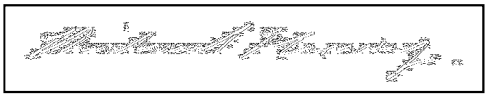
BS EN 14181 Report	
Permit Number:	**RP3133LD**
Operator:	**RWE Generation UK plc.**
Installation:	**Aberthaw Power Station**
Installation Type:	**Coal-Fired Power Station**
Emission Point:	**Unit 7**
Monitoring Dates:	**5th – 10th March 2015**

1709

Contract Reference:	FTBS 29312
Operator:	RWE Generation UK plc.
Address:	Aberthaw Power Plant The Leys Aberthaw, Nr Barry South Glamorgan CF62 4ZW
Client Contact:	Richard Kadim
Monitoring Organisation:	RPS Consultants
Address:	Noble House, Capital Drive, Linford Wood, Milton Keynes. MK14 6QP.
Report Date:	17th September 2015
Report Author:	Glyn Harrison
Report Approved By:	Richard Harvey
Position:	Principal Consultant
MCERTS Qualifications:	Level 2, Technical Endorsements 1, 2, 3 & 4
MCERTS Registration No.:	MM 02 020
Signature:	

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Section 1 – Executive Summary

1B.1 Result Summary – AST

EN 14181 Test Type		AST						
Stack designation		Unit 7						
Measurand	**Correlation coefficient of parallel data (R^2)**	**Derived Calibration function (y_i)**		**Established Calibrated Range[2]**	**AST Calibrated Range**	**Extrapolated Calibrated Range**	**Variability Test**	**Test of Calibration Function**
		y_i= a + bx_i						
Nitric Oxide as total NOx (Procal 1)	0.9834	-3.578[1]	1.022[1]	0 – 1634.6 mg/m^3 [2]	0 – 1172 mg/m^3 [2]	-	Pass	Pass
Sulphur Dioxide (Procal 1 – Low Range)	0.9014	-6.1[1]	1.082[1]	0 – 749.3 mg/m^3 [2]	0 – 275 mg/m^3 [2]	-	Pass	Pass
Sulphur Dioxide (Procal 1 – High Range)	0.9027	7.158[1]	0.952[1]	0 – 2302.4 mg/m^3 [2]	0 – 345 mg/m^3 [2]	-	Pass	Pass
Nitric Oxide as total NOx (Procal 2)	0.9821	-1.5[1]	0.979[1]	0 – 1320 mg/m^3 [2]	0 – 1092 mg/m^3 [2]	-	Pass	Pass
Sulphur Dioxide (Procal 2 – Low Range)	0.9640	-6.072[1]	0.885[1]	0 – 566 mg/m^3 [2]	0 – 281 mg/m^3 [2]	-	Pass	Pass
Sulphur Dioxide (Procal 2 – High Range)	0.9623	-5.884[1]	0.757[1]	0 – 599 mg/m^3 [2]	0 – 261 mg/m^3 [2]	-	Pass	Pass
Particulate Matter (Erwin SICK)	0.4722	0.6[1]	1.433[1]	0 – 55 mg/m^3 [3]	0 – 19.8 mg/m^3 [3]	Not applicable	Pass	Pass

1B.2 Result Summary – QAL2

EN 14181 Test Type	QAL2					
Stack designation	Unit 7					
Measurand	**Correlation coefficient of parallel data (R^2)**	**Derived Calibration function (y_i)** y_i= **a** + **b**x_i		**Calibrated Range**	**Extrapolated Calibrated Range**	**Variability Test**
Oxides of Nitrogen (GM32)	0.9936	21.795[1]	0.889[1]	0 - 1098 mg/m^3	0 – 2158 mg/m^3	Pass
Sulphur Dioxide (GM32 – Low Range)	0.9883	0.83[1]	1.066[1]	0 – 310.7 mg/m^3	0 – 1596 mg/m^3	Pass
Sulphur Dioxide (GM32 – High Range)	0.9882	0.659[1]	1.064[1]	0 – 310.6 mg/m^3	0 – 1596 mg/m^3	Pass

Notes (Both Tables):

1 – Calibration function derived using Method A.
2 – Calibrated range derived using AST parallel test data extended 10%.
3 - Calibrated range derived using QAL2 parallel test data extended 100%.
4 – Extrapolated calibrated range from QAL 2 - derived using reference materials

Note: The calibration functions, once applied, only remain valid as long as the QAL 3 data remains within control limits, and there are no manual adjustments made to the CEMS other than those allowed to bring the settings back within the QAL 3 control limits.

1C Deviations

SRM deviations	None
Reason for deviation	None
EN 14181 deviations	None
Reason for deviation	N/A
Impact on results	N/A
Further actions required	None

Section 2 - Information about the Regulated Installation

2.1 Regulatory Information

Name of operator	RWE Generation UK plc.
Name of Installation	Aberthaw Power Station
Address of installation	The Leys Aberthaw, Nr Barry South Glamorgan CF62 4ZW
Sector	LCPD
Permit Number	RP3133LD
Date of last QAL 2/AST	March 2014 AST – Procal 1 & 2, SICK OMD 41 & SICK GM32

Regulated Determinands

Determinand	Emission Point	48-Hour Mean	Calendar Monthly	Uncertainty Requirement
Oxides of Nitrogen	Unit 7	1210 mg/m^3 (NOx as NO_2)	1100 mg/m^3 (NOx as NO_2)	20% at the ELV
Sulphur Dioxide	Unit 7	440 mg/m^3	400 mg/m^3	20% at the ELV
Total particulate Matter	Unit 7	55 mg/m^3	25 mg/m^3	30% at the ELV

Note: ELVs at reference conditions 273K, 101.3kPa, 6% oxygen, dry gas

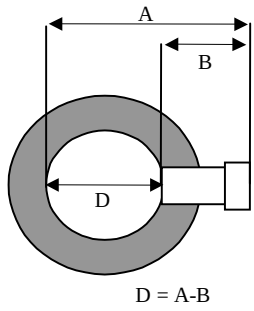
2.2 Operational Information and site monitoring provisions

2.2.1 Process type and emissions variations

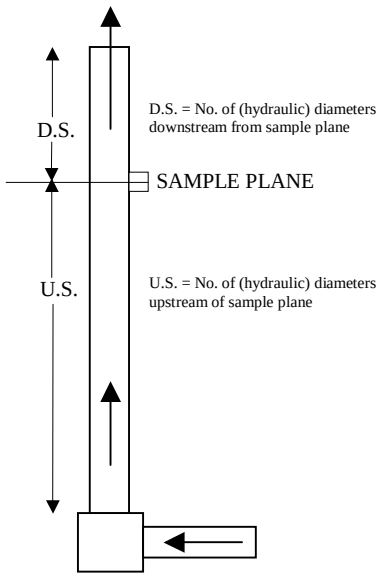
Process Type	Continuous - Coal-Fired Power Station
Process Variations	Once operational at maximum load variation is minimal
Expected emissions variations **1 Oxides of nitrogen** **2 Sulphur Dioxide** **3 Oxygen**	 850 - 1050 mg/m^3 as NO_2 – variable 150 - 300 mg/m^3 – variable 6 – 8 % – constant
Possible low level emissions	Sulphur Dioxide
Provision to deal with low level emissions	Use values from linearity checks to derive calibrated range
Other factors affecting monitoring results	None
Fuel type	Coal
Abatement	Flue Gas Desulphurisation & Combustion control

2.3 Monitoring Provisions at the installation

2.3.1 Stack & sampling ports



SKETCH OF SAMPLING POINT LOCATIONS, STACK GEOMETRY, MONITORING PLATFORM & SURROUNDS



A =~ 6.5m

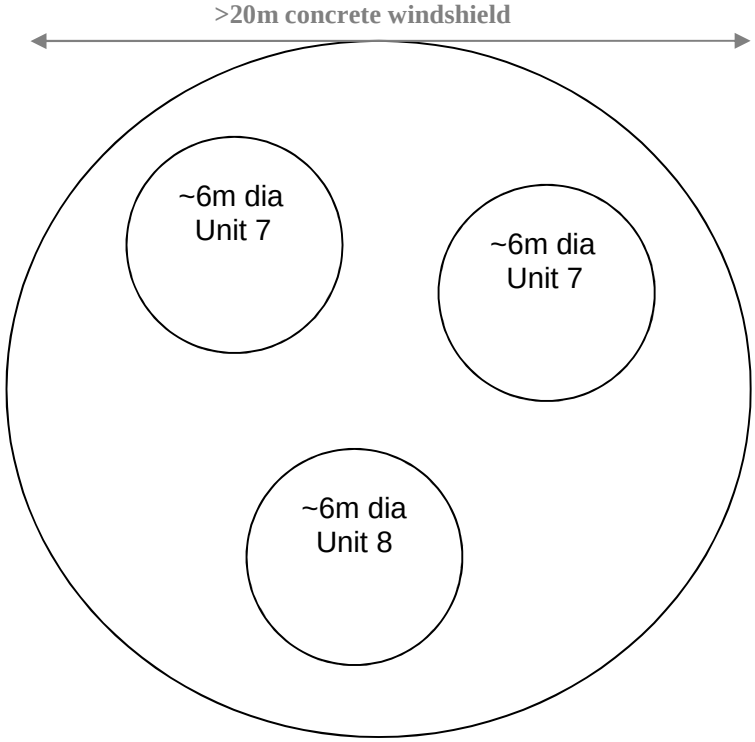
B = ~0.5m

D = ~6.00

D.S. = > 5HD

U.S. = > 5HD

Platform Diagram



Photograph of Stack

Photo of Monitoring Platform

Access was limited to ports due to the stack layout inside the windshield. The port shown is one of four.

2.3.2 Monitoring platform and site provisions

Requirement	Compliant	Notes
• A safe and clean working environment with sufficient space and weather protections.	CEMs cabinet – Monitoring probe -	Both cabinet and probe are located inside the windshield and are thus in a spacious, clean and weatherproof environment.
• Easy and safe access to the CEM.	CEMS cabinet – Monitoring probe -	Stairways to the relevant levels.
• Adequate supplies of reference materials, tools and spare parts.	Yes	
• 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 CEM.	N/A	There is no facility to introduce reference materials to the sample line or CEM. The CEMs are cross-duct IR (NO, NO_2, SO_2) and cross-duct forward scatter (particulate).
• Compliance with TGN M1	No	Unable to access sample port B
• Compliance with EN 15259 –		
flow stability criteria (if applicable),	Yes	
Stack gas homogeneity.	Yes	Stack gas homogeneity carried out previously by Atkins.

Temperature and Velocity Profile

Company Name:	RWE	Date:	06/03/15
Site Name:	Aberthaw	Run:	1
Sampling Point Ref:	Unit 7	Barometric Press. Mbar	1024
Project Reference:	FTBS 29312		
		Stack Diamter (m)	6.00
Stack Static press.mm H_2O:	-24	Stack Area (m2):	28.274

Traverse Point No.	Port A			Port C			Port D		
	Δ p, mm H_2O	Root Δ p	Stack Temp °C	Δ p, mm H_2O	Root Δ p	Stack Temp °C	Δ p, mm H_2O	Root Δ p	Stack Temp °C
1	30	5.477	60						
2	32	5.657	61						
3	32	5.657	61						
4									
5									
6									
7									
8				30	5.477	60	30	5.477	60
9				32	5.657	61	32	5.657	61
10				32	5.657	61	34	5.831	61
Minimum	30.0	5.477	60	30.0	5.477	60	30.0	5.477	60
Maximum	32.0	5.657	61	32.0	5.657	61	34.0	5.831	61
Mean	**31.3**	**5.597**	**60.7**	**31.3**	**5.597**	**60.7**	**32.0**	**5.655**	**60.7**
Sum	94	16.791	182	94	16.791	182	94	16.791	182
Total Sum							282	50.373	546

Max. pitot press. =	34.0
Min. pitot press. =	30.0
Ratio Max:Min =	1.1 :1

Notes : Port B inaccessible due to wall
Traverse points shown are those reacheable with usable length probe in windshell

Gas Data

Oxygen %	7.0
CO_2 %	12.00

Oxygen Correction

Required Correction Value	0
Actual Oxygen Factor	1
Enter 0 if correction is not required	

BS EN 13284-1 & M1 Sample Point Requirements	Requirement Met?
Duct gas Flow: angle with regard to duct access <15°?	Y
Duct Gas Flow Negative Velocity: Not Permitted	Y
Duct Gas Flow: Ratio of max to min velocity <3:1?	Y
Working Area > 5m²?	N
Handrails with removable chains / self closing gates across the top of the ladder?	Y
Handrails (approx 0,5 and 1,0 m high) and vertical baseboards (approx 0,25m high)?	Y
Scaffold Built to 'Heavy Duty' Scafftag Rating or at least 2.5kN/m2 loading	N/A
Handrails not restricting access to ports?	N
Room opposite sampling port equal or greater than the length of the sampling probe plus 1 metre?	N
Sufficient Power (Waterproof 110V BS4343 Standard) close or on the platform?	Y

2.4.1 Continuous Emissions Monitoring Systems at the installation

	Procal 1 & 2	SICK	SICK
Determinand	**NOx & SO_2**	**NOx & SO_2**	**Particulate**
Type	In Situ IR	In-situ Probe – UV-DOAS	Cross Duct Forward Scatter
Make	Procal	SICK Maihak GmbH	Erwin Sick
Model	Pulsi 200 series	GM32 – In-situ	OMD41
MCERTS Certificate	MC990006/07	MC100163/01	MC040042/01
Certification ranges	NO = 0 – 1000 ppm SO2 low = 0 – 250 ppm SO2 high = 0 – 1000 ppm	Measuring path length 1.25m: NO 0 to 70 mg/m3 & 0 to 700 mg/m3 SO2 0 to 75mg/m3 & 0 to 1000mg/m3 Measuring path length 1.00m NO 0 to 87.5 mg/m3 & 0 to 875 mg/m3 SO2 0 to 93.8 mg/m3 and 0 to 1250 mg/m3	0 – 0.3 extinction
Operational ranges	As Above	SO2 Low: 0 – 250 ppm SO2 High: 0 – 1000ppm NO: 0 – 1000ppm NO2: 0 - 100ppm	0 – 50 mg/m^3
Principle	Dual wavelength infra-red	UV DOAS	Opacity
Raw data units	ppm	ppm	Extinction
Reference condition of raw data	wet gas, no oxygen correction	wet gas, no oxygen correction	wet gas, no oxygen, temp or pressure correction
Signal output	4-20 mA	4 – 20mA	Fibre optics
Provision for logging of 14181 data	Data logged by DCS		
Location of sample	Measurement taken at monitoring platform. SRM sample obtained from monitoring platform.		
Moisture – Measurement or calculated	Measured Measured	Measured	Measured

Section 3 – Information about the Monitoring campaign

Table 3.1 - Monitoring Organisation Staff Details

Project Manager	Position	MCERTS Level	Technical Endorsements	Expiry Dates	MCERTS Registration Number
Glyn Harrison	Operations Manager (Stack Emissions)	2	1	10/19	MM 03 228
			2	06/17	
			3	12/16	

Site Team	Position	MCERTS Level	Technical Endorsements	Expiry Dates	MCERTS Registration Number
Ian Baggley	Consultant	2	1	06/18	MM 05 642
			2	03/19	
			3	12/17	
			4	03/17	
Chris Davies	Consultant	2	1	12/19	MM 03 252
			2	12/15	
			3	12/17	
			4	06/16	
Will Doward	Technician	1	-	-	MM 13 1249

Report Author	Position	MCERTS Level	Technical Endorsements	Expiry Dates	MCERTS Registration Number
Glyn Harrison	Operations Manager (Stack Emissions)	2	1	10/19	MM 03 228
			2	06/17	
			3	12/16	

Report Reviewer	Position	MCERTS Level	Technical Endorsements	Expiry Dates	MCERTS Registration Number
Richard Harvey	Principal Consultant	2	1	11/17	MM 02 020
			2	03/19	
			3	03/16	
			4	12/15	

3.2 - Monitoring Organisation Method Details

Emission Parameter	Standard Method	Monitoring Procedure No.	Monitoring Accreditation Status	Analysis Technique	Expected Uncertainty (%)	Analysis Procedure No.	Analytical Laboratory	Analysis Accreditation Status
Oxides of Nitrogen (as NO_2)	BS EN 14792:2005	RPSCE/1/21f	MCERTS	Chemiluminescence	6	N/A	N/A	N/A
Oxygen	BS EN 14789:2005	RPSCE/1/21g	MCERTS	Zirconia Cell	5	N/A	N/A	N/A
Sulphur Dioxide	TGN M22	RPSCE/1/24	MCERTS	FTIR	10	N/A	N/A	N/A
Total particulate Matter	BS EN 13284:2002	RPSCE/1/7c	MCERTS	Gravimetric	10 - 30	D9	RPS	UKAS

Equipment details

Emission Parameter	Analysis Technique	Analyser	Analyser Certification Status	Certified Ranges	Operational Ranges	Operating Principle
Oxygen	Zirconia Cell	Horiba PG 250 SRM	MCERTs certificate No MC110186/03	0 – 25%	0-25%	Extractive, multicomponent dry gas analyser. Sample extracted through sample probe and 5metre heated sample line (with integral heated filter) – line temperature 180°C. Sample line connected directly to a gas conditioner (peltier cooler) set at 3°C. Cold dry sample then passes to analyser. Sample is drawn through system by integral pump built into analyser.
Oxides of Nitrogen	Chemiluminescence	Horiba PG 250 SRM	MCERTs certificate No MC110186/03	0 – 130 mg/m^3 as NO 0 – 200 mg/m^3 as NO_2	0 – 1000ppm	
Sulphur Dioxide	FTIR	Gasmet DX4000	MCERTs certificate No MC30014/05	0 – 75mg/m^3	0 – 500 ppm	Extractive wet gas analyser. Sample obtained non-isokinetically. Sample extracted through sample probe and filtered before passing through 5metre heated sample line (with integral heated filter) – line temperature 180°C. Sample line connected directly to a heated sample pump which in turn was connected to the FTIR. Hot, wet sample then passes to analyser.
Stack Gas Moisture	FTIR	Gasmet DX4000	MCERTs certificate No MC30014/05	0-40%	0-40%	
Total Particulate Matter	Multipoint isokinetic sampling with in stack filtration	N/A	N/A	0 – 50mg/m^3	-	Extractive manual test. Sample obtained isokinetically through sharp edged nozzle. Sample gas passed through a pre weighed, pre blown filter. Filter holder mounted in-stack.

Section 4A1: Data & calculations – QAL2 – Unit 7, SICK GM32

Section 4A – Data and calculations – QAL2 SICK GM32

4A1.1 Table 4.1.1 – Raw monitoring Data – Oxides of Nitrogen

Test No	Test Date	Test Start Time	Test End Time	CEMS Raw Value (Wet)	CEMS Oxygen (dry)	CEMS Moisture	SRM Raw Value (dry)	SRM Oxygen (Dry)	SRM Moisture	SRM at CEMs Raw conditions (wet)
		hr:min		NO (ppm)	(%)	(%)	NOx (ppm)	(%)	(%)	NOx (ppm)
1	05/03/2015	15:10	16:10	450.8	6.21	2.31	425.97	6.7	2.1	417.0
2	05/03/2015	17:12	18:12	438.6	6.19	2.31	414.98	6.6	2.1	406.2
3	05/03/2015	19:14	20:14	455.9	6.70	2.23	432.12	6.8	2.1	423.2
4	05/03/2015	21:16	22:16	442.4	6.47	2.25	421.10	6.6	2.1	412.3
5	06/03/2015	01:02	02:02	389.1	6.83	2.30	369.56	7.0	2.1	361.7
6	06/03/2015	03:04	04:04	433.4	7.77	2.13	413.27	7.7	2.0	405.2
7	06/03/2015	05:06	06:06	367.3	7.90	1.97	353.81	7.8	1.8	347.5
8	06/03/2015	07:08	08:08	454.3	6.35	2.21	427.81	6.5	2.0	419.2
9	06/03/2015	09:09	10:09	468.4	6.53	2.25	442.43	6.6	2.1	432.9
10	06/03/2015	11:11	12:11	472.6	6.85	2.22	444.16	6.9	2.2	434.3
11	06/03/2015	13:13	14:13	510.0	5.97	2.45	479.21	6.5	2.4	467.7
12	09/03/2015	12:45	13:45	293.3	4.95	1.97	290.85	5.8	2.0	284.9
13	09/03/2015	14:47	15:47	359.8	6.42	2.10	369.90	6.5	2.1	362.1
14	09/03/2015	16:49	17:49	359.5	6.00	1.98	368.93	6.2	2.0	361.7
15	09/03/2015	18:51	19:51	298.6	5.77	1.92	299.71	6.4	1.9	294.0
16	09/03/2015	20:53	21:53	248.1	6.33	1.89	250.28	6.6	1.9	245.6
17	09/03/2015	22:55	23:55	244.8	6.72	1.88	246.92	6.9	1.8	242.4
18	10/03/2015	01:01	02:01	233.1	6.21	1.94	236.06	6.6	1.9	231.6
19	10/03/2015	03:03	04:03	238.2	6.58	2.04	240.94	7.0	2.0	236.1
20	10/03/2015	05:05	06:05	248.2	6.97	1.92	250.26	7.2	1.9	245.6
21	10/03/2015	07:07	08:07	248.1	6.67	1.88	251.34	7.0	1.8	246.8
22	10/03/2015	09:09	10:09	243.6	6.66	1.90	243.34	6.9	1.9	238.8
23	10/03/2015	13:13	14:13	301.0	6.43	1.88	297.92	6.6	1.9	292.1

Note:

. Emission concentrations expresed at reference conditions 273K, 101.3kPa

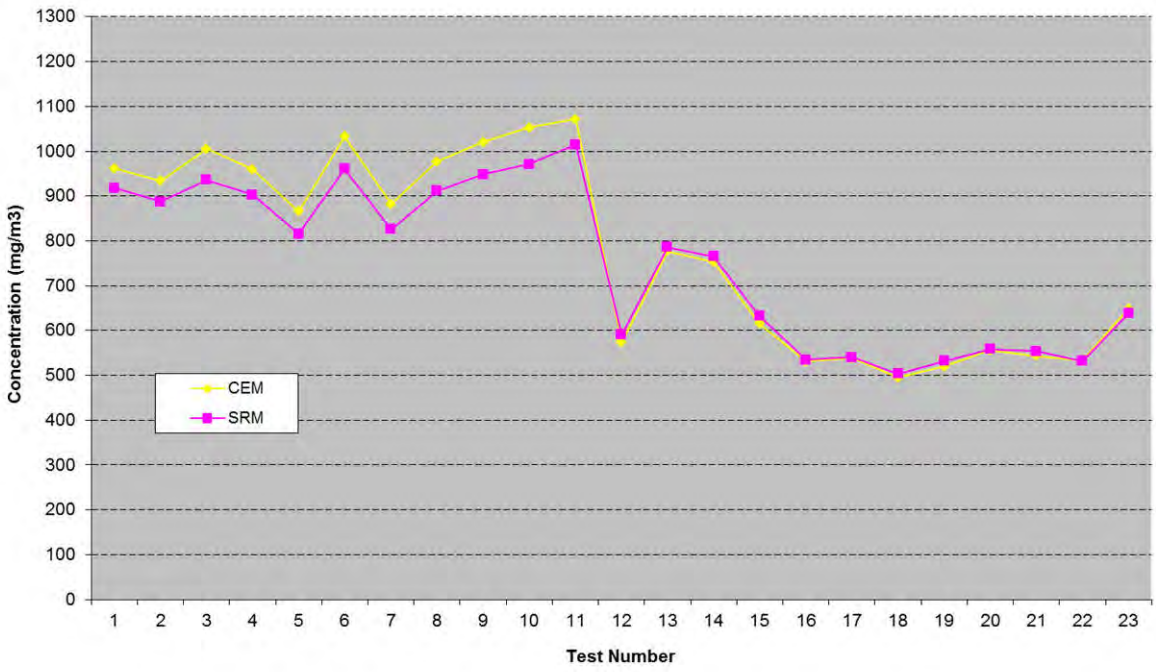
4A1.2 Table 4.2.1 - Standardised monitoring Data – Oxides of Nitrogen

Test No	Test Start Time	Test End Time	CEMS Standardised	SRM Standardised	SRM Uncertainty
	hr:min		NO as NO_2 (mg/m3)	NOx as NO_2 (mg/m3)	(mg/m3)
1	15:10	16:10	961.2	918.4	30.4
2	17:12	18:12	934.0	887.4	29.4
3	19:14	20:14	1004.8	936.3	31.0
4	21:16	22:16	959.6	902.8	29.9
5	1:02	2:02	865.9	815.2	27.0
6	3:04	4:04	1032.4	960.4	31.8
7	5:06	6:06	882.1	825.6	27.4
8	7:08	8:08	976.8	911.6	30.2
9	9:09	10:09	1020.6	948.5	34.0
10	11:11	12:11	1052.5	971.0	32.2
11	13:13	14:13	1071.9	1015.2	33.6
12	12:45	13:45	574.1	590.9	19.7
13	14:47	15:47	776.4	785.8	26.1
14	16:49	17:49	753.4	765.7	25.4
15	18:51	19:51	615.5	632.5	21.1
16	20:53	21:53	531.1	534.3	17.9
17	22:55	23:55	538.3	540.0	18.1
18	1:01	2:01	495.1	503.8	16.9
19	3:03	4:03	519.6	531.5	17.4
20	5:05	6:05	555.8	558.3	18.7
21	7:07	8:07	543.7	553.7	18.5
22	9:09	10:09	533.5	532.3	17.8
23	13:13	14:13	648.7	638.3	21.3

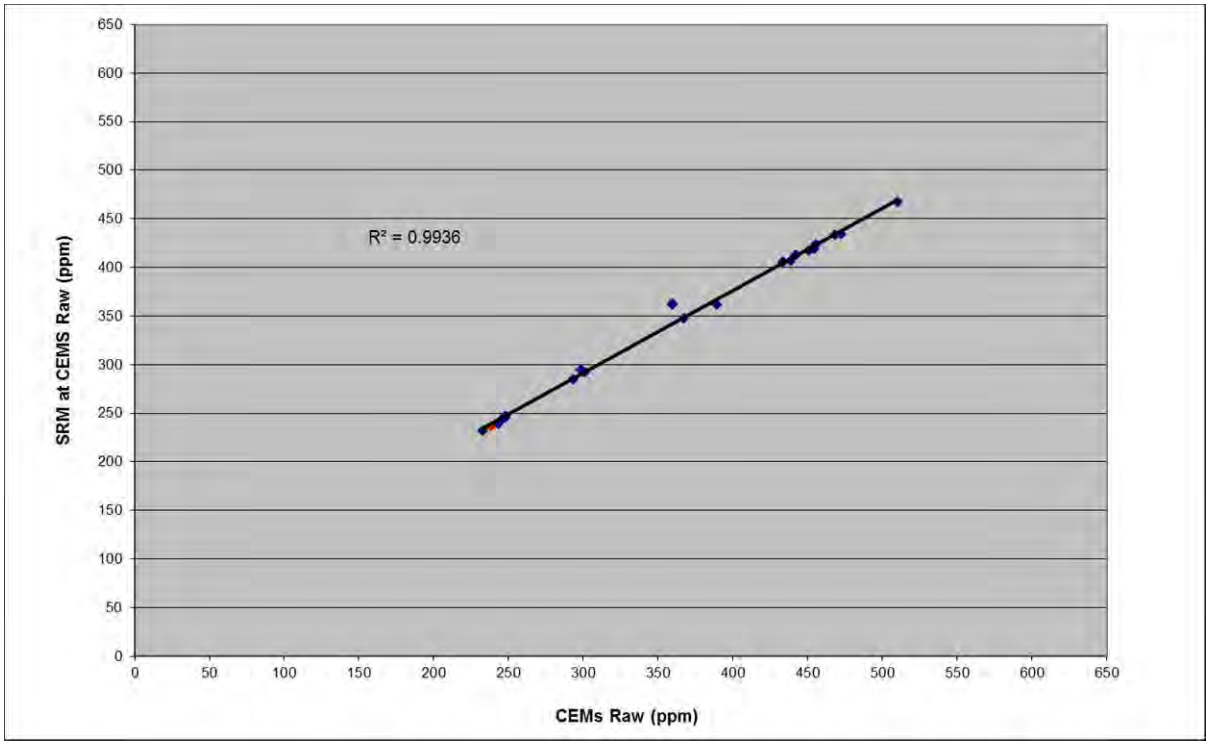
Note:

Emission concentrations expresed at reference conditions 273K, 101.3kPa 6 % Oxygen, dry gas

4A1.3 – Plot 1.1 - Time Series of Standardised CEM versus Standardised SRM data – Oxides of Nitrogen, (Expressed at reference conditions 273K, 101.3kPa, dry gas, 6% oxygen)



4A1.4 – Elimination of Outliers – Oxides of Nitrogen



Guidance on performing tests for outliers in MID 14181 section 6.3, states the following:

'As a general guide, when plotting the raw SRM and raw CEM data, if the R^2 value for the linear regression line is equal or more than 0.9, then it is not ordinarily necessary to perform an outlier test.
Additionally, any data points are not likely to be outliers unless they are more than three standard deviations from the regression line'

As the R^2 value for this determinand was 0.9936, an outlier test has not been undertaken.

4A1.5.1 Determination of Method A or Method B - Oxides of Nitrogen

Test No	Test Date	Test Start Time	Test End Time	SRM measured value (y)	SRM O2	SRM Standardised
		hr:min		(ppm)	(%)	(mg/m3)
1	05-Mar-15	15:10	16:10	426.0	6.7	918.4
2	05-Mar-15	17:12	18:12	415.0	6.6	887.4
3	05-Mar-15	19:14	20:14	432.1	6.8	936.3
4	05-Mar-15	21:16	22:16	421.1	6.6	902.8
5	06-Mar-15	1:02	2:02	369.6	7.0	815.2
6	06-Mar-15	3:04	4:04	413.3	7.7	960.4
7	06-Mar-15	5:06	6:06	353.8	7.8	825.6
8	06-Mar-15	7:08	8:08	427.8	6.5	911.6
9	06-Mar-15	9:09	10:09	442.4	6.6	948.5
10	06-Mar-15	11:11	12:11	444.2	6.9	971.0
11	06-Mar-15	13:13	14:13	479.2	6.5	1015.2
12	09-Mar-15	12:45	13:45	290.9	5.8	590.9
13	09-Mar-15	14:47	15:47	369.9	6.5	785.8
14	09-Mar-15	16:49	17:49	368.9	6.2	765.7
15	09-Mar-15	20:53	21:53	299.7	6.6	639.8
16	09-Mar-15	22:55	23:55	250.3	6.9	547.4
17	09-Mar-15	1:01	2:01	246.9	6.6	527.0
18	10-Mar-15	3:03	4:03	236.1	7.0	520.7
19	10-Mar-15	5:05	6:05	240.9	7.2	537.5
20	10-Mar-15	7:07	8:07	250.3	7.0	551.4
21	10-Mar-15	9:09	10:09	251.3	6.9	549.8
22	10-Mar-15	13:13	14:13	243.3	6.6	521.3
23	10-Mar-15	13:13	14:13	297.9	6.6	638.3
Sum				7970.88		
Emission Limit Value (ELV) =			1210	mg/Nm^3	Y_{max}	1015.22
15% of the ELV =			181.5	mg/Nm^3	Y_{min}	520.71
Therefore Ymax - Ymin > 15% of the ELV				**Method A**	$Y_{max - Ymin}$	494.51

4A1.6.1 Table 4.3.1 - Data used to derive calibration function - Oxides of Nitrogen,

Test No	Test Date	Test Start Time	Test End Time	SRM measured value (y)	CEMS measured signal (x)	Yi	Xi	Xi * Yi	Xi^2	b
		hr:min		NOx (ppm)	NO (ppm)	1	2	3	4	
1	09-May-14	Reference		0	0.33	-325.3751019	-341.3130754	111054.7767	116494.6155	
2	05-Mar-15	15:10	16:10	417.0	450.8	91.66	109.17	10006.54	11917.65	
3	05-Mar-15	17:12	18:12	406.2	438.6	80.80	96.93	7831.75	9394.95	
4	05-Mar-15	19:14	20:14	423.2	455.9	97.86	114.30	11185.28	13063.77	
5	05-Mar-15	21:16	22:16	412.3	442.4	86.92	100.73	8754.80	10146.01	
6	06-Mar-15	1:02	2:02	361.7	389.1	36.31	47.49	1724.70	2255.65	
7	06-Mar-15	3:04	4:04	405.2	433.4	79.83	91.78	7327.15	8424.02	
8	06-Mar-15	5:06	6:06	347.5	367.3	22.09	25.64	566.51	657.59	
9	06-Mar-15	7:08	8:08	419.2	454.3	93.83	112.64	10568.73	12686.86	
10	06-Mar-15	9:09	10:09	432.9	468.4	107.57	126.74	13633.47	16063.16	
11	06-Mar-15	11:11	12:11	434.3	472.6	108.96	130.96	14269.47	17149.92	
12	06-Mar-15	13:13	14:13	467.7	510.0	142.31	168.40	23964.11	28357.60	
13	09-Mar-15	12:45	13:45	284.9	293.3	-40.48	-48.38	1958.38	2340.59	
14	09-Mar-15	14:47	15:47	362.1	359.8	36.77	18.12	666.52	328.51	
15	09-Mar-15	16:49	17:49	361.7	359.5	36.30	17.89	649.32	319.92	
16	09-Mar-15	18:51	19:51	294.0	298.6	-31.40	-43.07	1352.42	1855.45	
17	09-Mar-15	20:53	21:53	245.6	248.1	-79.78	-93.55	7463.76	8751.65	
18	09-Mar-15	22:55	23:55	242.4	244.8	-83.00	-96.82	8036.00	9373.14	
19	10-Mar-15	1:01	2:01	231.6	233.1	-93.80	-108.51	10178.01	11774.04	
20	10-Mar-15	3:03	4:03	236.1	238.2	-89.23	-103.47	9232.70	10705.85	
21	10-Mar-15	5:05	6:05	245.6	248.2	-79.76	-93.41	7449.97	8725.16	
22	10-Mar-15	7:07	8:07	246.8	248.1	-78.58	-93.58	7353.82	8757.39	
23	10-Mar-15	9:09	10:09	238.8	243.6	-86.56	-98.05	8487.70	9613.85	
24	10-Mar-15	13:13	14:13	292.1	301.0	-33.25	-40.63	1351.01	1650.95	
Sum				7809.00	8199.43	0.00	0.00	285066.91	320808.29	0.89

4A1.7.1 Determination of Calibration Function - Oxides of Nitrogen

Method A

If Ymax-Ymin >15% of the ELV, the following formulae are used:

$b=\sum_{i=1}^{N}(xi-x)(yi-y)/\sum_{i=1}^{N}(xi-x)^2$ where $x=1/N\sum_{i=1}^{N}xi$ $y=1/N\sum_{i=1}^{N}yi$

x= 341.64

y= 325.38

b= 0.889

$a=y-bx$ a = 325.38 - 341.65 * 0.888 a= 21.795

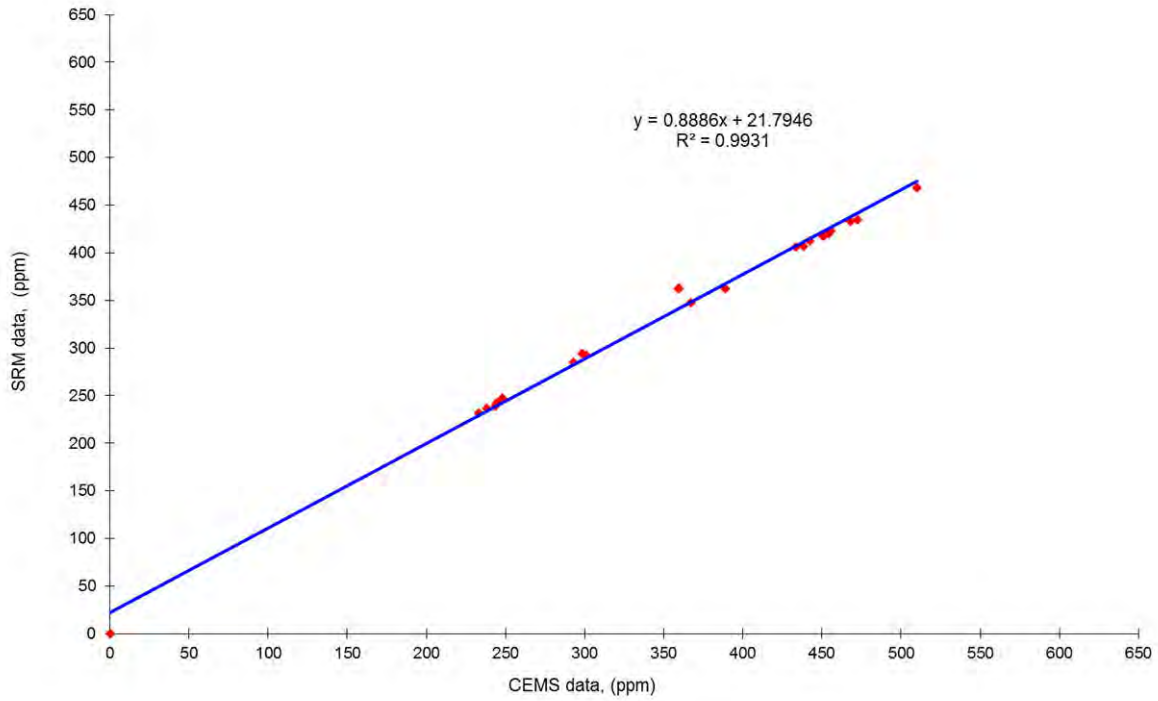
The calibration is function $y_i = a + bxi$ or yi = 21.795 + 0.889 * xi

4A1.8.1 Table 4.4.1 - Calculation of calibrated CEMS values - Oxides of Nitrogen

Test No	Test Date	Test Start Time	Test End Time	CEMS Raw Value (x)	CEMS Calibrated signal	CEMS Moisture	CEMS wet Oxygen	CEMS Calibrated Standardised Value	SRM Standardised
		hr:min		NO (ppm)	NO (ppm)	(%)	(%)	NO as NO2 (mg/m3)	NOx as NO2 (mg/m3)
1	09-May-14	Reference Gas		0.3	22.1			22.1	0.0
2	05-Mar-15	15:10	16:10	450.8	422.4	2.3	6.2	900.6	918.4
3	05-Mar-15	17:12	18:12	438.6	411.5	2.3	6.2	876.3	887.4
4	05-Mar-15	19:14	20:14	455.9	426.9	2.2	6.7	940.9	936.3
5	05-Mar-15	21:16	22:16	442.4	414.9	2.3	6.5	899.9	902.8
6	06-Mar-15	01:02	02:02	389.1	367.6	2.3	6.8	817.9	815.2
7	06-Mar-15	03:04	04:04	433.4	406.9	2.1	7.8	969.3	960.4
8	06-Mar-15	05:06	06:06	367.3	348.2	2.0	7.9	836.2	825.6
9	06-Mar-15	07:08	08:08	454.3	425.5	2.2	6.3	914.8	911.6
10	06-Mar-15	09:09	10:09	468.4	438.0	2.3	6.5	954.4	948.5
11	06-Mar-15	11:11	12:11	472.6	441.7	2.2	6.8	983.8	971.0
12	06-Mar-15	13:13	14:13	510.0	475.0	2.5	6.0	998.3	1015.2
13	09-Mar-15	12:45	13:45	293.3	282.4	2.0	5.0	552.8	590.9
14	09-Mar-15	14:47	15:47	359.8	341.5	2.1	6.4	737.0	785.8
15	09-Mar-15	16:49	17:49	359.5	341.3	2.0	6.0	715.1	765.7
16	09-Mar-15	18:51	19:51	298.6	287.1	1.9	5.8	591.8	632.5
17	09-Mar-15	20:53	21:53	248.1	242.2	1.9	6.3	518.6	534.3
18	09-Mar-15	22:55	23:55	244.8	239.3	1.9	6.7	526.3	540.0
19	10-Mar-15	01:01	02:01	233.1	229.0	1.9	6.2	486.2	503.8
20	10-Mar-15	03:03	04:03	238.2	233.4	2.0	6.6	509.2	531.5
21	10-Mar-15	05:05	06:05	248.2	242.4	1.9	7.0	542.7	558.3
22	10-Mar-15	07:07	08:07	248.1	242.2	1.9	6.7	530.9	553.7
23	10-Mar-15	09:09	10:09	243.6	238.2	1.9	6.7	521.8	532.3
24	10-Mar-15	13:13	14:13	301.0	289.3	1.9	6.4	623.4	638.3
				Sum				16970.3	

Emission Limit Value (ELV) =	1210	mg/Nm^3
Reference Oxygen	6 %	

4A1.9.1 Plot 2.1 CEM versus SRM Parallel Test Data at CEM measurement conditions –NOx ppm, wet gas.



