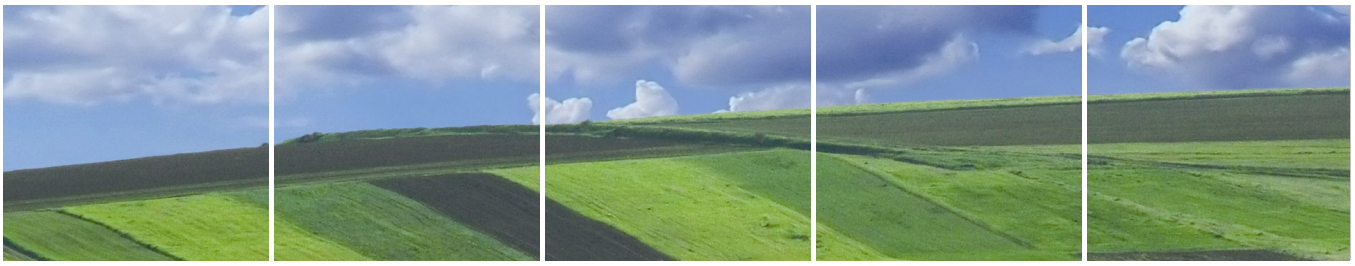
AEA



QA/QC Data Ratification and Intercalibration Report for the Automatic Urban and Rural Network, January-March 2010

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

AEAT/ENV/3049 Issue 1

ED42523

Title	QA/QC Data Ratification and Intercalibration Report for the Automatic Urban and Rural Network, January-March 2010
Customer	Department for Environment, Food and Rural Affairs, Scottish Government, Welsh Assembly Government and the DoE in Northern Ireland
Customer reference	RMP 4961
Confidentiality, copyright and reproduction	Unrestricted This report is the Copyright of Defra and the Devolved Administrations and has been prepared by AEA Technology plc under contract to Defra dated April 2008. 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 and the Devolved Administrations. AEA Technology plc 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.
File reference	
Reference number	AEAT/ENV/R/3049 Issue 1

AEA Group
The Gemini Building
Fermi Avenue
Harwell
Didcot
Oxfordshire
OX11 0QR

Tel: 0870 190 6574
Fax: 0870 190 6608

AEA is a business name of AEA Technology plc

AEA is certificated to ISO9001 and ISO14001

Author	Name	Stewart Eaton & Brian Stacey
Approved by	Name	Rachel Yardley
	Signature	
	Date	September 2010

Executive summary

Part A Data ratification, January-March 2010

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 Assembly Government and DoE in Northern Ireland.

Ratified hourly average data capture for the network averaged 88.8% for all pollutants (O_3, NO_2, SO_2, CO, PM_{10} and $PM_{2.5}$) during the 3-month reporting period January-March 2010. Data capture rates for only O_3 and SO_2 were above 90%. There were 43 sites with data capture less than 90% for the period.

The number of monitoring sites in the AURN during this quarter was 134, of which 70 are Local Authority owned sites affiliated to the national network. Some are co-located gravimetric particulate analysers at sites with automatic analysers.

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

Substantial changes have been made to the AURN network since the end of September 2007, and those implemented during 2009 are summarised in this report. The changes are necessary to ensure compliance with the new European Air Quality Directive (2008/50/EC). Considerable progress has been made in implementing these changes though they will still take some time to complete. Eight additional analysers (including three new sites) were commissioned this quarter.

Part B Winter 2010 Intercalibration

A total of 132 sites in the AURN were calibrated by AEA during the January-March 2010 Network Intercalibration exercise. Two sites (Great Dun Fell and Rochester Stoke) were not operational.

The results show that the majority of the network analysers are working satisfactorily and that data are generally of high quality. A total of 77 out of 406 analysers deviated by more than the appropriate acceptance criteria (see Section 7), and a further 4 NOx converters were found to be unacceptably inefficient. The concentrations of the on-site calibration gas cylinders were also checked. The certificate of calibration for the AURN is provided in Appendix 6.

Table of contents

Appendices

Appendix 1: Recommendations for Upgrade or Replacement of Equipment

Appendix 2: Data Gaps Listing: January-December 2010

Appendix 3: Inventory of Defra-owned Equipment

Appendix 4: Partisol Data Report

Appendix 5: Information for New Sites

Appendix 6: Certificate of Calibration

1 Introduction

This quarterly report covers the Quality Assurance and Control (QA/QC) activities undertaken by AEA to ratify automatic monitoring data from Defra and the Devolved Administrations' urban and rural air quality monitoring network (AURN) for the period January-March 2009. During this period there were 134 operational monitoring sites in the Network of which there are 99 urban sites, 27 rural sites and a further 8 sites in the London Air Quality Monitoring Network (LAQN) which are affiliated into the national network. There are currently 61 Defra-funded sites and 73 affiliate sites. Eleven sites have non-automatic particulate samplers (Partisols); some of these are collocated with FDMS analysers at Auchencorth Moss, Harwell, London North Kensington and Marylebone Road for both PM_{10} and PM_{25}.Port Talbot Margam has a Partisol, which was converted from $PM_{2.5}$ to PM_{10} during this quarter.

1.1 Overview of Network Performance

Ratified hourly average data capture for the network averaged 88.8% for all pollutants (O_3, NO_2, SO_2, CO, PM_{10} and $PM_{2.5}$) during the 3 month reporting period January-March 2010 (see Table 1.2). Only O_3 and SO_2 achieved 90% or higher data capture. Data capture rates are calculated using the actual data capture as hourly averages (daily for Partisol) against the total number of hours (or days) in the relevant period; service and maintenance are counted as lost data. For sites starting or closing, the data capture is based on the actual date starting or closing.

Table 1.2: AURN Ratified Data Capture (%) by Quarter, 2010

	CO	PM_{10}	$PM_{2.5}$	NO_2	O_3	SO_2	Mean
Q1 2010 %	90.3	85.1	85.9	89.9	91.8	91.2	88.8

Overall, 313 out of the 406 analysers (77%) achieved data capture levels above the required 90% target during this reporting period (See Table 1.3).

Table 1.3: Number of Analysers with Data Capture below 90%

Total Number Of Analysers		Q1 Jan-Mar 2010 (No. below 90%)
CO	24	5
NO_2	113	22
O_3	80	10
PM_{10}[1]	67	21
$PM_{2.5}$[1]	77	27
SO_2	45	10
Total <90%	-	93

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

In total, 43 out of the 134 operational network sites in the quarter (30%) had an average data capture rate below the required 90% level for the January-March 2010 period. This is influenced by the fact that new analysers at existing sites have data capture figures calculated from the start date of the quarter, not from the start of the analyser itself. The sites with overall data capture below 90% are listed in Table 1.4. The main site operational and QA/QC issues giving rise to data capture below the required 90% level are summarised in Section 4.

Table 1.4: Sites with Average Data Capture < 90%, January-March 2010

Site	Site Average	Principle reason for Data Loss
England		
Blackburn Darwen Roadside	40.3	NOx converter fault
Blackpool Marton	65.3	Monitoring suspended for infrastructural repairs
Bournemouth	85.3	Partisol removed for repair
Brighton Preston Park	88.6	Partisol filter exchange faults
Bristol Old Market	54.6	NOx converter fault
Bury Roadside	73.1	CO flow fault
Camden Kerbside	69.8	NOx analyser faults and $PM_{2.5}$ leaks
Coventry Memorial Park	82.2	O_3 sampling fault
Exeter Roadside	46.1	O_3 analyser fault
Great Dun Fell	36.2	Analyser fault
Harwell PARTISOL	69.4	PM_{10} Partisol removed for repair
London Bexley	88.0	Power and air con faults
London Harlington	72.2	NOx sampling internally; PM data poor quality
London Marylebone Road PARTISOL	75.6	Missing component in $PM_{2.5}$ Partisol; SO_2 analyser fault (under investigation)
London N. Kensington	86.7	Various analyser faults and internal sampling
London Teddington	80.4	$PM_{2.5}$ memory loss
Manchester Piccadilly	89.1	$PM_{2.5}$ pump fault
Middlesbrough	87.3	$PM_{2.5}$ data poor quality; suspected dryer fault
Portsmouth	74.2	$PM_{2.5}$ leak
Reading New Town	78.6	NOx baseline too high; suspected sampling fault
Rochester Stoke	**0.0**	Monitoring suspended whilst hut replaced; analyser faults on restart
Sandwell West Bromwich	82.8	O_3 internal sampling
Sandy Roadside	88.6	Poor PM_{10} data deleted by ERG
Southend-on-Sea	61.7	NOx data deleted due to high baseline
Stanford-le-Hope Roadside	76.2	Continuing poor PM_{10} performance
Storrington Roadside	68.5	PM_{10} noisy data deleted
Walsall Willenhall	36.1	Site burned down 4 February
York Fishergate	87.2	Power failure
Ireland		
N Ireland		
Armagh Roadside	77.7	NOx analyser out of service
Ballymena	86.1	Communications fault
Derry	61.9	Very poor $PM_{2.5}$ and PM_{10} perfomance still unresolved
Scotland		
Aberdeen Union Street Roadside	48.0	NOx converter fault
Auchencorth Moss	89.3	Partisol $PM_{2.5}$ filter exchange faults
Auchencorth Moss PM_{10} PM_{25}	64.8	PM_{10} leaks and faults
Fort William	85.9	NOx analyser fault
Glasgow Centre	81.3	PM_{10} FDMS dryer failure
Inverness	85.2	Very unstable NOx data
Wales		
Mold	68,9	NOx sampling fault
Narberth	83.2	SO_2 lamp failure; NOx autocal run-on
Newport	76.0	Suspected poor FDMS dryer performance
Port Talbot Margam PM_{10} $PM_{2.5}$ (Partisol $PM_{2.5}$ from 18/2/10)	83.3	Broken rain jar
Wrexham	82.7	Partisol sampling internally
Number of sites	41	

1.2 LSO Manual

As noted in Section 1.1, the LSO Manual has been extensively updated in March 2009 to include a section on the FDMS analysers and updates to the Partisol section Instructions for new analyser types recently introduced into the network are also available.. LSOs who operate any of these analysers should now use the new version of the manual.

During the site upgrade process, many sites have been equipped with analysers of more than one manufacturer, and LSOs for these sites will need several of the individual sections to cover all their equipment. For this reason, and for environmental reasons, printed copies will no longer be provided, but all relevant sections are available on the UK Air Quality Archive at http://www.airquality.co.uk/reports/empire/lsoman/lsoman.html.

Recent updates include changes to FDMS procedures, use of zero air cylinders for monthly calibrations, and the removal of the requirement for LSOs to perform monthly calibrations of the ozone analyser.

1.3 AURN Hub

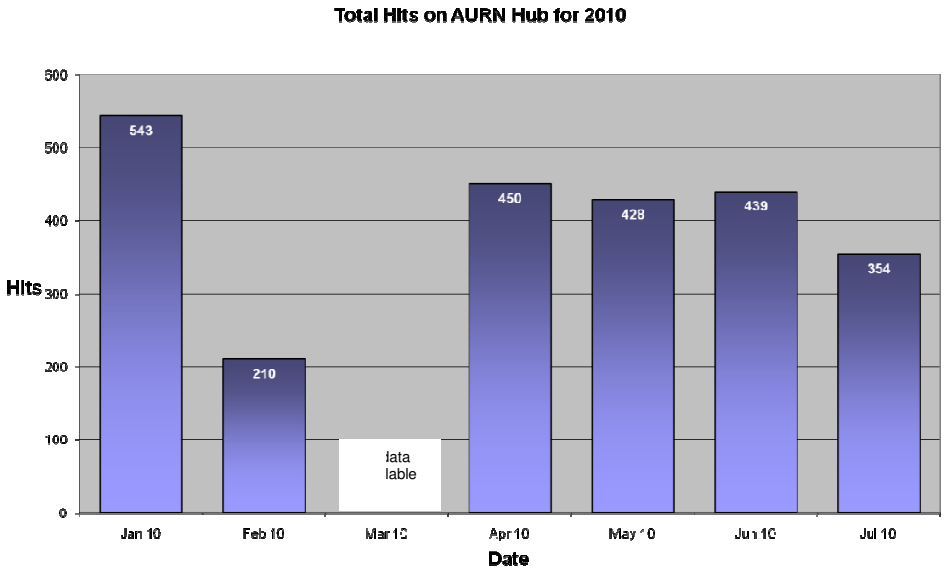
The AURN project information hub is located at[1]: http://www.aurnhub.co.uk/
The site is regularly updated and some of the more recent information includes:

- Monthly PM_{10} (Gravimetric) exceedences up to March 2009
- QA/QC Unit's Data Ratification Report October-December 2009
- CMCU Quarterly report, October-December 2009
- London Network Management Report October to December 2009
- Recent news items
- Updated version of the LSO manual.
- Site cylinder concentrations and pressures updated weekly
- QA/QC audit schedule and service schedule

The Hub has continued to provide a valuable source of information for interested organisations as shown in Figure 1.1.

[1] Password protected site: username and password available to LSOs and ESUs from rachel.yardley@aeat.co.uk

Figure 1.1: AURN Hub Hits 2010



1.4 AURN QA/QC Manual

The QA procedures used throughout the AURN network have been documented by AEA and BV. This document covers a wider range of procedures than covered in this report. The QA/QC manual can be downloaded at http://www.airquality.co.uk/reports/reports.php?report_id=574

1.5 Status of Ratified Data

1.5.1 Data Status

Once all the ratification checks and corrections have been made then the data are loaded to the Air Quality Archive with a status flag of "Ratified".

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 that 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 that 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.

Any further necessary corrections to an annual data set are, as far as possible, made before the UK results are sent to the European Commission in September of the following year.

In the event that there is a strong case for modifying datasets already sent to the European Commission, this will usually require widespread consultation and agreement before implementation.

An example is the correction of UK gravimetric PM_{10} monitoring data from 2000 to 2008, which was widely consulted on. The corrected data are now on the Air Quality Archive database and the revised dataset will be submitted to the Commission in September 2010.

Significant changes to ratified data will be described on the archive and in future QA/QC reports.

An initial description of the ratification procedures for FDMS data is given in the 2006 QA/QC Annual Report. Since then, procedures for ratification have been refined in light of experience by all parties involved; these are described in Section 12.3 of the 2008 Annual Report. On-site procedures by LSOs, ESUs and QA/QC Unit have also been revised for optimal instrument performance and reliability. LSOs should now follow these new procedures.

1.5.2 Changes to Ratified Data

During ratification of the January-March data, a number of issues were discovered which affect data already reported as ratified in previous quarters. As a result, the following data already reported as ratified have been deleted.

Edinburgh St Leonards PM_{10} 20 Nov-31 Dec 09 (and to 13 Jan 10) Poor quality data
London Harlington 14-17 Dec, 21-23 Dec & 28-29 Dec 2009. PM_{10} significantly less than $PM_{2.5}$
Mold NO_2: 4 Feb-31 March, sampling fault

.

2 Changes in the Network for Directive Compliance

The QA/QC Unit and the Central management and Control Unit (CMCU), in conjunction with Defra and the DAs, have carried out a major review of the monitoring network. This was necessary to ensure the network is compliant with the European Directive (2008/50/EC). There is a requirement for a minimum level of monitoring in each agglomeration and zone, and there is a need to measure $PM_{2.5}$ at many sites. The need for additional monitoring has been met by affiliating suitable sites from other organisations, adding additional analysers at existing sites, or in a small number of cases, installing new sites. Note that as a result of these changes, the concept of critical sites is no longer meaningful and has been discontinued.

Sites that are no longer necessary for compliance have, in a number of cases, been closed down, or individual analysers at sites have been de-affiliated. Table 2.1 shows the sites commissioned as part of the review.

Table 2.1: Sites Added to the AURN during 2010

	Pollutants	Date started
Ballymena	SO_2	01/01/10
Eastbourne	$PM_{2.5}$ PM_{10}	01/01/10
Storrington Roadside	$PM_{2.5}$ PM_{10}	01/01/10

The $PM_{2.5}$ Partisol at Inverness has been affiliated into the network backdated to 1 June 2008. In addition, several existing sites have had additional analysers (mainly $PM_{2.5}$) installed to ensure compliance. The analysers are listed in Table 2.2:

Table 2.2: Additional Analysers installed for Directive Compliance from 1 Jan 2010

Site	Pollutant	Date started
Chepstow A48	$PM_{2.5}$	09/02/10
Port Talbot Margam $PM_{2.5}$ PM_{10}	$PM_{2.5}$	19/02/10
Saltash Roadside	$PM_{2.5}$	23/02/10

The rural CO analysers at St Osyth and Market Harborough were discontinued from 31 Dec 2009. The Partisol at Port Talbot Margam was converted from $PM_{2.5}$ to $PM_{10.}$ on 18 February 2010.

A full description of the changes necessary for compliance with the Directive is given in Part B Section 8 of the January-March 2007 Report.

An equipment upgrade programme is underway to provide equipment that is demonstrated to be an equivalent measurement to the reference method. Annex vi of the EU Directive 2008/50/EC defines the reference methods and the procedure for demonstration of equivalence with these

The reference methods specified are those developed by CEN and published in the UK through British Standards. In compliance with Annex vi, D, all new equipment introduced into the network complies with the reference method or has been demonstrated to be equivalent. Going forward, there is a rolling programme to replace all monitoring equipment in the network with reference or equivalent methods by Jun 2013 – as required by the Directive. For the gaseous analysers, the relevant Standard Methods

include a requirement for type testing and approval. The mechanism in the UK to conform to this is described in Section 5.2 of the AURN QA/QC manual. Further details are available in Section 1.5.

A list of current approved equipment is available on the Sira website
http://www.siraenvironmental.com/UserDocs/mcerts/MCERTSCertifiedProductsCAMS.pdf

3 Generic Data Quality Issues

3.1 Gravimetric PM_{10} and $PM_{2.5}$ Data

Six Gravimetric PM_{10} analysers and eleven gravimetric $PM_{2.5}$ analysers (currently Partisol 2025s) are currently located at eleven sites in the network. These are listed below. Ratified data capture for the gravimetric PM (Partisol) analysers for the period January-March 2010 is given in Appendix 4. Six of the gravimetric analysers for which data are available did not reach the 90% data capture target in this quarter. The data remain provisional whilst the necessary QA checks are completed.

Table 3.1: Gravimetric PM_{10} and $PM_{2.5}$ Samplers

Site
Auchencorth Moss $PM_{2.5}$
Auchencorth Moss PM_{10}
Bournemouth $PM_{2.5}$
Brighton Preston Park $PM_{2.5}$
Harwell $PM_{2.5}$
Harwell PM_{10}
Inverness $PM_{2.5}$
Inverness PM_{10}
London Marylebone Road $PM_{2.5}$
London Marylebone Road PM_{10}
London N Kensington $PM_{2.5}$
London N Kensington PM_{10}
London Westminster $PM_{2.5}$
Northampton $PM_{2.5}$
Port Talbot Margam $PM_{2.5}$
Wrexham $PM_{2.5}$
Wrexham PM_{10}

The reasons for data loss in the gravimetric analysers are given in Appendix A4. Bureau Veritas has supplied the measured data, undertaken the filter weighing and calculated the particulate concentrations.

In 2008, evidence emerged that the Partisol sampling and analysis method was overestimating ambient particle concentrations, despite the filters (Whatman QMA quartz) being conditioned (to a standard temperature and humidity level) before each weighing.

After investigation and consultation it was decided that a "field blank" correction - based on filters that had been placed in the sampler but not actually used - should be subtracted from the measured concentrations. For years up to and including 2007, a monthly field blank correction has been used.

This field blank correction has been applied retrospectively, resulting in changes to previously ratified data. ***Any daily-measured PM_{10} or $PM_{2.5}$ data downloaded from the Archive before 1st July 2009 might therefore have changed.***

From January 2008 onwards, blank filters have been routinely included with each fortnightly batch of filters sent to each site. This makes it possible to apply a field blank correction specific to each site and 2-week period, which should provide a more accurate value for the daily mean PM concentration. Again, this correction has been applied retrospectively, so any daily-measured PM_{10} or $PM_{2.5}$ data downloaded from the Archive before **1st July 2009** may have changed.

Only data for which
(i) the weighings have been carried out by the current laboratory (i.e. Bureau Veritas) and

(ii) the filter material was quartz (Whatman QMA)

- have had the blank correction applied. Both field-blank corrected data and uncorrected data are still available for download from the Air Quality Archive.

