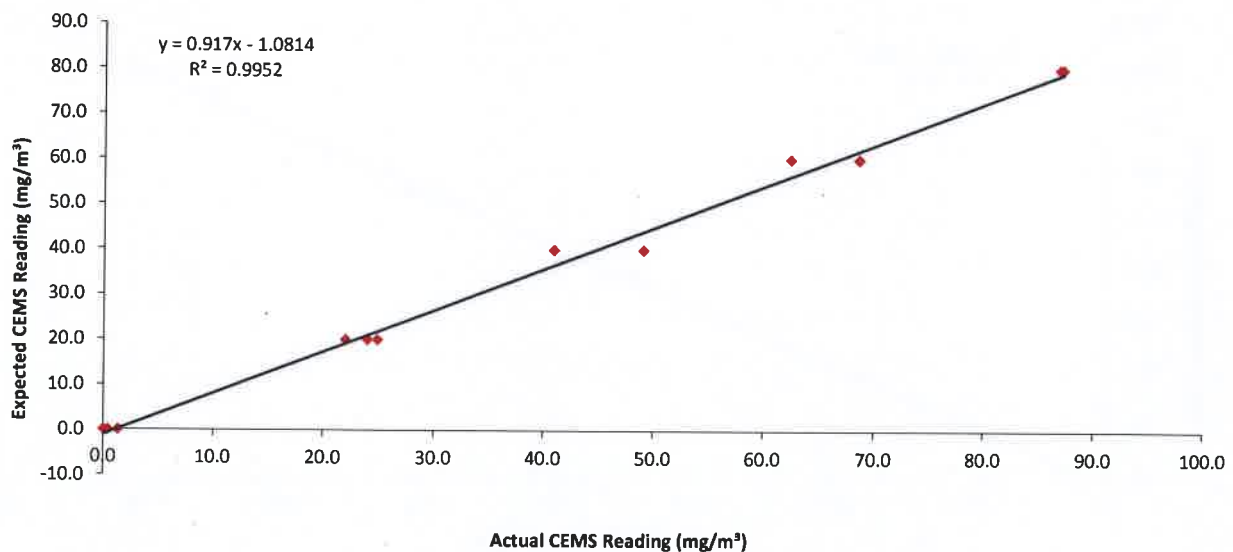
Linearity Point	Time of Readings	Linearity % Point	Expected Reading (mg/m ³)	Reading 1 4 x Response (mg/m ³)	Reading 2 1 x Response (mg/m ³)	Reading 3 1 x Response (mg/m ³)	Average CEMS Reading (mg/m ³)
1	13:30	0.00	0.00	0.40	0.00	0.00	0.13
2	13:40	60.00	60.00	62.40	68.60	68.70	66.57
3	13:50	20.00	20.00	24.00	22.00	24.90	23.63
4	14:00	80.00	80.00	87.00	87.30	87.10	87.13
5	14:10	0.00	0.00	1.30	1.30	1.30	1.30
6	14:20	40.00	40.00	41.00	49.10	49.10	46.40

NOTE: Concentrations obtained using calibrated Mass Flow Controllers (MFCs)

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	0.13	0.96	1.20	1.20	1.84	5	Pass
2	66.57	0.04	0.05	0.05			
3	23.63	-0.59	-0.74	0.74			
4	87.13	1.18	1.47	1.47			
5	1.30	-0.11	-0.14	0.14			
6	46.40	-1.47	-1.84	1.84			

