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QA/QC Data Ratification Report for the Automatic Urban and Rural Network, October-December 2011, and Annual Report 2011

**Report produced for the Department for
Environment, Food and Rural Affairs, Scottish
Government, Welsh Government and the DoE in
Northern Ireland**

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Executive summary

AEA carries out the quality assurance and control (QA/QC) activities for the Automatic Urban and Rural Monitoring Network (AURN) on behalf of the UK Department for Environment, Food and Rural Affairs (Defra), Scottish Government, Welsh Government and DoE in Northern Ireland.

Ratified hourly average data capture for the network averaged 93.2% for all pollutants (O_3 , NO_2 , SO_2 , CO , PM_{10} and $PM_{2.5}$) during the 3-month reporting period October-December 2011. Data capture for all pollutants except $PM_{2.5}$ were above 90%. There were 23 sites with data capture less than 90% for the period.

The number of monitoring sites in the AURN during this quarter was 135, of which 72 are Local Authority owned sites affiliated to the national network. Some are co-located and separately named gravimetric particulate analysers at sites with automatic analysers. Many affiliated sites have additional Defra-funded analysers installed on site.

The main reasons for data loss at the sites have been provided and these were predominantly due to instrument faults, response instability or problems associated with the replacement of analysers and infrastructure. A summary of recommendations to help improve network performance is given in Appendix 1.

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1 Introduction

This quarterly report covers the Quality Assurance and Control (QA/QC) activities undertaken by AEA to ratify automatic monitoring data from Defra and the Devolved Administrations' urban and rural air quality monitoring network (AURN) for the period October-December 2011. During this period there were 135 operational monitoring sites in the Network of which there are 100 urban sites, 27 rural sites and a further 8 sites in the London Air Quality Monitoring Network (LAQN) which are affiliated into the national network. There are currently 63 Defra-funded sites and 72 affiliate sites, although many affiliate sites have fully-funded PM₁₀ and/or PM_{2.5} analysers. Eleven sites have non-automatic particulate samplers (Partisols); some of these are collocated with FDMS analysers at Auchencorth Moss, Harwell, London North Kensington and Marylebone Road for both PM₁₀ and PM_{2.5}.

1.1 Overview of Network Performance

Ratified hourly average data capture for the network averaged 93.2% for all pollutants (O₃, NO₂, SO₂, CO, PM₁₀ and PM_{2.5}) during the 3 month reporting period October-December 2011 (see Table 1.1). All gaseous pollutants achieved 90% or higher data capture on average. Data capture rates are calculated using the actual data capture as hourly averages (daily for Partisol) against the total number of hours (or days) in the relevant period; service and maintenance are counted as lost data. It is permissible to discount routine service and calibration from achievable data capture targets, but this is not yet calculated. For sites starting or closing, the data capture is based on the actual date starting or closing. Some data remain provisional pending further investigation-see Section 1.3

Table 1.1: AURN Ratified Data Capture (%) by Quarter, 2011

	CO	PM ₁₀	PM _{2.5}	NO ₂	O ₃	SO ₂	Mean
Q1 2011	95.3	81.1	86.0	93.4	95.2	92.5	90.7
Q2 2011	97.8	86.4	88.4	93.2	96.2	97.1	92.7
Q3 2011	92.3	81.6	84.9	91.9	94.2	92.2	89.8
Q4 2011	97.0	90.7	89.3	94.2	97.5	95.2	93.2

Overall, 314 out of the 412 analysers (76%) achieved data capture levels above the required 90% target during this reporting period (See Table 1.2). Some changes to previously reported data have been made in this quarter, and so capture rates may be different to those in earlier reports.

Table 1.2: Number of Analysers with Data Capture below 90%

Total Number Of Analysers		Q1 Jan-Mar 2011 (No. below 90%)	Q2 Apr-June (No. below 90%)	Q3 July-Sept (No. below 90%)	Q4 Oct-Dec (No. below 90%)
CO	24	3	1	3	3
NO ₂	117	13	13	20	14
O ₃	82	7	9	11	3
PM ₁₀ ¹	68	24	17	28	15
PM _{2.5} ¹	76	25	19	29	19
SO ₂	46	6	2	7	5
Total <90%		78	61	98	59

1. Includes FDMS, FDMS, BAM and Partisol analysers.

In total, 23 out of the 135 operational network sites in the quarter (15%) had an average data capture rate below the required 90% level for the October-December 2011 period. This is influenced by the fact that new analysers at existing sites have data capture figures calculated from the start date of the

quarter, not from the start of the analyser itself. The main site operational and QA/QC issues giving rise to data capture below the required 90% level are summarised in Section 4.

1.2 Status of Ratified Data

During ratification of the October-December data, a number of issues were discovered which affect data already reported as ratified in previous quarters. As a result, the following data already reported as ratified have been deleted or rescaled, or data previously deleted have been reinstated.

PM₁₀ - Changes

- Birmingham Tyburn Roadside – Data reinstated January 2009 to 31 December 2010. Data 2009 to 2011 locked as ratified 28/5/12
- Birmingham Tyburn (background) – Data rejected 1 January to 6 October 2010 and 27 April 2011 (LSO cal) to 11 July 2011 (ESU c/o). Note PM10 data already rejected 11/7-21/7
- Glasgow Kerbside - Data rejected 1 May 2011 to 31 December 2011. Nb: Data already rejected 1 January to 30 April 2011. FDMS removed from site for repair (no data supplied) 17 June to 9 August 2011. Data capture was 0% for PM₁₀ in 2011.
- Leamington Spa - Data rejected from 12 May to 3 August 2011
- Middlesbrough - PM10 data rejected from 6 July (after data gap) to 2 September 2011 (ESU c/o).
- Newport – Data rejected 25 October to 31 December 2010. Note: data already rejected up to 25 October 2010
- Thurrock - Data rejected from 24 June 2010 (LSO cal) to 16 August 2010 (LSO Cal) and 12 May 2011 (LSO cal) to 28 June 2011 (EUS call out, data rejected 28/6-29/6)

