QAQC Report for the Automatic Urban and Rural Network, Oct-Dec 2014 and Annual Review 2014

Report for Defra and the Devolved Administrations

Customer Reference 21316

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Executive summary

Ricardo-AEA carries out the quality assurance and quality 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), the Scottish Government, Welsh Government and Department of Environment (DoE) in Northern Ireland.

A total of 142 monitoring stations in the AURN operated during the three-month period October – December 2014.

Ricardo-AEA carried out two Network Intercalibration exercises during calendar year 2014, in winter (January-March) and summer (August – September). The data were ratified quarterly in arrears and made available via Defra's online UK Air Information Resource (UK-AIR).

The target for annual data capture is 85%, which is based upon the 90% data capture target of the Air Quality Directive, with an allowance of 5% for planned maintenance. Ratified hourly average data capture for the network averaged 91.81% for all pollutants (O_3, NO_2, SO_2, CO, PM_{10} and $PM_{2.5}$) during the three-month reporting period October-December 2014. Average data capture for all pollutants were above 85%. There were 27 monitoring stations with data capture less than 90% for the period, of which 18 had data capture below 85%.

For the whole calendar year 2014, ratified hourly average data capture for the network averaged 88.46% for all pollutants (O_3, NO_2, SO_2, CO, PM_{10} and $PM_{2.5}$). There were 46 monitoring stations with data capture less than 90% for the period, of which 31 had data capture below 90%.

The main reasons for data loss were; planned site infrastructure upgrades, poor analyser performance and persistent temperature problems.

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1 Introduction

1.1 Background

The UK Automatic Urban and Rural Network (AURN) has been established to provide information on air quality concentrations throughout the UK for a range of pollutants. The primary function of the AURN is to provide data in compliance with EU Directives on Air Quality. However, in addition, the data and information from the AURN is required by scientists, policy makers and planners to enable them to make informed decisions on managing and improving air quality for the benefit of health and the natural environment.

A number of organisations are involved in the day-to-day running of the network. Currently, the role of Central Management and Co-ordination Unit (CMCU) for the AURN is contracted to Bureau Veritas, whilst the Environmental Research Group (ERG) of King's College London has been appointed as Management Unit for the AURN monitoring sites that are also part of the London Air Quality Network (LAQN). Ricardo-AEA undertakes the role of Quality Assurance and Control Unit (QA/QC Unit) for sites within the AURN. The responsibility for operating individual monitoring sites is assigned to local organisations with relevant experience in the field under the direct management (and contract to) CMCU. Calibration gases for the network are supplied by Air Liquide Ltd and are provided with an ISO17025 certificate of calibration by Ricardo-AEA. The monitoring equipment is serviced and maintained by a number of Equipment Support Units, under contract to the CMCU.

Dissemination of the data from the AURN via UK-AIR (the UK online Air Information Resource, http://uk-air.defra.gov.uk/) and other media such as teletext and freephone services is undertaken by the Data Dissemination Unit (DDU). A summary report of the data is also published annually in the "Air Pollution in the UK" series of reports.

A total of 139 monitoring stations in the AURN operated during this quarter. Some of these 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. These were predominantly due to instrument or air conditioning faults, response instability or problems associated with the replacement of analysers and infrastructure.

1.2 What this Report Covers

This report covers the three-month period October to December 2014, or "Quarter 4" of the year. As it is the final quarterly report of the year, it also includes a summary of significant events and statistics for the full calendar year, a summary of health and safety activities, an inventory of Defra-owned equipment held by the QA/QC Unit in connection with this work, and a section relating to issues of improved technologies. This report covers the main QA/QC activities; the relevant CMCU reports should be consulted for more detail on site operational issues.

1.3 Where to Find More Information

Further information on the AURN can be found in the following:

- The AURN Hub. This online resource for AURN stakeholders contains network-specific information relating to the AURN, including the LSO Manual, QA/QC audit and ESU service schedules, CMCU reports and supporting information.
- UK-AIR, which contains information on individual sites along with real-time hourly data, graphs and statistics.

1.4 Changes to the Network during this Year

Table 1.1 shows the new monitoring stations were commissioned in 2014, and those that closed in 2014.

Table 1.1 Station changes in 2014

New sites	Pollutants	Date started
Shaw Crompton Way	NO_2	24/2/14
Ealing Horn Lane	PM_{10}	21/05/14
Blackburn Accrington Road	NO_2	12/05/14
Coventry Allesley	NO_2 O_3 $PM_{2.5}$	11/06/14
Hafod-yr-ynys Roadside *	NO_2	14/10/14
Site Closures	**Pollutants**	**Date closed**
Blackburn Darwen Roadside	NO_2	17/03/14
Chesterfield	NO_2 PM_{10} $PM_{2.5}$	20/05/14

Changes that happened in the final quarter of the year are marked with an asterisk (*).

2 Methodology

2.1 Overview of QA/QC Activities

The QA/QC activities consist of the following key parts:

- QA/QC audits of all analysers in the network every six months (three months for ozone)
- Ratification of the data on a trhree-monthly basis, and upload ratified data to the Data Dissemination Unit
- Assessment of new site locations in conjunction with the CMCU, and assessment of compliance with the siting criteria in the Directive
- Investigation of instances of suspected poor quality data.

2.2 QA/QC Audits

The QA/QC intercalibration audits fulfil a number of important functions:

- A “health check” on the production of provisionally scaled data, which is rapidly disseminated to the public soon after collection.
- Identification of poorly-performing analysers and infrastructure, together with recommendations for corrective action.
- A measure of network performance, by examining for example, how different NOx analysers around the network respond to a common gas standard. This test checks how “harmonised” UK measurements are; i.e. that a 200ppb NO_2 pollution episode in (for example) Belfast would be reported in exactly the same way at every other site in the UK, regardless of the location or the analyser used to record the event.
- Assessment of the area around the monitoring station: has the environment changed in the last six months? Is the location still representative of the site classification?

The QA/QC audits test the following aspects of analyser performance:

1. Analyser accuracy and precision. These are basic checks to ensure analysers respond to known concentrations of gases in a reliable manner.

