CERTIFICATE OF CALIBRATION

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0401

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Signed:

Date of issue: 29 Apr 19

Certificate Number: 4478

Customer Name and Address:

Scottish Government
Water, Air, Soils and Flooding Division
Environmental Quality Directorate
Scottish Government
Victoria Quay
Edinburgh
EH6 6QQ

Description: Calibration factors for the air monitoring station(s) at Glasgow City Council

Ricardo Energy & Environment ID: ED61598/4478

The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95% The uncertainty evaluation has been carried out in accordance with UKAS requirements.

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Glasgow City Council
NOx analysers

Station	Date of Audit	Species	Analyser Serial no	Zero Response[1]	Zero uncertainty ppb	Calibration Factor[2]	Factor uncertainty %	Converter eff. (%)[3]
Glasgow Anderston	24-Dec-18	NOx	(Ecotech Serinus	2.3	2.5	0.9552	3.50	99.6
		NO		0.6	2.5	0.9426	3.50	
Glasgow Burgher St	19-Mar-19	NOx	CM11050006	0.3	2.5	0.8898	3.50	101.2
		NO		-0.2	2.5	0.8832	3.50	
Glasgow Byres Road	21-Dec-18	NOx	4156	-29.5	2.5	1.0321	3.50	98.5
		NO		-15.9	2.5	1.0685	3.50	
Glasgow Dumbarton Road	21-Dec-18	NOx	4154	-1.5	2.6	1.0893	3.50	98.8
		NO		1.2	2.6	1.1027	3.50	
Glasgow Waulkmillglen Reservoir	21-Dec-18	NOx	4155	0.7	2.5	1.0230	3.79	100.4
		NO		1.3	2.5	1.0136	4.03	
Glasgow Nithsdale Road	24-Dec-18	NOx	1152030001	0.0	2.5	0.9190	3.50	99.7
		NO		0.3	2.5	0.9169	3.50	

PM10 analysers

Station	Date of audit	Analyser Serial no	Calculated ko	Uncertainty %	Total flow	Uncertainty %	Main flow	Uncertainty %
Glasgow Abercromby Street	20-Dec-18	1200c191870611	16161	1.0	16.60	2.2	3.03	2.2
Glasgow Anderston	24-Dec-18	10105			4.56	2.2		2.2
Glasgow Broomhill	21-Dec-18	10106			4.70	2.2		2.2
Glasgow Burgher St	19-Mar-19	1200c149419903	16317	1.0	16.03	2.2	2.86	2.2
Glasgow Byres Road	21-Dec-18	8734			4.75	2.2		2.2
Glasgow Nithsdale Road	24-Dec-18	6249			4.48	2.2		2.2
Glasgow Waulkmillglen Reservoir	21-Dec-18	8735			4.71	2.2		2.2

PM2.5 analysers

Station	Date of audit	Analyser Serial no	Calculated ko	Uncertainty %	Total flow	Uncertainty %	Main flow	Uncertainty %
Glasgow Anderston	24-Dec-18	10105			4.56	2.2		2.2
Glasgow Broomhill	25-Dec-18	10106			4.70	2.2		2.2
Glasgow Byres Road	26-Dec-18	8734			4.75	2.2		2.2
Glasgow Nithsdale Road	27-Dec-18	6249			4.48	2.2		2.2
Glasgow Waulkmillglen Reservoir	28-Dec-18	8735			4.71	2.2		2.2

O3 analysers

Station	Date of Audit	Analyser Serial no	Zero Response[1]	Zero uncertainty ppb	Calibration Factor[2]	Factor uncertainty %
Glasgow Waulkmillglen Reservoir	21-Dec-18	3787	-1.9	3.0	0.9879	3.1

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The gaseous ambient analysers listed above have been tested for zero response, calibration factor, linearity and converter efficiency (NOx analysers) by documented methods. The factors have been calculated using certified gas standards. The particulate analysers listed above have been tested for sample flow rates and k_0(where appropriate) by documented methods. Note that the test results are valid on the day of test only, as analyser drift over time cannot be quantified. All results for gaseous species are given in ppb (parts per billion) mole fractions or ppm (parts per million) mole fractions.

[1] The zero response is the zero reading on the data logging system of the analyser when audit zero gas was introduced to the analysers under test.

[2] The calibration factor is the multiplying factor required to scale the reading on the data logging system of the analyser into reported concentration units (ppb for NO, NOx, SO_2, O_3 and ppm for CO. Where 1ppm = 1000ppb). It should be used in conjunction with the zero response. A corrected concentration is calculated using the following equation:

Concentration = F(Output - Zero Response)

Where F = Calibration Factor provided on this certificate

Output = Reading on the data logging system of the analyser

Zero Response = Zero Response provided on this certificate

[3] Converter eff. is the measured efficiency of the NO_2 to NO converter within the oxides of nitrogen analyser under test.

[4] The measured main flow rate (where this is applicable) is the flow rate through the sensor unit of the TEOM particulate analyser under test. The measured total flow rate is the total flow rate through the particulate analyser under test. Units of flow are $l.min^{-1}$, reported at prevailing ambient conditions unless otherwise specified. Where flow rates are highlighted in bold, it indicates that measurements were not made at the analyser sample inlet. These measurements therefore may not accurately reflect analyser performance in normal operation.

[5] The calculated k_0 value (specifically for TEOM analysers) is the calculated k_0 spring constant based on tests undertaken with filters of known weight.

The calibration results shaded are those that fall within our scope of accreditation, all other results on this certificate are not UKAS accredited, but have been included for completeness.