CERTIFICATE OF CALIBRATION

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0401

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Signed:

Date of issue: 09 May 19

Certificate Number: 4500

Customer Name and Address:

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

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

Ricardo Energy & Environment ID: ED61598/4500

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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Dundee 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]
Dundee Broughty Ferry Road	27-Jun-18	NOx	607	3.4	2.6	1.1806	3.50	98.1
		NO		0.6	2.6	1.1673	3.50	
Dundee Lochee Road	27-Jun-18	NOx	727	-3.8	2.5	0.9680	3.50	100.4
		NO		-1.2	2.6	0.9861	3.50	
Dundee Mains Loan	12-Jul-18	NOx	cm10490031	0.3	2.6	1.1520	3.50	99.1
		NO		0.3	2.6	1.1528	3.50	
Dundee Meadowside	28-Jun-18	NOx	2211692	4.0	2.6	1.1570	3.50	99.1
		NO		0.0	2.6	1.1404	3.50	
Dundee Seagate	28-Jun-18	NOx	726	4.9	2.6	1.0876	3.50	100.0
		NO		2.0	2.6	1.0953	3.50	
Dundee Whitehall Street	27-Jun-18	NOx	725	2.3	2.7	1.3140	3.50	99.7
		NO		1.8	2.7	1.3112	3.50	

PM10 analysers

Station	Date of audit	Analyser Serial no	Calculated ko	Uncertainty %	Total flow	Uncertainty %	Main flow	Uncertainty %
Dundee Broughty Ferry Road	27-Jun-18	1200c164210107	15069	1.0	16.12	2.2	3.03	2.2
Dundee Lochee Road	27-Jun-18	8732			3.90	2.2		2.2
Dundee Mains Loan	12-Jul-18	8379			4.51	2.2		2.2
Dundee Meadowside	28-Jun-18	M2079			11.15	2.2		2.2
Dundee Seagate	28-Jun-18	M2816			12.72	2.2		2.2
Dundee Whitehall Street	27-Jun-18	N14537			15.97	2.2		2.2

PM2.5 analysers

Station	Date of audit	Analyser Serial no	Calculated ko	Uncertainty %	Total flow	Uncertainty %	Main flow	Uncertainty %
Dundee Lochee Road	27-Jun-18	8732			3.90	2.2		2.2
Dundee Mains Loan	12-Jul-18	8379			4.51	2.2		2.2

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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.