2. Instrument linearity. This test refines the response checks on analysers, by assessing whether doubling a concentration of gas to the analyser results in a doubling of the analyser signal response. If an analyser's response characteristics are not linear, data cannot be reliably scaled into concentrations.
3. Instrument signal noise. This test checks that an analyser responds to calibration gases in a stable manner with time. A "noisy" analyser may not provide high quality data which may be difficult to process at lower concentrations.
4. Analyser response time. This test checks that the analyser responds quickly to a change in gas concentrations. If analyser response is too slow, data may not accurately reflect ambient concentrations.
5. Leak and flow checks. These tests ensure that ambient air reaches the analysers, without being compromised in any way. Leaks in the sampling system can affect the ability of the analyser to sample ambient air reliably.
6. NOx analyser converter efficiency. This test evaluates the ability of the analyser to measure NO_2. An inefficient converter severely compromises the data from the analyser.
7. FDMS k_0 evaluation. The analyser uses this factor to calculate mass concentrations, so the value is calculated to determine its accuracy compared to the stated value.
8. Particulate analyser flow rate checks. These tests ensure that the flow rates through critical parts of the analyser are within specified limits. There are specific analyser flow rates that are set to make sure particle size fractions and mass concentration calculations are performed correctly.
9. SO_2 analyser hydrocarbon interference. This test evaluates the analyser's ability to remove interfering hydrocarbon gases from the sample gas. A failed test could have significant implications for analyser data.
10. Evaluation of site cylinder concentrations. These tests use a set of Ricardo-AEA certified cylinders that are taken to all the sites. The concentrations of the site cylinders are used to scale pollution datasets, so it is important to ensure that the concentrations of gases in the cylinders do not change.
11. Competence of Local Site Operators (LSOs) in undertaking calibrations. As it is the calibrations by the LSOs that are used to scale pollution datasets, it is important to check that these are undertaken competently.
12. Zero "calibration" of all automatic PM analysers. This test allows the baseline performance of PM analysers to be evaluated, to determine whether any remedial action is required.

Once all data have been collected, a "Network Intercomparison" is conducted. This utilises the audit gas cylinders transported to each site in the Network. These cylinders are recently calibrated by the Calibration Laboratory at Ricardo-AEA, and allow us to examine how different site analysers respond when they are supplied with the same gas used at other sites. For ozone analysers, the calibration is undertaken with recently calibrated ozone photometers.

The technique used to process the intercomparison results is broadly as follows:

- The analyser responses to audit gas are converted into concentrations, using provisional calibration factors obtained from the Management Units on the day of the intercalibration. These factors are also used for the provisional data supplied to the web/interactive TV services.
- These individual results are tabulated, and statistical analyses undertaken (e.g. network average result, network standard deviation, deviation of individual sites from the network mean etc.).

These results are then used to pick out problem sites, or "outliers", which are investigated further to determine reasons and investigate possible remedies for the outliers. The definition of an outlier is an analyser result that falls outside the following limits:

- ±10% of the network average for NOx, CO and SO_2 analysers,
- ±5% of the reference standard photometer for Ozone analysers,
- ±2.5 % of the stated ko value for FDMS analysers,
- ±10% for particulate analyser flow rates,
- Particulate analyser average zero response within ±3.0 µg m^{-3}.
- ±10% for the recalculation of site cylinder concentrations.

Thus, the intercalibration investigates the quality of provisional data output by the Management Units for use in forecasting, interactive television services and the web. It also provides input into the ratification process by highlighting sites where close scrutiny of datasets is likely to be required.

Any outliers that are identified are rigorously checked to determine the cause, and any required corrective action to be taken, if necessary. There are a number of likely main causes for outlier results, as discussed below:

- Drift of an analyser between scheduled LSO calibrations. This is by far the most common cause of an outlier result, and one that is simply corrected for during ratification of data.
- Drift of site cylinder concentrations between intercalibrations. Site cylinders can sometimes become unstable, especially at low pressures. All site cylinder concentrations are checked every six months, and are replaced as necessary.
- Erroneous calibration factors. It can occasionally happen that an analyser calibration is unsuccessful, and results in unsuitable scaling factors being used to produce pollution datasets. These are identified and corrected during ratification.
- Pressurisation of the sampling system at the audit. Occasionally, an analyser can be very sensitive to small changes in applied flow rates of calibration gas. This is more difficult to identify and correct, and may have consequences for data quality.
- Leaks, sample switching valves, etc. Outliers can be generated if an analyser is not sampling ambient air properly. It is likely that if a leaking analyser is identified, data losses will result.

Full audits of all analysers are carried out at six-monthly intervals in the winter (January-February) and summer (July-August). In addition, audits of ozone analysers are also carried out in spring (April) and autumn (October).

2.2.1 Methodology for FDMS Baseline Checks

As part of the QA/QC remit for continuous improvement, an ad hoc study of particulate matter (PM) analyser baseline response has been undertaken for the past two 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 µg m^{-3}. The test is equally valid for BAM instruments, and thus the tests are also carried out on these.

2.3 Overview of Data Ratification

Data for each site are supplied monthly by the CMCUs. Once initial monthly data files have been received, checked and loaded into MODUS, the process of data ratification begins. This process is required to refine data scaling based on all the calibration and audit data available, and to identify, withdraw or flag anomalous data due to instrument or sampling faults or where data fall outside the Uncertainties or Limits of Detection defined by the Data Quality Objectives (**DQOs**) of Directive 2008/50/EC (the Air Quality Objective) and the European Union's Implementing Provisions for Reporting.

3 Intercalibration Results Summary (2015)

3.1 National Network Overview

Table 3.1 Summary of Network Intercomparisons, 2014

	Winter 2014			Summer 2014		
Parameter	Number of outliers	Number in network	% outliers in total	Number of outliers	Number in network	% outliers in total
NOx analyser	18	117	15%	23	115	20%
CO analyser	0	9	0%	0	7	0%
SO_2 analyser	6	6	20%	6	30	20%
Ozone analyser	23	82	28%	21	81	26%
FDMS and BAM analysers	3 k_0, 6 flow, (12 zero)	58 FDMS PM_{10} 2 BAM PM_{10} 69 FDMS $PM_{2.5}$ 2 BAM $PM_{2.5}$	7%	1 k_0, 10 flow, (17 zero)	57 FDMS PM_{10} 2 BAM PM_{10} 69 FDMS $PM_{2.5}$ 2 BAM $PM_{2.5}$	8%
Gravimetric PM analysers	0 flow	9 PM_{10} 9 $PM_{2.5}$	0%	1 flow	9 PM_{10} 9 $PM_{2.5}$	6%
Total	56	58 FDMS PM10	14.5%	62	381	16.3%

In the spring 2014 ozone intercalibration, there were 16 analysers out by more than 5%. The figure for the autumn exercise was 15.

3.2 Calculations of Measurement Uncertainty

The uncertainty of measurement of each analyser is calculated at each intercalibration. The values for the winter 2014 exercise is given in Table 3.2. The quoted values are the percentage error at the relevant Limit Value

Table 3.2 – Analyser measurement uncertainties

Date (2014)	Site	O_3	CO	SO_2	NO_2 annual	NO_2 hour	PM_{10}	$PM_{2.5}$
20-Jan	Barnsley Gawber	10.7		13.4	10	10		
16-Jan	Bath Roadside				13.5	14		
28-Jan	Billingham				13.5	14		