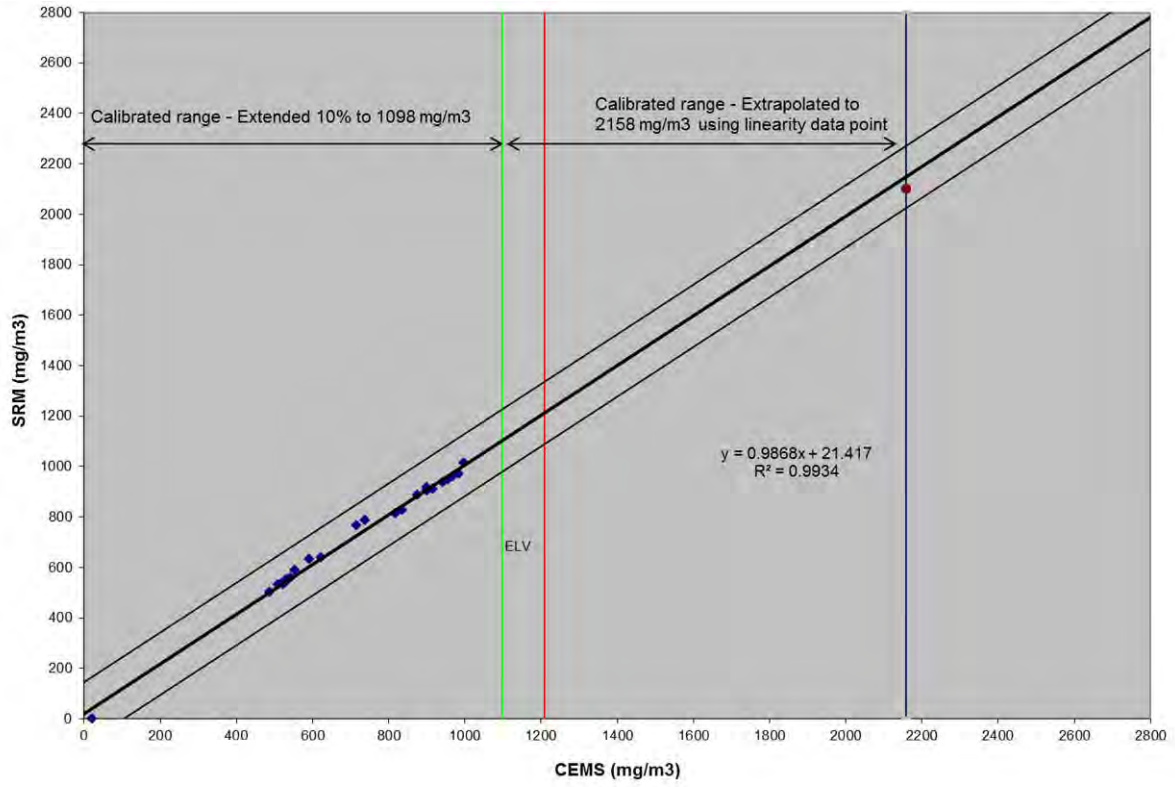
4A1.10.1 Table 4.5.1 – Data used for the Variability Test – Oxides of Nitrogen

Test No	Test Date	Test Start Time	Test End Time	CEMS Calibrated Standardised value	SRM Standardised value	Difference D1	Difference D1 - D	Squared Difference D1 - D
		hr:min		mg/m3	mg/m3			
1		Reference Gas		22.1	0.0	-22.09	-34.14	1165.32
2	05-Mar-15	15:10	16:10	900.6	918.4	17.82	5.78	33.36
3	05-Mar-15	17:12	18:12	876.3	887.4	11.04	-1.01	1.02
4	05-Mar-15	19:14	20:14	940.9	936.3	-4.63	-16.68	278.18
5	05-Mar-15	21:16	22:16	899.9	902.8	2.81	-9.24	85.42
6	06-Mar-15	01:02	02:02	817.9	815.2	-2.77	-14.82	219.60
7	06-Mar-15	03:04	04:04	969.3	960.4	-8.84	-20.89	436.38
8	06-Mar-15	05:06	06:06	836.2	825.6	-10.58	-22.63	512.14
9	06-Mar-15	07:08	08:08	914.8	911.6	-3.21	-15.26	232.77
10	06-Mar-15	09:09	10:09	954.4	948.5	-5.83	-17.88	319.76
11	06-Mar-15	11:11	12:11	983.8	971.0	-12.74	-24.79	614.38
12	06-Mar-15	13:13	14:13	998.3	1015.2	16.91	4.86	23.65
13	09-Mar-15	12:45	13:45	552.8	590.9	38.08	26.03	677.50
14	09-Mar-15	14:47	15:47	737.0	785.8	48.85	36.80	1354.30
15	09-Mar-15	16:49	17:49	715.1	765.7	50.54	38.49	1481.59
16	09-Mar-15	18:51	19:51	591.8	632.5	40.71	28.66	821.67
17	09-Mar-15	20:53	21:53	518.6	534.3	15.69	3.64	13.24
18	09-Mar-15	22:55	23:55	526.3	540.0	13.76	1.71	2.92
19	10-Mar-15	01:01	02:01	486.2	503.8	17.63	5.58	31.11
20	10-Mar-15	03:03	04:03	509.2	531.5	22.27	10.23	104.56
21	10-Mar-15	05:05	06:05	542.7	558.3	15.63	3.58	12.84
22	10-Mar-15	07:07	08:07	530.9	553.7	22.85	10.80	116.70
23	10-Mar-15	09:09	10:09	521.8	532.3	10.42	-1.63	2.65
24	10-Mar-15	13:13	14:13	623.4	638.3	14.84	2.80	7.81
24	Tests		Mean			12.05		
Sum								8548.87

4A1.11.1 - Variability Test Calculation – Oxides of Nitrogen

SD=	Root(1-Number).Integral(D1-D)^2		19.28	mg/m3(s,d),6%O_2
The uncertainty laid down by the authorities is 20% ELV as a 95% confidence interval. O_0 is therefore calculated as:-				
O_0=	0.2*1210 mg/m3 (s,d,6%O2)/1.96		123.47	mg/m3(s,d),6%O_2
For 25 tests, k_v =	0.9861			
Therefore variability=		19.28 <= 123.47 * 0.9861		
	or	19.28 <=	121.75	
Which is TRUE therefore the CEMS passes the test				

4A1.12.1 Plot 3.1 –Standardised CEM data versus standardised SRM - Oxides of Nitrogen (as NO_2) – Reference conditions 273K, 101.3kPa, dry gas, 6% oxygen



4A1.1.2 Table 4.1.2 – Raw monitoring Data – Sulphur Dioxide, Low Range

Test No	Test Date	Test Start Time	Test End Time	CEMS Raw Value (Wet)	CEMS Oxygen (dry)	CEMS Moisture	SRM Raw Value (Wet)	SRM Oxygen (Dry)	SRM Moisture	SRM at CEMs Raw conditions (wet)
		hr:min		SO2 (ppm)	(%)	(%)	SO2 (ppm)	(%)	(%)	SO2 (ppm)
1	05/03/2015	15:10	16:10	63.4	6.21	2.31	67.99	6.7	2.1	68.0
2	05/03/2015	17:12	18:12	51.7	6.19	2.31	55.77	6.6	2.1	55.8
3	05/03/2015	19:14	20:14	54.9	6.70	2.23	54.98	6.8	2.1	55.0
4	05/03/2015	21:16	22:16	77.8	6.47	2.25	83.10	6.6	2.1	83.1
5	06/03/2015	01:02	02:02	84.1	6.83	2.30	89.82	7.0	2.1	89.8
6	06/03/2015	03:04	04:04	79.2	7.77	2.13	85.68	7.7	2.0	85.7
7	06/03/2015	05:06	06:06	77.1	7.90	1.97	84.21	7.8	1.8	84.2
8	06/03/2015	07:08	08:08	87.1	6.35	2.21	92.40	6.5	2.0	92.4
9	06/03/2015	09:09	10:09	79.3	6.53	2.25	84.79	6.6	2.1	84.8
10	06/03/2015	11:11	12:11	72.6	6.85	2.22	76.61	6.9	2.2	76.6
11	06/03/2015	13:13	14:13	70.7	5.97	2.45	74.34	6.5	2.4	74.3
12	09/03/2015	12:45	13:45	54.6	4.95	1.97	59.06	5.8	2.0	59.1
13	09/03/2015	14:47	15:47	45.6	6.42	2.10	49.42	6.5	2.1	49.4
14	09/03/2015	16:49	17:49	49.0	6.00	1.98	53.39	6.2	2.0	53.4
15	09/03/2015	18:51	19:51	55.1	5.77	1.92	59.36	6.4	1.9	59.4
16	09/03/2015	20:53	21:53	55.9	6.33	1.89	61.15	6.6	1.9	61.2
17	09/03/2015	22:55	23:55	53.6	6.72	1.88	59.25	6.9	1.8	59.3
18	10/03/2015	01:01	02:01	59.0	6.21	1.94	65.53	6.6	1.9	65.5
19	10/03/2015	03:03	04:03	53.6	6.58	2.04	59.42	7.0	2.0	59.4
20	10/03/2015	05:05	06:05	51.5	6.97	1.92	57.07	7.2	1.9	57.1
21	10/03/2015	07:07	08:07	62.6	6.67	1.88	68.99	7.0	1.8	69.0
22	10/03/2015	09:09	10:09	70.4	6.66	1.90	77.28	6.9	1.9	77.3
23	10/03/2015	13:13	14:13	65.1	6.43	1.88	71.51	6.6	1.9	71.5

Note:

Emission concentrations expresed at reference conditions 273K, 101.3kPa

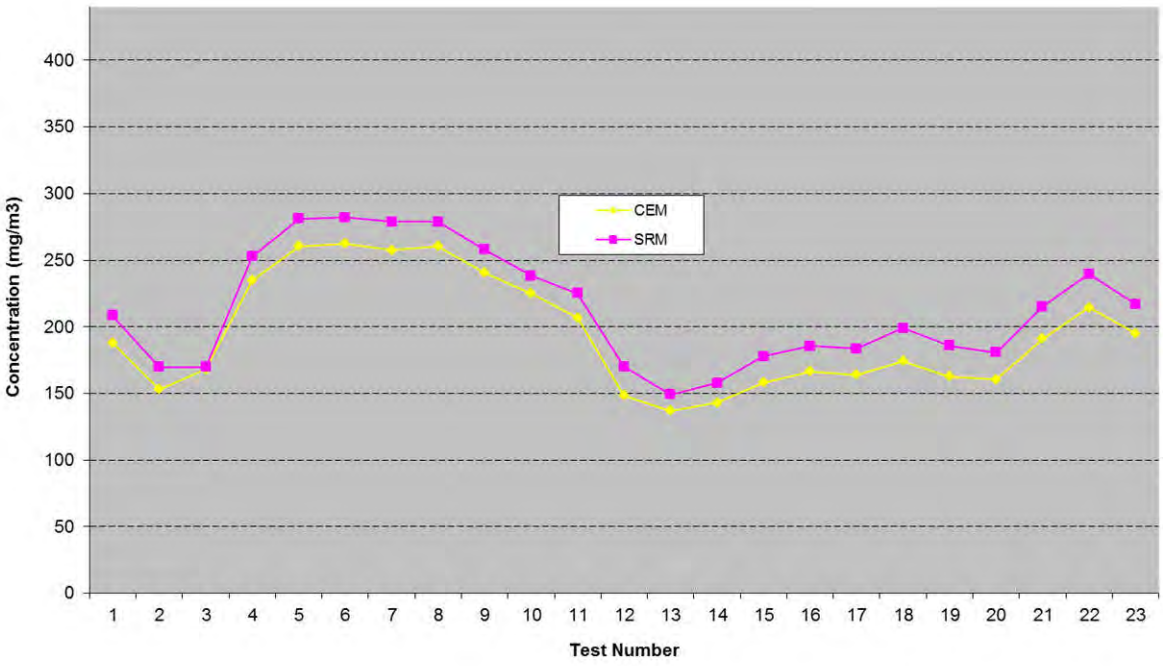
4A1.2.2 Table 4.2.2 -Standardised monitoring Data – Sulphur Dioxide, Low Range

Test No	Test Start Time	Test End Time	CEMS Standardised	SRM Standardised	SRM Uncertainty
	hr:min		SO_2 (mg/m3)	SO_2 (mg/m3)	(mg/m3)
1	15:10	16:10	188.2	208.2	31.9
2	17:12	18:12	153.1	169.6	31.7
3	19:14	20:14	168.2	169.6	32.2
4	21:16	22:16	234.9	252.7	32.2
5	1:02	2:02	260.4	281.0	32.4
6	3:04	4:04	262.4	282.0	32.4
7	5:06	6:06	257.4	278.7	32.4
8	7:08	8:08	260.5	278.7	32.4
9	9:09	10:09	240.4	257.8	32.2
10	11:11	12:11	225.0	238.2	32.1
11	13:13	14:13	206.8	225.2	31.4
12	12:45	13:45	148.6	169.9	31.7
13	14:47	15:47	136.9	149.2	31.7
14	16:49	17:49	142.9	157.8	31.7
15	18:51	19:51	158.0	177.7	31.8
16	20:53	21:53	166.4	185.6	31.8
17	22:55	23:55	163.9	183.5	31.8
18	1:01	2:01	174.3	198.9	31.9
19	3:03	4:03	162.7	185.7	31.1
20	5:05	6:05	160.5	180.8	31.1
21	7:07	8:07	190.9	215.2	32.0
22	9:09	10:09	214.6	239.5	32.1
23	13:13	14:13	195.2	217.0	32.0

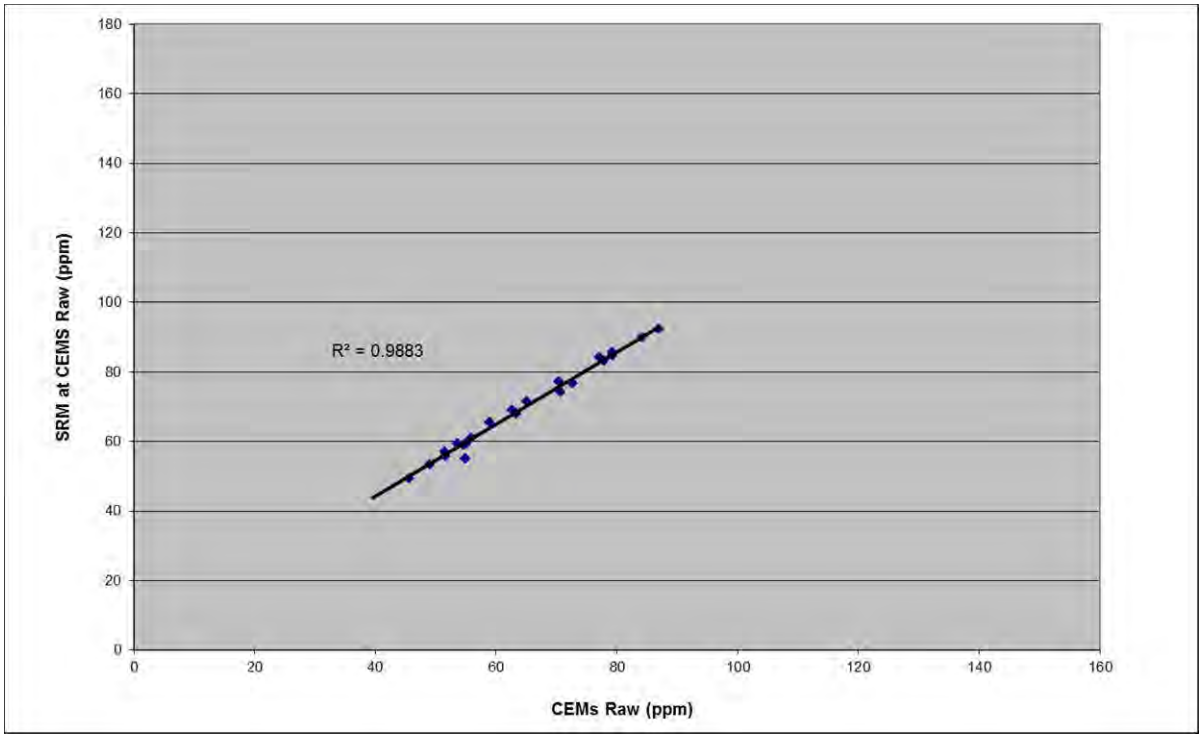
Note:

Emission concentrations expresed at reference conditions 273K, 101.3kPa 6 % Oxygen, dry gas

4A1.3.2 – Plot 1.2 - Time Series of Standardised CEM versus Standardised SRM data – Sulphur Dioxide, Low Range (Expressed at reference conditions 273K, 101.3kPa, dry gas, 6% oxygen)



4A1.4.2 – Elimination of Outliers – Sulphur Dioxide, Low Range.



Guidance on performing tests for outliers in MID 14181 section 6.3, states the following:

'As a general guide, when plotting the raw SRM and raw CEM data, if the R^2 value for the linear regression line is equal or more than 0.9, then it is not ordinarily necessary to perform an outlier test.
Additionally, any data points are not likely to be outliers unless they are more than three standard deviations from the regression line'

As the R^2 value for this determinand was 0.9883, an outlier test has not been undertaken.

4A1.5.2 Determination of Method A or Method B - Sulphur Dioxide, Low Range.

Test No	Test Date	Test Start Time	Test End Time	SRM measured value (y)	SRM Moisture	SRM O2	SRM Standardised
		hr:min		(ppm)	(%)	(%)	(mg/m3)
1	05-Mar-15	15:10	16:10	68.0	2.10	6.7	208.2
2	05-Mar-15	17:12	18:12	55.8	2.10	6.6	169.6
3	05-Mar-15	19:14	20:14	55.0	2.10	6.8	169.6
4	05-Mar-15	21:16	22:16	83.1	2.10	6.6	252.7
5	06-Mar-15	1:02	2:02	89.8	2.10	7.0	281.0
6	06-Mar-15	3:04	4:04	85.7	2.00	7.7	282.0
7	06-Mar-15	5:06	6:06	84.2	1.80	7.8	278.7
8	06-Mar-15	7:08	8:08	92.4	2.00	6.5	278.7
9	06-Mar-15	9:09	10:09	84.8	2.10	6.6	257.8
10	06-Mar-15	11:11	12:11	76.6	2.20	6.9	238.2
11	06-Mar-15	13:13	14:13	74.3	2.40	6.5	225.2
12	09-Mar-15	12:45	13:45	59.1	2.00	5.8	169.9
13	09-Mar-15	14:47	15:47	49.4	2.10	6.5	149.2
14	09-Mar-15	16:49	17:49	53.4	2.00	6.2	157.8
15	09-Mar-15	18:51	19:51	59.4	1.90	6.4	177.7
16	09-Mar-15	20:53	21:53	61.2	1.90	6.6	185.6
17	09-Mar-15	22:55	23:55	59.3	1.80	6.9	183.5
18	10-Mar-15	1:01	2:01	65.5	1.90	6.6	198.9
19	10-Mar-15	3:03	4:03	59.4	2.00	7.0	185.7
20	10-Mar-15	5:05	6:05	57.1	1.90	7.2	180.8
21	10-Mar-15	7:07	8:07	69.0	1.80	7.0	215.2
22	10-Mar-15	9:09	10:09	77.3	1.90	6.9	239.5
23	10-Mar-15	13:13	14:13	71.5	1.90	6.6	217.0
Sum				1591.12			

Emission Limit Value (ELV) =	440	mg/Nm^3	
15% of the ELV =	66	mg/Nm^3	
Therefore Ymax - Ymin > 15% of the ELV		**Method A**	

Y_{max}	281.97
Y_{min}	149.24
$Y_{max - Ymin}$	132.73

4A1.6.2 Table 4.3.2 - Data used to derive calibration function - Sulphur Dioxide, Low Range.

Test No	Test Date	Test Start Time	Test End Time	SRM measured value (y)	CEMS measured signal (x)
		hr:min		SO2 (ppm)	SO2 (ppm)
1	17-Feb-15	Reference Gas		0	0.37
2	05-Mar-15	15:10	16:10	68.0	63.4
3	05-Mar-15	17:12	18:12	55.8	51.7
4	05-Mar-15	19:14	20:14	55.0	54.9
5	05-Mar-15	21:16	22:16	83.1	77.8
6	06-Mar-15	1:02	2:02	89.8	84.1
7	06-Mar-15	3:04	4:04	85.7	79.2
8	06-Mar-15	5:06	6:06	84.2	77.1
9	06-Mar-15	7:08	8:08	92.4	87.1
10	06-Mar-15	9:09	10:09	84.8	79.3
11	06-Mar-15	11:11	12:11	76.6	72.6
12	06-Mar-15	13:13	14:13	74.3	70.7
13	09-Mar-15	12:45	13:45	59.1	54.6
14	09-Mar-15	14:47	15:47	49.4	45.6
15	09-Mar-15	16:49	17:49	53.4	49.0
16	09-Mar-15	18:51	19:51	59.4	55.1
17	09-Mar-15	20:53	21:53	61.2	55.9
18	09-Mar-15	22:55	23:55	59.3	53.6
19	10-Mar-15	1:01	2:01	65.5	59.0
20	10-Mar-15	3:03	4:03	59.4	53.6
21	10-Mar-15	5:05	6:05	57.1	51.5
22	10-Mar-15	7:07	8:07	69.0	62.6
23	10-Mar-15	9:09	10:09	77.3	70.4
24	10-Mar-15	13:13	14:13	71.5	65.1
Sum				1591.12	1474.18

Yi	Xi	Xi * Yi	Xi^2	b
1	2	3	4	
-66.29651389	-61.05410566	4047.674364	3727.603818	
1.69	2.02	3.42	4.08	
-10.53	-9.75	102.59	94.99	
-11.32	-6.56	74.23	43.02	
16.80	16.40	275.54	268.88	
23.52	22.67	533.32	514.01	
19.38	17.78	344.72	316.27	
17.91	15.64	280.12	244.54	
26.10	25.63	668.97	656.96	
18.49	17.89	330.79	319.94	
10.31	11.19	115.40	125.19	
8.04	9.32	74.99	86.93	
-7.24	-6.85	49.56	46.90	
-16.88	-15.84	267.33	250.92	
-12.91	-12.41	160.12	153.91	
-6.94	-6.36	44.10	40.42	
-5.15	-5.55	28.57	30.81	
-7.05	-7.84	55.27	61.53	
-0.77	-2.44	1.87	5.93	
-6.88	-7.80	53.65	60.87	
-9.23	-9.93	91.59	98.55	
2.69	1.19	3.20	1.41	
10.98	8.98	98.66	80.68	
5.21	3.66	19.09	13.41	
0.00	0.00	7724.76	7247.74	1.07

4A1.7.2 Determination of Calibration Function - Sulphur Dioxide, Low Range.

Method A

If Ymax-Ymin >15% of the ELV, the following formulae are used:

$b=\sum_{i=1}^{N}(xi-x)(yi-y)/\sum_{i=1}^{N}(xi-x)^2$ where $x=1/N\sum_{i=1}^{N}xi$ $y=1/N\sum_{i=1}^{N}yi$

x= 61.42

y= 66.30

b= 1.066

$a=y-bx$ a = 66.3 - 61.43 * 1.065

a= 0.830

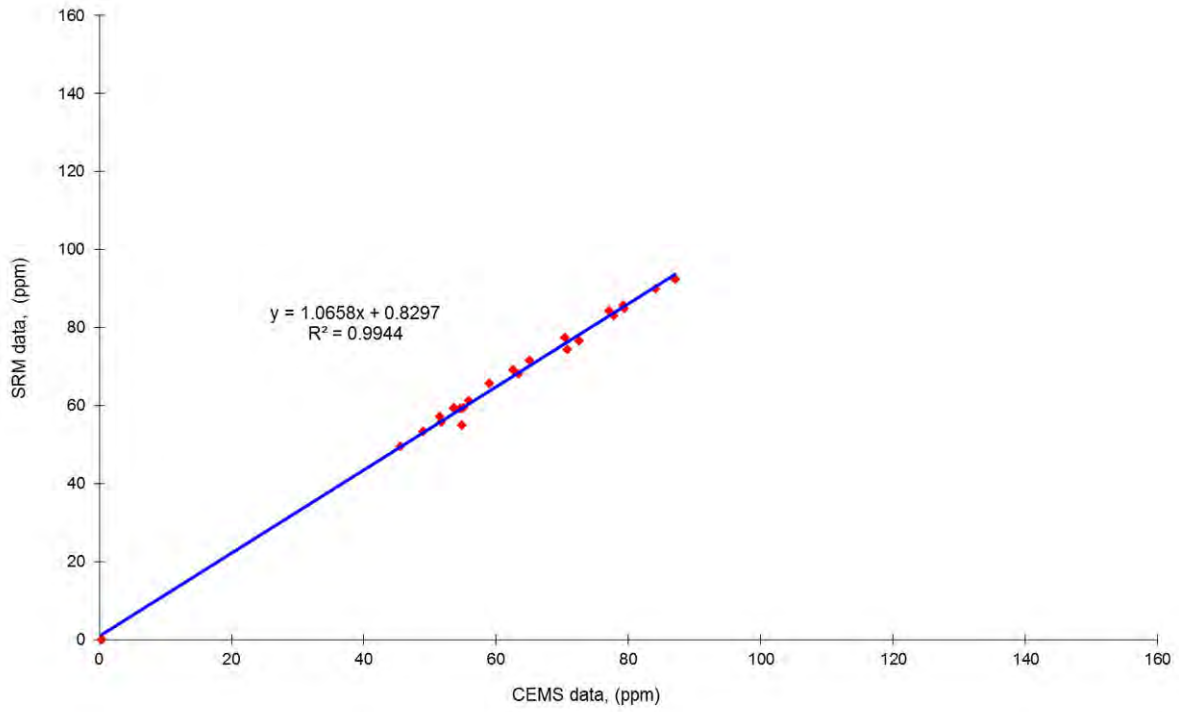
The calibration is function $y_i = a + bxi$ or yi = 0.83 + 1.066 * xi

4A1.8.2 Table A.4.4.2 - Calculation of calibrated CEMS values - Sulphur Dioxide, Low Range

Test No	Test Date	Test Start Time	Test End Time	CEMS Raw Value (x)	CEMS Calibrated signal	CEMS Moisture	CEMS dry Oxygen	CEMS Calibrated Standardised Value	SRM Standardised
		hr:min		SO2 (ppm)	SO2 (ppm)	(%)	(%)	SO2 (mg/m3)	SO2 (mg/m3)
1	17-Feb-15	Reference Gas		0.4	1.2			3.5	0.0
2	05-Mar-15	15:10	16:10	63.4	68.4	2.3	6.2	203.1	208.2
3	05-Mar-15	17:12	18:12	51.7	55.9	2.3	6.2	165.6	169.6
4	05-Mar-15	19:14	20:14	54.9	59.3	2.2	6.7	181.9	169.6
5	05-Mar-15	21:16	22:16	77.8	83.8	2.3	6.5	252.8	252.7
6	06-Mar-15	01:02	02:02	84.1	90.5	2.3	6.8	280.1	281.0
7	06-Mar-15	03:04	04:04	79.2	85.3	2.1	7.8	282.4	282.0
8	06-Mar-15	05:06	06:06	77.1	83.0	2.0	7.9	277.1	278.7
9	06-Mar-15	07:08	08:08	87.1	93.6	2.2	6.4	280.1	278.7
10	06-Mar-15	09:09	10:09	79.3	85.4	2.3	6.5	258.7	257.8
11	06-Mar-15	11:11	12:11	72.6	78.2	2.2	6.9	242.4	238.2
12	06-Mar-15	13:13	14:13	70.7	76.2	2.5	6.0	222.8	225.2
13	09-Mar-15	12:45	13:45	54.6	59.0	2.0	5.0	160.6	169.9
14	09-Mar-15	14:47	15:47	45.6	49.4	2.1	6.4	148.4	149.2
15	09-Mar-15	16:49	17:49	49.0	53.1	2.0	6.0	154.7	157.8
16	09-Mar-15	18:51	19:51	55.1	59.5	1.9	5.8	170.8	177.7
17	09-Mar-15	20:53	21:53	55.9	60.4	1.9	6.3	179.8	185.6
18	09-Mar-15	22:55	23:55	53.6	57.9	1.9	6.7	177.3	183.5
19	10-Mar-15	01:01	02:01	59.0	63.7	1.9	6.2	188.3	198.9
20	10-Mar-15	03:03	04:03	53.6	58.0	2.0	6.6	176.0	185.7
21	10-Mar-15	05:05	06:05	51.5	55.7	1.9	7.0	173.6	180.8
22	10-Mar-15	07:07	08:07	62.6	67.6	1.9	6.7	206.0	215.2
23	10-Mar-15	09:09	10:09	70.4	75.9	1.9	6.7	231.2	239.5
24	10-Mar-15	13:13	14:13	65.1	70.2	1.9	6.4	210.5	217.0
Sum								4827.7	

Emission Limit Value (ELV) =	440	mg/Nm^3
Reference Oxygen	6 %	

4A1.9.2 Plot 2.2 CEM versus SRM Parallel Test Data at CEM measurement conditions –Sulphur dioxide, wet gas



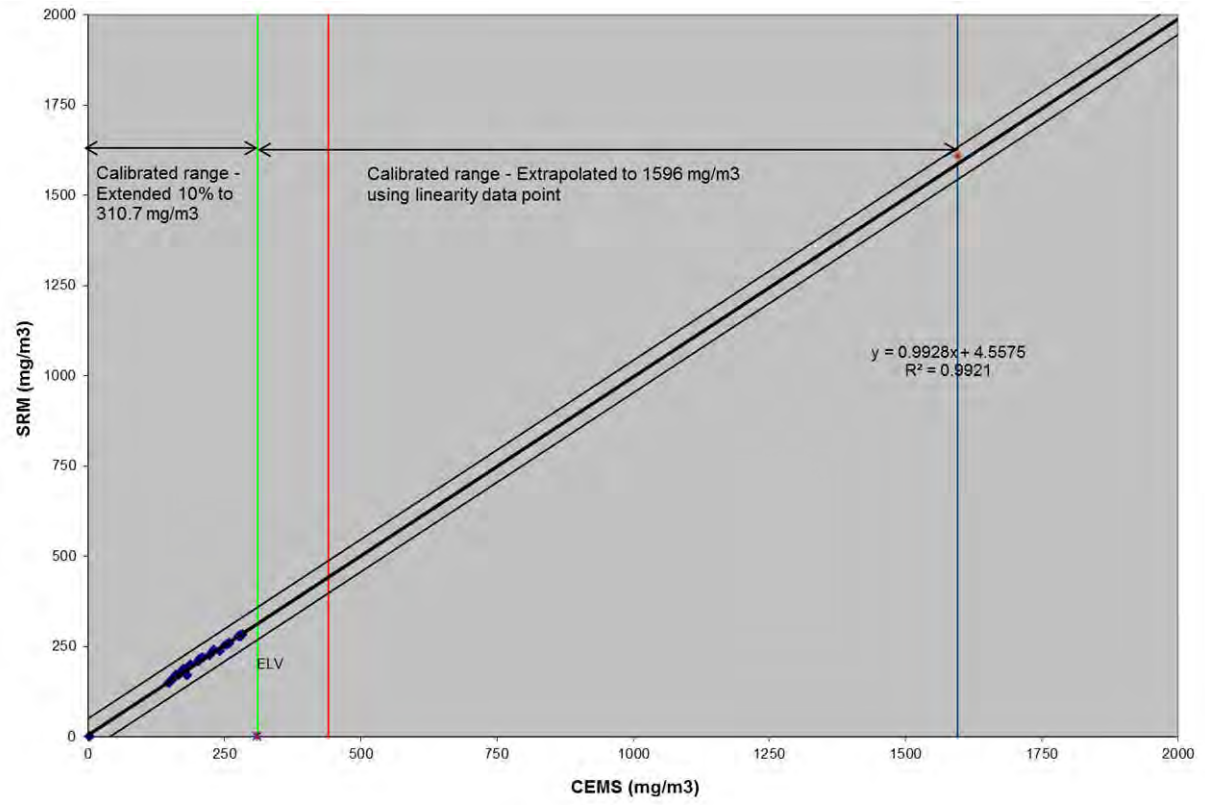
4A1.10.2 Table 4.5.2 – Data used for the Variability Test – Sulphur Dioxide, Low Range.

Test No	Test Date	Test Start Time	Test End Time	CEMS Calibrated Standardised value	SRM Standardised value	Difference D1	Difference D1 - D	Squared Difference D1 - D
		hr:min		mg/m3	mg/m3			
1	17-Feb-15	Reference Gas		3.5	0.0	-3.50	-6.61	43.64
2	05-Mar-15	15:10	16:10	203.1	208.2	5.15	2.04	4.18
3	05-Mar-15	17:12	18:12	165.6	169.6	3.96	0.85	0.73
4	05-Mar-15	19:14	20:14	181.9	169.6	-12.29	-15.40	237.25
5	05-Mar-15	21:16	22:16	252.8	252.7	-0.14	-3.25	10.55
6	06-Mar-15	01:02	02:02	280.1	281.0	0.84	-2.27	5.13
7	06-Mar-15	03:04	04:04	282.4	282.0	-0.46	-3.57	12.72
8	06-Mar-15	05:06	06:06	277.1	278.7	1.53	-1.57	2.48
9	06-Mar-15	07:08	08:08	280.1	278.7	-1.36	-4.47	20.01
10	06-Mar-15	09:09	10:09	258.7	257.8	-0.87	-3.98	15.81
11	06-Mar-15	11:11	12:11	242.4	238.2	-4.20	-7.30	53.36
12	06-Mar-15	13:13	14:13	222.8	225.2	2.35	-0.76	0.58
13	09-Mar-15	12:45	13:45	160.6	169.9	9.27	6.17	38.02
14	09-Mar-15	14:47	15:47	148.4	149.2	0.84	-2.26	5.13
15	09-Mar-15	16:49	17:49	154.7	157.8	3.07	-0.04	0.00
16	09-Mar-15	18:51	19:51	170.8	177.7	6.90	3.79	14.39
17	09-Mar-15	20:53	21:53	179.8	185.6	5.75	2.64	6.97
18	09-Mar-15	22:55	23:55	177.3	183.5	6.20	3.09	9.56
19	10-Mar-15	01:01	02:01	188.3	198.9	10.61	7.50	56.24
20	10-Mar-15	03:03	04:03	176.0	185.7	9.74	6.63	43.96
21	10-Mar-15	05:05	06:05	173.6	180.8	7.17	4.06	16.47
22	10-Mar-15	07:07	08:07	206.0	215.2	9.17	6.07	36.80
23	10-Mar-15	09:09	10:09	231.2	239.5	8.33	5.23	27.31
24	10-Mar-15	13:13	14:13	210.5	217.0	6.52	3.41	11.66
24	Tests		Mean			3.11		
Sum								672.96

4A1.11.2 - Variability Test Calculation – Sulphur Dioxide, Low Range.

SD=	Root(1-Number).Integral(D1-D)^2			5.41	mg/m3(s,d),6%O_2
The uncertainty laid down by the authorities is 20% ELV as a 95% confidence interval. O_0 is therefore calculated as:-					
O_0=	0.2*440 mg/m3 (s,d,6%O2)/1.96			44.90	mg/m3(s,d),6%O_2
For 25 tests, k_v =	0.9861				
Therefore variability=			5.41 <= 44.9 * 0.9861		
	or	5.41	<=	44.27	
Which is TRUE therefore the CEMS passes the test					

4A1.12.2 Plot 3.2 –Standardised CEM data versus standardised SRM - Sulphur dioxide, Low Range – Reference conditions 273K, 101.3kPa 6% oxygen, dry gas.



4A1.1.3 Table 4.1.3– Raw monitoring Data – Sulphur Dioxide, High Range

Test No	Test Date	Test Start Time	Test End Time	CEMS Raw Value (Wet)	CEMS Oxygen (dry)	CEMS Moisture	SRM Raw Value (Wet)	SRM Oxygen (Dry)	SRM Moisture	SRM at CEMs Raw conditions (wet)
		hr:min		SO2 (ppm)	(%)	(%)	SO2 (ppm)	(%)	(%)	SO2 (ppm)
1	05/03/2015	15:10	16:10	63.7	6.21	2.31	67.99	6.7	2.1	68.0
2	05/03/2015	17:12	18:12	52.0	6.19	2.31	55.77	6.6	2.1	55.8
3	05/03/2015	19:14	20:14	55.1	6.70	2.23	54.98	6.8	2.1	55.0
4	05/03/2015	21:16	22:16	78.1	6.47	2.25	83.10	6.6	2.1	83.1
5	06/03/2015	01:02	02:02	84.4	6.83	2.30	89.82	7.0	2.1	89.8
6	06/03/2015	03:04	04:04	79.5	7.77	2.13	85.68	7.7	2.0	85.7
7	06/03/2015	05:06	06:06	77.3	7.90	1.97	84.21	7.8	1.8	84.2
8	06/03/2015	07:08	08:08	87.3	6.35	2.21	92.40	6.5	2.0	92.4
9	06/03/2015	09:09	10:09	79.6	6.53	2.25	84.79	6.6	2.1	84.8
10	06/03/2015	11:11	12:11	72.9	6.85	2.22	76.61	6.9	2.2	76.6
11	06/03/2015	13:13	14:13	71.1	5.97	2.45	74.34	6.5	2.4	74.3
12	09/03/2015	12:45	13:45	54.9	4.95	1.97	59.06	5.8	2.0	59.1
13	09/03/2015	14:47	15:47	45.9	6.42	2.10	49.42	6.5	2.1	49.4
14	09/03/2015	16:49	17:49	49.4	6.00	1.98	53.39	6.2	2.0	53.4
15	09/03/2015	18:51	19:51	55.4	5.77	1.92	59.36	6.4	1.9	59.4
16	09/03/2015	20:53	21:53	56.2	6.33	1.89	61.15	6.6	1.9	61.2
17	09/03/2015	22:55	23:55	53.9	6.72	1.88	59.25	6.9	1.8	59.3
18	10/03/2015	01:01	02:01	59.3	6.21	1.94	65.53	6.6	1.9	65.5
19	10/03/2015	03:03	04:03	53.9	6.58	2.04	59.42	7.0	2.0	59.4
20	10/03/2015	05:05	06:05	51.8	6.97	1.92	57.07	7.2	1.9	57.1
21	10/03/2015	07:07	08:07	62.9	6.67	1.88	68.99	7.0	1.8	69.0
22	10/03/2015	09:09	10:09	70.6	6.66	1.90	77.28	6.9	1.9	77.3
23	10/03/2015	13:13	14:13	65.4	6.43	1.88	71.51	6.6	1.9	71.5

Note:

Emission concentrations expresed at reference conditions 273K, 101.3kPa

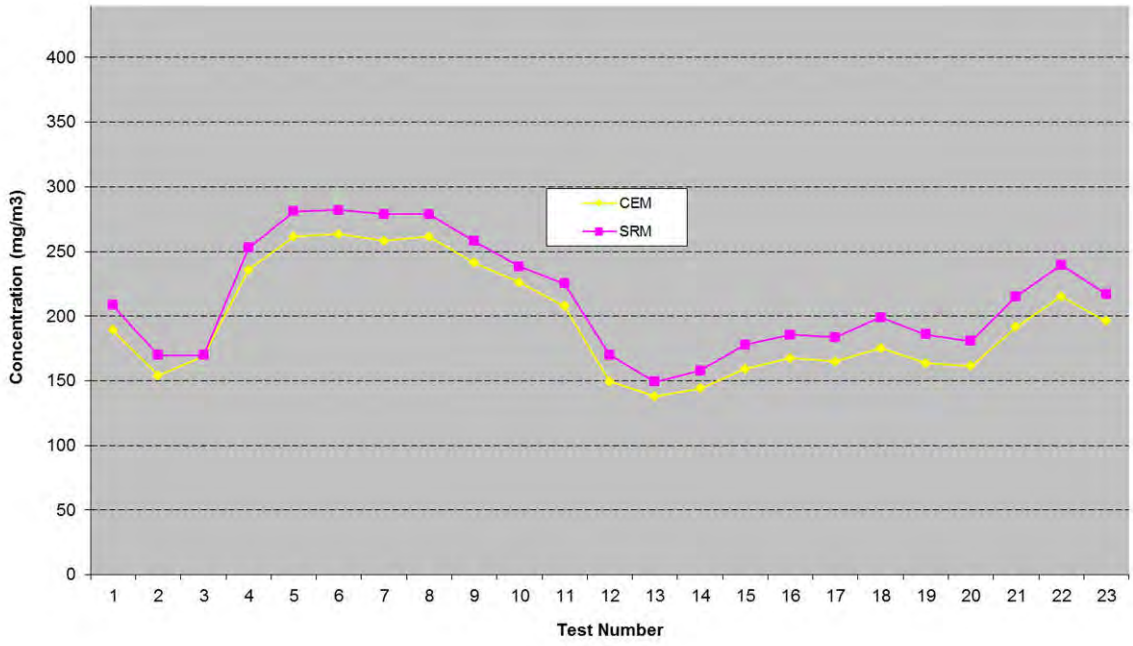
4A1.2.3 Table 4.2.3 -Standardised monitoring Data – Sulphur Dioxide, High Range

Test No	Test Start Time	Test End Time	CEMS Standardised	SRM Standardised	SRM Uncertainty
	hr:min		SO_2 (mg/m3)	SO_2 (mg/m3)	(mg/m3)
1	15:10	16:10	189.1	208.2	31.9
2	17:12	18:12	154.0	169.6	31.7
3	19:14	20:14	169.1	169.6	32.2
4	21:16	22:16	235.7	252.7	32.2
5	1:02	2:02	261.4	281.0	32.4
6	3:04	4:04	263.4	282.0	32.4
7	5:06	6:06	258.4	278.7	32.4
8	7:08	8:08	261.3	278.7	32.4
9	9:09	10:09	241.3	257.8	32.2
10	11:11	12:11	226.0	238.2	32.1
11	13:13	14:13	207.8	225.2	31.4
12	12:45	13:45	149.5	169.9	31.7
13	14:47	15:47	138.0	149.2	31.7
14	16:49	17:49	144.0	157.8	31.7
15	18:51	19:51	159.0	177.7	31.8
16	20:53	21:53	167.3	185.6	31.8
17	22:55	23:55	164.8	183.5	31.8
18	1:01	2:01	175.2	198.9	31.9
19	3:03	4:03	163.6	185.7	31.1
20	5:05	6:05	161.4	180.8	31.1
21	7:07	8:07	191.8	215.2	32.0
22	9:09	10:09	215.2	239.5	32.1
23	13:13	14:13	196.0	217.0	32.0

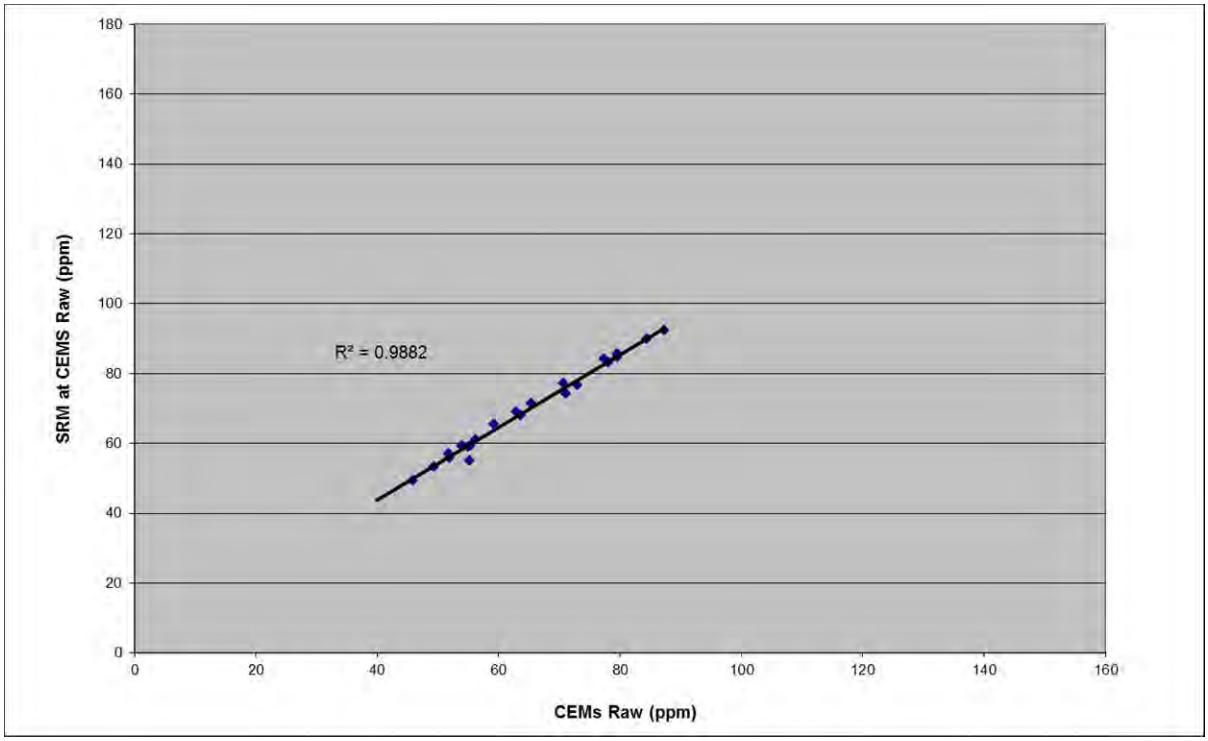
Note:

Emission concentrations expresed at reference conditions 273K, 101.3kPa 6 % Oxygen, dry gas

4A1.3.3 – Plot 1.3 - Time Series of Standardised CEM versus Standardised SRM data – Sulphur Dioxide, High Range (Expressed at reference conditions 273K, 101.3kPa, dry gas, 6% oxygen)



4A1.4.3 – Elimination of Outliers – Sulphur Dioxide, High Range.



Guidance on performing tests for outliers in MID 14181 section 6.3, states the following:

'As a general guide, when plotting the raw SRM and raw CEM data, if the R^2 value for the linear regression line is equal or more than 0.9, then it is not ordinarily necessary to perform an outlier test.
Additionally, any data points are not likely to be outliers unless they are more than three standard deviations from the regression line'

As the R^2 value for this determinand was 0.9882, an outlier test has not been undertaken.