PM₂₅ - Changes

- Birmingham Tyburn Roadside – Data reinstated January 2009 to 31 December 2010. Data 2009 to 2011 locked as ratified 28/5/12
- Birmingham Tyburn (background) - Data rejected from 1 January to 6 October 2010 and 1 May 2011 (LSO cal) to 5 July 2011. Note PM25 data already rejected 5/7-11/7
- Leamington Spa - Data rejected from 12 May to 3 August 2011
- London Bloomsbury Data rejected 14 to 22 July. Note: Data already rejected intermittently 20 to 22 July and then completely from 23 July to 11 August 2010 due to low data.
- London Harlington - Data rejected 1 to 7 June and 20 to 31 December 2011. Nb. Data already rejected 8 to 28 June due to an increase in volatiles were too high caused by an increase in temperatures.
- Middlesbrough - Data reinstated: February to August 2011. Some data still rejected 13/7-18/7 , 27/7-28/7, 3/8 & 20/8-21/8 periods of instability). Data in July 2011 (12/7-13/7) still left rejected due to instability after Audit. PM2.5 data rejected 17 July to 27 July (LSO cal). Note: Data previously rejected 13/7-17/7 & 27/7-28/7.
- Oxford St Ebbes - Data deleted from 16 April to 12 June 2011
- Salford Eccles – data deleted 30 July to 4 August 2011 (nb. no data 20/7-27/7 and unstable data rejected 27/7-30/7) and 7 to 23 September between Service and ESU call out.
- Wigan – No data up to 11 April. Data rejected from 11 April 2011 to 2 April 2012
- York Bootham - Data rejected 2 June (ESU c/o) to 31 August 2011. No data 31 August to 2 September

2 Changes in the Network for Directive Compliance

The following analysers were commissioned during the period October-December 2011:

The Walsall Willenhall site was destroyed by fire on 3 February 2010. A replacement site, Walsall Woodlands, was commissioned on 14 December 2011.

Sandwell West Bromwich, previously identified as non-compliant with the Air Quality Directive, was decommissioned on 31 December 2011.

3 Generic Data Quality Issues

3.1 FDMS Performance Issues

At the time of writing, there are a number of FDMS performance issues being investigated by the QA/QC unit. Most significant is the apparent baseline offset, which can result in data being higher or lower than might be expected. In order to determine this, zero checks are being carried out by placing a Hepa zero filter over the inlet and leaving for several days. This method does allow the determination of the analyser “zero” but requires a visit by QA/QC staff and the LSO, and therefore it will take time to complete all sites. The findings and implications of these tests will be discussed in future QA/QC reports..

3.2 Lack of Analyser Calibrations

For a number of sites, there have been no calibrations performed for a significant period of time. In many cases, this is due to a lack of calibration gas, and steps have been taken to alleviate this. In some cases, new LSO staff have taken responsibility for site duties, and have asked for training from the QA/QC Unit; some calibrations were therefore missed. In a limited number of cases, data have been lost as no suitable scaling factors could be determined.

4 Site Specific Issues

In this section, we now discuss in turn specific site issues for sites in the following geographic groupings – London, England (except London), Scotland, N. Ireland and Wales. Note that where analysers were commissioned during the period, the stated data capture for these instruments is calculated from the date of commissioning.

4.1 London

4.1.1 Data Capture

The data capture for sites in London (within the M25) for the period October-December 2011 is given in Table 4.1:

Table 4.1: Data capture for London: October-December 2011

Site	CO	PM ₁₀	PM ₂₅	NO ₂	O ₃	SO ₂	Site Average
England							
Camden Kerbside	-	96.4	89.5	95.2	-	-	93.7
Haringey Roadside	-	65.8	65.9	71.2	-	-	67.6
London Bexley	99.7	-	93.1	54.7	-	72.8	80.1
London Bloomsbury	99.9	99.6	99.5	99.9	99.9	99.7	99.7
London Cromwell Road 2	97.6	-	-	97.1	-	97.8	97.5
London Eltham	-	-	88.8	71.0	99.7	-	86.5
London Haringey	-	-	-	78.5	98.0	-	88.2
London Harlington	-	99.3	99.4	98.0	99.9	-	99.1
London Harrow Stanmore	-	-	98.9	-	-	-	98.9
London Hillingdon	-	-	-	99.1	99.9	-	99.5
London Marylebone Road	97.7	91.4	94.6	98.9	25.1	98.9	84.4
London Marylebone Road PARTISOL	-	98.9	91.3	-	-	-	95.1
London N. Kensington	95.9	94.1	97.8	98.4	97.6	98.6	97.1
London N. Kensington PARTISOL	-	89.1	56.5	-	-	-	72.8
London Teddington	-	-	99.5	98.4	95.5	-	97.8
London Westminster	99.8	-	85.9	99.9	99.7	99.7	97.0
Southwark A2 Old Kent Road	-	91.5	-	99.5	-	-	95.5
Tower Hamlets Roadside	99.9	-	-	96.2	-	-	98.1
Number of sites	7	9	13	15	9	6	18
Number of sites < 90%	0	2	5	4	1	1	6
Network Mean (%)	98.6	91.8	89.3	90.4	90.6	94.6	91.6

Shaded boxes are for data capture < 90%

Bold data captures are for data that are provisional and subject to further quality control

4.1.2 Site Specific Issues

Haringey Roadside

The power supply to the site was damaged as a result of civil disorder in the area on 8 August. Power supplies were restored at the end of October.

London Bexley

The SO₂ and NO_x analyser calibration systems were found to be incorrectly configured resulting in the analysers being pressurised during calibrations. Also, the manifold fan failed to restart following a power cut in September; Further problems with the NO_x analyser resulted in the loss of NO_x data up to 7 November.

London Eltham

Following an ESU callout on 5 October, the sample line was not reconnected to the analyser; this was rectified on 31 October. A number of dryer faults caused the loss of some PM_{2.5} data until a replacement dryer was fitted on 31 October.

London Haringey

The NO_x data were deleted from 15 to 29 November due to a sampling fault caused by a chipped glass on the sample filter holder.

London Marylebone Road

The ozone data appears to be unexpectedly low due to drifting baseline from September up to replacement of the analyser on 8 December. A total of 99 days data have been deleted.