Date (2014)	Site	O_3	CO	SO_2	NO_2 annual	NO_2 hour	PM_{10}	$PM_{2.5}$
20-Jan	Birmingham Acocks Green	12.4			13.5	14		16.4
21-Jan	Birmingham Tyburn	8.7		12.3	11.8	11.8	8.7	16.4
21-Jan	Birmingham Tyburn Roadside	12.4			13.5	14	8.7	16.4
15-Jan	Blackburn Darwen Roadside				10.5	10.5		
14-Jan	Blackpool Marton	10.7			10	10		No test
25-Feb	Bottesford	10.7						
27-Feb	Bournemouth	12.4			13.5	14		11
28-Jan	Brighton Preston Park	12.4			13.5	14		11
16-Jan	Bristol St Paul's	12.4			13.5	14	8.7	No test
04-Feb	Cambridge Roadside				10.5	10.5		
19-Feb	Camden Kerbside				10.5	10.5	8.7	16.4
10-Feb	Canterbury	12.4			13.5	14		
13-Jan	Carlisle Roadside				10.5	10.5	8.7	16.4
11-Feb	Charlton Mackrell	11.8			13.5	14		
11-Feb	Chatham Centre Roadside				13.5	14	8.7	16.4
21-Jan	Chesterfield				10.5	10.5	8.7	16.4
21-Jan	Chesterfield Roadside				10.5	10.5	8.7	16.4
18-Feb	Coventry Memorial Park	10.7			10	10		No test
29-Jan	Eastbourne				13.5	14	8.7	16.4
15-Jan	Exeter Roadside	8.7			11.8	11.8		
16-Jan	Glazebury	12.4			failed	test		
02-Jul	Great Dun Fell	12.4						
18-Feb	Haringey Roadside				10.5	10.5	8.7	16.4
12-Aug	Harwell	12.4		13.4	13.5	14	8.7	16.4
28-Jan	Harwell PARTISOL						8	11
29-Jan	High Muffles	12.4			13.5	14		
15-Jan	Honiton				13.5	14		
27-Jan	Horley				10.5	10.5		
14-Jan	Hull Freetown	10.7		13.4	10	10	8.7	16.4
22-Jan	Ladybower	12.4		13.4	13.5	14		
26-Feb	Leamington Spa	11.8			10.5	10.5	8.7	16.4
27-Feb	Leamington Spa Rugby Road				13.5	14	8.7	16.4
13-Jan	Leeds Centre	10.7	9.5	13.4	10	10	8.7	16.4
13-Jan	Leeds Headingley Kerbside				13.5	14	8.7	16.4
19-Feb	Leicester University	10.7			10	10		16.4
10-Feb	Leominster	12.4			13.5	14		
25-Feb	Lincoln Canwick Road				13.5	14		
09-Jan	Liverpool Queen's Drive Roadside				13.5	14		
09-Jan	Liverpool Speke	10.7		13.4	10	10	8.7	16.4
14-Feb	London Bexley			13.4	13.5	14		16.4

Date (2014)	Site	O_3	CO	SO_2	NO_2 annual	NO_2 hour	PM_{10}	$PM_{2.5}$
12-Feb	London Bloomsbury	12.4		13.4	13.5	14	10.38	26.38
27-Jan	London Eltham	11			10.5	10.5		16.4
18-Feb	London Haringey Priory Park South	11.8			13.5	14		
03-Jan	London Harlington	12.4			13.5	14	8.7	16.4
19-Feb	London Harrow Stanmore							16.4
06-Feb	London Hillingdon	33.72			10	10		
29-Jan	London Marylebone Road	12.4	9.5	13.4	13.5	14	8.7	16.4
29-Jan	London Marylebone Road PARTISOL						8	11
31-Jan	London N. Kensington	12.4	9.5	13.4	13.5	14	8.7	16.4
31-Jan	London N. Kensington PARTISOL						8	11
20-Feb	London Teddington	12.4			13.5	14		
20-Feb	London Teddington Bushy Park							16.4
04-Feb	London Westminster	No test			13.5	14		11
13-Feb	Lullington Heath	12.4		13.4	13.5	14		
15-Jan	Manchester Piccadilly	12.4		13.4	13.5	14		16.4
15-Jan	Manchester South	12.4			13.5	14		
20-Feb	Market Harborough	10.7			10	10		
29-Jan	Middlesbrough	12.4		13.4	13.5	14	8.7	16.4
27-Jan	Newcastle Centre	10.7			9.99	9.99	8.7	16.4
27-Jan	Newcastle Cradlewell Roadside				10.5	10.5		
17-Feb	Northampton Kingsthorpe	8.7			11.8	11.8		11
05-Feb	Norwich Lakenfields	10.7			10	10	8.7	16.4
24-Feb	Nottingham Centre	10.7		13.4	10	10	8.7	16.4
28-Feb	Oxford Centre Roadside				10.5	10.5		
25-Feb	Oxford St Ebbes				10.5	10.5	8.7	16.4
14-Jan	Plymouth Centre	10.7			10	10	8.7	16.4
25-Feb	Portsmouth	10.7			11.8	11.8	8.7	16.4
15-Jan	Preston	10.7			10	10		16.4
24-Feb	Reading New Town	10.7			10	10	8.7	16.4
11-Feb	Rochester Stoke			13.4	13.5	14	8.7	16.4
14-Jan	Salford Eccles	11.8			10.5	10.5	8.7	20.56
14-Jan	Saltash Callington Road						8.7	16.4
03-Feb	Sandy Roadside				13.5	14	11.48	16.4
13-Jan	Scunthorpe Town			11	10.5	10.5	8.7	
20-Jan	Sheffield Devonshire Green	10.7			10	10	8.7	16.4
21-Jan	Sheffield Tinsley				13.5	14		
05-Feb	Sibton	12.4						
26-Feb	Southampton Centre	10.7		13.4	10	10	8.7	16.4
13-Feb	Southend-on-Sea	10.7			10	10		16.4
05-Feb	Southwark A2 Old Kent Road				13.5	14	8.7	

Date (2014)	Site	O_3	CO	SO_2	NO_2 annual	NO_2 hour	PM_{10}	$PM_{2.5}$
13-Feb	St Osyth	10.7			10	10		
12-Feb	Stanford-le-Hope Roadside				13.5	14	36.48	16.4
28-Jan	Stockton-on-Tees Eaglescliffe				13.5	14	9.3	12.6
23-Jan	Stoke-on-Trent Centre	10.7			10	10	8.7	16.4
28-Jan	Storrington Roadside				10	10	8.7	16.4
28-Jan	Sunderland Silksworth	12.4			10.5	10.5		16.4
12-Feb	Thurrock	12.4		13.4	13.5	14	8.7	
13-Feb	Tower Hamlets Roadside				10.5	10.5		
22-Jan	Walsall Woodlands	12.4			13.5	14		
08-Jan	Warrington				10.5	10.5	8.7	16.4
06-Feb	Weybourne	10.7						
04-Feb	Wicken Fen	12.4		13.4	13.5	14		
14-Jan	Wigan Centre	12.4			10.5	10.5		16.4
06-Jan	Wirral Tranmere	10.7			10	10		31.6
12-Feb	Yarner Wood	12.4			13.5	14		
14-Jan	York Bootham						8.7	16.4
14-Jan	York Fishergate				10.5	10.5	8.7	16.4
26-Feb	Mace Head	Not approved						
19-Feb	Armagh Roadside				10.5	10.5	8.7	
18-Feb	Ballymena Ballykeel			11				
24-Feb	Belfast Centre	10.7	9.5	13.4	10	10	8.7	16.4
20-Feb	Derry	12.4		13.4	13.5	14	8.7	16.4
19-Feb	Lough Navar	12.4					8.7	
11-Feb	Aberdeen	12.4			13.5	14	8.7	16.4
11-Feb	Aberdeen Union Street Roadside				13.5	14		
05-Feb	Auchencorth Moss	12.4					8.7	16.4
05-Feb	Auchencorth Moss Partisol						8	11
05-Feb	Bush Estate	12.4			13.5	14		
20-Jan	Dumbarton Roadside				10.5	10.5		
13-Jan	Dumfries				13.5	14		
04-Feb	Edinburgh St Leonards	12.4	9.5	13.4	13.5	14	8.7	16.4
16-Jan	Eskdalemuir	12.4			13.5	14		
22-Jan	Fort William	12.4			13.5	14		
21-Jan	Glasgow Kerbside				15.3	15.3	8.7	16.4
21-Jan	Glasgow Townhead	10.7			13.76	14.24	8.7	16.4
03-Feb	Grangemouth			11	10.5	10.5	8.7	16.4
03-Feb	Grangemouth Moray				10.5	10.5		
12-Feb	Inverness				13.5	14	8	11
	Lerwick	No test						
04-Feb	Peebles	12.4			13.5	14		
05-Mar	Strath Vaich	12.4						
10-Feb	Aston Hill	12.4			13.5	14		
23-Jan	Cardiff Centre	12.4	9.5	13.4	13.5	14	8.7	16.4

