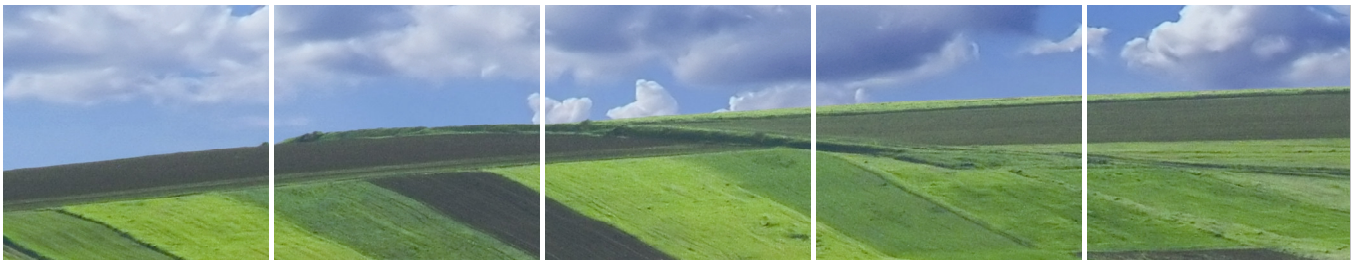
AEA



QA/QC Data Ratification and Intercalibration Report for the Automatic Urban and Rural Network, January-March 2009

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

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Executive summary

Part A Data Ratification January-March 2009

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 91.2% for all pollutants (O_3, NO_2, SO_2, CO, PM_{10} and $PM_{2.5}$) during the 3-month reporting period January-March 2009. Data capture rates for all pollutants except PM_{10} and $PM_{2.5}$ were above 90%. There were 34 sites with data capture less than 90% for the period.

The number of monitoring sites in the AURN during this quarter was 127, of which 66 are Local Authority owned sites affiliated to the national network. Some are colocated 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 sites out of service for relocation or refurbishment. A summary of recommendations given in this report to help improve network performance is given in Appendix 1.

Substantial changes have been made to the AURN network from the end of September 2007, and these 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. Sixteen additional analysers (including one new site) were commissioned this quarter.

Part B Winter 2009 Intercalibration

A total of 126 sites in the AURN were calibrated by AEA during the January-March 2009 Network Intercalibration exercise. One site (Southwark) was 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 70 out of 379 analysers deviated by more than the appropriate acceptance criteria (see Section 7), and a further 5 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.

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PART A DATA RATIFICATION REPORT JANUARY-MARCH 2009

Appendices

PART A

QA/QC Data Ratification Report for the Automatic Urban and Rural Network, January-March 2009

1 Introduction

Part A of 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 126 operational monitoring sites in the Network of which there are 92 urban sites, 26 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 66 affiliate sites. Auchencorth Moss, Harwell, London North Kensington and Marylebone Road have both Partisol and FDMS analysers for both PM_{10} and PM_{25}.

1.1 Recent changes in the network

This section gives an overview of the main changes that have taken place in the network during this quarter, including site closures, relocations or the addition of any new sites to the network. A summary of changes in the AURN for the period is given in Table 1.1. Major changes to the network at the end of December are described in Section 2.

Table 1.1 Changes in the Network, January-March 2009

Site	Pollutant	Date started	Date stopped
Aberdeen	$PM_{2.5}$	20/02/09	
Birmingham Centre	NO_2 O_3 $PM_{2.5}$	-	12/01/09
Birmingham Tyburn Roadside	NO_2 O_3 $PM_{2.5}$ PM_{10}	11/02/09	
Blackpool Marton	$PM_{2.5}$	28/01/09	
Bournemouth	$PM_{2.5}$	01/01/09	
Camden Kerbside	$PM_{2.5}$	19/02/09	
Carlisle Roadside	$PM_{2.5}$	17/03/09	
Haringey Roadside	$PM_{2.5}$	18/02/09	
Manchester Piccadilly	$PM_{2.5}$	15/01/09	
Preston	$PM_{2.5}$	27/01/09	
Sandy Roadside	$PM_{2.5}$	27/01/09	
Southend-on-Sea	$PM_{2.5}$	30/01/09	
Stockton-on-Tees Eaglescliffe	$PM_{2.5}$	21/01/09	
Wirral Tranmere	$PM_{2.5}$	28/01/09	

The QA/QC unit has also liased closely with the Central Management and Control Unit (CMCU) to update the Local Site Operator (LSO) manual for Partisol and FDMS analysers and LSOs with these analysers at their sites should now follow these new procedures.

Further details of the new sites, including locations, are given in Appendix 5.

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.

1.2 Overview of Network Performance

Ratified hourly average data capture for the network averaged 91.2% for all pollutants (O_3, NO_2, SO_2, CO, PM_{10} and $PM_{2.5}$) during the 3 month reporting period January-March 2009 (see Table 1.2 overleaf). All pollutants were 90% or higher data capture, except PM_{10} and $PM_{2.5}$. 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, 2009 (Using the start date of any new site)

	CO	PM_{10}	$PM_{2.5}$	NO_2	O_3	SO_2	Mean
Data capture Q1 2009	92%	89.2%	86.6%	90.6%	94.4%	96.5%	91.2%

Overall, 307 out of the 388 analysers (80%) 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 2009 (No. below 90%)
CO	26	7
NO_2	109	21
O_3	78	12
PM_{10}[1]	66	17
$PM_{2.5}$[1]	66	22
SO_2	43	2
Total <90%		81

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

In total, 34 out of the 126 operational network sites in the quarter (28%) had an average data capture rate below the required 90% level for the January-March 2009 period. Note that new analysers at existing sites will 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 2009

Site	Site Average (%)	Principal reason for data loss
England		
Birmingham Centre	80.2	Site closed for relocation
Blackpool Marton	84.8	Commencement of $PM_{2.5}$ FDMS measurement part-way through quarter
Camden Kerbside	79.3	Commencement of PM_{10} FDMS measurement part-way through quarter
Great Dun Fell	67.6	Water ingress, ice blocking inlet, logger faults
Haringey Roadside	41.3	Spurious PM_{10} and $PM_{2.5}$ data; NO_2 analyser fault
Harwell PARTISOL	86.1	See Appendix 4
High Muffles	89.8	Loose connections on O_3 analyser board
Liverpool Speke	87.1	FDMS PM_{10} locked up; rejection of $PM_{2.5}$ following power cut
London Bloomsbury	89.2	CO analyser pump fault; $PM_{2.5}$ drier repeatedly blowing fuses
London Cromwell Road 2	82.3	NOx PMT fault