London North Kensington Partisol

The PM_{2.5} data were rejected from 3 September because the flow was found to more than 10% out from value recorded by the Partisol.

4.2 England (excluding London)**4.2.1 Data Capture**

The data capture for sites in England for the period October-December 2011 is given in Table 4.2:

Table 4.2 Data Capture October-December 2011: England

Site	CO	PM ₁₀	PM ₂₅	NO ₂	O ₃	SO ₂	Site Average
England							
Barnsley 12	-	-	-	-	-	99.6	99.6
Barnsley Gawber	-	-	-	99.5	99.5	99.6	99.5
Bath Roadside	-	-	-	93.3	-	-	93.3
Billingham	-	-	-	95.7	-	-	95.7
Birmingham Acocks Green	-	-	98.6	100.0	99.9	100.0	99.6
Birmingham Tyburn	-	99.0	99.6	99.3	99.7	73.8	94.3
Birmingham Tyburn Roadside	-	98.2	32.3	99.4	99.8	-	82.4
Blackburn Darwen Roadside	-	-	-	98.8	-	-	98.8
Blackpool Marton	-	-	76.7	88.2	92.8	-	85.9
Bottesford	-	-	-	-	99.5	-	99.5
Bournemouth	-	-	91.3	92.8	100.0	-	94.7
Brighton Preston Park	-	-	90.2	9.3	100.0	-	66.5
Bristol Old Market	-	-	-	0.0	-	-	0.0
Bristol St Paul's	99.9	56.4	97.6	99.6	96.3	98.8	91.4
Bury Roadside	99.1	99.6	99.5	99.5	-	-	99.4
Cambridge Roadside	-	-	-	93.8	-	-	93.8
Camden Kerbside	-	96.4	89.5	95.2	-	-	93.7
Canterbury	-	-	-	89.5	100.0	-	94.7
Carlisle Roadside	-	88.8	70.7	97.0	-	-	85.5
Charlton Mackrell	-	-	-	99.6	99.2	-	99.4
Chatham Centre Roadside	-	99.3	98.9	82.9	-	-	93.7
Chesterfield	-	73.0	96.1	83.9	-	-	84.3
Chesterfield Roadside	-	99.7	92.8	99.8	-	-	97.4
Coventry Memorial Park	-	-	0.0	99.8	98.4	-	66.1
Eastbourne	-	99.4	99.6	100.0	-	-	99.6
Exeter Roadside	-	-	-	99.6	99.9	-	99.8
Glazebury	-	-	-	99.9	99.4	-	99.6
Great Dun Fell	-	-	-	-	94.2	-	94.2
Haringey Roadside	-	65.8	65.9	71.2	-	-	67.6

Site	CO	PM ₁₀	PM ₂₅	NO ₂	O ₃	SO ₂	Site Average
Harwell	-	99.8	99.8	99.7	100.0	99.8	99.8
Harwell PARTISOL	-	98.9	73.9	-	-	-	86.4
High Muffles	-	-	-	99.9	99.9	-	99.9
Horley	-	-	-	99.6	-	-	99.6
Hull Freetown	99.8	99.9	99.8	97.3	99.2	95.9	98.6
Ladybower	-	-	-	92.2	99.2	55.4	82.3
Leamington Spa	-	99.0	99.0	99.6	99.1	99.7	99.3
Leeds Centre	93.1	92.5	96.5	93.3	93.5	93.3	93.7
Leeds Headingley Kerbside	-	99.6	96.8	99.8	-	-	98.7
Leicester Centre	99.6	99.1	95.6	94.0	92.7	99.6	96.8
Leominster	-	-	-	99.9	99.6	99.7	99.7
Lincoln Canwick Road	-	-	-	98.6	-	-	98.6
Liverpool Queen's Drive Roadside	-	-	-	99.7	-	-	99.7
Liverpool Speke	99.7	93.4	98.6	95.6	99.6	99.1	97.7
London Bexley	99.7	-	93.1	54.7	-	72.8	80.1
London Bloomsbury	99.9	99.6	99.5	99.9	99.9	99.7	99.7
London Cromwell Road 2	97.6	-	-	97.1	-	97.8	97.5
London Eltham	-	-	88.8	71.0	99.7	-	86.5
London Haringey	-	-	-	78.5	98.0	-	88.2
London Harlington	-	99.3	86.4	98.0	99.9	-	95.9
London Harrow Stanmore	-	-	98.9	-	-	-	98.9
London Hillingdon	-	-	-	99.1	99.9	-	99.5
London Marylebone Road	97.7	91.4	94.6	98.9	25.1	98.9	84.4
London Marylebone Road PARTISOL	-	98.9	91.3	-	-	-	95.1
London N. Kensington	95.9	94.1	97.8	98.4	97.6	98.6	97.1
London N. Kensington PARTISOL	-	89.1	56.5	-	-	-	72.8
London Teddington	-	-	99.5	98.4	95.5	-	97.8
London Westminster	99.8	-	85.9	99.9	99.7	99.7	97.0
Lullington Heath	-	-	-	99.3	99.4	99.0	99.2
Manchester Piccadilly	-	-	93.9	95.7	99.6	99.9	97.3
Manchester South	-	-	-	99.9	100.0	-	99.9
Market Harborough	-	-	-	88.1	97.5	-	92.8
Middlesbrough	94.0	99.2	99.3	99.3	100.0	99.5	98.5
Newcastle Centre	99.6	99.0	99.4	98.7	99.7	98.5	99.1
Newcastle Cradlewell Roadside	-	-	-	98.0	-	-	98.0
Northampton	-	-	91.3	99.6	100.0	99.6	97.6
Norwich Lakenfields	-	91.3	95.5	98.5	99.6	98.8	96.7
Nottingham Centre	-	99.0	92.1	95.5	94.7	98.3	95.9
Oxford Centre Roadside	-	-	-	99.4	-	-	99.4
Oxford St Ebbes	-	99.3	98.8	95.2	-	-	97.7
Plymouth Centre	-	99.4	98.7	95.0	94.2	-	96.8
Portsmouth	-	99.0	98.5	98.6	99.8	-	99.0
Preston	-	-	80.7	99.9	99.9	-	93.5
Reading New Town	-	99.7	99.5	95.5	100.0	-	98.7
Rochester Stoke	-	99.5	99.7	99.8	100.0	99.7	99.7
Salford Eccles	99.5	98.9	96.0	83.2	92.9	64.1	89.1
Sandwell West Bromwich	-	-	-	97.3	97.3	97.2	97.3

