
QA/QC Data Ratification Report for the Automatic Urban and Rural Network, October-December 2013, and Annual Review 2013



Report for Department for Environment, Food and Rural Affairs, The Scottish Government, The Welsh Government, The Northern Ireland Department of Environment

Ricardo-AEA/R/3416

Issue 1

July 2014

Customer:

Department for Environment, Food and Rural Affairs, The Scottish Government, The Welsh Government, The Northern Ireland Department of Environment

Customer reference:

RMP 4961

Confidentiality, copyright & reproduction:

This report is Crown Copyright and has been prepared by Ricardo-AEA Ltd under contract to Defra. The contents of this report may not be reproduced in whole or in part, nor passed to any organisation or person without the specific prior written permission of Defra. Ricardo-AEA Ltd accepts no liability whatsoever to any third party for any loss or damage arising from any interpretation or use of the information contained in this report, or reliance on any views expressed therein.

Ricardo-AEA reference:

Report no. Ricardo-AEA/R/3416

Contact:

Rachel Yardley
Marble Arch Tower
55 Bryanston Street
London
W1H 7AA

t: 01235 753630

e: Rachel.yardley@ricardo-aea.com

Ricardo-AEA is certificated to ISO9001 and ISO14001

Author:

Stewart Eaton

Approved By:

Rachel Yardley

Date:

4 July/2014

Signed:

Executive summary

Ricardo-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 Department of Environment (DoE) in Northern Ireland.

Ratified hourly average data capture for the network averaged 92.27% for all pollutants (O_3 , NO_2 , SO_2 , CO , PM_{10} and $PM_{2.5}$) during the 3-month reporting period October-December 2013. Average data capture for all pollutants were above 90%. There were 30 stations with data capture less than 90% for the period.

A total of 129 monitoring stations in the AURN operated during this quarter, of which 60 are Local Authority owned stations affiliated to the national network. Some are co-located and separately named gravimetric particulate analysers at stations with automatic analysers. Many affiliated stations have additional Defra-funded analysers installed on site.

The main reasons for data loss at the stations have been provided and these were predominantly due to instrument faults, response instability or problems associated with the replacement of analysers and infrastructure. .

Table of contents

Section A Data Ratification Report, October-December 2013

| | | |
|----------|--|-----------|
| 1 | Introduction | 1 |
| 1.1 | Overview of Network Performance | 1 |
| 1.2 | Changes to Ratified Data | 2 |
| 2 | Changes in the Network for Directive Compliance | 3 |
| 3 | Generic Data Quality Issues | 3 |
| 3.1 | FDMS Performance Issues | 3 |
| 4 | Station Specific Issues | 4 |
| 4.1 | London | 4 |
| 1.1 | England (excluding London) | 5 |
| 4.2 | Scotland | 9 |
| 4.3 | Wales | 11 |
| 4.4 | Northern Ireland (including Mace Head) | 11 |
| 4.4 | Overall Data Capture | 12 |
| 5 | FDMS Baseline Checks | 13 |
| 6 | LSO Manual and AURN Hub | 14 |

Section B Annual Review 2013

| | | |
|-----------|--|-----------|
| 7 | Introduction | 16 |
| 8 | Changes to network during 2013 | 16 |
| 8.1 | Changes to Stations | 16 |
| 8.2 | Changes to Network Operation | 17 |
| 9 | Network Intercalibrations | 17 |
| 10 | ESU, CMCU, LSO and QA/QC Meetings | 18 |
| 11 | Network Data Capture | 18 |
| 12 | Significant Station Issues | 20 |
| 12.1 | Significant Data Loss | 20 |

Appendices

Appendix 1: Partisol Data Report

Appendix 2: Station Information

SECTION A Data Ratification Report, October-December 2013

1 Introduction

This quarterly report covers the Quality Assurance and Control (QA/QC) activities undertaken by Ricardo-AEA to ratify automatic monitoring data from Defra and the Devolved Administrations' urban and rural air quality monitoring network (AURN) for the period 1 October – 31 December 2013. During this quarter there were a total of 129 operational monitoring stations in the Network. There were 69 Defra-funded stations and 60 affiliate stations, although many affiliate stations have fully-funded PM₁₀ and/or PM_{2.5} analysers. Eleven stations have non-automatic particulate samplers (Partisols); some of these are co-located 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 (daily average for Partisols) data capture for the network averaged 92.27% for all pollutants (O₃, NO₂, SO₂, CO, PM₁₀ and PM_{2.5}) during the 3 month reporting period October-December 2013 (see Table 1.1). All species achieved 90% or higher data capture on average. Data capture statistics 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 stations starting or closing during the period, the data capture is based on the actual date starting or closing.

Table 1.1: AURN Ratified Data Capture (%) by Quarter, January-December 2013

| | CO | PM ₁₀ | PM _{2.5} | NO ₂ | O ₃ | SO ₂ | Mean |
|---------|-------|------------------|-------------------|-----------------|----------------|-----------------|-------|
| Q1 2013 | 95.42 | 89.99 | 91.63 | 90.65 | 94.17 | 92.38 | 91.87 |
| Q2 2013 | 94.51 | 79.72 | 87.77 | 94.95 | 96.25 | 93.27 | 91.92 |
| Q3 2013 | 91.13 | 78.04 | 77.27 | 91.00 | 93.56 | 88.16 | 86.59 |
| Q4 2013 | 97.23 | 90.83 | 93.59 | 94.04 | 94.66 | 91.94 | 92.27 |

Overall, 324 out of the 383 analysers (85%) achieved data capture levels above the required 90% target during this reporting period. Table 1.2 shows the number of analysers which did not meet the target.

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

| Total Number Of Analysers | | Q1 Jan-Mar 2013 (No. below 90%) | Q2 Apr-Jun 2013 (No. below 90%) | Q3 July-Sept 2013 (No. below 90%) | Q4 Oct-Dec 2013 (No. below 90%) |
|--------------------------------|-----|------------------------------------|------------------------------------|--------------------------------------|------------------------------------|
| CO | 7 | 1 | 1 | 1 | 0 |
| NO ₂ | 116 | 18 | 10 | 21 | 15 |
| O ₃ | 82 | 10 | 5 | 9 | 11 |
| PM ₁₀ ¹ | 69 | 15 | 28 | 34 | 18 |
| PM _{2.5} ¹ | 80 | 15 | 18 | 42 | 11 |
| SO ₂ | 29 | 4 | 2 | 6 | 4 |
| Total <90% | | 63 | 64 | 113 | 59 |

¹ Includes FDMS, BAM and Partisol analysers.

In total, 30 out of the 129 operational network stations in the quarter (23%) had an average data capture rate below the required 90% level for the October-December 2013 period.

1.2 Changes to Ratified Data

The following data from previous quarters have been changed as a result of the ratification process for this quarter:

- Birmingham Tyburn Roadside PM₁₀ deleted 26-30 September
- Blackburn Darwen Roadside NO_x, rescaled 1 January-30 September
- Carlisle Roadside PM₁₀, deleted 1 January-15 July
- Chesterfield PM_{2.5}, deleted 26 June-30 September
- Coventry Memorial Park PM_{2.5}, deleted 15 July-30 September
- Derry PM_{2.5}, deleted 15 March-17 April
- Grangemouth PM_{2.5} and PM₁₀, deleted 19 May-22 June
- Leamington Spa NO_x, deleted 15 July-30 September
- Leamington Spa Rugby Road PM₁₀, deleted 20 April-30 September
- London Bloomsbury PM_{2.5}, deleted 1 January-9 May
- London Eltham P_{2.5}, deleted 2 June-18 August
- Stanford-le-Hope Roadside PM_{2.5}, deleted 13-19 April
- Warrington PM_{2.5}, deleted 6-22 July

A list of changes to ratified data is given at <http://uk-air.defra.gov.uk/data/changes-to-ratified-data>

2 Changes in the Network for Directive Compliance

The following stations were commissioned during this period:

| Station | Pollutants measured | Date started |
|----------------------------|---|------------------|
| Glasgow Townhead | NO _x O ₃ PM _{2.5} PM ₁₀ | 7 October 2013 |
| Sheffield Devonshire Green | NO _x O ₃ PM _{2.5} PM ₁₀ | 31 October 2013 |
| Barnstaple A39 | PM _{2.5} PM ₁₀ | 14 November 2013 |

3 Generic Data Quality Issues

3.1 FDMS Performance Issues

Several FDMS analysers continued to give problems during the quarter. Out of 145 operational analysers, 29 had data capture less than 90% (21 less than 85%). However, average data capture for both PM_{2.5} and PM₁₀ were above 90% for this quarter.