Site	Site Average (%)	Principal reason for data loss
London Eltham	87.0	NOx pump fault
London Harlington	78.4	FDMS faults; NOx analyser pre-amplifier fault
London Marylebone Road PARTISOL	79.4	See Appendix 4
London N. Kensington PARTISOL	86.7	See Appendix 4
London Teddington	75.4	Temporary loan NOx analyser had catalogue of faults; air conditioning faults
Market Harborough	81.2	CO analyser faults
Newcastle Centre	88.8	Spurious O_3 data caused by logger problems
Oxford St Ebbes	86.7	FDMS PM_{10} started 27th January
Plymouth Centre	42.9	Site closed for upgrade of analysers
Preston	74.1	FDMS $PM_{2.5}$ leaks and spurious NOx baseline
Rochester Stoke	84.3	NOx converter fault
Sandy Roadside	86.5	Upgrade to FDMS
Scunthorpe Town	86.9	PM_{10} leak
Sheffield Centre	89.8	Various analyser problems up to upgrade on 27th March
Sibton	84.7	Main valve leak
Southwark Roadside	0.0	Site closed pending relocation
Warrington	82.6	Power cuts corrupted logger
Wigan Centre	81.3	Low volatile $PM_{2.5}$ concentrations
Yarner Wood	82.4	Power cuts
Ireland		
N Ireland		
Derry	71.7	Unexplained step in NOx response following audit; $PM_{2.5}$ drier fault
Scotland		
Aberdeen	82.3	Poor FDMS performance
Bush Estate	83.9	NOx internal sampling and spurious data
Fort William	60.6	Internal sampling
Glasgow Centre	78.4	Nox converter fault, CO pump fault
Wales		
Number of sites < 90%	34	

1.3 LSO Manual

As noted in Section 1.1, the LSO Manual has been extensively updated in March 2009 to include a section on the TEOM FDMS analysers. In addition, the Partisol section of the manual has been updated. LSOs with these analysers at their site should now use the new version of the manual. Instructions for new analyser types recently introduced into the network is also available.

During the site upgrade process, many sites are now 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 archive.

Copies of the new TEOM FDMS and Partisol sections are now available to the relevant LSOs via the Air Quality Archive (see below) as these analysers are installed into the network.

Air Quality Archive http://www.airquality.co.uk/reports/empire/lsoman/lsoman.html

1.4 AURN Hub

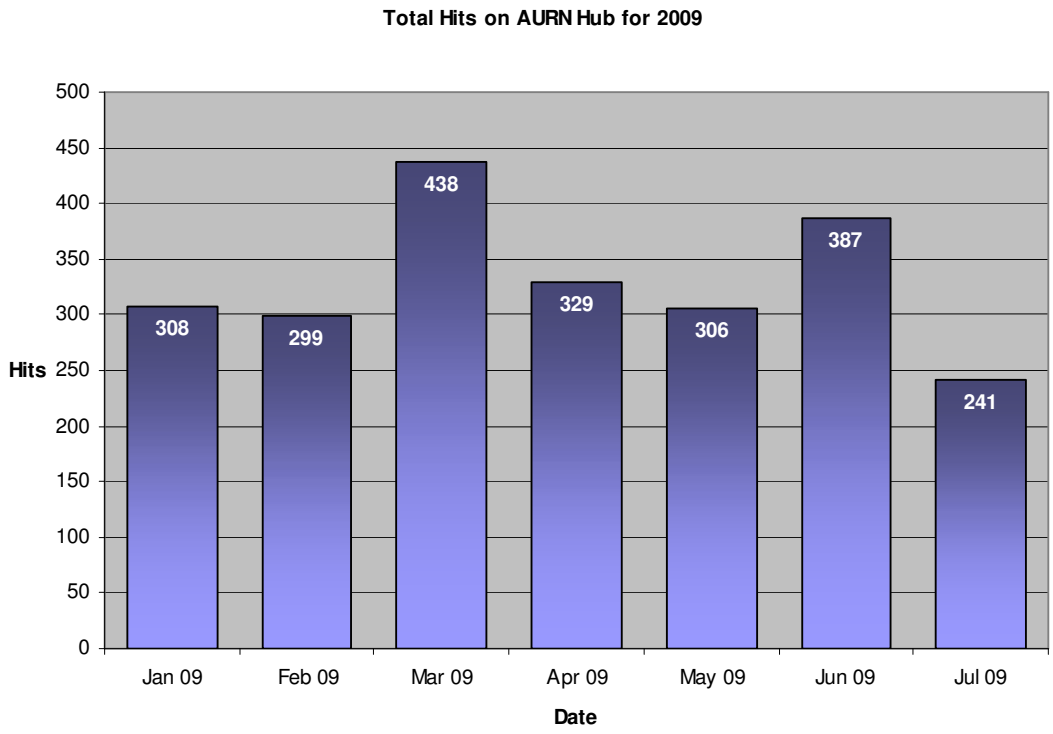
The AURN project information hub has recently been moved to a new web address located at[1]: http://www.aurnhub.co.uk/ This is a new location due to a change of host server; the user names and password remain unchanged.

The site is regularly updated and some of the more recent information includes:

- Monthly PM_{10} (Gravimetric) exceedences up to May 2009 (provisional);
- QA/QC Unit's Data Ratification and Intercalibration Report October-December 2008, including the 2008 Annual Review;
- Recent news items; and
- Updated version of the LSO manual.

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

Figure 1.1: AURN Hub Hits 2009



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

2 Changes in the Network for Directive Compliance

The QA/QC Unit and the CMCU Unit 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 Since 1 January 2009

Site	Pollutant	Date started
Birmingham Tyburn Roadside	NO_2 O_3 PM_{25} PM_{10}	11/02/09

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 2009

Site	Pollutant	Date started
Aberdeen	$PM_{2.5}$	20/02/09
Blackpool Marton	$PM_{2.5}$	28/01/09
Bournemouth	$PM_{2.5}$	01/01/09
Camden Kerbside	$PM_{2.5}$	19/02/09
Carlisle Roadside	$PM_{2.5}$	17/03/09
Haringey Roadside	$PM_{2.5}$	18/02/09
Manchester Piccadilly	$PM_{2.5}$	15/01/09
Preston	$PM_{2.5}$	27/01/09
Sandy Roadside	$PM_{2.5}$	27/01/09
Southend-on-Sea	$PM_{2.5}$	30/01/09
Stockton-on-Tees Eaglescliffe	$PM_{2.5}$	21/01/09
Wirral Tranmere	$PM_{2.5}$	28/01/09

.
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.

3 Generic Data Quality Issues

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

Six Gravimetric PM_{10} analysers and ten gravimetric $PM_{2.5}$ analysers (Partisol 2025s) are currently located at eleven sites in the network. These are listed below. Provisional data capture for the gravimetric PM_{10} (Partisol) analysers for the period January-March 2009 is given in Table 3.1. Six of the gravimetric analysers for which data are available did not reach the 90% data capture target in this quarter.

