



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 checked="" type="checkbox"/> | S Telfer |
| <input type="checkbox"/> | B Davies | <input type="checkbox"/> | S Gray |

Signed:

Date of issue: 25 February 2022

Certificate Number: 5743

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
 Falkirk Council

Ricardo Energy & Environment ID:

ED11194/5743

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.

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
 18 Blythswood Square (2nd Floor),
 Glasgow,
 G2 4BG

Tel. 01235 753205

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

Registered in England No.
 06229264

VAT Registration No.
 GB 212 8365 24



CERTIFICATE OF CALIBRATION



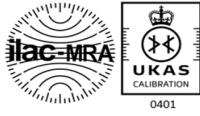
Date of issue: 25 February 2022
 Certificate Number: 5743
 Ricardo Energy & Environment ID: ED11194/5743

Falkirk Council
 NOx analysers

Station	Date of Audit	Species	Analyser Serial no	Zero Response ¹	Zero uncertainty nmol/mol	Calibration Factor ²	Factor uncertainty %	Converter eff. (%) ³
Falkirk Bainsford	17 February 2022	NOx	809007	-20.0	2.5	0.8535	3.50	93.9
		NO		-11.3	2.5	0.8642	3.50	
Falkirk Grangemouth MC	14 February 2022	NOx	8906170204	0.4	2.6	1.0320	3.50	96.5
		NO		-0.7	2.5	1.0209	3.50	
Falkirk Hags	15 August 2022	NOx	4793	0.8	2.5	1.0638	3.50	100.4
		NO		0.0	2.5	0.9733	3.50	
Falkirk Hope Street	15 February 2022	NOx	8907040214	-2.1	2.5	0.8389	3.50	99.3
		NO		-0.8	2.5	0.8468	3.50	
Falkirk West Bridge Street	16 February 2022	NOx	1228	-7.7	2.5	1.0441	3.50	96.8
		NO		-1.0	2.5	1.0613	3.50	

FIDAS analysers

Station	Date of audit	Analyser Serial no	Calculated ko ⁵	Uncertainty %	Total flow ⁴	Uncertainty %	Main flow	Uncertainty %
Falkirk Bainsford	17 February 2022	13696			4.52	2.2		2.2
Falkirk Grangemouth MC	14 February 2022	11616			4.55	2.2		2.2
Falkirk Hags	15 August 2022	6179			4.69	2.2		2.2
Falkirk Hope Street	15 February 2022	13555			4.65	2.2		2.2
Falkirk West Bridge Street	16 February 2022	7661			4.69	2.2		2.2
Falkirk Grangemouth Zetland Park	15 February 2022	13554			4.63	2.2		2.2



CERTIFICATE OF CALIBRATION



SO2 analysers

Station	Date of Audit	Analyser Serial no	Zero Response ¹	Zero uncertainty n/h	Calibration Factor ²	Factor uncertainty %	Response to m xylene (ppb)
Falkirk Bo'ness	14 February 2022	616X62GNF	4.3	2.5	0.8902	3.0	
Falkirk Grangemouth MC	14 February 2022	SM7N38YX	1.9	2.5	0.8699	2.5	
Falkirk Hope Street	15 February 2022	103004	-0.9	2.5	0.8745	2.5	
Falkirk Grangemouth Zetland Park	15 February 2022	408066600209	-1.8	2.6	1.0966	2.5	
Grangemouth Moray	12 January 2022	124MLC3B	2.1	2.5	0.9602	3.1	



CERTIFICATE OF CALIBRATION



Date of issue: 25 February 2022
Certificate Number: 5743
Ricardo Energy & Environment ID: ED11194/5743

The gaseous ambient analysers listed above have been tested for zero response, calibration factor, linearity and converter efficiency (NO_x 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 reported in concentration units of nmol/mol or $\mu\text{mol/mol}$.

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 (nmol/mol for NO, NO_x, SO₂, O₃ and $\mu\text{mol/mol}$ for CO). 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.