Site	CO	PM ₁₀	PM _{2.5}	NO ₂	O ₃	SO ₂	Site Average
Sandy Roadside	-	91.9	99.0	99.7	-	-	96.9
Scunthorpe Town	-	97.8	-	93.2	-	98.6	96.5
Sheffield Centre	86.6	91.9	94.7	95.4	99.5	92.8	93.5
Sheffield Tinsley	-	-	-	99.8	-	-	99.8
Sibton	-	-	-	-	100.0	-	100.0
Southampton Centre	99.9	99.8	98.6	99.5	99.6	99.3	99.4
Southend-on-Sea	-	-	99.6	99.8	99.8	-	99.7
Southwark A2 Old Kent Road	-	91.5	-	99.5	-	-	95.5
St Osyth	-	-	-	99.2	99.4	-	99.3
Stanford-le-Hope Roadside	-	87.0	42.3	99.1	-	98.0	81.6
Stockton-on-Tees Eaglescliffe	-	96.1	92.8	99.8	-	-	96.2
Stoke-on-Trent Centre	-	99.6	98.3	99.6	99.8	-	99.3
Storrington Roadside	-	95.0	99.5	99.8	-	-	98.1
Sunderland Silksworth	-	-	99.1	98.2	98.5	68.4	91.1
Thurrock	-	99.5	-	97.4	99.3	99.0	98.8
Tower Hamlets Roadside	99.9	-	-	96.2	-	-	98.1
Warrington	-	79.6	98.3	99.9	-	-	92.6
Weybourne	-	-	-	-	99.9	-	99.9
Wicken Fen	-	-	-	94.5	96.5	99.1	96.7
Wigan Centre	-	-	0.0	99.9	100.0	-	66.6
Wirral Tranmere	-	-	98.8	95.6	99.9	-	98.1
Yarner Wood	-	-	-	97.8	87.4	-	92.6
York Bootham	-	96.9	84.8	-	-	-	90.8
York Fishergate	-	99.1	98.6	99.0	-	-	98.9
Number of sites	18	48	62	90	62	36	100
Number of sites < 90%	1	7	15	12	2	5	18
Network Mean (%)	97.9	94.6	88.7	93.9	97.3	94.2	93.4

Shaded boxes are for data capture < 90%

Bold data captures are for data that are provisional and subject to further quality control

4.2.2 Site Specific Issues

Birmingham Tyburn Roadside

The PM_{2.5} FDMS performed poorly during the quarter, although the dryer was replaced in October. Problems persisted and all PM_{2.5} data from 7 November were deleted by the CMCU.

Blackpool Marton

A fault with the air conditioning system resulted in the site being switched off from 31 August to 8 October. In addition, a leaking inlet filter caused loss of NO_x data from the LSO calibration on 19 December to 3 January 2012.

Brighton Preston Park

The NO_x data have been deleted from 16 August to 31 December due to lack of reliable calibrations due to lack of an NO gas cylinder.

Bristol Old Market

A converter failure was recorded at the summer 2011 and winter 2012 audits, and NO_x data from 9 August 2011 to the service on 23 January 2012.

Carlisle Roadside

Both FDMS analysers suffered severe instability following QA/QC audit on 5 December. Ten days PM₁₀ data and 31 days PM_{2.5} data were lost.

Chesterfield

There was a significant period during the quarter where the PM_{2.5} concentrations were higher than PM₁₀. Some periods PM_{2.5} have been deleted during ratification. In addition, the NO_x baseline was spurious between the QA/QC audit on 8 December up to the LSO calibration on 22 December; data between these dates have been deleted.

Coventry Memorial Park

A suspected dryer fault resulted in an ESU callout on 2 September, but they were unable to fix and the instrument was removed for workshop repair. The instrument had still not been reinstalled as at 31 December.

Harwell Partisol

The PM_{2.5} Partisol developed a filter exchange failure following a power cut on 15 December.

Ladybower

The SO₂ analyser suffered excessively noisy data from 13 November due to UV lamp and photomultiplier faults. It was eventually removed for workshop repair.

Middlesbrough

The CO analyser has an intermittent fault causing the analyser to periodically reboot. An ESU callout on 2 September failed to rectify the fault, and the analyser was removed for workshop repair. Data have been lost from 5 August to 30 September.

Salford Eccles

The NO_x analyser suffered an ozonator failure on 5 October, and 10 days data were lost. Also a problem with the internal temperature caused the SO₂ data to be unstable from 23 October to 20 November; data for this period have been deleted.

Stanford-le-Hope Roadside

The PM_{2.5} data were excessively noisy for most of the quarter, and much of the data have been deleted up to the service in February 2012. Some PM₁₀ data were also deleted.

4.3 Scotland

4.3.1 Data Capture

The data capture for sites in Scotland for the period October-December 2011 is given in Table 4.3.

Table 4.3 Data Capture October-December 2011: Scotland

Site	CO	PM ₁₀	PM ₂₅	NO ₂	O ₃	SO ₂	Site Average
Scotland							
Aberdeen	-	94.6	95.1	97.0	96.9	-	95.9
Aberdeen Union Street Roadside	-	-	-	95.8	-	-	95.8
Auchencorth Moss	-	81.5	100.0	-	99.9	-	93.8
Auchencorth Moss PM ₁₀ PM ₂₅ (FDMS)	-	98.1	98.5	-	-	-	98.3
Bush Estate	-	-	-	99.7	100.0	-	99.8
Dumbarton Roadside	-	-	-	99.7	-	-	99.7
Dumfries	-	-	-	99.5	-	-	99.5
Edinburgh St Leonards	87.6	99.5	97.2	99.8	99.9	98.9	97.2
Eskdalemuir	-	-	-	99.7	100.0	-	99.8
Fort William	-	-	-	33.6	100.0	-	66.8