Date (2014)	Site	O_3	CO	SO_2	NO_2 annual	NO_2 hour	PM_{10}	$PM_{2.5}$
24-Jan	Chepstow A48				10.5	10.5	8.7	16.4
23-Jan	Cwmbran	10.7			11.8	11.8		
07-Jan	Mold	12.4			13.5	14		
21-Jan	Narberth	12.4		13.4	13.5	14	10.02	
23-Jan	Newport				10.5	10.5	16.43	16.4
	Port Talbot Margam	10.7	9.5	13.4	13.5	14	8.7	16.4
22-Jan	Port Talbot Margam Partisol						8	
22-Jan	Swansea Roadside				13.5	14	36.44	13.33
07-Jan	Wrexham			13.4	13.5	14	8	11

This table is updated and extended after every intercalibration to include upgraded sites and replacement analysers.

The poor measurement uncertainty reported for the PM analysers at London Bloomsbury, Salford Eccles, Stanford-le-Hope Roadside, Wirral Tranmere and Swansea Roadside arose as a result of the very low measured flow rates at the audit. The significance of this will be examined fully during ratification.

The ozone analyser at Mace Head is not a CEN compliant model and therefore no generic performance data have been calculated.

3.3 Certification

Certificates of calibration for each intercalibration exercise are provided on the AURN Hub (at http://aurnhub.defra.gov.uk/login.php)

4 Data Ratification Results (4th Quarter)

4.1 Data Capture – Network Overview

4.1.1 Overall Data Capture

Ratified hourly average (daily average for Partisols) data capture for the network averaged 91.81% for all pollutants (O_3, NO_2, SO_2, CO, PM_{10} and $PM_{2.5}$) during the three-month reporting period October-December 2014 (see Table 4.1). 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 calculated. For stations starting or closing during the period, the data capture is based on the actual date starting or closing. All pollutants achieved 85% or higher data capture on average. The data capture target for the purposes of monitoring compliance with the EU Air Quality Directive (Directive 2008/50/EC) is 90% excluding planned servicing and maintenance. For practical purposes in the AURN, planned maintenance is assumed to be 5% so a target of 85% data capture is used.

Table 4.1: AURN Ratified Data Capture (%) by Quarter, 2014

Quarter	CO	PM_{10}	$PM_{2.5}$	NO_2	O_3	SO_2	Mean
Q1 2014	95.35	85.45	83.51	94.31	95.01	90.02	89.72
Q2 2014	99.75	83.40	89.99	91.98	95.43	91.07	89.41
Q3 2014	86.65	80.07	78.89	87.16	93.33	94.85	85.94
Q4 2014	85.86	88.76	91.91	92.36	94.32	91.80	91.81

4.1.2 Generic Data Quality Issues

The following generic data quality issues have been identified in 2014:

- The use of obsolete mass transducer filters on FDMS analysers, resulting in high analyser noise

4.1.3 Data Precision

As part of the requirements of the INSPIRE Directive 2007/2/EC and 2011/850/EU Implementing Decision, data is required to be reported to one decimal place (two for CO). As of September 2014, a number of sites are still reporting gaseous data as integers. These are:

- Armagh Roadside
- Carlisle Roadside
- Newcastle Cradlewell Roadside
- Newport
- Scunthorpe (to 0.5ppb)
- Sunderland Silksworth
- Warrington
- Salford Eccles
- York Fishergate

4.2 Data Capture and Station-Specific Issues October-December 2014- England (Excluding Greater London)

Table 4.2 shows percentage data capture for sites in England during Quarter 4 of 2014. Where data capture between 85% and 90% the value is shaded orange: where data capture is less 85% it is shaded yellow. The table is followed by details of individual site-specific issues.

Table 4.2 Data Capture - England

Name	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Average
Barnsley Gawber				99.59	99.50	99.41	99.50
Barnstaple A39		87.86	87.00				87.43
Bath Roadside				99.91			99.91
Billingham				36.32			36.32

Name	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Average
Birmingham Acocks Green			99.46	99.64	99.41		99.50
Birmingham Tyburn		99.68	99.95	99.82	99.91	81.88	96.25
Birmingham Tyburn Roadside		98.10	99.50	99.68	99.09		99.09
Blackburn Accrington Road				99.77			99.77
Blackpool Marton			53.67	99.86	99.91		84.48
Bottesford					99.28		99.28
Bournemouth			100.00	99.77	98.32		99.07
Brighton Preston Park			100.00	99.91	99.91		99.91
Bristol St Paul's		99.82	80.39	99.95	99.86		95.01
Cambridge Roadside				99.91			99.91
Canterbury				99.86	81.88		90.87
Carlisle Roadside		91.49	91.12	83.92			88.84
Charlton Mackrell				99.91	99.91		99.91
Chatham Centre Roadside		99.64	99.41	98.69			99.25
Chesterfield Roadside		99.55	99.32	97.74			98.87
Coventry Allesley			97.64	88.50	99.64		95.25
Eastbourne		75.91	75.91	83.97			78.59
Exeter Roadside				99.50	99.82		99.66
Glazebury				99.86	99.82		99.84
Great Dun Fell					99.41		99.41
Harwell		83.51	97.28	92.66	97.60	97.60	93.73
Harwell (Partisol)		100.00	97.83				98.91
High Muffles				99.91	99.91		99.91
Honiton				94.88			94.88
Horley				60.42			60.42
Hull Freetown		84.96	99.82	99.95	99.59	100.00	96.87
Ladybower				99.86	99.86	99.73	99.82
Leamington Spa		99.82	99.86	60.96	99.64		90.07
Leamington Spa Rugby Road		97.74	99.59	99.73			99.02
Leeds Centre	99.73	97.15	99.64	99.73	94.84	99.23	98.38
Leeds Headingley Kerbside		95.83	99.18	99.73			98.25

