



# CERTIFICATE OF CALIBRATION

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Approved Signatories:

- |                          |          |                                     |            |
|--------------------------|----------|-------------------------------------|------------|
| <input type="checkbox"/> | S. Eaton | <input type="checkbox"/>            | B Stacey   |
| <input type="checkbox"/> | D Hector | <input type="checkbox"/>            | S Stratton |
| <input type="checkbox"/> | N Rand   | <input type="checkbox"/>            | S Telfer   |
| <input type="checkbox"/> | B Davies | <input checked="" type="checkbox"/> | S Gray     |

Signed:

Date of issue:

29 Apr 19

Certificate Number:

4471

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  
Dundee City Council

Ricardo Energy & Environment ID:

ED61598/4471

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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Date of issue: 29 Apr 19  
 Certificate Number: 4471  
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## Dundee City Council NOx analysers

Station	Date of Audit	Species	Analyser Serial no	Zero Response <sup>1</sup>	Zero uncertainty ppb	Calibration Factor <sup>2</sup>	Factor uncertainty %	Converter eff. (%) <sup>3</sup>
Dundee Broughty Ferry Road	05-Dec-18	NOx	607	0.7	2.6	1.1382	3.50	98.7
		NO		2.6	2.6	1.1333	3.50	
Dundee Lochee Road	05-Dec-18	NOx	727	7.4	2.6	1.1455	3.50	99.1
		NO		2.4	2.6	1.1302	3.50	
Dundee Meadowside	04-Dec-18	NOx	2211692	8.0	2.8	1.0919	3.50	100.4
		NO		0.0	2.8	1.0717	3.50	
Dundee Seagate	04-Dec-18	NOx	726	0.0	2.6	1.1909	3.50	98.2
		NO		-0.4	2.6	1.2030	3.50	
Dundee Whitehall Street	05-Dec-18	NOx	725	13.8	2.6	1.2153	3.50	99.5
		NO		12.9	2.6	1.2116	3.50	

## PM10 analysers

Station	Date of audit	Analyser Serial no	Calculated ko	Uncertainty %	Total flow	Uncertainty %	Main flow	Uncertainty %
Dundee Broughty Ferry Road	05-Dec-18	1200C164210107	15077	1.0	15.67	2.2	2.42	2.2
Dundee Lochee Road	05-Dec-18	8732			4.43	2.2		2.2
Dundee Mains Loan	04-Feb-19	8379			4.50	2.2		2.2
Dundee Meadowside	04-Dec-18	M2079			15.97	2.2		2.2
Dundee Seagate	04-Dec-18	M2816			12.86	2.2		2.2
Dundee Whitehall Street	05-Dec-18	M14537			15.44	2.2		2.2

## PM2.5 analysers

Station	Date of audit	Analyser Serial no	Calculated ko	Uncertainty %	Total flow	Uncertainty %	Main flow	Uncertainty %
Dundee Mains Loan	04-Feb-19	8379			4.50	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 (NO<sub>x</sub> 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<sub>0</sub>(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.

<sup>1</sup> 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.

<sup>2</sup> 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, NO<sub>x</sub>, SO<sub>2</sub>, O<sub>3</sub> 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

<sup>3</sup> Converter eff. is the measured efficiency of the NO<sub>2</sub> to NO converter within the oxides of

<sup>4</sup> The measured main flow rate (where this is applicable) is the flow rate through the sensor

<sup>5</sup> The calculated k<sub>0</sub> value (specifically for TEOM analysers) is the calculated k<sub>0</sub> 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.