Table 3.1: Gravimetric PM_{10} and $PM_{2.5}$ Data Capture (%) January-March 2009

Site	Provisional Data Capture, January-March 2009 (%)
Auchencorth Moss PM_{10}	94.4
Auchencorth Moss $PM_{2.5}$	97.7
Bournemouth $PM_{2.5}$	97.7
Brighton Preston Park $PM_{2.5}$	80.0
Harwell PM_{10}	80.0
Harwell $PM_{2.5}$	92.2
Inverness PM_{10}	95.5
Inverness $PM_{2.5}$	96.6
London Marylebone Road PM_{10}	86.6
London Marylebone Road $PM_{2.5}$	72.2
London N Kens PM_{10}	96.6
London N Kens $PM_{2.5}$	76.6
London Westminster $PM_{2.5}$	86.5
Northampton $PM_{2.5}$	90.0
Port Talbot Margam $PM_{2.5}$	98.8
Wrexham PM_{10}	95.6

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. Final ratification of these Partisol data is being delayed until the outcome of the current detailed investigations on all previous UK Partisol data are completed. These are described in "Analysis of Trends in Gravimetric Particulate Mass Measurements in the United Kingdom" published by CMCU in May 2008, available from:

http://www.airquality.co.uk/archive/news.php?news_id=106.

Recently, evidence emerged that this 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 upto and including 2007, a monthly field blank correction has been used[1].

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 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:

- Participation of both AEA and BV in the Workplace Analysis Scheme for Proficiency (WASP) run by HSL. Participants send in pre-weighed filters, which are spiked with sodium borate solution, dried and returned to participants to reweigh. (The dried borate is thus a surrogate for real particulate on a filter);
- Round-robin of blank filter weighings between BV, AEA and NPL. Three sets of filters and check weights are weighed by all three organisations. 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; and
- 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 implementation of these initiatives is complete, and the outcome will be reported in future QA/QC reports.

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 17 sites (17 analysers) showing continuing problems with the autocalibration run-on during January-March 2009 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 2009

Site	Pollutant	Run-On Conc (ppb)	Autocal Conc (ppb)	Hours lost	Months
Glasgow Centre	CO	0.1	33	1	Jan-Feb
Aston Hill	NO_2	1.4	50	2	Jan-Feb
				1	Mar
Barnsley Gawber	NO_2	2	200	1	Jan-Mar
Belfast Centre	NO_2	3	200	1	Jan-Mar
Birmingham Tyburn Roadside	NO_2	8	400	1	Feb
Bush Estate	NO_2	1.7	450	2	Jan
				1	Feb-Mar
Eskdalemuir	NO_2	1.8	500	1	Jan
				3	Feb
				2	Mar
Glazebury	NO_2	2.9	150	1	Jan-Feb
Liverpool Speke	NO_2	2	250	1	Jan-Mar
London Hillingdon	NO_2	11	900	1	Jan-Mar
Narberth	NO_2	0.6	90	1	Jan & Mar
				2	Feb
Newcastle Centre	NO_2	3	300	1	Jan-Mar
Rochester Stoke	NO_2	2.1	200	1	Jan-Mar
Walsall Willenhall	NO_2	3	250	1	Jan-Mar
Yarner Wood	NO_2	3.1	200	2	Jan-Feb
				3	Mar
Stoke-on-Trent Centre	O_3	-3	1000	1	Jan-Mar
London Bexley	SO_2	0	135	1	Jan-Mar

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 many analysers, particularly $PM_{2.5}$ and PM_{10} were commissioned during the period, and 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 2009 is given in Table 4.1:

Table 4.1: Data capture for London: January-March 2009

Site	Owner	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
London								
Camden Kerbside	Affiliate	-	47.3	95.2	95.4	-	-	79.3
Haringey Roadside	Affiliate	-	45.1	0.0	78.9	-	-	41.3
London Bexley	Affiliate	81.9	-	93.4	98.2	-	94.3	91.9
London Bloomsbury	DEFRA	75.1	98.4	69.0	96.1	98.5	98.4	89.2
London Cromwell Road 2	DEFRA	97.1	-	-	53.1	-	96.6	82.3
London Eltham	Affiliate	-	-	97.9	64.9	98.2	-	87.0
London Haringey	Affiliate	-	-	-	99.6	99.5	-	99.6
London Harlington	Affiliate	-	84.2	30.8	99.2	99.6	-	78.4
London Harrow Stanmore	Affiliate	-	-	94.0	-	-	-	94.0
London Hillingdon	DEFRA	-	-	-	94.4	98.6	-	96.5
London Marylebone Road	Affiliate	97.9	93.4	86.6	99.1	91.3	99.1	94.5
London Marylebone Road PARTISOL	DEFRA	-	86.7	72.2	-	-	-	79.4
London N. Kensington	Affiliate	98.8	96.0	96.8	98.1	97.5	97.9	97.5
London N. Kensington PARTISOL	DEFRA	-	96.7	76.7	-	-	-	86.7
London Teddington	Affiliate	-	-	97.6	29.1	99.4	-	75.4
London Westminster	DEFRA	93.9	-	85.6	97.8	88.4	97.8	92.7
Southwark Roadside	Affiliate	-	-	-	0.0	-	-	0.0
Tower Hamlets Roadside	Affiliate	98.8	-	-	99.3	-	-	99.1

Number of sites		7	8	13	15	9	6	18
Number of sites < 90%		2	4	7	5	1	0	10
Network Mean (%)		91.9	81.0	76.6	80.2	96.8	97.3	81.4

Shaded boxes are for data capture < 90%

4.1.2 Site Specific Issues

Camden Kerbside
The TEOM suffered a serious leak and 47 days data were lost as a result.

Haringey Roadside
The PM_{10} analyser continued to give very poor data for much of the period. No valid data have been reported since 1 August 2008. The $PM_{2.5}$ analyser installed on 18 February also produced very noisy data, which have been deleted for the quarter. The NOx analyser suffered from a temperature fault for part of this quarter.

London Bloomsbury
The CO pump seized, resulting in a loss of 21 days data. In addition, an electrical fault with the $PM_{2.5}$ drier caused repeated blown fuses; 27 days data were lost.

London Eltham
The NOx analyser lost 31 days as a result of a pump fault.

Southwark Roadside
This site has been out of commission since 2006 and no firm information is available on when monitoring might restart. The future of this site has been discussed at recent reviews.