Name	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Average
Leicester University			99.82	99.50	99.82		99.71
Leominster				98.87	99.82		99.34
Lincoln Canwick Road				99.73			99.73
Liverpool Queen's Drive Roadside				98.37			98.37
Liverpool Speke		99.46	99.68	99.82	99.82	97.60	99.28
Lullington Heath				94.66	98.19	91.35	94.73
Manchester Piccadilly			99.32	99.77	99.86	92.75	97.93
Manchester South				99.86	99.82		99.84
Market Harborough				95.38	99.23		97.31
Middlesbrough		99.95	99.64	99.59	99.95	99.68	99.76
Newcastle Centre		99.14	98.96	90.53	98.96		96.90
Newcastle Cradlewell Roadside				92.12			92.12
Northampton Kingsthorpe			89.13	99.68	99.77		99.51
Norwich Lakenfields		99.82	99.64	99.64	99.82		99.73
Nottingham Centre		85.28	87.73	92.98	95.20	94.25	91.09
Oldbury Birmingham Road				73.78			73.78
Oxford Centre Roadside				93.03			93.03
Oxford St Ebbes		97.06	99.41	99.59			98.69
Plymouth Centre		99.91	95.79	99.91	99.77		98.85
Portsmouth		99.77	99.50	83.11	99.91		95.57
Preston			91.53	99.73	99.73		97.00
Reading New Town		99.73	99.82	95.65	99.91		98.78
Rochester Stoke		90.35	98.32	99.68	99.82	99.59	97.55
Salford Eccles		99.68	99.68	95.34			98.23
Saltash Callington Road		89.76	86.41				88.09
Sandy Roadside		5.48	57.29	72.60			45.12
Scunthorpe Town		84.24		89.31		90.08	87.88
Shaw Crompton Way				99.73			99.73
Sheffield Devonshire Green		93.75	87.68	97.24	94.43		93.27
Sheffield Tinsley				99.95			99.95

Name	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Average
Sibton					99.59		99.59
Southampton Centre		99.95	99.68	99.32	99.59	99.18	99.55
Southend-on-Sea			68.57	96.97	96.92		87.48
St Osyth				95.24	99.14		97.19
Stanford-le-Hope Roadside		92.03	97.60	99.73			96.45
Stockton-on-Tees Eaglescliffe		99.50	99.50	99.86			99.62
Stoke-on-Trent Centre		99.46	99.59	99.64	99.86		99.64
Storrington Roadside		64.63	64.04	78.31			68.99
Sunderland Silksworth			68.66	91.35	91.67		83.89
Thurrock		99.68		99.68	99.95	99.37	99.67
Walsall Woodlands				100.00	99.91		99.95
Warrington		99.77	99.91	99.77			99.82
Weybourne					99.91		99.91
Wicken Fen				21.11	21.11	21.01	21.07
Wigan Centre			62.50	99.41	98.46		86.79
Wirral Tranmere			97.83	99.91	99.95		99.23
Yarner Wood				99.73	99.77		99.75
York Bootham		99.55	99.09				99.30
York Fishergate		99.50	99.59	99.68			99.59
Number of Sites	**1**	**39**	**50**	**76**	**52**	**16**	**84**
Number of sites < 85 %	**0**	**6**	**8**	**10**	**2**	**2**	**9**
Number of sites < 90%	**0**	**9**	**13**	**12**	**2**	**2**	**15**
Network mean	**99.73**	**90.21**	**92.45**	**93.85**	**97.25**	**91.42**	**93.39**

Barnstaple A39

There were a number of periods of elevated enclosure temperature caused by vermin damage to the air conditioning unit; these periods of data were deleted.

Billingham

The sample filters on site were found to be the incorrect size, and it is likely that the use of these resulted in the analyser sampling internally from 3 November into 2015. The erroneous data have been deleted.

Blackpool Marton

The $PM_{2.5}$ data were found to be a regional outlier for much of the quarter; this was probably due to a cooler fault which was eventually repaired on 28 October. Data from 25 September to 28 October have been deleted.

Carlisle Roadside

The NOx analyser showed severe drift between 1 and 16 October possibly due to air conditioning faults; data have been deleted.

Horley

The NOx analyser experienced various faults during the quarter, including ozone generator failure, resulting in considerable data loss. Replacement parts had to be sourced from Australia, which delayed repair.

Oldbury Birmingham Road

The commissioning of this site was delayed by vegetation around the cabinet.

Saltash Callington Road

Data capture narrowly missed the 90% target. The main reason for loss was due to a faulty mass transducer on the $PM_{2.5}$ FDMS in October.

Sandy Roadside

The PM_{10} analyser was removed for workshop repair, but faults continued following reinstallation. The $PM_{2.5}$ and NOx analysers suffered faults which were not detected due to persistent failure of the site communications.

Scunthorpe Town

The PM_{10} data was very noisy for much of the quarter. The PM_{10} analyser suffered several faults leading to sensor unit replacement on 28 November. There is ongoing concern as to the validity of some NOx calibrations due to confusion as to where the data is logged-the analyser or the logger. Some further investigation is required.

Southend-on-Sea

The $PM_{2.5}$ data were identified as a regional outlier up to the drier change on 27 October, and were deleted.

Storrington Roadside

Communications with the station were lost due to poor reception and no data was able to be collected. The CMCU sent a replacement modem, but reception remained poor. A new SIM card supplied, but could not establish communication with the site. The ESU attended for service and re-installed code activated switch. Data were collected from 13th December.

Sunderland Silksworth

The station was recommissioned on 8 October following the replacement of the cabin. The $PM_{2.5}$ analyser performance was poor, and the drier and the sensor unit both required replacement this quarter. Data were deleted up to 15 October (flow fault) and 6-19 November (sensor fault).

Wicken Fen

The station was closed for cabin replacement from 26 September to 12 December. The SO_2 data still appear to be erratic following re-commissioning.

Wigan Centre

The $PM_{2.5}$ FDMS was switched off from 24 September to 10 October due to overheating in the cabin. Further data were deleted from 9-31 December as an incorrect filter was found in the purge line during an ESU callout of 5 January 2015.

4.3 Data Capture and Station-Specific Issues October-December 2014- Greater London

Table 4.3 shows percentage data capture for sites in Greater London during Quarter 4 of 2014. Where data capture between 85% and 90% the value is shaded orange: where data capture is less 85% it is shaded yellow. The table is followed by details of individual site-specific issues.