Finally, during January and February 2009 all AURN sites measuring particulate matter by this method changed to PTFE-bonded glass fibre filters (Emfab), which are expected to offer improved performance. It may prove unnecessary to apply a field blank correction to data obtained using filters of this type. However, pending further investigation, it has been agreed with Defra that both uncorrected and corrected data should be available for download from the Air Quality Archive.

As a result of this, improved QA/QC procedures for Partisol measurements have been implemented by BV and the QA/QC Unit. These include:

- Round-robin of blank filter weighings between BV, AEA and NPL. Three sets of filters and check weights were weighed by all three organisations in April 2009. For the check weights there was no significant difference in results of the three laboratories. Quartz filters, and to a lesser extent, PTFE-coated glass fibre filters, exhibited some issues with conditioning which meant that the three laboratories could not be reliably compared. These issues are currently under consideration within the UK and Europe
- As described above, each batch of 14 days' filters now include a travel (field) blank in the cannister, which is treated exactly the same as the other filters in the batch, but not exposed, to be used for the correction of quartz filters
- Each batch of pre-weighed filters has an associated lab blank, which does not go to the site but stays in a sealed container at the lab for the duration of the exposure period, and is weighed again when the final weighings are done
- Both field and lab blank values are communicated to the QA/QC Unit, who monitor them on a long-term basis and check for any step changes, trends, or deviations from the typical spread of results.

The $PM_{2.5}$ Partisol at Marylebone Road was dound to be missing an internal connecting tube at the audit on 21 February. It is not clear when this was removed (possibly during cleaning of the cyclone) and as at August 2010 had not been repaired. Data from 2009 and this entire quarter have been deleted.

3.2 Auto-calibration Run-on

Autocalibration ”run-on” is a generic problem affecting many analysers in the network and is due to autocalibration gas leaking into the sampling system during the ambient measurement period immediately after the autocalibration cycle. The problem can be identified by examining the diurnal variation of pollutant concentrations for the individual sites. Invalid measurements (usually between 01:30 and 02:00) have been removed during data ratification. This can be a serious source of data loss resulting in one hour out of twenty four being deleted, which is 4% of the annual data capture. At some sites significantly more data are being lost resulting in data capture below the 90% data capture target for the period.

The Equipment Service Units (ESUs) have investigated the autocalibration run-ons at many of the sites and tried different ways to resolve the problem including thorough cleaning of the solenoid valves and installation of Permapure or silica gel driers. In most cases this has improved the situation but it has not always eliminated the problem completely. The new Thermo i-Series analysers are equipped with valves to allow the use of calibration cylinder gas to be used for autocalibrations. These should be less prone to run-on through internal contamination, provided the integrity of the valve seals is maintained.

The 30 sites (32 analysers) showing continuing problems with the autocalibration run-on during January-March 2010 are given in Table 3.2. Any autocalibration run-on data that look visibly significant have been deleted from these data sets during ratification.

Table 3.2: Autocalibration Run-ons: January-March 2010

Site	Pollutant	Run-On Conc	Autocal Conc	Hours lost
Belfast Centre	NO_2	4	300	1 hr (01:00 - 01:45)
Billingham	NO_2	3	200	None
Blackpool Marton	NO_2	3	250	None
Glasgow Kerbside	NO_2	8	300	None
Hull Freetown	NO_2	3	200	1 hr (01:00 - 01:30)
Leicester Centre	NO_2	3	455	1 hr (01:00 - 01:45)
London Hillingdon	NO_2	3	175	1 hr (01:00 - 01:45)
Norwich Lakenfields	NO_2	6	200	1 hr (01:00 - 01:45)
Oxford Centre Roadside	NO_2	4	200	1 hr (01:00 - 01:30)
Plymouth Centre	NO_2	3	275	1 hr (01:00 - 01:30)
Port Talbot Margam	NO_2	4	550	1 hr (01:00 - 02:00)
Reading New Town	NO_2	3	250	1 hr (01:00 - 01:30)
Sheffield Centre	NO_2	3	280	1 hr (01:00 - 01:30)
Southampton Centre	NO_2	3	300	1 hr (01:00 - 01:45)
Southend-on-Sea	NO_2	3	200	None
St Osyth	NO_2	3	200	1 hr (01:00 - 02:00)
Wicken Fen	NO_2	3	100	1 hr (01:00 - 02:00)
Wirral Tranmere	NO_2	3	250	1 hr (01:00 - 01:45)
Yarner Wood	NO_2	2	200	1 hr (01:00 - 01:45)

3.3 FDMS Installations

There have been a number of issues affecting the collection of valid data from FDMS analysers as these have been introduced into the network. The CMCU, QA/QC and ESUs have put considerable effort into solving these issues. Several FDMS analysers have proved particularly problematic and considerable ESU effort has been required to rectify the problems. Some are as yet unresolved-see Section 4.

It is important that the correct operation of the FDMS driers is checked and maintained. The QA/QC unit have been checking the drier types at the summer 2010 intercalibration exercise, and the ESUs have been asked to provide records of drier upgrades at they occur.

Several FDMS units have suffered from long-term problems during 2009 and into 2010, and these are described in more detail in the 2009 Annual Review. Considerable effort has been put into resolving these problems, and the experience gained by the QA/QC Unit, the CMCU and the ESUs will help ensure improved performance in the future.

The QA/QC Unit in particular, has developed a range of the techniques and statistical analyses of the data from FDMS units to more fully understand the problems encountered with these analysers. These include

- Improved on-site leak checks during QA/QC audits
- Calculation of drier efficiency on an hourly basis
- Comparison of volatile fractions over a regional basis to check for outliers, building on the principles of the Volatile Correction Model (VCM) developed by KCL.

4 Site Specific Issues

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

4.1 London

4.1.1 Data Capture

The data capture for sites in London (within the M25) for the period January-March 2010 is given in Table 4.1:

Table 4.1: Data capture for London: January-March 2010

Site	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
London							
Camden Kerbside	-	98.8	34.9	75.6	-	-	69.8
Haringey Roadside	-	95.4	96.3	90.6	-	-	94.1
London Bexley	82.5	-	86.6	93.4	-	89.4	88.0
London Bloomsbury	98.2	62.5	97.9	98.3	98.6	98.2	92.3
London Cromwell Road 2	97.7	-	-	97.7	-	97.7	97.7
London Eltham	-	-	95.2	97.9	97.5	-	96.9
London Haringey	-	-	-	99.6	94.8	-	97.2
London Harlington	-	63.0	48.7	79.2	97.8	-	72.2
London Harrow Stanmore	-	-	96.0	-	-	-	96.0
London Hillingdon	-	-	-	89.8	93.8	-	91.8
London Marylebone Road	92.8	84.2	97.7	97.5	92.0	83.2	91.3
London Marylebone Road PARTISOL	-	54.4	0	-	-	-	24.7
London N. Kensington	97.7	94.4	82.9	74.6	81.4	89.3	86.7
London N. Kensington PARTISOL	-	96.7	94.4	-	-	-	95.6
London Teddington	-	-	49.2	98.5	93.5	-	80.4
London Westminster	97.9	-	66.7	97.9	97.9	97.8	91.6
Tower Hamlets Roadside	94.6	-	-	99.1	-	-	**96.9**
Number of sites	7	8	13	14	9	6	17
Number of sites < 90%	1	4	7	4	1	3	6
Network Mean (%)	94.5	81.2	80.3	92.1	94.1	92.6	89.0

Shaded boxes are for data capture < 90%
Bold data captures are for data that are provisional and subject to further quality control

4.1.2 Site Specific Issues

Camden Kerbside
The $PM_{2.5}$ FDMS analyser was found to have a significant leak at the audit (main flow down 34%) and the pump vacuum was insufficient. Data have therefore been deleted from early December up to 8 January; problems continued on 22 January (21 days) and up to replacement of the seals on 25 March (29 days data lost). The NOx analyser continued to be unreliable up to repair on 14 January (48 days) and again 12 March (4 days) and 25 March (4 days), when the fault was traced to a dirty reaction cell.

London Bexley
Problems with the CO and SO_2 analysers followed a power cut on 27 January. A pump vacuum fault on the $PM_{2.5}$ FDMS following audit on 9 February; 6 days data were lost.

London Harlington
Following poor performance of the FDMS analysers during 2009, more data were lost from these analysers during January-March 2010. In addition, the NOx analyser was sampling internally following the service on 18 January; 17 days data were lost as a result.

London Marylebone Road $PM_{2.5}$ Partisol
As reported in the October-December 2009 QA/QC report, anomalous results from the $PM_{2.5}$ Partisol prompted a detailed investigation into the analyser performance in April 2010. It was found that a pipe on the sample inlet was missing, and so the instrument was sampling internally, bypassing the size selective head. No clear change point can be identified when the tube was removed, and so based on the agreement with the FDMS, all 2009 and Q1 2010 data from the Partisol have been deleted.

4.2 England (excluding London)

4.2.1 Data Capture

The data capture for sites in England for the period January-March 2010 is given in Table 4.2:

Table 4.2: Data capture for England (except London): January-March 2010

Site	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
England							
Barnsley 12	-	-	-	-	-	98.4	98.4
Barnsley Gawber	-	-	-	96.3	91.5	96.3	94.7
Bath Roadside	-	-	-	98.1	-	-	98.1
Billingham	-	-	-	98.7	-	-	98.7
Birmingham Tyburn	-	95.6	96.3	98.8	98.8	98.9	97.7
Birmingham Tyburn Roadside	-	93.6	98.0	97.1	92.0	-	95.2
Blackburn Darwen Roadside	-	-	-	40.3	-	-	40.3
Blackpool Marton	-	-	65.3	65.2	65.3	-	65.3
Bottesford	-	-	-	-	99.2	-	99.2
Bournemouth	-	-	58.9	98.5	98.6	-	85.3
Brighton Preston Park	-	-	68.9	98.3	98.6	-	88.6
Brighton	-	-	-	92.4	-	-	92.4

Site	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
England							
Roadside							
Bristol Old Market	95.4	-	-	13.8	-	-	54.6
Bristol St Paul's	97.2	97.6	95.0	81.8	97.4	97.3	94.4
Bury Roadside	15.0	99.3	78.7	99.6	-	-	73.1
Cambridge Roadside	-	-	-	98.0	-	-	98.0
Canterbury	-	-	-	97.7	-	-	97.7
Carlisle Roadside	-	98.9	97.5	99.5	-	-	98.6
Charlton Mackrell	-	-	-	98.5	97.7	-	98.1
Chesterfield	-	98.9	98.7	98.9	-	-	98.8
Chesterfield Roadside	-	98.6	93.9	96.0	-	-	96.2
Coventry Memorial Park	-	-	99.6	96.4	50.6	-	82.2
Eastbourne	-	98.0	98.8	-	-	-	98.4
Exeter Roadside	-	-	-	92.2	0.0	-	46.1
Glazebury	-	-	-	98.3	98.1	-	98.2
Great Dun Fell	-	-	-	-	36.2	-	36.2
Harwell	-	89.9	98.4	98.3	98.4	98.2	96.6
Harwell PARTISOL	-	45.6	93.3	-	-	-	69.4
High Muffles	-	-	-	98.4	98.6	-	98.5
Horley	-	-	-	99.5	-	-	99.5
Hull Freetown	98.3	98.9	95.1	93.6	95.6	94.3	96.0
Ladybower	-	-	-	93.2	98.2	95.3	95.6
Leamington Spa	-	98.9	98.6	99.3	99.5	98.8	99.0
Leeds Centre	61.1	99.5	99.4	90.1	97.1	97.1	90.7
Leeds Headingley Kerbside	-	95.3	99.1	98.8	-	-	97.7
Leicester Centre	98.1	99.4	98.5	94.1	98.3	94.5	97.2
Leominster	-	-	-	97.5	92.4	97.5	95.8
Liverpool Queen's Drive Roadside	-	-	-	98.2	-	-	98.2
Liverpool Speke	96.8	96.3	87.1	96.9	96.3	97.1	95.1
Lullington Heath	-	-	-	89.2	97.9	91.8	92.9
Manchester Piccadilly	-	-	76.1	93.7	92.3	94.2	89.1
Manchester South	-	-	-	98.4	98.4	-	98.4
Market Harborough	-	-	-	94.3	98.4	-	96.3
Middlesbrough	97.0	66.7	75.7	96.5	96.7	91.0	87.3
Newcastle Centre	79.7	96.1	96.2	96.1	96.2	96.0	93.4
Newcastle Cradlewell Roadside	-	-	-	99.5	-	-	99.5
Northampton	-	-	92.2	99.4	99.6	98.4	97.4
Norwich Lakenfields	-	99.4	99.3	82.4	95.0	78.5	**90.9**
Nottingham Centre	-	93.2	99.1	99.7	99.2	99.6	98.2
Oxford Centre Roadside	-	-	-	95.0	-	-	95.0
Oxford St Ebbes	-	86.2	95.8	99.3	-	-	93.8

Site	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
England							
Plymouth Centre	-	97.7	96.6	94.0	97.9	-	96.5
Portsmouth	-	97.7	7.6	93.0	98.5	-	74.2
Preston	-	-	82.8	95.2	95.1	-	91.0
Reading New Town	-	98.1	98.5	19.4	98.4	-	78.6
Rochester Stoke	-	0.0	0.0	0.0	0.0	0.0	0.0
Salford Eccles	99.1	99.3	99.0	99.2	99.1	98.7	99.1
Saltash Roadside	-	99.5	88.1	-	-	-	93.8
Sandwell West Bromwich	-	-	-	98.1	52.3	98.1	82.8
Sandy Roadside	-	75.5	96.9	93.5	-	-	88.6
Scunthorpe Town	-	99.1	-	98.5	-	98.4	98.7
Sheffield Centre	84.3	98.0	98.0	94.1	89.2	98.4	93.7
Sheffield Tinsley	-	-	-	97.8	-	-	97.8
Sibton	-	-	-	-	99.6	-	99.6
Southampton Centre	98.2	90.3	78.9	91.8	96.1	98.1	92.2
Southend-on-Sea	-	-	97.6	0.0	87.4	-	61.7
St Osyth	-	-	-	92.8	96.9	-	94.8
Stanford-le-Hope Roadside	-	93.2	49.8	93.4	-	68.5	76.2
Stockton-on-Tees Eaglescliffe	-	91.0	89.1	98.0	-	-	92.7
Stoke-on-Trent Centre	-	87.2	99.2	94.4	95.4	-	94.1
Storrington Roadside	-	47.9	89.1	-	-	-	68.5
Sunderland Silksworth	-	-	98.3	98.2	98.2	98.2	98.2
Thurrock	-	86.1	-	96.6	85.6	96.7	91.2
Walsall Willenhall	-	-	-	36.1	-	-	36.1
Warrington	-	99.1	98.4	99.6	-	-	99.0
Weybourne	-	-	-	-	96.3	-	96.3
Wicken Fen	-	-	-	93.7	98.1	98.1	96.6
Wigan Centre	-	-	84.5	98.5	96.9	-	93.3
Wirral Tranmere	-	-	98.6	84.4	92.8	-	91.9
Yarner Wood	-	-	-	97.6	98.6	-	98.1
York Bootham	-	99.6	99.6	-	-	-	99.6
York Fishergate	-	87.3	-	87.1	-	-	87.2
Number of sites	12	39	47	72	51	29	82
Number of sites < 90%	4	10	16	12	9	3	22
Network Mean (%)	85.0	89.6	87.3	88.9	89.1	91.9	88.4

Shaded boxes are for data capture < 90%
Bold data captures are for data that are provisional and subject to further quality control

4.2.2 Site Specific Issues

Blackburn Darwen Roadside
The NOx analyser suffered from a failed converter and logger faults during this quarter.

Bournemouth
The Partisol suffered prolonged faults-see Appendix 4 for details.

Brighton Preston Park
The Partisol suffered prolonged faults-see Appendix 4 for details.

Bristol Old Market
The NOx converter was found to be 87.5% at the QA/QC audit on 23 February. The NO_2 data have been deleted from 1 November to 19 March.

Bury Roadside
A CO flow fault was diagnosed as a faulty switching valve on 8 April. CO Data from 14 january to 8 April have been lost as a result. The $PM_{2.5}$ analyser also suffered from leaks from 29 February, resulting in 21 days data loss.

Coventry Memorial Park
A sampling fault resulted in the loss of ozone data from 10 December 2009 to 5 February. Subsequent data communication faults lost a further 8.6 days data.

Exeter Roadside
The poor quality ozone data at Exeter Roadside was highlighted in the October-December 2009 report. The low concentrations continued throughout January-March 2010 and all ozone data have been deleted. It is possible that the poor performance was due to excessively dirty conditions due to the ongoing building works.

Great Dun Fell
A motherboard fault in the ozone analyser resulted in the loss of data from 27 January to 25 March. Repairs were delayed by bad weather.

Middlesbrough
The FDMS analysers suffered various problems during the quarter; the resultant poor quality data were deleted during ratification.

Portsmouth
The $PM_{2.5}$ FDMS analyser suffered from a significant main flow leak; data from 7 January to 7 April have been deleted.

Preston
Elevated baselines in the NOx and NO channels gave cause for concern following an ESU visit on 16 June to remove the old analysers and equipment. Investigation by the QA/QC unit in September found that there was a gap in the roof around the sample inlet tubes. The pressurisation of the cabin by the air conditioning unit meant that cabin air was being sampled by the NOx analyser. The NOx data have been deleted from 16 June to September.

Reading New Town
The NOx fault described in the October-December 2009 report was cured on 12 March; no reason for the poor data was established, but was likely due to a sampling fault inadvertently cured at the service.

Rochester Stoke
The site has been closed since early November due to a water leak in the cabin. A replacement cabin has been purchased by the LSO, and the site restarted in early June 2010, although problems with some analysers persist.

Sandwell West Bromwich
The ozone analyser was sampling internally from 17 February to 13 April.

Sandy Roadside
The PM_{10} FDMS suffered from numerous leaks and flow faults, resulting in a total data loss of 20 days data.

Southend-on-Sea
The NOx baseline problem reported in the October-December 2009 report was repaired on 9 April. The ESU reported the sample lines were wrongly attached, and that the calibration system required excessive gas pressure to work correctly. A total of 98.5 days data were lost.

Stanford-le-Hope Roadside
The poor FDMS reported in January –December 2009 continued this quarter. Tests to establish if a baseline offset was present were carried out using a zero filter. A total of 100 days $PM_{2.5}$ data were deleted. The SO_2 analyser also suffered persistent performance issues which ultimately required to removal of the instrument for repair by the ESU.

Walsall Willenhall
The Walsall Willenhall site was destroyed by fire on 3 February. Work on commissioning a replacement site is under way.

4.3 Scotland

4.3.1 Data Capture

The data capture for sites in Scotland for the period January-March 2010 is given in Table 4.3.

Table 4.3 Ratified Data Capture for Scotland, January-March 2010

Site	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
Scotland							
Aberdeen	-	98.1	95.9	97.9	98.3	-	97.6
Aberdeen Union Street Roadside	-	-	-	48.0	-	-	48.0
Auchencorth Moss	-	98.9	70.0	-	99.1	-	89.3
Auchencorth Moss PM_{10} PM_{25} (FDMS)	-	31.5	98.2	-	-	-	64.8
Bush Estate	-	-	-	98.4	98.7	-	98.5
Dumfries	-	-	-	99.2	-	-	99.2
Edinburgh St Leonards	97.0	82.5	96.6	96.8	**96.9**	72.5	**90.4**
Eskdalemuir	-	-	-	**97.6**	98.5	-	**98.1**
Fort William	-	-	-	73.2	98.5	-	85.9
Glasgow Centre	97.2	0.0	98.9	97.2	97.2	97.2	81.3
Glasgow City Chambers	-	-	-	99.5	-	-	99.5
Glasgow Kerbside	-	98.5	98.4	97.1	-	-	98.0
Grangemouth	-	91.1	91.3	92.2	-	92.0	91.7
Grangemouth Moray	-	-	-	98.5	-	-	98.5
Inverness	-	96.7	85.6	71.3	-	-	84.5
Lerwick	-	-	-	-	99.4	-	99.4
Peebles	-	-	-	97.6	93.7	-	95.6
Strath Vaich	-	-	-	-	97.3	-	97.3
Number of sites	2	8	8	14	10	3	18
Number of sites < 90%	0	3	2	3	0	1	6
Network Mean (%)	97.1	74.7	91.9	90.3	97.8	87.2	89.9

Shaded boxes are for data capture < 90%
Bold data captures are for data that are provisional and subject to further quality control

4.3.2 Site Specific Issues

Aberdeen Union Street Roadside
As highlighted in the October-December 2009 report, a period of low NO_2 concentrations along with a raised baseline was observed at Aberdeen Union Street Roadside from 30 September up to a gap in the data in February 2010. The ESU reported a converter fault (outgassing NO_2) during February; the converter was replaced on 15 February 2010. All NO_2 data have been deleted between these dates.

