



Scottish Air Quality Database Overview and data QA/QC

Ken Stevenson
30 Mar 2010



Five Key Project Tasks

1. Data collection and QA/QC Ken
 2. Database and website
 3. Reports, meetings and seminars
 4. Trend analysis
 5. Spatial analysis (mapping) Justin
- Paul

Monitoring sites in the Database



Current Situation:

79 Sites on Scottish website (up from 62 in 2007)

- 17 AURN (National Network)
- 62 Local Authority

QA/QC of the Scottish sites

- Daily or hourly collection of data from each site
- Scaling of data from last calibration results
- Daily checking of data
- Update to website
- On-going data update as new information becomes available
- 6-monthly site audits – ensures traceability
- Collection and storage of all calibrations and service records etc
- 6-monthly data ratification
- Quality Circle data review
- Update ratified data to the website
- Provide statistical summary to LAs
- Assistance to LAs where-ever possible

Daily Checking

All data are checked every day by data checkers

We sent out about 260 mails to Scottish Local Authorities in last 6 months

Scottish Field Team have daily phone call/email discussion with site operators on faults issues

Faults will lead to some false alarms in the daily bulletin

6-monthly site intercalibration and audit

AEA visits every site every 6-months to undertake the intercalibration and site audit

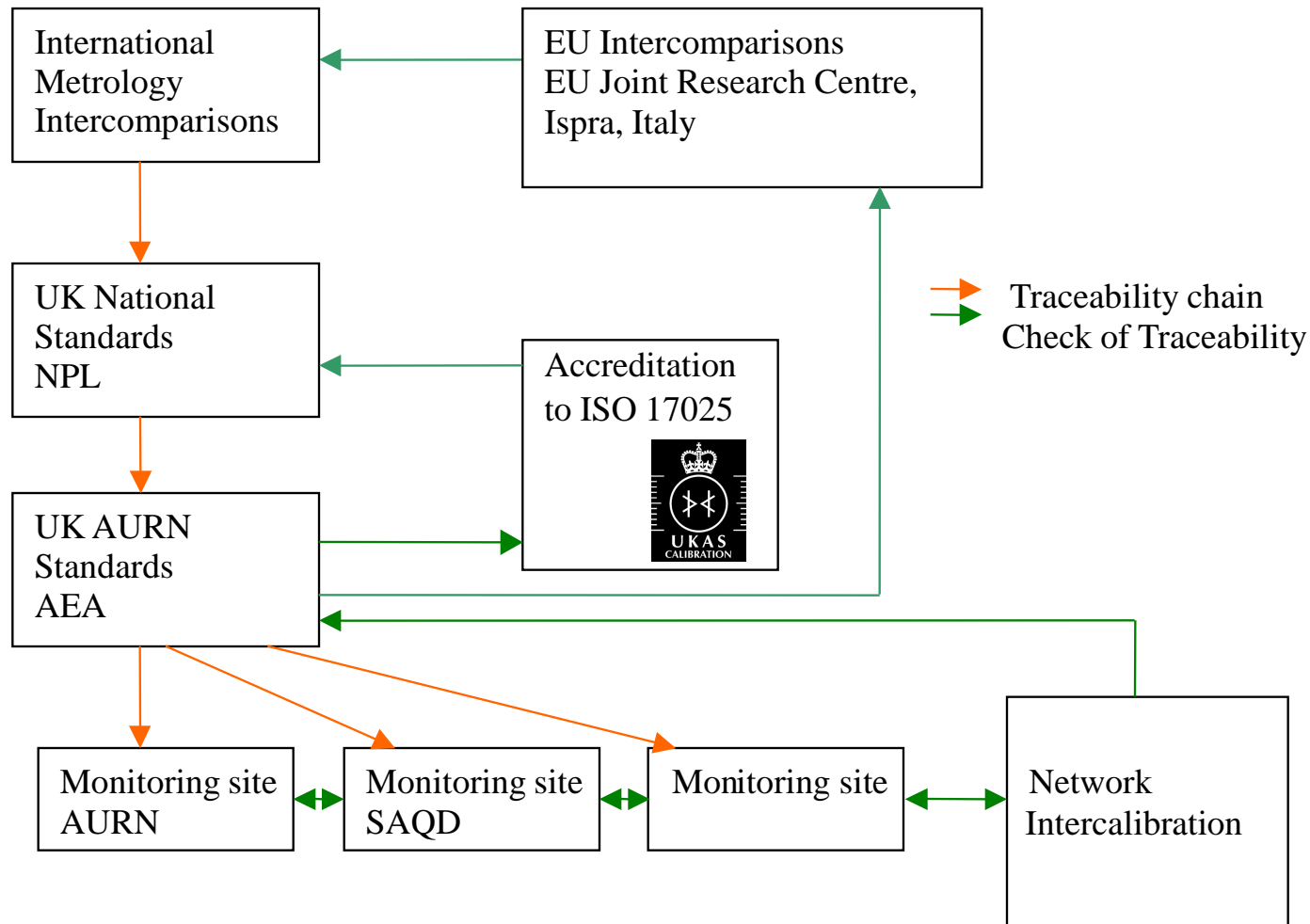
- Check Analysers
- Check Calibration Gases
- Site Infrastructure
- Meet with Local Operator