4 Station Specific Issues

In this section, we now discuss in turn specific station issues for the following geographic groupings – London, England (excluding London), Scotland, Northern Ireland and Wales. Where analysers were commissioned during the period, the stated data capture for these instruments is calculated from the date of commissioning. Analysers with data capture less than 90% are highlighted in yellow and those with data capture less than 85% are highlighted in orange.

4.1 London

4.1.1 Data Capture

The data capture for stations in London (within the M25) for the period October-December 2013 is given in Table 4.1:

Table 4.1 Data Capture for London, October-December 2013 (%)

| Station | CO | PM ₁₀ | PM ₂₅ | NO ₂ | O ₃ | SO ₂ | Average |
|-----------------------------------|-------|------------------|------------------|-----------------|----------------|-----------------|---------|
| Camden Kerbside | | 99.64 | 99.82 | 99.64 | | | 99.70 |
| Haringey Roadside | | 82.56 | 99.41 | 99.77 | | | 93.92 |
| London Bexley | | | 99.91 | 99.68 | | 97.10 | 98.90 |
| London Bloomsbury | | 99.28 | 99.64 | 99.55 | 99.91 | 98.96 | 99.47 |
| London Eltham | | | 66.62 | 95.20 | 99.55 | | 87.12 |
| London Haringey Priory Park South | | | | 99.82 | 99.41 | | 99.62 |
| London Harlington | | 86.59 | 99.68 | 95.02 | 95.74 | | 94.26 |
| London Harrow Stanmore | | | 80.53 | | | | 80.53 |
| London Hillingdon | | | | 99.91 | 93.89 | | 96.90 |
| London Marylebone Road | 99.64 | 96.24 | 96.88 | 99.46 | 99.50 | 24.41 | 86.02 |
| London Marylebone Road (Partisol) | | 98.91 | 98.91 | | | | 98.91 |
| London N. Kensington | 99.82 | 96.01 | 97.37 | 99.77 | 99.41 | 99.77 | 98.69 |
| London N. Kensington (Partisol) | | 100.00 | 90.22 | | | | 95.11 |
| London Teddington | | | | 99.18 | 0.54 | | 49.86 |
| London Teddington Bushy Park | | | 71.15 | | | | 71.15 |
| London | | | 100.00 | 99.82 | 99.91 | | 99.87 |

| Station | CO | PM ₁₀ | PM _{2.5} | NO ₂ | O ₃ | SO ₂ | Average |
|---|--------------|------------------|-------------------|-----------------|----------------|-----------------|--------------|
| Westminster | | | | | | | |
| Southwark A2 Old Kent Road | | 97.51 | | 85.82 | | | 91.67 |
| Tower Hamlets Roadside | | | | 91.49 | | | 91.49 |
| Number of Stations | 2 | 9 | 13 | 14 | 9 | 4 | 18 |
| Number of stations < 85 % | 0 | 1 | 3 | 0 | 1 | 1 | 3 |
| Number of stations < 90% | 0 | 2 | 3 | 1 | 1 | 1 | 5 |
| Network mean | 99.73 | 95.19 | 92.32 | 97.44 | 87.54 | 80.06 | 90.73 |

4.1.2 Station Specific Issues

London Eltham

The FDMS PM_{2.5} analyser was removed for workshop repair from 9 October to 5 November following loss of firmware after a power cut.

London Harrow Stanmore

A period of low data from 6 to 17 December was deleted; an engineer found the valve motor was faulty.

London Marylebone Road

The SO₂ data from 23 October to 7 January were deleted due to a flow fault resulting in flat data.

London Teddington

At the winter QA/QC audit on 20 February 2014, the ozone sample inlet was found to be connected to the wrong port on the analyser. Data have been deleted back to the autumn 2013 audit on 2 October 2013.

London Teddington Bushy Park

The FDMS PM_{2.5} data have been very noisy since installation of other equipment in the cabin. This is believed to be due to inadequate air conditioning in the cabin.

1.1 England (excluding London)

4.1.3 Data Capture

The data capture for stations in England for the period October-December 2013 is given in Table 4.2:

Table 4.2 Data Capture for England, October-December 2013

| Station | CO | PM ₁₀ | PM _{2.5} | NO ₂ | O ₃ | SO ₂ | Average |
|-----------------|----|------------------|-------------------|-----------------|----------------|-----------------|---------|
| Barnsley Gawber | | | | 99.32 | 99.46 | 95.97 | 98.25 |
| Barnstaple A39 | | 76.30 | 91.76 | | | | 84.03 |
| Bath Roadside | | | | 99.73 | | | 99.73 |
| Billingham | | | | 95.43 | | | 95.43 |

| Station | CO | PM ₁₀ | PM ₂₅ | NO ₂ | O ₃ | SO ₂ | Average |
|----------------------------------|-------|------------------|------------------|-----------------|----------------|-----------------|---------|
| Birmingham Acocks Green | | | 98.60 | 99.86 | 99.91 | | 99.46 |
| Birmingham Tyburn | | 99.37 | 99.68 | 65.81 | 99.91 | 99.73 | 92.90 |
| Birmingham Tyburn Roadside | | 96.33 | 87.95 | 94.38 | 93.43 | | 93.03 |
| Blackburn Darwen Roadside | | | | 99.77 | | | 99.77 |
| Blackpool Marton | | | 0.00 | 95.65 | 99.91 | | 65.19 |
| Bottesford | | | | | 99.14 | | 99.14 |
| Bournemouth | | | 97.83 | 99.82 | 99.95 | | 99.84 |
| Brighton Preston Park | | | 93.48 | 99.73 | 99.91 | | 99.69 |
| Bristol St Paul's | | 99.91 | 99.91 | 99.77 | 99.95 | | 99.89 |
| Cambridge Roadside | | | | 99.09 | | | 99.09 |
| Canterbury | | | | 99.00 | 99.14 | | 99.07 |
| Carlisle Roadside | | 99.68 | 99.37 | 99.86 | | | 99.64 |
| Charlton Mackrell | | | | 99.77 | 99.77 | | 99.77 |
| Chatham Centre Roadside | | 84.28 | 90.22 | 84.87 | | | 86.46 |
| Chesterfield | | 99.95 | 99.50 | 98.60 | | | 99.35 |
| Chesterfield Roadside | | 99.59 | 99.68 | 94.29 | | | 97.86 |
| Coventry Memorial Park | | | 46.97 | 95.52 | 99.77 | | 80.75 |
| Eastbourne | | 99.77 | 99.68 | 99.86 | | | 99.77 |
| Exeter Roadside | | | | 98.41 | 99.95 | | 99.18 |
| Glazebury | | | | 98.73 | 99.46 | | 99.09 |
| Great Dun Fell | | | | | 98.55 | | 98.55 |
| Harwell | | 97.60 | 99.37 | 67.66 | 99.86 | 95.70 | 92.04 |
| Harwell (Partisol) | | 91.30 | 100.00 | | | | 95.65 |
| High Muffles | | | | 92.89 | 97.37 | | 95.13 |
| Honiton | | | | 99.91 | | | 99.91 |
| Horley | | | | 99.59 | | | 99.59 |
| Hull Freetown | | 99.50 | 99.77 | 95.65 | 98.32 | 99.68 | 98.59 |
| Ladybower | | | | 99.46 | 99.55 | 96.42 | 98.48 |
| Leamington Spa | | 99.37 | 99.00 | 0.00 | 59.69 | | 64.52 |
| Leamington Spa Rugby Road | | 0.00 | 90.17 | 99.68 | | | 63.29 |
| Leeds Centre | 91.62 | 91.89 | 92.84 | 93.21 | 93.16 | 89.63 | 92.06 |
| Leeds Headingley Kerbside | | 99.86 | 96.42 | 99.73 | | | 98.67 |
| Leicester University | | | 93.03 | 82.65 | 82.65 | | 86.06 |
| Leominster | | | | 99.59 | 99.86 | | 99.73 |
| Lincoln Canwick Road | | | | 99.37 | | | 99.37 |
| Liverpool Queen's Drive Roadside | | | | 91.58 | | | 91.58 |
| Liverpool Speke | | 99.86 | 99.95 | 89.22 | 99.73 | 99.64 | 97.68 |
| Lullington Heath | | | | 96.51 | 99.37 | 94.88 | 96.92 |
| Manchester Piccadilly | | | 99.55 | 99.86 | 100.00 | 99.73 | 99.78 |
| Manchester South | | | | 99.82 | 100.00 | | 99.91 |
| Market Harborough | | | | 99.73 | 87.00 | | 93.37 |
| Middlesbrough | | 66.12 | 80.71 | 99.55 | 99.91 | 99.73 | 89.20 |
| Newcastle Centre | | 99.50 | 99.59 | 99.59 | 99.28 | | 99.49 |