Auchencorth Moss PM_{10} $PM_{2.5}$
The site continues to suffer from temperature control problems, resulting in unstable data.

Fort William
A NOx/NO switching valve fault was reported for the period 27 January to 15 February; all NO_2 data have been deleted for this period.

Glasgow Centre
The PM_{10} volatile concentrations at Glasgow Centre were anomalously high during the period and the data have been deleted.

Inverness
The NOx analyser produced anomalous data up to the service on 26 January; data have been deleted. Partisol problems are described in Appendix 4.

4.4 Wales

4.4.1 Data Capture

The data capture for sites in Wales for the period January-March 2010 is given in Table 4.4.

Table 4.4 Data Capture for Wales, January-March 2010

Site	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
Wales							
Aston Hill	-	-	-	97.8	98.5	-	98.2
Cardiff Centre	97.4	96.7	95.9	97.4	94.5	97.4	96.5
Chepstow A48	-	97.5	98.0	99.3	-	-	98.3
Cwmbran	-	-	-	95.4	99.2	-	97.3
Mold	-	-	-	38.1	99.8	-	68.9
Narberth	-	93.3	-	93.0	93.2	53.2	83.2
Newport	-	39.1	98.8	90.2	-	-	76.0
Port Talbot Margam	97.5	97.4	98.0	92.9	96.3	96.3	96.4
Port Talbot Margam PM_{10} $PM_{2.5}$ (Partisol)	-	95.1	71.4	-	-	-	83.3
Swansea Roadside	-	98.4	94.1	97.6	-	-	96.7
Wrexham	-	46.7	86.7	98.6	-	98.7	82.7
Number of sites	2	8	7	10	6	4	11

Number of sites < 90%	0	2	2	0	0	1	4
Network Mean (%)	97.4	83.0	91.8	96.1	96.9	86.4	91.6

Shaded boxes are for data capture < 90%
Bold data captures are for data that are provisional and subject to further quality control

4.4.2 Site Specific Issues

Mold
The QA/QC Unit noticed unusual NO_2/NOx ratios from this site during the ratification of the Jnauary-March 2010 data. Investigations by CMCU, LSO and the ESU were initially inconclusive, as all calibration and audit data were within expected limits. It was subsequently discovered that the sample inlet system was leaking, and cabin air was being sampled by the NOx analyser. Data have been deleted from 4 February (ESU visit) to 17 September 2010. The ozone was apparently unaffected.

Narberth
A leak in the sample holder resulted in the loss of 12 day's data.

Port Talbot Margam PM_{10} $PM_{2.5}$ (Partisol)
The analyser was converted from $PM_{2.5}$ to PM_{10} on 18 February, during which the rain jar was broken- see Appendix 4

Wrexham
The Partisol was sampling internally for part of the period, and suffered from filter exchange failures- see Appendix 4.

4.5 Northern Ireland (including Mace Head)

4.5.1 Data Capture

The data capture for sites in Northern Ireland (including Mace Head) for the period January-March 2010 is given in Table 4.5.

Table 4.5: Data Capture for Ireland, January-March 2010

Site	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
N Ireland							
Armagh Roadside	-	99.5	-	55.8	-	-	77.7
Ballymena	-	-	-	-	-	86.1	86.1
Belfast Centre	97.3	74.8	93.0	90.6	97.4	97.4	91.7
Derry	-	22.7	0.0	98.6	98.7	89.5	61.9
Lough Navar	-	98.9	-	-	99.7	-	99.3
Mace Head	-	-	-	-	99.9	-	99.9
Number of sites	1	4	2	3	3	3	5
Number of sites < 90%	0	2	1	1	0	2	3
Network Mean (%)	97.3	74.0	46.5	81.7	98.6	91.0	83.3

Shaded boxes are for data capture < 90%
Bold data captures are for data that are provisional and subject to further quality control

4.5.2 Site Specific Issues

Armagh Roadside
The NOx analyser was replaced on 9 February; all data prior to this have been deleted.

Ballymena
A logger & communications fault on 28 January resulted in the loss of 12 days data.

Derry
The FDMS instruments have continued to experience problems during this quarter. The PM_{10} analyser was found to be leaking badly at the QA/QC audit on 15 February; data have been deleted back to the ESU visit on 3 December. The $PM_{2.5}$ analyser shows a significant step change in August following a repair to fix a leak identified at audit. It is reported that the drier upgrade had been incorrectly installed. All data have been deleted up to 18 May 2010.

4.6 Overall Data Capture

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

Table 4.6: Data Capture by Pollutant, Entire Network

Site	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	
Number of sites	24	67	77	113	80	45	134
Number of sites < 90%	5	21	27	22	10	10	43
Network Mean (%)	90.3	85.1	85.9	89.9	91.8	91.2	88.8

A summary of the main site analyser operational problems, which have resulted in data capture below the required 90% level during the reporting period January-March 2010 is given in Appendix 2. The number of days and hours of data lost for each cause is also given. In some cases the data gap extends beyond this three-month reporting period. The table lists all gaps of 6 hours or more for each pollutant where overall data capture is below 90%. Note that data capture is calculated for the whole month for each pollutant (except for new sites, which are from the start date), so additional analysers installed during the period will have reduced data captures quoted.

4.7 Sites Highlighted in Previous Reports

Several analysers have been highlighted recently as being of concern to the QA/QC unit. An update is given in Table 4.7.

Table 4.1: Status of Analysers Highlighted in Previous Reports

Site	Analyser	Fault	Current status
Armagh Roadside	NOx		Replacement analyser fitted
Auchencorth Moss	FDMS PM_{10} and $PM_{2.5}$		Negative $PM_{2.5}$ data still observed. PM_{10} data deleted this quarter

Site	Analyser	Fault	Current status
Barnsley Gawber	SO_2		Now fixed
Derry	PM_{10} $PM_{2.5}$	Poor performance	Problems still continue-see Section 4.5.2
London Teddington	Site	Air conditioning	No progress reported
Rochester Stoke	All channels	No data	Site turned off for repairs to hut; now replaced but problems continue with NOx analyser
Swansea Roadside	$PM_{2.5}$		Performance improved
Weybourne	O_3	No IZS	No progress reported

Part B-Winter 2010 Intercalibration

5 Introduction

In January to March 2010, AEA undertook an intercalibration of 132 monitoring stations in operation in the Defra and the Devolved Administrations Automatic Urban and Rural Monitoring Network.

The intercalibration exercise is a vital step in the process of data ratification. The audits are used to undertake a number of analyser and infrastructure performance checks that cannot be performed by Local Site Operators, with a view to ensuring confidence in the accuracy, consistency and traceability of air pollution measurements made at all the monitoring stations.

The intercalibration requires the coordination and close cooperation of QA/QC unit, Management Units, ESU's and LSO's in making sure the entire operation runs smoothly and is the result of many months of planning.

Leading up to the intercalibration, a draft schedule of visits is prepared and circulated to MU's and ESU's for approval. ESU ozone photometers are calibrated at AEA and all QA/QC equipment and cylinders are tested, calibrated and verified before use.

QA/QC visits are always undertaken before any ESU visits, to allow the performance of the sites to be quantified for the six month period prior to the visit. During the QA/QC visit, the LSO usually attends to demonstrate their competence in performing routine calibrations.

The audits are used to transport independent calibration standard gases and test apparatus to all of the sites, to quantify the performance of the entire measurement process at the monitoring stations. The results obtained from these tests are fed into the ratification process, where any correction of datasets can be applied to account for any performance anomalies.

ESU visits are normally undertaken within a three week period following the QA/QC visit. At this time, the analysers and sampling systems are all cleaned and serviced in accordance with manufacturer's specifications. The analysers are then set up ready for the following six month period, until the next round of intercalibrations and servicing.

This scheduling has proven to be very successful in delivering reliable operation of monitoring stations and high quality data. The programme is iterative: improvements and enhancements are continually added to further improve performance and analyse results.

6 Scope of Intercalibration Exercise

The QA/QC visits 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; for example that a 200ppb NO_2 pollution episode in Edinburgh 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. TEOM ko 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 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 (LSO) in undertaking calibrations. As it is the calibrations by the LSO's that are used to scale pollution datasets, it is important to check that these are undertaken competently.

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 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 TEOM analysers,
- ±10% for particulate analyser flow rates,
- ±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.

7 Results

The results section has been restructured to allow easier regional analysis. As well as a detailed national summary, a regional summary and breakdown outlier analysis is provided.

7.1 National Network Overview

The results of the intercalibration are summarised in Table 7.1 below:

Table 7.1 - Summary of audited analyser performance – 132 UK stations

Parameter	Number of outliers	Number in network	% outliers in total
NOx analyser	37	115	33%
CO analyser	3	26	12%
SO_2 analyser	10	43	23%
Ozone analyser	13	81	17%
TEOM and BAM analysers	2 k_0, 11 flow	4 TEOM PM_{10} 53 FDMS PM_{10} 1 BAM PM_{10} 0 TEOM $PM_{2.5}$ 63 FDMS $PM_{2.5}$ 1 BAM $PM_{2.5}$	11%
Gravimetric PM analysers	1	8 PM_{10} 9 $PM_{2.5}$	6%
Total	77	406	19%

Two of the 134 sites were not in operation at the time of the intercalibration: Great Dun Fell and Rochester Stoke were switched off at the time of the audits.

The number of analyser outliers identified is similar to the previous exercise. At the Summer 2009 intercalibration 18% of the analysers in use were identified as outliers.

The procedures used to determine network performance are documented in AEA Work Instructions. These methods are regularly updated and improved and are evaluated by the United Kingdom Accreditation Service (UKAS). AEA holds ISO17025 accreditation for the on-site calibration of all the analyser types (NOx, CO, SO_2, O_3) and for the determination of the TEOM ko factor and particulate analyser flow rates used in the network. An ISO17025 certificate of calibration (Calibration Laboratory number 0401) for the analysers in the AURN is appended to this report.

7.2 Network Intercomparisons

Parameter	Network Mean	Audit reference concentration	Network Accuracy %	%Std Dev
NO	468 ppb	457 ppb	2.3	4.0
NO_2	457 ppb	454 ppb	0.7	4.4
CO	20.2 ppm	20.3 ppm	-0.3	3.4
SO_2	163 ppb	158 ppb	3.3	4.3

- Oxides of Nitrogen.

A total of 37 outliers (33%) were identified during this intercalibration. This is worse than the Summer exercise where 24% of the analysers were identified as outliers. In addition, there were four converters which fell outside the ±5% acceptance limits.

- Carbon Monoxide

  Three analysers were identified as outliers at this intercalibration. This result is worse than the Summer exercise, when no analysers fell outside the acceptance limits.

- Sulphur Dioxide

  A total of 10 outliers (23%) were identified at this intercalibration. This is slightly worse than the Summer exercise, when 9 analysers were identified as outliers. All m-xylene interference tests were less than 30ppb.

- Ozone

  A total of 13 outliers (17%) were identified during the Summer exercise. This is better than the previous intercalibration, where 20 analysers were found to be outside the ±5% acceptance criterion.

- Particulate Analysers

  Two calculated TEOM and FDMS k0 determinations were outside the required ±2.5% of their stated values. This is similar to the previous exercise - three outliers were identified in the Summer intercalibration

  Eleven TEOM main flows were found to be outside the ±10% acceptance limits, compared to seven in total at the Summer exercise.
  One Partisol analyser total flow was outside the acceptance limits.

- Site Cylinder Concentrations

  10 of the 299 site cylinders used to scale ambient pollution data were found to be outside the ±10% acceptance limit.

London Sites

The results of the intercomparison for the 16 London sites in operation at the time of the intercalibration are summarised in Table 7.2 below:

Table 7.2 - Summary of audited analyser performance – London Sites

Parameter	Number of outliers	Number in region
NOx analyser	3	14
NOx converter	0	
CO analyser	0	7
SO_2 analyser	1	6
Ozone analyser	1	9
TEOM and BAM analysers	0 k_0, 1 flow	0TEOM PM_{10} 6 FDMS PM_{10} 0 TEOM $PM_{2.5}$ 10 FDMS $PM_{2.5}$
Gravimetric PM analysers	1	2 PM_{10} 1 $PM_{2.5}$
Cylinders	0	41

Scottish Sites

The results of the intercomparison for the 18 Scottish sites are summarised in Table 7.3 below:

Table 7.3- Summary of audited analyser performance – Scottish Sites

Parameter	Number of outliers	Number in region
NOx analyser	9	14
NOx converter	1	
CO analyser	0	2
SO_2 analyser	0	3
Ozone analyser	2	10
TEOM and BAM analysers	1 k_0, 2 flow	0 TEOM PM_{10} 6 FDMS PM_{10} 0 TEOM $PM_{2.5}$ 6 FDMS $PM_{2.5}$
Gravimetric PM analysers	0	2 PM_{10} 2 $PM_{2.5}$
Cylinders	1	33

Welsh Sites

The results of the intercomparison for the 10 Welsh sites are summarised in Table 7.4 below:

Table 7.4 - Summary of audited analyser performance – Welsh Sites

Parameter	Number of outliers	Number in region
NOx analyser	1	10
NOx converter	0	
CO analyser	0	2
SO_2 analyser	0	4
Ozone analyser	0	6
TEOM and BAM analysers	0 k_0, 1 flow	2 TEOM PM_{10} 4 FDMS PM_{10} 0 TEOM $PM_{2.5}$ 4 FDMS $PM_{2.5}$
Gravimetric PM analysers	0	1 PM_{10} 2 $PM_{2.5}$
Cylinders	1	26

Northern Ireland Sites (incl. Mace Head)

The results of the intercomparison for the 5 Northern Irish and Mace Head sites are summarised in Table 7.5 below:

Table 7.5 - Summary of audited analyser performance – Northern Irish Sites

Parameter	Number of outliers	Number in region
NOx analyser	1	3
NOx converter	0	
CO analyser	0	1
SO_2 analyser	1	2
Ozone analyser	0	4
TEOM and BAM analysers	0 k_0, 1 flow	0 TEOM PM_{10} 4 FDMS PM_{10} 0 TEOM $PM_{2.5}$ 1 FDMS $PM_{2.5}$
Gravimetric PM analysers	0	0 PM_{10} 0 $PM_{2.5}$
Cylinders	1	9

English Sites

The results of the intercomparison for the 79 English sites are summarised in Table 7.6 below:

Table 7.6 - Summary of audited analyser performance – English Sites

Parameter	Number of outliers	Number in region
NOx analyser	23	74
NOx converter	3	
CO analyser	3	14
SO_2 analyser	9	28
Ozone analyser	11	52
TEOM and BAM analysers	1 k_0, 6 flow	2 TEOM PM_{10} 33 FDMS PM_{10} 1 BAM PM_{10} 0 TEOM $PM_{2.5}$ 38 FDMS $PM_{2.5}$ 1 BAM $PM_{2.5}$
Gravimetric PM analysers	0	3 PM_{10} 7 $PM_{2.5}$
Cylinders	7	179

As noted earlier, the results from the intercalibration exercises are used to inform the entire data ratification process. Any actions required as a result of the intercalibration findings are discussed in the ratification section of this report.

A summary of individual site performance is givein in Table 7.7

Table 7.7 – Summary of results for AURN intercalibration, Jan-Mar 2010

SITE	NO_x	CO	SO_2	O_3	PM_{10}	$PM_{2.5}$
Barnsley 12			Outlier			
Barnsley Gawber	OK		OK	Outlier		
Bath Roadside	Converter fail					
Billingham	Outlier					
Birmingham Centre	OK			OK	Leak fail	OK

SITE	NO_x	CO	SO_2	O_3	PM_{10}	$PM_{2.5}$
Birmingham Tyburn	Leak fail		OK	OK	OK	Leak fail
Birmingham Tyburn Roadside	OK			Outlier	OK	OK
Blackburn Darwen Roadside	Outlier + Converter fail					
Blackpool Marton	Outlier			OK		OK
Bottesford				OK		
Bournemouth	OK			OK		OK
Brighton Preston Park	OK			Leak fail		OK
Brighton Roadside	OK					
Bristol Old Market	Converter fail	OK				
Bristol St Paul's	NO cyl outlier	OK	OK	OK	OK	OK
Bury Roadside	OK	Leak fail			OK	OK
Cambridge Roadside	OK					
Canterbury	OK			OK		
Carlisle Roadside	Outlier				OK	OK
Charlton Mackrell	OK			OK		
Chatham Roadside	OK				OK	OK
Chesterfield	OK				Leak fail	OK
Chesterfield Roadside	OK				OK	OK
Coventry Memorial Park	Leak fail			Outlier Leak fail	OK	OK
Eastbourne					OK	OK
Exeter Roadside	OK			Outlier		
Glazebury	Outlier			OK		
Great Dun Fell	Site	not	Visited	Snowed	In	
Harwell	OK		OK	OK	Flow outlier	OK
Harwell Partisols					OK	OK
High Muffles	Outlier			OK		
Horley	OK					
Hull Freetown	OK	OK	OK	OK	OK	OK
Ladybower	Outlier		Outlier	OK		
Leamington Spa	OK		OK	OK	OK	OK
Leeds Centre	OK	Outlier	OK	OK	OK	OK
Leeds Headingley Roadside	OK				OK	OK
Leicester Centre	OK	OK	Outlier	OK	OK	OK
Leominster	OK			OK		
Liverpool Queen's Drive Roadside	NO cyl outlier					
Liverpool Speke	Outlier	Outlier	OK	OK	OK	OK

SITE	NO_x	CO	SO_2	O_3	PM_{10}	$PM_{2.5}$
Lullington Heath	Outlier		OK	OK		
Manchester Piccadilly	Outlier			Leak fail		OK
Manchester South	OK			OK		
Market Harborough	OK	OK		OK		
Middlesbrough	OK	OK	Outlier +17% Cyl drift	OK	k_0 -2.8%	OK
Newcastle Centre	OK	OK	OK	OK	Flow outlier, leak fail	Leak fail
Newcastle Cradlewell Roadside	OK					
Northampton	Outlier		Outlier +14% Cyl drift	Outlier +9%	OK	
Norwich Lakenfields	Leak fail		OK	OK	Flow outlier	OK
Nottingham Centre	OK		Outlier -11%	OK	Leak fail	OK
Oxford Centre Roadside	Outlier + NO cyl outlier					
Oxford St Ebbes	Outlier			OK	OK	OK
Plymouth Centre	Outlier			OK	OK	OK
Portsmouth	OK			OK	OK	Flow outlier, leak fail
Preston	Outlier			OK		OK
Reading New Town	Outlier		OK	OK	OK	OK
Rochester Stoke	Site	not	Operational	OK	OK	OK
Salford Eccles	Outlier	OK	OK	OK	OK	OK
Saltash Roadside					OK	OK
Sandwell West Bromwich	Outlier + NO cyl outlier		OK	OK		Leak fail
Sandy Roadside	OK				Leak fail	OK
Scunthorpe Town	OK		OK		OK	
Sheffield Centre	OK	OK	OK	OK	OK	OK
Sheffield Tinsley	OK					
Sibton				OK		
Southampton Centre	OK	OK	OK	OK	OK	OK
Southend-on-Sea	Outlier + NO cyl outlier			OK		OK
St Osyth	Outlier	Outlier -13%		OK		
Stanford-le-Hope Roadside	OK		OK		OK	Flow outlier
Stockton-on-Tees Eaglescliffe	OK				OK	OK
Stoke-on-Trent Centre	OK			Outlier +10%	OK	OK

SITE	NO_x	CO	SO_2	O_3	PM_{10}	$PM_{2.5}$
Storrington Roadside	OK				OK	OK
Sunderland Silksworth	Outlier			OK		OK
Thurrock	Outlier		Outlier +13%	OK	OK	OK
Walsall Willenhall	Site	not	operational			
Warrington	OK				OK	OK
Weybourne				OK		
Wicken Fen	OK		OK	Outlier -10%		
Wigan Centre	OK			Outlier -9%		OK
Wirral Tranmere	Outlier			OK		OK
Yarner Wood	OK			Outlier –9%		
York Bootham					OK	OK
York Fishergate	OK				Flow outlier	OK