Lab. 0401



Traceability Chain



Selection of problems found at 2009 audits

Cylinders:-

8 NO and 1 SO₂

Analysers

1 Converter < 95%

TEOM & FDMS:-

10 Ko out (mostly marginal)

14 Main Flow out

3 Leak test failed

3 Low pump vacuums (FDMS only)

Timing error

logger clock set 12 hrs out

Where appropriate, these problems all
accounted for during ratification

UKAS Certificate of Calibration



CERTIFICATE OF CALIBRATION

Glangarnock Technology Centre, Caladonian Road, Lochshore Business Park, Glangarnock, Ayrshire, KA14 3DD. Telephone 0870 1906289 Fax 0870 1905151



Approved Signatories:

K. Stevenson

S. Stratton

Signed:

Date: 10/11/09

Date of issue:

10th November 2009

Cert No: 2152

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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 Aberdeen City Council's Union Street (PM10), Anderson Drive, Market Street 2, Wellington Road, and Kings Road air monitoring stations.

AEA identification Number:

43060001/ABERD/ A5B5C4C5D3E1

Site / Date Test Carried Out	Species	Analysers Serial No.	Zero Response ¹	Uncertainty (ppb)	Calibration Factor ²	Uncertainty %	Conversion eff. (%) ³
Anderson Drive 12 th August 2009	NOx	215	5.7	5.4	1.1237	5.0	99.0
	NO	215	4.0	5.0	1.1190	5.0	N/A
Market Street 2 11 th August 2009	NOx	983	Analysers Fault	N/A	N/A	N/A	N/A
	NO	983	Analysers Fault	N/A	N/A	N/A	N/A
Market Street 2 7 th October 2009	NOx	983	0.85	5.0	1.3525	5.0	100.0
	NO	983	-2.05	5.0	1.3522	5.0	N/A
Wellington Road 11 August 2009	NOx	2248	1.0	5.3	1.0498	5.0	96.7
	NO	2248	-0.7	5.0	1.0582	5.0	N/A
Kings Road 11 th August 2009	NOx	2640	2.0	5.4	1.5347	5.0	102.5
	NO	2640	1.0	5.0	1.5509	5.0	N/A

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%. This 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 reassurance of measurement to recognised national standards, the limits of measurement, and the National Physical Laboratory or other recognised national standards laboratories. This certificate may not be reproduced other than in full, except with the prior written consent of the issuing laboratory.

Date of issue:

Cert No: 2152

AEA Identification Number:

43060001/ABERD/ A5B5C4C5D3E1

10th November 2009

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Site / Date Test Carried Out	Species	Analysers Serial No.	Parameter	Specified Value	Measured Value	Deviation %
Union Street 11 th August 2009	TEOM PM ₁₀	22936	Main Flow ⁴	3.00	3.16	5.3
			Aux Flow ⁴	13.65		
			Total Flow ⁴	16.67	16.95	1.7
			k ₀ ⁵	13170	13292	0.9
Anderson Drive 12 th August 2009	TEOM PM ₁₀	24832	Main Flow ⁴	3.00	2.99	-0.2
			Aux Flow ⁴	13.67		
			Total Flow ⁴	16.67	16.23	-2.6
			k ₀ ⁵	13152	13121	-0.2
Market Street 2 11 th August 2009	TEOM PM ₁₀	22400	Main Flow ⁴	2.02	1.59	-21.1
			Aux Flow ⁴	14.88		
			Total Flow ⁴	16.67	15.84	-5.0
			k ₀ ⁵	13120	12989	-1.0
Wellington Road 11 August 2009	TEOM PM ₁₀	25544	Main Flow ⁴	3.00	3.23	7.6
			Aux Flow ⁴	13.67		
			Total Flow ⁴	16.67	17.03	2.1
			k ₀ ⁵	13947	13788	-1.1
Kings Road 11 th August 2009	BAM PM ₁₀	17685	Main Flow	16.67	17.66	5.9