| Station | CO | PM ₁₀ | PM ₂₅ | NO ₂ | O ₃ | SO ₂ | Average |
|-------------------------------------|--------------|------------------|------------------|-----------------|----------------|-----------------|--------------|
| Newcastle Cradlewell Roadside | | | | 59.19 | | | 59.19 |
| Northampton Kingsthorpe | | | 97.83 | 99.77 | 99.91 | | 99.80 |
| Norwich Lakenfields | | 99.86 | 99.41 | 99.77 | 99.91 | | 99.74 |
| Nottingham Centre | | 93.75 | 99.73 | 99.64 | 87.45 | 86.01 | 93.32 |
| Oxford Centre Roadside | | | | 45.06 | | | 45.06 |
| Oxford St Ebbes | | 95.43 | 95.06 | 98.32 | | | 96.27 |
| Plymouth Centre | | 98.46 | 90.63 | 99.82 | 99.91 | | 97.20 |
| Portsmouth | | 68.66 | 99.50 | 69.70 | 99.91 | | 84.44 |
| Preston | | | 97.51 | 98.69 | 99.59 | | 98.60 |
| Reading New Town | | 99.46 | 99.05 | 99.73 | 99.82 | | 99.51 |
| Rochester Stoke | | 99.14 | 99.23 | 95.15 | 99.82 | 99.73 | 98.61 |
| Salford Eccles | | 99.68 | 99.68 | 95.47 | 99.95 | | 98.69 |
| Saltash Callington Road | | 24.86 | 99.46 | | | | 62.16 |
| Sandy Roadside | | 53.49 | 92.98 | 99.32 | | | 81.93 |
| Scunthorpe Town | | 79.17 | | 98.46 | | 99.00 | 92.21 |
| Sheffield Devonshire Green | | 98.22 | 99.07 | 97.96 | 85.56 | | 95.20 |
| Sheffield Tinsley | | | | 57.47 | | | 57.47 |
| Sibton | | | | | 97.60 | | 97.60 |
| Southampton Centre | | 99.91 | 97.37 | 99.28 | 99.28 | 99.77 | 99.12 |
| Southend-on-Sea | | | 97.28 | 99.68 | 99.77 | | 98.91 |
| St Osyth | | | | 99.55 | 99.32 | | 99.43 |
| Stanford-le-Hope Roadside | | 98.96 | 97.51 | 99.68 | | | 98.72 |
| Stockton-on-Tees Eaglescliffe | | 98.55 | 96.11 | 95.43 | | | 96.69 |
| Stoke-on-Trent Centre | | 95.02 | 99.82 | 99.73 | 99.86 | | 98.61 |
| Storrington Roadside | | 94.57 | 94.16 | 95.11 | | | 94.61 |
| Sunderland Silksworth | | | 95.29 | 51.45 | 94.34 | | 80.36 |
| Thurrock | | 86.01 | | 92.62 | 96.56 | 99.64 | 93.70 |
| Walsall Woodlands | | | | 99.91 | 99.91 | | 99.91 |
| Warrington | | 98.32 | 99.59 | 89.72 | | | 95.88 |
| Weybourne | | | | | 88.63 | | 88.63 |
| Wicken Fen | | | | 99.41 | 99.77 | 15.22 | 71.47 |
| Wigan Centre | | | 99.32 | 94.75 | 99.73 | | 97.93 |
| Wirral Tranmere | | | 99.86 | 99.77 | 99.86 | | 99.83 |
| Yarner Wood | | | | 63.77 | 84.60 | | 74.18 |
| York Bootham | | 88.13 | 89.40 | | | | 88.77 |
| York Fishergate | | 76.13 | 94.07 | 94.88 | | | 88.36 |
| | | | | | | | |
| Number of stations < 85 % | 0 | 9 | 3 | 11 | 3 | 1 | 15 |
| Number of stations < 90% | 0 | 11 | 5 | 13 | 7 | 3 | 19 |
| Network mean | 91.62 | 86.75 | 93.80 | 92.11 | 96.89 | 91.90 | 92.05 |

4.1.4 Station Specific Issues

Barnstaple A39

The Barnstaple A39 station was commissioned on 15 November; however a fault with the PM₁₀ analyser resulted in the loss of data until 21 November.

Blackpool Marton

The PM_{2.5} data from Blackpool Marton had been of poor quality for some time and all data were deleted from 1 January to 30 September 2013. No improvement was noted in the fourth quarter, and the fault was only resolved following removal from site and repair by the UK distributor. The collection of acceptable quality data recommenced on 20 February 2014.

Chatham Centre Roadside

A motherboard fault on the PM₁₀ FDMS resulted in the loss of data from 26 October to 7 November. A pressure sensor fault also caused the loss of PM_{2.5} data from 12 to 18 November. A NO_x sampling fault followed an LSO calibration on 19 December; data to the end of the year have been deleted.

Coventry Memorial Park

The PM_{2.5} data was very noisy for much of the year. An ESU callout on 18 November found a leak in a filter unit, which when rectified, resulted in improved data quality. The PM_{2.5} data from 15 July to 18 November have been deleted.

Leamington Spa

The ESU were called out to attend to a problem with negative data being recorded on 20 November, and although a converter fault was identified, no repair was carried out until 14 January 2014. On inspection of the calibrations and the data plots, the fault actually started at the service on 15 July; all NO_x data from 15 July to 14 January 2014 have been deleted. In addition, a logger fault occurred and was removed for investigation at the ESU callout on 20 November, but the ozone analyser was not correctly configured to log data. Thus, the ozone data have been lost from this visit up to 12 December, when a further visit to the station to attempt repairs was made.

Leamington Spa Rugby Road

The PM₁₀ volatile concentrations have been lower than the PM_{2.5} volatiles for much of 2013, and the PM₁₀ data have been deleted from 20 April up to the end of 2013. The analyser was removed for workshop repair in December.

Leicester University

Communication faults resulted in the loss of data from 12 to 18 October (all pollutants) and 6 to 15 November (NO_x and ozone).

Middlesbrough

The PM_{2.5} FDMS was replaced on 15 October following 103 days lost data. The PM₁₀ data from 1 to 31 October have been deleted due to high volatile concentrations compared to other stations in the region.