Site	CO	PM ₁₀	PM ₂₅	NO ₂	O ₃	SO ₂	Site Average
Glasgow Centre	99.8	82.1	95.0	94.6	99.8	99.8	95.2
Glasgow Kerbside	-	0.0	82.3	99.5	-	-	60.6
Grangemouth	-	99.5	89.2	98.3	-	99.7	96.7
Grangemouth Moray	-	-	-	97.3	-	-	97.3
Inverness	-	82.6	94.6	94.8	-	-	90.7
Lerwick	-	-	-	-	98.0	-	98.0
Peebles	-	-	-	99.9	95.1	-	97.5
Strath Vaich	-	-	-	-	99.4	-	99.4
Number of sites	2	8	8	14	10	3	18
Number of sites < 90%	1	4	2	1	0	0	2
Network Mean (%)	93.7	79.8	94.0	93.5	98.9	99.4	93.4

4.3.2 Site Specific Issues

Fort William

A leak was found in the sample inlet of the NO_x analyser; data have been deleted from 26 July to 26 October

Glasgow Kerbside

Noisy and suspiciously low data resulted in a succession of engineers visits. The PM₁₀ sensor was ultimately removed for workshop repair; all PM₁₀ data for 2011 have been deleted. The air conditioning unit has been a particular source of problems during this and previous quarters.

4.4 Wales

4.4.1 Data Capture

The data capture for sites in Wales for the period October-December 2011 is given in Table 4.4.

Table 4.4 Data Capture October-December 2011: Wales

Site	CO	PM ₁₀	PM ₂₅	NO ₂	O ₃	SO ₂	Site Average
Wales							
Aston Hill	-	-	-	99.5	99.9	-	99.7
Cardiff Centre	99.4	98.9	79.2	94.1	99.8	99.1	95.1
Chepstow A48	-	99.0	93.9	98.1	-	-	97.0
Cwmbran	-	-	-	99.6	99.8	-	99.7
Mold	-	-	-	99.9	100.0	-	99.9
Narberth	-	86.8	-	99.4	85.7	99.1	92.7
Newport	-	65.6	53.1	68.9	-	-	62.5
Port Talbot Margam	99.6	96.7	97.1	99.7	99.5	99.5	98.7
Port Talbot Margam PM ₁₀ PM _{2.5} (PM ₁₀ Partisol)	-	96.7	-	-	-	-	96.7
Swansea Roadside	-	57.9	96.3	99.6	-	-	84.6
Wrexham	-	100.0	100.0	99.5	-	99.6	99.8
Number of sites	2	8	6	10	6	4	11
Number of sites < 90%	0	3	2	1	1	0	2
Network Mean (%)	99.5	87.7	86.6	95.8	97.4	99.3	93.3

4.4.2 Site Specific Issues

Newport

The PM_{2.5} dryer was replaced on 28 July following a period of high dewpoints. Further instability resulted in the loss of data from 12 August to 26 October.

Swansea Roadside

The Swansea Roadside FDMS instruments performed very poorly during 2011, and the instruments were ultimately replaced with BAM instruments in November. The PM₁₀ FDMS data up to removal have been deleted, and some further data loss occurred after replacement due to communications problems..

4.5 Northern Ireland (including Mace Head)

4.5.1 Data Capture

The data capture for sites in Northern Ireland (including Mace Head) for the period October-December 2011 is given in Table 4.5.

Table 4.5 Data Capture October-December 2011: Ireland

Site	CO	PM ₁₀	PM ₂₅	NO ₂	O ₃	SO ₂	Site Average
Ireland							
Mace Head	-	-	-	-	99.8	-	99.8
N Ireland							
Armagh Roadside	-	96.8	-	99.8	-	-	98.3
Ballymena Ballykeel	-	-	-	-	-	98.4	98.4
Belfast Centre	83.6	93.9	97.7	99.8	99.8	99.7	95.8
Derry	-	99.7	98.8	100.0	94.8	94.7	97.6
Lough Navar	-	0.0	-	-	98.9	-	49.4
Number of sites	1	4	2	3	4	3	6
Number of sites < 90%	1	1	0	0	0	0	1
Network Mean (%)	83.6	72.6	98.3	99.8	98.3	97.6	89.9

4.5.2 Site Specific Issues

Lough Navar

At the ESU service on 6 February, the bypass flow on the FDMS was found to be disconnected from the splitter unit in the roofspace. As this is not accessed by the QA/QC Unit, it was deduced that the tube must have been removed at the last engineer's visit, which was during the summer. All PM₁₀ data have therefore been deleted from 24 August 2011 to 14 February 2012, when the tube was reattached.

4.6 Overall Data Capture

Overall data capture for each pollutant across the network for the quarter is given in Table 4.6

Table 4.6: Data Capture by Pollutant, Entire Network

Site	CO	PM₁₀	PM₂₅	NO₂	O₃	SO₂	
Number of sites	23	68	78	117	82	46	135
Number of sites < 90%	3	15	19	14	3	5	23
Network Mean (%)	97.0	90.7	89.3	94.2	97.5	95.2	93.2

Note that data capture is calculated for the whole month for each pollutant (except for new sites, which are from the start date), so additional analysers installed during the period will have reduced data captures quoted.

Section 2 Annual Review 2011

5 Introduction

The QA/QC Unit has produced detailed quarterly reports giving an overview of network performance, reasons for data losses and data capture statistics.

Recommendations for equipment and site upgrades and replacements have also been made. A list of the reports for 2011 is given in Table 5.1.

Table 5.1 QA/QC Data Ratification and Intercalibration Reports, 2011

	Type	Report Title	Reference
1	Ratification and Intercalibration	QA/QC Data Ratification and Intercalibration Report for the Automatic Urban and Rural Network, January-March 2011	AEAT/ENV/R/3194
2	Ratification	QA/QC Data Ratification Report for the Automatic Urban and Rural Network, April-June 2011	AEAT/ENV/R/3236
3	Ratification and Intercalibration	QA/QC Data Ratification and Intercalibration Report for the Automatic Urban and Rural Network July-September 2011	AEAT/ENV/R/3248
4	Ratification and Annual Review	QA/QC Data Ratification Report for the Automatic Urban and Rural Network October-December 2011 and Annual Review for 2011	AEAT/ENV/R/3284

All reports are available on the UK Air Information Resource website (<http://uk-air.defra.gov.uk/>).