Table 4.3 Data Capture – Greater London

Name	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Average
Camden Kerbside		99.86	99.55	99.77			99.73
Ealing Horn Lane		99.91					99.91
Haringey Roadside			98.91	100.00			99.46
London Bexley			96.06	99.68		95.24	97.00
London Bloomsbury		99.86	99.95	99.82	99.86	99.59	99.82
London Eltham			66.89	15.13	99.68		60.57
London Haringey Priory Park South				0.00	99.91		49.95
London Harlington		97.46	97.60	93.70	61.37		87.53
London Harrow Stanmore			93.43				93.43
London Hillingdon				99.82	99.46		99.64
London Marylebone Road	93.21	98.69	99.05	99.55	94.79	99.64	97.49
London Marylebone Road (Partisol)		98.91	100.00				99.46
London N. Kensington	98.51	77.17	99.91	98.37	82.52	98.46	92.49
London N. Kensington (Partisol)		100.00	100.00				100.00
London Teddington				99.82	98.01		98.91
London Teddington Bushy Park			79.66				79.66
London Westminster			98.91	99.64			99.61
Southwark A2 Old Kent Road		0.00		0.00			0.00
Tower Hamlets Roadside				99.82			99.82
Number of Sites	**2**	**9**	**13**	**14**	**8**	**4**	**19**
Number of sites < 85 %	**0**	**2**	**2**	**3**	**2**	**0**	**4**
Number of sites < 90%	**0**	**2**	**2**	**3**	**2**	**0**	**5**
Network mean	**95.86**	**85.76**	**94.61**	**78.94**	**91.95**	**98.23**	**87.08**

London Eltham

A fault with the NOx power supply unit was found during the service on 22 August; the analyser was removed for workshop repair, finally being reinstalled on 28 August where a fault with the ozone generator was diagnosed. The analyser was finally reinstalled on 17 December. The PM2.5 switching valve developed a fault around 1 December, and was removed for repair. Data recommenced on 11 March.

London Haringey Priory Park South

The NOx analyser developed several faults during the quarter, and was not successfully repaired before the ESU entered liquidation, leaving the site with no LSO or ESU cover. All NOx data for the quarter have been deleted. A replacement analyser was installed on 7 January.

London Teddington Bushy Park

Following a prolonged period of poor quality data which were deleted in previous quarters, a replacement mass transducer on 24 September. Further problems with leaks in the system resulted in further data loss up to 23 October.

Southwark A2 Roadside

This site remained closed pending cabin repair for the entire quarter. The ESU entered liquidation during the quarter which has delayed repair.

4.4 Data Capture and Station-Specific Issues October-December 2014– Wales

Table 4.4 shows percentage data capture for sites in Scotland during Quarter 4 of 2014. Where data capture between 85% and 90% the value is shaded orange: where data capture is less 85% it is shaded yellow. The table is followed by details of individual site-specific issues.

Table 4.4 Data Capture Wales

Name	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Average
Aston Hill				97.37	100.00		98.69
Cardiff Centre	97.83	98.19	99.82	97.64	99.86	98.46	98.63
Chepstow A48		98.51	99.91	99.86			99.43
Cwmbran				99.59	99.73		99.66
Hafod-yr-ynys Roadside				97.73			97.73
Narberth		97.78		97.96	97.74	98.19	97.92
Newport		99.82	99.55	99.91			99.76
Port Talbot Margam		100.00					100.00
Port Talbot Margam	99.64	96.29	55.53	98.37	99.68	99.68	91.53
Swansea Roadside		96.69	96.74	99.82			97.75
Wrexham		97.83	100.00	99.86		99.91	99.85
Number of Sites	**2**	**8**	**6**	**10**	**5**	**4**	**11**
Number of sites < 85 %	**0**	**0**	**1**	**0**	**0**	**0**	**0**
Number of sites < 90%	**0**	**0**	**1**	**0**	**0**	**0**	**0**
Network mean	**98.73**	**98.14**	**91.92**	**98.81**	**99.40**	**99.06**	**98.27**

4.5 Data Capture and Station-Specific Issues October-December 2014– Scotland

Table 4.5 shows percentage data capture for sites in Scotland during Quarter 4 of 2014. Where data capture between 85% and 90% the value is shaded orange: where data capture is less 85% it is shaded yellow. The table is followed by details of individual site-specific issues.

Table 4.5 Data Capture Scotland

Name	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Average
Aberdeen		83.92	92.84	93.16	84.56		88.62
Aberdeen Union Street Roadside				99.18			99.18
Auchencorth Moss (Partisol)		100.00	100.00		99.77		99.79
Auchencorth Moss (FDMS)		99.77	99.86				99.82
Bush Estate				91.67	91.80		91.73
Dumbarton Roadside				99.86			99.86
Dumfries				99.37			99.37
Edinburgh St Leonards	21.97	20.65	6.52	21.83	21.92	15.99	18.15
Eskdalemuir				99.91	99.91		99.91
Fort William				99.86	90.13		95.00
Glasgow Great Western Road				99.77			99.77
Glasgow Kerbside		88.55	80.27	76.18			81.65
Glasgow Townhead		72.83	82.97	99.82	99.82		88.86
Grangemouth		95.83	95.11	96.11		94.88	95.48
Grangemouth Moray				99.55			99.55
Inverness		100.00	100.00	99.68			99.71
Lerwick					0.00		0.00
Peebles				99.82	99.86		99.84
Strathvaich					76.77		76.77
Number of Sites	**1**	**8**	**8**	**15**	**10**	**2**	**19**
Number of sites < 85 %	**1**	**3**	**3**	**2**	**4**	**1**	**4**
Number of sites < 90%	**1**	**4**	**3**	**2**	**4**	**1**	**6**
Network mean	**21.97**	**82.70**	**82.20**	**91.72**	**76.45**	**55.43**	**85.95**

Edinburgh St Leonards

The site was closed from 12 September to 9 December for replacement of the cabin.

Glasgow Kerbside

The site NOx analyser developed a fault, and was replaced with a hotspare on 17 October. Unfortunately, the memory was wiped on removal, and data to 8 November have been lost. In addition, the air conditioning system continued to cause extreme spiking of both FDMS units each evening, and some data have been deleted each day. The FDMS units were removed for relocation in early January 2015.

Glasgow Townhead

There were several callouts for unstable data from both the $PM_{2.5}$ and PM_{10} analysers during the quarter. No specific reason was found, but believed due to vibration and temperature issues.

Lerwick

Lerwick remained closed due to relocation of the site.

Strathvaich

Data were lost between 10 to 22 December due to an unspecified instrument fault.

4.6 Data Capture and Station-Specific Issues October-December 2014- Northern Ireland

Table 4.6 shows percentage data capture for sites in Northern Ireland (also the Mace Head site in the Republic of Ireland) during Quarter 4 of 2014. Where data capture between 85% and 90% the value is shaded orange: where data capture is less 85% it is shaded yellow. The table is followed by details of individual site-specific issues.