Newcastle Cradlewell Roadside

The NO_x data have been deleted from 25 November due to a pump fault.

Oxford Centre Roadside

A loan NO_x analyser was installed 29 October following a flow fault with the station analyser which could not be repaired on site. No data from the temporary analyser have been supplied; the repaired station analyser was reinstalled on 6 December.

Portsmouth

A fault with the data logger used for recording NO_x and PM₁₀ data occurred on 1 December, resulting in the loss of these data up to 15 December when communications restarted without any intervention. However, the fault reoccurred on 19 December up to 2 January, when the power supply was repaired.

Saltash Callington Road

Much of the PM₁₀ volatile data were anomalously high compared to other stations and the PM₁₀ data from 18 October to 24 December have been deleted.

Sandy Roadside

The PM₁₀ data were noisy during the quarter; data from 25 November to 31 December have been deleted.

Sheffield Tinsley

The NO_x analyser suffered from flow and ozonator faults persisting since the previous quarter. These were finally rectified on 9 November.

Sunderland Silksworth

The NO_x pump failed on 30 September, but the lack of a service contract prevented a replacement until 6 November. The analyser had then become contaminated with NO₂ from the permeation tube, and satisfactory data were not collected until 14 November.

Weybourne

A suspected pump failure caused the loss of data from 26 October to 5 November.

Wicken Fen

As reported in previous QA/QC reports, the SO₂ data were unacceptably noisy during 2013. Data have been deleted from 20 December 2012 to 31 December 2013, and probably will be into 2014.

Yarner Wood

The station was turned off from 22 to 30 October as a result of a water leak. The NO_x analyser developed an unspecified fault resulting in severe autocalibration run-on from 10 to 15 October and again from 1 to 5 November. The ozone analyser had a power supply failure resulting in loss of data from 6-12 November.

York Bootham

The PM_{2.5} FDMS suffered a pump fault and leaks during the quarter, plus two zero checks, which are part of the FDMS audit procedure and which prevent the analyser from monitoring ambient air for a few days each time. The PM₁₀ FDMS also suffered some minor leaks and zero checks resulting in the loss of data.

York Fishergate

A period of very unstable PM₁₀ data from 30 October to 8 November was deleted.

4.2 Scotland

4.2.1 Data Capture

The data capture for stations in Scotland for the period October-December 2013 is given in Table 4.3.

Table 4.3 Data Capture for Scotland, October-December 2013

| Station | CO | PM ₁₀ | PM _{2.5} | NO ₂ | O ₃ | SO ₂ | Average |
|-------------------------------------|--------------|------------------|-------------------|-----------------|----------------|-----------------|--------------|
| Aberdeen | | 98.51 | 98.73 | 91.26 | 98.87 | | 96.84 |
| Aberdeen Union Street Roadside | | | | 99.00 | | | 99.00 |
| Auchencorth Moss | | 93.48 | 97.83 | | 95.56 | | 95.57 |
| Auchencorth Moss (FDMS) | | 88.86 | 73.32 | | | | 81.09 |
| Bush Estate | | | | 99.73 | 99.86 | | 99.80 |
| Dumbarton Roadside | | | | 98.51 | | | 98.51 |
| Dumfries | | | | 99.46 | | | 99.46 |
| Edinburgh St Leonards | 91.49 | 97.37 | 98.73 | 99.86 | 99.91 | 99.00 | 97.73 |
| Eskdalemuir | | | | 99.50 | 99.64 | | 99.57 |
| Fort William | | | | 99.86 | 99.86 | | 99.86 |
| Glasgow Kerbside | | 89.22 | 79.08 | 99.18 | | | 89.16 |
| Glasgow Townhead | | 99.41 | 97.79 | 93.03 | 99.66 | | 97.47 |
| Grangemouth | | 95.83 | 95.79 | 94.88 | | 96.78 | 95.82 |
| Grangemouth Moray | | | | 99.59 | | | 99.59 |
| Inverness | | 98.91 | 98.91 | 99.73 | | | 99.67 |
| Lerwick | | | | | 0.00 | | 0.00 |
| Peebles | | | | 99.73 | 99.91 | | 99.82 |
| Strath Vaich | | | | | 70.83 | | 70.83 |
| Number of Stations | 1 | 8 | 8 | 14 | 10 | 2 | 18 |
| Number of stations < 85 % | 0 | 0 | 2 | 0 | 2 | 0 | 3 |
| Number of stations < 90% | 0 | 2 | 2 | 0 | 2 | 0 | 4 |
| Network mean | 91.49 | 95.20 | 92.52 | 98.10 | 86.41 | 97.89 | 89.99 |

4.2.2 Station Specific Issues

Auchencorth Moss

Persistent air conditioning problems caused data loss from both analysers.

Glasgow Kerbside

Continuing problems with the air conditioning unit resulted in the loss of data from both FDMS units.

Lerwick

The station is temporarily closed due to building works at the Observatory.

Strath Vaich

Following damage to the analyser and modem caused by a lightning strike, data were lost from 5 December to 22 January 2014.

4.3 Wales

4.3.1 Data Capture

The data capture for stations in Wales for October-December 2013 is given in Table 4.4.

Table 4.4 Data Capture for Wales, October-December 2013

| Station | CO | PM ₁₀ | PM ₂₅ | NO ₂ | O ₃ | SO ₂ | Average |
|-------------------------------------|--------------|------------------|------------------|-----------------|----------------|-----------------|--------------|
| Aston Hill | | | | 98.01 | 96.11 | | 97.06 |
| Cardiff Centre | 99.95 | 99.91 | 99.59 | 97.51 | 94.88 | 99.37 | 98.54 |
| Chepstow A48 | | 99.77 | 99.77 | 95.70 | | | 98.41 |
| Cwmbran | | | | 99.82 | 99.82 | | 99.82 |
| Mold | | | | 99.82 | 99.86 | | 99.84 |
| Narberth | | 57.34 | | 99.82 | 99.86 | 90.22 | 86.81 |
| Newport | | 83.47 | 99.18 | 94.02 | | | 92.23 |
| Port Talbot Margam (Partisol) | | 97.83 | | | | | 97.83 |
| Port Talbot Margam | 99.41 | 99.32 | 99.41 | 85.91 | 98.19 | 99.05 | 96.88 |
| Swansea Roadside | | 99.73 | 99.59 | 99.86 | | | 99.73 |
| Wrexham | | 96.74 | 96.74 | 96.38 | | 96.33 | 96.37 |
| Number of Stations | 2 | 8 | 6 | 10 | 6 | 4 | 11 |
| Number of stations < 85 % | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| Number of stations < 90% | 0 | 2 | 0 | 1 | 0 | 0 | 1 |
| Network mean | 99.68 | 91.76 | 99.05 | 96.68 | 98.12 | 96.24 | 96.68 |

4.3.2 Station Specific Issues

Narberth

The volatile concentrations became erratic following filter change on 11 November; data have been deleted to 17 December when data improved.

4.4 Northern Ireland (including Mace Head)

4.3.3 Data Capture

The data capture for stations in Northern Ireland (including Mace Head in the Republic of Ireland) for the period October to December 2013 is given in Table 4.5.

Table 4.5 Data Capture for Ireland, October-December 2013

| Station | CO | PM ₁₀ | PM ₂₅ | NO ₂ | O ₃ | SO ₂ | Average |
|-------------------------------------|--------------|------------------|------------------|-----------------|----------------|-----------------|--------------|
| Armagh Roadside | | 90.94 | | 99.77 | | | 95.36 |
| Ballymena Ballykeel | | | | | | 97.42 | 97.42 |
| Belfast Centre | 98.69 | 97.33 | 97.78 | 95.43 | 89.81 | 99.68 | 96.45 |
| Derry | | 92.66 | 71.06 | 98.10 | 98.14 | 97.64 | 91.52 |
| Lough Navar | | 87.59 | | | 98.78 | | 93.18 |
| Mace Head | | | | | 100.00 | | 100.00 |
| Number of Stations | 1 | 4 | 2 | 3 | 3 | 3 | 6 |
| Number of stations < 85 % | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Number of stations < 90% | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| Network mean | 98.69 | 92.13 | 84.42 | 97.77 | 95.58 | 98.25 | 94.79 |

4.3.4 Station Specific Issues

All stations achieved 90% or higher data capture this quarter.