4.2 England (excluding London)

4.2.1 Data Capture

The data capture for sites in England for the period January-March 2009 is given in Table 4.2:

Table 4.2: Data capture for England (except London): January-March 2009

Site	Owner	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
England								
Barnsley 12	DEFRA	-	-	-	-	-	98.5	98.5
Barnsley Gawber	Affiliate	-	-	-	93.5	97.6	97.5	96.2
Bath Roadside	Affiliate	-	-	-	94.4	-	-	94.4
Billingham	DEFRA	-	-	-	98.4	-	-	98.4
Birmingham Centre	DEFRA	-	-	80.4	79.8	80.4	-	80.2
Birmingham Tyburn	Affiliate	-	78.7	94.7	98.5	98.5	98.7	93.8
Birmingham Tyburn Roadside	Affiliate	-	96.2	75.2	96.2	98.6	-	91.5
Blackpool Marton	DEFRA	-	89.3	57.9	95.8	96.2	-	84.8
Bottesford	Affiliate	-	-	-	-	99.5	-	99.5
Bournemouth	DEFRA	-	-	97.8	99.5	99.7	-	99.0

Site	Owner	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
Brighton Preston Park	DEFRA	-	-	78.9	98.8	99.4	-	92.4
Brighton Roadside	Affiliate	-	-	-	96.0	-	-	96.0
Bristol Old Market	Affiliate	99.5	-	-	99.4	-	-	99.4
Bristol St Paul's	DEFRA	98.4	97.5	97.2	98.1	98.0	98.3	97.9
Bury Roadside	Affiliate	93.0	97.8	-	96.9	-	-	95.9
Cambridge Roadside	Affiliate	-	-	-	98.4	-	-	98.4
Canterbury	Affiliate	-	-	-	98.4	-	-	98.4
Carlisle Roadside	Affiliate	-	89.9	89.7	92.5	-	-	90.7
Charlton Mackrell	Affiliate	-	-	-	98.6	98.7	-	98.6
Chesterfield	Affiliate	-	98.4	98.6	98.6	-	-	98.5
Chesterfield Roadside	Affiliate	-	99.3	-	99.2	-	-	99.2
Coventry Memorial Park	DEFRA	-	-	96.4	99.5	99.5	-	98.5
Exeter Roadside	Affiliate	-	-	-	99.6	99.6	-	99.6
Glazebury	DEFRA	-	-	-	94.0	97.9	-	95.9
Great Dun Fell	DEFRA	-	-	-	-	67.6	-	67.6
Harwell	DEFRA	-	96.9	96.9	97.1	97.1	97.2	97.0
Harwell PARTISOL	Affiliate	-	80.0	92.2	-	-	-	86.1
High Muffles	DEFRA	-	-	-	91.0	88.7	-	89.8
Horley	Affiliate	-	-	-	99.5	-	-	99.5
Hull Freetown	DEFRA	93.7	94.7	86.1	94.0	93.7	94.7	92.8
Ladybower	DEFRA	-	-	-	98.3	98.3	98.3	98.3
Leamington Spa	Affiliate	-	98.1	97.0	97.8	99.1	99.2	98.2
Leeds Centre	DEFRA	98.9	96.3	98.5	99.4	98.5	99.1	98.5
Leeds Headingley Kerbside	Affiliate	-	97.9	-	97.5	-	-	97.7
Leicester Centre	DEFRA	99.5	96.7	98.9	99.6	99.4	99.5	98.9
Leominster	DEFRA	-	-	-	98.2	97.6	97.5	97.8
Liverpool Queen's Drive Roadside	Affiliate	-	-	-	98.6	-	-	98.6
Liverpool Speke	DEFRA	96.8	61.8	77.9	92.7	96.4	96.8	87.1
Lullington Heath	DEFRA	-	-	-	99.2	99.2	98.5	99.0
Manchester Piccadilly	DEFRA	-	89.2	98.3	76.5	96.7	95.6	91.3
Manchester South	Affiliate	-	-	-	98.3	98.3	-	98.3
Market Harborough	DEFRA	61.3	-	-	92.8	89.5	-	81.2
Middlesbrough	Affiliate	98.1	99.6	68.5	97.3	90.7	98.0	92.0
Newcastle Centre	DEFRA	97.2	97.2	96.8	93.1	58.3	90.2	88.8
Newcastle Cradlewell Roadside	Affiliate	-	-	-	99.0	-	-	99.0
Northampton	Affiliate	-	-	90.0	99.4	97.1	99.5	96.5
Nottingham Centre	DEFRA	-	-	89.5	95.9	96.0	91.3	93.2
Oxford Centre Roadside	Affiliate	-	-	-	99.3	-	-	99.3
Oxford St Ebbes	Affiliate	-	67.7	94.2	98.2	-	-	86.7

Site	Owner	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
Plymouth Centre	DEFRA	-	0.0	-	64.0	64.7	-	42.9
Portsmouth	Affiliate	-	97.5	98.5	98.4	98.5	-	98.2
Preston	DEFRA	-	97.5	62.8	41.7	94.6	-	74.1
Reading New Town	DEFRA	-	96.9	98.1	96.9	96.9	-	97.2
Rochester Stoke	Affiliate	-	97.3	98.7	28.4	98.6	98.5	84.3
Salford Eccles	Affiliate	93.7	94.5	98.2	68.7	93.6	93.3	90.3
Saltash Roadside	Affiliate	-	99.2	-	-	-	-	99.2
Sandwell West Bromwich	Affiliate	-	-	-	96.4	95.7	96.6	96.2
Sandy Roadside	Affiliate	-	67.3	97.6	94.5	-	-	86.5
Scunthorpe Town	Affiliate	-	68.8	-	96.9	-	95.0	86.9
Sheffield Centre	DEFRA	75.0	95.5	94.3	95.0	95.0	84.3	89.8
Sheffield Tinsley	DEFRA	-	-	-	96.9	-	-	96.9
Sibton	DEFRA	-	-	-	-	84.7	-	84.7
Southampton Centre	DEFRA	97.2	96.3	96.1	97.0	97.1	97.1	96.8
Southend-on-Sea	DEFRA	-	95.7	95.1	99.4	99.4	-	97.4
St Osyth	DEFRA	98.6	-	-	98.6	98.1	-	98.4
Stanford-le-Hope Roadside	Affiliate	-	98.8	-	96.3	-	98.1	97.8
Stockton-on-Tees Eaglescliffe	Affiliate	-	99.1	95.5	88.5	-	-	94.3
Stoke-on-Trent Centre	DEFRA	-	93.8	95.1	95.2	91.5	-	93.9
Sunderland Silksworth	Affiliate	-	-	99.4	89.4	89.4	88.5	91.7
Thurrock	Affiliate	-	92.6	-	96.4	97.2	97.3	95.9
Walsall Willenhall	Affiliate	-	-	-	95.5	-	-	95.5
Warrington	Affiliate	-	76.0	85.6	86.3	-	-	82.6
Weybourne	Affiliate	-	-	-	-	99.2	-	99.2
Wicken Fen	DEFRA	-	-	-	90.4	98.1	98.2	95.6
Wigan Centre	Affiliate	-	-	46.9	98.5	98.5	-	81.3
Wirral Tranmere	DEFRA	-	97.9	95.9	94.9	95.0	-	95.9
Yarner Wood	DEFRA	-	-	-	78.1	86.8	-	82.4
York Bootham	Affiliate	-	94.5	99.4	-	-	-	97.0
York Fishergate	Affiliate	-	97.5	-	97.4	-	-	97.4
Number of sites		14	40	39	71	51	28	79
Number of sites < 90%		2	11	12	10	9	2	19
Network Mean (%)		92.9	89.5	90.0	93.2	94.1	96.3	93.0