Table 4.6 Data Capture Ireland

Name	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Average
Mace Head					99.77		99.77
Armagh Roadside		0.00		95.83			47.92
Ballymena Ballykeel						100.00	100.00
Belfast Centre	90.17	99.91	99.50	94.38	98.51	99.46	96.99
Belfast Stockman's Lane		99.46		98.73			99.09
Derry		88.99	99.68	99.95	99.95	99.95	97.71
Lough Navar		98.05			99.41		98.73
Number of Sites	**1**	**5**	**2**	**4**	**4**	**3**	**7**
Number of sites < 85 %	**0**	**1**	**0**	**0**	**0**	**0**	**1**
Number of sites < 90%	**0**	**2**	**0**	**0**	**0**	**0**	**1**
Network mean	**90.17**	**77.28**	**99.59**	**97.23**	**99.41**	**99.80**	**91.46**

Armagh Roadside

The unstable $PM_{2.5}$ data previously reported continued into this quarter. The analyser received insufficient attention from the ESU up to their entering liquidation. All $PM_{2.5}$ data have been deleted, and this may well continue into 2015.

4.7 Changes to Previously Ratified Data

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

- Barnstaple $PM_{2.5}$; 9 -19 May , deleted
- Camden Kerbside PM_{10}; 4-19 Aug, data deleted
- Carlisle Roadside $PM_{2.5}$ 19-20 June, data deleted
- Leeds Centre $PM_{2.5}$ 23-30 April, data deleted
- Liverpool Speke PM_{10}, 9-18 July, data deleted
- Manchester Piccadilly O_3, 1 Jan-30 September, rescaled as a result of audit results
- Portsmouth NOx, 22-30 September, sample inlet tube connected to wrong manifold
- Reading New Town NOx, 1 April-30 September rescaled as a result of audit results
- Rochester Stoke $PM_{2.5}$ 1-15 July, data deleted
- Saltash Callington Road $PM_{2.5}$ 18-23 July, data deleted
- Sandy Roadside PM_{10} 12-30 March, data deleted
- Stanford-le-Hope $PM_{2.5}$, 26 March-8 April, data deleted
- Stoke-on-Trent Centre, O_3, 10 February-30 September, rescaled as a result of audit results
- Stoke-on-Trent NOx, 1 July-30 September, rescaled due to an incorrectly recorded analyser calibration
- Storrington Roadside 21 July-30 September, rescaled due to flow fault
- Warrington $PM_{2.5}$ 8 June-1 July, data deleted
- Warrington NOx, 1 July-30 September, rescaled due to an incorrectly recorded analyser calibration
- Wigan Centre NOx, 1 July-30 September, rescaled in line with Q4 calibrations.
- Wirral Tranmere NOx, 1-30 June, rescaled in line with subsequent calibrations

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

5 Health and Safety Report 2014

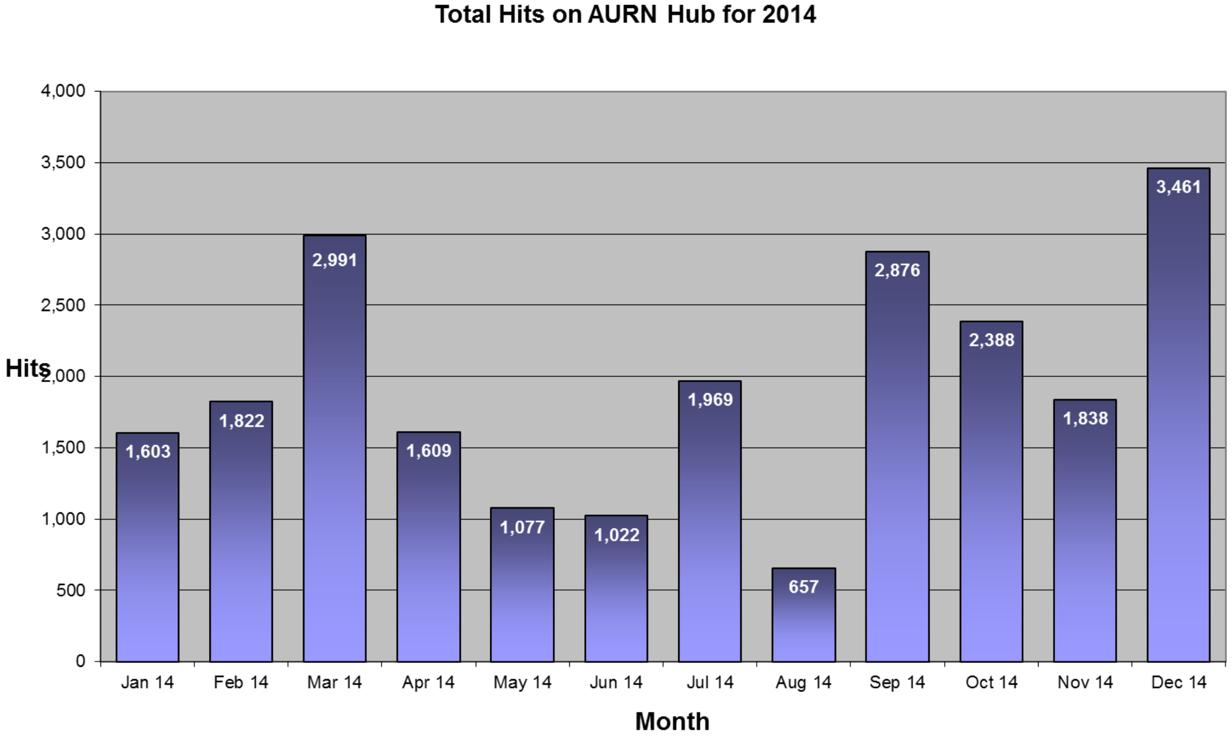
The risk status of the following monitoring stations was raised to “High” on the Health & Safety Database during 2014. This list includes all Defra monitoring networks, not just the AURN, as the QAQC contractor acts as health and safety co-ordinator for all monitoring networks. All the problems were satisfactorily resolved.

1. London Cromwell Road 2 (not AURN): 03/03/2014 – water ingress through the wall of the cabin. (Reported by Sim Tang, CEH).
2. Liverpool Speke, 02/05/2014: the cabin floor collapsed as a result of degradation of the site infrastructure, leading to exposed wires and hence constituted an electrical risk. The site was closed until the energy supplier had completed repair works (reported by CMCU).
3. York Bootham 07/07/2014 – a wasps’ nest.
4. Billingham 16/10/2014: unsatisfactory site electrical test – site electrically unsafe.
5. Scunthorpe Town 19/11/2014: unsecured cylinders and trip hazards within the cabin.
6. Billingham 12/12/2014 – another electrical issue.

6 AURN Hub

A summary of the usage statistics of the AURN Hub is given in Figure 6.1. The Hub has seen enhanced usage amongst all Network stakeholders due to the introduction of the Health and Safety Database.

Figure 6.1 Usage Statistics for the AURN Hub



7 Equipment Upgrade Requirements

7.1 Equipment

As can be seen from the asset list in Section 8, many of the ozone photometers used by the QA/QC Unit are of considerable age, and consideration should be given to replacing the oldest ones in the near future. Many of the Sabio instruments listed are no longer in a serviceable condition.

7.2 Site Infrastructures

The QA/QC Unit is not aware of any station infrastructure which is currently in need of repair or replacement.