4.4 Overall Data Capture

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

Table 4.6 Overall Data Capture, October-December 2013

| | CO | PM ₁₀ | PM ₂₅ | NO ₂ | O ₃ | SO ₂ | Average |
|---------------------------|-------|------------------|------------------|-----------------|----------------|-----------------|---------|
| Number of Stations | 7 | 69 | 80 | 116 | 82 | 29 | 129 |
| Number of stations < 85 % | 0 | 12 | 9 | 11 | 6 | 2 | 20 |
| Number of stations < 90% | 0 | 18 | 11 | 15 | 11 | 4 | 30 |
| Network mean | 97.23 | 90.83 | 93.59 | 94.04 | 94.66 | 91.94 | 92.27 |

5 FDMS Baseline Checks

As part of the QA/QC remit for continuous improvement, an ad hoc study of PM analyser baseline response has been undertaken for the past 2 years. This study has been coordinated following investigations of issues identified both by CMCU during routine operation and by QA/QC unit during the ratification process.

The study initially concentrated on FDMS analysers, examining the baseline profile of the reference channels and the relationship with other neighbouring monitoring stations. It has become clear that, on a daily mean basis, regional reference PM concentrations regularly reach a minimum value that approaches $0 \mu\text{g m}^{-3}$.

With this information, stations where this observation was not true were “zero calibrated” using high efficiency scrubbers installed on the sample inlets. The results of these calibrations have been used to compare against the analyser baseline responses and, in all comparisons, calibration and baseline show excellent agreement.

The detection limit is calculated by multiplying the standard deviation of the zero calibration by 3.3. Typical results show that a healthy FDMS should have a detection limit of less than $5 \mu\text{g m}^{-3}$.

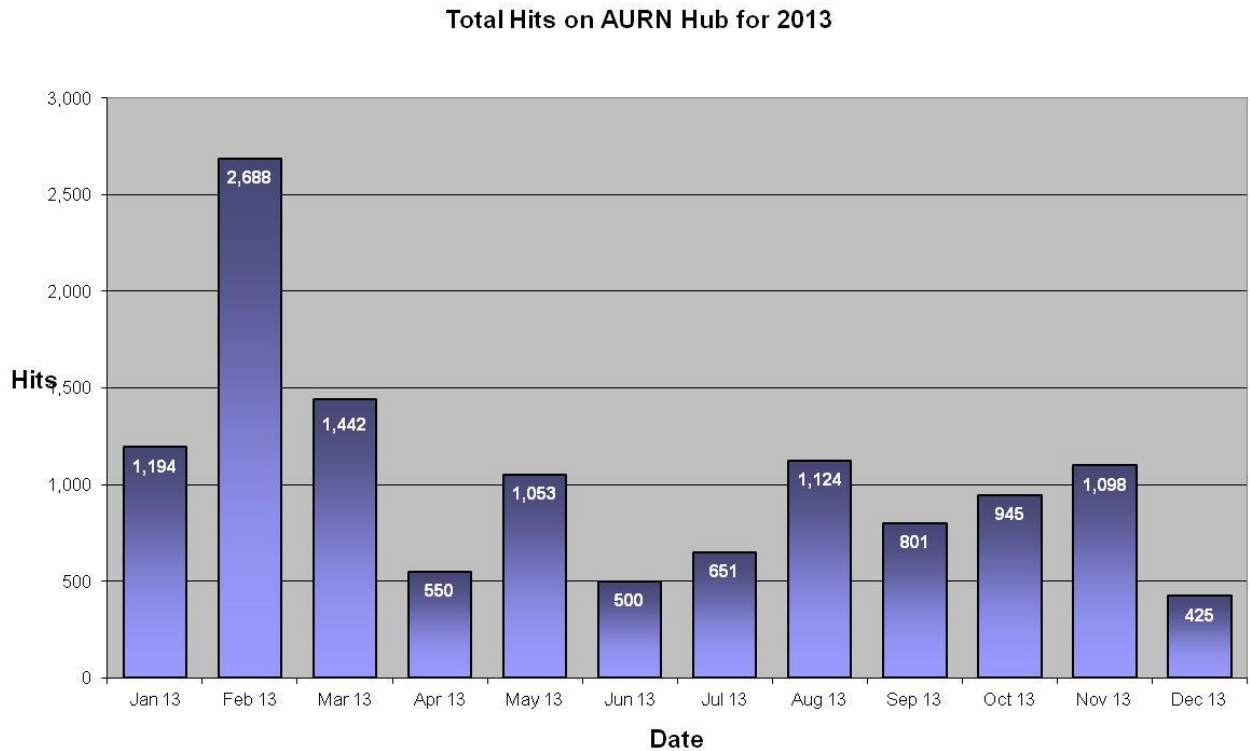
Recent European guidance (CEN TS16450) provides a recommendation that zero tests on PM analysers should yield a result no higher than $3 \mu\text{g m}^{-3}$, which provides the AURN with a robust performance limit for data ratification.

6 LSO Manual and AURN Hub

The QA/QC Unit has revised and reissued the LSO manual [RY1] in light of procedural changes and the introduction of new types of analysers employed. This manual is available via the AURN Hub at <http://uk-air.defra.gov.uk/reports/empire/lsoman/lsoman.html>. The AURN Hub is a password protected website for the use of AURN contractors including Local Site Operators and Equipment Support units.

Figure 6.1 shows the number of visits to the AURN Hub during 2013.

Figure 6.1 AURN Hub Hits, 2013



Current versions of the LSO calibrations spreadsheet are also available to download from the LSO manual page of the Hub.

Section B - 2013 Annual Report

7 Introduction

The QA/QC Unit has produced detailed quarterly reports during 2013, giving an overview of network performance, reasons for data losses and data capture statistics.

Recommendations for equipment and station upgrades and replacements have also been made.

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, station 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. Changes to ratified data made during the October to December 2013 ratification cycle are described in section 1.2 of this report. Changes made during previous quarters are listed in the previous quarterly ratification reports. A full list of changes to ratified data is given at <http://uk-air.defra.gov.uk/data/changes-to-ratified-data>.

8 Changes to network during 2013

8.1 Changes to Stations

The following new stations were commissioned in 2013 - see Table 8.1.

Table 8.1: Stations Added to the AURN during 2013

| | Pollutants | Date started |
|------------------------------|---|-------------------|
| London Teddington Bushy Park | PM _{2.5} | 29 August 2013 |
| Leicester University | NO _x O ₃ PM _{2.5} | 27 September 2013 |
| Glasgow Townhead | NO _x O ₃ PM _{2.5} PM ₁₀ | 7 October 2013 |
| Sheffield Devonshire Green | NO _x O ₃ PM _{2.5} PM ₁₀ | 31 October 2013 |

| | | |
|----------------|------------------------------------|------------------|
| Barnstaple A39 | PM _{2.5} PM ₁₀ | 14 November 2013 |
|----------------|------------------------------------|------------------|

The following stations were closed in 2013:

- Leicester Centre
- Sheffield Centre

8.2 Changes to Network Operation

No significant changes were made to QA/QC operations across the AURN during 2013.

9 Network Intercalibrations

Two complete network intercomparisons were carried out at 6-monthly intervals during 2013. 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. The purpose of these intercomparisons is to determine the network measurement accuracy, consistency and intercomparability across the entire network. The latest exercise covered 127 stations plus the 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 outside the defined accuracy limits (the “outlier” stations) is given in Table 9.1. A full definition of what constitutes an outlier station for the different pollutants is given in the appropriate Quarterly Reports. Note also that, for the vast majority of these outlier stations, the data will have been fully corrected as part of the subsequent data ratification process.