Shaded boxes are for data capture < 90%

4.2.2 Site Specific Issues

Manchester Picadilly
The NOx converter was found to have failed at the QA/QC audit

Market Harborough
The CO analyser had a variety of faults resulting in the loss of 35 days data

Newcastle Centre
The ozone analyser produced spurious high data following service.

Preston
The NOx analyser produced very noisy data from 1 December 2008; data were deleted to the service on 18 February. This repair was not entirely successful, and further blocks of data have been deleted. A serious leak was also identified in the $PM_{2.5}$ analyser at the QA/QC audit in February.

Sunderland Silksworth
The logger developed a fault affecting all gaseous channels resulting in numerous small gaps.

Warrington
The site was adversely affected by power cuts during the quarter.

Yarner Wood
The site was adversely affected by power cuts during the quarter.

4.3 Scotland

4.3.1 Data Capture

The data capture for sites in Scotland for the period January-March 2009 is given in Table 4.3.

Table 4.3: Data Capture for Scotland January-March 2009

Site	Owner	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
Scotland								
Aberdeen	Affiliate	-	94.0	57.4	93.8	84.0	-	82.3
Aberdeen Union Street Roadside	Affiliate	-	-	-	90.7	-	-	90.7
Auchencorth Moss	DEFRA	-	94.4	97.8	-	99.6	-	97.3
Auchencorth Moss PM_{10} PM_{25} (Partisol)	DEFRA	-	99.5	99.2	-	-	-	99.4
Bush Estate	DEFRA	-	-	-	72.3	95.6	-	83.9
Dumfries	DEFRA	-	-	-	92.6	-	-	92.6
Edinburgh St Leonards	DEFRA	89.0	98.5	98.2	97.7	97.7	97.7	96.5
Eskdalemuir	DEFRA	-	-	-	90.0	98.3	-	94.2
Fort William	DEFRA	-	-	-	60.5	60.6	-	60.6
Glasgow Centre	DEFRA	84.9	30.1	98.8	65.0	96.7	95.1	78.4
Glasgow City Chambers	DEFRA	-	-	-	98.2	-	-	98.2
Glasgow Kerbside	DEFRA	-	92.5	-	91.7	-	-	92.1
Grangemouth	Affiliate	-	96.1	99.0	98.4	-	98.2	97.9
Inverness	DEFRA	-	95.6	96.7	98.2	-	-	96.8
Lerwick	DEFRA	-	-	-	-	99.4	-	99.4
Strath Vaich	DEFRA	-	-	-	-	92.0	-	92.0
Number of sites		2	8	7	12	9	3	16
Number of sites < 90%		2	1	1	3	2	0	4
Network Mean (%)		86.9	87.6	92.4	87.4	91.5	97.0	90.8

Shaded boxes are for data capture < 90%

4.3.2 Site Specific Issues

Aberdeen
The $PM_{2.5}$ analyser installed on 28 February suffered several problems during the quarter. The O_3 analyser pump failed, losing 13 days data.

Auchencorth Moss PM_{10} $PM_{2.5}$ (FDMS)
Continuing occurrences of negative data from both FDMS analysers continue. Investigations into this are continuing.

Bush NOx
The NOx analyser was left internally sampling following service on 12 January. In addition, spurious data was deleted following the LSO calibration on 6 February. A total of 21 days data were lost.

Fort William
It was found that sample inlet had been not connected to the ozone analyser since service on 29 January (35 days). The data has been rejected. In addition, it was suspected that the NOx analyser was internally sampling from 5 February to 4 March. These data have been deleted.

Glasgow Centre
The NOx analyser had a converter fault from 26 November to 30 January 2009. The site was upgraded with new analysers on 27 February and FDMS PM_{10} on 4 March, but numerous instrument problems were noted.

4.4 Wales

4.4.1 Data Capture

The data capture for sites in Wales for the period January-March 2009 is given in Table 4.4.

Table 4.4 Data Capture for Wales, January-March 2009

Site	Owner	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
Wales								
Aston Hill	DEFRA	-	-	-	84.5	96.7	-	90.6
Cardiff Centre	DEFRA	85.0	96.9	95.9	97.2	97.3	97.0	94.9
Chepstow A48	Affiliate	-	99.0	-	90.5	-	-	94.7
Cwmbran	Affiliate	-	-	-	99.5	97.6	-	98.6
Narberth	DEFRA	-	92.2	-	88.4	93.7	93.5	91.9
Newport	Affiliate	-	98.7	98.7	99.6	-	-	99.0
Port Talbot Margam	Affiliate	93.2	94.7	97.7	95.4	92.5	95.6	94.8
Port Talbot Margam $PM_{2.5}$	Affiliate	-	-	98.9	-	-	-	98.9
Swansea Roadside	Affiliate	-	96.3	77.6	97.4	-	-	90.4
Wrexham	DEFRA	-	95.6	-	98.1	-	98.0	97.2
Number of sites		2	7	5	9	5	4	10
Number of		1	0	1	2	0	0	0

Site	Owner	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
sites < 90%								
Network Mean (%)		89.1	96.2	93.8	94.5	95.5	96.0	95.1

Shaded boxes are for data capture < 90%

4.4.2 Site Specific Issues

Aston Hill
A significant loss of NOx data was due to autocalibration run-on (see section 3.2).

Swansea Roadside
The $PM_{2.5}$ analyser suffered a significant leak and periods where the sample dew point was too high- possibly indicating poor drier performance.

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 2009 is given in Table 4.5.