Uncertainties:

TEOM PM₁₀

Main Flow
Total Flow
Aux Flow
k₀

±2.2%
±2.2%
±2.2%
±1.0%

Data Ratification

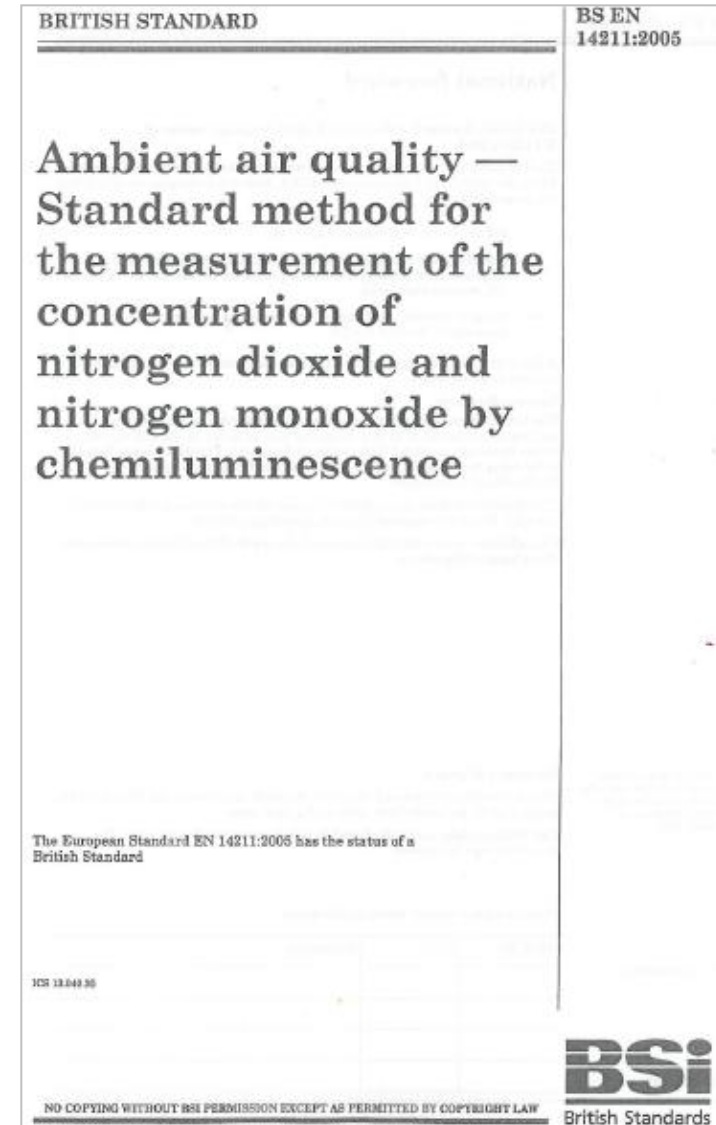
- Calibration history
- Audit results
- Comparison of all pollutants at the site
- Comparison with other sites
- Identify episode periods
- Diurnal average
- NO/NO_x ratio
- FDMS – use of diagnostic information

Update to ratification procedures

Correction for NO_x converter efficiency

“A correction to the NO₂ concentration shall be made when the converter efficiency is between 95% and 100%”

- Needs to be implemented in 2010
- Small increase in NO₂ concentrations
- Data may be rejected if the converter efficiency is below 95%