Table 9.1 Outliers identified during 2013 intercalibration exercises.

| Analyser | Winter 2013 intercalibration | | | Summer 2013 intercalibration | | |
|--------------------------|------------------------------|--|---------------------|--|--|---------------------|
| | Number of outliers | Number in network | % outliers in total | Number of outliers | Number in network | % outliers in total |
| NOx analyser | 26 | 117 | 22% | 36 | 117 | 31% |
| CO analyser | 0 | 9 | 0% | 0 | 9 | 0% |
| SO ₂ analyser | 6 | 30 | 20% | 8 | 30 | 27% |
| Ozone analyser | 17 | 82 | 21% | 14 | 82 | 17% |
| FDMS and BAM analysers | 1 k ₀ , 4 flow | 58 FDMS PM ₁₀ 2 BAM PM ₁₀ 69 FDMS PM _{2.5} 2 BAM PM _{2.5} | 4% | 0 k ₀ , 4 flow, (33 zero) | 58 FDMS PM ₁₀ 2 BAM PM ₁₀ 69 FDMS PM _{2.5} 2 BAM PM _{2.5} | 3% |
| Gravimetric PM analysers | 0 flow | 9 PM ₁₀ 9 PM _{2.5} | 0% | 0 flow | 9 PM ₁₀ 9 PM _{2.5} | 0% |
| Total | 54 | 387 | 14.0% | 62 | 387 | 16.0% |

Stations 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 station.

The intercalibration visits are also used to ensure information about network stations 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 stations, the detailed set-up parameters for the FDMS particle analysers, and how station locations compare to the requirements listed in the Air Quality Directive.

In addition to the network intercalibrations, the QA/QC Unit carries out pre-commissioning audits on new stations 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 stations 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 stations to ensure data may be disseminated in time for Directive Compliance.

10 ESU, CMCU, LSO and QA/QC Meetings

During 2013, 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 station 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 hosted the AURN LSO webinar in 2013. The presentations from the webinar are available on the AURN Hub.

The calibration gas supplier has been invited to a number of meetings with both QA/QC and the CMCUs, and a number of long-standing issues have been wholly or partly resolved.

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 K_o measurements to be made.

11 Network Data Capture

The data capture for the calendar year 2013 are given in Table 11.1.

Table 11.1 Summary of data capture by pollutant, 2013

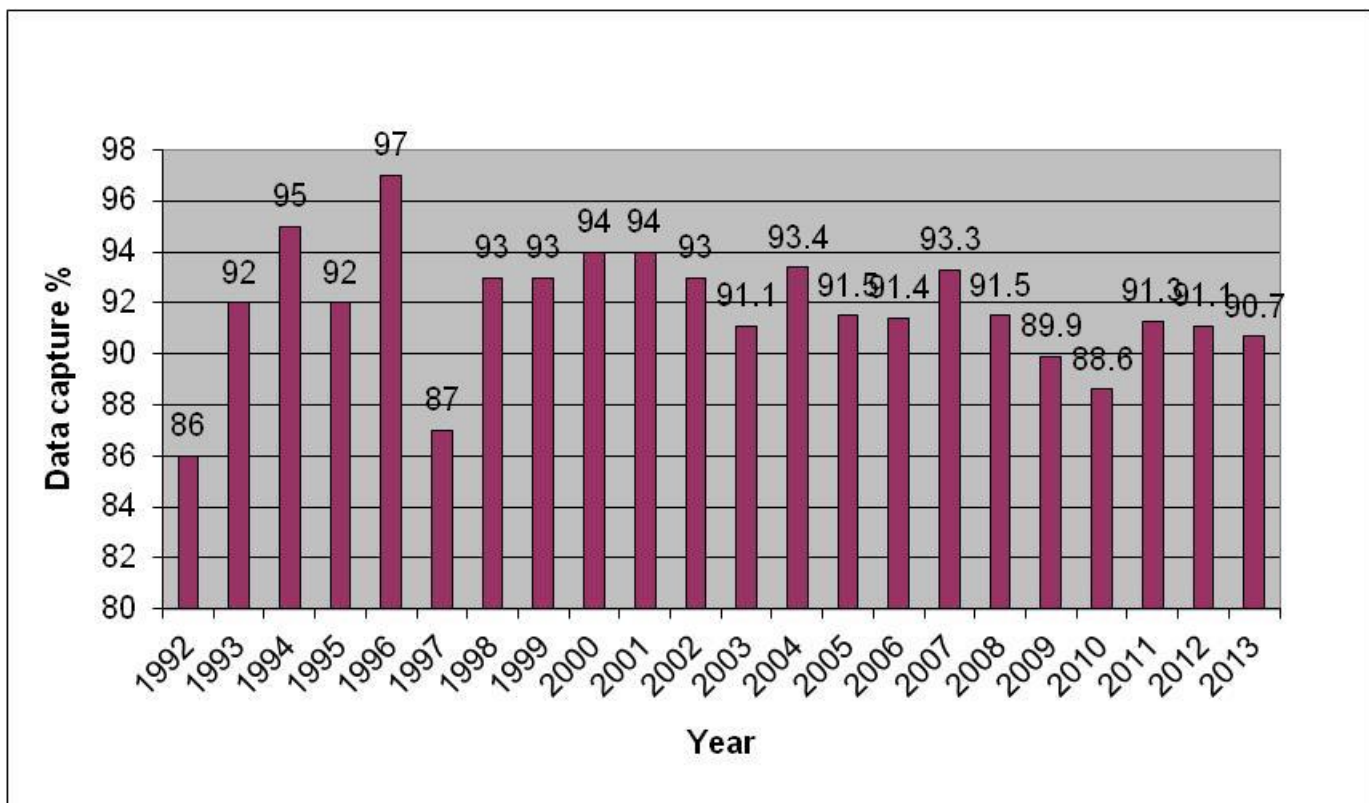
| Station | CO | PM ₁₀ | PM ₂₅ | NO ₂ | O ₃ | SO ₂ | |
|-------------------------|--------------|------------------|------------------|-----------------|----------------|-----------------|--------------|
| Number of stations | 7 | 71 | 83 | 118 | 84 | 29 | 138 |
| Number of stations <90% | 1 | 27 | 22 | 18 | 5 | 4 | 23 |
| Number of stations <85% | 1 | 33 | 29 | 22 | 12 | 5 | 48 |
| Network Mean (%) | 94.57 | 84.93 | 87.87 | 92.79 | 94.75 | 91.42 | 90.71 |

For these stations, pollution statistics calculated for analysers with data capture above 75% or modelled data have to be used for submission to the European Commission in the annual compliance assessment. 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 stations.

For future compliance with the Air Quality Directive, data capture should exceed 85% for each station, allowing for routine calibration and maintenance.

The network annual average data capture of 90.7% is similar to the previous year. The performance has again been affected this year by long-term problems with analysers, mainly FDMS. Figure 11.1 shows the annual network data capture since the start of the AURN in 1992.

Figure 11.1 Data Capture 1992-2013



12 Significant Station Issues

12.1 Significant Data Loss

A number of stations 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 23 stations with data capture below 85% for the year is given in Table 12.1. This table shows network data capture for 1 January-31 December 2013 from the start date of any new station, and only includes stations with average data capture < 85%. For comparison with previous years, there were 48 stations with data capture below 90%.