Table 4.5: Data Capture for Ireland, January-March 2009

Site	Owner	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
N Ireland								
Belfast Centre	DEFRA	96.4	89.2	97.1	92.6	96.4	96.4	94.7
Derry	Affiliate	-	99.6	0.0	59.4	99.7	99.8	71.7
Lough Navar	DEFRA	-	98.7	-	-	98.7	-	98.7
Mace Head	DEFRA	-	-	-	-		-	
Number of sites		1	3	2	2	3	2	4
Number of sites < 90%		0	1	1	1	0	0	1
Network Mean (%)		96.4	95.8	48.5	76.0	98.3	98.1	88.3

Shaded boxes are for data capture < 90%

4.5.2 Site Specific Issues

Derry
Faults with the $PM_{2.5}$ analyser were reported in the previous quarter. Problems continued during the fourth quarter of 2008, and continued into 2009. The problem was identified as a drier fault, and the ESU have been requested to replace the drier; this was carried out in June 2009.

4.6 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 4.6.

Table 4.6: Status of Analysers Highlighted in Previous Reports

Site	Analyser	Fault	Current status
Auchencorth Moss	FDMS PM_{10} and $PM_{2.5}$		Negative data still observed, particularly $PM_{2.5}$
Bury Roadside	CO	Unstable data	Now repaired
Derry	PM_{10} $PM_{2.5}$	Poor performance	Pumps repaired Q1 2009
Exeter Roadside	Site	Closed for building work	Restarted, but work still continuing. Audits and servicing not carried out
Glasgow Centre	NOx	Converter fault	Now repaired
Haringey Roadside	PM_{10}	Very noisy data	Fixed Apr 2009
London Cromwell Road	NOx	Drift	Repaired Jan 09
London Harlington	$PM_{2.5}$		
London Teddington	Site	Air conditioning	No progress reported
Lough Navar	Site	Power cuts/logger	Now repaired
Newport	PM_{10}	Various faults	Now repaired
St Osyth	Site	Air conditioning	No progress reported
Strathvaich	Site	Power cuts	No longer evident
Weybourne	O_3	No manual calibrations or IZS	No progress reported
Rural CO analysers	CO	Baseline drift	Drift still evident
Various	Rural ozone analysers	Temporary instruments installed some of which have no autocals	Reinstallation of these analysers has started.

4.7 FDMS Issues

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.

A description of the issues is given in Part B of the October-December 2008 QA/QC Report.

5 Sites with Data Capture below 90%

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 2009 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.

6 Data Capture Statistics

Table 6.1 provides a summary of the data capture figures for the network for the 3-month period January-March 2009.

Table 6.1 Data Capture Statistics January-March 2009

Network Data Capture for 01/01/2009 to 31/03/2009 from start date of any new site

Site	Owner	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
Number of sites		26	66	66	109	78	43	127
Number of sites < 90%		7	17	22	21	12	2	34
Network Mean (%)		92.0	89.2	86.6	90.6	94.4	96.5	91.2

Part B Winter 2009 Intercalibration

7 Introduction

In January to March 2009, AEA undertook an intercalibration of 126 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, ESUs and LSOs 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 Management Units (MUs) and ESUs 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 scheduled ESU service 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.

8 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; ie that a 100µgm^{-3} 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? Is the site still compliant with the requirements of the EU Directive?

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 LSOs 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 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.

9 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.
National Network Overview

The results of the intercalibration are summarised in Table 9.1 below:

Table 9.1 - Summary of audited analyser performance – 126 UK stations

Parameter	Number of outliers	Number in network	% outliers in total
NOx analyser	23	109	21%
CO analyser	4	25	16%
SO_2 analyser	10	43	23%
Ozone analyser	27	78	35%
TEOM and BAM analysers	0 k_0, 6 flow	25 TEOM PM_{10} 33 FDMS PM_{10} 2 TEOM $PM_{2.5}$ 46 FDMS $PM_{2.5}$	6%
Gravimetric PM analysers	0	8 PM_{10} 9 $PM_{2.5}$	0%
Total	70	379	18%

Three of the 126 sites were not in operation at the time of the intercalibration: Norwich Centre, Stockton-on-Tees Eaglescliffe and Southwark Roadside are awaiting relocation.

In addition to these results, 12 of the 286 site cylinders (~4%) used to scale instrument data into concentrations appeared to have drifted by more than 10% from their certificated values.

Five NOx converters were found to be outside than the ±5% acceptance limit.

The number of analyser outliers identified is similar to the previous exercise. At the Summer 2008 intercalibration 17% 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 k_0 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.

9.1 Network Intercomparisons

9.1.1 Summary

- Oxides of Nitrogen.

  A total of 23 outliers (21%) were identified during this intercalibration. This is slightly better than the Summer exercise where 24% of the analysers were identified as outliers. In addition, there were five converters which fell outside the ±5% acceptance limits. Individual outliers will be discussed in detail in the following sections.

  Using the methodology detailed earlier, comparison of the network averages to audit cylinder concentrations showed that the network measures concentrations of NOx and NO to within a maximum of 1% of the network standards. The percentage standard deviations of these

results, which are an indication of how close the results are grouped together, were less than 5% in all cases. These are excellent results, and demonstrate that raw data from the vast majority of NOx analysers are accurate, harmonised and traceable to national metrology standards.

- Carbon Monoxide

  A total of 4 analysers (16%) were identified as outliers at this intercalibration. This result is slightly worse than the Summer 08 exercise, when 3 analysers fell outside the acceptance limits. Individual outliers will be discussed in detail in the following sections.

  Comparison of the network average to audit cylinder concentrations showed that the network measures concentrations of CO to within 0.5% of the network standards. The percentage standard deviation of these results, which are an indication of how close the results are grouped together, was less than 2.5%. This is an excellent result, and demonstrates that raw data from the vast majority of CO analysers are accurate, harmonised and traceable to national metrology standards.

- Sulphur Dioxide

  A total of 10 outliers (23%) were identified at this intercalibration. This is slightly worse than the Summer 08 exercise, when 9 analysers were identified as outliers. Individual outliers will be discussed in detail in the following sections. All m-xylene interference tests were less than 30ppb.

  Comparison of the network averages to audit cylinder concentrations showed that the network measures concentrations of SO_2 to within 1% of the network standards. The percentage standard deviation of these results, which are an indication of how close the results are grouped together, was less than 5%. This is a very good result, and demonstrates that raw data from the vast majority of SO_2 analysers are accurate, harmonised and traceable to national metrology standards

- Ozone

  A total of 27 outliers (35%) were identified during the Winter 09 exercise. This is similar to the previous intercalibration, where only 15 analysers were found to be outside the ±5% acceptance criterion.

  Of the 27 outliers, 12 were within ±10%, 14 were within ±25% and one was significantly greater than ±25%. Individual outliers will be discussed in detail in the following sections.

- Particulate Analysers

  All calculated TEOM and FDMS PM_{10} k0 determinations were inside the required ±2.5% of their stated values. This is much better than the previous exercise - three outliers were identified in the Summer 08 intercalibration

  Six TEOM PM_{10} main flows were found to be outside the ±10% acceptance limits, compared to three in total at the Summer 08 exercise.