Data are routinely ratified on a 3-monthly basis. It should however be noted that there are occasionally circumstances where data which have been flagged as “Ratified” could be subject to further revision. This may be for example where:

- A QA/QC audit has detected a problem which affects data back into an earlier ratification period.
- Long-term analysis has detected an anomaly between expected and measured trends which requires further investigation and possible data correction. This was the case with 2000 –2008 gravimetric particulate monitoring data in the UK national network.
- Further research comes to light which indicates that new or tighter QA/QC criteria are required to meet the data quality objectives. This may require review and revision of historical data by applying the new criteria.

In addition, site issues found during one quarter may affect data from previous quarters, and it may be necessary on occasions to delete data which have already been reported as ratified. A list of these occurrences is given in each QA/QC report and also on UK-AIR.

6 Changes to network during 2011

The following new analysers were commissioned at existing sites in 2011-see Table 6.1.

Table: 6.1 Additional Analysers installed for Directive Compliance from 1 Jan 2011

Site	Pollutant	Date started
Canterbury,	O ₃	15/3/2011
York Fishergate	PM _{2.5}	1/9/2011

The following new sites were commissioned in 2011-see Table 6.2.

Table 6.2: Sites Added to the AURN during 2011

	Pollutants	Date started
Birmingham Acocks Green	NO _x O ₃ SO ₂ PM _{2.5}	18/03/2011
Lincoln Canwick Road	NO ₂	1/8/2011
Southwark A2 Old Kent Road	NO ₂ PM ₁₀	01/01/2011

The following sites were closed in 2011:

Glasgow City Chambers (16 March)
Sandwell West Bromwich (31 December)

The CO analyser at Bristol Old Market was decommissioned on 15 July following instrument failure.

7 Network Intercalibrations

Two complete network intercomparisons were carried out at 6-monthly intervals during 2011. In addition, all network ozone analysers are calibrated by the QA/QC Unit every three months. These are an important part of the overall QA/QC programme for the AURN network. The purpose of these intercomparisons is to determine the network measurement accuracy, consistency and intercomparability across the entire network. The latest exercise covered 127 sites plus any co-located Partisols. The procedures used, and a summary of the results obtained, are provided in the January-March and July-September QA/QC reports.

A summary of the number of analysers in the network found to be providing provisional data outwith the defined accuracy limits (the "outlier" sites) is given in Figure 7.1. A full definition of what constitutes an outlier site for the different pollutants is given in the appropriate Quarterly Reports. Note also that, for the vast majority of these outlier sites, the data will have been fully corrected as part of the subsequent data ratification process.

Figure 7.1 Outliers identified during 2011 intercalibration exercises.

Analyser	Winter 2011 intercalibration			Summer 2011 intercalibration		
	Number of outliers	Number in network	% outliers in total	Number of outliers	Number in network	% outliers in total
NO _x analyser	19	114	17%	26	118	22%
CO analyser	2	26	8%	1	24	4%
SO ₂ analyser	7	45	16%	14	46	30%
Ozone analyser	16	81	20%	9	83	11%
TEOM and BAM analysers	3 k ₀ , 4 flow	4 TEOM PM ₁₀ 54 FDMS PM ₁₀ 1 BAM PM ₁₀ 0 TEOM PM _{2.5} 68 FDMS PM _{2.5} 1 BAM PM _{2.5}	5%	1 k ₀ , 2 flow	60 FDMS PM ₁₀ 1 BAM PM ₁₀ 67 FDMS PM _{2.5} 1 BAM PM _{2.5}	2%
Gravimetric PM analysers	0	7 PM ₁₀ 9 PM _{2.5}	0%	1 flow	9 PM ₁₀ 12 PM _{2.5}	5%
Total	51	408	12%	54	421	12.8%

Sites which have been commissioned, recommissioned in new locations or have had new analysers installed have been audited by the QA/QC Unit prior to the publication of the data from the site.

The intercalibration visits are also used to ensure information about network sites and analysers are correct and up to date. For example, at recent network intercalibration exercises, information has been gathered on the sample manifold systems used at all sites, the detailed set-up parameters for the FDMS particle analysers, and how site locations compare to the requirements listed in the EC Directives.

In addition to the network intercalibrations, the QA/QC Unit carries out pre-commissioning audits on new sites and analysers introduced to the network. Although these audits are not included in the summary above, these provide a vital role in ensuring the overall data quality; data are not disseminated from new sites or analysers until a satisfactory performance has been verified by the QA/QC Unit. The installation timetable for FDMS PM₁₀ and PM_{2.5} analysers, and new CEN-compliant gas analysers has meant the QA/QC Unit has had to make numerous replicate visits to sites to ensure data may be disseminated in time for Directive Compliance, for example.

8 ESU, CMCU, LSO and QA/QC Meetings

During 2011, the QA/QC Unit continued to liaise closely with the ESUs to ensure optimal performance of the network through service and maintenance arrangements. The QA/QC Unit have provided the ESUs with spreadsheets to calculate various analyser performance parameters (eg converter efficiency, linearity) in line with the CEN requirements; ESUs have been requested to integrate the principles into their routine site tests.

All parties were in agreement that work undertaken by the ESUs is a vitally important part of the overall data quality management process for the network, and it is planned to repeat the meetings at regular intervals. Regular meetings between Defra and the devolved administrations, CMCU and the QA/QC Unit have also been initiated.

The QA/QC Unit has attended and presented at the AURN LSO meeting, and presented network updates as appropriate. These presentations are available on the AURN Hub.

The QA/QC Unit has continued to provide ESUs with ozone photometer calibrations prior to the start

of each 6-monthly service schedule. In addition, weighed FDMS filters have been supplied to ESUs as required, to enable reliable Ko measurements to be made.

9 Network Data Capture

The overall network data capture for 2011 was 91.3%, which is just above the 90% target level. However, not all sites achieved >90% and a table of data capture for the 40 sites with less than 90% capture is given in Section 10.