4A1.5.3 Determination of Method A or Method B - Sulphur Dioxide, High Range.

Test No	Test Date	Test Start Time	Test End Time	SRM measured value (y)	SRM Moisture	SRM O2	SRM Standardised
		hr:min		(ppm)	(%)	(%)	(mg/m3)
1	05-Mar-15	15:10	16:10	68.0	2.10	6.7	208.2
2	05-Mar-15	17:12	18:12	55.8	2.10	6.6	169.6
3	05-Mar-15	19:14	20:14	55.0	2.10	6.8	169.6
4	05-Mar-15	21:16	22:16	83.1	2.10	6.6	252.7
5	06-Mar-15	1:02	2:02	89.8	2.10	7.0	281.0
6	06-Mar-15	3:04	4:04	85.7	2.00	7.7	282.0
7	06-Mar-15	5:06	6:06	84.2	1.80	7.8	278.7
8	06-Mar-15	7:08	8:08	92.4	2.00	6.5	278.7
9	06-Mar-15	9:09	10:09	84.8	2.10	6.6	257.8
10	06-Mar-15	11:11	12:11	76.6	2.20	6.9	238.2
11	06-Mar-15	13:13	14:13	74.3	2.40	6.5	225.2
12	09-Mar-15	12:45	13:45	59.1	2.00	5.8	169.9
13	09-Mar-15	14:47	15:47	49.4	2.10	6.5	149.2
14	09-Mar-15	16:49	17:49	53.4	2.00	6.2	157.8
15	09-Mar-15	18:51	19:51	59.4	1.90	6.4	177.7
16	09-Mar-15	20:53	21:53	61.2	1.90	6.6	185.6
17	09-Mar-15	22:55	23:55	59.3	1.80	6.9	183.5
18	10-Mar-15	1:01	2:01	65.5	1.90	6.6	198.9
19	10-Mar-15	3:03	4:03	59.4	2.00	7.0	185.7
20	10-Mar-15	5:05	6:05	57.1	1.90	7.2	180.8
21	10-Mar-15	7:07	8:07	69.0	1.80	7.0	215.2
22	10-Mar-15	9:09	10:09	77.3	1.90	6.9	239.5
23	10-Mar-15	13:13	14:13	71.5	1.90	6.6	217.0
Sum				1591.12			

Emission Limit Value (ELV) =	440	mg/Nm^3	
15% of the ELV =	66	mg/Nm^3	
Therefore Ymax - Ymin > 15% of the ELV		**Method A**	

Y_{max}	281.97
Y_{min}	149.24
$Y_{max - Ymin}$	132.73

4A1.6.3 Table 4.3.3 - Data used to derive calibration function - Sulphur Dioxide, High Range.

Test No	Test Date	Test Start Time	Test End Time	SRM measured value (y)	CEMS measured signal (x)	Yi	Xi	Xi * Yi	Xi^2	b
		hr:min		SO2 (ppm)	SO2 (ppm)	1	2	3	4	
1	17-Feb-15	Reference Gas		0	0.37	-66.29651389	-61.3427173	4066.808309	3762.928965	
2	05-Mar-15	15:10	16:10	68.0	63.7	1.69	2.02	3.41	4.07	
3	05-Mar-15	17:12	18:12	55.8	52.0	-10.53	-9.74	102.54	94.89	
4	05-Mar-15	19:14	20:14	55.0	55.1	-11.32	-6.57	74.31	43.11	
5	05-Mar-15	21:16	22:16	83.1	78.1	16.80	16.39	275.36	268.54	
6	06-Mar-15	1:02	2:02	89.8	84.4	23.52	22.68	533.58	514.51	
7	06-Mar-15	3:04	4:04	85.7	79.5	19.38	17.80	345.04	316.87	
8	06-Mar-15	5:06	6:06	84.2	77.3	17.91	15.63	280.03	244.37	
9	06-Mar-15	7:08	8:08	92.4	87.3	26.10	25.63	669.02	657.05	
10	06-Mar-15	9:09	10:09	84.8	79.6	18.49	17.89	330.85	320.05	
11	06-Mar-15	11:11	12:11	76.6	72.9	10.31	11.20	115.55	125.53	
12	06-Mar-15	13:13	14:13	74.3	71.1	8.04	9.37	75.40	87.88	
13	09-Mar-15	12:45	13:45	59.1	54.9	-7.24	-6.79	49.12	46.07	
14	09-Mar-15	14:47	15:47	49.4	45.9	-16.88	-15.77	266.15	248.70	
15	09-Mar-15	16:49	17:49	53.4	49.4	-12.91	-12.33	159.08	151.92	
16	09-Mar-15	18:51	19:51	59.4	55.4	-6.94	-6.30	43.72	39.73	
17	09-Mar-15	20:53	21:53	61.2	56.2	-5.15	-5.54	28.50	30.66	
18	09-Mar-15	22:55	23:55	59.3	53.9	-7.05	-7.85	55.32	61.63	
19	10-Mar-15	1:01	2:01	65.5	59.3	-0.77	-2.42	1.86	5.87	
20	10-Mar-15	3:03	4:03	59.4	53.9	-6.88	-7.81	53.71	61.00	
21	10-Mar-15	5:05	6:05	57.1	51.8	-9.23	-9.93	91.59	98.55	
22	10-Mar-15	7:07	8:07	69.0	62.9	2.69	1.18	3.18	1.39	
23	10-Mar-15	9:09	10:09	77.3	70.6	10.98	8.92	97.95	79.53	
24	10-Mar-15	13:13	14:13	71.5	65.4	5.21	3.67	19.12	13.45	
Sum				1591.12	1481.11	0.00	0.00	7741.19	7278.30	1.06

4A1.7.3 Determination of Calibration Function - Sulphur Dioxide, High Range.

Method A

If Ymax-Ymin >15% of the ELV, the following formulae are used:

$$b=\sum_{i=1}^{N}(xi-x)(yi-y)/\sum_{i=1}^{N}(xi-x)^2 \quad \text{where} \quad x=1/N\sum_{i=1}^{N}xi \quad y=1/N\sum_{i=1}^{N}yi$$

x= 61.71

y= 66.30

b= 1.064

$a=y-bx$ a = 66.3 - 61.72 * 1.063 a= 0.659

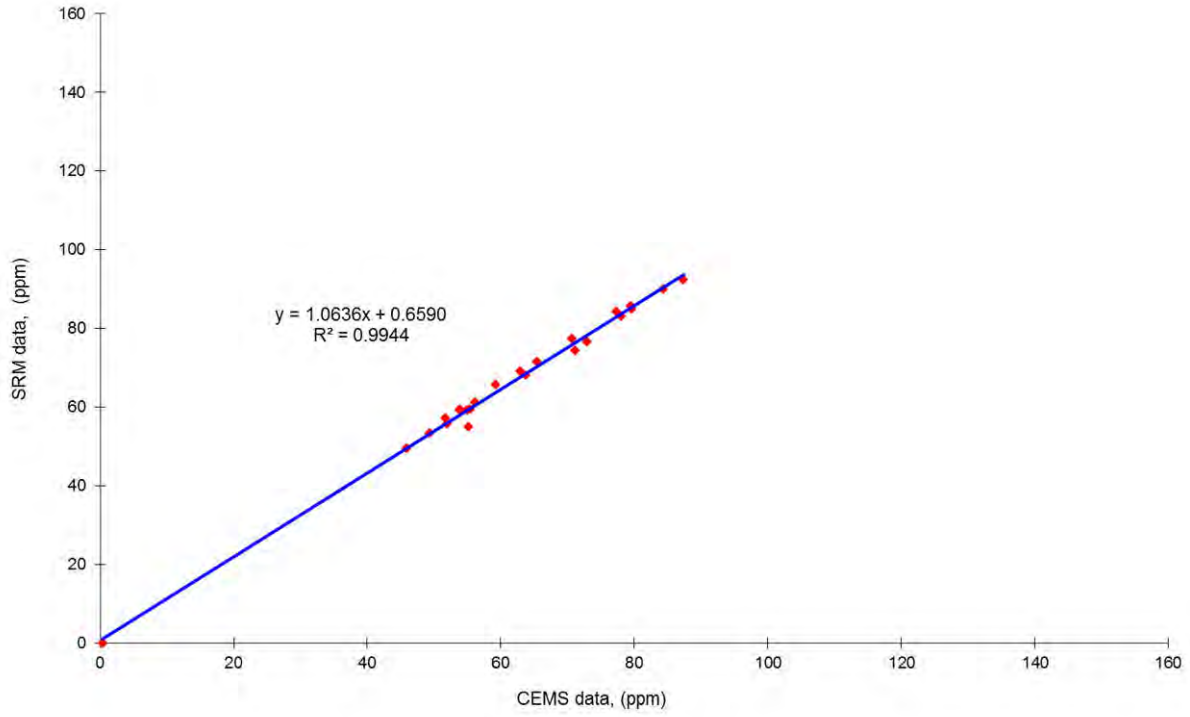
The calibration is function $y_i = a + bxi$ or yi = 0.659 + 1.064 * xi

4A1.8.3 Table A.4.4.3 - Calculation of calibrated CEMS values - Sulphur Dioxide, High Range.

Test No	Test Date	Test Start Time	Test End Time	CEMS Raw Value (x)	CEMS Calibrated signal	CEMS Moisture	CEMS dry Oxygen	CEMS Calibrated Standardised Value	SRM Standardised
		hr:min		SO2 (ppm)	SO2 (ppm)	(%)	(%)	SO2 (mg/m3)	SO2 (mg/m3)
1	17-Feb-15	Reference Gas		0.4	1.1			3.0	0.0
2	05-Mar-15	15:10	16:10	63.7	68.4	2.3	6.2	203.0	208.2
3	05-Mar-15	17:12	18:12	52.0	55.9	2.3	6.2	165.7	169.6
4	05-Mar-15	19:14	20:14	55.1	59.3	2.2	6.7	181.9	169.6
5	05-Mar-15	21:16	22:16	78.1	83.7	2.3	6.5	252.7	252.7
6	06-Mar-15	01:02	02:02	84.4	90.4	2.3	6.8	280.0	281.0
7	06-Mar-15	03:04	04:04	79.5	85.2	2.1	7.8	282.4	282.0
8	06-Mar-15	05:06	06:06	77.3	82.9	2.0	7.9	277.0	278.7
9	06-Mar-15	07:08	08:08	87.3	93.6	2.2	6.4	279.9	278.7
10	06-Mar-15	09:09	10:09	79.6	85.3	2.3	6.5	258.6	257.8
11	06-Mar-15	11:11	12:11	72.9	78.2	2.2	6.9	242.4	238.2
12	06-Mar-15	13:13	14:13	71.1	76.3	2.5	6.0	222.9	225.2
13	09-Mar-15	12:45	13:45	54.9	59.1	2.0	5.0	160.8	169.9
14	09-Mar-15	14:47	15:47	45.9	49.5	2.1	6.4	148.7	149.2
15	09-Mar-15	16:49	17:49	49.4	53.2	2.0	6.0	155.0	157.8
16	09-Mar-15	18:51	19:51	55.4	59.6	1.9	5.8	171.0	177.7
17	09-Mar-15	20:53	21:53	56.2	60.4	1.9	6.3	179.9	185.6
18	09-Mar-15	22:55	23:55	53.9	57.9	1.9	6.7	177.3	183.5
19	10-Mar-15	01:01	02:01	59.3	63.7	1.9	6.2	188.3	198.9
20	10-Mar-15	03:03	04:03	53.9	58.0	2.0	6.6	176.0	185.7
21	10-Mar-15	05:05	06:05	51.8	55.7	1.9	7.0	173.7	180.8
22	10-Mar-15	07:07	08:07	62.9	67.6	1.9	6.7	206.0	215.2
23	10-Mar-15	09:09	10:09	70.6	75.8	1.9	6.7	230.9	239.5
24	10-Mar-15	13:13	14:13	65.4	70.2	1.9	6.4	210.5	217.0
Sum								4827.6	

Emission Limit Value (ELV) =	440	mg/Nm^3
Reference Oxygen	6 %	

4A1.9.3 Plot 2.3 CEM versus SRM Parallel Test Data at CEM measurement conditions –Sulphur dioxide, wet gas.



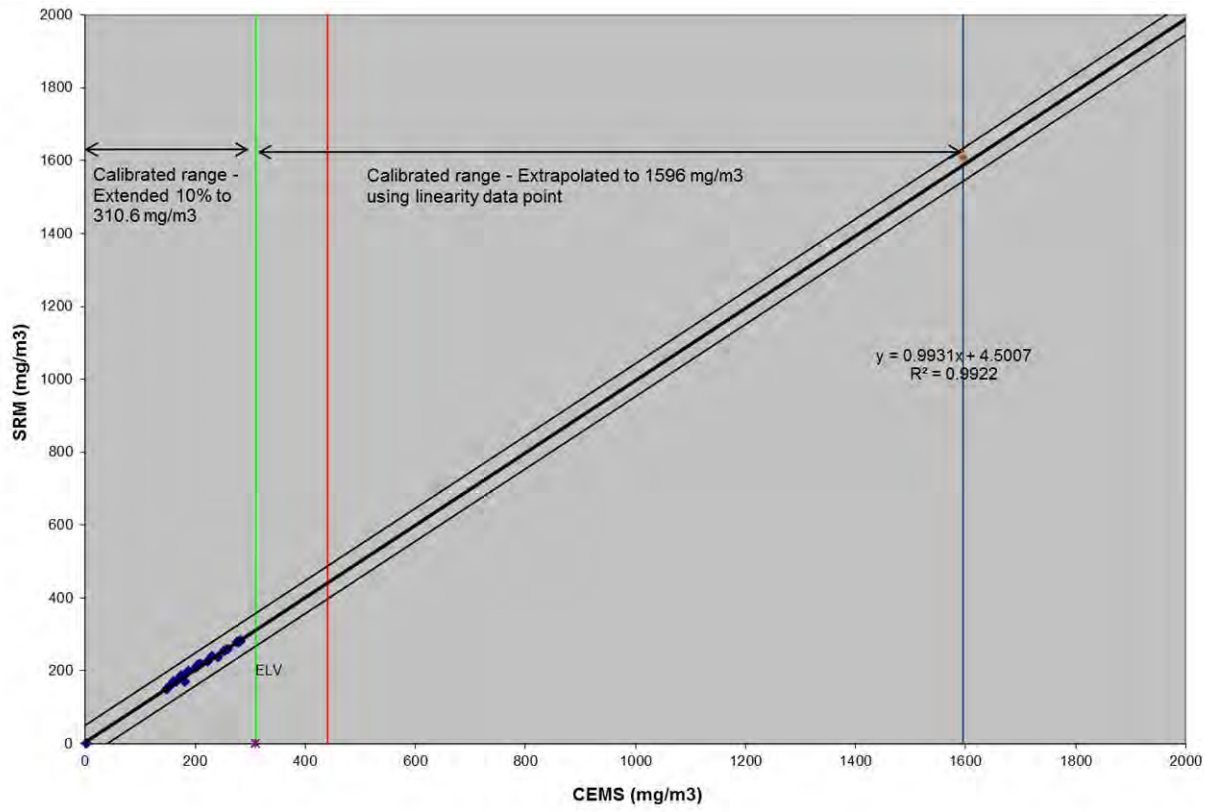
4A1.10.3 Table 4.5.3 – Data used for the Variability Test – Sulphur Dioxide, High Range.

Test No	Test Date	Test Start Time	Test End Time	CEMS Calibrated Standardised value	SRM Standardised value	Difference D1	Difference D1 - D	Squared Difference D1 - D
		hr:min		mg/m3	mg/m3			
1	17-Feb-15	Reference Gas		3.0	0.0	-3.01	-6.12	37.43
2	05-Mar-15	15:10	16:10	203.0	208.2	5.17	2.06	4.26
3	05-Mar-15	17:12	18:12	165.7	169.6	3.88	0.77	0.59
4	05-Mar-15	19:14	20:14	181.9	169.6	-12.32	-15.43	237.97
5	05-Mar-15	21:16	22:16	252.7	252.7	0.00	-3.11	9.66
6	06-Mar-15	01:02	02:02	280.0	281.0	0.96	-2.15	4.61
7	06-Mar-15	03:04	04:04	282.4	282.0	-0.39	-3.50	12.23
8	06-Mar-15	05:06	06:06	277.0	278.7	1.67	-1.44	2.08
9	06-Mar-15	07:08	08:08	279.9	278.7	-1.20	-4.31	18.58
10	06-Mar-15	09:09	10:09	258.6	257.8	-0.76	-3.87	14.96
11	06-Mar-15	11:11	12:11	242.4	238.2	-4.17	-7.28	52.98
12	06-Mar-15	13:13	14:13	222.9	225.2	2.25	-0.86	0.74
13	09-Mar-15	12:45	13:45	160.8	169.9	9.06	5.95	35.36
14	09-Mar-15	14:47	15:47	148.7	149.2	0.51	-2.60	6.74
15	09-Mar-15	16:49	17:49	155.0	157.8	2.74	-0.37	0.14
16	09-Mar-15	18:51	19:51	171.0	177.7	6.69	3.58	12.85
17	09-Mar-15	20:53	21:53	179.9	185.6	5.67	2.56	6.55
18	09-Mar-15	22:55	23:55	177.3	183.5	6.17	3.06	9.35
19	10-Mar-15	01:01	02:01	188.3	198.9	10.55	7.44	55.40
20	10-Mar-15	03:03	04:03	176.0	185.7	9.71	6.60	43.61
21	10-Mar-15	05:05	06:05	173.7	180.8	7.10	3.99	15.91
22	10-Mar-15	07:07	08:07	206.0	215.2	9.21	6.10	37.17
23	10-Mar-15	09:09	10:09	230.9	239.5	8.60	5.49	30.18
24	10-Mar-15	13:13	14:13	210.5	217.0	6.53	3.42	11.68
24	Tests		Mean			3.11		
Sum								661.02

4A1.11.3 - Variability Test Calculation – Sulphur Dioxide, High Range.

SD=	Root(1-Number).Integral(D1-D)^2			5.36	mg/m3(s,d),6%O_2
The uncertainty laid down by the authorities is 20% ELV as a 95% confidence interval. O_0 is therefore calculated as:-					
O_0=	0.2*440 mg/m3 (s,d,6%O2)/1.96			44.90	mg/m3(s,d),6%O_2
For 30 tests, k_v =	0.9885				
Therefore variability=			5.36 <= 44.9 * 0.9885		
	or	5.36	<=	44.38	
Which is TRUE therefore the CEMS passes the test					

4A1.12.3 Plot 3.3 –Standardised CEM data versus standardised SRM - Sulphur dioxide, High Range – Reference conditions 273K, 101.3kPa., 6% oxygen, dry gas.



Section 4B1: Data & Calculations – AST – Unit 7, Procal 1

Section 4B1 – Data and calculations – AST Procal 1

4B1 4.1.1 Table 4.1.1 – Raw monitoring Data – Oxides of Nitrogen

Test No	Date	Test Start Time	Test End Time	CEMS Raw Value (wet)	CEMS Oxygen (dry)	CEMS Moisture	SRM Raw value (dry)	SRM Oxygen (dry)	SRM Moisture	SRM at CEMs Raw conditions
		hr:min		(ppm)	(%)	(%)	(ppm)	(%)	(%)	(ppm)
1	05-Mar-15	15:10	16:10	438.13	6.21	2.31	425.97	6.71	2.10	417.04
2	05-Mar-15	17:12	18:12	428.47	6.19	2.31	414.98	6.59	2.12	406.18
3	05-Mar-15	19:14	20:14	451.51	6.70	2.23	432.12	6.78	2.06	423.24
4	05-Mar-15	21:16	22:16	438.19	6.47	2.25	421.10	6.63	2.09	412.29
5	06-Mar-15	1:02	2:02	383.85	6.83	2.30	369.56	7.03	2.13	361.69
6	06-Mar-15	3:04	4:04	437.98	7.77	2.13	413.27	7.73	1.95	405.21
7	06-Mar-15	5:06	6:06	377.60	7.90	1.97	353.81	7.79	1.79	347.47
8	06-Mar-15	7:08	8:08	448.41	6.35	2.21	427.81	6.54	2.01	419.21
9	06-Mar-15	9:09	10:09	465.80	6.53	2.25	442.43	6.63	2.14	432.95
10	06-Mar-15	11:11	12:11	469.95	6.85	2.22	444.16	6.90	2.21	434.34
11	06-Mar-15	13:13	14:13	499.71	5.97	2.45	479.21	6.46	2.41	467.68

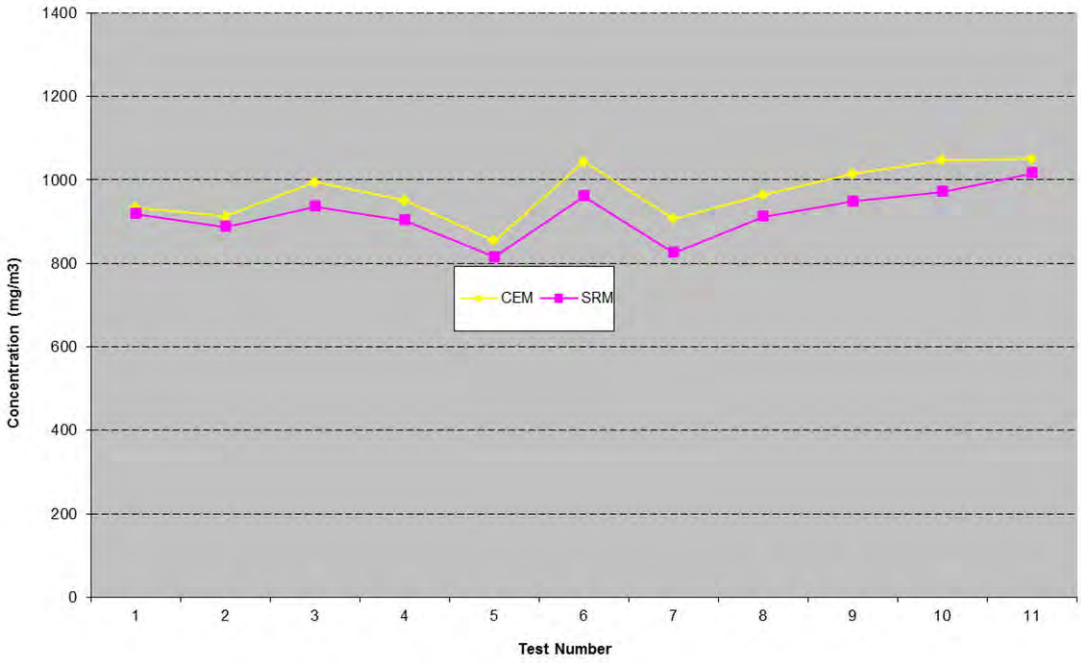
Note:
Emission concentrations expresed at reference conditions 273K, 101.3kPa

4B1 4.2.1 Table 4.2.1 – Standardised monitoring Data – Oxides of Nitrogen

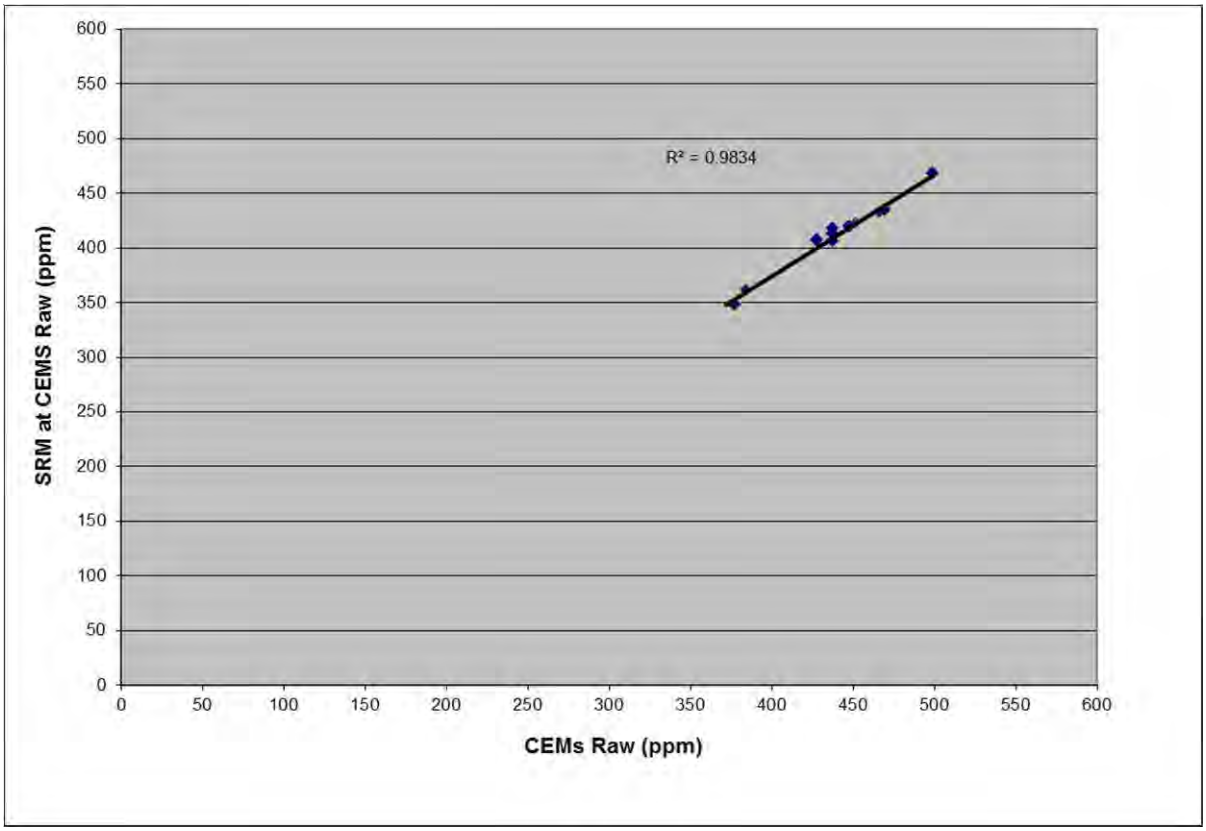
Test No	Date	Test Start Time	Test End Time	CEMS Standardised	SRM Standardised	SRM Uncertainty
		hr:min		(mg/m3)	(mg/m3)	(mg/m3)
1	05-Mar-15	15:10	16:10	934.1	918.4	30.4
2	05-Mar-15	17:12	18:12	912.5	887.4	29.4
3	05-Mar-15	19:14	20:14	995.1	936.3	31.0
4	05-Mar-15	21:16	22:16	950.5	902.8	29.9
5	06-Mar-15	1:02	2:02	854.1	815.2	27.0
6	06-Mar-15	3:04	4:04	1043.2	960.4	31.8
7	06-Mar-15	5:06	6:06	906.9	825.6	27.4
8	06-Mar-15	7:08	8:08	964.2	911.6	30.2
9	06-Mar-15	9:09	10:09	1015.0	948.5	34.0
10	06-Mar-15	11:11	12:11	1046.6	971.0	32.2
11	06-Mar-15	13:13	14:13	1050.2	1015.2	33.6

Note:
Emission concentrations expresed at reference conditions 273K, 101.3kPa 6 % Oxygen, dry gas

4B1 4.3.1 Plot 1.1 –Time Series of Standardised CEM versus Standardised SRM data – Oxides of Nitrogen. Reference conditions: 273K, 101.3kPa, dry gas, 6% oxygen.



4B1 4.4.1 –Elimination of Outliers – Oxides of Nitrogen.



Guidance on performing tests for outliers in MID 14181 section 6.3, states the following:

'As a general guide, when plotting the raw SRM and raw CEM data, if the R^2 value for the linear regression line is equal or more than 0.9, then it is not ordinarily necessary to perform an outlier test.
Additionally, any data points are not likely to be outliers unless they are more than three standard deviations from the regression line'

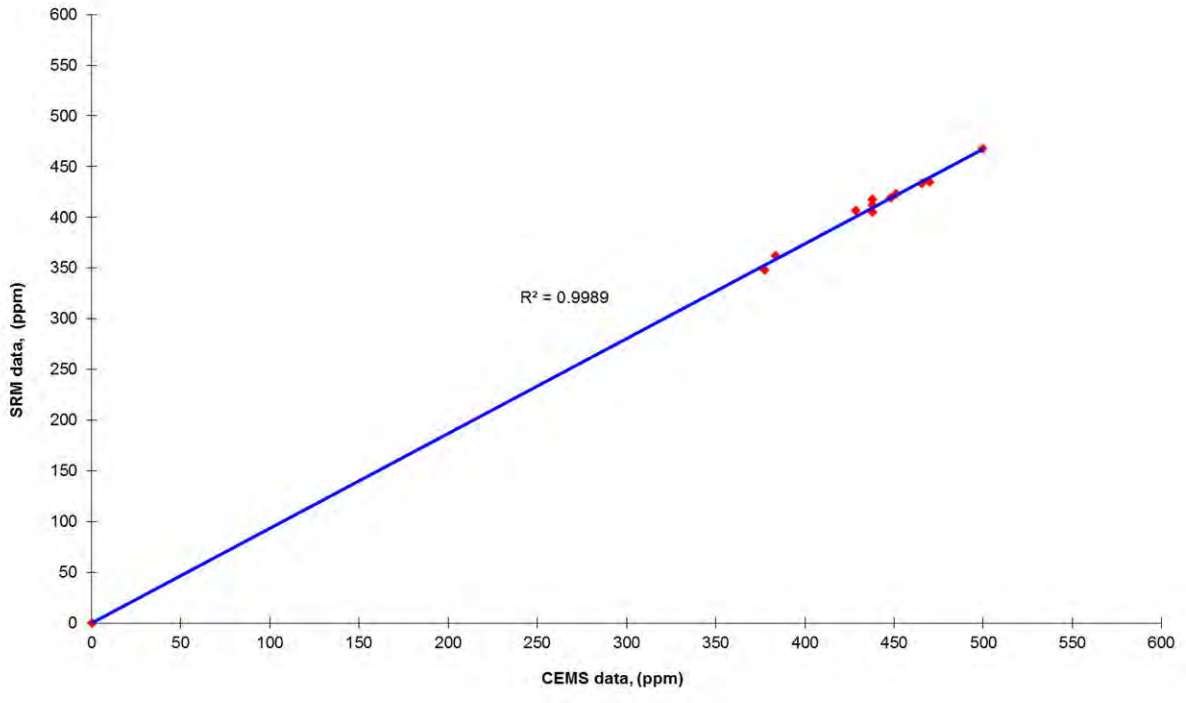
As the R^2 value for this determinand was 0.9834, an outlier test has not been undertaken.

4B1 4.5.1 Table 4.3.1 - Data used to Calculate Calibrated Values – Oxides of Nitrogen

Test No	Date	Test Start Time	Test End Time	CEMS Raw Value (x)	CEMS Calibrated signal	CEMS dry Oxygen	CEMS Moisture	CEMS Standardised Value (dry)	CEMS Calibrated Standardised Value	SRM Standardised
		hr:min		(ppm)	(ppm)	%	%	(mg/Nm^3)	(mg/Nm^3)	(mg/m3)
1	18-Feb-15	Reference		0.3	-3.2	N/A	N/A	0.7	-6.6	0.0
2	05-Mar-15	15:10	16:10	438.1	444.2	6.21	2.31	934.1	947.1	918.4
3	05-Mar-15	17:12	18:12	428.5	434.3	6.19	2.31	912.5	924.9	887.4
4	05-Mar-15	19:14	20:14	451.5	457.9	6.70	2.23	995.1	1009.1	936.3
5	05-Mar-15	21:16	22:16	438.2	444.3	6.47	2.25	950.5	963.7	902.8
6	06-Mar-15	01:02	02:02	383.9	388.7	6.83	2.30	854.1	865.0	815.2
7	06-Mar-15	03:04	04:04	438.0	444.0	7.77	2.13	1043.2	1057.7	960.4
8	06-Mar-15	05:06	06:06	377.6	382.3	7.90	1.97	906.9	918.2	825.6
9	06-Mar-15	07:08	08:08	448.4	454.7	6.35	2.21	964.2	977.7	911.6
10	06-Mar-15	09:09	10:09	465.8	472.5	6.53	2.25	1015.0	1029.5	948.5
11	06-Mar-15	11:11	12:11	470.0	476.7	6.85	2.22	1046.6	1061.7	971.0
12	06-Mar-15	13:13	14:13	499.7	507.1	5.97	2.45	1050.2	1065.8	1015.2
Sum								10673.12		

Emission Limit Value (ELV) =	1210	mg/Nm^3
Reference Oxygen	6	%
Established Calibration Function y_i=	-3.578 + 1.022xi	

Plot of CEM versus SRM Parallel Test Data at CEM measurement conditions – wet gas



4B1 4.6.1 Table 4.4.1 – Data used for the Variability Test – Oxides of Nitrogen

Test No	Date	Test Start Time	Test End Time	CEMS Calibrated Standardised value	SRM Standardised value	Difference D1	Difference D1 - D	Squared Difference D1 - D
		hr:min		mg/m3	mg/m3			
1	18-Feb-15	Reference		-6.6	0.0	6.6	66.74	4454.75
2	05-Mar-15	15:10	16:10	947.1	918.4	-28.67	31.43	987.70
3	05-Mar-15	17:12	18:12	924.9	887.4	-37.55	22.55	508.61
4	05-Mar-15	19:14	20:14	1009.1	936.3	-72.79	-12.69	161.07
5	05-Mar-15	21:16	22:16	963.7	902.8	-60.91	-0.81	0.66
6	06-Mar-15	01:02	02:02	865.0	815.2	-49.82	10.28	105.69
7	06-Mar-15	03:04	04:04	1057.7	960.4	-97.23	-37.13	1378.73
8	06-Mar-15	05:06	06:06	918.2	825.6	-92.65	-32.55	1059.44
9	06-Mar-15	07:08	08:08	977.7	911.6	-66.07	-5.97	35.66
10	06-Mar-15	09:09	10:09	1029.5	948.5	-80.95	-20.85	434.76
11	06-Mar-15	11:11	12:11	1061.7	971.0	-90.62	-30.52	931.44
12	06-Mar-15	13:13	14:13	1065.8	1015.2	-50.57	9.52	90.71
Mean						-60.10		
Sum								10149.22

4B1 4.7.1 - Variability Test and Test of Calibration Function Calculations – Oxides of Nitrogen

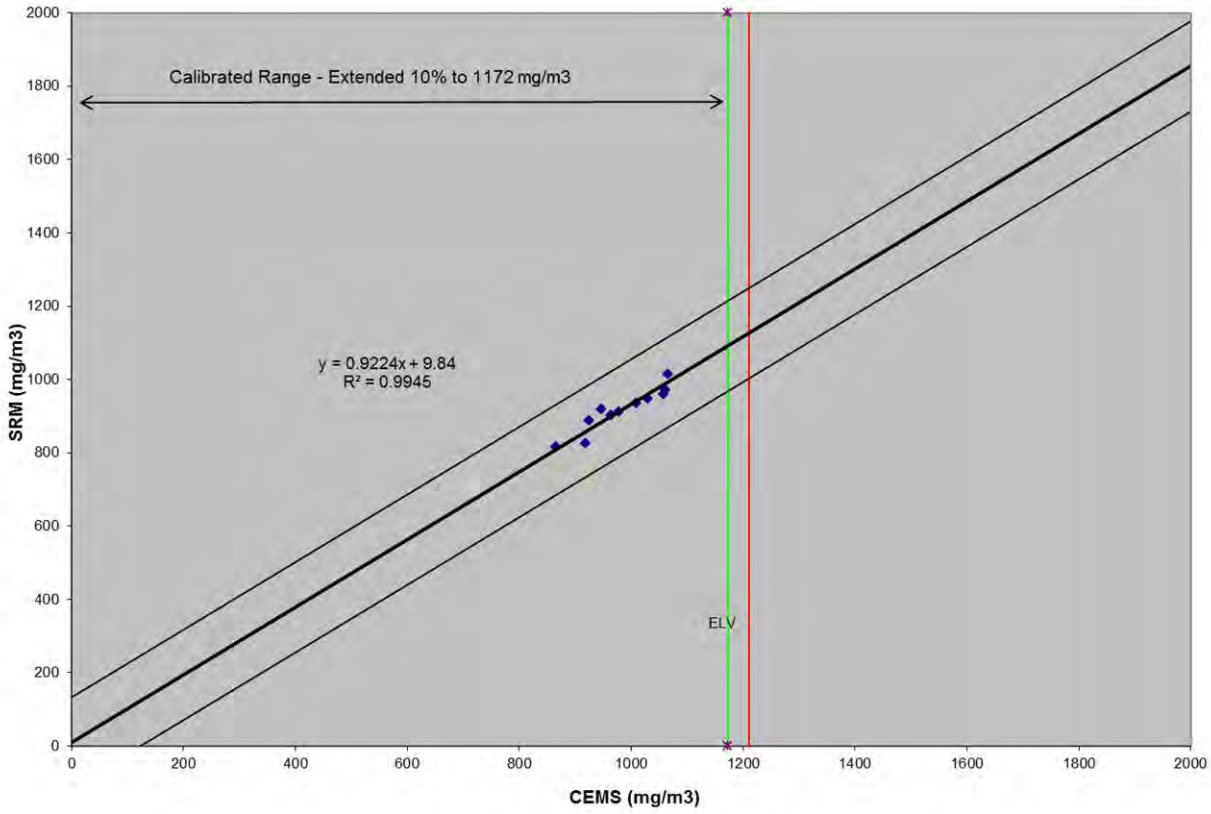
Variability Test

SD=	Root(1-Number).Integral(D1-D)^2	30.38	mg/m3(s,d),6%O2
The uncertainty laid down by the authorities is 20% ELV as a 95% confidence interval. O_0 is therefore calculated as:-			
O_0=	0.2*1210 mg/m3 (s,d,6%O2)/1.96	123.47	mg/m3(s,d),6%O2
For 12 tests, kv =	0.9695		
Therefore variability=	30.38 <= 123.47 * 0.9695*1.5		
or	30.38 <=	179.56	
Which is TRUE therefore the CEMS passes the test			

Test of Calibration Function

The calibration of the AMS is accepted if:	D1<= $t_{0.95}(N\text{-}1)$*(s,d/root N)+O_0		
	D1=	60.10	
For 12 tests, t0.95(N-1) =	1.796		
Therefore test of calibration =	60.1 <=1.796*(30.38/root 12)+123.47		
or	60.10 <=	139.22	
Which is TRUE therefore the calibration function is VALID			

4B1 4.8.1 Plot 2.1 –Standardised CEM data versus standardised SRM - Oxides of Nitrogen (as NO_2) – Reference conditions 273K, 101.3kPa, dry gas, 6% oxygen.



4B1 4.1.2 Table 4.1.2 – Raw monitoring Data – Sulphur Dioxide Low Range

Test No	Date	Test Start Time	Test End Time	CEMS Raw Value (wet)	CEMS Oxygen (dry)	CEMS Moisture	SRM Raw value (wet)	SRM Oxygen (dry)	SRM Moisture	SRM at CEMs Raw conditions
		hr:min		(ppm)	(%)	(%)	(ppm)	(%)	(%)	(ppm)
1	05-Mar-15	15:10	16:10	68.49	6.21	2.31	67.99	6.71	2.10	67.99
2	05-Mar-15	17:12	18:12	55.34	6.19	2.31	55.77	6.59	2.12	55.77
3	05-Mar-15	19:14	20:14	56.80	6.70	2.23	54.98	6.78	2.06	54.98
4	05-Mar-15	21:16	22:16	73.96	6.47	2.25	83.10	6.63	2.09	83.10
5	06-Mar-15	1:02	2:02	78.03	6.83	2.30	89.82	7.03	2.13	89.82
6	06-Mar-15	3:04	4:04	75.23	7.77	2.13	85.68	7.73	1.95	85.68
7	06-Mar-15	5:06	6:06	72.81	7.90	1.97	84.21	7.79	1.79	84.21
8	06-Mar-15	7:08	8:08	82.19	6.35	2.21	92.40	6.54	2.01	92.40
9	06-Mar-15	9:09	10:09	75.79	6.53	2.25	84.79	6.63	2.14	84.79
10	06-Mar-15	11:11	12:11	68.77	6.85	2.22	76.61	6.90	2.21	76.61
11	06-Mar-15	13:13	14:13	61.58	5.97	2.45	74.34	6.46	2.41	74.34

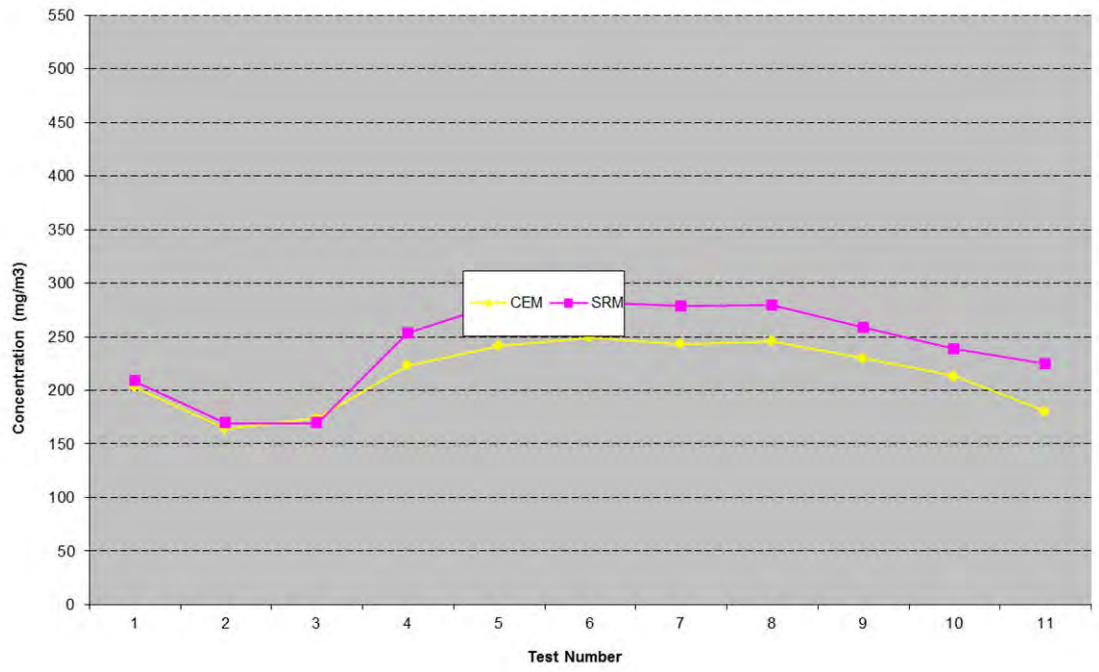
Note:
Emission concentrations expresed at reference conditions 273K, 101.3kPa

B1 4.2.2 Table 4.2.2 – Standardised monitoring Data – Sulphur Dioxide - Low Range

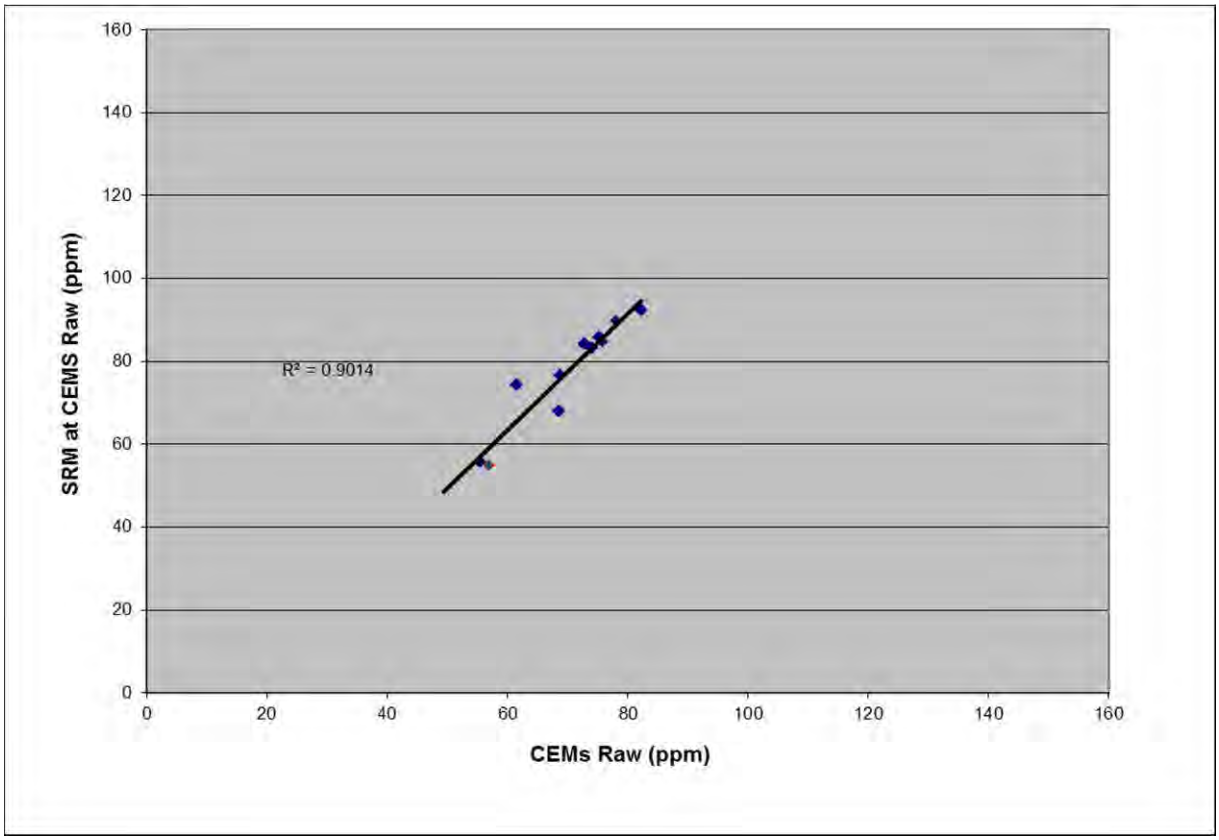
Test No	Date	Test Start Time	Test End Time	CEMS Standardised	SRM Standardised	SRM Uncertainty
		hr:min		(mg/m3)	(mg/m3)	(mg/m3)
1	05-Mar-15	15:10	16:10	203.2	208.3	31.9
2	05-Mar-15	17:12	18:12	164.0	169.5	31.7
3	05-Mar-15	19:14	20:14	174.2	169.2	32.2
4	05-Mar-15	21:16	22:16	223.2	253.2	32.2
5	06-Mar-15	1:02	2:02	241.6	281.6	32.4
6	06-Mar-15	3:04	4:04	249.3	282.6	32.4
7	06-Mar-15	5:06	6:06	243.3	278.4	32.4
8	06-Mar-15	7:08	8:08	245.9	279.6	32.4
9	06-Mar-15	9:09	10:09	229.8	258.5	32.2
10	06-Mar-15	11:11	12:11	213.1	238.3	32.1
11	06-Mar-15	13:13	14:13	180.1	224.5	31.4

Note:
Emission concentrations expresed at reference conditions 273K, 101.3kPa 6 % Oxygen, dry gas

4B1 4.3.2 Plot 1.2 –Time Series of Standardised CEM versus Standardised SRM data – Sulphur Dioxide - Low Range. Reference conditions: 273K, 101.3kPa, dry gas, 6% oxygen.