  All Partisol and $PM_{2.5}$ analysers successfully passed the audit tests.

- Site Cylinder Concentrations

  12 of the 286 site cylinders used to scale ambient pollution data were found to be outside the ±10% acceptance limit. These outliers will be examined in detail in the following sections.

9.1.2 London Sites

The results of the intercomparison for the 14 London sites in operation at the time of the intercalibration are summarised below:

Table 9.2 - Summary of audited analyser performance – London Sites

Parameter	Number of outliers	Number in region
NOx analyser	4	14
CO analyser	2	7
SO_2 analyser	1	7
Ozone analyser	2	9
TEOM and BAM analysers	0 k_0, 2 flow	6 TEOM PM_{10} 2 FDMS PM_{10} 0 TEOM $PM_{2.5}$ 8 FDMS $PM_{2.5}$
Gravimetric PM analysers	0	2 PM_{10} 0 $PM_{2.5}$
Cylinders	1	42

The NOx outliers at Bexley and Eltham were attributed to drifts in the analysers responses between calibrations. No data were lost from either site during the ratification process.

The NOx analyser at Cromwell Road was found to be malfunctioning at the audit. Subsequent investigation during ratification found that this fault had been ongoing and undetected for two months prior to the audit. These data have been rejected as a result.

The NOx outlier at Teddington was caused as a result of an emptying calibration cylinder. Careful examination of the data has confirmed no need for any rescaling or rejection of data from this analyser.

The SO_2 outlier at Westminster was attributed to a drift in the site cylinder concentration. The data have been successfully rescaled and no data were lost from the site during the ratification process.

The flow rates of the TEOM analyser at Haringey Roadside were again found to be out of specification. On this occasion, a leak was identified after the total flow through the analyser was measured at 7.5 l/min. The data have been carefully examined, but rejection of the entire dataset from the summer service has been necessary.

The total flow rate of the TEOM analyser at Camden Kerbside was found to be 33% lower than required. A leak was identified in the system and following careful examination, 6 weeks of data were rejected.

9.1.3 Scottish Sites

The results of the intercomparison for the 16 Scottish sites are summarised below:

Table 9.3 - Summary of audited analyser performance – Scottish Sites

Parameter	Number of outliers	Number in region
NOx analyser	2	13
CO analyser	1	2
SO_2 analyser	1	3
Ozone analyser	3	9
TEOM and BAM analysers	0 k_0, 0 flow	2 TEOM PM_{10} 4 FDMS PM_{10} 0 TEOM $PM_{2.5}$ 4 FDMS $PM_{2.5}$
Gravimetric PM analysers	0	2 PM_{10} 1 $PM_{2.5}$
Cylinders	0	31

The NOx outliers at Glasgow Centre and Aberdeen Union Street were traced to analyser drifts in responses between LSO calibrations. No data were rejected from Aberdeen Union Street during ratification, but a converter failure at Glasgow Centre resulted in two months of data rejection.

The CO outlier at Glasgow centre was found to be due to analyser drift, no data were lost as a result of this finding.

The SO_2 analyser at Edinburgh appears to have performed badly on the day of the audit. The analyser data has been carefully examined, but no rejection was necessary on this occasion.

The Ozone outliers at Lerwick, Eskdalemuir and Edinburgh were all successfully rescaled without data losses during ratification.

The NOx converter at Glasgow Centre was found to be under the required 95% performance requirement (90%). Following careful examination, two months of data have been rejected.

9.1.4 Welsh Sites

The results of the intercomparison for the 9 Welsh sites are summarised below:

Table 9.4 - Summary of audited analyser performance – Welsh Sites

Parameter	Number of outliers	Number in region
NOx analyser	3	9
CO analyser	0	2
SO_2 analyser	1	4
Ozone analyser	0	5
TEOM and BAM analysers	0 k_0, 0 flow	3 TEOM PM_{10} 3 FDMS PM_{10} 0 TEOM $PM_{2.5}$ 2 FDMS $PM_{2.5}$
Gravimetric PM analysers	0	1 PM_{10} 1 $PM_{2.5}$
Cylinders	1	24

The NOx outlier at Chepstow was found to be due to a drift in the site cylinder concentration. Data have been successfully rescaled, no data rejection was required.

The NOx outliers at Narberth and Port Talbot were traced to analyser drifts in responses between LSO calibrations. No data were rejected from either of these analysers during ratification.

The site NO cylinder concentrations at Cwmbran were found to be within acceptable limits, following modification of the calibration system to use stainless steel tubing. This has been a persistent issue

many sites – where oxidation of the NO in the cylinder compromised the stability of the calibration results. The modification has been recommended for all sites that use site NO cylinders for daily autocal checks.

The NO cylinder at Chepstow appears to have drifted by 12% from its certified value. This will be rechecked at the summer intercalibration and action taken as necessary.

The SO_2 outlier at Cardiff appears to be due to the factor and processing used by CMCU, compared to those used by QA/QC. Ambient data are unaffected and data quality has not been compromised.

9.1.5 Northern Ireland Sites (incl. Mace Head)

The results of the intercomparison for the 4 Northern Irish and Mace Head sites are summarised below:

Table 9.5 - Summary of audited analyser performance – Northern Irish Sites

Parameter	Number of outliers	Number in region
NOx analyser	0	2
CO analyser	0	1
SO_2 analyser	1	2
Ozone analyser	0	4
TEOM and BAM analysers	0 k_0, 0 flow	2 TEOM PM_{10} 1 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	2	7

The SO_2 outlier at Derry was attributed to a corresponding change in the site cylinder concentration. Data have been successfully rescaled, no rejection of data was required. The cylinder will be rechecked at the summer intercalibration and action taken as necessary.

The NO cylinder at Belfast appears to have drifted by 12% from its certified value. This will be rechecked at the summer intercalibration and action taken as necessary.

9.1.6 English Sites

The results of the intercomparison for the 76 English sites are summarised below:

Table 9.6 - Summary of audited analyser performance – English Sites

Parameter	Number of outliers	Number in region
NOx analyser	14	71
CO analyser	1	13
SO_2 analyser	6	27
Ozone analyser	22	52
TEOM and BAM analysers	0 k_0, 4 flow	12 TEOM PM_{10} 23 FDMS PM_{10} 2 TEOM $PM_{2.5}$ 31 FDMS $PM_{2.5}$
Gravimetric PM analysers	0	3 PM_{10} 7 $PM_{2.5}$
Cylinders	8	179

Of the 14 NOx outliers, 6 can be attributed to changes in analyser responses between LSO calibrations (Chesterfield Roadside, Glazebury, Hull Freetown, Liverpool Queen's Drive Roadside, Manchester Piccadilly and St Osyth). All of these outliers were corrected for with no rejection of data required.