Table 12.1 Significant data loss, 2013 – Stations with < 85% data capture only

| Name | CO | PM ₁₀ | PM ₂₅ | NO ₂ | O ₃ | SO ₂ | Avg. | |
|----------------------------------|----|------------------|------------------|-----------------|----------------|-----------------|-------|---|
| Peebles | | | | 50.70 | 50.84 | | 50.77 | Sampling fault, data deleted |
| Auchencorth Moss | | 58.96 | 61.59 | | | | 60.27 | Air conditioning problem, PM ₁₀ analyser chiller fault and spares hard to obtain |
| Market Harborough | | | | 69.35 | 54.54 | | 61.95 | Sampling fault, data deleted |
| Liverpool Queen's Drive Roadside | | | | 64.57 | | | 64.57 | Leaking sample filter holder; air conditioning faults |
| Blackpool Marton | | | 0.00 | 95.92 | 99.20 | | 65.04 | Persistent PM _{2.5} fault, all data for 2013 deleted |
| London Teddington Bushy Park | | | 65.27 | | | | 65.27 | Temperature faults |
| Lerwick | | | | | 65.63 | | 65.63 | Station closed for redevelopment |
| Wicken Fen | | | | 98.87 | 99.42 | 3.84 | 67.37 | Persistent SO ₂ analyser fault |
| Harwell | | 52.74 | 57.33 | 49.53 | 98.05 | 95.81 | 70.69 | High FDMS baselines; NO ₂ sampling fault following inlet replacement |
| Leamington Spa Rugby Road | | 29.19 | 95.74 | 98.33 | | | 74.42 | Persistent FDMS fault, PM _{2.5} volatiles higher than PM ₁₀ for whole of Q4 |
| Leamington Spa | | 79.73 | 79.89 | 53.07 | 89.51 | | 75.55 | PM _{2.5} and PM ₁₀ -high baselines. Nox converter fault |

| Name | CO | PM ₁₀ | PM ₂₅ | NO ₂ | O ₃ | SO ₂ | Avg. | |
|---------------------------|----|------------------|------------------|-----------------|----------------|-----------------|-------|--|
| Aberdeen | | 88.80 | 83.07 | 44.70 | 87.83 | | 76.10 | NOx converter fault; further faults required a loan analyser which was not calibrated. Sample dew point faults during summer |
| Sheffield Tinsley | | | | 79.47 | | | 79.47 | Various analyser faults |
| Coventry Memorial Park | | | 57.51 | 84.21 | 98.44 | | 80.05 | Persistently noisy PM data often below negative limit of detection. NOx analyser had unspecified fault for two periods in year |
| Carlisle Roadside | | 46.24 | 95.84 | 99.51 | | | 80.53 | High PM ₁₀ baseline due to drier fault |
| Newport | | 67.92 | 85.98 | 88.55 | | | 80.82 | PM ₁₀ volatiles regional outlier. Logger fault resulted in loss of Nox and PM10 data |
| Leicester University | | | 88.19 | 78.36 | 78.36 | | 81.64 | Communications faults |
| Leeds Headingley Kerbside | | 81.60 | 65.83 | 99.11 | | | 82.18 | PM _{2.5} regional outlier; PM ₁₀ data often not in agreement with other stations, generally poor data |
| Saltash Callington Road | | 69.77 | 97.01 | | | | 83.39 | PM ₁₀ poor agreement with other stations |
| Barnstaple A39 | | 76.30 | 91.76 | | | | 84.03 | PM ₁₀ regional outlier |
| Chesterfield | | 90.31 | 69.10 | 93.71 | | | 84.37 | PM _{2.5} regional outlier |
| Oxford Centre Roadside | | | | 84.37 | | | 84.37 | Hot spare NOx analyser installed in Q4 but data not supplied |
| Portsmouth | | 74.08 | 94.05 | 83.85 | 86.04 | | 84.50 | PM ₁₀ and logger faults, PM _{2.5} pump fault |

Appendices

Appendix 1: Partisol Data – October – December 2013

Appendix 2: Station Information

Appendix 1

Partisol Data: October-December 2013

All Partisol samplers reported >90% data capture

Appendix 2

Station Information

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

| Site Name | Defra (D) or Affiliate (A) | Environment Type | Zone | Start Date |
|---------------------------|----------------------------|------------------|---------------------------------|------------|
| Belfast Centre | D | Background Urban | Belfast Urban Area | 08/03/1997 |
| Wirral Tranmere | D | Background Urban | Birkenhead Urban Area | 14/05/2000 |
| Blackpool Marton | D | Background Urban | Blackpool Urban Area | 14/06/2000 |
| Bournemouth | A | Background Urban | Bournemouth Urban Area | 05/03/2000 |
| Brighton Preston Park | D | Background Urban | Brighton/Worthing/Littlehampton | 03/11/2000 |
| Bristol St Paul's | D | Background Urban | Bristol Urban Area | 15/06/2000 |
| Cardiff Centre | D | Background Urban | Cardiff Urban Area | 12/05/1997 |
| Auchencorth Moss | D | Background Rural | Central Scotland | 01/01/2000 |
| Bush Estate | D | Background Rural | Central Scotland | 01/04/1998 |
| Dumbarton Roadside | A | Traffic Urban | Central Scotland | 01/09/2000 |
| Grangemouth | A | Industrial Urban | Central Scotland | 01/01/2000 |
| Grangemouth Moray | A | Industrial Urban | Central Scotland | 01/06/2000 |
| Coventry Memorial Park | D | Background Urban | Coventry/Bedworth | 26/02/2000 |
| Bottesford | A | Background Rural | East Midlands | 01/10/1997 |
| Chesterfield | A | Background Urban | East Midlands | 13/03/2000 |
| Chesterfield Roadside | A | Traffic Urban | East Midlands | 11/03/2000 |
| Ladybower | D | Background Rural | East Midlands | 15/07/1998 |
| Lincoln Canwick Rd. | D | Traffic Urban | East Midlands | 27/07/2000 |
| Market Harborough | D | Background Rural | East Midlands | 11/11/2000 |
| Northampton Kingsthorpe | A | Background Urban | East Midlands | 09/07/2000 |
| Cambridge Roadside | A | Traffic Urban | Eastern | 26/06/1999 |
| Norwich Lakenfields | D | Background Urban | Eastern | 01/09/2000 |
| Sandy Roadside | A | Traffic Urban | Eastern | 28/07/2000 |
| Sibton | D | Background Rural | Eastern | 01/07/1997 |
| St Osyth | D | Background Rural | Eastern | 11/05/2000 |
| Stanford-le-Hope Roadside | A | Traffic Urban | Eastern | 22/01/2000 |
| Thurrock | A | Background Urban | Eastern | 01/09/1999 |
| Weybourne | A | Background Rural | Eastern | 30/05/2000 |
| Wicken Fen | D | Background Rural | Eastern | 15/10/1999 |
| Edinburgh St Leonards | D | Background Urban | Edinburgh Urban Area | 24/11/2000 |
| Glasgow Kerbside | D | Traffic Urban | Glasgow Urban Area | 10/03/1999 |
| Glasgow Townhead | D | Background Urban | Glasgow Urban Area | 07/10/2000 |
| Camden Kerbside | A | Traffic Urban | Greater London | 16/05/1999 |
| Haringey Roadside | A | Traffic Urban | Greater London | 16/05/1999 |