4B1 4.4.2 – Elimination of Outliers – Sulphur Dioxide - Low Range.



Guidance on performing tests for outliers in MID 14181 section 6.3, states the following:

'As a general guide, when plotting the raw SRM and raw CEM data, if the R^2 value for the linear regression line is equal or more than 0.9, then it is not ordinarily necessary to perform an outlier test.
Additionally, any data points are not likely to be outliers unless they are more than three standard deviations from the regression line'

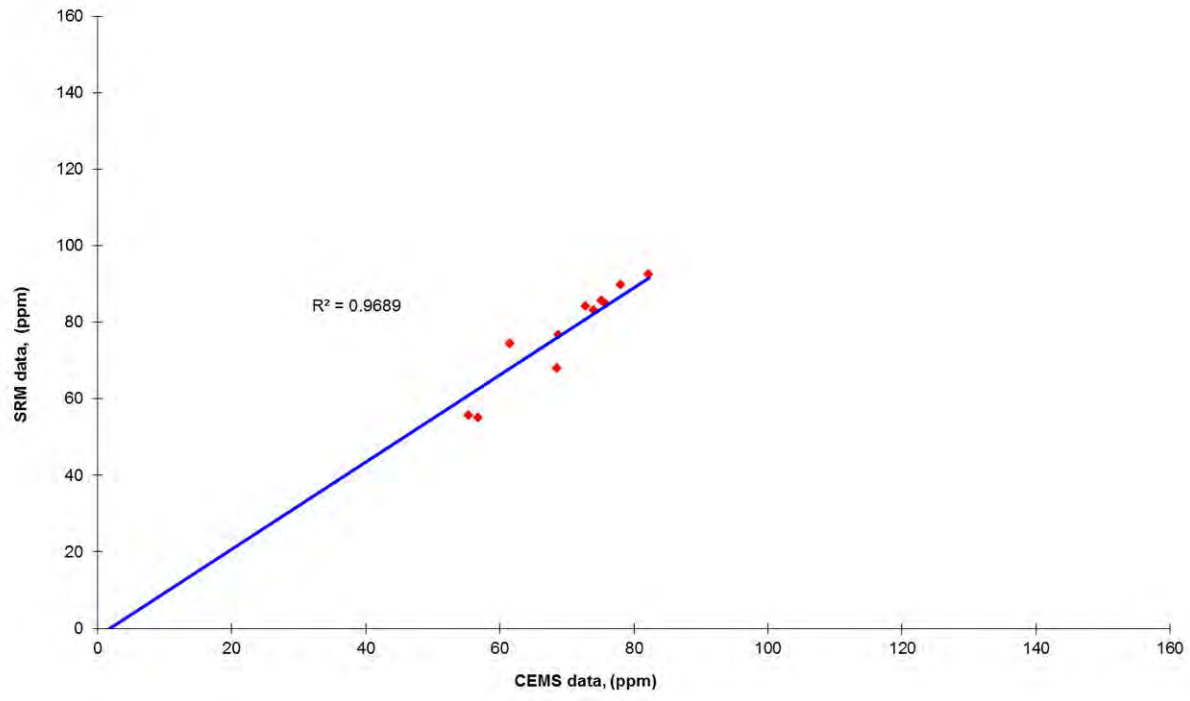
As the R^2 value for this determinand was 0.9014, an outlier test has not been undertaken

4B1 4.5.2 Table 4.3.2 - Data used to Calculate Calibrated Values – Sulphur Dioxide - Low Range.

Test No	Date	Test Start Time	Test End Time	CEMS Raw Value (x)	CEMS Calibrated signal	CEMS dry Oxygen	CEMS Moisture	CEMS Standardised Value (dry)	CEMS Calibrated Standardised Value	SRM Standardised
		hr:min		(ppm)	(ppm)	%	%	(mg/Nm^3)	(mg/Nm^3)	(mg/m3)
1	18-Feb-15	Reference		-0.5	-6.6	N/A	N/A	-0.5	-19.0	0.0
2	05-Mar-15	15:10	16:10	68.5	68.0	6.21	2.31	203.2	201.8	208.3
3	05-Mar-15	17:12	18:12	55.3	53.8	6.19	2.31	164.0	159.3	169.5
4	05-Mar-15	19:14	20:14	56.8	55.4	6.70	2.23	174.2	169.7	169.2
5	05-Mar-15	21:16	22:16	74.0	73.9	6.47	2.25	223.2	223.1	253.2
6	06-Mar-15	01:02	02:02	78.0	78.3	6.83	2.30	241.6	242.5	281.6
7	06-Mar-15	03:04	04:04	75.2	75.3	7.77	2.13	249.3	249.5	282.6
8	06-Mar-15	05:06	06:06	72.8	72.7	7.90	1.97	243.3	242.8	278.4
9	06-Mar-15	07:08	08:08	82.2	82.8	6.35	2.21	245.9	247.8	279.6
10	06-Mar-15	09:09	10:09	75.8	75.9	6.53	2.25	229.8	230.1	258.5
11	06-Mar-15	11:11	12:11	68.8	68.3	6.85	2.22	213.1	211.7	238.3
12	06-Mar-15	13:13	14:13	61.6	60.5	5.97	2.45	180.1	177.0	224.5
				Sum				2366.99		

Emission Limit Value (ELV) =	440	mg/Nm^3
	Reference Oxygen	6 %
Established Calibration Function y_i=	-6.1 + 1.082xi	

Plot of CEM versus SRM Data at CEM measurement conditions– Sulphur Dioxide - Low Range. wet gas



4B1 4.6.2 Table 4.4.2 – Data used for the Variability Test – Sulphur Dioxide - Low Range

Test No	Date	Test Start Time	Test End Time	CEMS Calibrated Standardised value	SRM Standardised value	Difference D1	Difference D1 - D	Squared Difference D1 - D
		hr:min		mg/m3	mg/m3			
1	18-Feb-15	Reference		-19.0	0.0	19.0	-6.63	43.92
2	05-Mar-15	15:10	16:10	201.8	208.3	6.57	-19.04	362.38
3	05-Mar-15	17:12	18:12	159.3	169.5	10.18	-15.42	237.74
4	05-Mar-15	19:14	20:14	169.7	169.2	-0.53	-26.13	682.68
5	05-Mar-15	21:16	22:16	223.1	253.2	30.06	4.46	19.90
6	06-Mar-15	01:02	02:02	242.5	281.6	39.14	13.54	183.25
7	06-Mar-15	03:04	04:04	249.5	282.6	33.02	7.42	55.02
8	06-Mar-15	05:06	06:06	242.8	278.4	35.53	9.93	98.64
9	06-Mar-15	07:08	08:08	247.8	279.6	31.76	6.16	37.90
10	06-Mar-15	09:09	10:09	230.1	258.5	28.35	2.75	7.54
11	06-Mar-15	11:11	12:11	211.7	238.3	26.63	1.02	1.05
12	06-Mar-15	13:13	14:13	177.0	224.5	47.54	21.94	481.19
Mean						25.60		
Sum								2211.21

4B1 4.7.2 - Variability Test and Test of Calibration Function Calculations – Sulphur Dioxide - Low Range.

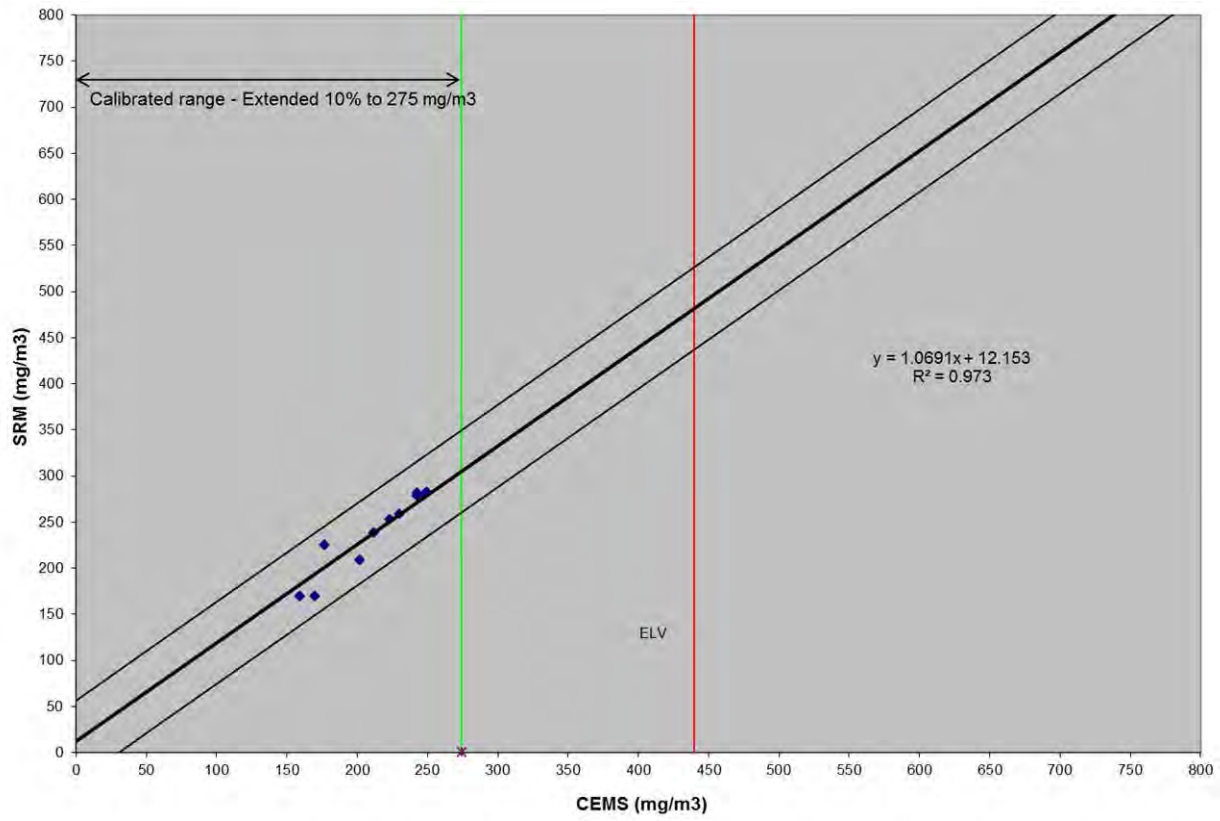
Variability Test

SD=	Root(1-Number).Integral(D1-D)^2	14.18	mg/m3(s,d),6%O2
The uncertainty laid down by the authorities is 20% ELV as a 95% confidence interval. O_0 is therefore calculated as:-			
O_0=	0.2*440 mg/m3 (s,d,6%O2)/1.96	44.90	mg/m3(s,d),6%O2
For 12 tests, kv =	0.9695		
Therefore variability=	14.18 <= 44.9 * 0.9695*1.5		
or	14.18 <=	65.29	
Which is TRUE therefore the CEMS passes the test			

Test of Calibration Function

The calibration of the AMS is accepted if:	D1<= $t_{0.95}(N-1)$*(s,d/root N)+O_0	
D1=	25.60	
For 12 tests, t0.95(N-1) :	1.796	
Therefore test of calibration =	25.6 <=1.796*(14.18/root 12)+44.9	
or	25.60 <=	52.25
Which is TRUE therefore the calibration function is VALID		

4B1 4.8.2 Plot 2.2 – Standardised CEM data versus standardised SRM - Sulphur Dioxide - Low Range – Reference conditions 273K, 101.3kPa, dry gas, 6% oxygen.



4B1 4.1.3 Table 4.1.3 – Raw monitoring Data – Sulphur Dioxide High Range

Test No	Date	Test Start Time	Test End Time	CEMS Raw Value (wet)	CEMS Oxygen (dry)	CEMS Moisture	SRM Raw value (wet)	SRM Oxygen (dry)	SRM Moisture	SRM at CEMs Raw conditions
		hr:min		(ppm)	(%)	(%)	(ppm)	(%)	(%)	(ppm)
1	05-Mar-15	15:10	16:10	84.46	6.21	2.31	67.99	6.71	2.10	67.99
2	05-Mar-15	17:12	18:12	69.44	6.19	2.31	55.77	6.59	2.12	55.77
3	05-Mar-15	19:14	20:14	70.94	6.70	2.23	54.98	6.78	2.06	54.98
4	05-Mar-15	21:16	22:16	90.53	6.47	2.25	83.10	6.63	2.09	83.10
5	06-Mar-15	1:02	2:02	95.26	6.83	2.30	89.82	7.03	2.13	89.82
6	06-Mar-15	3:04	4:04	91.74	7.77	2.13	85.68	7.73	1.95	85.68
7	06-Mar-15	5:06	6:06	88.65	7.90	1.97	84.21	7.79	1.79	84.21
8	06-Mar-15	7:08	8:08	99.82	6.35	2.21	92.40	6.54	2.01	92.40
9	06-Mar-15	9:09	10:09	92.64	6.53	2.25	84.79	6.63	2.14	84.79
10	06-Mar-15	11:11	12:11	84.80	6.85	2.22	76.61	6.90	2.21	76.61
11	06-Mar-15	13:13	14:13	76.85	5.97	2.45	74.34	6.46	2.41	74.34

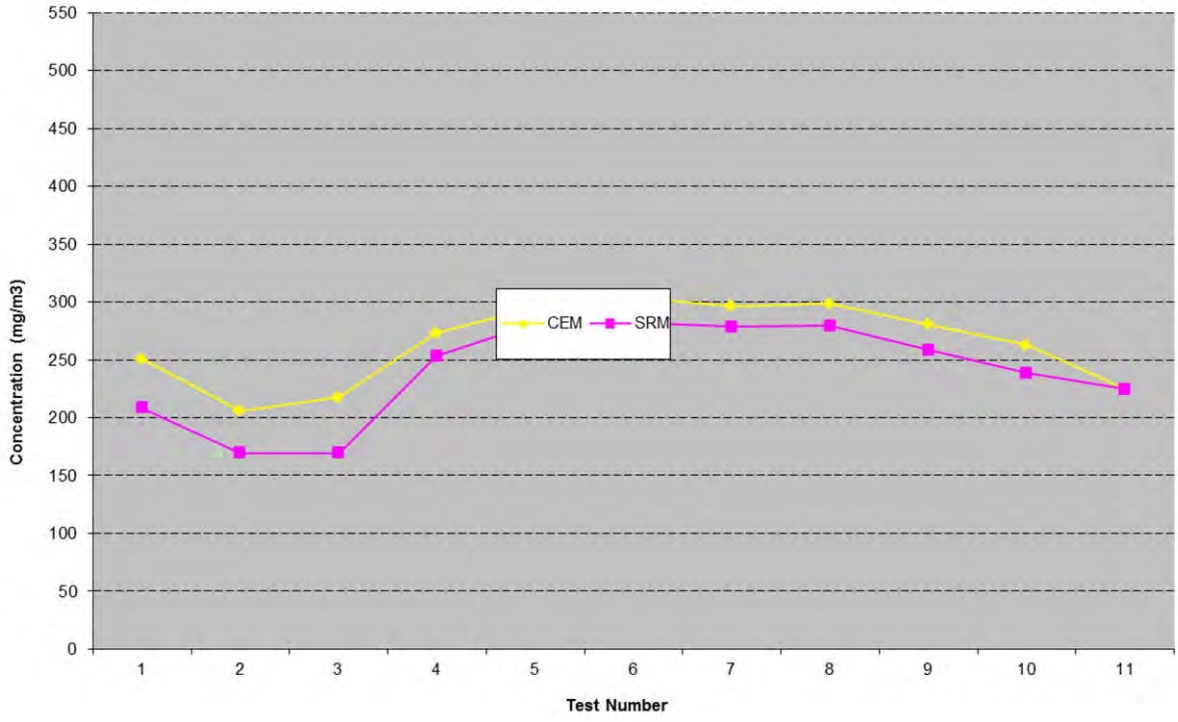
Note:
Emission concentrations expresed at reference conditions 273K, 101.3kPa

4B1 4.2.3 Table 4.2.3 – Standardised monitoring Data – Sulphur Dioxide - High Range

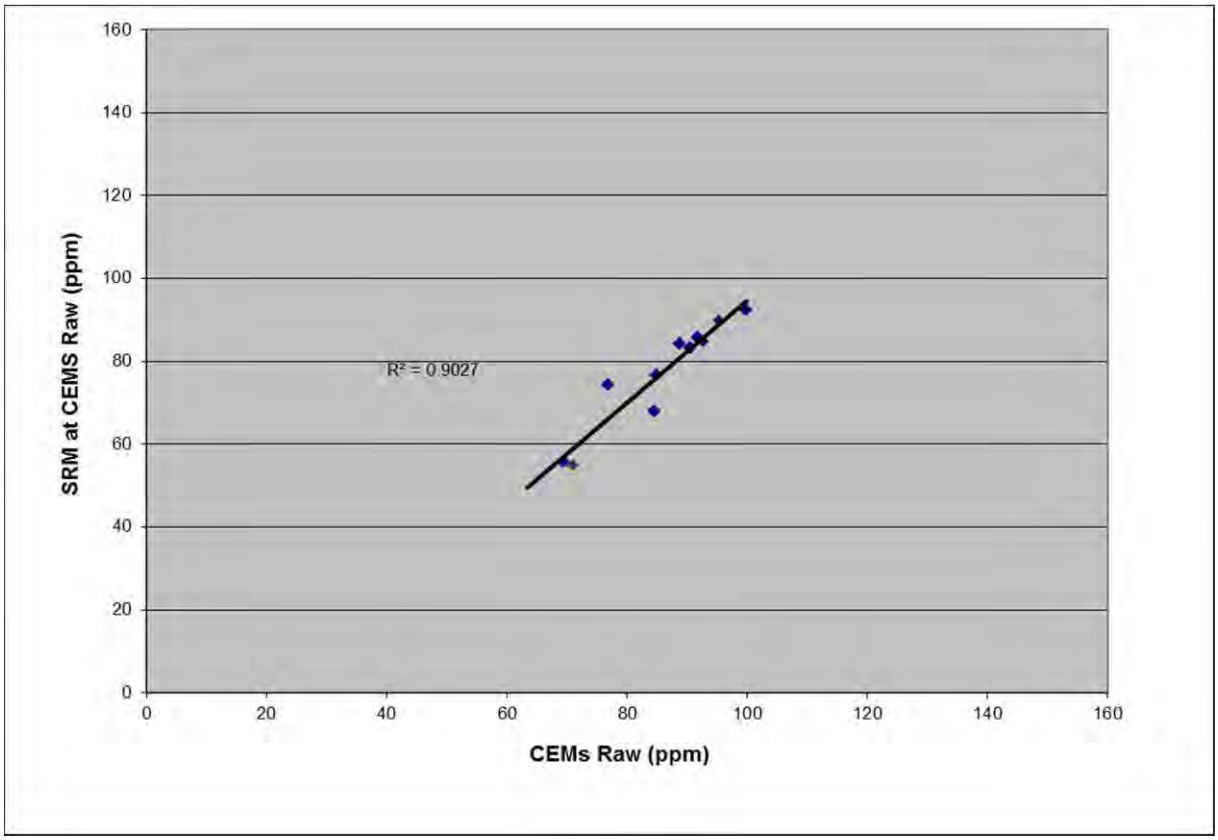
Test No	Date	Test Start Time	Test End Time	CEMS Standardised	SRM Standardised	SRM Uncertainty
		hr:min		(mg/m3)	(mg/m3)	(mg/m3)
1	05-Mar-15	15:10	16:10	250.6	208.3	31.9
2	05-Mar-15	17:12	18:12	205.8	169.5	31.7
3	05-Mar-15	19:14	20:14	217.5	169.2	32.2
4	05-Mar-15	21:16	22:16	273.2	253.2	32.2
5	06-Mar-15	1:02	2:02	294.9	281.6	32.4
6	06-Mar-15	3:04	4:04	304.0	282.6	32.4
7	06-Mar-15	5:06	6:06	296.2	278.4	32.4
8	06-Mar-15	7:08	8:08	298.6	279.6	32.4
9	06-Mar-15	9:09	10:09	280.8	258.5	32.2
10	06-Mar-15	11:11	12:11	262.7	238.3	32.1
11	06-Mar-15	13:13	14:13	224.7	224.5	31.4

Note:
Emission concentrations expresed at reference conditions 273K, 101.3kPa 6 % Oxygen, dry gas

4B1 4.3.3 Plot 1.3 –Time Series of Standardised CEM versus Standardised SRM data – Sulphur Dioxide - High Range. Reference conditions: 273K, 101.3kPa, dry gas, 6% oxygen.



4B1 4.4.3 – Elimination of Outliers – Sulphur Dioxide - High Range.



Guidance on performing tests for outliers in MID 14181 section 6.3, states the following:

'As a general guide, when plotting the raw SRM and raw CEM data, if the R^2 value for the linear regression line is equal or more than 0.9, then it is not ordinarily necessary to perform an outlier test.
Additionally, any data points are not likely to be outliers unless they are more than three standard deviations from the regression line'

As the R^2 value for this determinand was 0.9014, an outlier test has not been undertaken

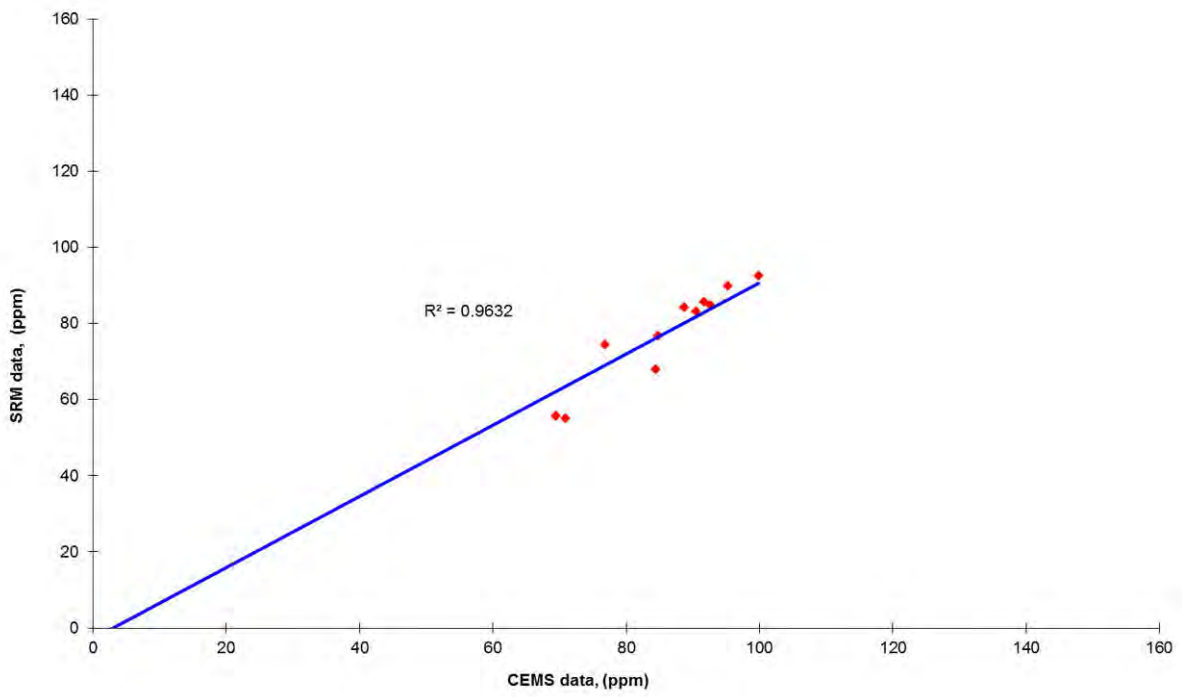
4B1 4.5.3 Table 4.3.3 - Data used to Calculate Calibrated Values – Sulphur Dioxide - High Range.

Test No	Date	Test Start Time	Test End Time	CEMS Raw Value (x)	CEMS Calibrated signal	CEMS dry Oxygen	CEMS Moisture	CEMS Standardised Value (dry)	CEMS Calibrated Standardised Value	SRM Standardised
		hr:min		(ppm)	(ppm)	%	%	(mg/Nm^3)	(mg/Nm^3)	(mg/m3)
1	18-Feb-15	Reference		-0.5	6.7	N/A	N/A	-0.5	19.1	0.0
2	05-Mar-15	15:10	16:10	84.5	87.6	6.21	2.31	250.6	259.8	208.3
3	05-Mar-15	17:12	18:12	69.4	73.3	6.19	2.31	205.8	217.1	169.5
4	05-Mar-15	19:14	20:14	70.9	74.7	6.70	2.23	217.5	229.0	169.2
5	05-Mar-15	21:16	22:16	90.5	93.3	6.47	2.25	273.2	281.7	253.2
6	06-Mar-15	01:02	02:02	95.3	97.8	6.83	2.30	294.9	302.9	281.6
7	06-Mar-15	03:04	04:04	91.7	94.5	7.77	2.13	304.0	313.1	282.6
8	06-Mar-15	05:06	06:06	88.7	91.6	7.90	1.97	296.2	305.9	278.4
9	06-Mar-15	07:08	08:08	99.8	102.2	6.35	2.21	298.6	305.7	279.6
10	06-Mar-15	09:09	10:09	92.6	95.3	6.53	2.25	280.8	289.1	258.5
11	06-Mar-15	11:11	12:11	84.8	87.9	6.85	2.22	262.7	272.3	238.3
12	06-Mar-15	13:13	14:13	76.9	80.3	5.97	2.45	224.7	234.9	224.5
Sum								2908.64		

Emission Limit Value (ELV) =	440	mg/Nm^3

	Reference Oxygen	6	%
Established Calibration Function y_i=	7.158 + 0.952xi		

Plot of CEM versus SRM Data at CEM measurement conditions– Sulphur Dioxide - High Range. wet gas



4B1 4.6.3 Table 4.4.3 – Data used for the Variability Test – Sulphur Dioxide - High Range.

Test No	Date	Test Start Time	Test End Time	CEMS Calibrated Standardised value	SRM Standardised value	Difference D1	Difference D1 - D	Squared Difference D1 - D
		hr:min		mg/m3	mg/m3			
1	18-Feb-15	Reference		19.1	0.0	-19.1	13.16	173.12
2	05-Mar-15	15:10	16:10	259.8	208.3	-51.45	-19.20	368.61
3	05-Mar-15	17:12	18:12	217.1	169.5	-47.57	-15.32	234.79
4	05-Mar-15	19:14	20:14	229.0	169.2	-59.81	-27.56	759.69
5	05-Mar-15	21:16	22:16	281.7	253.2	-28.55	3.70	13.69
6	06-Mar-15	01:02	02:02	302.9	281.6	-21.28	10.97	120.27
7	06-Mar-15	03:04	04:04	313.1	282.6	-30.59	1.65	2.74
8	06-Mar-15	05:06	06:06	305.9	278.4	-27.55	4.70	22.05
9	06-Mar-15	07:08	08:08	305.7	279.6	-26.14	6.11	37.32
10	06-Mar-15	09:09	10:09	289.1	258.5	-30.60	1.65	2.73
11	06-Mar-15	11:11	12:11	272.3	238.3	-34.01	-1.76	3.11
12	06-Mar-15	13:13	14:13	234.9	224.5	-10.34	21.91	480.12
Mean						-32.25		
Sum								2218.25

4B1 4.7.3 - Variability Test and Test of Calibration Function Calculations – Sulphur Dioxide - High Range.

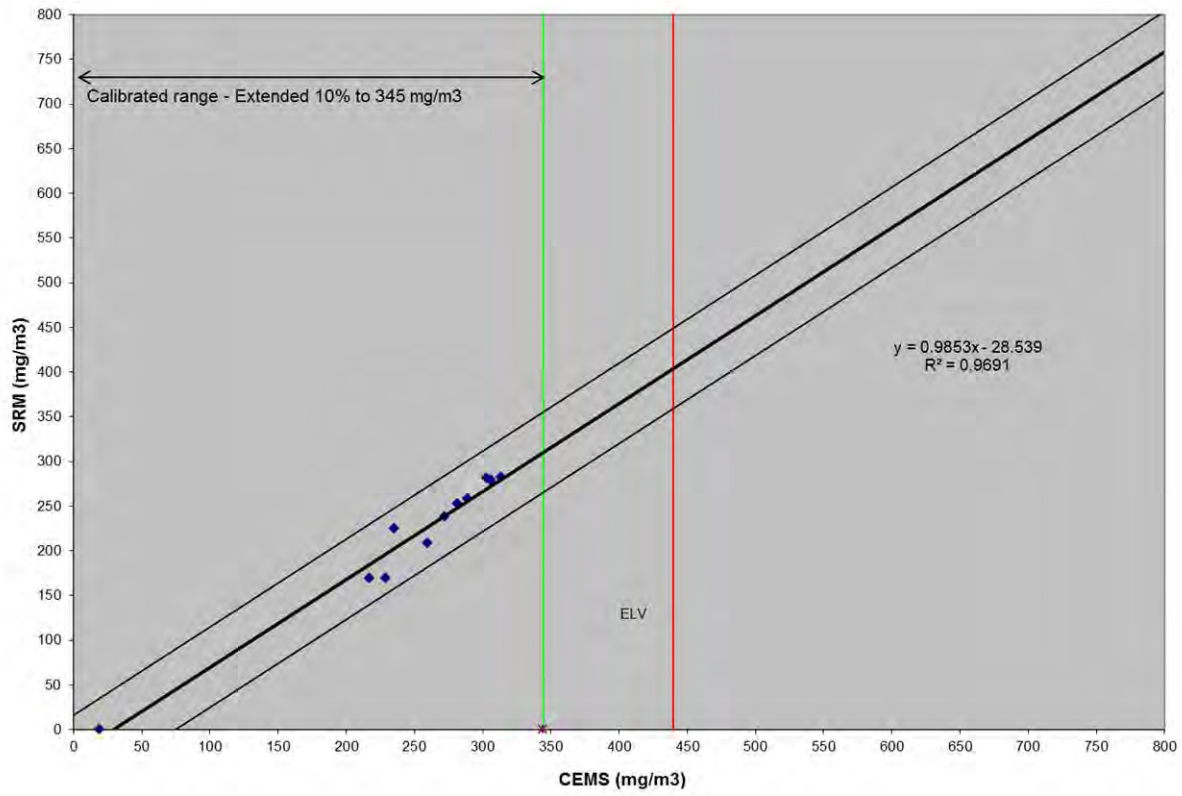
Variability Test

SD=	Root(1-Number).Integral(D1-D)^2	14.20	mg/m3(s,d),6%O2
The uncertainty laid down by the authorities is 20% ELV as a 95% confidence interval. O_0 is therefore calculated as:-			
O_0=	0.2*440 mg/m3 (s,d,6%O2)/1.96	44.90	mg/m3(s,d),6%O2
For 12 tests, kv =	0.9695		
Therefore variability=	14.2 <= 44.9 * 0.9695*1.5		
or	14.20 <=	65.29	
Which is TRUE therefore the CEMS passes the test			

Test of Calibration Function

The calibration of the AMS is accepted if:	D1<= $t_{0.95}(N\text{-}1)$*(s,d/root N)+O_0	
	D1=	32.25
For 12 tests, t0.95(N-1) =	1.796	
Therefore test of calibration =	32.25 <=1.796*(14.2/root 12)+44.9	
or	32.25 <=	52.26
Which is TRUE therefore the calibration function is VALID		

4B1 4.8.3 Plot 2.3 – Standardised CEM data versus standardised SRM - Sulphur Dioxide - High Range – Reference conditions 273K, 101.3kPa, dry gas, 6% oxygen.



Section 4B2: Data & calculations – AST – Unit 7, Procal 2

Section 4B2 – Data and calculations – AST Procal 2

4B2 4.1.1 Table 4.1.1 – Raw monitoring Data – Oxides of Nitrogen

Test No	Date	Test Start Time	Test End Time	CEMS Raw Value (wet)	CEMS Oxygen (dry)	CEMS Moisture	SRM Raw value (dry)	SRM Oxygen (dry)	SRM Moisture	SRM at CEMs Raw conditions
		hr:min		(ppm)	(%)	(%)	(ppm)	(%)	(%)	(ppm)
1	05-Mar-15	15:10	16:10	426.32	6.21	1.85	425.97	6.71	2.10	417.04
2	05-Mar-15	17:12	18:12	414.67	6.19	1.86	414.98	6.59	2.12	406.18
3	05-Mar-15	19:14	20:14	421.59	6.70	1.88	432.12	6.78	2.06	423.24
4	05-Mar-15	21:16	22:16	416.34	6.47	1.85	421.10	6.63	2.09	412.29
5	06-Mar-15	1:02	2:02	371.90	6.83	2.02	369.56	7.03	2.13	361.69
6	06-Mar-15	3:04	4:04	406.82	7.77	1.95	413.27	7.73	1.95	405.21
7	06-Mar-15	5:06	6:06	347.75	7.90	1.86	353.81	7.79	1.79	347.47
8	06-Mar-15	7:08	8:08	428.66	6.35	1.90	427.81	6.54	2.01	419.21
9	06-Mar-15	9:09	10:09	439.96	6.53	1.95	442.43	6.63	2.14	432.95
10	06-Mar-15	11:11	12:11	443.13	6.85	2.00	444.16	6.90	2.21	434.34
11	06-Mar-15	13:13	14:13	485.68	5.97	2.12	479.21	6.46	2.41	467.68

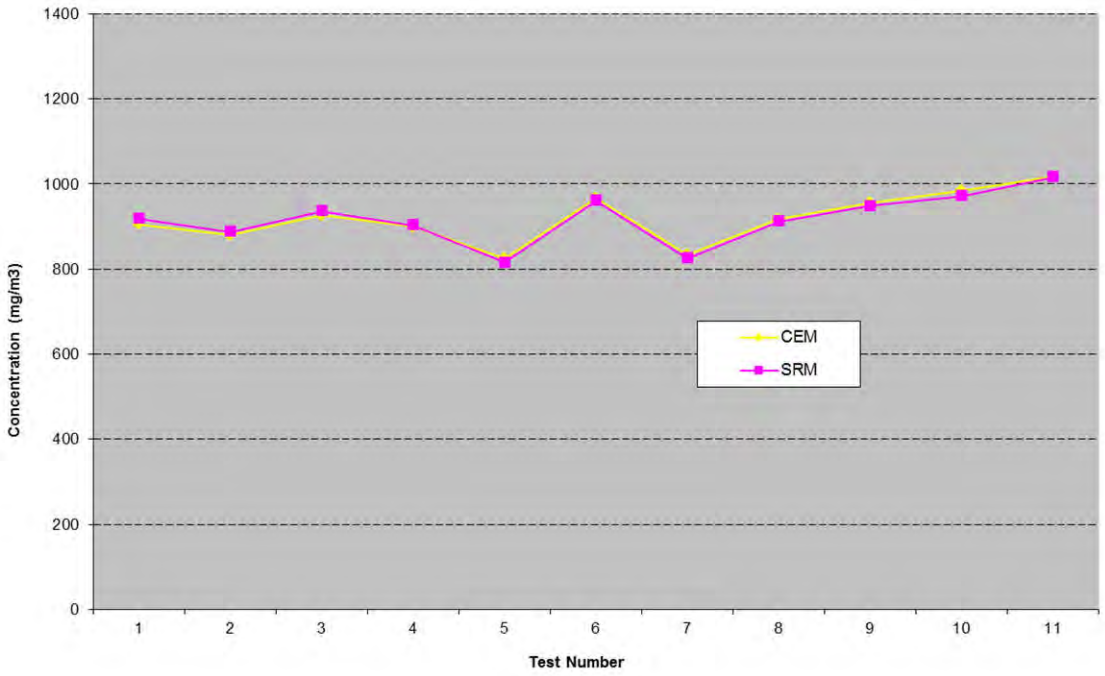
Note:
Emission concentrations expresed at reference conditions 273K, 101.3kPa

4B2 4.2.1 Table 4.2.1 – Standardised monitoring Data – Oxides of Nitrogen

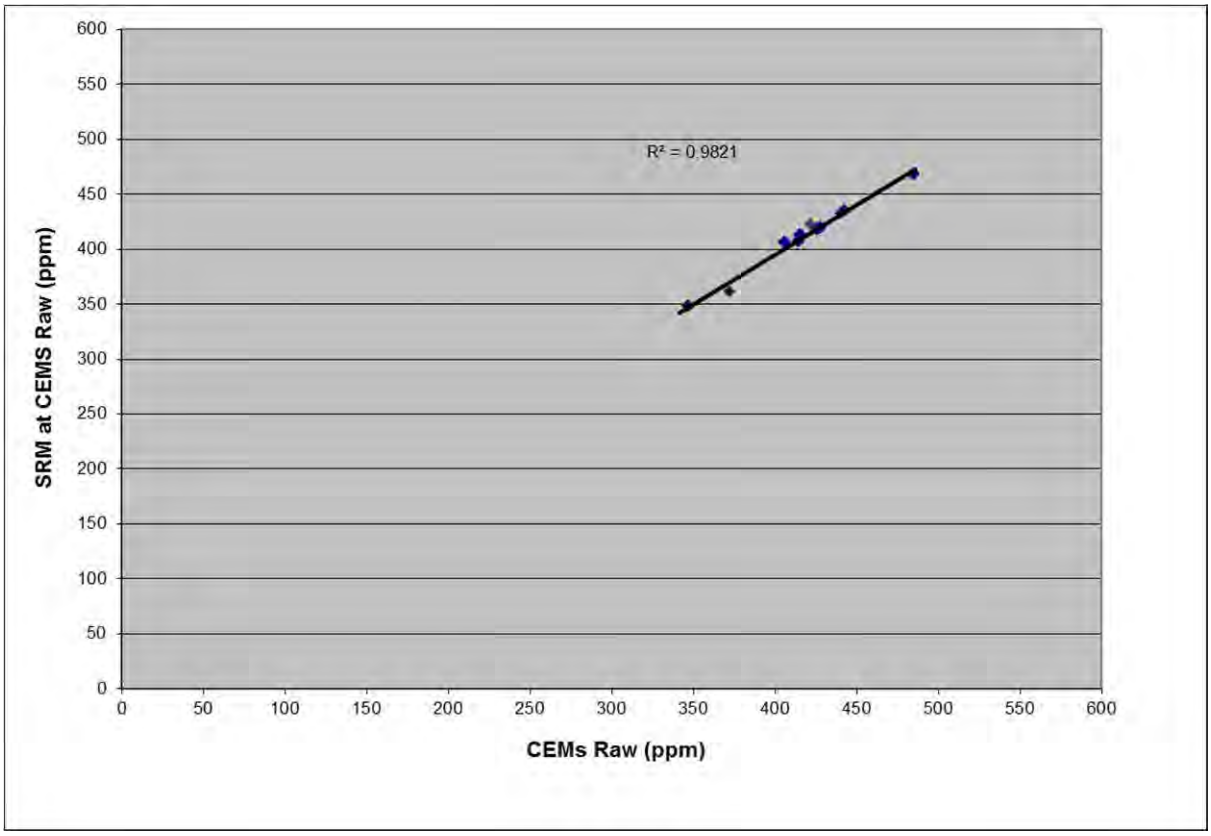
Test No	Date	Test Start Time	Test End Time	CEMS Standardised	SRM Standardised	SRM Uncertainty
		hr:min		(mg/m3)	(mg/m3)	(mg/m3)
1	05-Mar-15	15:10	16:10	904.7	918.4	30.4
2	05-Mar-15	17:12	18:12	879.1	887.4	29.4
3	05-Mar-15	19:14	20:14	925.9	936.3	31.0
4	05-Mar-15	21:16	22:16	899.4	902.8	29.9
5	06-Mar-15	1:02	2:02	825.2	815.2	27.0
6	06-Mar-15	3:04	4:04	967.2	960.4	31.8
7	06-Mar-15	5:06	6:06	834.2	825.6	27.4
8	06-Mar-15	7:08	8:08	918.8	911.6	30.2
9	06-Mar-15	9:09	10:09	955.7	948.5	34.0
10	06-Mar-15	11:11	12:11	984.7	971.0	32.2
11	06-Mar-15	13:13	14:13	1017.2	1015.2	33.6

Note:
Emission concentrations expresed at reference conditions 273K, 101.3kPa 6 % Oxygen, dry gas

4B2 4.3.1 Plot 1.1 –Time Series of Standardised CEM versus Standardised SRM data – Oxides of Nitrogen. Reference conditions: 273K, 101.3kPa, dry gas, 6% oxygen.