SITE	NO_x	CO	SO_2	O_3	PM_{10}	$PM_{2.5}$
Camden Kerbside	OK				Leak fail	Flow outlier leak fail
Haringey Roadside	Outlier				OK	OK
London Bexley	OK	OK	OK		OK	OK
London Bloomsbury	Outlier	OK	OK	OK	OK	OK
London Cromwell Road 2	OK	OK	OK			
London Eltham	OK		OK	OK	OK	OK
London Haringey	OK			OK		
London Harlington	OK			OK	OK	OK
London Hillingdon	OK			OK		
London Marylebone Road	OK	OK	OK	Outlier	OK	OK
London Marylebone Road Partisols					OK	Leak fail
London N. Kensington	OK	OK	OK	OK	OK	OK
London N. Kensington Partisols					OK	OK
London Harrow Stanmore						OK
London Teddington	Outlier			OK		OK
London Westminster	OK	OK	Outlier	OK		OK
Tower Hamlets Roadside	OK	OK				

SITE	NO_x	CO	SO_2	O_3	PM_{10}	$PM_{2.5}$
Aston Hill	OK			OK		
Cardiff Centre	OK	OK	OK	OK	Flow outlier	OK
Chepstow A48	OK				OK	OK
Cwmbran	OK			OK	Leak fail	
Mold	OK			OK		
Narberth	OK		OK	OK	Leak fail	

SITE	NO_x	CO	SO_2	O_3	PM_{10}	$PM_{2.5}$
Newport	OK				OK	OK
Port Talbot Margam	OK	OK	OK	OK	OK	OK
Port Talbot Margam Partisol						OK
Swansea Roadside	OK				OK	OK
Wrexham	Outlier + cyl outlier		OK		OK	OK

SITE	NO_x	CO	SO_2	O_3	PM_{10}	$PM_{2.5}$
Aberdeen	Outlier + converter fail			Outlier	OK	OK
Aberdeen Union St Roadside	OK					
Auchencorth Moss	OK			OK	k_0 outlier	Leak fail
Auchencorth Moss Partisols					Flow outlier	OK
Bush Estate	OK			OK		
Dumfries	Outlier + Cyl outlier					
Edinburgh St Leonards	Outlier	OK	OK	Outlier	OK	Leak fail
Eskdalemuir	Outlier			OK		
Fort William	Outlier			OK		
Glasgow Centre	Outlier	OK	OK	OK	OK	Flow outlier
Glasgow Centre Partisols					OK	OK
Glasgow City Chambers	Outlier					
Glasgow Kerbside	Outlier				OK	OK
Glasgow Kerbside Partisols					OK	OK
Grangemouth	Outlier		OK		OK	OK
Inverness	OK				OK	
Lerwick				OK		
Strath Vaich				OK		

SITE	NO_x	CO	SO_2	O_3	PM_{10}	$PM_{2.5}$
NORTHERN IRELAND						
Armagh Roadside	Outlier				OK	
Ballymena Ballykeel			OK			
Belfast Centre	OK	OK	OK	OK	OK	OK
Derry	OK		Outlier + cyl outlier	OK	Flow outlier, leak fail	Leak fail
Lough Navar				OK	OK	
IRELAND						
Mace Head				OK		

8 Site Cylinder Concentrations

During the intercalibration, the concentrations of the on-site cylinders were evaluated using the audit cylinder standards. The calculated results showed that 10 of the 299 cylinders (~3%) used to scale analyser data into concentrations (NO, CO and SO_2) were outside the ±10% acceptance criterion. This is much better than the summer exercise, where 7.5% of the scaling cylinders were outside the acceptance limits. There were 7 NO cylinders and 3 SO_2 cylinders identified as outliers.

In addition, the concentrations of 37 NO_2 cylinders appear to have drifted by more than 10%. NO_2 cylinders are not used for the scaling of data and so will not be replaced at this time. Hence, a total of 47 of the 299 cylinders (16%) were outside the acceptance limits. This is much better than the previous intercalibration, where 20% of the total cylinder population were found to be out of specification. The number of outlying NO_2 cylinders has not increased since the last audit, so no further remedial action will be taken at this stage.

4 of the 10 NO cylinders (Oxford C, Sandwell, Southend, Dumfries) appear to have been contaminated; a significant oxidation of the NO into NO_2 has occurred since the last intercalibration. These have been replaced and the performance of the new cylinders will be closely monitored at subsequent audits.

The Derry SO_2 cylinder result appears to be due to a poorly performing analyser on the day of the audit. Future performance will be closely assessed.

The remainder of the cylinders were all just outside the 10% limit. These will all be checked at the summer audits and appropriate action taken if necessary.

9 Site Information

All site information is now uploaded to CMCU and the AQ archive for dissemination using Google Earth. QA/QC unit make considerable effort in ensuring that site locations are accurate on the new Google Earth site information and AQ archive pages. All future additions to the AURN will include accurate positioning using Google Earth. Site location information is available in links from the AURN hub.

10 CEN

The European Committee for Normalisation (CEN) have prepared a series of documents prescribing how analysers must be operated, to produce datasets that conform to the Data Quality Objectives of the EC Directives. The CEN documents for operation of air pollution analysers; BS EN14211 (NOx), BS EN14212 (SO_2), BS EN14626 (CO) and BS EN14625 (O_3) set out a series of performance criteria for analysers which must be achieved, both in the field and under laboratory conditions. The test requirements have been extensively reported in previous intercalibration summaries and should be referenced for further information.

The CEN operating methodologies are now finalised and published and have been incorporated into the requirements of the air quality Directive 2008/50/EC. Older, non-compliant equipment still on site after this date will need to be replaced before June 2013. AEA have taken steps to ensure the procedures used in the UK comply with the requirements ahead of any imposed deadlines. To this end, the procedures used for the intercomparisons have been fully compliant with the CEN protocols since January 2006.

To comply with the Directive, the uncertainty for gaseous analyser measurements must be less than ±15%.

For sites that have CEN-compliant gaseous instrumentation, it is possible to calculate the overall uncertainty of measuring air quality. This information is site and analyser specific and presented in the table below:

Table 10.1 – Analyser measurement uncertainties (%)

Date	Site	O_3	CO	SO_2	NO_x	NO
19-Jan	Barnsley 12			14.3		
19-Jan	Barnsley Gawber	10.7		13.4	10	10
22-Feb	Bath Roadside				13.5	14
19-Jan	Billingham				13.5	14
04-Feb	Birmingham Tyburn	8.7		12.3	11.8	11.8
04-Feb	Birmingham Tyburn Roadside	12.4			13.5	14
18-Feb	Blackpool Marton	10.7			10	10
08-Feb	Bournemouth	12.4			13.5	14
22-Feb	Brighton Preston Park	12.4			13.5	14
22-Feb	Brighton Roadside				13.5	14
23-Feb	Bristol Old Market		9.5		13.5	14
23-Feb	Bristol St Paul's	12.4	9.5	13.4	13.5	14
23-Feb	Canterbury				13.5	14
18-Feb	Charlton Mackrell	12.4			13.5	14
16-Feb	Exeter Roadside	8.7			11.8	11.8
27-Jan	Glazebury	12.4			13.5	14
28-Jan	Harwell	12.4		13.4		
10-Feb	High Muffles				13.5	14
12-Jan	Hull Freetown	10.7	9.5	13.4	10	10
02-Mar	Ladybower	12.4		13.4	13.5	14
13-Jan	Leeds Centre	10.7	9.5	13.5		
13-Jan	Leeds Headingley Kerbside				10	10
11-Feb	Leicester Centre	10.7	9.5	13.4	10	10
21-Jan	Leominster	12.4		13.4	13.5	14
17-Feb	Liverpool Queen's Drive Roadside				13.5	14
16-Feb	Liverpool Speke	10.7	9.5	13.4	10	10
09-Feb	London Bexley		9.5	14.9	13.5	14
04-Feb	London Bloomsbury	12.4	9.5	13.5	13.5	14
09-Feb	London Cromwell Road 2		9.5	13.4	13.5	14
02-Feb	London Haringey				13.5	14
14-Jan	London Harlington	12.4			13.5	14
27-Jan	London Hillingdon	10.7			10	10
11-Feb	London Marylebone Road	12.4	9.5	15.7	13.5	14
08-Feb	London Westminster	12.4	9.5	14	13.5	14
19-Jan	Lullington Heath	12.4		13.4	13.5	14

Date	Site	O_3	CO	SO_2	NO_x	NO
26-Jan	Manchester Piccadilly				10	10
27-Jan	Manchester South	12.4			13.5	14
26-Jan	Market Harborough	12.4	18.8		10	10
19-Jan	Middlesbrough	12.4	9.5	14.2	13.5	14
18-Jan	Newcastle Centre	10.7	9.5	19	10	10
18-Jan	Newcastle Cradlewell Roadside				10.5	10.5
10-Feb	Northampton	8.7		12.6	11.8	11.8
13-Jan	Norwich Lakenfields	10.7		13.4	10	10
11-Mar	Nottingham Centre	10.7		13.4	10	10
17-Feb	Plymouth Centre	10.7			10	10
28-Jan	Portsmouth				11.8	11.8
17-Feb	Preston	10.7			10	10
24-Feb	Reading New Town	10.7			10	10
03-Feb	Sandwell West Bromwich	8.7		12.7	11.8	11.8
11-Feb	Sandy Roadside				13.5	14
14-Jan	Scunthorpe Town			13.4		
02-Mar	Sheffield Centre	12.4	9.5	16.2	13.5	14
12-Jan	Sibton	12.4				
10-Feb	Southampton Centre	10.7	9.5	14	10	10
17-Feb	Southend-on-Sea	10.7			10	10
18-Feb	St Osyth	10.7	15.7		10	10
18-Feb	Stanford-le-Hope Roadside			13.5	13.5	14
20-Jan	Stockton-on-Tees Eaglescliffe				13.5	14
20-Jan	Stoke-on-Trent Centre	10.7			10	10
18-Jan	Storrington Roadside				10	10
20-Jan	Sunderland Silksworth	12.4				
16-Feb	Thurrock	12.4		13.4	13.5	14
11-Jan	Wicken Fen	12.4		13.4	13.5	14
16-Feb	Wirral Tranmere	10.7			10	10
20-Jan	Yarner Wood	12.4			13.5	14
16-Feb	Armagh Roadside				10.5	10.5
11-Feb	Belfast Centre	10.7	9.5	13.4	10	10
15-Feb	Derry	12.4		13.4	13.5	14
03-Feb	Lough Navar	12.4				
19-Jan	Aberdeen	12.4			13.5	14
19-Jan	Aberdeen Union Street Roadside				13.5	14
03-Feb	Auchencorth Moss	12.4				
12-Jan	Bush Estate	12.4			13.5	14
09-Feb	Dumfries				13.5	14
12-Jan	Edinburgh St Leonards	12.4	9.5	13.6	13.5	14
11-Feb	Eskdalemuir	12.4			13.5	14
13-Jan	Fort William	0			13.5	14
06-Jan	Glasgow Centre	10.7	9.5	16.4	13.5	14
07-Jan	Glasgow City Chambers				10.5	10.5
07-Jan	Glasgow Kerbside				10	10
20-Jan	Inverness				13.5	14
03-Feb	Lerwick	12.4				
25-Feb	Peebles	12.4			13.5	14
20-Jan	Strath Vaich	12.4				
02-Feb	Cardiff Centre	12.4	9.5	13.8	13.5	14
27-Jan	Cwmbran				11.8	11.8
18-Jan	Mold	12.4			13.5	14
03-Feb	Narberth	12.4		13.4	13.5	14
26-Jan	Newport				10.5	10.5
02-Jan	Port Talbot Margam		9.5	13.4	13.5	14
03-Feb	Swansea Roadside				13.5	14
23-Feb	Wrexham			13.4	13.5	14

11 Safety

AEA undertakes regular extensive risk assessments of all its activities on-site, to ensure that its staff are not exposed to unsafe practices while working.

The most significant risk to field operators remains safe access to PM sample inlets to perform flow tests. This gains increased importance with FDMS analysers, where meaningful flow tests are impossible if access to the sample inlet cannot be achieved. We have successfully trialled a modified ladder design that does not require ladder restraints. We have rolled this out to all QA/QC field operators and recommended its use to all ESUs and MUs. There are now just a few sites where it is not currently possible to measure flows safely:

Table 11.1 Actions Required for Safe Roof Access

Site	Action required
Liverpool Speke	Has half barrier - needs full barrier
Middlesbrough	Roof access required, needs barrier
Coventry Memorial Park	Sloping roof - access not possible
Southend on Sea	Sloping roof - access not possible
Glasgow Kerbside	Needs new ladder support or railings
Thurrock	Sloping roof - access not possible

It is recommended that roof access at these sites is investigated, to determine whether safe access can be achieved.

In addition, the PM inlet cages at Plymouth Centre are securely bolted to the roof, with no easy means of accessing the heads without unbolting the cages. These need to be modified with doors to allow the LSO, ESU and QA/QC rapid access to the heads.

12 Certification

The Network Certificate of Calibration is presented in Appendix 6. This certificate presents the results of the individual analyser scaling factors on the day of the audit, as calculated by AEA using the audit cylinder standards, in accordance with our ISO17025 accreditation.

13 Summary

The intercalibration exercise has demonstrated its value as an effective tool in determining overall site performance and assessing the reliability and traceability of air quality measurements from a large scale network. The results from this intercalibration have been used to assess data quality during the ratification of the network datasets for the period October 2009 to March 2010.

Appendices

Appendix 1

Recommendations for Upgrade or Replacement of Equipment

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

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

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

	Recommendations January 2010	Priority	Action
30	All permanently pressurised cylinder calibration systems to be fitted with passivated stainless steel tubing-see Section 8	High	ESU
	Recommendations August 2008	**Priority**	**Action**
27	Many sites require modifications to permit safe roof access for measuring PM analyser flows	High	CMCU
	Recommendations January 2008	**Priority**	**Action**
25	It is recommended that LSO's continue to pay particular attention to the NO_2 calibration results, to see whether the NO response is significantly higher (>10ppb) than that obtained for the zero calibration. These observations should be reported to CMCU as soon as possible	High	LSO
24	It is strongly recommended that ESU's clean all NOx analyser switching valves during servicing, and ensure the valve is leak checked afterwards.	High	ESU
	Recommendations January 2007		
22	ESUs to ensure all NOx converter software settings to be 100%.	High	ESUs to check at service
	Recommendations July 2005		
13	Continuing problems with some autocal run-ons causing loss of up to 2 hours per day-see Section 3.2 **CMCU to ensure ESUs are asked to attend to offending sites (Action May 2008)**	High	Many sites now cured, but some need attention at next ESU visit

Appendix 2

Gaps listing January-March 2010

Pollutant	Data Capture (%)	Start date	End date	Reason	Comments	N0. of days	No. of hours
England							
Blackburn Darwen Roadside							
NO2	40.30%	01-Jan-10	15-Feb-10	QAQC audit	Audit CE 95.1%. Converter replaced at Service	45.5	1093
		26-Feb-10	04-Mar-10	Logger fault	Envidas logger not logging	5.9	141
		16-Mar-10	18-Mar-10	Logger fault	ENG C/O Envidas data logger removed because of fault	2	47
Blackpool Marton							
NO2	65.20%	01-Mar-10	31-May-10	Switched out-of-service	ENG C/O Site closed down because the hut leaks	92	2208
O3	65.30%	01-Mar-10	31-May-10	Switched out-of-service	ENG C/O Site closed down because the hut leaks	92	2208
PM25	65.30%	01-Mar-10	31-Mar-10	Switched out-of-service	ENG C/O Site closed down because the hut leaks	31	744
Bournemouth							
Brighton Preston Park							
Bristol Old Market							
NO2	13.80%	01-Nov-09	19-Mar-10	NO2 converter fault	Converter Failure at 88%	139	3324
Bristol St Paul's							
NO2	81.80%	10-Mar-10	26-Mar-10	Instrument fault	PMT failure and leak	16	385
Bury Roadside							
CO	15.00%	14-Jan-10	08-Apr-10	Sampling fault	Flow problems throughout period	83.9	2014
PM25	78.70%	29-Dec-09	19-Jan-10	Sampling fault	Leak	21.3	510
Camden Kerbside							
NO2	75.60%	27-Nov-09	14-Jan-10	Instrument fault	Multitude of faults	48.1	1154
		12-Mar-10	16-Mar-10	Instrument fault	Combination of zero mV and instability	3.9	93
		25-Mar-10	29-Mar-10	Operator error	Rejected data following LSO cal on 25th	3.8	92
PM25	34.90%	05-Dec-09	08-Jan-10	Instrument fault	Noisy data	34.3	822
		22-Jan-10	12-Feb-10	Unstable response	Period of unstable data	21.2	508
		24-Feb-10	25-Mar-10	Unstable response	Period of unstable data	29.3	703
Coventry Memorial Park							
O3	50.60%	10-Dec-09	05-Feb-10	Sampling fault	Sampling fault due to filter not sealing correctly	57.5	1379
		16-Feb-10	18-Feb-10	Communication fault	No data assume lack of comms	2.6	62

		09-Mar-10	15-Mar-10	Communication fault	Comms failure	5.9	142
Exeter Roadside							
O3	0.00%	01-Mar-10	31-Mar-10	ESU service		31	744
Great Dun Fell							
O3	36.20%	27-Jan-10	25-Mar-10	Instrument fault	Call out: Motherboard failure	57.3	1374
Harwell							
PM10	89.90%	08-Jan-10	11-Jan-10	Sampling fault	Negative data	3.4	82
		28-Jan-10	30-Jan-10	QAQC audit	Recovery after audit	2.5	61
		09-Feb-10	10-Feb-10	ESU service		1.2	28
		10-Mar-10	11-Mar-10	FDMS volatile recovery or noisy	Recovery after filter change on 10/3	0.8	18
Leeds Centre							
CO	61.10%	18-Jan-10	20-Jan-10	ESU service	SERVICE Changed from manifold to individual sample lines	2.1	50
		30-Jan-10	05-Feb-10	Instrument fault	IR source failed	6.5	155
		11-Feb-10	09-Mar-10	Instrument fault	IR source failed	26.1	627
Liverpool Speke							
PM25	87.10%	02-Jan-10	03-Jan-10	Unstable response	Unstable data deleted	0.5	13
		16-Feb-10	23-Feb-10	Unstable response	ENG C/O PM 2.5 Data was noisy following audit - replaced filters	7.3	176
		02-Mar-10	05-Mar-10	ESU service		2.7	64
London Bexley							
CO	82.50%	27-Jan-10	01-Feb-10	Power cut	Power failure	5.2	124
		23-Feb-10	24-Feb-10	ESU service		1.1	27
		20-Mar-10	29-Mar-10	Power cut	ENG C/O Replaced power supply	8.6	206
PM25	86.60%	27-Jan-10	28-Jan-10	Power cut	power failure	1.4	33
		01-Feb-10	02-Feb-10	Air Conditioning or Temp fault	air conditioning fault led to temperature fault on FDMS	1.2	28
		09-Feb-10	15-Feb-10	FDMS volatiles noisy	following auditPM2.5 Pump vacuum too low.	6.2	148
		24-Feb-10	24-Feb-10	ESU service	Service	0.3	6
		20-Mar-10	23-Mar-10	Power cut	Power failure and recovery.	2.6	63
SO2	89.40%	27-Jan-10	01-Feb-10	Power cut	ENG C/O SO2 dead. Replaced 5V power supply	5.2	124
		23-Feb-10	24-Feb-10	ESU service		1.1	27
		20-Mar-10	23-Mar-10	Power cut	Power failure	2.8	67
London Bloomsbury							
PM10	62.50%	11-Jan-10	14-Jan-10	Instrument fault	Bad data deleted	4	96
		25-Jan-10	27-Jan-10	Instrument fault	Bad data deleted	3	72
		13-Feb-10	11-Mar-10	Instrument fault	Recurring fault & FDMS removed from site for repair	26	625
London Harlington							
NO2	79.20%	18-Jan-10	04-Feb-10	Sampling fault	internal sampling since service.	17.2	413
PM10	63.00%	04-Jan-10	04-Jan-10	High noise	short data gap then noisy.	0.4	10
		28-Feb-10	16-Apr-10	High noise	ENG C/O V seals replaced then air con fault	47.5	1141