A summary of data capture by pollutant for the year 2011 is given in Table 9.1

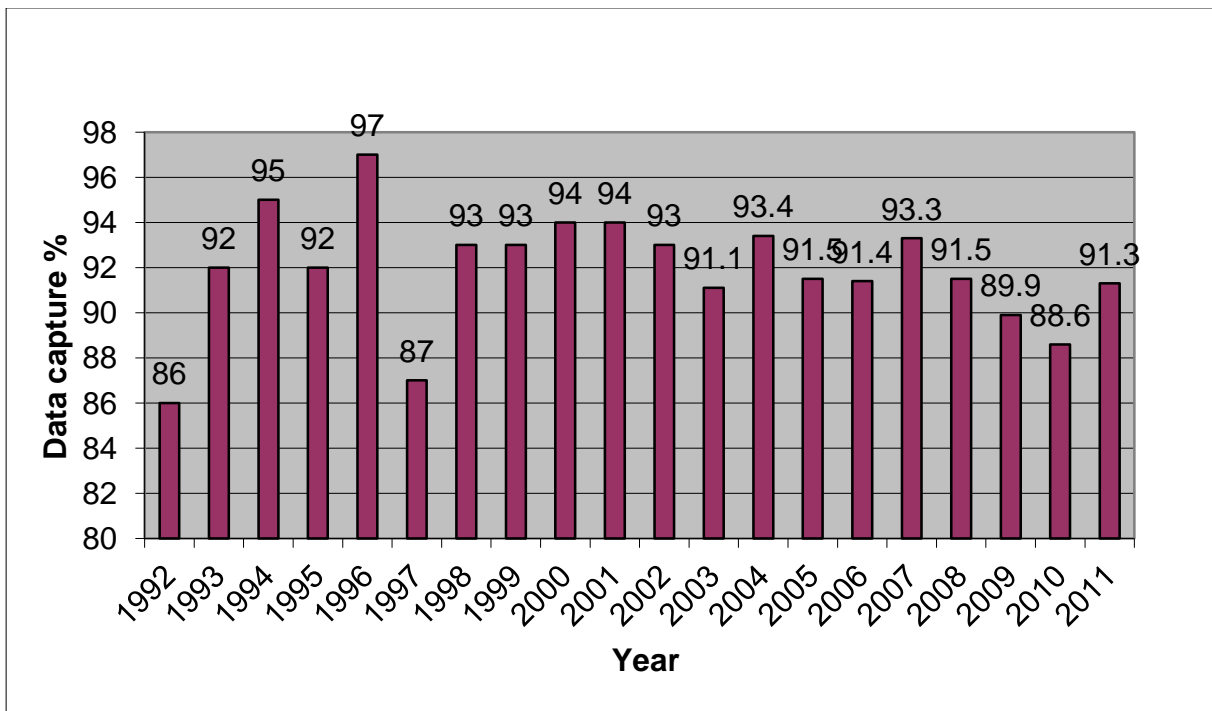
Table 9.1 Summary of data capture by pollutant, 2011

Site	CO	PM ₁₀	PM ₂₅	NO ₂	O ₃	SO ₂	Site Average
Number of sites	24	68	78	118	82	46	136
Number of sites < 90%	2	33	35	20	8	8	40
Network Mean (%)	95.7	83.0	85.4	93.5	95.9	94.6	91.3

For these sites, pollution statistics calculated for analysers with data capture above 75% or modelled data have to be used. However, neither of these approaches is entirely satisfactory. Hence, the QA/QC unit continues to make the recommendation that greater attention needs to be paid to minimising data loss from all sites.

The network annual average data capture of 91.3% is higher than the previous year. The performance has again been affected this year by long-term problems with analysers, mainly FDMS. Figure 10.1 shows the annual network data capture since the start of the AURN in 1992.

Figure 10.1 Data Capture 1992-2011



10 Significant Site Issues

A number of sites have been identified at which the analyser performance has been below expectation, and significant quantities of data have been deleted from previous quarters. These are discussed individually below. These data from previous quarters may have been reported as ratified.

A brief description of the main sources of data loss at the 40 sites with data capture below 90% for the year is given in Table 10.1.

Table 10.1 Significant data loss, 2011

Sites with average data capture < 90%

Site	CO	PM ₁₀	PM ₂₅	NO ₂	O ₃	SO ₂	Site Avg.	Principle reason for loss
England								
Birmingham Tyburn	-	76.1	79.3	99.1	99.6	93.0	89.4	High PM baselines
Blackpool Marton	-	-	59.5	82.8	84.7	-	75.6	Air conditioning fault; analysers turned off
Brighton Preston Park	-	-	78.6	64.1	91.6	-	78.1	Lack of calibrations due to no span gas
Bristol Old Market	98.6	-	-	59.8	-	-	79.2	Converter failure
Chesterfield Roadside	-	65.7	89.7	87.1	-	-	80.8	Electrical supply fault; various FDMS faults
Coventry Memorial Park	-	-	63.5	97.7	98.6	-	86.6	Prolonged FDMS fault
Eastbourne	-	64.6	98.2	43.9	-	-	68.9	Lack of calibrations, PM ₁₀ valve fault
Haringey Roadside	-	65.5	73.1	73.7	-	-	70.8	Power supply damaged in riots
Harwell PARTISOL	-	91.8	84.1	-	-	-	87.9	Filter exchange faults
Leamington Spa	-	69.8	68.4	98.4	99.2	96.8	86.5	High PM baselines
London Bexley	98.5	-	96.9	87.4	-	69.0	88.0	Unreliable loan SO ₂ analyser
London Eltham	-	-	79.1	91.0	98.7	-	89.6	Loss of FDMS firmware; sample heads not connected
London Haringey	-	-	-	67.1	99.2	-	83.1	Sampling and PMT faults
London Harlington	-	58.1	84.1	96.2	98.2	-	84.1	Dryer fault
London Marylebone Road	96.2	93.6	95.3	97.2	56.9	86.9	87.7	Ozone analyser fault
London Marylebone Road PARTISOL	-	81.1	82.2	-	-	-	81.6	PM _{2.5} sampler removed for repair; PM ₁₀ sampler damaged by water ingress
Market Harborough	-	-	-	78.6	88.7	-	83.6	Internal sampling, ozone analyser fault
Oxford St Ebbes	-	93.7	82.2	93.9	-	-	89.9	High PM _{2.5} baseline
Rochester Stoke	-	72.1	84.1	88.8	88.6	84.0	83.5	Air conditioning and analyser faults
Salford Eccles	95.0	93.6	88.4	86.5	94.0	80.3	89.6	