4B2 4.4.1 –Elimination of Outliers – Oxides of Nitrogen.



Guidance on performing tests for outliers in MID 14181 section 6.3, states the following:

'As a general guide, when plotting the raw SRM and raw CEM data, if the R2 value for the linear regression line is equal or more than 0.9, then it is not ordinarily necessary to perform an outlier test.
Additionally, any data points are not likely to be outliers unless they are more than three standard deviations from the regression line'

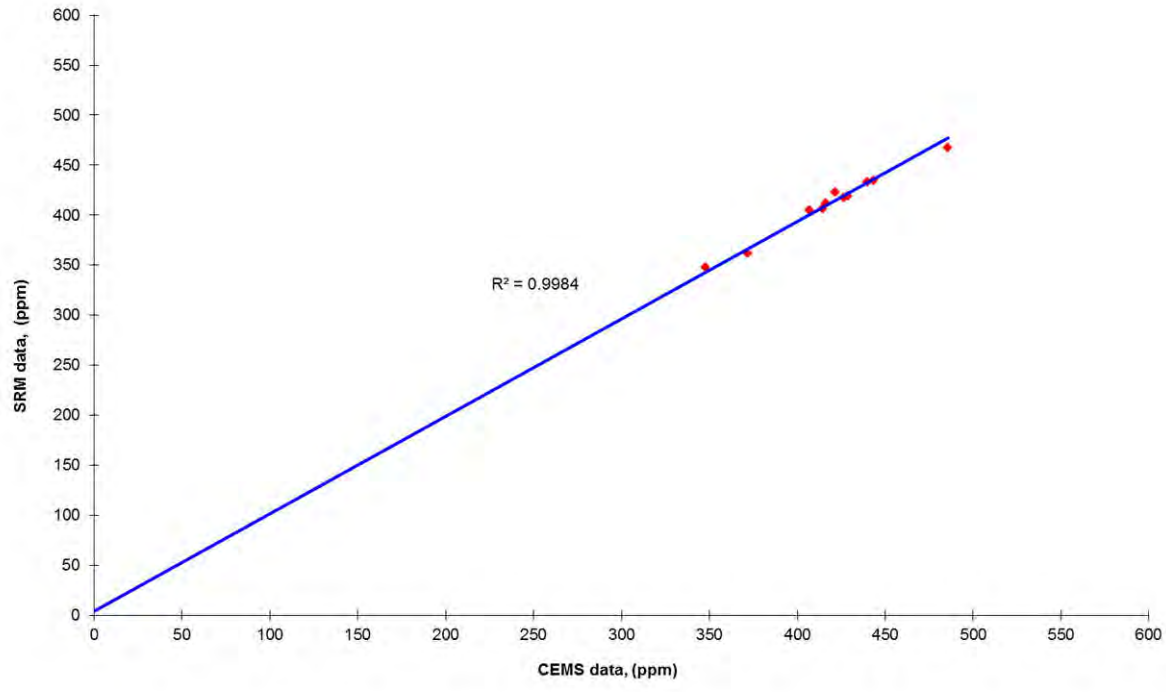
As the R2 value for this determinand was 0.9821, an outlier test has not been undertaken.

4B2 4.5.1 Table 4.3.1 - Data used to Calculate Calibrated Values – Oxides of Nitrogen

Test No	Date	Test Start Time	Test End Time	CEMS Raw Value (x)	CEMS Calibrated signal	CEMS dry Oxygen	CEMS Moisture	CEMS Standardised Value (dry)	CEMS Calibrated Standardised Value	SRM Standardised
		hr:min		(ppm)	(ppm)	%	%	(mg/Nm^3)	(mg/Nm^3)	(mg/m3)
1	18-Feb-15	Reference		-1.3	-2.8	N/A	N/A	-2.7	-5.8	0.0
2	05-Mar-15	15:10	16:10	426.3	415.9	6.21	1.85	904.7	882.5	918.4
3	05-Mar-15	17:12	18:12	414.7	404.5	6.19	1.86	879.1	857.4	887.4
4	05-Mar-15	19:14	20:14	421.6	411.2	6.70	1.88	925.9	903.1	936.3
5	05-Mar-15	21:16	22:16	416.3	406.1	6.47	1.85	899.4	877.3	902.8
6	06-Mar-15	01:02	02:02	371.9	362.6	6.83	2.02	825.2	804.5	815.2
7	06-Mar-15	03:04	04:04	406.8	396.8	7.77	1.95	967.2	943.3	960.4
8	06-Mar-15	05:06	06:06	347.8	338.9	7.90	1.86	834.2	813.1	825.6
9	06-Mar-15	07:08	08:08	428.7	418.2	6.35	1.90	918.8	896.3	911.6
10	06-Mar-15	09:09	10:09	440.0	429.2	6.53	1.95	955.7	932.4	948.5
11	06-Mar-15	11:11	12:11	443.1	432.3	6.85	2.00	984.7	960.7	971.0
12	06-Mar-15	13:13	14:13	485.7	474.0	5.97	2.12	1017.2	992.7	1015.2
Sum								10109.43		

Emission Limit Value (ELV) =	1210	mg/Nm^3
Reference Oxygen	6	%
Established Calibration Function y_i=	-1.5 + 0.979xi	

Plot of CEM versus SRM Parallel Test Data at CEM measurement conditions – wet gas



4B2 4.6.1 Table 4.4.1 – Data used for the Variability Test – Oxides of Nitrogen

Test No	Date	Test Start Time	Test End Time	CEMS Calibrated Standardised value	SRM Standardised value	Difference D1	Difference D1 - D	Squared Difference D1 - D
		hr:min		mg/m3	mg/m3			
1	18-Feb-15	Reference		-5.8	0.0	5.8	-13.80	190.51
2	05-Mar-15	15:10	16:10	882.5	918.4	35.86	16.30	265.77
3	05-Mar-15	17:12	18:12	857.4	887.4	29.96	10.39	108.05
4	05-Mar-15	19:14	20:14	903.1	936.3	33.17	13.61	185.27
5	05-Mar-15	21:16	22:16	877.3	902.8	25.47	5.91	34.94
6	06-Mar-15	01:02	02:02	804.5	815.2	10.65	-8.91	79.45
7	06-Mar-15	03:04	04:04	943.3	960.4	17.11	-2.45	6.03
8	06-Mar-15	05:06	06:06	813.1	825.6	12.47	-7.09	50.27
9	06-Mar-15	07:08	08:08	896.3	911.6	15.34	-4.22	17.84
10	06-Mar-15	09:09	10:09	932.4	948.5	16.15	-3.41	11.64
11	06-Mar-15	11:11	12:11	960.7	971.0	10.32	-9.24	85.39
12	06-Mar-15	13:13	14:13	992.7	1015.2	22.48	2.92	8.51
Mean						19.56		
Sum								1043.66

4B2 4.7.1 - Variability Test and Test of Calibration Function Calculations – Oxides of Nitrogen

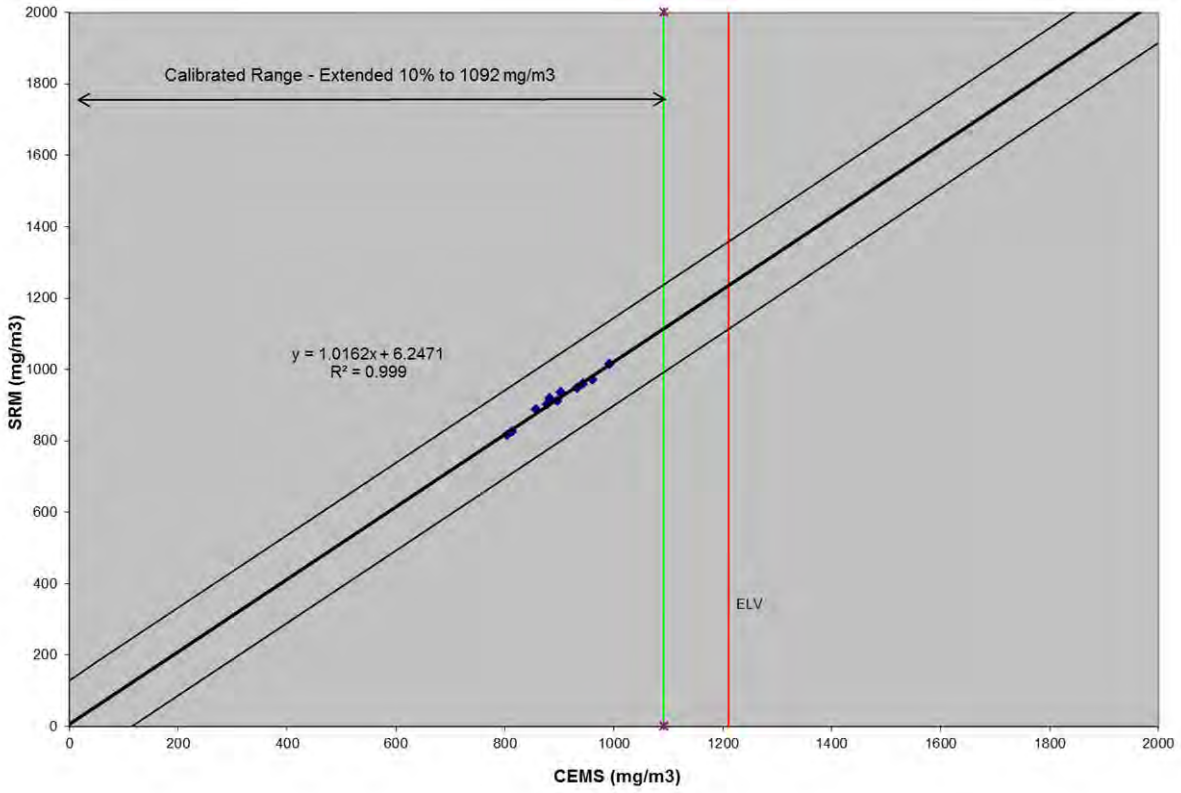
Variability Test

SD=	Root(1-Number).Integral(D1-D)^2	9.74	mg/m3(s,d),6%O2
The uncertainty laid down by the authorities is 20% ELV as a 95% confidence interval. O_0 is therefore calculated as:-			
O_0=	0.2*1210 mg/m3 (s,d,6%O2)/1.96	123.47	mg/m3(s,d),6%O2
For 12 tests, kv =	0.9695		
Therefore variability=	9.74 <= 123.47 * 0.9695*1.5		
or	9.74 <= 179.56		
Which is TRUE therefore the CEMS passes the test			

Test of Calibration Function

The calibration of the AMS is accepted if:	D1<= $t_{0.95}(N-1)$*(s,d/root N)+O_0		
	D1=	19.56	
For 12 tests, t0.95(N-1) =	1.796		
Therefore test of calibration =	19.56 <=1.796*(9.74/root 12)+123.47		
or	19.56 <= 128.52		
Which is TRUE therefore the calibration function is VALID			

4B2 4.8.1 Plot 2.1 –Standardised CEM data versus standardised SRM - Oxides of Nitrogen (as NO_2) – Reference conditions 273K, 101.3kPa, dry gas, 6% oxygen.



4B2 4.1.2 Table 4.1.2 – Raw monitoring Data – Sulphur Dioxide Low Range

Test No	Date	Test Start Time	Test End Time	CEMS Raw Value (wet)	CEMS Oxygen (dry)	CEMS Moisture	SRM Raw value (wet)	SRM Oxygen (dry)	SRM Moisture	SRM at CEMs Raw conditions
		hr:min		(ppm)	(%)	(%)	(ppm)	(%)	(%)	(ppm)
1	05-Mar-15	15:10	16:10	84.48	6.21	1.85	67.99	6.71	2.10	67.99
2	05-Mar-15	17:12	18:12	71.10	6.19	1.86	55.77	6.59	2.12	55.77
3	05-Mar-15	19:14	20:14	72.78	6.70	1.88	54.98	6.78	2.06	54.98
4	05-Mar-15	21:16	22:16	92.86	6.47	1.85	83.10	6.63	2.09	83.10
5	06-Mar-15	1:02	2:02	99.93	6.83	2.02	89.82	7.03	2.13	89.82
6	06-Mar-15	3:04	4:04	93.89	7.77	1.95	85.68	7.73	1.95	85.68
7	06-Mar-15	5:06	6:06	91.37	7.90	1.86	84.21	7.79	1.79	84.21
8	06-Mar-15	7:08	8:08	103.69	6.35	1.90	92.40	6.54	2.01	92.40
9	06-Mar-15	9:09	10:09	95.48	6.53	1.95	84.79	6.63	2.14	84.79
10	06-Mar-15	11:11	12:11	87.89	6.85	2.00	76.61	6.90	2.21	76.61
11	06-Mar-15	13:13	14:13	84.54	5.97	2.12	74.34	6.46	2.41	74.34

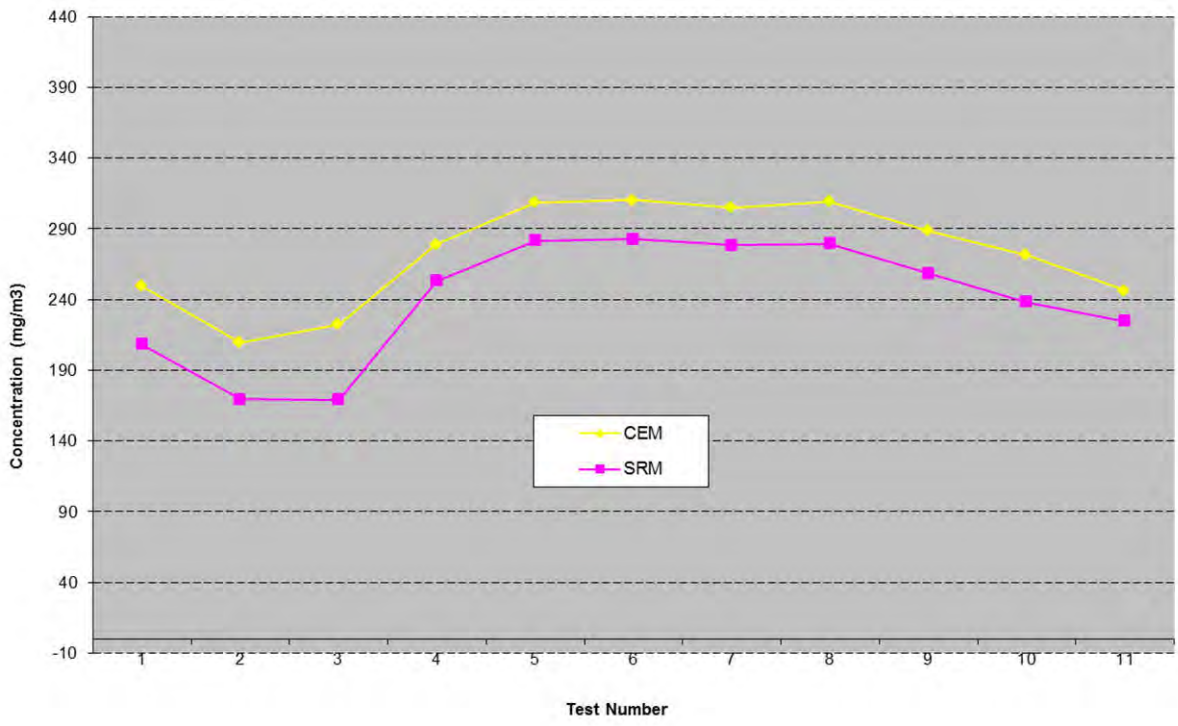
Note:
Emission concentrations expresed at reference conditions 273K, 101.3kPa

4B2 4.2.2 Table 4.2.2 – Standardised monitoring Data – Sulphur Dioxide - Low Range

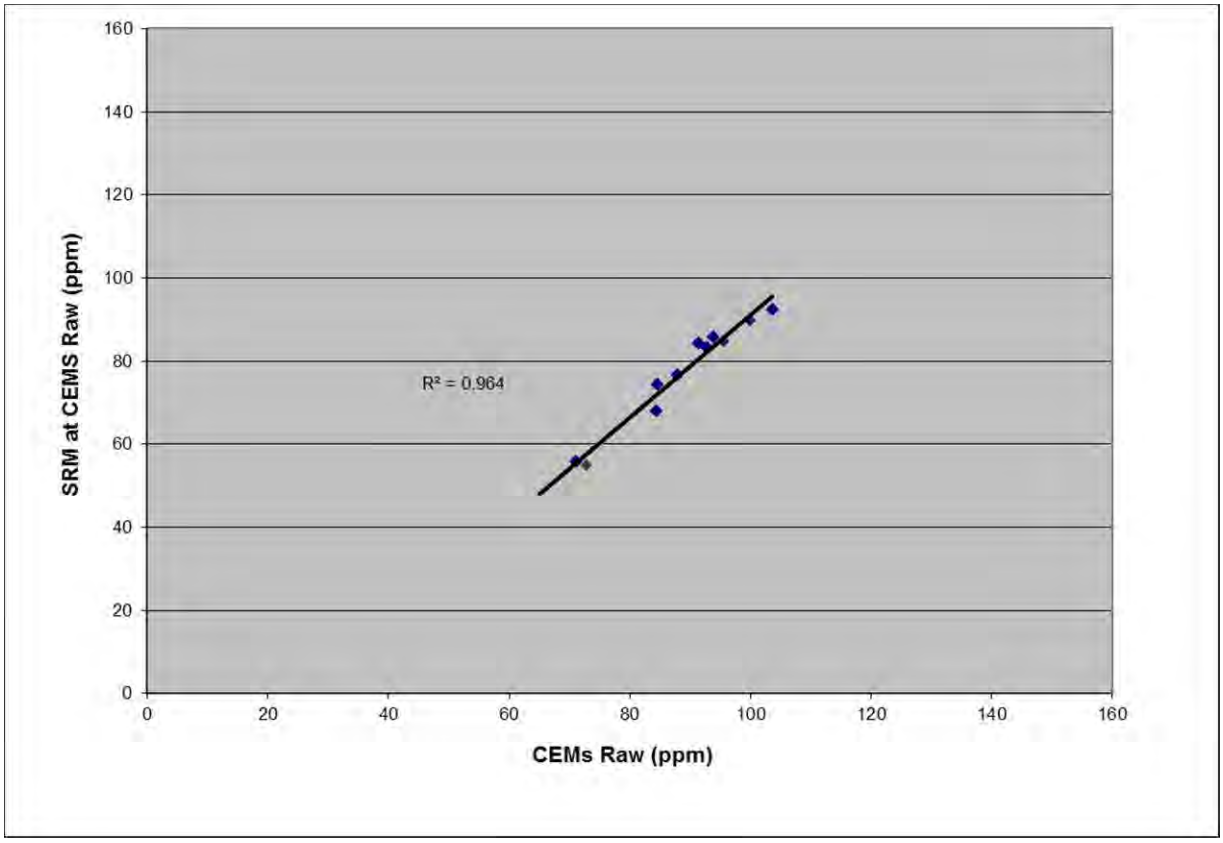
Test No	Date	Test Start Time	Test End Time	CEMS Standardised	SRM Standardised	SRM Uncertainty
		hr:min		(mg/m3)	(mg/m3)	(mg/m3)
1	05-Mar-15	15:10	16:10	249.4	208.3	31.9
2	05-Mar-15	17:12	18:12	209.7	169.5	31.7
3	05-Mar-15	19:14	20:14	222.4	169.2	32.2
4	05-Mar-15	21:16	22:16	279.1	253.2	32.2
5	06-Mar-15	1:02	2:02	308.5	281.6	32.4
6	06-Mar-15	3:04	4:04	310.6	282.6	32.4
7	06-Mar-15	5:06	6:06	305.0	278.4	32.4
8	06-Mar-15	7:08	8:08	309.2	279.6	32.4
9	06-Mar-15	9:09	10:09	288.6	258.5	32.2
10	06-Mar-15	11:11	12:11	271.7	238.3	32.1
11	06-Mar-15	13:13	14:13	246.3	224.5	31.4

Note:
Emission concentrations expresed at reference conditions 273K, 101.3kPa 6 % Oxygen, dry gas

4B2 4.3.2 Plot 1.2 –Time Series of Standardised CEM versus Standardised SRM data – Sulphur Dioxide - Low Range. Reference conditions: 273K, 101.3kPa, dry gas, 6% oxygen.



4B2 4.4.2 – Elimination of Outliers – Sulphur Dioxide - Low Range.



Guidance on performing tests for outliers in MID 14181 section 6.3, states the following:

'As a general guide, when plotting the raw SRM and raw CEM data, if the R2 value for the linear regression line is equal or more than 0.9, then it is not ordinarily necessary to perform an outlier test.
Additionally, any data points are not likely to be outliers unless they are more than three standard deviations from the regression line'

As the R2 value for this determinand was 0.9640, an outlier test has not been undertaken.

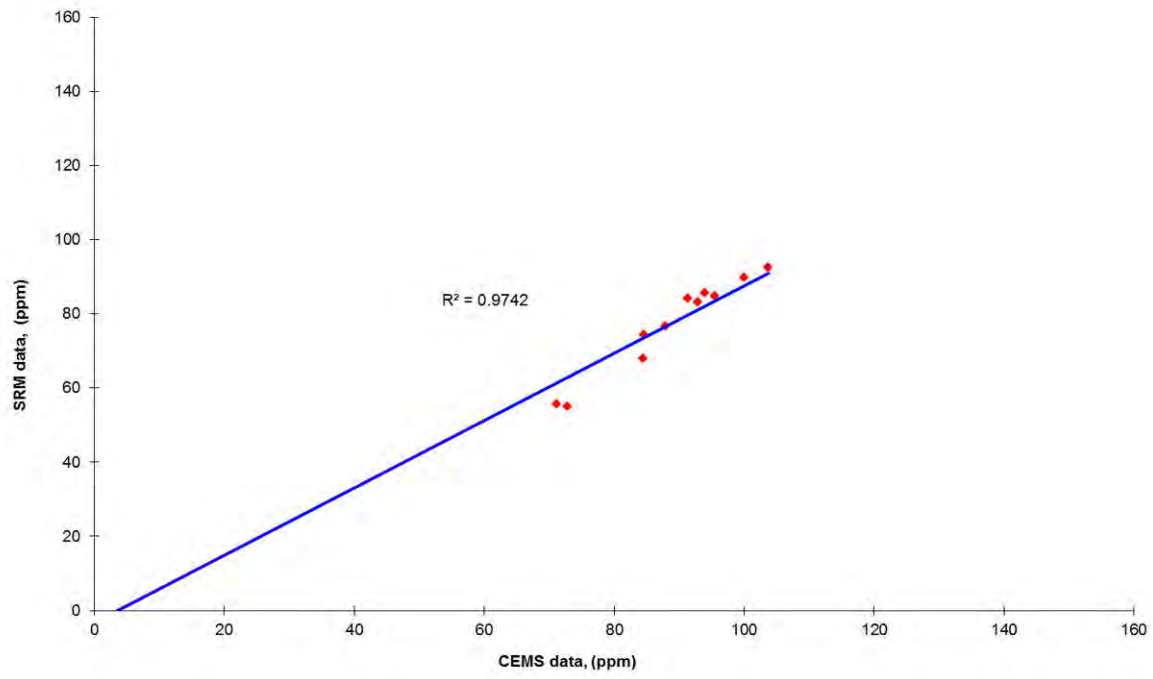
4B2 4.5.2 Table 4.3.2 - Data used to Calculate Calibrated Values – Sulphur Dioxide - Low Range.

Test No	Date	Test Start Time	Test End Time	CEMS Raw Value (x)	CEMS Calibrated signal	CEMS dry Oxygen	CEMS Moisture	CEMS Standardised Value (dry)	CEMS Calibrated Standardised Value	SRM Standardised
		hr:min		(ppm)	(ppm)	%	%	(mg/Nm^3)	(mg/Nm^3)	(mg/m3)
1	18-Feb-15	Reference		-0.5	-6.5	N/A	N/A	-0.5	-18.6	0.0
2	05-Mar-15	15:10	16:10	84.5	68.7	6.21	1.85	249.4	202.8	208.3
3	05-Mar-15	17:12	18:12	71.1	56.8	6.19	1.86	209.7	167.7	169.5
4	05-Mar-15	19:14	20:14	72.8	58.3	6.70	1.88	222.4	178.3	169.2
5	05-Mar-15	21:16	22:16	92.9	76.1	6.47	1.85	279.1	228.7	253.2
6	06-Mar-15	01:02	02:02	99.9	82.4	6.83	2.02	308.5	254.3	281.6
7	06-Mar-15	03:04	04:04	93.9	77.0	7.77	1.95	310.6	254.8	282.6
8	06-Mar-15	05:06	06:06	91.4	74.8	7.90	1.86	305.0	249.6	278.4
9	06-Mar-15	07:08	08:08	103.7	85.7	6.35	1.90	309.2	255.5	279.6
10	06-Mar-15	09:09	10:09	95.5	78.4	6.53	1.95	288.6	237.0	258.5
11	06-Mar-15	11:11	12:11	87.9	71.7	6.85	2.00	271.7	221.7	238.3
12	06-Mar-15	13:13	14:13	84.5	68.7	5.97	2.12	246.3	200.3	224.5
Sum								2999.99		

Emission Limit Value (ELV) =	440	mg/Nm^3

	Reference Oxygen	6	%
Established Calibration Function y_i=	-6.072 + 0.885xi		

Plot of CEM versus SRM Data at CEM measurement conditions– Sulphur Dioxide - Low Range. wet gas



4B2 4.6.2 Table 4.4.2 – Data used for the Variability Test – Sulphur Dioxide - Low Range

Test No	Date	Test Start Time	Test End Time	CEMS Calibrated Standardised value	SRM Standardised value	Difference D1	Difference D1 - D	Squared Difference D1 - D
		hr:min		mg/m3	mg/m3			
1	18-Feb-15	Reference		-18.6	0.0	18.6	0.99	0.98
2	05-Mar-15	15:10	16:10	202.8	208.3	5.50	-12.12	146.92
3	05-Mar-15	17:12	18:12	167.7	169.5	1.84	-15.78	248.98
4	05-Mar-15	19:14	20:14	178.3	169.2	-9.03	-26.65	710.24
5	05-Mar-15	21:16	22:16	228.7	253.2	24.41	6.79	46.07
6	06-Mar-15	01:02	02:02	254.3	281.6	27.37	9.75	94.98
7	06-Mar-15	03:04	04:04	254.8	282.6	27.78	10.16	103.16
8	06-Mar-15	05:06	06:06	249.6	278.4	28.77	11.14	124.18
9	06-Mar-15	07:08	08:08	255.5	279.6	24.01	6.39	40.77
10	06-Mar-15	09:09	10:09	237.0	258.5	21.42	3.80	14.43
11	06-Mar-15	11:11	12:11	221.7	238.3	16.59	-1.03	1.06
12	06-Mar-15	13:13	14:13	200.3	224.5	24.19	6.57	43.20
Mean						17.62		
Sum								1574.98

4B2 4.7.2 - Variability Test and Test of Calibration Function Calculations – Sulphur Dioxide - Low Range.

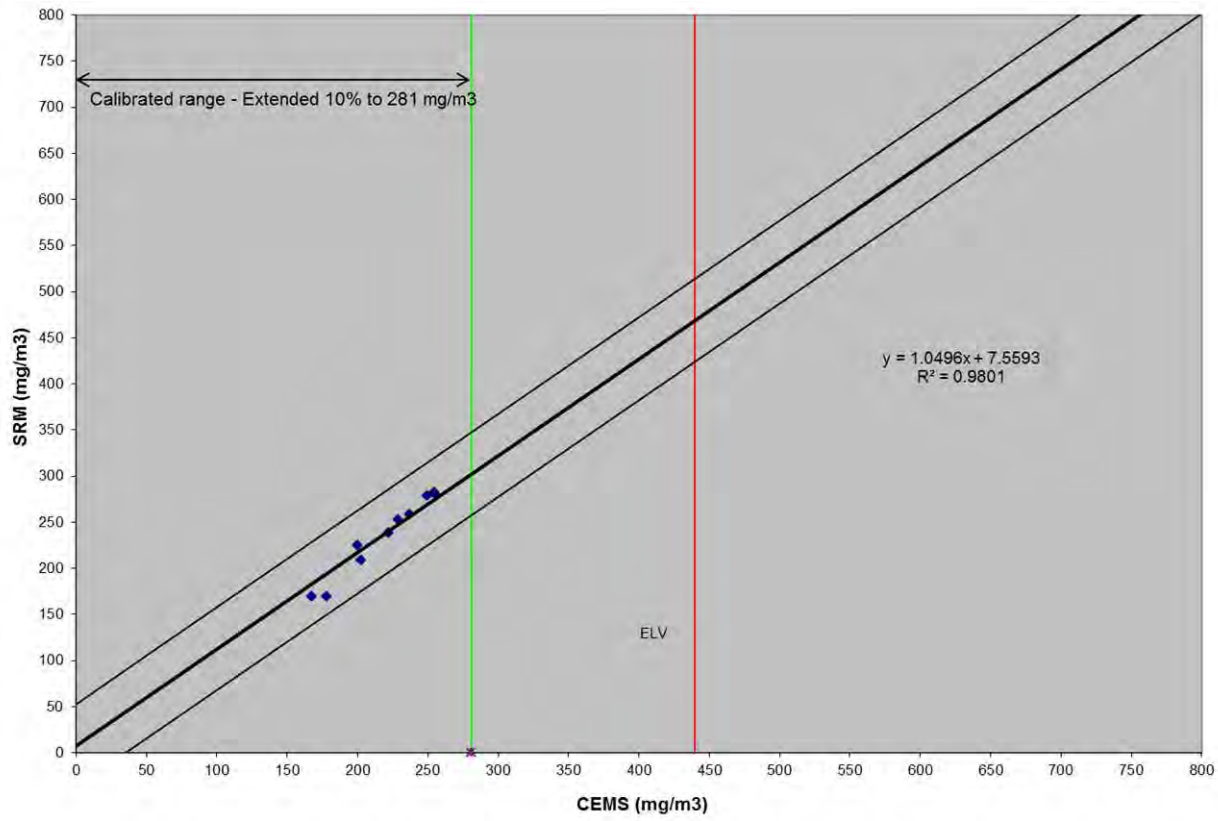
Variability Test

SD=	Root(1-Number).Integral(D1-D)^2	11.97	mg/m3(s,d),6%O2
The uncertainty laid down by the authorities is 20% ELV as a 95% confidence interval. O_0 is therefore calculated as:-			
O_0=	0.2*440 mg/m3 (s,d,6%O2)/1.96	44.90	mg/m3(s,d),6%O2
For 12 tests, kv =	0.9695		
Therefore variability=	11.97 <= 44.9 * 0.9695*1.5		
or	11.97 <=	65.29	
Which is TRUE therefore the CEMS passes the test			

Test of Calibration Function

The calibration of the AMS is accepted if:	D1<= $t_{0.95}(N-1)$*(s,d/root N)+O_0	
	D1=	17.62
For 12 tests, t0.95(N-1) =	1.796	
Therefore test of calibration =	17.62 <=1.796*(11.97/root 12)+44.9	
or	17.62 <=	51.10
Which is TRUE therefore the calibration function is VALID		

4B2 4.8.2 Plot 2.2 – Standardised CEM data versus standardised SRM - Sulphur Dioxide - Low Range – Reference conditions 273K, 101.3kPa, dry gas, 6% oxygen.



4B2 4.1.3 Table 4.1.3 – Raw monitoring Data – Sulphur Dioxide High Range

Test No	Date	Test Start Time	Test End Time	CEMS Raw Value (wet)	CEMS Oxygen (dry)	CEMS Moisture	SRM Raw value (wet)	SRM Oxygen (dry)	SRM Moisture	SRM at CEMs Raw conditions
		hr:min		(ppm)	(%)	(%)	(ppm)	(%)	(%)	(ppm)
1	05-Mar-15	15:10	16:10	92.76	6.21	1.85	67.99	6.71	2.10	67.99
2	05-Mar-15	17:12	18:12	78.58	6.19	1.86	55.77	6.59	2.12	55.77
3	05-Mar-15	19:14	20:14	80.30	6.70	1.88	54.98	6.78	2.06	54.98
4	05-Mar-15	21:16	22:16	101.55	6.47	1.85	83.10	6.63	2.09	83.10
5	06-Mar-15	1:02	2:02	108.99	6.83	2.02	89.82	7.03	2.13	89.82
6	06-Mar-15	3:04	4:04	102.50	7.77	1.95	85.68	7.73	1.95	85.68
7	06-Mar-15	5:06	6:06	99.84	7.90	1.86	84.21	7.79	1.79	84.21
8	06-Mar-15	7:08	8:08	112.97	6.35	1.90	92.40	6.54	2.01	92.40
9	06-Mar-15	9:09	10:09	104.32	6.53	1.95	84.79	6.63	2.14	84.79
10	06-Mar-15	11:11	12:11	96.21	6.85	2.00	76.61	6.90	2.21	76.61
11	06-Mar-15	13:13	14:13	92.65	5.97	2.12	74.34	6.46	2.41	74.34

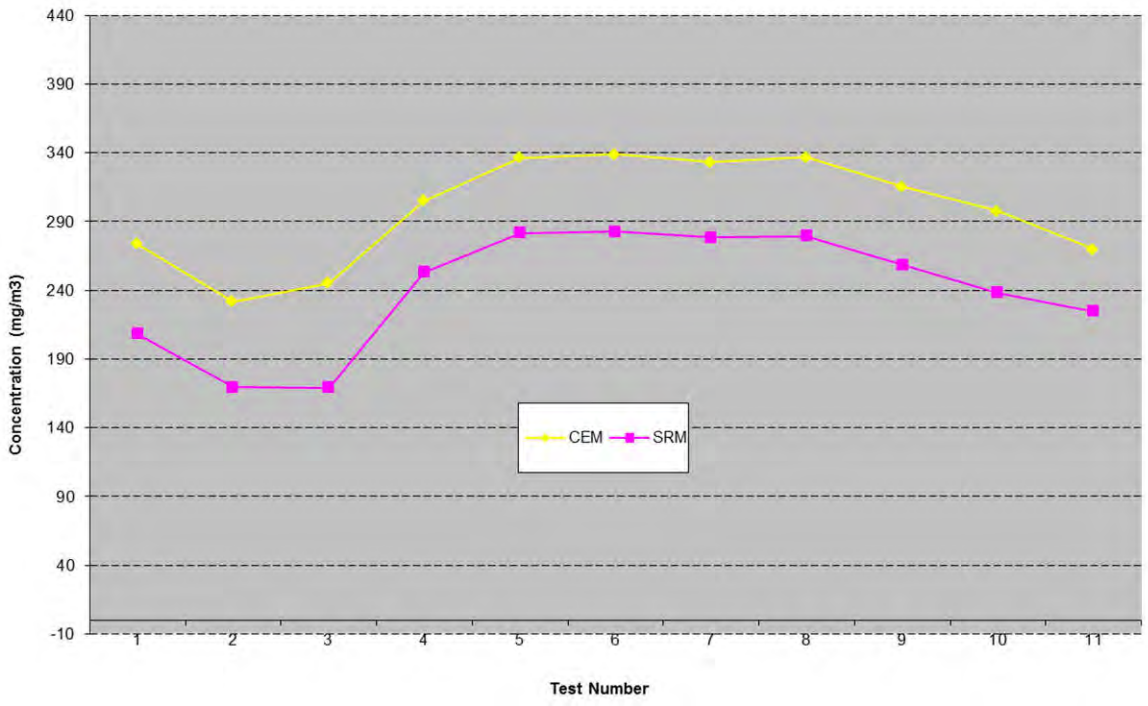
Note:
Emission concentrations expresed at reference conditions 273K, 101.3kPa

4B2 4.2.3 Table 4.2.3 – Standardised monitoring Data – Sulphur Dioxide - High Range

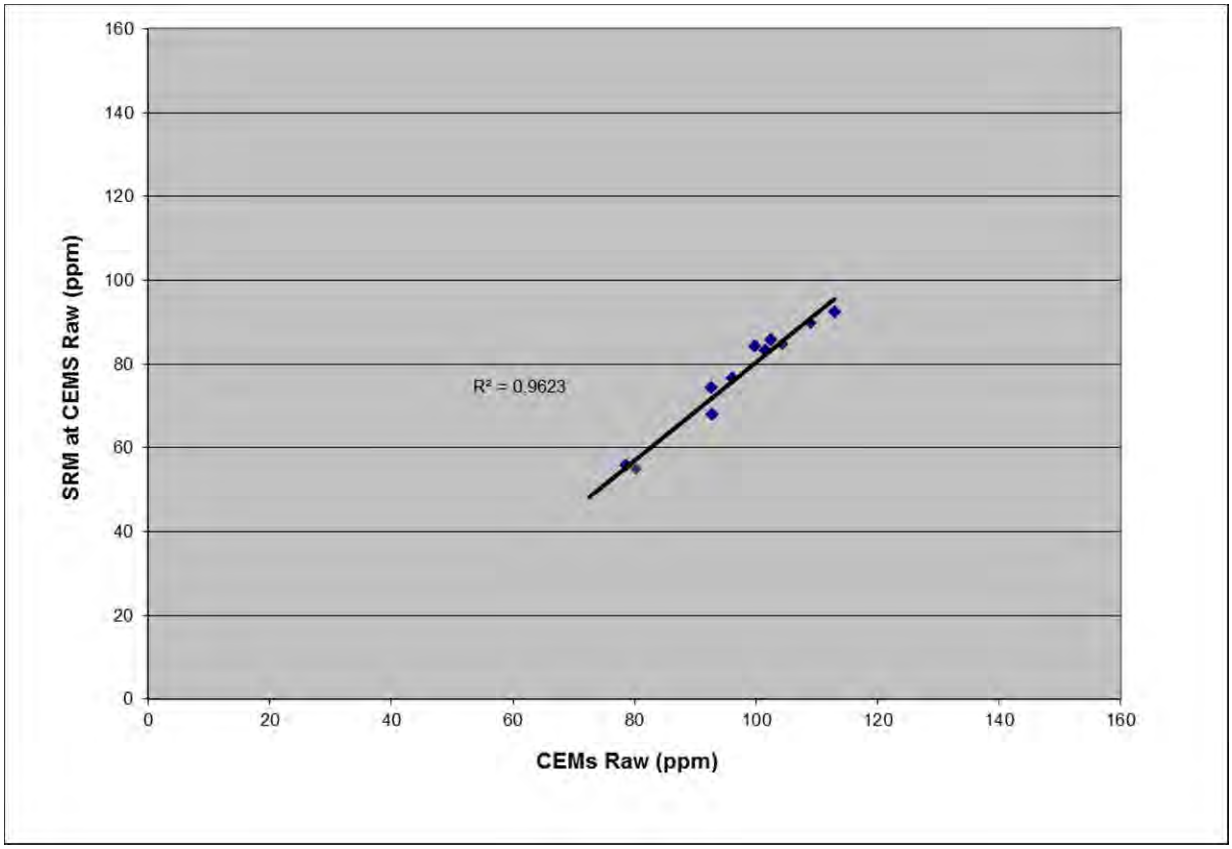
Test No	Date	Test Start Time	Test End Time	CEMS Standardised	SRM Standardised	SRM Uncertainty
		hr:min		(mg/m3)	(mg/m3)	(mg/m3)
1	05-Mar-15	15:10	16:10	273.9	208.3	31.9
2	05-Mar-15	17:12	18:12	231.8	169.5	31.7
3	05-Mar-15	19:14	20:14	245.3	169.2	32.2
4	05-Mar-15	21:16	22:16	305.2	253.2	32.2
5	06-Mar-15	1:02	2:02	336.4	281.6	32.4
6	06-Mar-15	3:04	4:04	339.0	282.6	32.4
7	06-Mar-15	5:06	6:06	333.2	278.4	32.4
8	06-Mar-15	7:08	8:08	336.9	279.6	32.4
9	06-Mar-15	9:09	10:09	315.3	258.5	32.2
10	06-Mar-15	11:11	12:11	297.5	238.3	32.1
11	06-Mar-15	13:13	14:13	270.0	224.5	31.4

Note:
Emission concentrations expresed at reference conditions 273K, 101.3kPa 6 % Oxygen, dry gas

4B2 4.3.3 Plot 1.3 –Time Series of Standardised CEM versus Standardised SRM data – Sulphur Dioxide - High Range. Reference conditions: 273K, 101.3kPa, dry gas, 6% oxygen.



4B2 4.4.3 – Elimination of Outliers – Sulphur Dioxide - High Range.



Guidance on performing tests for outliers in MID 14181 section 6.3, states the following:

'As a general guide, when plotting the raw SRM and raw CEM data, if the R2 value for the linear regression line is equal or more than 0.9, then it is not ordinarily necessary to perform an outlier test.
Additionally, any data points are not likely to be outliers unless they are more than three standard deviations from the regression line'

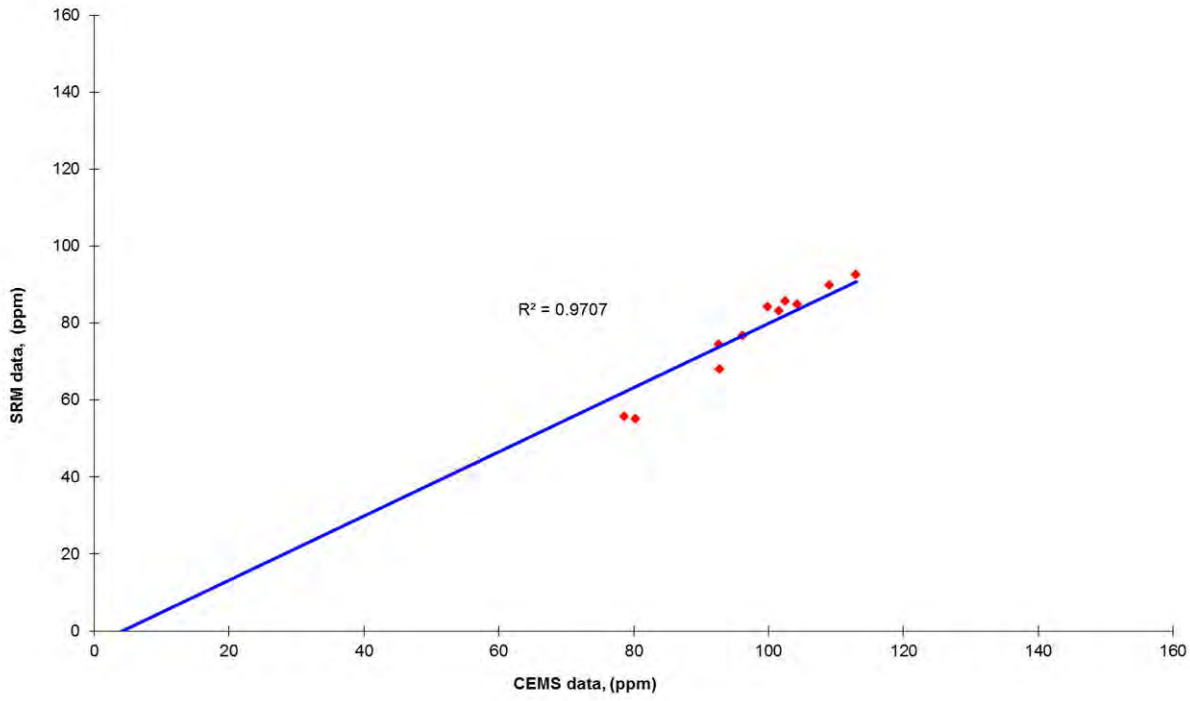
As the R2 value for this determinand was 0.9623, an outlier test has not been undertaken.