PM25	48.70%	04-Jan-10	19-Jan-10	High noise	Data deleted	15.4	369
		02-Feb-10	02-Feb-10	High noise	unstable period.	0.3	8
		24-Feb-10	26-Mar-10	High noise	ENG C/O no details of repair.	30.1	723
London Hillingdon							
NO2	89.80%	29-Jan-10	02-Feb-10	No mV data collected		3.9	94
		15-Feb-10	16-Feb-10	ESU service		1.2	28
London Marylebone Road							
PM10	84.20%	07-Feb-10	18-Feb-10	Unstable response	Unstable FDMS data on all channels	12	288
		21-Feb-10	22-Feb-10	Power cut		1.3	32
SO2	83.20%	21-Feb-10	22-Feb-10	Power cut		1.3	30
		17-Mar-10	30-Mar-10	Instrument fault	ENG C/O Attend site to address issues with drifting baseline.	13	313
London N. Kensington							
NO2	74.60%	01-Feb-10	18-Feb-10	Instrument fault	various alarms + oos switch faulty-repaired at esu	17.5	421
		24-Feb-10	26-Feb-10	Instrument fault	c/o replaced SO2 NOx CO & O3 analysers :-API	1.6	38
		30-Mar-10	31-Mar-10	Power cut		0.7	16
O3	81.40%	16-Jan-10	21-Jan-10	Instrument fault	ENG C/O Replaced faulty UIV lamp.	5.7	137
		14-Feb-10	15-Feb-10	Instrument fault	c/o to fix noisy analyser	1.5	36
		24-Feb-10	25-Feb-10	Switched out-of-service	new installation	1.3	30
		24-Mar-10	07-Apr-10	Sampling fault	Internal sampling	14	337
PM25	82.90%	01-Jan-10	05-Jan-10	Instrument fault	ENG C/O Found that the units display was blank. Fixed	4.1	98
		12-Jan-10	22-Jan-10	Instrument fault	call out -memory loss-memory reset	9.6	230
		01-Feb-10	01-Feb-10	ESU service		0.3	6
		30-Mar-10	01-Apr-10	Power cut		1.7	41
SO2	89.30%	24-Feb-10	25-Feb-10	Switched out-of-service	New analyser installation	1.2	28
		10-Mar-10	11-Mar-10	Switched out-of-service	calibration followed by oos -overnight cal	0.4	10
		24-Mar-10	07-Apr-10	Switched out-of-service	Internally sampling	14	337
London Teddington							
PM25	49.20%	14-Jan-10	22-Jan-10	Instrument fault	ENG C/O TEOM PM2.5 FDMS screen blank. Reloaded software	7.9	190
		29-Jan-10	08-Feb-10	Instrument fault	ENG C/O PM2.5 FDMS unable to connect/download. Reloaded software	10	241
		01-Mar-10	17-Mar-10	ESU service	SERVICE Sample fan fault	16.7	401
		23-Mar-10	31-Mar-10	Instrument fault	locked up analyser again?	8.2	197
Lullington Heath							
NO2	89.20%	13-Jan-10	13-Jan-10	Power cut		0.3	6
		25-Jan-10	26-Jan-10	ESU service	Site Service	1.2	28
Manchester Piccadilly							
PM25	76.10%	19-Nov-09	18-Jan-10	Unstable response	ENG C/O FDMS PUMP VACUUM LOW. Serviced pump	60.3	1447
		15-Feb-10	17-Feb-10	ESU service		2.1	50
		30-Mar-10	31-Mar-10	Unstable response	Rejection of low data	1.5	36
Middlesbrough							

PM10	66.70%	01-Jan-10	27-Jan-10	High noise	Very noisy + service 27 Jan	26.6	638
		07-Feb-10	09-Feb-10	Unstable response	erroneous data	3	72
PM25	75.70%	25-Jan-10	27-Jan-10	ESU service	service	2.2	52
		07-Feb-10	23-Feb-10	Unstable response	intermittent flow fault - re seated filter	16.7	400
		23-Mar-10	25-Mar-10	Unstable response	unstable data (dew point)	2	48
Newcastle Centre							
CO	79.70%	18-Jan-10	05-Feb-10	Sampling fault	CO exhaust was connect to sample at the audit	18.1	434
Norwich Lakenfields							
NO2	82.40%	20-Jan-10	21-Jan-10	ESU service	SERVICE Set up NO using ET NO cylinder	1.3	31
		28-Jan-10	05-Feb-10	High noise	Noisy data deleted	8	193
		18-Feb-10	19-Feb-10	Power cut	Possible power cut	1.2	29
		15-Mar-10	16-Mar-10	Power cut	Possible power cut	1.4	34
SO2	78.50%	15-Jan-10	03-Feb-10	Instrument fault	UV lamp problems	19	457
Oxford St Ebbes							
PM10	86.20%	08-Jan-10	08-Jan-10	QAQC audit	AUDIT Ozone out 16.4% Site NO2 cyl more than 10% from stated valu	0.3	8
		29-Jan-10	09-Feb-10	ESU service	SERVICE PM10 found to be leaking at DFU. DFU's replaced	11.6	278
Portsmouth							
PM25	7.60%	07-Jan-10	07-Apr-10	Instrument fault	Main flow leak of replacement instrument	89.6	2150
Preston							
PM25	82.80%	03-Jan-10	09-Jan-10	FDMS volatile recovery or noisy	ENG C/O Replaced V seal.	6.3	151
		17-Feb-10	24-Feb-10	QAQC audit	ENG C/O very noisy following audit.	7.5	180
		27-Feb-10	27-Feb-10	High noise	Data deleted	0.3	6
		10-Mar-10	11-Mar-10	ESU service		0.9	22
Reading New Town							
NO2	19.40%	01-Sep-09	12-Mar-10	QAQC audit		193	4623
		29-Mar-10	30-Mar-10	Instrument fault	Locked up	1	25
Rochester Stoke							
NO2	0.00%	03-Nov-09	31-May-10	Switched out-of-service	Site offline	209	5027
O3	0.00%	03-Nov-09	31-May-10	Switched out-of-service	LSO turned off site due to water leak	209	5027
PM10	0.00%	01-Jan-10	31-Mar-10		Old cabin with leaking roof to be replaced.	90	2160
PM25	0.00%	03-Nov-09	31-Jan-10	Switched out-of-service	LSO turned off site due to water leak	89.6	2151
SO2	0.00%	21-Oct-09	31-Jan-10	Power cut	Power failures due to leak from roof	102	2451
		03-Nov-09	31-May-10	Switched out-of-service	Site switched out of sevice	209	5027
Saltash Roadside							
PM25	88.10%	23-Feb-10	23-Feb-10	Monitoring suspended	Monitoring of PM2.5 started 23/2/10	0.8	18
		19-Mar-10	22-Mar-10	FDMS volatile recovery or noisy	Long volatile recovery	3.6	86
Sandwell West Bromwich							

O3	52.30%	17-Feb-10	13-Apr-10	ESU service	Low response. Internal sampling	55	1321
Sandy Roadside							
PM10	75.50%	06-Jan-10	23-Jan-10	Unstable response	Data rejected by ERG	17.1	411
		11-Feb-10	11-Feb-10	QAQC audit	AUDIT Vac too low 11". Leak test failed significantly	0.4	9
		16-Feb-10	16-Feb-10	Instrument fault	ENG C/O Replaced pump - inline vaccum now -15inHg.	0.3	6
		06-Mar-10	06-Mar-10	Unstable response	Data rejected by ERG	0.3	7
		07-Mar-10	08-Mar-10	Unstable response	Data rejected by ERG	0.4	9
		09-Mar-10	09-Mar-10	Unstable response	Data rejected by ERG	0.3	7
		19-Mar-10	20-Mar-10	Unstable response	Data rejected by ERG	1.3	30
Sheffield Centre							
CO	84.30%	18-Mar-10	31-Mar-10	ESU service		13.7	328
O3	89.20%	29-Jan-10	02-Feb-10	No mV data collected	No data for any pollutant.	4.3	103
		06-Mar-10	08-Mar-10	No mV data collected	no info	1.9	46
		18-Mar-10	19-Mar-10	ESU service		1.1	27
		27-Mar-10	29-Mar-10	No mV data collected	no info	1.9	46
Southampton Centre							
PM25	78.90%	02-Mar-10	19-Mar-10	Instrument fault	Software lost at Service.	17.2	412
		21-Mar-10	21-Mar-10	Air Conditioning or Temp fault		0.4	9
		27-Mar-10	27-Mar-10	Air Conditioning or Temp fault		0.3	7
		30-Mar-10	30-Mar-10	Air Conditioning or Temp fault		0.3	6
Southend-on-Sea							
NO2	0.00%	01-Jan-10	09-Apr-10	Instrument fault	Excessively high NOx baseline; data deleted	98.5	2365
O3	87.40%	06-Jan-10	11-Jan-10	Instrument fault	ENG C/O Fixed lamp Intensity warning.	5.2	125
		13-Feb-10	15-Feb-10	Instrument fault	Fixed leak because of wrong Thermo analyser locking up	2	48
		27-Feb-10	01-Mar-10	Instrument fault	Thermo analyser locking up	2.3	54
		03-Mar-10	04-Mar-10	ESU service		0.7	17
Stanford-le-Hope Roadside							
PM25	49.80%	13-Jan-10	15-Jan-10	Switched out-of-service	delted data - testing true zero	2.1	50
		18-Feb-10	17-May-10	ESU service	SERVICE + leak	88.1	2114
SO2	68.50%	01-Feb-10	01-Feb-10	Switched out-of-service	esu call out to investigate unstable span	0.3	6
		04-Mar-10	17-Apr-10	Instrument fault	pmt repair at esu workshop	44.5	1069
Stockton-on-Tees Eaglescliffe							
PM25	89.10%	01-Jan-10	01-Jan-10	Communication fault	Missing data assume comms due to times	0.7	17
		27-Jan-10	27-Jan-10	Unstable response	Low and -ve data rejected	0.5	11
		31-Jan-10	02-Feb-10	Communication fault	Missing data assume comms due to times	2.5	60
		08-Feb-10	09-Feb-10	Unstable response	Low and -ve data rejected	0.3	6
		09-Feb-10	10-Feb-10	Unstable response	Low and -ve data rejected	0.3	7
		28-Feb-10	28-Feb-10	Unstable response	Low and -ve data rejected	1	23
		15-Mar-10	15-Mar-10	Unstable response	Low and -ve data rejected	0.5	13
		28-Mar-10	29-Mar-10	Unstable response	Low and -ve data rejected	0.9	22

		31-Mar-10	01-Apr-10	Unstable response	Low and -negative data rejected	0.9	21
Stoke-on-Trent Centre							
PM10	87.20%	21-Jan-10	01-Feb-10	Instrument fault	Period instability & PM2.5 > PM10	11.1	267
Storrington Roadside							
PM10	47.90%	18-Jan-10	05-Mar-10		ENG C/O	45.6	1095
		24-Mar-10	25-Mar-10	High noise	short period of negative & noisy data	0.3	7
PM25	89.10%	18-Jan-10	18-Jan-10	QAQC audit		0.3	7
		21-Feb-10	02-Mar-10	Unstable response	LSO C/O PM2.5 call-out. No problem found. Replaced filters	9.1	219
Thurrock							
O3	85.60%	02-Jan-10	04-Jan-10	Power cut	Change in baseline	1.5	37
		16-Jan-10	18-Jan-10	Flat response	pump fault	1.1	27
		05-Feb-10	06-Feb-10	Flat response	pump fault	0.9	22
		06-Feb-10	07-Feb-10	Flat response	pump fault	0.3	8
		11-Feb-10	18-Feb-10	Instrument fault	change in baseline and response.	7.6	182
		02-Mar-10	03-Mar-10	ESU service	UV lamp needs replacement soon	1.1	27
PM10	86.10%	02-Jan-10	03-Jan-10	Unstable response	erratic data nulled.filter loading? cal next day	0.5	12
		05-Feb-10	05-Feb-10	No mV data collected	Gap following cal on 4th.	0.8	20
		16-Feb-10	26-Feb-10	ESU service	Engineer found aux flow line not connected to large DFU	9.6	231
		02-Mar-10	03-Mar-10	ESU service	SO2 UV lamp needs replacement soon	1.3	30
Walsall Willenhall							
NO2	36.10%	03-Feb-10	31-May-10	Monitoring suspended	LSO reports site burnt down.	117	2809
Wigan Centre							
PM25	84.50%	02-Mar-10	15-Mar-10	FDMS volatile noisy	ENG C/O Call out for noise data Full service undertaken	13.1	314
Wirral Tranmere							
NO2	84.40%	25-Jan-10	28-Jan-10	Instrument fault	Thermo analysers locking up	2.9	70
		25-Feb-10	26-Feb-10	Instrument fault	Thermo analysers locking up	1.1	26
		05-Mar-10	08-Mar-10	Instrument fault	Thermo analysers locking up	3.1	74
		10-Mar-10	12-Mar-10	ESU service		2	48
		14-Mar-10	15-Mar-10	Instrument fault	Thermo analysers locking up	1.1	27
York Fishergate							
NO2	87.10%	26-Jan-10	26-Jan-10	ESU service		0.3	6
		04-Mar-10	15-Mar-10	Power cut	Power failure	11	264
PM10	87.30%	04-Mar-10	15-Mar-10	Power cut	LSO confirms power failure	11	264
N Ireland							
Armagh Roadside							
NO2	55.80%	01-Apr-09	09-Feb-10	Instrument removed for repair		315	7553
Ballymena							
SO2	86.10%	28-Jan-10	09-Feb-10	Communication fault	Loss of data due to comms or logger fault	12.2	292

Belfast Centre							
PM10	74.80%	02-Mar-10	24-Mar-10	Air Conditioning or Temp fault	Service Elevated Volatiles & A/Con Failure	22.4	538
Derry							
PM10	22.70%	01-Jan-10	11-Mar-10	Instrument fault	large V seal on transducer leaking; no spare available	69.5	1669
PM25	0.00%	26-Aug-09	24-Feb-10	Instrument fault	ENG C/O Repaired a leak on the PM2.5 found at audit	183	4384
		01-Feb-10	31-Mar-10	Instrument fault	Poor quality data deleted during ratification	59	1416
SO2	89.50%	15-Feb-10	24-Feb-10	ESU service		9	216
Scotland							
Aberdeen Union Street Roadside							
NO2	48.00%	23-Sep-09	16-Feb-10	NO2 converter fault		147	3518
Auchencorth Moss							
Auchencorth Moss PM10 PM25							
PM10	31.50%	03-Aug-09	02-Mar-10	Instrument fault	Instrument fault - no analyser on site	212	5080
		31-Mar-10	31-Mar-10	Power cut		0.6	15
Edinburgh St Leonards							
PM10	82.50%	01-Nov-09	13-Jan-10	Instrument fault	Low response from FDMS	73.8	1771
		27-Jan-10	29-Jan-10	ESU service		2.4	57
		09-Mar-10	09-Mar-10	QAQC audit		0.4	10
SO2	72.50%	01-Jan-10	06-Jan-10	Instrument fault	Replaced UV lamp	5.8	138
		27-Jan-10	29-Jan-10	ESU service		2.1	51
		23-Feb-10	11-Mar-10	Rapid zero or sensitivity drift	Hot spare instrument installed	16.5	397
Fort William							
NO2	73.20%	27-Jan-10	15-Feb-10	Instrument fault	Faulty switching valve	19.1	459
		24-Feb-10	28-Feb-10	Flat response		4.7	113
Glasgow Centre							
PM10	0.00%	01-Jan-10	31-Mar-10	FDMS volatile noisy	High Volatiles	90	2160
Inverness							
NO2	71.30%	22-Dec-09	26-Jan-10	Instrument fault	Data anomalously low	35	841
Wales							
Narberth							
SO2	53.20%	18-Feb-10	26-Apr-10	Sampling fault	Filter holder was not fully tightened.	67.2	1613
Newport							
PM10	39.10%	01-Jan-10	27-Jan-10	QAQC audit		26.5	637
		29-Jan-10	01-Feb-10	FDMS delta dew point < 4C	dew point temp too low	3.3	78

08-Feb-10	15-Feb-10	FDMS delta dew point < 4C	dew point temp too low	6.7	160
18-Feb-10	25-Feb-10	ESU service		7	167
26-Feb-10	26-Feb-10	FDMS delta dew point < 4C	dew point temp too low	0.4	10
28-Feb-10	05-Mar-10	FDMS delta dew point < 4C	dew point temp too low	5	119
06-Mar-10	12-Mar-10	FDMS delta dew point < 4C	dew point temp too low	5.4	130
15-Mar-10	16-Mar-10	FDMS delta dew point < 4C	dew point temp too low	0.5	12

Appendix 3

Inventory of Defra owned Equipment

An up-to-date inventory of Department-owned equipment used by the QA/QC Unit is provided below:

QA/QC Unit's inventory of Department-owned equipment, January 2010

Computer software	The HIS (Heuristic Information System) software suite used for all data management. A few specific capabilities of HIS were developed in order to meet specific Department deliverables or requirements (examples include software for annual report analysis/compilation, for formatting/transmitting network data to archive or DDU and for reporting Directive compliance data to the EC).
Field support equipment	Field support equipment: 1 intercalibration equipment set (includes mass flow controllers and read-out unit) A second intercalibration (commissioned January 2001) UV photometers: API model M401 s/n 123- purchased April 1999 API model 401 s/n 151 - purchased October 2000 API model 401 s/n 176 – purchased December 2002 API model 401 s/n 290 – purchased May 2004 API model 401 s/n 291 – purchased May 2004 API model 401 s/n 292 purchased May 2004 API model 401 s/n 293 purchased May 2004 API Model 703 s/n 254 purchased Jan 2010 API Model 703 s/n 255 purchased Jan 2010 Mass flow controllers - purchased April 2002 (incorporated into existing audit dilution apparatus) 3 Drycal flow meters - purchased September 2002 1 Mass flow controller read-out unit to be incorporated in the audit dilution apparatus – purchased September 2002. A third intercalibration kit (commissioned May 2004) Drycal flow meter – purchased March 2004 Sabio 2010 dilution calibrator – purchased February 2005 Sabio 2020 zero air generator – purchased February 2005 Sabio 2030 ozone photometer – purchased February 2005 Sabio 2010 dilution calibrator – purchased June 2006 Sabio 2020 zero air generator – purchased June 2006 Sabio 2030 ozone photometer – purchased June 2006 Sabio 2020 zero air generator – purchased March 2008 Sabio 2030 ozone photometer – purchased March 2008 Sabio 2010 dilution calibrator – purchased March 2008
Zero air pumps	6 spare zero air pumps for routine maintenance/repair of zero air generators in the AURN.
Analysers	AC31 dual chamber NO_x analyser TEI 43C SO_2 analyser TEI 48C CO analyser M265 chemiluminescent ozone analyser (All of the above purchased on behalf of Defra by Casella Stanger in March 2003 and transferred to QA/QC Unit)

Appendix 4

Partisol Data: January-March 2010

Partisol data were ratified for the following sites and measurement periods.

Site	Start date	End date	Ratified Data Capture, %
Auchencorth Moss PM_{10}	1st Jan	31st Mar	99
Auchencorth Moss $PM_{2.5}$	1st Jan	31st Mar	70
Bournemouth $PM_{2.5}$	1st Jan	31st Mar	59
Brighton Preston Park $PM_{2.5}$	1st Jan	31st Mar	69
Harwell PM_{10}	1st Jan	31st Mar	44
Harwell $PM_{2.5}$	1st Jan	31st Mar	93
Inverness PM_{10}	1st Jan	31st Mar	99
Inverness $PM_{2.5}$	1st Jan	31st Mar	86
L. Marylebone Road PM_{10}	1st Jan	31st Mar	54
L. Marylebone Road $PM_{2.5}$	1st Jan	31st Mar	**0**
London N Kens PM10	1st Jan	31st Mar	97
London N Kens $PM_{2.5}$	1st Jan	31st Mar	94
London Westminster $PM_{2.5}$	1st Jan	31st Mar	67
Northampton $PM_{2.5}$	1st Jan	31st Mar	92
Port Talbot Margam PM_{10}	1st Jan	31st Mar	42
Port Talbot Margam $PM_{2.5}$	1st Jan	31st Mar	39
Wrexham PM_{10}	1st Jan	31st Mar	47
Wrexham $PM_{2.5}$	1st Jan	31st Mar	87

Bureau Veritas carry out the following:

- filter conditioning and weighing.
- Calculation of ambient particulate concentrations using the Partisol download data and the filter weighings.
- Providing a field blank correction based on filters supplied with each batch, which travel to the Partisol site in the canister with the other filters, but are not actually exposed.
- Checking that the correct filter ID is matched with the correct day's sampling data.
- Checking that the PM10 and PM2.5 datasets "track" each other.
- Do a rough comparison of ambient concentrations with those from co-located or nearby FDMS-TEOM sites.