Quality Circle

Quality Circle

- Project Manager
- Data Manager
- Field Manager
- Other senior staff

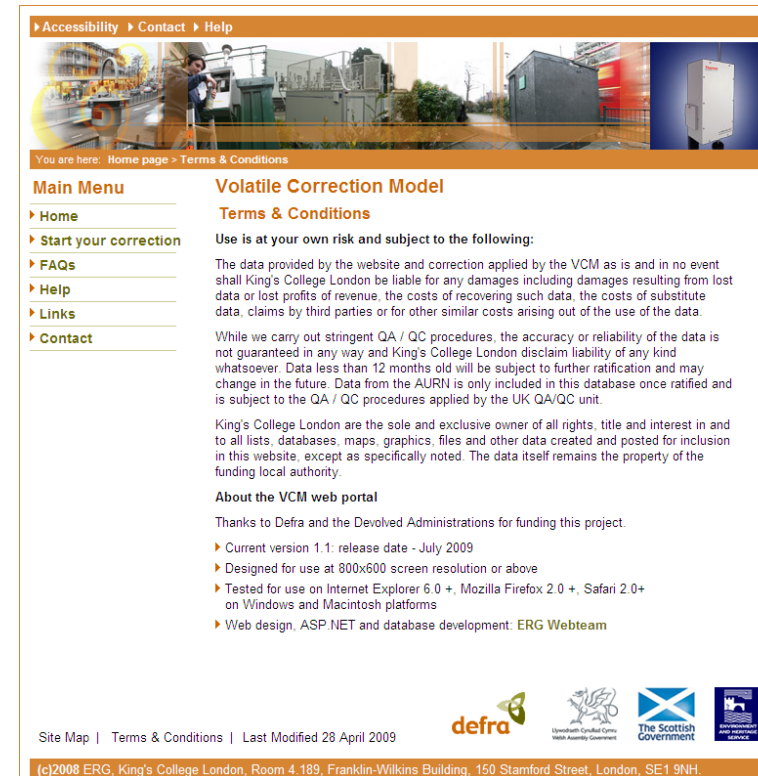
Aims of the Quality Circle

- Final decisions on data
- Identify quality issues
- Feedback via actions
& recommendations



PM Volatile Correction Model

- Correct TEOM data for loss of volatile particles
- FDMS analyser measures volatile particles
- Volatile particle concentrations are similar over regional scale
- Use volatile measurement from nearby FDMS(<130km) to correct TEOM data.



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Volatile Correction Model

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About the VCM web portal

Thanks to Defra and the Devolved Administrations for funding this project.

- Current version 1.1: release date - July 2009
- Designed for use at 800x600 screen resolution or above
- Tested for use on Internet Explorer 6.0 +, Mozilla Firefox 2.0 +, Safari 2.0+ on Windows and Macintosh platforms
- Web design, ASP.NET and database development: [ERG Webteam](#)

Site Map | Terms & Conditions | Last Modified 28 April 2009

defra
Department for Environment, Food and Rural Affairs

Welsh Government
Gŵylfa'r Llywodraeth Cymru

The Scottish Government
Gobair na' Bheil

Department of the Environment
Northern Ireland Executive

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2008 – pilot - Daily VCM data available as spreadsheet

2009 - Scottish TEOM will be available as hourly VCM corrected data from the website.

Example of AP Summary Sheet

Air Pollution Report

Produced by AEA on behalf of The Scottish Government

FALKIRK GRANGEMOUTH MC

01 January to 31 December 2009

These data have been fully ratified by AEA

Municipal Chambers

POLLUTANT	PM ₁₀ ⁺	NO ₂	NO _x	SO ₂
Number Very High	0	0	-	0
Number High	0	0	-	0
Number Moderate	0	0	-	17
Number Low	8535	8715	-	34523
Maximum 15-minute mean	237 µg m ⁻³	162 µg m ⁻³	848 µg m ⁻³	471 µg m ⁻³
Maximum hourly mean	126 µg m ⁻³	143 µg m ⁻³	709 µg m ⁻³	319 µg m ⁻³
Maximum running 8-hour mean	100 µg m ⁻³	107 µg m ⁻³	443 µg m ⁻³	188 µg m ⁻³
Maximum running 24-hour mean	58 µg m ⁻³	90 µg m ⁻³	366 µg m ⁻³	128 µg m ⁻³
Maximum daily mean	39 µg m ⁻³	84 µg m ⁻³	351 µg m ⁻³	98 µg m ⁻³
Average	16 µg m ⁻³	23 µg m ⁻³	41 µg m ⁻³	7 µg m ⁻³
Data capture	97.3 %	99.5 %	99.5 %	98.8 %