4B2 4.5.3 Table 4.3.3 - Data used to Calculate Calibrated Values – Sulphur Dioxide - High Range.

Test No	Date	Test Start Time	Test End Time	CEMS Raw Value (x)	CEMS Calibrated signal	CEMS dry Oxygen	CEMS Moisture	CEMS Standardised Value (dry)	CEMS Calibrated Standardised Value	SRM Standardised
		hr:min		(ppm)	(ppm)	%	%	(mg/Nm^3)	(mg/Nm^3)	(mg/m3)
1	18-Feb-15	Reference		-0.5	-6.3	N/A	N/A	-0.5	-17.9	0.0
2	05-Mar-15	15:10	16:10	92.8	64.3	6.21	1.85	273.9	190.0	208.3
3	05-Mar-15	17:12	18:12	78.6	53.6	6.19	1.86	231.8	158.1	169.5
4	05-Mar-15	19:14	20:14	80.3	54.9	6.70	1.88	245.3	167.8	169.2
5	05-Mar-15	21:16	22:16	101.6	71.0	6.47	1.85	305.2	213.4	253.2
6	06-Mar-15	01:02	02:02	109.0	76.6	6.83	2.02	336.4	236.5	281.6
7	06-Mar-15	03:04	04:04	102.5	71.7	7.77	1.95	339.0	237.2	282.6
8	06-Mar-15	05:06	06:06	99.8	69.7	7.90	1.86	333.2	232.6	278.4
9	06-Mar-15	07:08	08:08	113.0	79.6	6.35	1.90	336.9	237.5	279.6
10	06-Mar-15	09:09	10:09	104.3	73.1	6.53	1.95	315.3	220.9	258.5
11	06-Mar-15	11:11	12:11	96.2	66.9	6.85	2.00	297.5	207.0	238.3
12	06-Mar-15	13:13	14:13	92.6	64.3	5.97	2.12	270.0	187.2	224.5
				Sum				3284.08		

Emission Limit Value (ELV) =	440	mg/Nm^3
	Reference Oxygen	6 %
Established Calibration Function y_i=	-5.884 + 0.757xi	

Plot of CEM versus SRM Data at CEM measurement conditions– Sulphur Dioxide - High Range. wet gas



4B2 4.6.3 Table 4.4.3 – Data used for the Variability Test – Sulphur Dioxide - High Range.

Test No	Date	Test Start Time	Test End Time	CEMS Calibrated Standardised value	SRM Standardised value	Difference D1	Difference D1 - D	Squared Difference D1 - D
		hr:min		mg/m3	mg/m3			
1	18-Feb-15	Reference		-17.9	0.0	17.9	-13.22	174.89
2	05-Mar-15	15:10	16:10	190.0	208.3	18.36	-12.76	162.87
3	05-Mar-15	17:12	18:12	158.1	169.5	11.42	-19.70	388.00
4	05-Mar-15	19:14	20:14	167.8	169.2	1.47	-29.65	878.92
5	05-Mar-15	21:16	22:16	213.4	253.2	39.78	8.67	75.08
6	06-Mar-15	01:02	02:02	236.5	281.6	45.12	14.01	196.18
7	06-Mar-15	03:04	04:04	237.2	282.6	45.36	14.25	202.96
8	06-Mar-15	05:06	06:06	232.6	278.4	45.75	14.63	214.17
9	06-Mar-15	07:08	08:08	237.5	279.6	42.08	10.96	120.07
10	06-Mar-15	09:09	10:09	220.9	258.5	37.58	6.46	41.74
11	06-Mar-15	11:11	12:11	207.0	238.3	31.31	0.19	0.04
12	06-Mar-15	13:13	14:13	187.2	224.5	37.29	6.17	38.09
Mean						31.12		
Sum								2493.02

4B2 4.7.3 - Variability Test and Test of Calibration Function Calculations – Sulphur Dioxide - High Range.

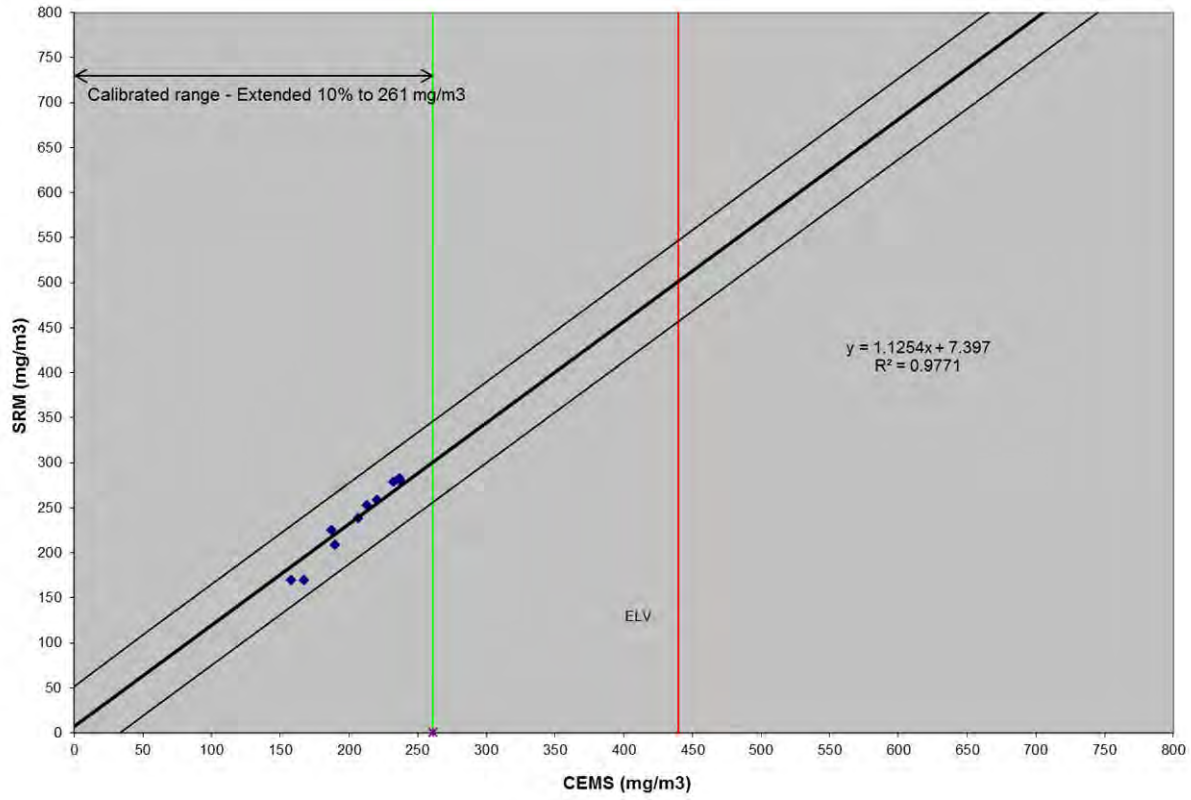
Variability Test

SD=	Root(1-Number).Integral(D1-D)^2	15.05	mg/m3(s,d),6%O2
The uncertainty laid down by the authorities is 20% ELV as a 95% confidence interval. O_0 is therefore calculated as:-			
O_0=	0.2*440 mg/m3 (s,d,6%O2)/1.96	44.90	mg/m3(s,d),6%O2
For 12 tests, kv =	0.9695		
Therefore variability=	15.05 <= 44.9 * 0.9695*1.5		
or	15.05 <=	65.29	
Which is TRUE therefore the CEMS passes the test			

Test of Calibration Function

The calibration of the AMS is accepted if:	D1<= $t_{0.95}(N\text{-}1)$*(s,d/root N)+O_0	
	D1=	31.12
For 12 tests, t0.95(N-1) =	1.796	
Therefore test of calibration =	31.12 <=1.796*(15.05/root 12)+44.9	
or	31.12 <=	52.70
Which is TRUE therefore the calibration function is VALID		

4B2 4.8.3 Plot 2.3 – Standardised CEM data versus standardised SRM - Sulphur Dioxide - High Range – Reference conditions 273K, 101.3kPa, dry gas, 6% oxygen.



Section 4B3: Data & Calculations – AST – Unit 7, SICK OMD 41

4B3 4.1 Table 4.1 – Raw monitoring Data – Total Particulate Matter

Test No	Date	Test Start Time	Test End Time	CEMS Raw Value (Extinction)	CEMS Oxygen (Wet)	CEMS Moisture (Wet)	CEM Stack Temp	CEM Stack Press	SRM Raw value (dry)	SRM Moisture (Wet FT)	SRM Oxygen (Dry)	SRM Stack Temp	SRM Stack Press	SRM at CEMs Raw conditions
		hr:min		%	(%)	(%)	C	kpa	(mg/m3)	(%)	(%)	C	kpa	(mg/m3)
1	06-Mar-15	9:05	9:55	3.3	6.4	2.25	63.5	100.2	6.8	2.1	6.6	60.9	102.2	5.5
2	06-Mar-15	10:10	11:00	4.2	5.8	2.26	64.0	100.2	3.6	2.1	6.6	61.9	102.1	2.9
3	06-Mar-15	11:10	12:00	4.7	6.8	2.31	66.2	100.2	11.2	2.2	6.9	63.0	102.1	9.0
4	06-Mar-15	12:10	13:00	4.3	6.3	1.97	66.1	100.2	8.3	2.2	6.7	63.8	102.1	6.7
5	09-Mar-15	13:00	13:55	3.2	4.9	1.99	56.4	100.1	8.1	2.0	5.8	54.3	101.2	6.6
6	09-Mar-15	14:10	15:00	2.6	5.6	2.03	57.3	100.1	0.6	2.0	6.0	55.0	101.2	0.5
7	10-Mar-15	10:07	10:58	1.9	6.4	1.93	56.5	100.2	2.7	1.9	6.8	54.3	102.3	2.2

Note:

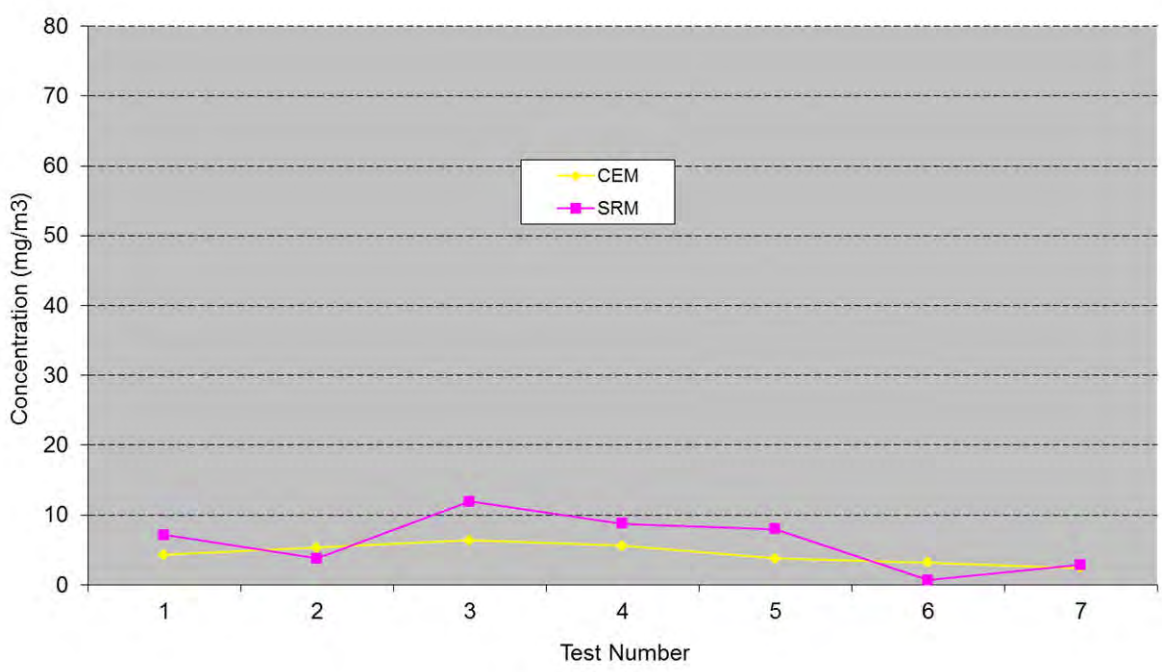
Emission concentrations expresed at reference conditions 273K, 101.3kPa

4B3 4.2 Table 4.2 – Standardised monitoring Data – Total Particulate Matter

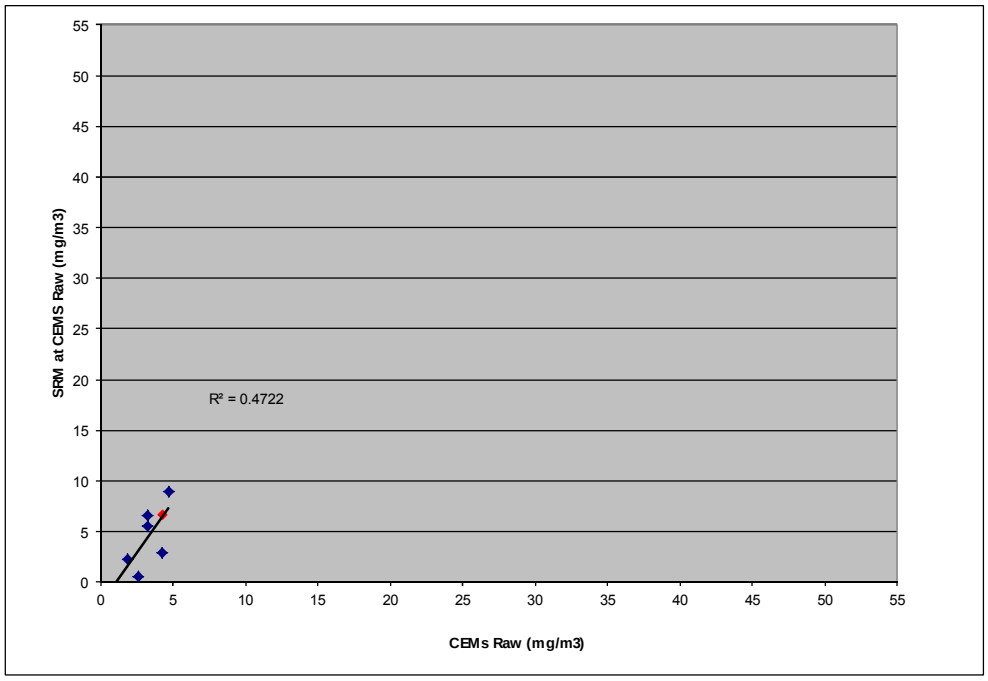
Test No	Date	Test Start Time	Test End Time	CEMS Standardised Value	SRM Standardised Value	SRM Uncertainty
		hr:min		(mg/m3)	mg/m3)	(mg/m3)
1	06-Mar-15	9:05	9:55	4.3	7.1	0.31
2	06-Mar-15	10:10	11:00	5.3	3.8	0.31
3	06-Mar-15	11:10	12:00	6.4	11.9	1.31
4	06-Mar-15	12:10	13:00	5.6	8.8	0.32
5	09-Mar-15	13:00	13:55	3.8	8.0	0.34
6	09-Mar-15	14:10	15:00	3.2	0.6	0.47
7	10-Mar-15	10:07	10:58	2.4	2.8	0.47

Note:
Emission concentrations expresed at reference conditions 273K, 101.3kPa 6 % Oxygen, dry gas

4B3 4.3 Plot 1 –Time Series of Standardised CEM versus Standardised SRM data – Total Particulate Matter. Reference conditions: 273K, 101.3kPa, dry gas, 6% oxygen.



4B3 4.4 – Elimination of Outliers – Total Particulate Matter.



Test No	Date	Test Start Time	Test End Time	CEMS Raw Value (Extinction)	SRM Value at CEMS Raw conditions	Difference Di	Difference Di - $\bar{D}i$	Is Result an Outlier - Di-$\bar{D}i$> 2SD
		hr:min		%	(mg/m3)			
1	06-Mar-15	09:05	09:55	3.3	5.5	2.26	0.94	No
2	06-Mar-15	10:10	11:00	4.2	2.9	-1.32	-2.64	No
3	06-Mar-15	11:10	12:00	4.7	9.0	4.28	2.96	No
4	06-Mar-15	12:10	13:00	4.3	6.7	2.40	1.07	No
5	09-Mar-15	13:00	13:55	3.2	6.6	3.35	2.02	No
6	09-Mar-15	14:10	15:00	2.6	0.5	-2.08	-3.40	No
7	10-Mar-15	10:07	10:58	1.9	2.2	0.37	-0.96	No
					Average $\bar{D}i$	1.32		
				Standard Deviation		2.39		
				Standard Deviation x2		4.78		

4B3 4.5 Table 4.3 - Data used to Calculate Calibrated Values – Total Particulate Matter.

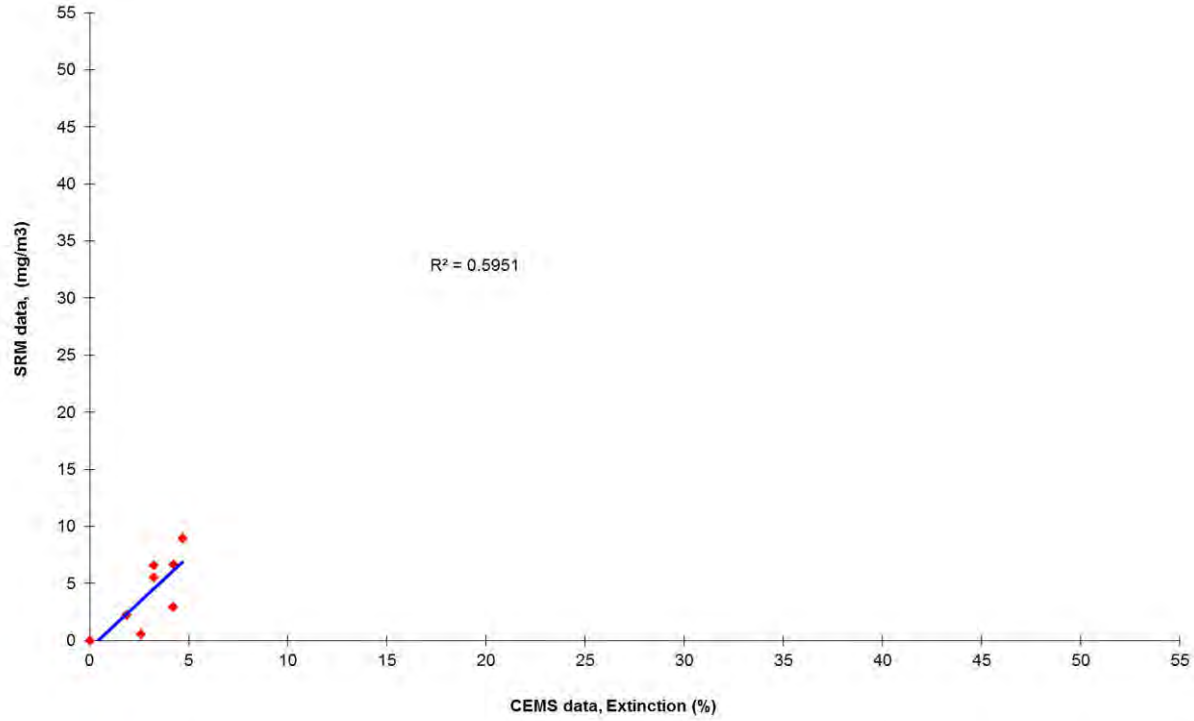
Test No	Date	Test Start Time	Test End Time	CEMS Raw Value (Extinction)	CEMS Calibrated signal	CEMS Moisture	CEMS Temp	CEMS Pressure	CEMS Dry Oxygen	CEMS Standardised Value (dry)	CEMS Calibrated Standardised Value	SRM Standardised
		hr:min		%	(mg/m3)	(%)	(^{o}C)	(kPa)	(%)	(mg/Nm^{3})	(mg/Nm^{3})	(mg/m3)
1	06-Mar-15	Reference		0.0	0.6	N/A	N/A	N/A	0.0	0.0	0.4	0.0
2	06-Mar-15	09:05	09:55	3.3	5.3	2.3	63.5	100.2	6.4	4.3	6.9	7.1
3	06-Mar-15	10:10	11:00	4.2	6.7	2.3	64.0	100.2	5.8	5.3	8.4	3.8
4	06-Mar-15	11:10	12:00	4.7	7.3	2.3	66.2	100.2	6.8	6.4	9.9	11.9
5	06-Mar-15	12:10	13:00	4.3	6.7	2.0	66.1	100.2	6.3	5.6	8.8	8.8
6	09-Mar-15	13:00	13:55	3.2	5.2	2.0	56.4	100.1	4.9	3.8	6.1	8.0
7	09-Mar-15	14:10	15:00	2.6	4.3	2.0	57.3	100.1	5.6	3.2	5.3	0.6
8	10-Mar-15	10:07	10:58	1.9	3.3	1.9	56.5	100.2	6.4	3.2	4.2	0.6
Sum										**31.65**		

Emission Limit Value (ELV) =	**55**	mg/Nm^{3}

Reference Oxygen **6 %**

Established Calibration Function y_i=	0.6 + 1.433xi

Plot of CEM versus SRM Data at CEM measurement conditions– Total Particulate Matter, at stack temperature, pressure and moisture conditions.



4B3 4.6 Table 4.4 – Data used for the Variability Test – Total Particulate Matter.

Test No	Test Start Time	Test End Time	CEMS Calibrated Standardised value	SRM Standardised value	Difference D1	Difference D1 - D	Squared Difference D1 - D
	hr:min		mg/m3	mg/m3			
1	Reference		0.4	0.0	-0.43	0.72	0.51
2	09:05	09:55	6.9	7.1	0.25	1.39	1.94
3	10:10	11:00	8.4	3.8	-4.63	-3.48	12.12
4	11:10	12:00	9.9	11.9	1.99	3.14	9.84
5	12:10	13:00	8.8	8.8	-0.06	1.08	1.17
6	13:00	13:55	6.1	8.0	1.89	3.04	9.23
7	14:10	15:00	5.3	0.6	-4.63	-3.49	12.19
8	10:07	10:58	4.2	0.6	-3.54	-2.39	5.73
8 Tests		Mean			-1.14		
Sum							52.72

4B3 4.7 - Variability Test and Test of Calibration Function Calculations – Total Particulate Matter.

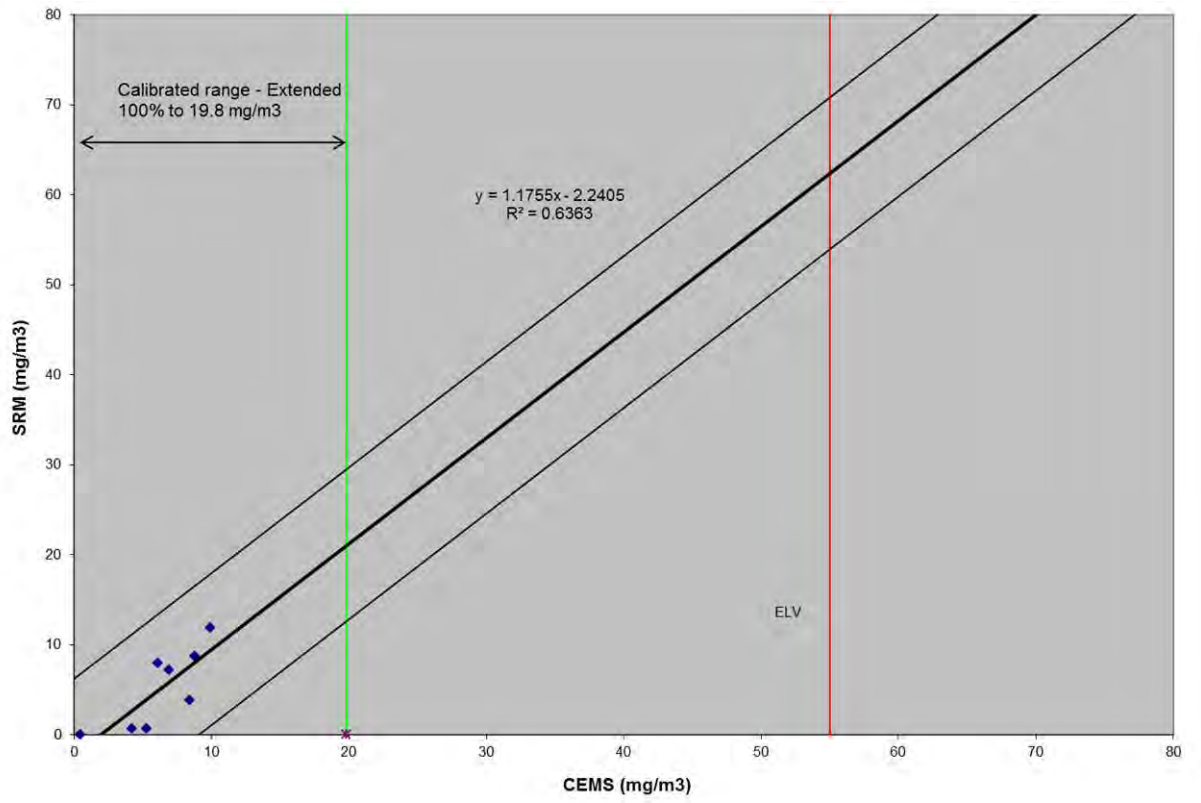
Variability Test

SD=	Root(1-Number).Integral$(D1-D)^2$	2.74	mg/m3(s,d),6%O_2
The uncertainty laid down by the authorities is 30% ELV as a 95% confidence interval. O_0 is therefore calculated as:-			
O_0=	0.3*55 mg/m3 (s,d,6%O2)/1.96	8.42	mg/m3(s,d),6%O_2
For 8 tests, k_v =	0.9521		
Therefore variability=	2.74 <= 8.42 * 0.9521 * 1.5		
or	2.74 <= 12.02		
Which is TRUE therefore the CEMS passes the test			

Test of Calibration Function

The calibration of the AMS is accepted if:		D1<= $t_{0.95}(N-1)$*(s,d/root N)+O_0	
	D1=	1.14	
For 8 tests, t0.95(N-1) =	1.895		
Therefore test of calibration =	1.14 <=1.895*(2.74/root 8)+8.42		
or	1.14 <= 10.26		
Which is TRUE therefore the calibration function is VALID			

4B3 4.8 Plot 2 – Standardised CEM data versus standardised SRM - Total Particulate Matter – Reference conditions 273K, 101.3kPa, dry gas, 6% oxygen.



Section 5 – Results of Functional tests

Table 5.1 - Audit of functional tests

Operator	RWE Generation UK plc.	
Site	Aberthaw Power Plant	
Stack	Unit 7	
Process Sector	LCPD	
Analyser A - Make Model **MCERTs Certificate Number**	Procal 1 - Pulsi 2000, In Situ IR MC990006/07	
Analyser B - Make Model **MCERTs Certificate Number**	Procal 2 - Pulsi 2000, In Situ IR MC990006/07	
Analyser C - Make Model **MCERTs Certificate Number**	Erwin SICK OMD41, Cross Duct Forward Scatter MC040042/01	
Analyser D - Make Model **MCERTs Certificate Number**	SICK Maihak GmbH GM32 – In-situ MC100163/01	
Parameters Tested	**Daily ELV**	**Certified range**
NO & NO_2	1210 mg/m^3 (NO_x as NO_2)	PROCAL: NO = 0 – 1000 ppm GM 32: Measuring path length 1.25m: NO 0 to 70 mg/m3 & 0 to 700 mg/m3 GM 32: Measuring path length 1.00m NO 0 to 87.5 mg/m3 & 0 to 875 mg/m3
Total Particulate Matter	55 mg/m^3	Erwin SICK: TPM = 0 – 200 mg/m3
SO_2	440 mg/m^3	PROCAL = SO2 low = 0 – 250 ppm SO2 high = 0 – 1000 ppm GM 32: Measuring path length 1.25m: SO2 0 to 75mg/m3 & 0 to 1000mg/m3 GM 32: Measuring path length 1.00m SO2 0 to 93.8 mg/m3 and 0 to 1250 mg/m3

Analysers A & B	
Organisation carrying out tests -	Parker/Procal
Status of organisation – CEMS manufacturer/operator/service contractor	CEMS OEM
Test engineer	M Findley
Date of tests	17th – 19th February 2015
Analyser C & D	
Organisation carrying out tests -	SICK
Status of organisation – CEMS manufacturer/operator/service contractor	CEMS OEM
Test engineer	Rhodri Jones
Date of tests	25th February 2015

Functional Test compliance with EN 14181

Requirement	Compliance Y/N	Notes
1 – Alignment and cleanliness All checks specified in MID 14181 carried out ? – Sampling System A visual inspection of the sampling system shall be performed, noting the condition of the following components, when fitted: - sampling probe; - gas conditioning systems; - pumps; - all connections; - sample lines; - power lines; - filters. The sampling system shall be in good condition and free of any visible faults, which may decrease the quality of the testing.	Yes	**Procal** – Yes **SICK (OMD)** – Yes – Optics cleaned **SICK (GM32)** – Yes
	Yes	
2 - Leak Test Leak testing shall be performed according to the AMS manuals. The test shall cover the entire sampling system.	N/A	**Procal** – N/A although differential pressure noted as OK **SICK (OMD & GM32)** – N/A
Results of leak check compliant with requirements of relevant standards	N/A	
3 - Zero and Span Check Analyser Reference zero and span materials shall be used to verify the corresponding readings of the AMS.	Yes	**Procal** – Yes **SICK (OMD 41)** – Yes – although based on the use of filters **SICK (GM32)** – Yes, although based on the use of filters
Results compliant with requirements of relevant standards Parameter:		
NO SO_2 TPM	Yes (Procal) Yes (Procal) Yes	**SICK (GM32)** – Span value of filters not stated, though analyser response recorded **SICK (OMD41)** - Span values recorded as mA signals

Requirement	Compliance Y/N	Notes
4 - Zero and Span Check Full System Reference zero and span materials shall be used to verify the corresponding readings of the AMS.	N/A	Procal, & SICK GM 32 analysers are in situ type and therefore there is as such, no 'full system'.
5 – NOx converter efficiency check	N/A	
6 - Linearity The linearity of the analysers shall be checked using five different reference materials, including zero concentration.	Yes – Procal, SICK OMD 41 No – SICK GM32	**Procal** – Yes **SICK (OMD)** – Yes – although based on the use of filters
The reference material with zero concentration, as well as the reference materials with four different concentrations, shall have a verifiable quantity and quality.	Yes	**Procal** – Yes **SICK** – Yes – although based on the use of filters **SICK (GM32)** - N/A
The reference material concentrations shall be selected such that the measured values are approximately 20%, 40%, 60% and 80% of two times the emission limit.	See note	**Procal** – Yes **SICK** – Used 8 points using filters **SICK (GM32)** - N/A
The dry test reference material shall be applied to the inlet of the AMS. Reference materials can be introduced directly into the analyser as long as the integrity of the sample system has been proved	N/A	N/A

Requirement	Compliance Y/N	Notes
6 – Linearity (continued) After each change in concentration, the first instrument readings shall be taken after a time period equal to at least three times the response time of the AMS. At each reference material concentration, at least three readings shall be made. The time period between the start of each of the three readings shall be separated by at least four times the response time. A risk based approach may be adopted in order to reduce the time for the linearity tests	No N/A	**Procal** – No times stated in report **SICK (OMD & GM32)** – No times stated in report
Linearity Test Pass Parameter		**Procal** – Yes **SICK (OMD)** – Yes
NO, SO_2 & TPM	Yes	
6 – Interferences (only required in the event of a failure of the QAL 2/AST)	N/A	
7 – Zero and Span Drift (Audit)	Yes	
8- Response time The response of the AMS shall be checked. This can be performed, if appropriate, by feeding the reference material at the end of the sampling probe. The response time shall not exceed the measured value as identified during QAL 1.	See Note	**Procal** – Yes **SICK (OMD 41)** – Yes **SICK (GM 32)** – No

Requirement	Compliance Y/N	Notes
9a – Service Report - **PROCAL**		
• Document reference	Yes	
• Instrument manufacturer	Yes	Procal
• Instrument Type	Yes	In-situ
• Instrument model	Yes	PULSI 200
• Instrument Serial No's	Yes	
• Operating principal	Yes	
• Operating range	Yes	
• Certification details	Yes	
• Compliance with MCERTS	Yes	
• Location	Yes	
• Date and time of work	Yes	Date only
• Equipment used - Type serial no's etc	Yes	Gas divider and regulator nos
• Gases used – certificate numbers, expiry dates, type	No	Copy of gas certificates offered to customer
• NOx converter efficiency check	N/A	
• Calibration and linearity data	Yes	
• Logged data for period of calibration/linearity	No	
• Name & signature of test engineer	Yes	

Requirement	Compliance Y/N	Notes
9c – Service Report – **SICK OMD**		
• Document reference	Yes	
• Instrument manufacturer	Yes	
• Instrument Type	Yes	
• Instrument model	Yes	
• Instrument Serial No's	Yes	
• Operating principal	Yes	
• Operating range	Yes	
• Certification details	Yes	
• Compliance with MCERTS	Yes	
• Location	Yes	
• Date and time of work	Yes	Date Only
• Equipment used - Type serial no's etc	Yes	On Linearity Sheet
• Gases used – certificate numbers, expiry dates, type	N/A	Linearity carried out using filters. Filter numbers stated (F1 to F8)
• NOx converter efficiency check	N/A	
• Calibration and linearity data	Yes	
• Logged data for period of calibration/linearity	Yes	Data supplied separately by client
• Name & signature of test engineer	Yes	

Requirement	Compliance Y/N	Notes
9c – Service Report – **SICK GM32**		
• Document reference	Yes	
• Instrument manufacturer	Yes	
• Instrument Type	Yes	
• Instrument model	Yes	
• Instrument Serial No's	Yes	
• Operating principal	Yes	
• Operating range	Yes	
• Certification details	Yes	
• Compliance with MCERTS	Yes	
• Location	Yes	
• Date and time of work	Yes	
• Equipment used - Type serial no's etc	No	
• Gases used – certificate numbers, expiry dates, type	Yes	
• NOx converter efficiency check	N/A	
• Calibration and linearity data	Yes	
• Logged data for period of calibration/linearity	Yes	Analyser readout checked against DCS values
• Name & signature of test engineer	Yes	

CALIBRATION CERTIFICATE

Site	Aberthaw
Date	18/02/2015
Instrument	Unit 7 Primary
Instrument Ref	8800623 8500442M
Engineer	M.Findley

Results:

Component	Units	Range FSD	Gas conc	Cert ref	Results		% error FSD
					pre cal	post cal	
CO	PPM	500	333	Site Gas	310	331	-0.4
NO	PPM	1000	667	Site Gas	679	676	0.9
SO2-H	PPM	1000	800	5501912	811	811	1.1
SO2-L	PPM	250	200	5503378	211	211	4.4

Cross sensitivity tests:

Test/ Gas conc	Response			% Error FSD		
	CO	NO	SO2-H	CO	NO	SO2-H
CO2 15%	10	14	-1	2.0	1.4	-0.1
H2O 2.5%	10	-3	12	2.0	-0.3	1.2
CO2 15% & H2O 2.5%	11	5	10	2.2	0.5	1.0

Test/ Gas conc	Response			% Error FSD		
	SO2-L			SO2-L		
CO2 15%	-1			-0.4		
H2O 2.5%	5			2.0		
CO2 15% & H2O 2.5%	4			1.6		

Signature: M. Findley

M.Findley
Procal Customer Support Engineer

Kittiwake Procal Ltd, 5 Maxwell Road, Woodston, Peterborough, PE2 7HU, UK
Tel: +44 (0) 17336 232495 Email: procalsales@parker.com Website: www.procal.com

7-7853-02 cal cert site visit general use Change note: 7007110 Date: 17/03/09

Functionality Test Results

DECLARATION OF CONFORMITY

We,

Kittiwake Procal Ltd
5 Maxwell Road
Woodston
Peterborough
Cambridgeshire
PE2 7HU
United Kingdom

Tel: (+44) (0) 1733 232495
Fax: (+44) (0) 1733 235255
e-mail: post@procal.com
Web site: www.procal.com

Declare that the product: **Type PULSI 200 Analyser** ***installed at***

Customer	**Aberthaw**
Control Unit Serial Number	**8800623**
P200 Serial Number	**8500442M**
Site Identification	**Unit 7 Primary**

To which this declaration relates is in conformance with the MCERTs Performance Standard for Continuous Emission Monitoring Systems: Version 2. Revision 1 (April 2003).

MCERTS Product Conformance Certificates:

Licence	Certificate Number	Variation	Dated
ACU	SIRA MC 990006/	8	02/10/09
ACWn	SIRA MC 050060/	6	02/10/09

MCERTs Certification Body:

Sira Certification Service	
12 Acorn Industrial Park	Tel: (+44) (0) 1322 520500
Crayford Road	
Crayford	Fax: (+44) (0) 1322 520501
Dartford	
Kent	
DA1 4AL	e-mail: info@siraenvironmental.com
United Kingdom	Web site: www.siracertification.com

Quality System:

ISO 9001:2008	Certificate Nr: 062043	Dated: 11/06/09

EN 15267-2	Dated:	2009
EN 15267-3	Dated:	2007

Technical Standards Used:

All tests carried out to Kittiwake Procal's working procedures and those within Annex A of EN14181, Version 2.3 June 2010, relating to functionality testing by CEMs' manufacturers.

Signed:..... ***Date:***..... 18/2/2015

1.0 Alignment and Cleanliness.

1.1 Internal Check of Analyser

Analyser under test	Status	Notes
Optical path clear	√	
Optics clean	√	Process Mirror replaced
Internal wiring ok	√	
Air supply on	√	
Purge flow >300 ltrs/hr	√	Ok
Pressure differential <80mBar	√	38

2.0 Zero and Span Checks.

2.1 Zero Check

Component:	H2O	CO2	CO	NO	SO2-H	SO2-L	Ta	Ts	Ps
Units:	%	mau	PPM	PPM	PPM	PPM			
Process conc	2.4	145	673	459	47	36	26.8	130	1006
Zero conc	0	0	-5	-2	-1	-1	26.8	129	1044
% error	<2	<2	<2	<2	<2	<2			
Pass/Fail	Pass	Pass	Pass	Pass	Pass	Pass			
T90 recovery									

2.2 Span Check

Component:	H2O	CO2	CO	NO	SO2-H	SO2-L	Ta	Ts	Ps
Units:	%	mau	PPM	PPM	PPM	PPM			
Full range	10		500	1000	1000	250			
Zero Conc	0	0	-5	-2	-1	-1	26.8	129	1044
Test Gas Conc			333	667	800	200			
Cert number			Site Gas	Site Gas	040005 501912	040005 503378			
Response Conc			331	676	867	187	26.8	132	1035
% Error			<2	<2	>2	>2			
Pass/Fail			Pass	Pass	Fail	Fail			
T90 time Seconds				75	70	75			

2.3 Filter Level Checks

All on zero air	F6	F2	F7	F5G	F3	F1G	F4	F8
Factory	1890	3979	4090	2306	3471	2218	539	3481
Last visit	1270	2479	2701	1538	2409	1589	413	2422
This visit	1691	3364	3697	2111	3166	2090	447	2873

2.4 Interference Checks

Component:	H2O	CO2	CO	NO	SO2-H	SO2-L
Units:	%	mau	PPM	PPM	PPM	PPM
ZERO	0	0	1	1	1	1
CO2 15%	0	148	10	14	-1	-1
H2O 2.5 %	2.6	2	10	-3	12	5
H2O 2.5% & CO2 15%	2.7	146	11	5	10	4

3.0 Data Acquisition.

Displayed \ Component		H2O %	CO PPM	NO PPM	SO2-H PPM	SO2-L PPM
Zero	Analyser	0	-5	-2	-1	-1
	DCS					
	4-20mA					
Span	Analyser	2.6	331	676	867	187
	DCS					
	4-20mA					

4.0 Linear coefficient record.

Coefficient \ Component		H2O	CO2	CO	NO	SO2-H	SO2-L
Last test	Linear	2.160e-2	1	7.612e+0	1.379e+1	4.932e+0	4.423e+0
	Squared	4.210e-5	0	1.122e-1	4.429e-2	-5.139e-4	1.431e-3
	Cubed						
This test	Linear	2.16e-2	1	8.152e0	1.379e1	5.105e0	4.423e0
	Squared	4.12e-5	0	1.202e-1	4.429e-2	-5.319e-4	1.431e-3
	Cubed						

5.0 Test Information

5.1 Procal Engineer: **Michael Findley**

5.2 Test House:

5.3 Test House Engineer:

Appendix 1. Pro-forma for assessing and reporting the results of the functional tests

Requirement		Notes
1. Alignment and Cleanliness		
A visual inspection, with reference to the CEMs manuals, shall be carried out on the following when applicable:		
• Internal check of the CEM	√	All Functions ok
• Cleanliness of the optical components	√	Process Mirror replaced
• Flushing air supply	√	Ok
• Obstructions in the optical path	√	None
• After re-assembly at the measurement location at least the following shall be checked	√	No re-assembly required
• Alignment of the measuring system	√	
• Contamination control (internal check of optical surfaces)	√	Ok
2. Sampling Systems		
A visual inspection of the sampling system shall be performed, noting the condition of the following components, when fitted:		
• Sampling probe	n/a	
• Gas conditioning systems	n/a	
• Pumps	n/a	
• All connections	√	Ok
• Sample lines	n/a	
• Power supplies	√	Ok
• Filters	√	Ok
• 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 data	√	Ok
3. Leak testing		
• Leak testing shall be performed according to the CEMs manuals. The tests shall cover the entire sampling system.	n/a	
4. Zero and Span check		
• Reference zero and span materials shall be used to verify the corresponding readings of the CEM.	√	Ok
• In case of non-extractive CEM, 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 CEM at the measurement location.	√	Ok
5. Linearity		
• 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.	√	Data collected on ACU and customer DCS during testing

Requirement		Notes
DCS logged values should be included in the instrument service report.	√	Data collected on ACU and customer DCS during testing
• The linearity of the CEM's response shall be checked using five different reference materials, including a zero concentration.	√	See linearity Cert
• The reference material with zero concentration, as well as the reference materials with four different concentrations, shall have a verifiable quantity and quality.	√	Recorded on Test Sheet
• 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.	√	Gas points derived from blending full gas range using a Procal P900, a water generator/gas blender
• 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. 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 CEM.	√	See linearity Cert
The individual CEMs are tested using the following concentrations applied in a randomized sequence:		
• Reference material with zero concentration;	√	See linearity Cert
Reference material concentration approximately 20 % of 2 times the emission limit;	√	See linearity Cert
• Reference material concentration approximately 40 % of 2 times the emission limit;	√	See linearity Cert
• Reference material concentration approximately 60 % of 2 times the emission limit;	√	See linearity Cert
• Reference material concentration approximately 80 % of 2 times the emission limit;	√	See linearity Cert
• Reference material with zero concentration;	√	See linearity Cert
After each change in concentration, the first instrument reading shall ordinarily be taken after a time period equal to at least three times the response time of the CEM. At each reference material concentration, at least three readings shall be made, six readings shall be taken at zero. The time period between the start of each of the three readings shall be separated by at least four times the response time. The test-laboratory may apply a risk-based approach to linearity testing in order to reduce the time for the tests. For example, the readings may be taken after less than 3x the response time; however, if the CEM fails the linearity test, then the test laboratory shall repeat the linearity test and wait at least 3x the response time as stated above. Alternatively, the number of repetitions of the test may be reduced if the CEM passes the required performance criteria by a factor of at least 2 (i.e. half the allowable residual). Increasing the waiting time to 5x the response time, for example, may be a means of meeting this requirement. Where no other method is possible, the linearity can also be performed with the aid of reference materials such as grating filters or gas filters.		