Site	CO	PM ₁₀	PM ₂₅	NO ₂	O ₃	SO ₂	Site Avg.	Principle reason for loss
Sandy Roadside	-	36.5	39.2	93.6	-	-	56.4	Prolonged FDMS faults; air conditioning and access problems
Scunthorpe Town	-	95.2	-	95.3	-	71.2	87.2	Persistent SO ₂ analyser faults
Southend-on-Sea	-	-	61.4	66.8	66.8	-	65.0	Closed for building works
Southwark A2 Old Kent Road	-	80.8	-	73.7	-	-	77.2	NOx converter fault following installation of site
Wigan Centre	-	-	0.0	97.8	92.9	-	63.6	Anomalous PM _{2.5} volatile concentrations
Yarner Wood	-	-	-	85.5	82.5	-	84.0	Ozone analyser fault; manifold fan switched off
York Bootham	-	85.9	66.7	-	-	-	76.3	PM _{2.5} > PM ₁₀
York Fishergate	-	42.1	98.0	94.6	-	-	78.2	Closed while new enclosure installed
N Ireland								
Belfast Centre	94.7	60.9	80.8	98.7	98.7	98.7	88.8	Vandalism
Derry	-	93.0	55.1	99.3	97.7	93.7	87.8	FDMS faults
Lough Navar	-	60.0	-	-	98.7	-	79.3	FDMS auxiliary flow disconnected
Scotland								
Aberdeen Union Street Roadside	-	-	-	86.3	-	-	86.3	Sampling fault
Auchencorth Moss PM10 PM25	-	80.2	98.8	-	-	-	89.5	PM ₁₀ analyser removed for repair
Fort William	-	-	-	64.3	97.8	-	81.1	Leak in sampling inlet
Glasgow Kerbside	-	0.0	90.2	98.1	-	-	62.8	Air conditioning and FDMS faults
Wales								
Cardiff Centre	98.7	55.9	74.3	95.2	98.8	93.9	86.1	Poor FDMS performance; PM10 removed for lengthy repair
Chepstow A48	-	84.6	79.5	98.8	-	-	87.6	PM _{2.5} > PM ₁₀ ; analysers removed for repair
Narberth	-	48.3	-	97.7	95.4	97.1	84.6	Air conditioning and FDMS faults
Newport	-	80.5	61.1	91.0	-	-	77.5	FDMS dryer faults
Swansea Roadside	-	62.5	28.6	99.1	-	-	63.4	FDMS units unreliable; ultimately replaced by BAMs

Bold data captures are for data that are provisional and subject to further quality control

Appendices

Appendix 1: Recommendations for Upgrade or Replacement of Equipment

Appendix 2: Partisol Data Report

Appendix 3: Information for New Sites

Appendix 1

Recommendations for Upgrade or Replacement of Equipment

As requested by Defra, QA/QC Unit has provided a list of suggestions for equipment that may need replacing or upgrading in the network. The following provides a summary of the outstanding issues to date since July 2005. Recommendations have been prioritised as follows:

Priority	Definition	Time-scale
High	Immediate action necessary to avoid compromising data capture/quality or safety.	Within 2 weeks
Medium	Essential but not immediate	3-6 months
Low	Desirable but not essential	As appropriate

* Note – QA/QC Unit's practice is to notify CMCU immediately of any high priority issues at the time of the event

Table A1 Recommendations.

	Recommendations February 2012	Priority	Action
32	ESUs are reminded of the importance of supplying service records for Partisol samplers to QA/QC Unit	High	ESU
31	Zero air scrubbers to be changed for zero air cylinders at all sites (where possible)	Medium	QA/QC ESU
	Recommendations August 2008	Priority	Action
27	Many sites require modifications to permit safe roof access for measuring PM analyser flows	High	CMCU
	Recommendations January 2008	Priority	Action
25	It is recommended that LSOs continue to pay particular attention to the NO ₂ calibration results, to see whether the NO response is significantly higher (>10ppb) than that obtained for the zero calibration. These observations should be reported to CMCU as soon as possible	High	LSO
24	It is strongly recommended that ESUs clean all NOx analyser switching valves during servicing, and ensure the valve is leak checked afterwards. Suspect leaking valves are highlighted by the QA/QC Unit during audits	High	ESU
	Recommendations January 2007		
22	ESUs to ensure all NOx converter software settings to be 100%.	High	ESUs to check at service

Appendix 2

Partisol Data: October-December 2011

The principal reasons for data loss (for instruments where data capture <90%) are given in Table A2.1

Table A2.1 Reasons for Data Loss

Site	Data capture	Principal reasons for loss
Auchencorth Moss PM ₁₀	82%	Filters went through Partisol unexposed 16-31 December
Harwell PM _{2.5}	74%	Instrument failure 8 December
Inverness PM ₁₀	83%	Numerous filter exchange failures. This instrument has a history of such problems.
London North Kensington PM ₁₀	89%	Filter exchange failures followed by pump failure, 25 November-1 December. Power supply fault 6 December. Flow correction necessary 14 July-9 November
London North Kensington PM _{2.5}	56%	Flowrate >10% from 16.7l/min 1 October-9 November
London Westminster PM _{2.5}	86%	Filter exchange failures 17-31 October. Communications failure 14-15 December

Appendix 3

Site Details for New Sites 2011

Details of all site locations can be found at <http://uk-air.defra.gov.uk/interactive-map>

Site	Start date	Latitude	Longitude	Altitude (m)	Site type	Area type
York Fishergate	31/08/2011	53.951889	-1.075861	-	traffic	Urban
Lincoln Canwick Rd.	27/07/2011	53.221373	-0.534189	7	traffic	Urban
Birmingham Acocks Green	18/03/2011	52.437165	-1.829999	10	Background	Urban
Southwark A2 Old Kent Road	01/01/2011	51.480499	-0.05955	10	traffic	Urban



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