



0401

CERTIFICATE OF CALIBRATION

Ricardo Energy & Environment, 18 Blythswood Square, Glasgow, G2 4BG

Telephone 01235 753642

Authorised Signatories:

D Hector ✓
S Stratton

Signed:



Date of Issue: 18th July 2017

Certificate Number: 3759

Page 1 of 3

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 Dundee Council's Broughty ferry Rd, Lochee Rd, Mains Loan, Meadowside, Seagate and Whitehall air monitoring stations.

Site / Date Test Carried Out	Species	Analyser Serial No.	Zero Response ₁	Uncertainties ppb	Calibration Factor ²	Uncertainties %	Converter eff. (%) ³
Broughty Ferry Rd 8 th August 2016	NO _x	607	2.0	2.8	1.5570	3.5	97.4
	NO		1.0	2.8	1.5730	3.5	
Lochee Road 8 th August 2016	NO _x	727	5.3	2.6	1.1335	3.5	98.2
	NO		2.4	2.6	1.1453	3.5	
Meadowside 9 th August 2016	NO _x	2211692	2.0	2.7	1.0646	3.5	99.6
	NO		0.0	2.7	1.0625	3.5	
Seagate 9 th August 2016	NO _x	726	1.4	2.8	1.6062	3.5	98.2
	NO		1.3	2.8	1.6152	3.5	
Whitehall St 9 th August 2016	NO _x	725	1.1	2.5	1.0394	3.5	101.3
	NO		0.7	2.5	1.0364	3.5	

The reported expanded uncertainty is 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.

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. Ricardo Energy & Environment is a trading name of Ricardo-AEA Ltd.

Ricardo Energy & Environment

Head Office
Gemini Building,
Fermi Avenue,
Harwell,
Oxon
OX11 0QR

Tel: +44 (0)1235 753 000

Registered office

Shoreham Technical Centre
Shoreham-by-Sea
West Sussex
BN43 5FG

Registered in England No.

08229264

VAT Registration No.

GB 212 8365 24

Site / Date Test Carried Out	Species	Analyser Serial No.	Parameter	Specified Value	Measured Value	Deviation %	Uncertainty %
Broughty Ferry Rd 8 th August 2016	TEOM PM ₁₀	23739	Main Flow ⁴	3.00	2.91	-2.9	2.25
			Aux Flow ⁴	13.67			2.25
			Total Flow	16.67	16.24	-2.6	2.25
			k ₀ ⁵	15009	15282	1.8	1.0
Broughty Ferry Rd 22 nd November 2016	TEOM PM ₁₀	22421	Main Flow ⁴	3.00	3.13	4.2	2.25
			Aux Flow ⁴	13.67			2.25
			Total Flow	16.67	15.67	-6.0	2.25
			k ₀ ⁵	15009	15420	2.7	1.0
Mains Loan 22 nd November 2016	TEOM PM ₁₀	25750	Main Flow ⁴	3.00	3.10	3.2	2.25
			Aux Flow ⁴	13.67			2.25
			Total Flow	16.67	16.73	0.4	2.25
			k ₀ ⁵	13176	13401	1.7	1.0

Site / Date Test Carried Out	Species	Analyser Serial No.	Parameter	Specified Value	Measured Value	Deviation %	Uncertainty %
Lochee Road 8 th July 2016	BAM PM10	M2080	Total Flow ⁴	16.67	17.20	3.2	2.25
Meadowside 9 th August 2016	BAM PM10	M2079	Total Flow ⁴	16.67	15.85	-4.9	2.25
Seagate 9 th August 2016	BAM PM10	M2816	Total Flow ⁴	16.67	15.70	-5.8	2.25
Whitehall St 9 th August 2016	BAM PM10	N14537	Total Flow ⁴	16.67	15.48	-7.1	2.25

The gaseous ambient analysers listed above have been tested for zero response, calibration factor, linearity and converter efficiency (NO_x analysers only) 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 k₀ (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.

¹The 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.

²The 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, NO_x, SO₂, O₃ and ppm for CO. Where 1 ppm = 1000 ppb). 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

³Converter eff. is the measured efficiency of the NO₂ to NO converter within the oxides of nitrogen analyser under test.

⁴The measured main flow rate (where applicable) is the flow rate through the sensor unit of the TEOM particulate analyser under test. The measured aux flow rate (where applicable) is the flow rate through the bypass tubing 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. 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.

⁵The calculated k₀ value (TEOM analysers only) is the calculated k₀ 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 k₀ value.

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