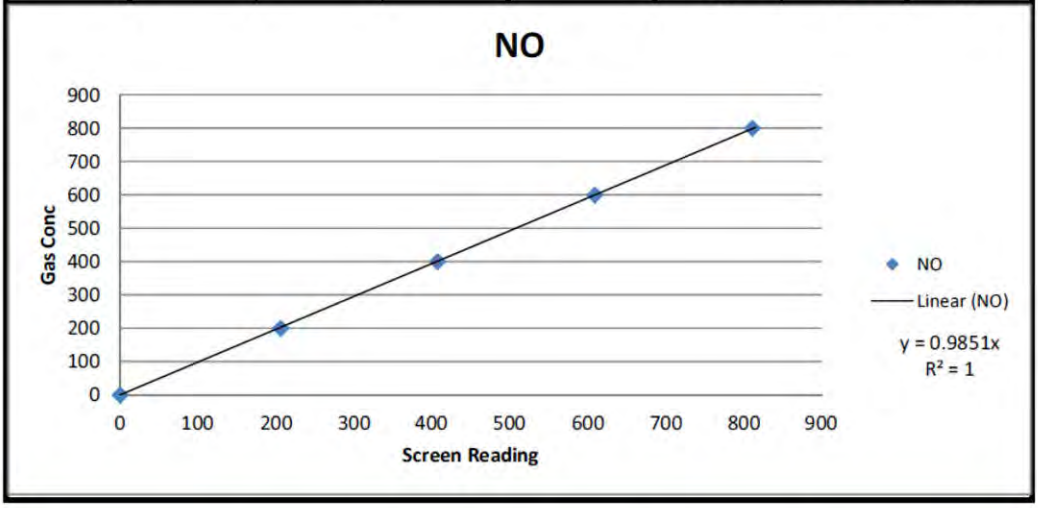
Requirement		Notes
The linearity shall be calculated and tested using the procedure as given in EN 14181 annex B. If the CEM does not pass this test; then the problem shall be identified and rectified.		
6. Interferences		
• A test shall be undertaken if the process gases to be monitored contain components that are known interferences, as identified during QAL1 and there is a failure of the QAL2 or AST which could be due to interferents.	√	Interference checks made with water vapour, CO2 and each gas species. See Calcert
7. Zero and Span drift (Audit)		
• 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.	√	Customer has procedure in place and documented evidence
. Response Time		
• The response time of the CEM 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.	√	Response time recorded on test sheet and this report
9. Service Report		
As a minimum requirement the service report should include the following:		
• Document reference for work instruction for the type of work being undertaken	√	Parker Procal Method Statement
• Instrument manufacturer	√	Parker Procal (UK)
• Instrument type	√	Pulsi 2000
• Instrument model	√	P2000
• Instrument Serial No	√	8500442M
• Operating principle	√	GFCIR/NIR
• Operating range	√	Recorded on this report
• Certification details	√	mcerted
• Compliance with MCERTS (including certificate no.)	√	SIRA MC 990006/08
• Location	√	Aberthaw Power Station, Wales
• Date and time work was undertaken	√	18/02/2015
• Equipment used - type, serial no's, calibration dates	√	Procal Water Generator/Gas divider Pcal #2
• Gases used - certificate numbers, expiry dates, binary / mix	√	Copy of Gas certs can be provided
• NOx converter efficiency test, if applicable	n/a	
• Calibration and linearity data as required by EN14181	√	See Linearity & Calcert data
• **Logged** data for period of calibration and linearity. Note there may be gaps in the data, in such cases, the test laboratory shall state why there are gaps in the data	√	See Linearity & Calcert data

LINEARISATION RESULTS

Site	Aberthaw
Date	18/02/2015
Instrument	Unit 7 Primary
Instrument Ref	8800623 8500442M
Engineer	Michael Findley

The above analyser has undergone a linearisation check and calibration, if required, in accordance with the company's quality system. The following results were obtained.

Component	Units	Range FSD	Gas conc	Cert ref	Results		% error
					pre cal	post cal	FSD
NO	PPM	1000	800	40005501912	811	811	1.1
					814	814	1.4
					815	815	1.5
NO	PPM	1000	600	40005501912	609	609	0.9
					612	612	1.2
					613	613	1.3
NO	PPM	1000	400	40005501912	407	407	0.7
					408	408	0.8
					405	405	0.5
NO	PPM	1000	200	40005501912	206	206	0.6
					205	205	0.5
					204	204	0.4



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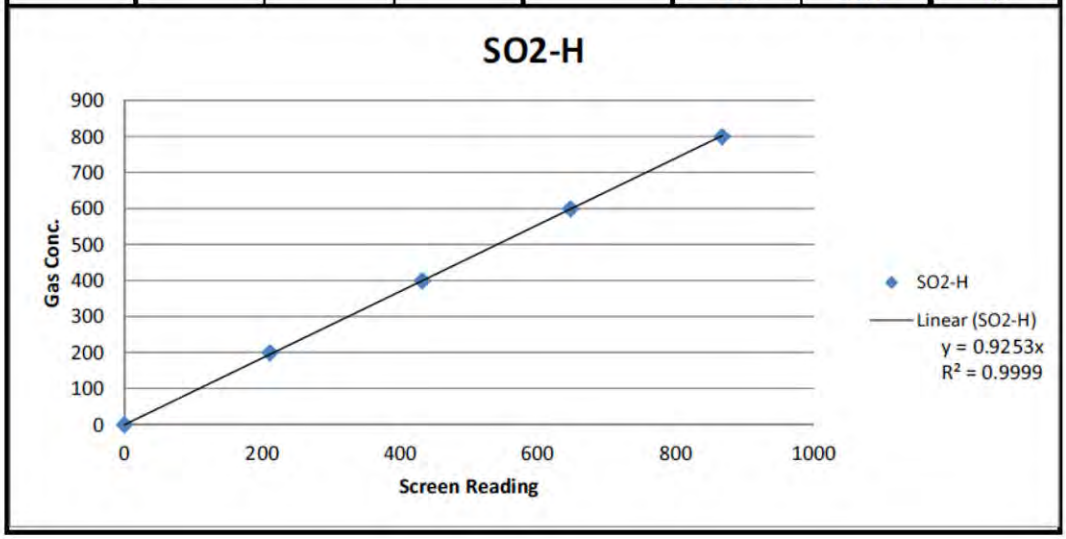
7-7862-04 Linearisation Certificate Change note: 7009251 Date: 30/07/1

Component	Units	Range FSD	Gas conc	Cert ref	Results		% error
					pre cal	post cal	FSD
SO2-H	PPM	1000	800	40005503378	867	867	6.7
					866	866	6.6
					866	866	6.6
SO2-H	PPM	1000	600	40005503378	647	647	4.7
					650	650	5.0
					650	650	5.0
SO2-H	PPM	1000	400	40005503378	432	432	3.2
					431	431	3.1
					432	432	3.2
SO2-H	PPM	1000	200	40005503378	211	211	1.1
					211	211	1.1
					212	212	1.2



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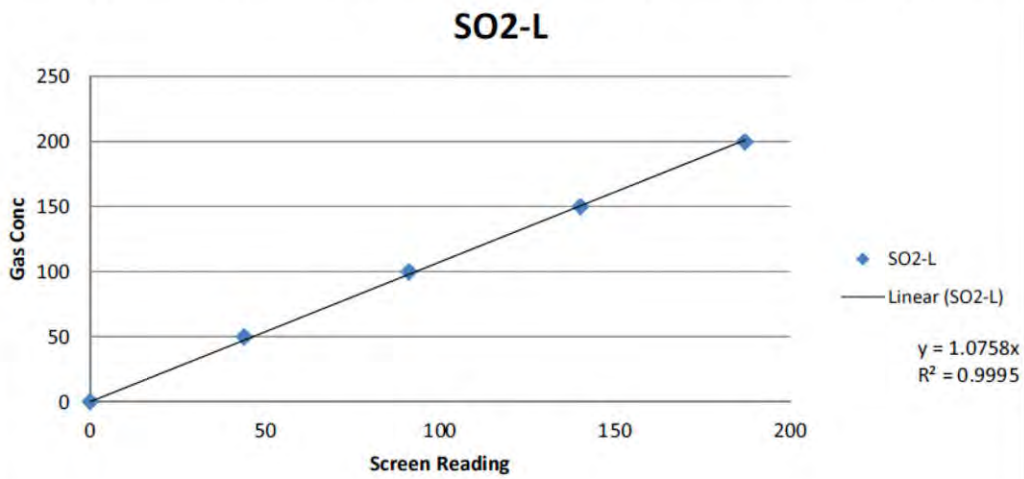
7-7862-04 Linearisation Certificate Change note: 7009251 Date: 30/07/12

Component	Units	Range FSD	Gas conc	Cert ref	Results		% error FSD
					pre cal	post cal	
SO2-L	PPM	250	200	40005503378	187	187	-5.2
					187	187	-5.2
					187	187	-5.2
SO2-L	PPM	250	150	40005503378	140	140	-4.0
					139	139	-4.4
					139	139	-4.4
SO2-L	PPM	250	100	40005503378	91	91	-3.6
					92	92	-3.2
					92	92	-3.2
SO2-L	PPM	250	50	40005503378	44	44	-2.4
					44	44	-2.4
					44	44	-2.4



Zero	H2O	CO2	CO	NO	SO2 - H	SO2 - L
#1	0	0	1	1	1	1
#2	0	1	2	5	0	0
#3	0	0	-5	-2	-1	-1
#4	0	0	-6	4	3	3
#5	0	0	5	0	-2	-2
#6	0	-1	1	-6	-4	-4

Signature:

Procal Customer Support Engineer

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E-mail: asampson@procal.com Website: www.procal.com

7-7862-04 Linearisation Certificate Change note: 7009251 Date: 30/07/12

Functionality Test Results

DECLARATION OF CONFORMITY

We,

Kittiwake Procal Ltd
5 Maxwell Road
Woodston
Peterborough
Cambridgeshire
PE2 7HU
United Kingdom

Tel: (+44) (0) 1733 232495
Fax: (+44) (0) 1733 235255
e-mail: post@procal.com
Web site: www.procal.com

declare that the product: **Type PULSI 200 Analyser** ***installed at***

Customer	**RWE Aberthaw**
Control Unit Serial Number	**8800624**
P200 Serial Number	**8500705**
Site Identification	**Unit 7 Secondary**

to which this declaration relates is in conformance with the MCERTs Performance Standard for Continuous Emission Monitoring Systems: Version 2. Revision 1 (April 2003).

MCERTS Product Conformance Certificates:

Licence	Certificate Number	Variation	Dated
ACU	SIRA MC 990006/	8	02/10/09
ACWn	SIRA MC 050060/	6	02/10/09

MCERTs Certification Body:

Sira Certification Service	
12 Acorn Industrial Park	Tel: (+44) (0) 1322 520500
Crayford Road	
Crayford	Fax: (+44) (0) 1322 520501
Dartford	
Kent	
DA1 4AL	e-mail: info@siraenvironmental.com
United Kingdom	Web site: www.siracertification.com

Quality System:

ISO 9001:2008	Certificate Nr: 062043	Dated: 11/06/09

EN 15267-2	Dated:	2009
EN 15267-3	Dated:	2007

Technical Standards Used:

All tests carried out to Kittiwake Procal's working procedures and those within Annex A of EN14181, Version 2.3 June 2010, relating to functionality testing by CEMs' manufacturers.

Signed:..... ***.....*** ***Date:...18/02/2015.....***

1.0 Alignment and Cleanliness.

1.1 Internal Check of Analyser

Analyser under test	Status	Notes
Optical path clear	Yes	OK
Optics clean	Yes	OK
Internal wiring ok	Yes	
Air supply on	Yes	
Purge flow >300 ltrs/hr	Yes	
Pressure differential <80mBar	Yes	16 mbar

2.0 Zero and Span Checks.

2.1 Zero Check

Component: Units:	H2O %	CO2 mAU	CO ppm	NO ppm	SO2-H ppm	SO2-L ppm	Ta	Ts	Ps
Process conc	1.9	218	1000	423	74	67	25.5	129.7	1027.5
Zero conc	-0.1	-4	1	-4	1	1	25.5	129.2	1043.2
% error	<2	<2	<2	<2	<2	<2			
Pass/Fail	Pass	Pass	Pass	Pass	Pass	Pass			
T90 recovery									

2.2 Span Check

Component: Units:	H2O %	CO2 mAU	CO ppm	NO ppm	SO2-H ppm	SO2-L ppm	Ta	Ts	Ps
Full range	10		500	1000	1000	250			
Zero Conc	-0.1	-6	5	-2	-2	-2	25.2	130.2	1036.9
Test Gas Conc			306	800	800	200			
Cert number			5682016	5501912	040005503377				
Response Conc			316	820	820	196			
% Error			2	2	2	<2			
Pass/Fail			Pass	Pass	Pass	Pass			
T90 time				70	70	70			

2.3 Filter Level Checks

All on zero air	F2	F4	F6	F1G	F7	F5G	F8	F3	
Factory	2093	3650	3904	2426	3776	2399	463	2281	
Last visit	1995	2473	3808	2437	3805	2672	491	2381	
This visit	1996	3466	3773	2426	3783	2677	494	2358	

2.4 Interference Checks

Component: Units:	H2O %	CO2 mAU	CO ppm	NO ppm	SO2-H ppm	SO2-L ppm
ZERO	0	-2	-3	-4	0	0
CO2 15%	0.2	222	1	-4	3	1
H2O 2.5%	2	3	-1	-15	9	6
H2O + CO2	2.3	227	1	-13	12	9

3.0 Data Acquisition.

Displayed \ Component							
Zero	Analyser						
	DCS						
	4-20mA						
Span	Analyser						
	DCS						
	4-20mA						

4.0 Linear coefficient record.

Coefficient \ Component		H2O	CO2	CO	NO	SO2-H	SO2-L
Last test	Linear	1.650e-2		7.400e+0	1.200e+1	6.373e+0	5.810e+0
	Squared	4.400e-5		1.120e-1	4.150e-2	-1.570e-3	5.790e-3
	Cubed						
This test	Linear	1.650e-2		7.400e+0	1.200e+1	6.373e+0	5.810e+0
	Squared	4.400e-5		1.120e-1	4.150e-2	-1.570e-3	5.790e-3
	Cubed						

5.0 Test Information

5.1 Procal Engineer: Panteleimon Kompeas-Charidis

5.2 Test House:

5.3 Test House Engineer:

Appendix 1. Pro-forma for assessing and reporting the results of the functional tests

Requirement		Notes
1. Alignment and Cleanliness		
A visual inspection, with reference to the CEMs manuals, shall be carried out on the following when applicable:		
• Internal check of the CEM	√	All functions ok
• Cleanliness of the optical components	√	
• Flushing air supply	√	Ok
• Obstructions in the optical path	√	None
• After re-assembly at the measurement location at least the following shall be checked	√	No re-assembly required
• Alignment of the measuring system	√	No alignment required
• Contamination control (internal check of optical surfaces)	√	Filter levels ok
2. Sampling Systems		
A visual inspection of the sampling system shall be performed, noting the condition of the following components, when fitted:		
• Sampling probe	n/a	
• Gas conditioning systems	n/a	
• Pumps	n/a	
• All connections	√	Ok
• Sample lines	n/a	
• Power supplies	√	Ok
• Filters	√	Ok
• 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 data	√	Ok
3. Leak testing		
• Leak testing shall be performed according to the CEMs manuals. The tests shall cover the entire sampling system.	n/a	
4. Zero and Span check		
• Reference zero and span materials shall be used to verify the corresponding readings of the CEM.	√	Ok
• In case of non-extractive CEM, 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 CEM at the measurement location.	√	Ok
5. Linearity		
• 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.	√	Data collected on ACU MK4 & customer DCS during testing

Requirement		Notes
DCS logged values should be included in the instrument service report.	√	Data collected on ACU MK4 & customer DCS during testing
• The linearity of the CEM's response shall be checked using five different reference materials, including a zero concentration.	√	See linearity Cert
• The reference material with zero concentration, as well as the reference materials with four different concentrations, shall have a verifiable quantity and quality.	√	See gas certs
• 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.	√	Gas points derived from blending full gas range using a Procal P9000, a water generator/gas blender
• 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. 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 CEM.	√	See linearity cert
The individual CEMs are tested using the following concentrations applied in a randomised sequence:		
• Reference material with zero concentration;	√	See linearity cert
Reference material concentration approximately 20 % of 2 times the emission limit;	√	See linearity cert
• Reference material concentration approximately 40 % of 2 times the emission limit;	√	See linearity cert
• Reference material concentration approximately 60 % of 2 times the emission limit;	√	See linearity cert
• Reference material concentration approximately 80 % of 2 times the emission limit;	√	See linearity cert
• Reference material with zero concentration;	√	See linearity cert
After each change in concentration, the first instrument reading shall ordinarily be taken after a time period equal to at least three times the response time of the CEM. At each reference material concentration, at least three readings shall be made, six readings shall be taken at zero. The time period between the start of each of the three readings shall be separated by at least four times the response time. The test-laboratory may apply a risk-based approach to linearity testing in order to reduce the time for the tests. For example, the readings may be taken after less than 3x the response time; however, if the CEM fails the linearity test, then the test laboratory shall repeat the linearity test and wait at least 3x the response time as stated above. Alternatively, the number of repetitions of the test may be reduced if the CEM passes the required performance criteria by a factor of at least 2 (i.e. half the allowable residual). Increasing the waiting time to 5x the response time, for example, may be a means of meeting this requirement. Where no other method is possible, the linearity can also be performed with the aid of reference materials such as grating filters or gas filters.		

Requirement		Notes
The linearity shall be calculated and tested using the procedure as given in EN 14181 annex B. If the CEM does not pass this test; then the problem shall be identified and rectified.		
6. Interferences		
• 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 interferents.	√	Interference checks made with Water vapour, CO2 and each gas species. See also Calcert
7. Zero and Span drift (Audit)		
• 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.	√	
. Response Time		
• The response time of the CEM 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.	√	Response time recorded on test sheet.
9. Service Report		
As a minimum requirement the service report should include the following:		
• Document reference for work instruction for the type of work being undertaken	√	Procal Method Statement
• Instrument manufacturer	√	Procal
• Instrument type	√	Pulsi 2000
• Instrument model	√	P2000
• Instrument Serial No	√	8500705
• Operating principle	√	GFCIR & NIR
• Operating range	√	Recorded on this report
• Certification details	√	Mcerted
• Compliance with MCERTS (including certificate no.)	√	SIRA MC 990006/08
• Location	√	RWE Aberthaw
• Date and time work was undertaken	√	18/02/2015
• Equipment used - type, serial no's, calibration dates	√	Procal Water Generator/Gas divider Pcal #6
• Gases used - certificate numbers, expiry dates, binary / mix	√	Copy of Gas certs can be provided
• NOx converter efficiency test, if applicable	n/a	
• Calibration and linearity data as required by EN14181	√	See Linearity & Calcert Data
• **Logged** data for period of calibration and linearity. Note there may be gaps in the data, in such cases, the test laboratory shall state why there are gaps in the data	√	See Linearity & Calcert Data

PROCAL

Parker

Visit Ref:0000548

Service Engineers Report

Client Aberthaw Power Station RWE INNOGY PLC THE LEYS (NEAR BARRY) SOUTH GLAMORGAN **Contact** James Beveridge **Tel No.** 01446 750271	**Job Category** Chargeable UK **Activity** Functionality inc. Linearisation **Date of Visit** 16/02/2015 **Analyser/System No.** U8 Secondary U9 Secondary U7 Secondary

Qty	Description	Part No.

Travel Time	9 Hours	Mileage driven	498
Site Time	3 Days	Expenses incurred	£358.94
Engineer	Pandeli Kompeas-Charidis	For Client	

Notes for Call

8800624: Linearisation completed on all Secondary Units 7, 8 & 9

Unit7 Secondary 8500705: Dry gases no coefficient changes made, NO reads quite OK, SO2-H reads slightly high, SO2-L reads rather low and CO reads a bit high but within spec

Unit8 Secondary 8500726: Dry gases, all coefficients had to be changed; NO, SO2 & CO gases now all within spec, SO2-L & SO2-H readings now in close match which was achieved also by reverting back to older X-product coefficients

Unit9 Secondary 8500707: Dry gases no coefficient changes made, NO reads rather low, SO2-H reads rather high, SO2-L and CO read quite OK

Please refer to certs for more details

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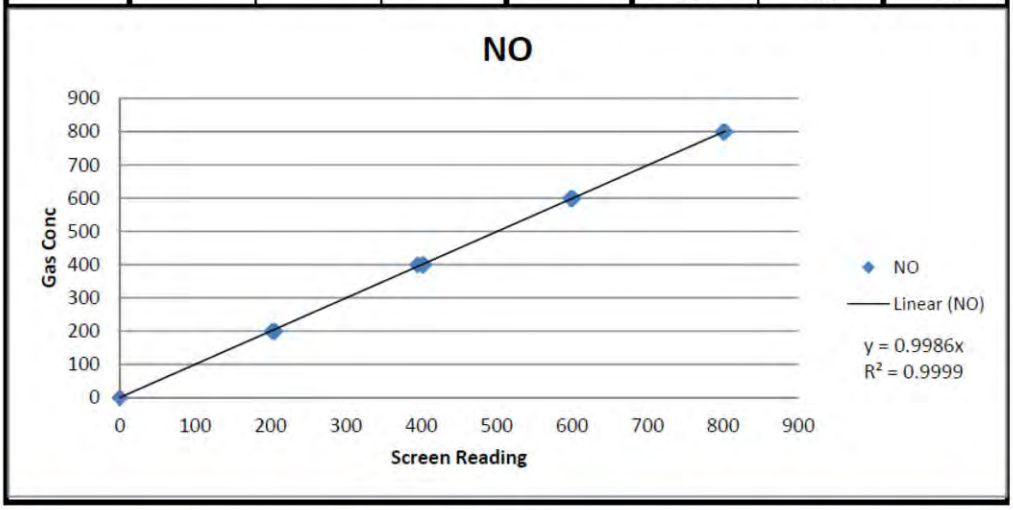
Telephone: +44 01733 232495 Fax: +44 01733 235255 Web: www.procal.com

LINEARISATION RESULTS

Site	RWE Aberthaw
Date	18/02/2015
Instrument	Unit 7 Secondary
Instrument Ref	8800624 8500705
Engineer	PKC

The above analyser has undergone a linearisation check and calibration, if required, in accordance with the company's quality system. The following results were obtained.

Component	Units	Range FSD	Gas conc	Cert ref	Results pre cal	Results post cal	% error FSD
NO	ppm	1000	800	40005501912	800	800	0.0
					801	801	0.1
					803	803	0.3
NO	ppm	1000	200	40005501912	206	206	0.6
					205	205	0.5
					202	202	0.2
NO	ppm	1000	600	40005501912	601	601	0.1
					598	598	-0.2
					600	600	0.0
NO	ppm	1000	400	40005501912	401	401	0.1
					403	403	0.3
					395	395	-0.5



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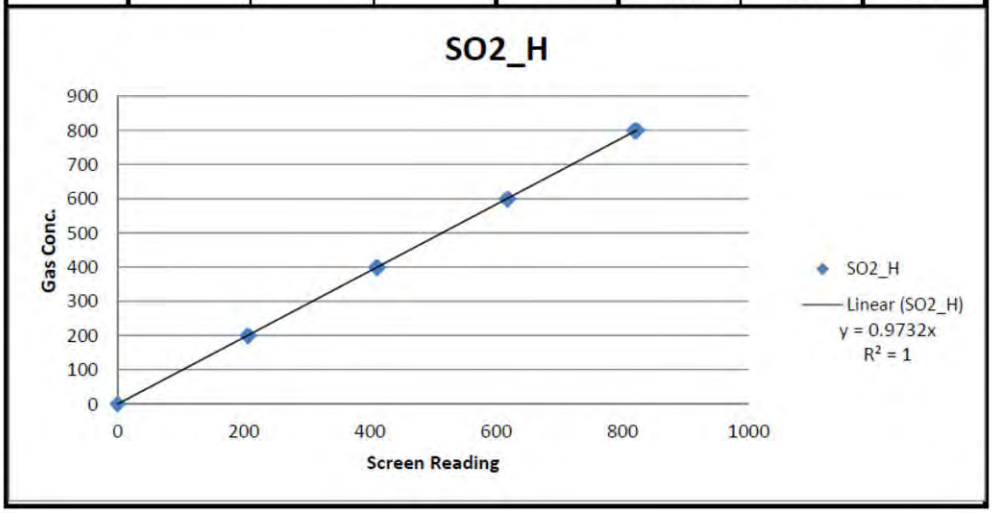
7-7862-04 Linearisation Certificate Change note: 7009251 Date: 30/07/12

Component	Units	Range FSD	Gas conc	Cert ref	Results		% error FSD
					pre cal	post cal	
SO2_H	ppm	1000	800	40005503377	820	820	2.0
					823	823	2.3
					819	819	1.9
SO2_H	ppm	1000	200	40005503377	206	206	0.6
					206	206	0.6
					207	207	0.7
SO2_H	ppm	1000	600	40005503377	617	617	1.7
					618	618	1.8
					619	619	1.9
SO2_H	ppm	1000	400	40005503377	410	410	1.0
					412	412	1.2
					411	411	1.1



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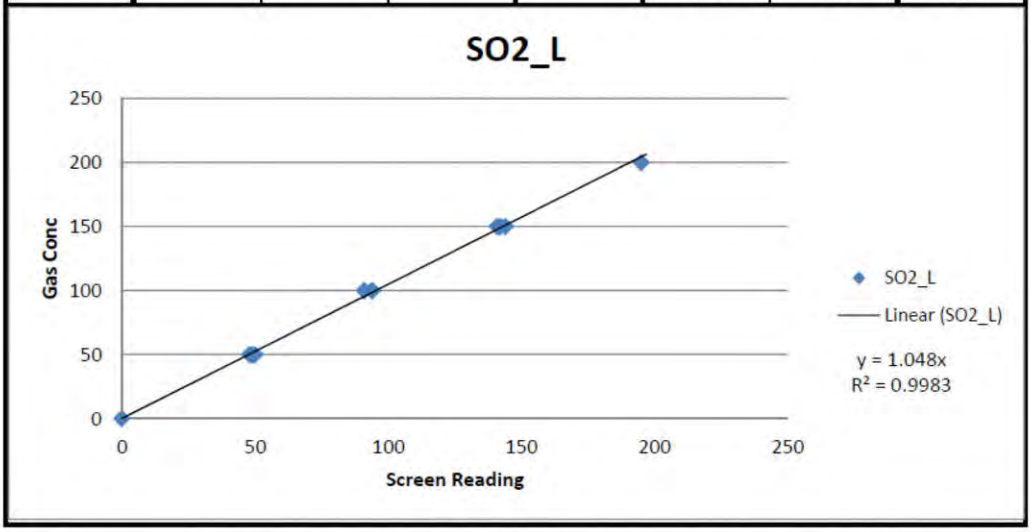
E-mail: asampson@procal.com Website: www.procal.com

7-7862-04 Linearisation Certificate Change note: 7009251 Date: 30/07/12

Component	Units	Range FSD	Gas conc	Cert ref	Results		% error
					pre cal	post cal	FSD
SO2_L	ppm	250	200	40005503377	195	195	-2.0
					196	196	-1.6
					197	197	-1.2
SO2_L	ppm	250	50	40005503373	49	49	-0.4
					48	48	-0.8
					50	50	0.0
SO2_L	ppm	250	150	40005503373	141	141	-3.6
					142	142	-3.2
					144	144	-2.4
SO2_L	ppm	250	100	40005503373	94	94	-2.4
					91	91	-3.6
					94	94	-2.4



Zero	H2O	CO2	CO	NO	SO2 - H	SO2 - L
#1	0	0	0	0	-1	-1
#2	0	-1	2	-1	1	1
#3	-0.1	-4	1	-4	1	1
#4	-0.1	-6	5	-2	-2	-2
#5	-0.1	-2	1	-1	1	1
#6	0	-2	0	0	-1	-1

Signature:

PKC
Procal Customer Support Engineer

Kittiwake Procal Ltd, 5 Maxwell Road, Woodston, Peterborough, PE2 7HU, UK TEL:+44(0)1733 23495 FAX:+44(0)1733 235255
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7-7862-04 Linearisation Certificate Change note: 7009251 Date: 30/07/12

PROCAL

Parker

Visit Ref:0000601

Service Engineers Report

Client Aberthaw Power Station RWE INNOGY PLC THE LEYS (NEAR BARRY) SOUTH GLAMORGAN **Contact** James Beveridge **Tel No.** 01446 750271	**Job Category** Contract **Activity** Functionality inc. Linearisation **Date of Visit** 16/03/2015 **Analyser/System No.** U8 Secondary U7 Primary U8 Primary U9 Primary

Qty	Description	Part No.

Travel Time	10hrs	Mileage driven	510
Site Time	4 Days	Expenses incurred	£455.55
Engineer	Michael Findley	For Client	

Notes for Call

Unit 7 Primary 8500443M

Dry gas test carried out on functionality test, NO, CO, within spec. SO2-H & SO2-L out of spec but no adjustment made.
.
Linearization tests completed on NO, SO2-H & SO2-L channels. SO2-H & SO2-L greater than 2% but reading on the high scale for SO2-H and the low scale for SO2-L. No adjustments made to SO2-H or SO2-L channel. NO channel within spec.

Unit 8 Primary 8500916M

Dry gas test carried out on functionality test, NO, CO, within spec. SO2-H & SO2-L out of spec but no adjustment made.
.
Linearization tests completed on NO, SO2-H & SO2-L channels. SO2-H & SO2-L greater than 2% but reading on the high scale for SO2-H & SO2-L channel. No adjustments made to SO2-H or SO2-L channel. NO channel within spec.

Unit 9 Primary 8500442M

Dry gas test carried out on functionality test, CO & SO2-L, within spec. NO & SO2-L slightly out of spec but no adjustment made.
.
Linearization tests completed on NO, SO2-H & SO2-L channels. SO2-L within spec and SO2-H & NO channels greater than 2% no adjustments made to SO2-H or NO channel.

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SICK

U7 - OMD 41 Particulate Monitor

BS EN 14181 – Functional Test & Maintenance Report

Customer	RWE nPower
Site	Aberthaw
Contact	James Beveridge
Service Ref No.	SVON017322
Survey Dates	12.02.2015
Device Type	OMD41
Receiver S/N	9807 8000
Reflector S/N	9807 8000
Evaluation Unit S/N	9807 8000
Device Location	Unit 7
MCERTS Cert No	MC 040042/01
Certification Details	See Certificate
Measurement Principle	Opacity
SICK Engineer	Rhodri Jones
Signature	

Dust reading before check			
	Opacity or Extinction		Extinction
	Dust in mg / m³	mg/m³	0.0
	Contamination	mA	0.000%
	Dust reading, measured values	mA	4.0
	Control cycle, Zero point values	mA	4.0
	Control cycle, Span value	mA	16.8

1. Alignment & Cleanliness			
1.1	Visual Inspection of the analyser	☒	Analyser dusty but OK
1.2	Internal check of the analyser	☒	Internal optics cleaned
1.3	Cleanliness of optical components	☒	Cleaned using optic cloth
1.4	Flushing of air supply	☒	Purge air OK
1.5	Obstructions in the optical path	☒	Cross duct - no obstructions

2. Sampling System			
2.1	System in good condition and free from faults	☒	No faults or warnings
2.2	Visual Inspection of sampling probe	☒	N/A
2.3	Check of the Gas Conditioning System	☒	**N/A**
2.4	Check of the sample pump	☒	**N/A**
2.5	Check of all hoses, gas lines and connections	☒	NA
2.6	Check of power supplies	☒	Power supplies OK
2.7	Check of all filters	☒	Purge air filter OK
2.8	Check of heated lines are operating correctly	☒	**N/A**
2.9	Efficiency of NOx converter > 95% (if applicable)	☒	**N/A**
2.10	Has the response time been checked by applying gas to probe	☒	**N/A**

3. Serviceability			
3.1	Safe & Clean working environment for servicing	☒	Workshop available
3.2	Adequate supply of reference gases	☒	NA
3.3	Adequate supply of spare parts	☒	Whole spare analysers availabl
3.4	Ability to apply gas at probe	☒	NA
3.5	Output signals checked	☒	Analogue outputs spot on

4.	**Zero Span & Leak Checks**		
4.1	Leak check of whole system carried out	☒	**N/A**
4.2	Are the QAL3 checks (control cycle) being done	☒	Yes - 3 x Daily
4.3	Are the QAL3 checks being logged and plotted on control charts	☒	Yes - OK
4.4	Are the QAL3 charts exhibiting signs of drift	☒	No - OK

5.	**Linearity**		
5.1	Checks at 0, 20%, 40%, 60% & 80% of 2 X Daily ELV's	☒	**N/A – % of Analyser Range**
5.2	Different concentrations applied in a random sequence	☒	Refer to linearity report
5.3	Has the response time for each component been recorded (T90)	☒	Refer to linearity report
5.4	Have the first readings been taken at 3 x T90	☒	Refer to linearity report
5.5	Have three readings been taken at least 4 x T90 apart	☒	Refer to linearity report
5.6	Does the filter set have a valid calibration	☒	Refer to linearity report

6.	**Visual Inspection**		
6.1	Check if measured values are plausible in the control room	☒	Yes
6.2	Check if control cycle (zero/span) is valid	☒	Recorded & stored
6.3	Check if there is any error message	☒	No errors
6.4	Check for mechanical or electrical connection damage	☒	No damage
6.5	Check mechanical mounting	☒	Sound

7.	**Purge Air Unit**		
7.1	Check the hoses and ring nozzles	☒	All OK
7.2	Clean the pre-filter	☒	Replaced
7.3	Replace the filter insert	☒	Replaced
7.4	Check function of filter monitor purge switch.	☒	OK

8.	**Fail Safe Shutter (FSS Option)**		
8.1	Check function of fail-safe shutter	☒	Not fitted on stack

9. Optical unit			
9.1	Clean housing	☒	Housing cleaned
9.2	Check and, if necessary readjust optical axis	☒	Not required
9.3	Clean optical boundary surfaces for sender & receiver	☒	Optical surfaces cleaned
9.4	Check and replace desiccant cartridge, part no. 2008475	☒	Not required
9.5.	Check the transmitter diode	☒	OK
9.6	Check the stepper motor	☒	Stepper motor functioning well
9.7	Check zero point. Re-calibrate zero point if required	☒	Reading Zero in workshop
9.8	Check function of control cycle	☒	Good
9.9	Carry out internal linearity check, record results below	☒	See below

Linearity Measurement	**Set value**	**Actual Value**	**Deviation in %**	**< 2% OK?**
Zero	4.00 mA	4.00 mA	0.0	OK
Span 2 (approx. 30%)	14.1 mA	14.1 mA	0.0	OK
Span 1 (approx. 70%)	16.8 mA	16.8 mA	0.0	OK
Span 3 (100%)	20.00 mA	20.00 mA	0.0	OK

10. Connection unit			
10.1	Check the analogue and digital input and output signals	☒	Reading 4.0 @ 4.0mA

11. Final check			
11.1	Check function of complete measurement system	☒	System functioning well
11.2	Check the availability of the system	☒	100%
11.3	Write device data into the report file	☒	Device data saved
11.4	Complete Service Report and Measurement Log-file	☒	Report complete

12. Additional details:	
Quality of maintenance work by plant personnel: Good	
Cleanliness of measuring station and devices: OK	
Maintenance work done (in addition to Annex 1): NA	
Problems found, solution applied: No problems	
Recommendation for repair, changes: NA	
Availability of the unit:	100 %
Proposal how to reach higher availability and better emission data quality: NA	
Training provided to plant personnel, proposal for settlement: Training recently provided	
Training requirements detected: NA	
Others:NA	

Dust reading after check		
Opacity or Extinction		Extinction
Dust in mg / m³	mg/m³	0.0
Contamination	mA	0.00%
Dust reading, measured values	mA	0.0mg/m3
Control cycle, Zero point values	mA	4.0
Control cycle, Span value	mA	16.8

Remarks
Analyser functioning correctly
Approved by customer Name: Position:

OMD41 – Functional Test Report 5 / 5

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Linearity Results Sheet

Service Ref: SVON017322 Date: 12.02.2015

Customer Order No.: 0

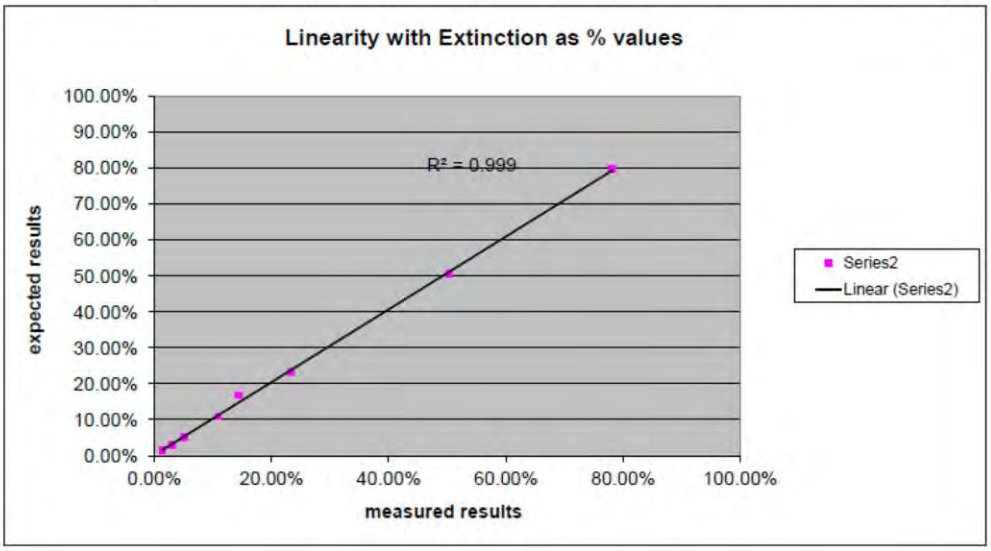
Customer:		Status	Chargable
		Device-type:	OMD41-2
		Serial Number :	98078000
		Filter Box Serial Number :	95278033
Contact:	James Beveridge		

Location	Unit 7

4 Results:

Component:	Particulate	Range	1.60	Extinction

	Expected Extinction	Expected %range	Measured Extinction	Measured %range	% Error of Range	Pass/Fail
Filter 1	0.022	1.363%	0.021	1.333%	-0.03%	PASS
Filter 2	0.049	3.056%	0.049	3.063%	0.01%	PASS
Filter 3	0.083	5.181%	0.082	5.146%	-0.04%	PASS
Filter 4	0.175	10.919%	0.174	10.875%	-0.04%	PASS
Filter 5	0.270	16.856%	0.229	14.333%	-2.52%	PASS
Filter 6	0.375	23.431%	0.373	23.333%	-0.10%	PASS
Filter 7	0.809	50.550%	0.805	50.333%	-0.22%	PASS
Filter 8	1.276	79.763%	1.251	78.208%	-1.55%	PASS



Engineer's Comments : LINEARITY TEST WAS SUCCESSFUL

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SICK

Maintenance Report OMD41

☒ Maintenance ☐ Repair

Customer:	RWE nPower	Custumer no:	FGD U7
Country:	UK	Location:	Aberthaw, Barry
Receiver:	M221	Serial no.:	98078003
Reflector:	R22	Serial no.:	98078003
Eval.Unit:	A3	Serial no.:	98078000

Plant operating status:	**Instrument in workshop**

	done	Remarks:
Check weekly/monthly/ quarterly log files: Log files ok?	☒	NA
Training recommended:	☒	Training provided

Dust reading before check

	Opacity or Extinction		Extinction
	Dust in mg / m³	mg/m³	0.0 mg/m3
	Contamination	mA	0.0%
	Dust reading, measured values	mA	4.0
	Control cycle, Zero point values	mA	4.0
	Control cycle, Span value	mA	16.80

1. Visual Inspection

1.1	Check if measured values are plausible in the control room	☒	Yes
1.2	Check if control cycle is (zero/span) valid (control room or recorder or evaluation unit)	☒	QAL3 charts consistent
1.3	Check if there is any error message	☒	No errors or warnings
1.4	Check for mechanical or electrical connection damage	☒	No mechanical damage
1.5	Check mechanical mounting	☒	All sound

2. Purge Air Unit

2.1	Check the hoses and ring nozzles	☒	All sound
2.2	Clean the pre-filter	☒	NA
2.3	Replace the filter insert, part no. 5306091 for OMD41 SN > 97xxxxxx, or part no.6700149 for OMD41 SN <96xxxxxx	☒	Purge air maintained internall
2.4	Check function of filter monitor purge switch.	☒	Not fitted

3. Fail Safe Shutter (FSS Optional)

3.1	☐ Check function of fail-safe shutter	☒	Not fitted on stack

4. Optical unit

4.1	Clean housing	☒	Housing cleaned
4.2	Check and, if necessary readjust optical axis	☒	Not required
4.3	Clean optical boundary surfaces for sender/receiver and reflector, 2 x part no. 4003353	☒	Both optical surfaces cleaned
4.4	Check and replace desiccant cartridge, part no. 2008475	☒	Blue - OK

4.5.	Check the transmitter diode	☒	Course = 132 Good
4.6	Check the stepper motor	☒	All motors functioning correct
4.7	Check zero point, re-calibrate at smoke-free measurement point if it deviates	☒	Not required
4.8	Check function of control cycle	☒	Good
4.9	Linearity check	☒	See below

Linearity Measurement	**Set value**	**Actual Value**	**Deviation in %**	< 2% OK?
Zero	4.00 mA	4.00 mA	0.0	OK
Span 2 (aprox. 30%)	14.11 mA	14.11 mA	0.0	OK
Span 1 (aprox. 70%)	16.8 mA	16.8 mA	0.0	OK
Span 3 (100%)	20.00 mA	20.00 mA	0.0	OK

5. Connection unit

	Check the analogue and digital input and output signals	☒	Analgogue outputs +/- 0.1 mA

6. Final check

6.1	Check function of complete measurement system	☒	System functioning Well
6.2	Check the availability of the system	☒	100%
6.3	Write device data into the report file	☒	Device data saved
6.4	Complete Service Report and Measurement Log-file	☒	Report complete

7. Report in writing to the plant manager as follows:

Quality of maintenance work by plant personnel: Good
Cleanliness of measuring station and devices: OK
Maintenance work done(in addition to Annex 1): NA
Problems found, solution applied: No problems
Recommendation for repair, changes: NA
Availability of the unit: 100 %
Proposal how to reach higher availability and better emission data quality: NA
Training provided to plant personnel, proposal for settlement: Training already provided
Training requirements detected: NA
Others:

Dust reading after check

	Opacity or Extinction		Extinction
	Dust in mg / m³	mg/m³	0.0 mg/m3
	Contamination	mA	0.000%
	Dust reading, measured values	mA	0.0 mg/m3
	Control cycle, Zero point values	mA	4.00
	Control cycle, Span value	mA	16.8

Remarks :

System functioning perfectly

Date : 09.02.2015	Name Plant person: _____ Technician: Rhodri Jones

31.03.15 Maintenance check list OMD 41 2 / 2

Unit 7 - GM32 Commissioning

Customer data

Customer:	RWE N Power	Customer no:	UNIT 7
Country:	UK - Wales	City:	Cardiff
Plant:	Aberthaw	Location:	U8

1 Device data

Device type:	GM32	Device no:	1210606
Serial no:	1406 8012		

Process optic: GMP ☒ GPP ☐ CD ☐

Serial no: 1406 8012 Device no: Type: In Situ

2 Plant data

Location:	Outside ☐	Under cover ☐	Inside ☒		
Tag number					
Orientation of the stack	Horizontal ☐	Vertical ☒	Angle of	90	°
Orientation of the GM32	Horizontal ☒	Vertical ☐	Angle of	0	°
Length of probe / Flange-Flange (CD)	1500	mm	Active measurement distance / Aperture	500	mm
Zero path	NA	mm	Differential pressure	1024	hpa
Ambient temperature	8	°C	Gas temperature	68	°C
I/O Modules on site	☒		I/O Modules relocated	☐	
Plant operating status	Online - Base Load				

3 Prerequisite

		Y	N	Remarks
3.1	Documentation + Delivery complete	☒	☐	Delivery Complete
3.2	Platform at measurement spot has suitable dimension?	☒	☐	Plenty of room
3.3	If this measurement location is under legal regulation, has it been acknowledged by an official body?	☒	☐	Yes, QAL2 to be carried out
3.4	Customer specific data for parameterization available?	☒	☐	Yes
3.5	Purge air unit installed and electrically connected?	☒	☐	Yes
3.6	Connection unit installed and electrically connected?	☒	☐	Yes
3.7	Zero point stands / tube available (only CD)?	☐	☒	NA

4 Preliminary work		Y	N	Remarks
4.1	Mounting of flanges like described in the Operating Instruction?	☒	☐	Yes
4.2	Check for damage	☒	☐	No Damage
4.3	Check ambient conditions (ref. ch. 2)	☒	☐	Clean, warm & Dry
4.4	Check mounting conditions (ref. ch. 2)	☒	☐	OK
4.5	Check mounting	☒	☐	Good
4.6	Check cables / wires for correct installation	☒	☐	Correct
4.7	Check main power supply voltage	☒	☐	240V

5 Purge Air Unit (only GMP / Cross-Duct)		Y	N	Remarks
5.1	Purge air unit type	X	X	SIEMENS
5.2	Check the rotation direction	☒	☐	+ve Pressure
5.3	Check hoses for correct installation	☒	☐	Installed correctly
5.4	Purge air heating installed?	☒	☐	Leister air heater
5.5	Differential pressure monitor installed?	☒	☐	Yes

6 Sender / receiver unit				
		Y	N	Remarks
6.1	Clean all optical surfaces	☒	☐	All clean
6.2	Dessicant cartridges exchanged?	☐	☒	Yes x 2
6.3	Check output of power supply voltages	☒	☐	See Below
6.3.1	26V±0,3V: 25.72V	☒	☐	OK
6.3.2	115V±1V: 113.2	☒	☐	OK
6.4	Check emission free zero point	☒	☐	Reading zero for all components
6.5	Adjust purge air heating (option)	☒	☐	Value: position 9
6.6	Check and adjust differential pressure monitor (option)	☒	☐	OK
6.7	Install the GM32 at the measurement spot	☒	☐	Installed
6.8	Adjust optical alignment	☒	☐	Adjusted to centre
6.9	Check signals	☒	☐	See Below
	A: 275 / B: 216			OK
	C: 291 / D: 217			OK
6.10	Note lamp data	☒	☐	100% (Zero hours)
	Maximum lamp intensity: 18750			Exposure: 259 ms
				Lamp pulse: 120 mA
6.11	Note software revision	☒	☐	See below
	Device Process: 9171698_X938_130708			Display: 91048 69
	Process optic: /			

6.12 Check stepper motor for proper function	☒	☐	All cycles perform well
6.13 Check parameterization	☒	☐	Configured to site requirements
6.14 Parameterize the I/O Modules	☒	☐	OK
6.15 Perform loop test	☒	☐	Analogue outputs & Ranging checked
6.16 Measured values are plausible (ref. Ch. 8)	☒	☐	Yes
6.17 Save device data	☒	☐	SOPAS project & Device File saved
6.18 Complete Commissioning Sign-Off Sheet	☒	☐	Report complete
6.19 Instruct the operator personnel Hand over the maintenance manual and check lists - Measurement reading - Perform customer maintenance - Read messages	☒	☐	Basic training provided

7 Input / Output / Ranges

7.1 Analog output / Display

Live zero: 4.0 mA			Output of control values: Y ☒ / N ☐				
Analog output	Comp.	Source	Unit	Range		Control value	Remark
				Start	Ende		
1	SO2	MV01	ppm	0	1200	☒	Checked to DCS
2	SO2	MV01	ppm	0	250	☒	Checked to DCS
3	NO	MV02	ppm	0	1000	☒	Checked to DCS
4	NO2	MV03	ppm	0	100	☒	Checked to DCS
5	Temp	MV05	C	0	200	☐	
6	Press.	MV06	hPa	900	1200	☐	

7.2 Analog input

Analog input	Source	Unit	Live zero	Start	End
1	NA				
2					

7.3 Digital output

Digital output	Signal	Inv.
1	Failure	☒
2	Maintenance Request	☐
3	Not Measuring	☐
4	Output Control Values	☐
5	Uncertain	☐
6	Extended	☐
7	Purge air failure	☐
8	No Function	☐

7.4 Digital input

Digital input	Source	Inv.
1	Check Cycle	☐
2	Maintenance	☐
3	Ouput Control Values	☐
4	Disable Check Cycle	☐

8 Measurement values after commissioning					
	Unit	Range	Reading	Zero point	Span point
SO2	ppm	1200	18	0	840
NO	ppm	1000	399	0	700
SO2 low	ppm	250	18.3	0	175
NO2	ppm	100	3.8	0	70
Temp.			70	- X -	- X -
Press.			1013	- X -	- X -

Remarks	
Analyser functioning correctly - Ok for live service	
	Name
Date : 20th February 2015	Plant personnel: _____
	Engineer: Rhodri Jones

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SICK

Unit 7 - GM32

BS EN 14181 – Functional Test & Maintenance Report

Customer	RWN nPower
Site	Aberthaw
Contact	James Beverage
Service Ref No.	SVON017322
Survey Dates	20th February 2015
Device Type	GM32 Probe version
Serial Number	1406 8012
Device Location	Unit 7
MCERTS Cert No	MC100163/01
Certification Details	See Certificate
Measurement Principle	UV Spectroscopy
SICK Engineer	Rhodri Jones
Signature	

Actual installation data			**Remarks**
Location	Outside ☐	Under cover ☐	Inside ☒
Ambient temperature	8 °C		
Gas temperature	80 °C		
Length of the probe / Flange – Flange (CD)	1500 mm		
Active measurement distance	500 mm		
Zero path	N/A mm		

Plant operating status:	Online

Measurement values before check					
	Unit	Range	Reading	Zero point	Span point
$SO_{2\ Hi}$	ppm	0-1200	73	-0.014	838.148
NO	ppm	0-1000	448	-0.001	698.457
NO_2	ppm	0-100	-0.0	-0.057	69.846
$SO_{2\ Lo}$	ppm	0-250	73.1	-0.014	174.614
Temp.	°C	0-200	66	- X -	- X -
Press.	hPa	900-1200	1001	- X -	- X -

Lamp data				
Max. lamp intensity	18500	Exposure:	259	ms
		Lamp pulse:	100	mA

1. Alignment & Cleanliness		
1.1 Visual Inspection of the analyser	☒	Brand new analyser
1.2 Internal check of the analyser	☒	Checked. No problems detected.
1.3 Cleanliness of optical components	☒	New analyser - Clean
1.4 Flushing of air supply	☒	Air supply purged
1.5 Obstructions in the optical path	☒	No obstructions found
1.6 Check optical alignment of the Analyser	☒	Checked & adjusted alignment.

2.	**Sampling System**		
2.1	System in good condition and free from faults	☒	Yes
2.2	Visual Inspection of sampling probe	☒	New
2.3	Check of the Gas Conditioning System	☒	N/A
2.4	Check of the sample pump	☒	N/A
2.5	Check of all hoses, gas lines and connections	☒	Checked analyser & air hoses.
2.6	Check of power supplies	☒	Checked. OK
2.7	Check of all filters	☒	Replaced purge air filter
2.8	Check of heated lines are operating correctly	☒	N/A
2.9	Efficiency of NOx converter > 95% (if applicable)	☒	N/A
2.10	Has the response time been checked by applying gas to probe	☒	N/A

3.	**Serviceability**		
3.1	Safe & Clean working environment for servicing	☒	Working environment is ok
3.2	Adequate supply of reference gases	☒	N/A
3.3	Adequate supply of spare parts	☒	Spare analyser available
3.4	Ability to apply gas at probe	☒	N/A
3.5	Output signals checked	☒	Analogue outputs checked

4.	**Zero Span & Leak Checks**		
4.1	Leak check of whole system carried out	☒	N/A
4.2	Have span checks been carried out at suitable levels	☒	70% of range
4.3	Have zero checks been carried out at suitable levels	☒	At Zero

5.	**Linearity**		
5.1	Checks at 0, 20%, 40%, 60% & 80% of 2 X Daily ELV's	☒	Refer to linearity report
5.2	Different concentrations applied in a random sequence	☒	Refer to linearity report
5.3	Has the response time for each component been recorded (T90)	☒	Refer to linearity report
5.4	Have the first readings been taken at 3 x T90	☒	Refer to linearity report
5.5	Have three readings been taken at least 4 x T90 apart	☒	Refer to linearity report
5.6	Are the gases used traceable to ISO 17025 standards	☒	Refer to linearity report

6. Visual inspection		
6.1 Check measured values are plausible in control room	☒	Checked. All ok
6.2 Check if control cycle is (zero/span) valid	☒	Checked. Valid zero and span
6.3 Check if messages are active	☒	Checked
Failure: No		
Maintenance Req: No		
Uncertain: No		
6.4 Check for mechanical damages	☒	No mechanical damage detected
6.5 Check attachments and connections	☒	Checked. All ok

7. Purge air unit (only GMP and Cross-Duct)		
7.3 Check the hoses and clamps for hose	☒	Checked hoses & clamps. All ok
7.4 Exchange purge air filter (order no 5306091)	☒	Replaced purge air filter
7.5 Clean pre-filter housing	☒	Checked and cleaned
7.6 Check noise of blower	☒	Checked. OK
7.7 Check function of purge air heating and setting (option)	☒	Checked. Operating correctly
7.8 Check function of differential pressure monitor (option)	☒	Checked. Operating correctly

8. Probe (GMP or GPP)		
8.3 Clean probe	☒	Brand new probe
8.4 Check Probe for corrosion	☒	New probe
8.5 Check probe for damage and functionality	☒	perfect

9. Connection unit		
9.3 Clean housing	☒	Cleaned housing
9.4 Check power supply	☒	Checked Power supply
26V±0,3V: 25.90 115V±1V: 114.0		
9.5 Check analogue input / output (option)	☒	Checked. OK
9.6 Check digital input / output (option)	☒	Checked. OK
9.7 Check parameterization of the I/O-Module	☒	Checked. OK

10. Sender / receiver unit (reflector)			
10.3	Check drying agent cartridges, exchange if req.	☒	both dessicants replaced
10.4	Clean all optical surfaces.	☒	Cleaned all optical surfaces
10.5	Check stepper motor for proper function	☒	Checked Motor. OK
10.6	Check fans	☒	Fans are operating correctly.
10.7	Check spectrometer signals	☒	Checked spectrometer signal. All ok.
10.8	Check lamp	☒	New Lamp
10.9	Check emission free zero point	☒	ChReading zeroecked.
10.10	Check the alignment adjust	☒	Checked & adjusted alignment
10.11	Check signal strength	☒	New Lamp - 100%
A: 270	B: 315		Good values
C: 312	D: 339		Good values
10.12	Check mirror steps	☒	OK
Dx: -0.053	Dy: -0.015		OK
10.13	Check parameterization	☒	As required

11. Final check			
11.3	Check function of complete measurement system	☒	Good
11.4	Check the availability of the system	☒	100%
11.5	Save device data external	☒	Saved Data
11.6	Complete service report	☒	Service report complete

12. Additional comments	
Quality of maintenance work by plant personnel: Good	
Cleanliness of measuring station and devices: OK	
Maintenance work done (in addition to Annex 1): NA	
Problems found, solution applied: No problems	
Recommendation for repair, changes NA	
Availability of the unit:	100%
Proposal how to reach higher availability and better emission data quality:	NA
Training provided to plant personnel, proposal for settlement:TRaining Reccomended	
Training requirements detected: NA	

13. Measurement values after check					
	Unit	Range	Reading	Zero point	Span point
$SO_{2\ Hi}$	ppm	0-1200	32	0.2	837.9
NO	ppm	0-100	412	-0.0	698.2
NO_2	ppm	0-100	0.5	-0.1	69.8
$SO_{2\ Lo}$	ppm	0-250	31.9	0.2	174.6
Temp.	°C	0-200	65	- X -	- X -
Press.	hPa	900-1200	1001	- X -	- X -

Remarks

Analyser in very good working order - No faults or warnings

Approved by customer Name:

Position:

GM32 Probe Version – Functional Test & Maintenance Report 6 / 6

SICK

Unit 7 - GM32 Linearity Report

Customer	RWE Npower
Site	Aberthaw Power Station
Permit Ref	A1234
Contact	James Beveridge
Service Ref No.	SVON017322
Survey Date	20.02.2015
Device Type	GM32
Device Location	Unit 7
Serial Number	1406 8012
MCERTS Cert No	MC100163/01
Certification Details	See Certificate
Measurement Principle	U.V DOAS
Gas Box Serial Number	0816 8035
SICK Engineer	Rhodri Jones
Signature	

Sick (UK) Ltd
Waldkirch House
39 Hedley Road
St.Albans
Hertfordshire
AL1 5BN

Tel: 0044 (0) 1727 831121
Fax:0044 (0) 1727 855332
E-Mail: info@sick.co.uk

SICK

GM32 SO_2 Linearity

Customer	RWE Npower
Site	Aberthaw Power Station
Product	GM32
Analyser Serial Number	1406 8012
MCERTS Certificate Number	MC100163/01
Location	Unit 7
Active Path Length (mm)	500

Site Permit Ref	A1234
SVON No	SVON017322
Order Number	AXC1235784133
QAL2/AST/Routine	QAL2
Date	16.02.2015
Engineer	Rhodri Jones

Gas Box Serial Number	0816 8035
Calibration Date	01/12/2014
Calibration Gas Cylinder Ref:	VC3713C
Test Gas Conc. (ppm)	3752
Test Gas Conc. ($mg.m^{-3}$)	10693
Gas Expiry Date	19.01.2018
Tolerance	2%

Response Time (T_{90}) Seconds	30
Permit Daily ELV for SO_2 ($mg.m^{-3}$)	440
Permit Daily ELV x 2 ($mg.m^{-3}$) (c_{ti})	880
Analyser Range	1200
Ambient Pressure (hPa)	1024
Results Visible on DCS?	Yes, when not in maintenance mode
Corrections Applied?	None - As measured (ppm)

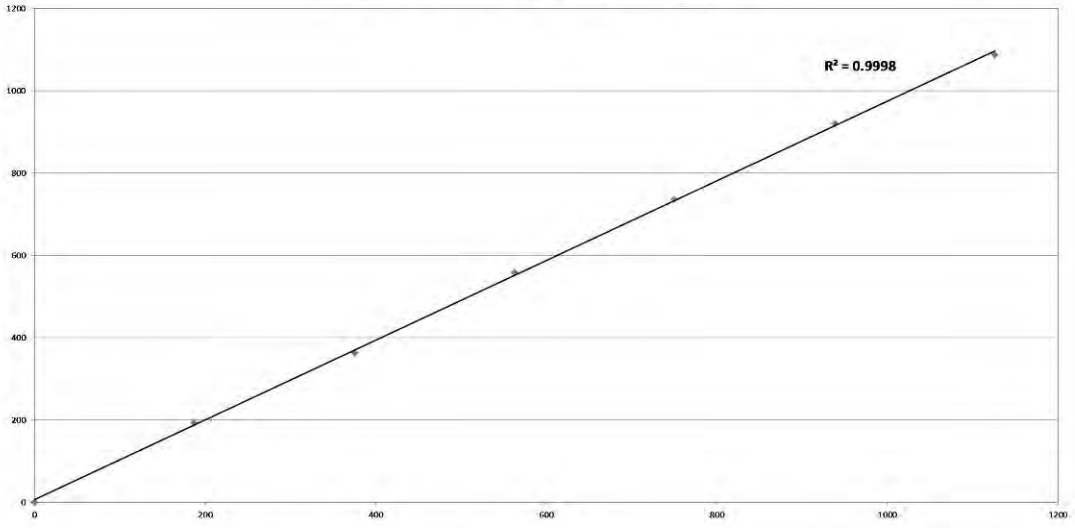
Component 1	SO_2
Set Pt Time ($4xT_{90}$) sec	120
Log Time ($3xT_{90}$) sec	90
Gasbox Temperature (°C)	80
Reference Temperature (K)	273
ppm to $mg.m^{-3}$ for SO_2	2.85

Linearity Results								
% 2 x ELV	Test Cell Length (mm)	Expected (ppm)	Reading 1 (ppm)	Reading 2 (ppm)	Reading 3 (ppm)	Average Reading	DCS	Time
244%	100	**750.40**	736.60	734.20	735.00	**735.27**		
183%	75	**562.80**	551.00	563.60	561.20	**558.60**		
305%	125	**938.00**	926.40	915.70	918.00	**920.03**		
61%	25	**187.60**	193.10	192.20	193.60	**192.97**		
122%	50	**375.20**	361.10	367.70	362.50	**363.77**		
366%	150	**1125.60**	1090.00	1081.00	1090.00	**1087.00**		

Zero Results			
ZERO	Analyser Reading (ppm)	DCS (ppm)	Time
Zero Reading 1	0.00		09:38
Zero Reading 2	0.20		09:42
Zero Reading 3	1.00		09:46
Zero Reading 4	1.00		11:53
Zero Reading 5	0.00		11:55
Zero Reading 6	0.00		11:58
AVERAGE	**0.37**		

Test Cell Length (mm)	Actual Value (ppm)	% Range	% 2 x ELV	Average CEM Reading (ppm)	$d_{c,rel}$	$dc_{,rel}$ <5% (EN 14181)
NA	0.00	0.0%	0%	0.37	-0.46%	PASS
25mm	187.60	15.6%	61%	192.97	0.74%	PASS
50mm	375.20	31.3%	122%	363.77	-0.54%	PASS
75mm	562.80	46.9%	183%	558.60	0.91%	PASS
100mm	750.40	62.5%	244%	735.27	0.30%	PASS
125mm	938.00	78.2%	305%	920.03	0.61%	PASS
150mm	1125.60	93.8%	366%	1087.00	-1.11%	PASS

Applied Concentration (ppm) v CEM Reading (ppm)



Engineer	Rhodri Jones
Signature	
Comments	Analyser exhibiting a linear response

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E-Mail: info@sick.co.uk

SICK

GM32 NO Linearity

Customer	RWE Npower
Site	Aberthaw Power Station
Product	GM32
Analyser Serial Number	1406 8012
MCERTS Certificate Number	MC100163/01
Location	Unit 7
Active Path Length (mm)	500

Site Permit Ref	A1234
SVON No	SVON017322
Order Number	AXC123784133
QAL2/AST/Routine	QAL2
Date	20.02.2015
Engineer	Rhodri Jones

Gas Box Serial Number	0816 8035
Calibration Date	01/12/2014
Calibration Gas Cylinder Ref:	VCSMG3285
Test Gas Conc. (ppm)	6817
Test Gas Conc. ($mg.m^{-3}$)	9135
Gas Expiry Date	30.01.2018
Tolerance	2%

Response Time (T_{90}) Seconds	20
Permit Daily ELV for NO ($mg.m^{-3}$)	1210
Permit Daily ELV x 2 ($mg.m^{-3}$) (c_u)	2420
Analyser Range	1000
Ambient Pressure (hPa)	1024
Results Visible on DCS?	Yes, when not in maintenance mode
Corrections Applied?	None - As measured (ppm)

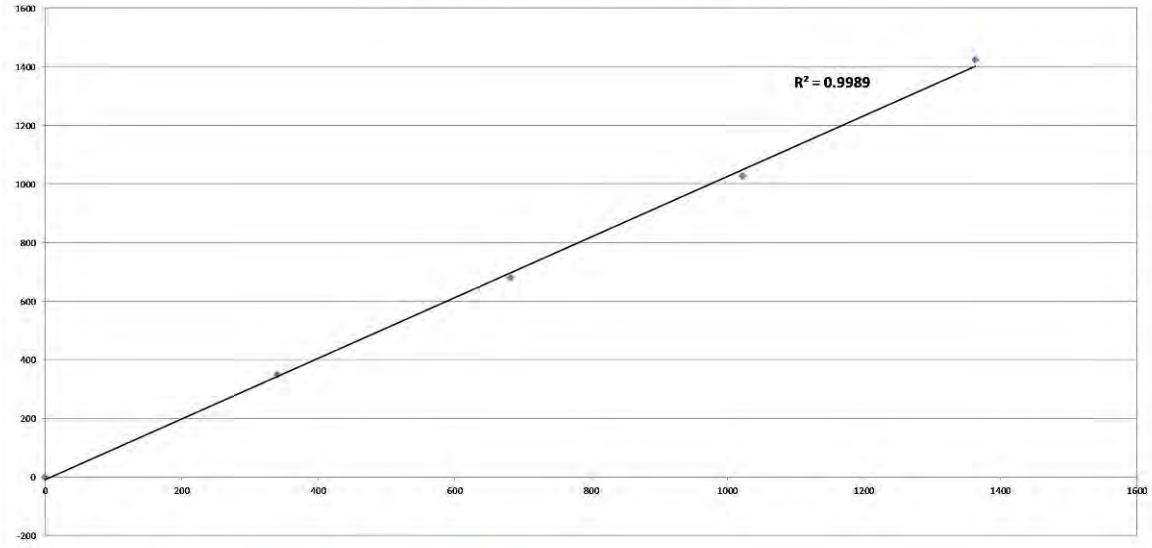
Component 1	NO
Set Pt Time ($4xT_{90}$) sec	80
Log Time ($3xT_{90}$) sec	60
Gasbox Temperature (°C)	80
Reference Temperature (K)	273
ppm to $mg.m^{-3}$ for NO	1.34

Linearity Results								
% 2 x ELV	Test Cell Length (mm)	Expected (ppm)	Reading 1 (ppm)	Reading 2 (ppm)	Reading 3 (ppm)	Average Reading	DCS	DCS Time
75%	100	**1363.40**	1425.00	1425.00	1422.00	**1424.00**		15:01 - 15:04
57%	75	**1022.55**	1027.00	1026.00	1031.00	**1028.00**		15:17 - 15:20
19%	25	**340.85**	359.00	346.00	345.00	**350.00**		15:11 - 15:15
38%	50	**681.70**	679.00	679.00	680.00	**679.33**		15:07 - 15:10

Zero Results			
ZERO	Analyser Reading (ppm)	DCS (ppm)	Time
Zero Reading 1	1.00		11:50
Zero Reading 2	0.00		11:55
Zero Reading 3	1.00		12:00
Zero Reading 4	0.00		12:40
Zero Reading 5	0.00		12:45
Zero Reading 6	0.00		12:50
AVERAGE	0.33		

Test Cell Length (mm)	Actual Value (ppm)	% Range	% 2 x ELV	Average CEM Reading (ppm)	$d_{c,rel}$	$dc_{,rel}$ <5% (EN 14181)
NA	0.00	0.0%	0%	0.33	0.23%	PASS
25mm	340.85	34.1%	14%	350.00	0.16%	PASS
50mm	681.70	68.2%	28%	679.33	-0.75%	PASS
75mm	1022.55	102.3%	42%	1028.00	-0.86%	PASS
100mm	1363.40	136.3%	56%	1424.00	0.98%	PASS

Applied Concentration (ppm) v CEM Reading (ppm)



Engineer	Rhodri Jones
Signature	
Comments	Analyser exhibiting a linear response

Version 2.0, 07/08/2014 - Uncontrolled when printed

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GM32 NO_2 Linearity

Customer	RWE Npower
Site	Aberthaw Power Station
Product	GM32
Analyser Serial Number	1406 8012
MCERTS Certificate Number	MC100163/01
Location	Unit 7
Active Path Length (mm)	500

Site Permit Ref	A1234
SVON No	SVON017322
Order Number	AXC1235784133
QAL2/AST/Routine	AST
Date	20.02.2015
Engineer	Rhodri Jones

Gas Box Serial Number	0816 8035
Calibration Date	01/12/2014
Calibration Gas Cylinder Ref:	VCD116712
Test Gas Conc. (ppm)	986
Test Gas Conc. ($mg.m^{-3}$)	2021
Gas Expiry Date	30.01.2018
Tolerance	2%

Response Time (T_{90}) Seconds	50
Permit Daily ELV for NO_2 ($mg.m^{-3}$)	121.0
Permit Daily ELV x 2 ($mg.m^{-3}$) (c_u)	242
Analyser Range	100
Ambient Pressure (hPa)	970
Results Visible on DCS?	Yes, when not in maintenance mode
Corrections Applied?	None - As measured (ppm)

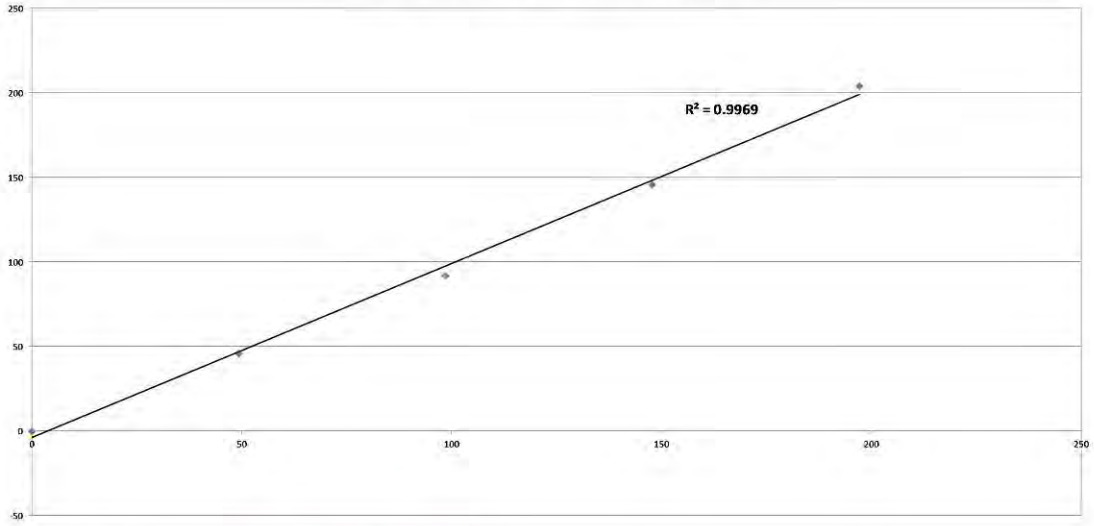
Component 1	NO_2
Set Pt Time ($4xT_{90}$) sec	200
Log Time ($3xT_{90}$) sec	150
Gasbox Temperature (°C)	80
Reference Temperature (K)	273
ppm to $mg.m^{-3}$ for NO_2	2.05

Linearity Results								
% 2 x ELV	Test Cell Length (mm)	Expected (ppm)	Reading 1 (ppm)	Reading 2 (ppm)	Reading 3 (ppm)	Average Reading	DCS	Time
167%	100	**197.20**	192.60	207.90	212.30	**204.27**		15:26 - 15:29
125%	75	**147.90**	145.10	146.40	146.30	**145.93**		15:35 - 15:39
42%	25	**49.30**	45.70	45.30	46.70	**45.90**		15:30 - 15:34
84%	50	**98.60**	91.30	91.30	93.00	**91.87**		15:21 - 15:25

Zero Results			
ZERO	Analyser Reading (ppm)	DCS (ppm)	Time
Zero Reading 1	-0.10		09:35
Zero Reading 2	-0.70		09:38
Zero Reading 3	0.10		10:32
Zero Reading 4	-0.30		10:36
Zero Reading 5	2.00		
Zero Reading 6	-1.50		
AVERAGE	-0.08		

Test Cell Length (mm)	Actual Value (ppm)	% Range	% 2 x ELV	Average CEM Reading (ppm)	$d_{c,rel}$	$dc_{,rel}$ <5% (EN 14181)
NA	0.00	0.0%	0%	-0.08	1.06%	PASS
25mm	49.30	49.3%	20%	45.90	-0.75%	PASS
50mm	98.60	98.6%	41%	91.87	-2.57%	PASS
75mm	147.90	147.9%	61%	145.93	-1.04%	PASS
100mm	197.20	197.2%	81%	204.27	2.25%	PASS

Applied Concentration (ppm) v CEM Reading (ppm)



Engineer	Rhodri Jones
Signature	
Comments	

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Table 5.2 - Functional Tests carried out by RPS

Requirement	Compliance	Notes
10 Documentation of Records The following documentation shall be controlled, readily accessible and up to date: - a plan of the CEMS; - all manuals (maintenance, users, etc.);	Yes Yes	A plan of the AMS resides in the Electrical Control & Instrumentation section offices and at the analyser. .
- log books to document possible malfunctions and action taken; - service reports;	Yes Yes	 All service reports are filed.
- QAL 3 documentation including actions taken as a result of out of control situations	Yes	There is a well established QAL3 system in place and analyser drift is routinely monitored using shewart charts. Evidence was provided to RPS.
Management system procedures for maintenance, calibration and training;	Yes	The Performance dept manage and review maintenance and calibration and training carried out by the EC&I team.
Training records/certificates	Yes	Evidence was provided to RPS

Requirement	Compliance	Notes
Maintenance schedules.	Yes	Maintenance scheduled by Performance.
Auditing Plans & Records – Evidence that the operator includes procedures for the management of the CEMS within the auditing cycle of the management system.	Yes	Carried out using dedicated Technical Team from Swindon Head Office. An auditor witnessed the parallel tests, which suggest a good level of organisation.

APPENDIX 1: SRM Calibration Data

Table A1.1– SRM On-Site Calibrations

Sample Date	Equipment Name	Equipment ID Number	Span Gas Type	ID Number	Span Gas Concentration	Pre-Sampling Result*		Post-Sampling Result*	
						Zero	Span	Zero	Span
5th – 6th March 2015	Horiba PG 250	FYS403	NO (17025)	183469	911 ppm	1ppm	911ppm	1ppm	912ppm
			O_2 (V.U.)	221743	15.04 %	0.07 %	15.24 %	0.05%	15.02%
	Gasmet DX4000	1610	SO_2 (17025)	216990	54.98 ppm	-0.65ppm	22.16ppm	0.07ppm	58.98#ppm
6th March 2015	Horiba PG 250	FYS403	NO (17025)	183469	911 ppm	1ppm	912ppm	3ppm	914ppm
			O_2 (V.U.)	221743	15.04 %	0.05%	15.02%	0.04%	14.94%
	Gasmet DX4000	1610	SO_2 (17025)	216990	54.98 ppm	0.07ppm	58.98#ppm	0.06ppm	55.3ppm
9th – 10th March 2015	Horiba PG 250	FYS403	NO (17025)	183469	911 ppm	0ppm	913ppm	2ppm	912ppm
			O_2 (V.U.)	221743	15.04 %	0.04 %	14.98 %	0.02 %	15.16 %
	Gasmet DX4000	1610	SO_2 (17025)	216990	54.98 ppm	-1.00 ppm	54.85 ppm	-0.85 ppm	55.2 ppm

Notes

- **- Calibration values are those for the entire sample system.*
- *- Zero gas 99.999% N_2*

APPENDIX 2 – Accreditation Schedule

Schedule of Accreditation

issued by

United Kingdom Accreditation Service

21 - 47 High Street, Feltham, Middlesex, TW13 4UN, UK

UKAS TESTING

1709

Accredited to ISO/IEC 17025:2005

The Environmental Consultancy Ltd trading as RPS Consultants

Issue No: 060 **Issue date:** 11 December 2014

14 Cornhill
London
EC3V 3ND

Contact: Mr S Hurst
Tel: +44 (0) 20 7280 3200
Fax: +44 (0) 20 7283 9248
E-Mail: hursts@rpsgroup.com
Website: www.rpsgroup.com

Testing performed by the Organisation at the locations specified below

Locations covered by the organisation and their relevant activities

Laboratory locations:

Location details		Activity	Location code
Address Unit A1 Lowfields Business Park Elland HX 5 9DE	**Local contact** Mr B Durden Tel: +44 (0)1422 324180 Fax: +44 (0)1422 324188 Email: rpshu@rpsgroup.com	Health and Hygiene	A
Address Tern Place Denmore Road Bridge of Don Aberdeen AB23 8JX	**Local contact** Mr I Edmans Tel: +44 (0)845 60 123 88 Fax: +44 (0)1224 706 998 Email: rpsasb@rpsgroup.com	Health and Hygiene	B
Address 14 Cornhill London EC3V 3ND	**Local contact** Mr D Blyton Tel: +44 (**0**)20 7280 3200 Fax: +44 (0) 20 7283 9248 Email: rpslo@rpsgroup.com	Support Functions: Quality Management, including contract review, document control, auditing and quality control	D
Address Noble House Capital Drive Linford Wood Milton Keynes MK14 6QP	**Local contact** Mr B Durden Tel: +44 (0)1235 437 100 Fax: +44 (0)1908 669899 Email: rpsmk@rpsgroup.com	Health and Hygiene	E
Address Suite 4C Rhodes Business Park Silburn Way Middleton Manchester M24 4NE	**Local contact** Mr B Durden Tel: +44 (0) 161 6549069 Fax: +44 (0)161 6436495 Email: rpswn@rpsgroup.com	Health and Hygiene	F

Assessment Manager: LS3

Page 1 of 8

UKAS TESTING 1709 Accredited to ISO/IEC 17025:2005	**Schedule of Accreditation** **issued by** **United Kingdom Accreditation Service** 21 - 47 High Street, Feltham, Middlesex, TW13 4UN, UK
	The Environmental Consultancy Ltd **trading as RPS Consultants** **Issue No:** 060 **Issue date:** 11 December 2014
Testing performed by the Organisation at the locations specified	

Site activities performed away from the locations listed above:

Location details	Activity	Location code
Premises including domestic, commercial and industrial	Health and Hygiene Environmental Sampling and Testing	Elland - H Aberdeen - I London - K Milton Keynes - L Middleton - M
Customers sites requiring Stack Emissions Testing	Stack emissions Testing	Elland - H Milton Keynes - L
Mobile Laboratories	Health and Hygiene	London - J

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21 - 47 High Street, Feltham, Middlesex, TW13 4UN, UK

The Environmental Consultancy Ltd
trading as RPS Consultants

Issue No: 060 **Issue date:** 11 December 2014

Testing performed by the Organisation at the locations specified

DETAIL OF ACCREDITATION

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
	Health and Hygiene	Health and Safety Executive Asbestos: The analysts' guide for sampling, analysis and clearance procedures (HSG 248)	
ASBESTOS FIBRES IN AIR	Sampling of air for fibre counting	HSG 248:February 2005 (Documented In-House Procedure)	I, K, L, M
	Fibre counting	HSG 248:February 2005 (Documented In-House Procedure)	B, E, F, I, J, K, L, M
	4 Stage Clearance Process	HSG 248:February 2005 (Documented In-House Procedure)	I, K,L, M
ASBESTOS IN BULK MATERIALS including materials and products suspected of containing asbestos	Sampling of bulk materials for asbestos identification	HSG 248:February 2005 (Documented In-House Procedure)	I, K, L, M
	Identification of: Amosite Chrysotile Crocidolite Fibrous Actinolite Fibrous Anthophyllite Fibrous Tremolite	HSG 248:February 2005 (Documented In-House Procedure using stereo-microscopy, polarised light microscopy and dispersion staining)	B, F
Testing of Stack Emissions to Atmosphere	Sampling with subsequent analysis by an ISO/IEC 17025 accredited laboratory	National, International and other recognised standards using documented In-House work instructions to meet the requirements of DD CEN/TS 15675:2007/ BS EN 15259:2007	
	Gaseous Organic Compounds - sorbent tube method	USEPA Method 18 (RPSCE/1/19a)	L
	Total Particulate Matter (20 to 1000 mg/m^3)	BS ISO 9096:2003 (RPSCE/1/7/d)	H, L

Assessment Manager: LS3

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Testing performed by the Organisation at the locations specified

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
Testing of Stack Emissions to Atmosphere (cont'd)	Sampling with subsequent analysis by an ISO/IEC 17025 accredited laboratory (cont'd)	National, European, International and Environment Agency specified standards including MIDs and Documented In-House work instructions to meet the requirements of the Environment Agency (MCERTS) Performance Standard and DD CEN/TS 15675:2007/ BS EN 15259:2007	
	Total Particulate Matter	BS EN 13284-1:2002 (RPSCE/1/7c)	H, L
	Hydrogen Chloride	BS EN 1911:2010 (RPSCE/1/8b)	H, L
	Halides and Halogens: Hydrogen Bromide Chlorine Bromine	US EPA Method 26 and 26A (RPSCE/1/8a)	H, L
	Sulphur dioxide	BS EN 14791:2005 (RPSCE/1/23)	H, L
	Hydrogen Fluoride	BS ISO 15713:2006 (RPSCE/1/8c)	H, L
	Mercury	BS EN 13211:2002 (RPSCE/1/9b)	H, L
	Metals	BS EN 14385:2004 (RPSCE/1/9c)	H, L
	Dioxins and furans	BS EN 1948-1:2006 (RPSCE/1/10b)	H, L
	Dioxin-like Polychlorinated Biphenyls (PCBs)	BS EN 1948-4:2010 (RPSCE/1/10b)	H, L
	Polycyclic Aromatic hydrocarbons (PAH's)	BS ISO 11338-1:2003 (RPSCE/1/10c)	H, L

Assessment Manager: LS3 Page 4 of 8

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United Kingdom Accreditation Service
21 - 47 High Street, Feltham, Middlesex, TW13 4UN, UK

The Environmental Consultancy Ltd
trading as RPS Consultants

Issue No: 060 **Issue date:** 11 December 2014

Testing performed by the Organisation at the locations specified

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
Testing of Stack Emissions to Atmosphere (cont'd)	Sampling with subsequent analysis by an ISO/IEC 17025 accredited laboratory (cont'd)	National, European, International and Environment Agency specified standards including MIDs and Documented In-House work instructions to meet the requirements of the Environment Agency (MCERTS) Performance Standard and DD CEN/TS 15675:2007/ BS EN 15259:2007 (cont'd)	
	Formaldehyde	US EPA Method 316 (RPSCE/1/22)	H, L
	Speciated VOCs (carbon and other suitable tubes) (Dry stacks only): Aliphatic VOCs Aromatic VOCs Aliphatic amines Aromatic amines Cresols Phenols Acetic acid	BS EN 13649:2002 (RPSCE/1/19b)	H, L
	Amines (Total aromatic and aliphatic)	BS EN 13649:2002, NIOSH method 2010 + 2002 (RPSCE/1/19c)	H, L
	Isocyanates	USEPA Method 207-1 (documented in-house method RPSCE/1/18C)	H, L
	Isocyanates	USEPA CTM 036 (documented in-house method RPSCE/1/18D Rev A)	H, L
	Hydrogen cyanide	US EPA OTM 29 (RPSCE/1/16a)	L
	Hydrogen sulphide	US EPA Method 11 (RPSCE/1/17)	H, L
	Ammonia	BS EN 14791:2005 (RPSCE/1/14b)	H, L

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Testing performed by the Organisation at the locations specified

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
Testing of Stack Emissions to Atmosphere (cont'd)	<u>Sampling and On-Site Analysis</u>	National, European, International and Environment Agency specified standards including MIDs and Documented In-House work instructions to meet the requirements of the Environment Agency (MCERTS) Performance Standard and DD CEN/TS 15675:2007/ BS EN 15259:2007	
	Water Vapour	BS EN 14790:2005 (RPSCE/1/12b)	H, L
	<u>Sampling and On-Line Analysis</u>		
	Pressure, Temperature and Velocity (Point Velocity Method)	BS EN 16911-1:2013 (RPSCE 1/2 – Differential Pressure Device (Pitot Tube) Method	H, L
	Pressure, Temperature and Velocity	BS EN 13284-1:2002 BS ISO 9096:2003 (RPSCE/1/2)	H, L
	Water Vapour*	EA TGN M22 (RPSCE/1/24 - Validated FTIR analyser)	H, L
	Carbon Monoxide*	BS EN 15058:2006 (RPSCE/1/21h - NDIR analyser) EA TGN M22 (RPSCE/1/24 - Validated FTIR analyser)	H, L
	Carbon Dioxide*	ISO 12039:2001 (RPSCE/1/21e - NDIR analyser) EA TGN M22 (RPSCE/1/24 - FTIR analyser)	H, L
	Nitrogen Monoxide (NO)*	BS EN 14792:2005 (RPSCE/1/21f - Chemiluminescence analyser) EA TGN M22 (RPSCE/1/24 - Validated FTIR analyser)	H, L

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Testing performed by the Organisation at the locations specified

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
Testing of Stack Emissions to Atmosphere (cont'd)	Sampling and On-Line Analysis (cont'd)	National, European, International and Environment Agency specified standards including MIDs and Documented In-House work instructions to meet the requirements of the Environment Agency (MCERTS) Performance Standard and DD CEN/TS 15675:2007/ BS EN 15259:2007 (cont'd)	
	Nitrogen Dioxide (NO_2)*	EA TGN M22 (RPSCE/1/24 - Validated FTIR analyser)	H, L
	Oxides of Nitrogen (NOx)*	BS EN 14792:2005 (RPSCE/1/21f - Chemiluminescence analyser) EA TGN M22 (RPSCE/1/24 - Validated FTIR analyser)	H, L
	Nitrous Oxide (N_2O)*	EA TGN M22 (RPSCE/1/24 Rev B - Validated FTIR analyser)	H, L
	Sulphur dioxide*	EA TGN M22 (RPSCE/1/24 - FTIR analyser)	H, L
	Oxygen*	BS EN 14789:2005 (RPSCE/1/21g - validated Zirconium cell analyser)	H, L
	Total Gaseous Organic Carbon* (TOC/VOC) (0 to 1000 mg/m³)	BS EN 12619:2013 (RPSCE/1/4b - FID analyser)	H, L

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Testing performed by the Organisation at the locations specified	

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used	Location Code
Stack Emissions - Continuous Emissions Monitoring Systems (CEMS)	QAL 2 and the Annual Surveillance Test (AST) for CEMS	Documented in house procedure RPSCE/1/25 to meet the requirements of BS EN 14181:2004, Environment Agency MID 14181 and other requirements of the Environment Agency (MCERTS) Performance Standard and DD CEN/TS 15675:2007/ BS EN 15259:2007	H, L
END			

* - The scale range of the analyser used for this test must be that detailed on its current MCERTS certificate or a range validated by the organisation to meet MCERTS requirements.