The raw data and calculated concentrations are supplied to AEA in a spreadsheet, which is uploaded to AEA's Partisol processing system.

AEA complete the ratification process by

- Independently checking BV's calculation of the ambient PM_{10} concentration.
- Ensuring that data with a Partisol fault code or filter fault are rejected.
- Checking site audit data where available.
- Carrying out a more detailed quarterly comparison of Partisol data with co-located or nearby FDMS-TEOM data.

13.1.1 Data Rejection

Data codes are recorded during ambient measurement, and filter faults are recorded during filter weighings. Some codes indicate a fatal fault and are used to automatically reject data during ratification.

13.1.1.1 Measurement codes are shown below.

The measurement codes reported by BV are as follows:

New Code	Meaning	Reject
0	OK	No
8	Power Failure	Only if < 18h data.
4	System re-set	Only if < 18h data.
10	Flow 1 out of range	Yes
20	Flow 2 out of range	Yes
40	Flow 3 out of range	Yes
2000	Difference between ambient T and filter T > $\pm 5^{o}C$	No
10000	Elapsed sample period out of range/out of filters	Reject if < 18h data.
40000	Coefficient of variation of average flow too high (i.e. too much variation in flow)	If not caused by "audit" status e.g. inlet cleaning. Or if < 18h data.
100000	Elapsed Sample Period out of range (< 23 hours or >25 hours).	Reject if < 18h data.
102000	Difference between ambient T and filter T > $\pm 5^{o}C$, causing Elapsed Sample Period out of range (< 23 hours or >25 hours).	Reject only if < 18h valid data or vol < 18 m3.
100008	Elapsed Sample Period out of range (< 23 hours or >25 hours), *and* Power Failure.	Yes (power failure)

The following faults should also be recorded during filter weighings and should be indicated by BV in their spreadsheet under "Lab Comments". All are fatal except "filter inverted".

13.1.1.2

13.1.1.3 Filter faults

Filter exposed inverted
Filter cut inside edge
Filter damaged some missing
Filter appears unexposed
Filter not returned
Filter inverted and in reverse order in canister

Site Audits

Site audit results for the AURN Partisols are shown in the table below. Audits take place every 6 months, so there may not necessarily have been an audit during the "quarter" currently being ratified. The table below therefore shows the two most recent audits.

The flowrate must be within +/-10% of the nominal value (16.7 m3/h).

Site Audits – Summer 2009 and winter 2009-10 periods.

Site	Audit date	Flowrate m3/h	% out from 16.7 m3/h
Auchencorth Moss PM_{10} (serial no. 21550)	1 Jul 2009 3 Feb 2010	17.2 16.7	3.42 0
Auchencorth Moss $PM_{2.5}$ (serial no. 21548)	1 Jul 2009 3 Feb 2010	16.6 16.7	-0.54 0
Bournemouth $PM_{2.5}$ (serial no. 21257)	10 Aug 2009 8 Feb 2010	17.20 17.48	3.18 4.70
Brighton Preston Park $PM_{2.5}$ (212200001)	01 Sep 2009 22 Feb 2010	16.87 No access	1.20 No access
Harwell PM_{10}	23 Feb 2009 28 Jan 2010	16.99 16.7	1.92 0
Harwell $PM_{2.5}$	23 Feb 2009 28 Jan 2010	16.86 16.7	1.14 0
Inverness PM_{10} (serial no. 21255)	12 Aug 2009 20 Jan 2010	16.58 16.7	-0.54 0
Inverness $PM_{2.5}$ (serial no. 21861)	12 Aug 2009 20 Jan 2010	16.62 16.7	-0.48 0
London Marylebone Road PM_{10} (serial no. 21306)	19 Aug 2009 11 Feb 2010	Not tested, no safe ladder access. 16.79	Not tested, no safe ladder access. 0.68
London Marylebone Road $PM_{2.5}$ (serial no. 21493)	19 Aug 2009 11 Feb 2010	Not tested, no safe ladder access. Partisol not operating.	Not tested, no safe ladder access. Partisol not operating.
London N Kens PM_{10} (serial no. 21722)	13 Jul 2009 12 Jan 2010	Not tested, no safe ladder access 16.53	- 1.0
London N Kens $PM_{2.5}$	13 Jul 2009 12 Jan 2010	Not tested, no safe ladder access. 16.31	- 2.3
London Westminster $PM_{2.5}$	17 Aug 2009 8 Feb 2010	17.36 16.0	4.14 0
Northampton $PM_{2.5}$	19 Aug 2009 10 Feb 2010	Not tested, no safe ladder access.	- -
Port Talbot Margam $PM_{2.5}$	4 Aug 2009 2 Jan 2010	not tested 16.7	not tested 0
Wrexham $PM_{2.5}$ (serial no. 21224)	12 Aug 2009 23 Feb 2010	16.06 16.7	-3.66 0
Wrexham $PM_{2.5}$	23 Feb 2010	16.7	0

(serial no. 21011)			

Flowrate test results in all cases where it was possible to carry out a flowrate test on the Partisol were normal (i.e. within 10%).

13.1.2 Auchencorth Moss

PM_{10}: Data capture was 99% for this quarter. Only one day's data was lost:

- 31st Jan, negative value < -4 ugm^{-3}. Note: cut-offs for negative data to be confirmed.

$PM_{2.5}$: Data capture was 70% for this quarter. Data losses as follows:

- 1st – 20th Jan Filter Exchange Failure (FEF).
- 17th Feb FEF
- 19th Feb, PM2.5 >> PM10.
- 23rd, 27th Feb – 1st Mar, 27th Mar, 31st Mar : < 18 hours sampling.

The data loss this quarter is partially attributed to the weather; the ESU can not go on site without an escort which was not available due to the adverse conditions. Also, the ESU did not have a necessary replacement part.

13.1.3 Bournemouth

$PM_{2.5}$ only: Data capture was 59% for this quarter. Following a filter exchange failure on 24th Feb, the Partisol was taken to the ESU's workshop for repair, where it remained for the rest of the quarter.

13.1.4 Brighton Preston Park

$PM_{2.5}$ only: Data capture was 69% for this quarter. Data losses as follows:

- 7th – 11th Jan: Filter exchange failure (FEF)
- 9th – 17th Feb: FEF followed by visits by LSO and ESU.
- 19th – 20th Feb: power failure
- 1st – 3rd Mar: ran out of filters
- 5th – 11th Mar: Problems starting with failure of Partisol to register filters, ending with ESU on site to rebuild push mechanism on 11th.
- 16th Mar: routine service
- 25th Mar: FEF.

Last quarter there was a major breakdown due to water ingress. It is possible that some of the FEFs and other problems here could result from this.

Harwell

PM_{10}: 44% data capture.The Partisol lost data from 5th Feb, and the keypad was found to be unresponsive when the site was visited on 10th Feb. The instrument was removed for repair and remained out of action for the rest of February and most of March. From the available data, it seems to be under-reading by on average 7 ugm^{-3} compared to the co-located FDMS.

$PM_{2.5}$: 93% data capture. Data losses as follows:

- 26th – 31st Mar – filter exchange failure.

13.1.5 Inverness

PM_{10}: 99% data capture. Missing data:

- 25th Jan: routine service.

.

A very high concentration of 83 ugm^{-3} occurred on 6th Mar. This looks suspect but has not been rejected as there is no indication that the value is not valid. There were also peaks in PM_{10} at Inverness on 10th Jan, 10th Feb and 23rd Feb that were not reflected in the Edinburgh St Leonards data. There is no reason to suspect these are invalid, but they are probably due to local sources.

$PM_{2.5}$: 62% data capture. Data losses:

- 25th Jan: routine service.
- 10th – 11th Feb: filter exchange failure

.

London Marylebone Road

PM_{10}: Data capture = 54%. Data losses:

- 5th – 11th Jan: Filter exchange failures requiring ESU visit.
- 19th Feb – 23rd Mar: unit failed and removed for repairs.

$PM_{2.5}$: ***The $PM_{2.5}$ Partisol has consistently under-read relative to the co-located FDMS. An investigative visit on 28th April discovered that a piece of tubing inside the sampler was completely missing, so the Partisol had been sampling from inside the housing. It is not clear when this tubing was removed, but all data from that time will be invalid and must be deleted. It is suspected that this could be well back into 2009.***

Specific faults:

- 21st Feb: power failure
- 22nd Feb: delayed filter change
- 24th Feb: < 18 hours sampling.

London North Kensington

PM_{10}: data capture 97%.Data losses:

- 28th Jan – error in initial weighing.
- 5th Feb, 28th Mar, < 18 hours sampling.

$PM_{2.5}$: Data capture was 94%. Data losses:

- 4th Feb Filter exchange failure
- 3rd Mar – initial weighing error.
- 29th – 31st Mar: unspecified failure: < 18 hours data.

London Westminster

$PM_{2.5}$ only. Data capture = 67%. Data losses –

- 3rd Feb – power failure.
- 14th, 15th Feb – filter exchange failure.
- 5th Mar to end of month: low flows led to ESU callout: pump and water trap removed for repairs. Partisol remained out of action.

Northampton

$PM_{2.5}$ only: Data capture was 92%. Data losses:

- 19th Jan, 24th – 26th Jan, 16th – 17th Mar: filter exchange failure.
- 23rd Feb: routine service.

Port Talbot Margam

PM_{10}: Partisol was converted to PM_{10} as of 18th Feb. Data capture 43%. Data losses:

- 18th Feb, double exposed filter.
- 21st Mar: error in initial weighing.

$PM_{2.5}$: data capture = 39%.

Data losses:

- 1st and 3rd Jan – double filters in holders.
- 19th – 30th Jan – broken rain jar.

Overall data capture for both parameters: 82%.

13.1.6 Wrexham

PM_{10}: Data capture was 28%. Data losses:

- 18th Jan – 24th Feb: Partisol sampling internally due to missing connector.
- 11th Feb, 17th – 24th Mar: filter exchange failures
- 25th Mar: left in STOP mode by ESU.

.

$PM_{2.5}$: new last quarter of 2009. Data capture 87%. Data losses:

- 11th – 17th Jan: filter exchange failure
- 29th Jan – record lost
- 16th Mar – filter not re-weighed
- 19th – 20th Mar: samples but no record.

.

Appendix 5

Site Details for New Sites

Site Name	Pollutants	Region Name	Grid	Latitude	Longitude	Altitude m	Type
Eastbourne	PM_{10} PM_{25}	SE England	TQ 60085 02118	560085	102118	-	URBAN BACKGROUND
Storrington Roadside	PM_{10} PM_{25}	SE England	TQ 08991 14249	508991	114249	-	ROADSIDE

Appendix 6

Certificate of Calibration

QA/QC Data Ratification Report January-March 2010
AEA/ENV/R/3049 Issue 1

CERTIFICATE OF CALIBRATION

551.11, Harwell, Didcot, Oxfordshire OX11 0QJ. Telephone 0870 1906465

UKAS CALIBRATION

0401

Certificate Number: 02312
AEA Identification Number: ED42523030

Approved Signatories: K. Stevenson
S. Eaton

Signed:

Date of issue: 11 August 2010

Customer Name and Address: Dr Emily Nicholl

AEQ Division
Department for Environment, Food and Rural Affairs
Ashdown House (Zone E14)
123 Victoria Street
London SW1E 6DE

Description: Calibration factors for monitoring stations in the Automatic Urban Monitoring Network

1. Northern Ireland Sites (including Mace Head)

Carbon Monoxide

Date Year = 2010	Site	Analyser number	[1]Zero output	Uncertainty (ppm)	[2]Calibration Factor	Uncertainty (%)	*Maximum Residual (%)
11-Feb	Belfast Centre	462	-1	0.3	1.058	3	1.1

Sulphur Dioxide

Date Year =2010	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)	*m-xylene interference (ppb)
11-Feb	Belfast Centre	1766	-1	4	1.194	5	0.8	12.8
15-Feb	Derry	1697	1	4	1.195	5	1.1	5.0

Ozone

Date Year =2010	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)
11-Feb	Belfast Centre	08060038	0	5	1.013	3.1	0.4
15-Feb	Derry	1586	-1	5	1.010	3.1	1.2
03-Feb	Lough Navar	1640	1	5	0.987	3.1	1.3
04-Feb	Mace Head	77086-385	0	5	0.998	3.1	0.4

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95% The uncertainty evaluation has been carried out in accordance with UKAS requirements.

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to recognised national standards, and to units of measurement realised at the National Physical Laboratory or other recognised national standards laboratories.This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

Oxides of Nitrogen

Date Year =2010	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
16-Feb	Armagh Roadside	NO		0	5	1.061	5	2.1	
		NOx		2	5	1.061	5	2.3	97.5
11-Feb	Belfast Centre	NO	08050074	0	5	1.004	5	1.6	
		NOx		0	5	1.000	5	1.6	99.6
15-Feb	Derry	NO	2130	3	5	1.141	5	0.6	
		NOx		5	5	1.141	5	0.5	98.6

Particulate Analysers

Date Year =2010	Site		Analyser number	Calculated Spring Constant k_0	Uncertainty (%)	[4]k_0 accuracy (%)	[3]Measured Main Flow (l/min)	Uncertainty (%)	[3]Measured Total Flow /**Aux Flow** (l/min)	Uncertainty (%)
16-Feb	Armagh Roadside	PM10	23945	13467	1	-0.8	3.04	2.2	16.80	2.2
11-Feb	Belfast Centre	PM10	24423	14215	1	0.2	3.12	2.2	16.70	2.2
11-Feb	Belfast Centre	PM25	26565	15512	1	-1.4	3.02	2.2	15.88	2.2
15-Feb	Derry	PM10	2701	10855	1	-0.3	1.83	2.2	13.78	2.2
15-Feb	Derry	PM25	21313	16001	1	1.2	2.94	2.2	16.17	2.2
03-Feb	Lough Navar	PM10	221196	12865	1	0.4	3.03	2.2	17.03	2.2

2. Scottish Sites

Carbon Monoxide

Date Year = 2010	Site	Analyser number	[1]Zero output	Uncertainty (ppm)	[2]Calibration Factor	Uncertainty (%)	*Maximum Residual (%)
12-Jan	Edinburgh St Leonards	240	0	0.3	1.024	3	1.1
06-Jan	Glasgow Centre	241	1	0.3	0.974	3	3.5

Sulphur Dioxide

Date Year =2010	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)	*m-xylene interference (ppb)
12-Jan	Edinburgh St Leonards	71	11	4	0.943	5	2.7	13.2
06-Jan	Glasgow Centre	1630	-2	4	1.241	10.3	4.1	10.0
08-Jan	Grangemouth	703b-274	0	4	0.919	5.1	3.9	6.4

Ozone

Date Year =2010	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)
19-Jan	Aberdeen	800	-1	5	1.114	3.6	2.8
03-Feb	Auchencorth Moss	17501	-1	5	1.004	3.6	0.6
12-Jan	Bush Estate	1645	0	5	1.009	3.2	0.9
12-Jan	Edinburgh St Leonards	136	3	5	1.481	3.2	1.4
11-Feb	Eskdalemuir	14343	7	5	1.039	3.7	1.9
13-Jan	Fort William	1023	-1	5	1.003	3.2	1.7
06-Jan	Glasgow Centre	08060029	-1	5	1.029	3.3	1.4
03-Feb	Lerwick	1643	0	5	0.999	3.1	0.5
25-Feb	Peebles	437	-3	5	1.036	3.6	0.4
20-Jan	Strath Vaich	721	0	5	0.948	3.5	0.3

Oxides of Nitrogen

Date Year =2010	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
19-Jan	Aberdeen	NO	519	1	5	1.224	5	0.7	
		NOx		1	5	1.180	5	1.2	84.5
19-Jan	Aberdeen Union Street Roadside	NO	984	0	5	1.380	5	0.4	
		NOx		2	5	1.361	5	0.7	97.4
12-Jan	Bush Estate	NO	2244	-1	5	1.040	5	2.9	
		NOx		-2	5	1.034	5	1.9	103.6
09-Feb	Dumfries	NO	12189	1	5	0.993	5	1.2	
		NOx		-2	5	1.097	5	0.7	97.0
12-Jan	Edinburgh St	NO	73	3	5	0.673	5	1.3	

Date Year =2010	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
	Leonards	NOx		3	5	0.669	5	1.3	97.0
11-Feb	Eskdalemuir	NO	14899	0	5	1.216	5	0.9	
		NOx		0	5	0.822	5	0.4	100.7
13-Jan	Fort William	NO	344	1	5	2.254	5	1.9	
		NOx		-1	5	2.426	5	3.8	95.6
06-Jan	Glasgow Centre	NO	1713	4	5	1.123	5	1.4	
		NOx		4	5	1.103	5	1.2	97.7
07-Jan	Glasgow City Chambers	NO	m1800-m730	0	5	1.005	5	2.7	
		NOx		1	5	1.004	5	2.4	98.3
07-Jan	Glasgow Kerbside	NO	080450061	1	5	0.898	5	2.4	
		NOx		-9	5	0.867	5	1.9	100.7
08-Jan	Grangemouth	NO	700b-312	1	5	0.861	5	1.0	
		NOx		4	5	0.869	5	0.4	97.9
08-Jan	Grangemouth Moray	NO	912011	0	5	0.976	5	1.9	
		NOx		1	5	0.960	5	1.9	96.6
20-Jan	Inverness	NO	1489	-36	5	1.122	5	0.5	
		NOx		-94	5	0.978	5	1.3	99.2
25-Feb	Peebles	NO	2213	1	5	1.067	5	1.6	
		NOx		1	5	1.071	5	1.0	96.1

Particulate Analysers

Date Year =2010	Site		Analyser number	Calculated Spring Constant k_0	Uncertainty (%)	[4]k_0 accuracy (%)	[3]Measured Main Flow (l/min)	Uncertainty (%)	[3]Measured Total Flow /**Aux Flow** (l/min)	Uncertainty (%)
19-Jan	Aberdeen	PM10	24427	11553	1	-0.1	2.92	2.2	16.21	2.2
19-Jan	Aberdeen	PM25	27368	12059	1	-1.3	2.92	2.2	16.00	2.2
03-Feb	Auchencorth Moss	PM10	Analyser not present at time of audit							
03-Feb	Auchencorth Moss	PM25	26033	13638	1	-2.7	2.95	2.2	16.29	2.2
03-Feb	Auchencorth Moss Partisol	PM10	21550						15.07	2.2
03-Feb	Auchencorth Moss Partisol	PM25	21548						17.25	2.2
12-Jan	Edinburgh St Leonards	PM10	21308	11459	1	-1	3.02	2.2	16.24	2.2
12-Jan	Edinburgh St Leonards	PM25	27233	16832	1	-1.1	3.18	2.2	16.36	2.2
06-Jan	Glasgow Centre	PM10	27331	15508	1	-0.8	3.09	2.2	16.20	2.2
06-Jan	Glasgow Centre	PM25	22980	13132	1	-0.1	3.60	2.2	17.65	2.2
07-Jan	Glasgow Kerbside	PM10	27344	14937	1	-0.6	Not tested		unsafe access	
07-Jan	Glasgow Kerbside	PM25	27337	14983	1	-0.9	Not tested		unsafe access	
08-Jan	Grangemouth	PM10	27228	15873	1	-0.3	2.95	2.2	16.17	2.2
08-Jan	Grangemouth	PM25	27259	13602	1	-1.2	2.87	2.2	15.10	2.2
20-Jan	Inverness	PM10	21255						16.88	2.2
20-Jan	Inverness	PM25	21861						16.82	2.2

3. Welsh Sites

Carbon Monoxide

Date Year = 2010	Site	Analyser number	[1]Zero output	Uncertainty (ppm)	[2]Calibration Factor	Uncertainty (%)	*Maximum Residual (%)
02-Feb	Cardiff Centre	14325	0	0.3	1.081	3	5.0
02-Jan	Port Talbot Margam	10787	-1	0.3	0.051	3	5.0

Sulphur Dioxide

Date Year =2010	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)	*m-xylene interference (ppb)
02-Feb	Cardiff Centre	14319	14	4	0.834	5.5	4.3	9.7
03-Feb	Narberth	14896	9	4	1.214	5	1.4	21.8
02-Jan	Port Talbot Margam	11669	10	4	1.097	5	2.0	13.2

Date Year =2010	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)	*m-xylene interference (ppb)
23-Feb	Wrexham	12183	8	4	1.032	5	3.1	3.7