Graphical Representation of Linearity Data



HYDROGEN CHLORIDE: LINEARITY CHECK CALCULATIONS

SITA UK Ltd, Wrexham

A1 - Main Stack

14/11/2013

Linearity Readings on CEMS

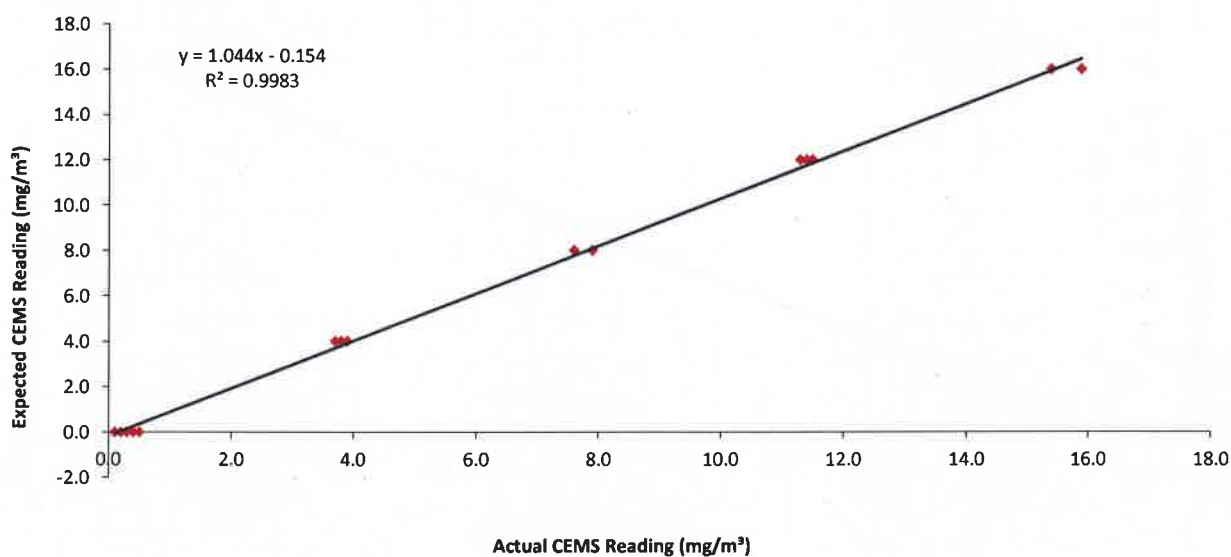
Linearity Point	Time of Readings	Linearity % Point	Expected Reading (mg/m ³)	Reading 1 4 x Response (mg/m ³)	Reading 2 1 x Response (mg/m ³)	Reading 3 1 x Response (mg/m ³)	Average CEMS Reading (mg/m ³)
1	10:00	0.00	0.00	0.40	0.20	0.20	0.27
2	10:20	60.00	12.00	11.30	11.50	11.40	11.40
3	10:40	20.00	4.00	3.80	3.70	3.90	3.80
4	11:00	80.00	16.00	15.90	15.40	15.90	15.73
5	11:30	0.00	0.00	0.10	0.30	0.50	0.30
6	11:50	40.00	8.00	7.60	7.90	7.60	7.70

NOTE: Concentrations obtained using calibrated Mass Flow Controllers (MFCs)

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	0.27	-0.12	-0.78	0.78	1.70	5	Pass
2	11.40	0.25	1.58	1.58			
3	3.80	0.19	1.17	1.17			
4	15.73	-0.27	-1.70	1.70			
5	0.30	-0.16	-1.00	1.00			
6	7.70	0.12	0.72	0.72			

Graphical Representation of Linearity Data





Section 5 - Results of the Functional Tests



OXYGEN: LINEARITY CHECK CALCULATIONS

SITA UK Ltd, Wrexham

A1 - Main Stack

14/11/2013

Linearity Readings on CEMS

Linearity Point	Time of Readings	Linearity % Point	Expected Reading (% v/v)	Reading 1 4 x Response (% v/v)	Reading 2 1 x Response (% v/v)	Reading 3 1 x Response (% v/v)	Average CEMS Reading (% v/v)
1	16:00	0.00	0.00	0.00	0.00	0.00	0.00
2	16:15	60.00	12.60	13.10	13.10	13.10	13.10
3	16:05	20.00	4.20	4.40	4.40	4.40	4.40
4	16:24	80.00	16.80	17.40	17.40	17.40	17.40
5	16:30	0.00	0.00	0.00	0.00	0.00	0.00
6	16:27	40.00	8.36	8.80	8.80	8.80	8.80

NOTE: Concentrations obtained using calibrated Mass Flow Controllers (MFCs)

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	0.03	0.17	0.17	0.57	5	Pass
2	13.10	0.00	-0.01	0.01			
3	4.40	-0.01	-0.08	0.08			
4	17.40	0.05	0.31	0.31			
5	0.00	0.03	0.17	0.17			
6	8.80	-0.10	-0.57	0.57			

Graphical Representation of Linearity Data

