



CERTIFICATE OF CALIBRATION

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Approved Signatories:

- | | | | |
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Signed:

Date of issue:

25 Apr 18

Certificate Number:

3928

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 stations at
City of Glasgow Council

Ricardo Energy & Environment ID:

ED61598/3928

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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City of Glasgow 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	04-Jul-17	NOx	529B-229	2.0	2.6	1.0800	3.50	96.3
		NO		1.0	2.7	1.0780	3.50	
Glasgow Burgher Street (retest)	12-Sep-17	NOx	cm11050006	0.0	2.9	1.7228	3.50	101.4
		NO		0.0	2.9	1.7154	4.41	
Glasgow Byres Road	30-Jun-17	NOx	m1362-m575	0.0	2.5	0.9205	3.50	99.7
		NO		0.0	2.7	0.9203	3.50	
Glasgow Dumbarton Road	11-Sep-17	NOx	404b-174	-15.0	2.5	1.0624	3.67	101.4
		NO		-16.0	2.8	1.0626	3.60	
Glasgow Waulkmillglen Reservoir	07-Jul-17	NOx	697B-309	-1.0	2.6	0.9725	3.50	104.4
		NO		-1.0	2.5	0.9641	3.50	

PM10 analysers

Station	Date of audit	Analyser Serial no	Calculated ko	Uncertainty %	Total flow	Uncertainty %	Main flow	Uncertainty %
Glasgow Abercromby Street	28-Jun-17	26459	15968	1.0	16.08	2.2	3.11	2.2
Glasgow Anderston	04-Jul-17	21650	14177	1.0	16.44	2.2	3.07	2.2
Glasgow Broomhill	28-Jun-17	26460	15359	1.0	16.65	2.2	3.12	2.2
Glasgow Burgher Street	04-Jul-17	140AB256580505	16753	1.0	17.24	2.2	3.18	2.2
Glasgow Byres Road	30-Jun-17	140ab260310602	12958	1.0	16.61	2.2	3.12	2.2
Glasgow Nithsdale Road	07-Jul-17	26457	14399	1.0	15.24	2.2	3.02	2.2
Glasgow Waulkmillglen Reservoir	07-Jul-17	22763	13844	1.0	17.94	2.2	3.25	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	07-Jul-17	M1620-M334	1.0	3.0	1.0096	3.7



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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, SO2, O3 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:

$$\text{Concentration} = F(\text{Output} - \text{Zero Response})$$

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 NO2 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 $\text{l}\cdot\text{min}^{-1}$, 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 % deviation indicates the closeness of the calculated result to the manufacturer's specified value of k_0 .

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.