* PM₁₀ Indicative Gravimetric Equivalent µg m⁻³

+ PM₁₀ as measured by a TEOM using a gravimetric factor of 1.3

fgf Indicative Gravimetric Equivalent

All mass units are at 20°C and 1013mb

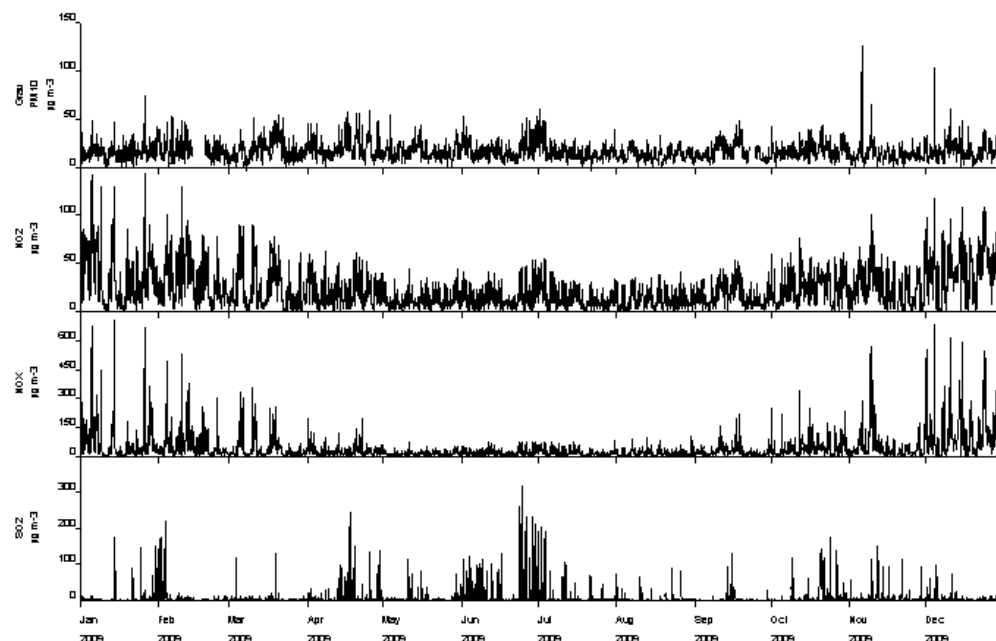
NO_x mass units are NO_x as NO₂ µg m⁻³

Pollutant	Air Quality Regulations (2000) and Air Quality (Scotland) Amendment Regulations 2002	Exceedences	Days
PM ₁₀ Particulate Matter (Gravimetric)	Daily mean > 50 µg m ⁻³	0	0
PM ₁₀ Particulate Matter (Gravimetric)	Annual mean > 40 µg m ⁻³	0	-
PM ₁₀ Particulate Matter (Gravimetric)	Annual mean > 18 µg m ⁻³	0	-
Nitrogen Dioxide	Annual mean > 40 µg m ⁻³	0	-
Nitrogen Dioxide	Hourly mean > 200 µg m ⁻³	0	0
Nitrogen Oxides (NO ₂)	Annual mean > 30 µg m ⁻³	1	-
Sulphur Dioxide	15-minute mean > 266 µg m ⁻³	17	7
Sulphur Dioxide	Hourly mean > 350 µg m ⁻³	0	0
Sulphur Dioxide	Daily mean > 125 µg m ⁻³	0	0
Sulphur Dioxide	Annual mean > 20 µg m ⁻³	0	-

Air Pollution Report

Produced by AEA on behalf of The Scottish Government

Falkirk Grangemouth MC Air Monitoring
Hourly Mean Data for 01 January to 31 December 2009



Conclusions

- QA/QC work is key to everything
- Audits and Ratification are a major part of the project work
- Daily checks and feedback also a major task
- We strive to support LAs and work closely with them –
 - respond to requests and enquiries
 - offer advice
 - chase for calibrations
 - Inform if we see problems with the data
- The database is building rapidly
 - 2006 – ~20 sites
 - 2007 – 44 sites
 - 2008 – 62 sites
 - 2009 – 79 sites

Any Questions ?

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