| Site Name | Defra (D) or Affiliate (A) | Environment Type | Zone | Start Date |
|-----------------------------------|----------------------------|---------------------|-------------------------------|------------|
| London Bexley | A | Background Suburban | Greater London | 01/05/199 |
| London Bloomsbury | D | Background Urban | Greater London | 23/01/199 |
| London Eltham | A | Background Suburban | Greater London | 08/10/199 |
| London Haringey Priory Park South | A | Background Urban | Greater London | 26/10/20 |
| London Harlington | A | Industrial Urban | Greater London | 01/01/200 |
| London Harrow Stanmore | A | Background Urban | Greater London | 16/12/200 |
| London Hillingdon | D | Background Urban | Greater London | 02/08/199 |
| London Marylebone Road | A | Traffic Urban | Greater London | 17/07/199 |
| London N. Kensington | A | Background Urban | Greater London | 01/04/199 |
| London Teddington | D | Background Urban | Greater London | 08/08/199 |
| London Teddington Bushy Park | D | Background Urban | Greater London | 09/08/20 |
| London Westminster | D | Background Urban | Greater London | 17/07/200 |
| Southwark A2 Old Kent Road | A | Traffic Urban | Greater London | 24/10/20 |
| Tower Hamlets Roadside | A | Traffic Urban | Greater London | 01/04/199 |
| Manchester Piccadilly | D | Background Urban | Greater Manchester Urban Area | 18/12/199 |
| Manchester South | A | Industrial Suburban | Greater Manchester Urban Area | 06/12/199 |
| Salford Eccles | A | Industrial Urban | Greater Manchester Urban Area | 20/03/199 |
| Fort William | D | Background Suburban | Highland | 22/06/200 |
| Inverness | D | Traffic Urban | Highland | 11/07/200 |
| Lerwick | D | Background Rural | Highland | 25/05/200 |
| Strathvaich | D | Background Rural | Highland | 18/03/198 |
| Hull Freetown | D | Background Urban | Kingston-Upon-Hull Urban Area | 06/11/200 |
| Leicester University | D | Background Urban | Leicester Urban Area | 27/09/20 |
| Liverpool Queen's Drive Roadside | A | Traffic Urban | Liverpool Urban Area | 01/01/200 |
| Liverpool Speke | D | Industrial Urban | Liverpool Urban Area | 24/11/199 |
| Stockton-on-Tees Eaglescliffe | A | Traffic Urban | North East | 01/09/200 |
| Sunderland Silksworth | A | Background Urban | North East | 09/12/200 |
| Aberdeen | D | Background Urban | North East Scotland | 18/09/199 |
| Aberdeen Union Street Roadside | A | Traffic Urban | North East Scotland | 01/01/200 |
| Aston Hill | D | Background Rural | North Wales | 26/06/198 |
| Wrexham | D | Traffic Urban | North Wales | 01/03/200 |
| Carlisle Roadside | A | Traffic Urban | North West & Merseyside | 14/02/200 |
| Glazebury | D | Background Rural | North West & Merseyside | 01/04/198 |
| Great Dun Fell | D | Background Rural | North West & Merseyside | 09/05/198 |
| Warrington | A | Industrial Urban | North West & Merseyside | 21/10/200 |
| Wigan Centre | A | Background Urban | North West & Merseyside | 08/10/200 |
| Armagh Roadside | A | Traffic Urban | Northern Ireland | 01/01/200 |
| Ballymena Ballykeel | A | Background Urban | Northern Ireland | 01/01/20 |

| Site Name | Defra (D) or Affiliate (A) | Environment Type | Zone | Start Date |
|----------------------------|----------------------------|---------------------|------------------------|------------|
| Derry | A | Background Urban | Northern Ireland | 29/04/199 |
| Lough Navar | D | Background Rural | Northern Ireland | 02/04/199 |
| Nottingham Centre | D | Background Urban | Nottingham Urban Area | 02/09/199 |
| Portsmouth | A | Background Urban | Portsmouth Urban Area | 01/01/200 |
| Stoke-on-Trent Centre | D | Background Urban | Potteries | 11/03/199 |
| Preston | D | Background Urban | Preston Urban Area | 06/06/200 |
| Reading New Town | D | Background Urban | Reading Urban Area | 17/10/200 |
| Mace Head | A | Background Rural | Republic of Ireland | 03/04/198 |
| Dumfries | D | Traffic Urban | Scottish Borders | 01/03/200 |
| Eskdalemuir | D | Background Rural | Scottish Borders | 23/04/198 |
| Peebles | D | Background Urban | Scottish Borders | 06/11/200 |
| Sheffield Devonshire Green | D | Background Urban | Sheffield Urban Area | 31/10/200 |
| Sheffield Tinsley | D | Background Urban | Sheffield Urban Area | 28/11/199 |
| Canterbury | A | Background Urban | South East | 02/01/200 |
| Chatham Roadside | A | Traffic Urban | South East | 01/07/200 |
| Eastbourne | A | Background Urban | South East | 01/07/200 |
| Harwell | D | Background Rural | South East | 22/06/199 |
| Horley | A | Industrial Suburban | South East | 21/11/200 |
| Lullington Heath | D | Background Rural | South East | 04/10/198 |
| Oxford Centre Roadside | A | Traffic Urban | South East | 15/04/199 |
| Oxford St Ebbes | A | Background Urban | South East | 01/01/200 |
| Rochester Stoke | A | Background Rural | South East | 26/01/199 |
| Storrington Roadside | A | Traffic Urban | South East | 01/08/200 |
| Chepstow A48 | A | Traffic Urban | South Wales | 01/01/200 |
| Cwmbran | A | Background Urban | South Wales | 20/07/200 |
| Narberth | D | Background Rural | South Wales | 20/01/199 |
| Newport | A | Background Urban | South Wales | 01/01/200 |
| Barnstaple A39 | D | Traffic Urban | South West | 14/11/200 |
| Bath Roadside | D | Traffic Urban | South West | 18/11/199 |
| Charlton Mackrell | D | Background Rural | South West | 03/09/200 |
| Exeter Roadside | A | Traffic Urban | South West | 02/07/199 |
| Honiton | D | Background Urban | South West | 27/05/200 |
| Plymouth Centre | D | Background Urban | South West | 29/09/199 |
| Saltash Callington Road | D | Traffic Urban | South West | 19/12/200 |
| Yarner Wood | D | Background Rural | South West | 26/06/198 |
| Southampton Centre | D | Background Urban | Southampton Urban Area | 04/01/199 |
| Southend-on-Sea | D | Background Urban | Southend Urban Area | 24/07/200 |
| Port Talbot Margam | D | Industrial Urban | Swansea Urban Area | 11/01/200 |
| Swansea Roadside | A | Traffic Urban | Swansea Urban Area | 20/09/200 |
| Billingham | D | Industrial Urban | Teesside Urban Area | 01/01/198 |
| Middlesbrough | A | Industrial Urban | Teesside Urban Area | 01/01/199 |
| Newcastle Centre | D | Background Urban | Tyneside | 08/03/199 |

| Site Name | Defra (D) or Affiliate (A) | Environment Type | Zone | Start Date |
|-------------------------------|----------------------------|---------------------|---------------------------|------------|
| Newcastle Cradlewell Roadside | A | Traffic Urban | Tyneside | 10/03/200 |
| Leamington Spa | A | Background Urban | West Midlands | 26/07/199 |
| Leamington Spa Rugby Road | D | Traffic Urban | West Midlands | 10/04/200 |
| Leominster | D | Background Suburban | West Midlands | 18/07/200 |
| Walsall Woodlands | A | Background Urban | West Midlands | 01/05/200 |
| Birmingham Acocks Green | D | Background Urban | West Midlands Urban Area | 18/03/200 |
| Birmingham Tyburn | A | Background Urban | West Midlands Urban Area | 16/08/200 |
| Birmingham Tyburn Roadside | D | Traffic Urban | West Midlands Urban Area | 11/02/200 |
| Leeds Centre | D | Background Urban | West Yorkshire Urban Area | 04/01/199 |
| Leeds Headingley Kerbside | A | Traffic Urban | West Yorkshire Urban Area | 17/02/200 |
| Barnsley Gawber | D | Background Urban | Yorkshire & Humberside | 07/07/199 |
| High Muffles | D | Background Rural | Yorkshire & Humberside | 16/07/199 |
| Scunthorpe Town | A | Industrial Urban | Yorkshire & Humberside | 06/06/200 |
| York Bootham | A | Background Urban | Yorkshire & Humberside | 01/01/200 |
| York Fishergate | A | Traffic Urban | Yorkshire & Humberside | 01/01/200 |

RICARDO-AEA

The Gemini Building
Fermi Avenue
Harwell
Didcot
Oxfordshire
OX11 0QR

Tel: 01235 753212
Fax: 01235 753001

www.ricardo-aea.com