Ozone

Date Year =2010	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)
21-Jan	Aston Hill	144	-1	5	0.976	3.1	0.8
02-Feb	Cardiff Centre	14348	-3	5	0.986	3.6	1.1
27-Jan	Cwmbran	205004	1	5	1.013	3.4	0.7
18-Jan	Mold	17499	1	5	1.030	3.1	0.9
03-Feb	Narberth	10280	3	5	1.054	3.7	3.5
02-Jan	Port Talbot Margam	94754	6	5	0.522	3.6	1.7

Oxides of Nitrogen

Date Year =2010	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
21-Jan	Aston Hill	NO NOx	m2068- m853	3 2	5 5	1.329 1.293	5 5	0.4 0.4	100.4
02-Feb	Cardiff Centre	NO NOx	14326	1 4	5 5	1.181 1.148	5 5	1.6 2.6	99.9
25-Jan	Chepstow A48	NO NOx	1	99 104	5 5	1.034 1.046	5 5	1.2 1.3	98.6
27-Jan	Cwmbran	NO NOx	l00n2xg8	0 1	5 5	0.938 0.892	5 5	4.4 3.0	99.3
18-Jan	Mold	NO NOx	14862	-3 -2	5 5	1.079 1.063	5 5	1.3 1.4	100.5
03-Feb	Narberth	NO NOx	14311	0 1	5 5	1.148 1.125	5 5	1.2 2.1	98.6
26-Jan	Newport	NO NOx	671	3 20	5 5	0.833 0.867	5 5	1.5 1.8	99.3
02-Jan	Port Talbot Margam	NO NOx	12813	1 3	5 5	0.920 0.909	5 5	1.9 1.4	95.6
03-Feb	Swansea Roadside	NO NOx	16695	2 0	5 5	1.178 1.079	5 5	2.1 4.5	95.6
23-Feb	Wrexham	NO NOx	12185	2 4	5 5	1.071 1.054	5 5	2.4 2.2	98.8

Particulate Analysers

Date Year =2010	Site		Analyser number	Calculated Spring Constant k_0	Uncertainty (%)	[4]k_0 accuracy (%)	[3]Measured Main Flow (l/min)	Uncertainty (%)	[3]Measured Total Flow /**Aux Flow** (l/min)	Uncertainty (%)
02-Feb	Cardiff Centre	PM10	24449	10967	1	-0.3	3.02	2.2	15.42	2.2
02-Feb	Cardiff Centre	PM25	26499	13654	1	-1.6	2.86	2.2	14.40	2.2
25-Jan	Chepstow A48	PM10	2128	10682	1	0.4	2.74	2.2	16.69	2.2
03-Feb	Narberth	PM10	21143	12565	1	0.6	**3.12**	**2.2**	**14.21**	**2.2**
26-Jan	Newport	PM10	22589	11730	1	-2.1	**3.01**	**2.2**	**13.14**	**2.2**
26-Jan	Newport	PM25	27225	15922	1	-0.7	2.93	2.2	15.12	2.2
02-Jan	Port Talbot Margam	PM10	22588	14440	1	-0.3	2.97	2.2	15.77	2.2
02-Jan	Port Talbot Margam	PM25	25081	10453	1	-1.0	2.95	2.2	15.43	2.2
02-Jan	Port Talbot Margam Partisol	PM25	89903						16.42	2.2
03-Feb	Swansea Roadside	PM10	26293	15349	1	-1.6	**2.81**	**2.2**	**12.69**	**2.2**
03-Feb	Swansea Roadside	PM25	26292	14197	1	-1.6	**2.95**	**2.2**	**12.95**	**2.2**
23-Feb	Wrexham	PM10	21224						15.93	2.2
23-Feb	Wrexham	PM25	21011						15.54	2.2

4. London Sites

Carbon Monoxide

Date Year = 2010	Site	Analyser number	[1]Zero output	Uncertainty (ppm)	[2]Calibration Factor	Uncertainty (%)	*Maximum Residual (%)
09-Feb	London Bexley	14871	0	0.3	0.988	3	0.9

Date Year = 2010	Site	Analyser number	[1]Zero output	Uncertainty (ppm)	[2]Calibration Factor	Uncertainty (%)	*Maximum Residual (%)
04-Feb	London Bloomsbury	14330	0	0.3	1.003	3	2.2
09-Feb	London Cromwell Rd 2	10776	0	0.3	0.889	3	0.8
11-Feb	London Marylebone Rd	651	1	0.3	0.976	3	0.5
12-Jan	London N. Kensington	360	2	0.3	1.236	3	0.7
08-Feb	London Westminster	867	0	0.3	1.001	3.1	2.9
25-Feb	Tower Hamlets Road	1434	1	0.3	0.923	3	0.6

Sulphur Dioxide

Date Year =2010	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)	*m-xylene interference (ppb)
09-Feb	London Bexley	14869	-2	4	0.938	7.9	3.1	17.5
04-Feb	London Bloomsbury	14323	7	4	1.146	5	2.5	12.2
09-Feb	London Cromwell Rd 2	10779	2	4	1.047	5	0.8	13.2
11-Feb	London Marylebone Rd	411	1	4	0.991	9.4	4.4	11.3
12-Jan	London N. Kensington	1020	51	4	1.484	7.1	2.7	12.4
08-Feb	London Westminster	705	10	4	0.598	6.1	1.9	12.6

Ozone

Date Year =2010	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)
04-Feb	London Bloomsbury	14907	-1	5	1.045	3.6	1.2
04-Feb	London Eltham	375	8	5	0.999	3.3	5.5
02-Feb	London Haringey	538	20	5	0.994	3.1	0.2
14-Jan	London Harlington	107	-2	5	0.991	3.1	0.3
27-Jan	London Hillingdon	8060034	0	5	1.046	3.6	1.1
11-Feb	London Marylebone Rd	769	8	5	0.881	3.9	2.2
12-Jan	London N. Kensington	497	10	5	0.992	3.1	0.9
01-Mar	London Teddington	588	-1	5	0.990	3.1	0.4
08-Feb	London Westminster	879	-4	5	0.955	3.1	1.5

Oxides of Nitrogen

Date Year =2010	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
10-Feb	Camden Kerbside	NO NOx	623	2 2	5 5	1.187 1.157	5 5	0.8 0.8	 95.8
02-Feb	Haringey Roadside	NO NOx	397	2 2	5 5	2.112 1.945	5 5	2.2 2.3	 98.4
09-Feb	London Bexley	NO NOx	14870	1 1	5 5	1.041 1.046	5 5	0.7 1.2	 98.6
04-Feb	London Bloomsbury	NO NOx	14328	0 0	5 5	1.365 1.285	5 5	1.3 2.7	 98.8
09-Feb	London Cromwell Rd 2	NO NOx	10775	0 0	5 5	1.252 1.224	5 5	0.4 0.2	 99.7
04-Feb	London Eltham	NO NOx	307	2 3	5 5	1.229 1.024	5 5	3.8 5.0	 99.1
02-Feb	London Haringey	NO NOx	1084	1 1	5 5	1.349 1.287	5 5	0.6 0.8	 96.7
14-Jan	London Harlington	NO NOx	1090	0 0	5 5	1.048 1.038	5 5	1.1 1.2	 100.9
27-Jan	London Hillingdon	NO NOx	8050017	7 8	5 5	0.853 0.847	5 5	3.7 3.6	 101.5
11-Feb	London Marylebone Rd	NO NOx	439	2 0	5 5	1.912 1.873	5 5	1.0 0.9	 96.0
12-Jan	London N. Kensington	NO NOx	459	2 3	5 5	0.938 1.086	5 5	2.0 1.5	 95.5
01-Mar	London Teddington	NO NOx	287	0 0	5 5	0.978 0.954	5 5	2.7 2.8	 98.5
08-Feb	London Westminster	NO NOx	573	1 2	5 5	1.526 1.509	5 5	2.5 2.3	 102.1
25-Feb	Tower Hamlets Roadside	NO NOx	306	2 5	5 5	1.342 1.239	5 5	2.4 0.8	 99.5

Particulate Analysers

Date Year =2010	Site		Analyser number	Calculated Spring Constant k_0	Uncertainty (%)	[4]k_0 accuracy (%)	[3]Measured Main Flow (l/min)	Uncertainty (%)	[3]Measured Total Flow /**Aux Flow** (l/min)	Uncertainty (%)
10-Feb	Camden Kerbside	PM10	21159	11906	1	-0.7	3.14	2.2	16.11	2.2
10-Feb	Camden Kerbside	PM25	21391	15907	1	-0.5	1.98	2.2	12.25	2.2
02-Feb	Haringey Roadside	PM10	27338	15260	1	0.0	2.95	2.2	15.17	2.2
02-Feb	Haringey Roadside	PM25	27278	14653	1	-0.7	2.96	2.2	15.13	2.2
09-Feb	London Bexley	PM25	25077	11544	1	-0.4	2.94	2.2	16.26	2.2
04-Feb	London Bloomsbury	PM10	24446	13786	1	0.3	3.04	2.2	15.88	2.2
04-Feb	London Bloomsbury	PM25	27240	14734	1	-0.2	3.00	2.2	15.64	2.2
04-Feb	London Eltham	PM25	27048	14036	1	1.6	2.96	2.2	16.18	2.2
14-Jan	London Harlington	PM10	22835	14090	1	-0.8	2.98	2.2	15.60	2.2
14-Jan	London Harlington	PM25	23959	12725	1	-0.6	2.93	2.2	15.24	2.2
01-Feb	London Harrow Stanmore	PM25	27274	16076	1	-1.0	3.05	2.2	16.29	2.2
11-Feb	London Marylebone Rd	PM10	27230	16830	1	-0.7	2.90	2.2	16.60	2.2
11-Feb	London Marylebone Rd	PM25	27239	14149	1	-1.1	3.01	2.2	16.02	2.2
11-Feb	London Marylebone Road Partisol	PM10							16.79	2.2
11-Feb	London Marylebone Road Partisol	PM25					No flow-failed test			
12-Jan	London N. Kensington	PM10	27391	12557	1	-0.9	2.97	2.2	15.80	2.2
12-Jan	London N. Kensington	PM25	21342	15635	1	-1.0	2.98	2.2	16.58	2.2
12-Jan	London N. Kensington Partisol	PM10							16.31	2.2
12-Jan	London N. Kensington Partisol	PM25							16.53	2.2
01-Mar	London Teddington	PM25		Analyser fault on arrival-no tests possible						
08-Feb	London Westminster	PM25	20939						16.63	2.2

5. English Sites

Carbon Monoxide

Date Year = 2010	Site	Analyser number	[1]Zero output	Uncertainty (ppm)	[2]Calibration Factor	Uncertainty (%)	*Maximum Residual (%)
23-Feb	Bristol Old Market	10429	-2	0.3	0.944	3	0.8
23-Feb	Bristol St Paul's	14417	-1	0.3	1.000	3	1.3
19-Jan	Bury Roadside		0	0.3	1.023	3	0.7
12-Jan	Hull Freetown	1499	-1	0.3	0.948	3	3.3
13-Jan	Leeds Centre	1501	1	0.3	1.013	3	2.0
11-Feb	Leicester Centre	14868	0	0.3	1.051	3	1.9
16-Feb	Liverpool Speke	14329	0	0.3	0.922	3	0.7
26-Jan	Market Harborough	1500	1	0.3	0.978	10.8	0.0
19-Jan	Middlesbrough	14202	0	0.3	0.995	3	3.5
18-Jan	Newcastle Centre	14866	-1	0.3	1.015	3	5.6
26-Jan	Salford Eccles	2386	0	0.3	0.952	3	1.9
02-Mar	Sheffield Centre	459	0	0.3	0.995	3	2.6
10-Feb	Southampton Centre	460	0	0.3	0.995	3	1.7
18-Feb	St Osyth	721	0	0.3	1.126	8.6	0.2

Sulphur Dioxide

Date Year =2010	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)	*m-xylene interference (ppb)
19-Jan	Barnsley 12	10781	-2	4	1.022	6.6	3.1	13.2
19-Jan	Barnsley Gawber	60	2	4	0.933	5	1.3	3.1
04-Feb	Birmingham Tyburn		-1	4	0.950	5	0.7	0.5
23-Feb	Bristol St Paul's	14322	30	4	0.975	5	0.9	9.8
28-Jan	Harwell	83	7	4	0.988	5	0.5	15.7
12-Jan	Hull Freetown	342	-1	4	1.062	5	0.5	5.5
02-Mar	Ladybower	12180	-1	4	0.850	5	1.4	11.1
29-Jan	Leamington Spa	53	3	4	0.879	5	0.4	26.1
13-Jan	Leeds Centre	08050084	2	4	1.158	5	2.3	9.8
11-Feb	Leicester Centre	14321	-4	4	1.086	5	2.9	16.1
21-Jan	Leominster		-1	4	0.992	5	0.6	11.4
16-Feb	Liverpool Speke	17509	1	4	0.997	5	0.2	13.5
19-Jan	Lullington Heath	1179	1	4	0.775	5	0.4	15.1
26-Jan	Manchester Piccadilly	g-ra447-011	-12	4	0.698	24.1	14.5	9.3
19-Jan	Middlesbrough	14166	13	4	0.784	6.6	5.0	0.6
18-Jan	Newcastle Centre	14897	-6	4	1.530	14.3	5.8	14.2
10-Feb	Northampton	890563033	3	4	0.819	5.6	5.9	1.0
13-Jan	Norwich Lakenfields	cm0805000 81	1	4	1.017	5	0.9	5.4
11-Mar	Nottingham Centre	19066	-7	4	1.141	5	1.8	2.1
26-Jan	Salford Eccles	2366	0	4	0.994	10.3	10.8	1.0
03-Feb	Sandwell West Bromwich		2	4	1.038	5.7	2.7	0.0
14-Jan	Scunthorpe Town	468	14	4	1.060	5	1.7	
02-Mar	Sheffield Centre	1130	12	4	0.964	10.2	3.3	2.9
10-Feb	Southampton Centre	343	1	4	1.015	6.0	2.3	21.9
18-Feb	Stanford-le-Hope Roadside	1828	-10	4	0.887	5	2.4	11.6
20-Jan	Sunderland Silksworth	996b382	1	4	1.111	5	1.0	9.1
16-Feb	Thurrock	10554	15	4	0.797	5	1.7	4.4
11-Jan	Wicken Fen	82	14	4	0.765	5	1.6	20.4

Ozone

Date Year =2010	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)
19-Jan	Barnsley Gawber	47	0	5	1.071	3.2	2.0
04-Feb	Birmingham Tyburn		-1	5	0.989	3.1	0.9
04-Feb	Birmingham Tyburn Road	1054	-2	5	1.094	3.1	0.4
18-Feb	Blackpool Marton	08060037	-2	5	1.003	3.6	0.4
19-Jan	Bottesford	357	-1	5	0.991	3.7	1.5
08-Feb	Bournemouth	17503	-1	5	1.011	3.6	0.8
22-Feb	Brighton Preston Park	542	-7	5	0.514	3.2	0.4
23-Feb	Bristol St Paul's	14358	-2	5	0.981	3.2	3.8
18-Feb	Charlton Mackrell	95249	-1	5	0.959	3.1	0.6
21-Jan	Coventry Memorial Park	08060019	0	5	1.397	3.6	0.8
16-Feb	Exeter Roadside	f0100e0s	-1	5	0.945	3.2	1.6
27-Jan	Glazebury	138	-1	5	0.971	3.2	0.8
	Great Dun Fell	Site	snowed	in	visit	not	possible
28-Jan	Harwell	1643	-1	5	1.011	3.2	2.1
10-Feb	High Muffles	17502	1	5	1.071	3.6	0.9
12-Jan	Hull Freetown	08060045	-1	5	0.997	3.2	0.6
02-Mar	Ladybower	17498	-1	5	1.018	3.1	0.6
29-Jan	Leamington Spa	1459	-1	5	1.006	3.1	0.4
13-Jan	Leeds Centre	08060036	-1	5	0.973	3.1	0.9
11-Feb	Leicester Centre	70096	-1	5	1.041	3.1	1.5
21-Jan	Leominster	170	1	5	0.971	3.1	0.8
16-Feb	Liverpool Speke	08060041	0	5	1.044	3.6	0.6
19-Jan	Lullington Heath	1644	-1	5	1.006	3.3	0.6
26-Jan	Manchester Piccadilly			Analyser	fault	leak test	fail
27-Jan	Manchester South	1317	-2	5	1.030	3.1	0.8
26-Jan	Market Harborough	08060031	0	5	1.020	3.1	1.0
19-Jan	Middlesbrough	14203	-1	5	1.009	3.3	0.7

Date Year =2010	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)
18-Jan	Newcastle Centre	08060033	0	5	1.027	3.2	0.1
10-Feb	Northampton	47r76str	0	5	0.915	3.2	1.2
13-Jan	Norwich Lakenfields	08060028	0	5	1.052	3.1	0.6
11-Mar	Nottingham Centre	60032	0	5	1.009	3.1	1.6
17-Feb	Plymouth Centre	08060027	0	5	1.030	3.1	1.2
28-Jan	Portsmouth	205002	2	5	1.022	3.1	0.2
17-Feb	Preston	08060042	0	5	0.951	3.6	1.1
24-Feb	Reading New Town	08060025	0	5	1.033	3.6	1.0
26-Jan	Salford Eccles	2363	-4	5	1.021	3.2	2.4
03-Feb	Sandwell West Bromwich		0	5	0.979	3.3	4.6
02-Mar	Sheffield Centre	24	1	5	1.007	3.1	1.1
12-Jan	Sibton	146	0	5	0.981	3.1	0.7
10-Feb	Southampton Centre	08060021	0	5	1.050	3.6	1.3
17-Feb	Southend-on-Sea	08060017	-9	5	0.975	3.1	1.1
18-Feb	St Osyth	08060035	0	5	1.033	3.4	0.3
20-Jan	Stoke-on-Trent Centre	26	0	5	0.902	3.6	1.9
20-Jan	Sunderland Silksworth	436	1	5	1.020	3.5	3.8
16-Feb	Thurrock	10788	1	5	0.869	4.3	1.7
12-Jan	Weybourne	366	0	5	0.988	3.1	0.6
11-Jan	Wicken Fen	165	-2	5	1.127	3.4	1.3
25-Jan	Wigan Centre		1	5	1.102	3.2	0.7
16-Feb	Wirral Tranmere	08050040	-1	5	0.992	3.6	0.6
20-Jan	Yarner Wood	176	-2	5	1.094	3.2	1.4

Oxides of Nitrogen

Date Year =2010	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
19-Jan	Barnsley	NO	74	0	5	0.931	5	0.8	
	Gawber	NOx		1	5	0.911	5	0.7	100.0
22-Feb	Bath Roadside	NO	12758	7	5	1.114	5	2.7	
		NOx		11	5	1.111	5	2.5	94.2
19-Jan	Billingham	NO	574	-1	5	1.430	5	2.2	
		NOx		3	5	1.396	5	1.3	99.5
04-Feb	Birmingham	NO		1	5	1.134	5	0.5	
	Tyburn	NOx		4	5	1.110	5	0.5	99.4
04-Feb	Birmingham	NO	68	1	5	0.642	5	2.6	
	Tyburn Roadside	NOx		4	5	0.629	5	2.2	97.8
28-Jan	Blackburn Darwen	NO	688B-303	4	5	0.985	5	1.4	
	Roadside	NOx		0	5	1.054	5	1.9	85.9
18-Feb	Blackpool	NO	08050075	0	5	0.944	5	2.6	
	Marton	NOx		-2	5	0.894	5	0.6	100.0
08-Feb	Bournemouth	NO	17507	1	5	1.143	5	2.5	
		NOx		2	5	1.091	5	2.3	98.8
22-Feb	Brighton	NO	2222	3	5	1.133	5	2.8	
	Preston Park	NOx		4	5	1.109	5	2.4	101.3
22-Feb	Brighton	NO	1225	0	5	0.990	5	2.7	
	Roadside	NOx		-2	5	1.162	5	1.6	99.4
23-Feb	Bristol Old	NO	10510	-4	5	1.230	5	0.6	
	Market	NOx		-8	5	1.244	5	0.3	87.5
23-Feb	Bristol St Paul's	NO	14353	0	5	1.372	5	1.4	
		NOx		1	5	1.336	5	2.3	97.3
19-Jan	Bury Roadside	NO	1357	0	5	1.359	5	3.0	
		NOx		-1	5	1.372	5	3.2	97.6
11-Jan	Cambridge	NO	303	-1	5	0.766	5	1.1	
	Roadside	NOx		-3	5	0.756	5	0.7	96.7
23-Feb	Canterbury	NO		-3	5	1.234	5	2.2	
		NOx		-5	5	1.153	5	3.0	100.5
09-Feb	Carlisle	NO		-1	5	1.084	5	2.3	
	Roadside	NOx		7	5	1.186	5	2.8	98.5
18-Feb	Charlton	NO	12895	1	5	1.231	5	0.5	
	Mackrell	NOx		0	5	1.222	5	1.1	98.4
20-Jan	Chesterfield	NO	528	-1	5	0.518	5	0.9	
		NOx		5	5	0.518	5	1.0	99.1
20-Jan	Chesterfield	NO	9841	101	5	1.063	5	3.6	
	Roadside	NOx		103	5	1.068	5	3.0	97.4
21-Jan	Coventry	NO	08030109	2	5	0.822	5	1.9	
	Memorial Park	NOx		2	5	0.805	5	2.6	99.1
16-Feb	Exeter Roadside	NO	g0000d1s	0	5	1.113	5	1.4	