8 Inventory of Defra-Owned Equipment

This section provides an updated list of all Defra-owned equipment used by the QAQC unit. Not all equipment listed is in operational condition.

Table 8.1 Current Asset List as held by Ricardo-AEA

Contract	Location	Asset	Serial number	Date in service
AURN QA/QC	Harwell - Ludbridge Mill	API model M401	123	01/04/1999
AURN QA/QC	Glasgow	API model M401	151	01/10/2000
AURN QA/QC	Harwell - Ludbridge Mill	API model M401	176	01/12/2002
AURN QA/QC	Glasgow	API model M401	291	01/05/2004
AURN QA/QC	Harwell - Ludbridge Mill	API model M402	245	unknown
AURN QA/QC	Harwell - Ludbridge Mill	API model M401	292	01/05/2004
AURN QA/QC	Harwell - Ludbridge Mill	API model M401	293	01/05/2004
AURN QA/QC	Glasgow	API model M703	255	01/01/2010
AURN QA/QC	Glasgow	Sabio 2010 dilution calibrator	03740708	01/02/2005
AURN QA/QC	Harwell - Ludbridge Mill	Sabio 2020 dilution calibrator	02720306B	01/06/2006
AURN QA/QC	Harwell - Ludbridge Mill	Sabio 2020 zero air generator	02710306B	01/06/2006
AURN QA/QC	Harwell - Ludbridge Mill	Sabio 2020 zero air generator	03731208C	01/03/2006
AURN QA/QC	Harwell - Ludbridge Mill	Sabio 2030 ozone photometer	7820708	01/03/2008
AURN QA/QC	Harwell - Ludbridge Mill	Sabio 2010 dilution calibrator	02940306A	01/03/2008
AURN QA/QC	Glasgow	Drycal flow meter	110085	unknown

Contract	Location	Asset	Serial number	Date in service
AURN QA/QC	Harwell - Ludbridge Mill	Drycal flow meter	107881	2006
AURN QA/QC	Glasgow	Drycal low flow meter	6699	2002
AURN QA/QC	Glasgow	Sabio 2020 zero air source	03620708b	2006
AURN QA/QC	Glasgow	Sabio 2020 zero air source	03711208c	2006
AURN QA/QC	Harwell - Ludbridge Mill	Sabio 2020 zero air source	03701208c	2006
AURN QA/QC	Harwell - Ludbridge Mill	AC31 dual chamber NOx analyser	1672	01/03/2003
AURN QA/QC	Harwell - Ludbridge Mill	TEI 43C SO_2 analyser	386	01/03/2003
AURN QA/QC	Harwell - Ludbridge Mill	TEI 48C CO analyser	48C-77631-386	01/03/2003
AURN QA/QC	Harwell - Ludbridge Mill	M265 chemilumines-cent ozone analyser	066, ET number 16373	01/03/2003
AURN QA/QC	Glasgow	API fluorescent S02 Analyser Model 100A	1572	unknown
AURN QA/QC	Glasgow	Thermo NO-NO2-NOx Analyser Model 42c	42c-56236-307	unknown
AURN QA/QC	Harwell - Ludbridge Mill	API model M703	278	30/06/2010
AURN QA/QC	Harwell - Ludbridge Mill	API model M703	279	30/06/2010
AURN QA/QC	Harwell - Ludbridge Mill	Ozone analyser Thermo 49i	713021785	unknown
AURN QA/QC	Harwell - Ludbridge Mill	Ozone analyser Thermo 49i	713021784	unknown
AURN QA/QC	Harwell - Ludbridge Mill	API model M703	254	06/01/2010
AURN QA/QC	Harwell - Ludbridge Mill	API model M703	18942	06/01/2010

9 Improved Technology

9.1 Improvements Introduced

No new technologies have been introduced into the network during 2014.

9.2 Potential Improvements

In previous quarters, there have been several discrepancies between QA/QC and ESU measured flowrates on Partisol samplers. It is probable that this is due to day-to day variations in flowrate when the filter is changed. Currently, the QA/QC Unit only measures the flowrate at winter and summer audits; it is proposed that the flowrates are also measured at the spring and autumn ozone audits.

10 Conclusions and Recommendations

10.1 Data Capture 2014

The data capture across the whole network for 2014 is given in Table 10.1.

Table 10.1 Data Capture, 2014

Name	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Average
Number of Sites	7	71	80	121	80	29	142
Number of sites < 85 %	1	24	27	27	7	5	31
Number of sites < 90%	1	33	39	33	13	8	46
Network mean	91.86	84.72	85.57	90.45	93.96	91.90	88.76

The network average data capture was 88.76%, though as can be seen, 31 sites failed to meet the target of 85%. Principal reasons for data loss include site infrastructure upgrades, poor analyser performance and persistent temperature problems.

10.2 Sites where Data Capture was Below 85%

Table 10.2 shows the sites that failed to meet the requirement for 85% data capture in 2014.

Table 10.2 Sites below 85%, 2014

Name	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Average
Middlesbrough		69.68	91.02	83.57	87.61	90.94	84.56
Preston			77.96	86.92	87.10		83.99
Leamington Spa Rugby Road		60.81	94.19	96.69			83.90
Sunderland Silksworth			77.15	87.87	85.63		83.55
Camden Kerbside		75.99	75.03	99.52			83.52

Name	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Average
Port Talbot Margam	94.75	96.00	19.91	90.62	98.56	98.53	83.06
Newcastle Centre		83.14	82.79	80.98	84.42		82.83
London Eltham			83.70	64.84	97.40		81.98
Portsmouth		59.04	91.71	74.09	99.30		81.04
Saltash Callington Road		92.98	68.79				80.88
Exeter Roadside				77.97	78.41		78.19
Eastbourne		76.28	75.75	80.90			77.64
Carlisle Roadside		73.37	75.56	79.11			76.01
Billingham				75.81			75.81
Haringey Roadside		84.66	82.55	65.26			75.31
Blackburn Accrington Road				75.01			75.01
Glasgow Kerbside		71.26	60.69	92.79			74.93
Wicken Fen				74.16	76.96	73.05	74.72
Wirral Tranmere			64.95	55.29	99.04		73.09
Edinburgh St Leonards	65.55	70.22	65.50	72.42	72.48	72.39	69.76
Oxford St Ebbes		35.82	72.69	99.27			69.26
Storrington Roadside		44.79	85.15	72.71			67.55
Belfast Stockman's Lane		53.21		74.36			63.78
Sandy Roadside		30.81	75.33	84.59			63.58
Glasgow Great Western Road				57.28			57.28
Armagh Roadside		38.69		71.61			55.15
Coventry Memorial Park			36.56	42.71	42.88		40.72
Southwark A2 Old Kent Road		39.09		38.18			38.64
London Teddington Bushy Park			38.07				38.07
Lerwick					0.00		0.00

Details of data loss and the causes are given in the previous quarterly reports, or in the appropriate CMCU reports. Reports are available at http://uk-air.defra.gov.uk/library/reports?section_id=13 .

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