Date Year =2010	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
		NOx		-2	5	1.004	5	1.4	99.1
27-Jan	Glazebury	NO	78	2	5	1.527	5	3.5	
		NOx		1	5	1.482	5	4.1	101.2
28-Jan	Harwell	NO	79	1	5	1.174	5	0.1	
		NOx		2	5	1.140	5	0.8	99.5
10-Feb	High Muffles	NO	12553	1	5	1.175	5	0.5	
		NOx		1	5	1.206	5	2.2	95.9
01-Feb	Horley	NO	m525	-1	5	0.891	5	1.4	
		NOx		1	5	0.892	5	1.0	100.7
12-Jan	Hull Freetown	NO	08060056	1	5	0.905	5	1.4	
		NOx		-1	5	0.970	5	1.3	100.4
02-Mar	Ladybower	NO	14326	0	5	1.170	5	1.6	
		NOx		0	5	1.155	5	2.1	100.5
29-Jan	Leamington Spa	NO	1705	1	5	1.446	5	1.4	
		NOx		2	5	1.451	5	1.9	98.8
13-Jan	Leeds Centre	NO	08050066	0	0	0.986	0	2.1	
		NOx		-1	0	1.011	0	2.0	100.0
13-Jan	Leeds Headingley Kerbside	NO	696b-308	50	5	1.100	5	2.0	
		NOx		53	5	1.114	5	2.4	99.5
11-Feb	Leicester Centre	NO	70093	1	5	0.846	5	0.7	
		NOx		1	5	0.832	5	0.5	100.3
21-Jan	Leominster	NO	346	0	5	1.008	5	0.8	
		NOx		2	5	0.988	5	0.9	97.5
17-Feb	Liverpool Queen's Drive Roadside	NO	16957	-3	5	1.000	5	3.7	
		NOx		-6	5	0.963	5	3.4	98.1
16-Feb	Liverpool Speke	NO	08050069	2	5	0.818	5	1.6	
		NOx		2	5	0.812	5	1.8	97.7
19-Jan	Lullington Heath	NO	2579	1	5	1.104	5	1.4	
		NOx		1	5	1.086	5	0.5	97.8
26-Jan	Manchester Piccadilly	NO	08650065	2	5	0.836	5	1.9	
		NOx		2	5	0.823	5	2.3	100.9
27-Jan	Manchester South	NO	2115	2	5	1.078	5	3.1	
		NOx		3	5	1.055	5	3.7	97.2
26-Jan	Market Harborough	NO	08050068	1	5	0.858	5	4.1	
		NOx		2	5	0.895	5	4.5	95.3
19-Jan	Middlesbrough	NO	13160	0	5	1.452	5	1.2	
		NOx		0	5	1.450	5	1.3	103.5
18-Jan	Newcastle Centre	NO	08050063	4	5	0.729	5	2.7	
		NOx		-5	5	0.703	5	2.4	100.3
18-Jan	Newcastle Cradlewell Road	NO	m2160-m860	0	5	1.108	5	3.2	
		NOx		5	5	1.114	5	3.3	99.1
10-Feb	Northampton	NO	8atj6apr	-1	5	0.966	5	5.8	
		NOx		1	5	0.951	5	5.4	98.9
13-Jan	Norwich Lakenfields	NO	08050057	-1	5	1.077	5	0.6	
		NOx		-1	5	1.059	5	0.4	99.6
11-Mar	Nottingham Centre	NO	50072	2	5	0.733	5	0.5	
		NOx		2	5	0.732	5	0.2	99.7
08-Jan	Oxford Centre Roadside	NO	M2350-M947	101	5	1.154	5	1.9	
		NOx		104	5	1.170	5	2.6	99.5
08-Jan	Oxford St Ebbes	NO	M0946	94	5	1.118	5	1.1	
		NOx		92	5	1.097	5	2.1	96.1
17-Feb	Plymouth Centre	NO	08050062	-1	5	0.903	5	1.7	
		NOx		0	5	0.889	5	1.6	101.7
28-Jan	Portsmouth	NO	POT7CYA5	0	5	0.993	5	1.2	
		NOx		2	5	0.974	5	1.0	98.4
17-Feb	Preston	NO	08050064	8	5	0.770	5	1.7	
		NOx		8	5	0.741	5	1.5	98.0
24-Feb	Reading New Town	NO	08050059	1	5	0.815	5	0.5	
		NOx		0	5	0.800	5	1.4	99.3
	Rochester Stoke	NO	473	Site not operational at audit					
		NOx							
26-Jan	Salford Eccles	NO	2381	0	5	0.972	5	1.5	
		NOx		3	5	0.989	5	0.7	99.2
03-Feb	Sandwell West Bromwich	NO		0	5	0.949	5	2.5	
		NOx		1	5	0.926	5	2.5	101.3
11-Feb	Sandy Roadside	NO	2585	0	5	1.172	5	0.8	
		NOx		0	5	1.152	5	0.8	98.4
14-Jan	Scunthorpe Town	NO	m1225-m526	31	5	2.348	5	0.6	
		NOx		47	5	2.451	5	0.5	99.1
02-Mar	Sheffield Centre	NO	55	2	5	0.860	5	2.9	
		NOx		2	5	0.821	5	2.7	99.7

Date Year =2010	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
03-Mar	Sheffield Tinsley	NO NOx	10772	2 0		1.220 1.184	not tested		
10-Feb	Southampton Centre	NO NOx	08030106	1 1	5 5	0.813 0.788	5 5	3.2 3.2	100.0
17-Feb	Southend-on-Sea	NO NOx	08050071	0 0	5 5	0.747 0.656	5 5	1.1 1.1	97.2
18-Feb	St Osyth	NO NOx	08050073	0 0	5 5	0.913 0.888	5 5	2.7 2.9	100.4
18-Feb	Stanford-le-Hope Roadside	NO NOx	2570	1 1	5 5	0.940 0.934	5 5	0.6 1.1	96.3
20-Jan	Stockton-on-Tees Eaglescliffe	NO NOx	10445	1 2	5 5	1.032 1.042	5 5	1.2 1.1	98.0
20-Jan	Stoke-on-Trent Centre	NO NOx	50070	1 -2	5 5	0.789 0.856	5 5	3.0 2.9	100
20-Jan	Sunderland Silksworth	NO NOx	734b-322	0 1	5 5	0.969 0.961	5 5	2.1 1.4	98.5
16-Feb	Thurrock	NO NOx	11004	0 1	5 5	1.233 1.217	5 5	1.5 1.5	98.5
	Walsall Willenhall	NO NOx	Site not in operation at audit visit						
28-Jan	Warrington	NO NOx	450B-198	1 5	5 5	0.992 1.000	5 5	3.1 2.7	98.8
11-Jan	Wicken Fen	NO NOx	2223	3 5	5 5	1.101 1.091	5 5	0.4 0.1	98.3
25-Jan	Wigan Centre	NO NOx	??	3 0	5 5	0.956 0.924	5 5	1.8 1.9	100.4
16-Feb	Wirral Tranmere	NO NOx	08050060	-5 -9	5 5	0.732 0.712	5 5	0.6 0.6	99.7
20-Jan	Yarner Wood	NO NOx	1784	0 0	5 5	0.913 0.931	5 5	0.3 0.8	98.4
13-Jan	York Fishergate	NO NOx	622b-272	0 1	0 0	1.168 1.232	0 0	0.3 0.2	96.4

Particulate Analysers

Date Year =2009	Site		Analyser number	Calculated Spring Constant k_0	Uncertainty (%)	[4]k_0 accuracy (%)	[3]Measured Main Flow (l/min)	Uncertainty (%)	[3]Measured Total Flow /**Aux Flow** (l/min)	Uncertainty (%)
04-Feb	Birmingham Tyburn	PM10	27255	14771	1	-1.1	2.88	2.2	15.90	2.2
04-Feb	Birmingham Tyburn	PM25	21372	14618	1	-0.5	2.95	2.2	16.02	2.2
04-Feb	Birmingham Tyburn Roadside	PM10	2000	12071	1	-2.5	2.83	2.2	15.34	2.2
04-Feb	Birmingham Tyburn Roadside	PM25	2000	13891	1	-1.3	2.99	2.2	15.68	2.2
18-Feb	Blackpool Marton	PM25	24424	12883	1	-0.1	Not tested		unsafe access	
08-Feb	Bournemouth	PM25	1						17.48	2.2
22-Feb	Brighton Preston Park	PM25							16.61	2.2
23-Feb	Bristol St Paul's	PM10	24426	13296	1	0.9	Not tested		unsafe access	
23-Feb	Bristol St Paul's	PM25	26495	13668	1	-1.8	Not tested		unsafe access	
19-Jan	Bury Roadside	PM10	27335	16033	1	-1.0	2.98	2.2	16.75	2.2
19-Jan	Bury Roadside	PM25	27334	14909	1	-1.0	2.88	2.2	16.84	2.2
09-Feb	Carlisle Roadside	PM10	27257	14325	1	-1.1	2.94	2.2	15.34	2.2
09-Feb	Carlisle Roadside	PM25	27320	13789	1	-1.0	2.96	2.2	16.33	2.2
20-Jan	Chesterfield	PM10	27316	16295	1	-0.2	2.83	2.2	16.09	2.2
20-Jan	Chesterfield	PM25	27314	12471	1	0.3	**2.93**	**2.2**	**12.85**	**2.2**
20-Jan	Chesterfield Roadside	PM10	22299	11168	1	-1.6	2.99	2.2	15.99	2.2
20-Jan	Chesterfield Roadside	PM25	27339	15167	1	-1.6	**2.99**	**2.2**	**12.92**	**2.2**
21-Jan	Coventry Memorial Park	PM25					Not tested		unsafe access	
24-Feb	Eastbourne	PM10	27238	15036	1	-1.2	2.96	2.2	16.17	2.2
24-Feb	Eastbourne	PM25	27244	14834	1	0.0	2.90	2.2	16.09	2.2
28-Jan	Harwell	PM10	27333	14775	1	-1.1	3.47	2.2	16.13	2.2

Date Year =2009	Site		Analyser number	Calculated Spring Constant k_0	Uncertainty (%)	[4]k_0 accuracy (%)	[3]Measured Main Flow (l/min)	Uncertainty (%)	[3]Measured Total Flow /**Aux Flow** (l/min)	Uncertainty (%)
28-Jan	Harwell	PM25	21366	12403	1	0.1	3.05	2.2	15.65	2.2
28-Jan	Harwell Partisol	PM10	201439 802						16.71	2.2
28-Jan	Harwell Partisol	PM25	210209 902						17.13	2.2
12-Jan	Hull Freetown	PM10	24445	14188	1	0.6	Not tested		icy ground	
12-Jan	Hull Freetown	PM25	26498	13934	1	-1.8	Not tested		icy ground	
29-Jan	Leamington Spa	PM10	27295	14872	1	-0.8	3.01	2.2	15.40	2.2
29-Jan	Leamington Spa	PM25	27248	14125	1	-0.4	3.06	2.2	15.68	2.2
13-Jan	Leeds Centre	PM10	24451	13411	1	0.1	Not tested		icy ground	
13-Jan	Leeds Centre	PM25	27254	16978	1	-0.4	Not tested		icy ground	
13-Jan	Leeds Headingley Kerbside	PM10	27287	15024	1	-1.0	Not tested		unsafe access	
13-Jan	Leeds Headingley Kerbside	PM25	27249	14593	1	-0.7	Not tested		unsafe access	
11-Feb	Leicester Centre	PM10	24442	14170	1	-2.0	2.90	2.2	15.79	2.2
11-Feb	Leicester Centre	PM25	26500	14704	1	-1.7	2.92	2.2	15.66	2.2
16-Feb	Liverpool Speke	PM10	24450	15734	1	-0.5	2.32	2.2	15.54	2.2
16-Feb	Liverpool Speke	PM25	26564	14690	1	-1.5	2.76	2.2	16.24	2.2
26-Jan	Manchester Piccadilly	PM25	26038	13877	1	-1.1	2.93	2.2	15.24	2.2
19-Jan	Middlesbrough	PM10	24325	13742	1	-2.8	Inlet locked		not accessible	
19-Jan	Middlesbrough	PM25	27195	15726	1	-1.8	2.96	2.2	15.13	2.2
18-Jan	Newcastle Centre	PM10	24448	13811	1	-0.1	2.74	2.2	14.63	2.2
18-Jan	Newcastle Centre	PM25	24447	14841	1	0.0	3.06	2.2	15.94	2.2
10-Feb	Northampton	PM25					Not tested		unsafe access	
13-Jan	Norwich Lakenfields	PM10	21495	14020	1	-0.6	2.99	2.2	14.65	2.2
13-Jan	Norwich Lakenfields	PM25	27328	15513	1	-0.6	3.04	2.2	15.27	2.2
11-Mar	Nottingham Centre	PM25	25025	12083	1	-0.8	3.01	2.2	16.49	2.2
08-Jan	Oxford St Ebbes	PM10	21350	14717	1	-0.7	2.99	2.2	16.35	2.2
08-Jan	Oxford St Ebbes	PM25	27235	17063	1	-0.6	**2.93**	**2.2**	**13.32**	**2.2**
17-Feb	Plymouth Centre	PM10	24428	12930	1	-0.1	3.03	2.2	15.91	2.2
17-Feb	Plymouth Centre	PM25	27221	12208	1	-0.6	3.10	2.2	15.76	2.2
28-Jan	Portsmouth	PM10	2000	13262	1	-0.4	2.83	2.2	16.79	2.2
28-Jan	Portsmouth	PM25	21358	18285	1	-1.4	2.66	2.2	15.21	2.2
17-Feb	Preston	PM25	22881	12758	1	-1.5	Not tested		unsafe access	
24-Feb	Reading New Town	PM10	21315	13197	1	0.0	2.96	2.2	16.84	2.2
24-Feb	Reading New Town	PM25	25090	13950	1	-1.3	2.93	2.2	15.62	2.2
	Rochester Stoke	PM10		Not tested		Site closed for repair				
	Rochester Stoke	PM25		Not tested		Site closed for repair				
26-Jan	Salford Eccles	PM10	21168	14505	1	0.6	2.94	2.2	15.56	2.2
26-Jan	Salford Eccles	PM25	27205	14498	1	-1.0	2.95	2.2	15.31	2.2
17-Feb	Saltash Roadside	PM10	24328	14076	1	-0.5	3.09	2.2	15.90	2.2
17-Feb	Saltash Roadside	PM25		Analyser	not	yet	on	site		
11-Feb	Sandy Roadside	PM10	22018	13808	1	-1.0	2.87	2.2	15.70	2.2
11-Feb	Sandy Roadside	PM25	27260	13709	1	-0.7	2.94	2.2	15.38	2.2
14-Jan	Scunthorpe Town	PM10	27366	14982	1	-0.1	Not	tested	unsafe	access
02-Mar	Sheffield Centre	PM10	25024	12192	1	-0.5	2.97	2.2	16.18	2.2
02-Mar	Sheffield Centre	PM25	27253	15631	1	0.0	3.00	2.2	15.80	2.2
10-Feb	Southampton Centre	PM10	24448	13929	1	0.4	3.01	2.2	16.36	2.2
10-Feb	Southampton Centre	PM25	27256	16461	1	-0.4	3.13	2.2	16.62	2.2
17-Feb	Southend-on-Sea	PM25	22927	12374	1	-0.5	**3.06**	**2.2**	**12.65**	**2.2**
18-Feb	Stanford-le-Hope Roadside	PM10	24397	13494	1	0.4	2.91	2.2	15.49	2.2

Date Year =2009	Site		Analyser number	Calculated Spring Constant k_0	Uncertainty (%)	[4]k_0 accuracy (%)	[3]Measured Main Flow (l/min)	Uncertainty (%)	[3]Measured Total Flow /**Aux Flow** (l/min)	Uncertainty (%)
18-Feb	Stanford-le-Hope Roadside	PM25	27226	15410	1	-0.7	2.51	2.2	15.64	2.2
20-Jan	Stockton-on-Tees Eaglescliffe	PM10	17691	n/a (BAM)					15.60	2.2
20-Jan	Stockton-on-Tees Eaglescliffe	PM25	17805	n/a (BAM)					15.70	2.2
20-Jan	Stoke-on-Trent Centre	PM10	25028	12420	1	-0.7	unsafe access		16.21	2.2
20-Jan	Stoke-on-Trent Centre	PM25	27262	13378	1	-0.9	3.00	2.2	15.81	2.2
20-Jan	Sunderland Silksworth	PM25	27247	15501	1	-1.9	Not tested		Not tested	
16-Feb	Thurrock	PM10	27329	13892	1	-1.1	**3.08**	**2.2**	**13.63**	**2.2**
28-Jan	Warrington	PM10	27183	17185	1	-1.4	**2.90**	**2.2**	**12.72**	**2.2**
28-Jan	Warrington	PM25	27269	16236	1	-0.8	**2.89**	**2.2**	**12.54**	**2.2**
25-Jan	Wigan Centre	PM25	27291	15121	1	-0.6	**3.08**	**2.2**	**14.05**	**2.2**
16-Feb	Wirral Tranmere	PM25	22883	13196	1	-0.7	Not tested		**14.32**	**2.2**
13-Jan	York Bootham	PM10	21877	14612	1	-0.9	Not tested		icy ground	
13-Jan	York Bootham	PM25	27209	16386	1	-1.4	Not tested		icy ground	
13-Jan	York Fishergate	PM10	22101	13410	1	1.7	**3.43**	**2.2**	**15.42**	**2.2**

The above factors have been calculated using certified standards. The analysers listed above have been tested for zero response, calibration factor, linearity, converter efficiency (NOx analysers), m-xylene interference (SO_2 analysers), k_0 / main flow rate (for TEOM analysers) and total flow rate (for particulate analysers), by documented methods. Note that the test results are valid on the day of test only, as analyser drift over time cannot be quantified.

The calibration results for NOx, NO, CO, SO_2, O_3 and Particulates are those that fall within our scope of accreditation. Results marked with an asterisk (*) on this certificate fall outside our accreditation, but have been included for completeness.

[1] The zero response is the zero reading on the logging system of the analyser when audit zero gas was introduced to the analysers under test.
[2] The calibration factor is the multiplying factor required to scale the reading on the data logging system into concentration units (ppb for NO, NOx and SO_2, ppm for CO – 1ppm = 1000 ppb). It should be used in conjunction with the analyser output and the zero response, according to the following equation:

Concentration = (output – zero response) x Calibration factor

The scaling factor for gaseous analysers is calculated using mole fraction concentrations.

[3] The measured main flow rate (where this is applicable) is the flow rate through the sensor unit of a TEOM analyser. The measured aux flow rate (where this is applicable) is the flow rate through the bypass tubing of the TEOM particulate analyser under test. The measured total flow rate is the total flow rate through the particulate analyser under test. Units of flow are $l.min^{-1}$. Measurements shown in **bold** are not made at the normal sample inlet and may not therefore accurately represent the actual flow through the inlet.
[4] The k_0 accuracy value (specifically for TEOM analysers) indicates the closeness of the calculated result to the manufacturer's specified value of k_0.

* The maximum residual is the percentage maximum deviation of the worst linearity point from the line of best fit
* Converter is the measured efficiency of the NO_2 to NO converter in the Nitrogen Oxides analyser
* meta-xylene interference is the response of the SO_2 analyser when supplied with approx 1ppm meta-xylene.

This certificate is an electronic representation of a certificate signed by Stewart Eaton and held by AEA at the above address. Hard copies are available on request.

AEA group
551.11 Harwell
Didcot
Oxfordshire
OX11 0QJ
Tel: 0870 190 6465
Fax: 0870 190 6608