6 outliers can be attributed to changes in site cylinder concentrations. The cylinders at Cambridge Roadside and Lullington Heath (+12%) are relatively minor and will be reassessed at the summer audit. The other 4 cylinders (Leicester, Southend, Yarner Wood and York Fishergate) all showed considerable oxidation of NO and have been replaced. Data from all 6 sites have been successfully rescaled with no rejection required.

The NOx outlier at Oxford Centre Roadside was found to be due to the factor and processing used by CMCU, compared to those used by QA/QC. The cylinder database at CMCU showed a different concentration for the site cylinder compared to the certified value. QA/QC have incorporated additional checks to make sure this potential loophole is closed. In any case, ratified ambient data are unaffected and data quality has not been compromised.

Four NOx converters fell outside the ±5% acceptance limits:

Barnsley Gawber (88%) - The ESU found the converter to be within limits. Close examination of the data revealed no significant performance issues; no data were rejected.

Manchester Piccadilly (89%) - 1 month of data rejected

Market Harborough (93%) - Close examination of the data revealed no significant performance issues; no data were rejected.

Rochester Stoke (88%) - 2 months of data rejected

The CO outlier at Market Harborough was due to a small drift in the site cylinder concentration. This is a very low concentration cylinder (~1.5ppm), so small differences in calculated site cylinder concentrations will have a disproportionate effect on results. The outlier was corrected for with no rejection of data required.

Three of the six SO_2 outliers (Leicester, Rochester Stoke, Sheffield Centre) were found to be due to changes in analyser responses between LSO calibrations. Both of these outliers were corrected for with no rejection of data required.

The SO_2 outliers at Barnsley Gawber and Southampton appear to be due to the factor and processing used by CMCU, compared to those used by QA/QC. Ambient data are unaffected and data quality has not been compromised.

The SO_2 outlier at Scunthorpe Town was found to be due to a drift in the site cylinder concentration. This was corrected during ratification with no rejection required. The cylinder will be carefully checked at the summer audit

The extreme ozone outlier at Hull Freetown was found to be due to a poorly performing UV lamp. Following close examination, data were successfully rescaled with no rejection required.

Data from the remaining 21 ozone outliers were successfully rescaled with no data rejection necessary.

Four TEOM flow outliers were identified;

Scunthorpe Aux (40% of required flow) – 12 weeks of data rejected
Southampton Total (50%) – no data rejected, following careful examination
Coventry Aux (40%) – 6 weeks data rejected
Preston Main (85%) – 2 weeks data rejected

9.2 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 12 of the 286 cylinders (~4%) used to scale analyser data into concentrations (NO, CO and SO_2) were outside the ±10% acceptance criterion. This is somewhat better than the summer 2008 exercise, where 5% of the scaling cylinders were outside the acceptance limits.

In addition, the concentrations of 23 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 35 of the 286 cylinders (12%) were outside the acceptance limits. This is better than the previous intercalibration, where 15% of the cylinders were found to be out of specification.

The site cylinder evaluations are performed by calibrating the analysers with site and audit cylinder gas through the same inlet system, and using the conditioned site cylinder regulators, thus minimising any possible errors due to contaminated tubing or regulators.

In determining which cylinders should be replaced or reanalysed, the analyser and audit performance is taken into account, as well as previous audit results for each cylinder. During this exercise, all 12 poorly performing site cylinders used to scale data were investigated further:

The contaminated NO cylinders at Leicester, Southend, Yarner Wood and York Fishergate were all replaced as a matter of course and data rescaled as necessary.

The majority of contaminated NO cylinders occurrences coincide at sites where the cylinders are used as daily functional checks. One of the possible causes for the contamination could be oxygen permeation through the PTFE tubing of the gas delivery system and thus into the cylinder. QA/QC have procured a length of high quality deactivated stainless steel tubing and fitted it to the NO cylinder at Cwmbran by the ESU at the summer 2008 service exercise. The cylinder performance at the Winter 09 exercise was found to be completely acceptable. We have therefore recommended that all permanently pressurised calibration cylinder systems are upgraded to use this stainless steel system.

Recommendation

All permanently pressurised cylinder calibration systems to be fitted with passivated stainless steel tubing

The SO_2 cylinders at Hull and Westminster were low pressure and approaching the end of their useful lives, compromising the validity of these results. They have now been replaced

The remainder of the cylinders (SO_2 at Scunthorpe, Belfast and Derry, NO at Cambridge, Lullington Heath and Chepstow) were all just outside the 10% limit. These will all be checked at the summer audits and appropriate action taken if necessary.

10 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 AURNHUB.

11 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 (SO2), 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 new air quality Directive 2008/50/EC. Member States will have until June 2010 to ensure their monitoring networks are compliant. 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 11.1 – Analyser measurement uncertainties (%)

Date	Site	O3	CO	SO2	NOx	NO
14-Jan	Barnsley 12			14		
04-Mar	Bath Roadside				13.5	14
14-Jan	Billingham				13.5	14
09-Jan	Birmingham Centre	12.4			13.5	14
11-Feb	Bournemouth	12.4			13.5	14
02-Mar	Brighton Preston Park	12.4			13.5	14
02-Mar	Brighton Roadside				13.5	14
06-Mar	Bristol Old Market		9.5		13.5	14
03-Mar	Bristol St Paul's	12.4	9.5	13.4	13.5	14
12-Jan	Bury Roadside		13.9		10.5	10.5
19-Jan	Cambridge Roadside				10	10
03-Mar	Canterbury				13.5	14
21-Jan	Carlisle Roadside				10.5	10.5
11-Feb	Charlton Mackrell	12.4			13.5	14
15-Jan	Glazebury	12.4			13.5	14
23-Feb	Harwell			13.8	13.5	14
22-Jan	High Muffles				13.5	14
12-Jan	Hull Freetown	11.8	13.9	12.7	10.5	10.5
29-Jan	Ladybower			12.1	13.5	14
28-Jan	Leominster	12.4		14.4	13.5	14
09-Feb	Liverpool Queen's Drive Roadside				13.5	14
23-Feb	London Bexley		9.5	13.4	13.5	14
19-Feb	London Bloomsbury	12.4		14.3	13.5	14
04-Feb	London Cromwell Road 2		9.5	16.2	13.5	14
03-Feb	London Haringey				13.5	14
02-Feb	London Harlington	12.4			13.5	14
17-Feb	London Marylebone Road	12.4	9.5	16.3	13.5	14
02-Mar	London Teddington	10.7			13.5	14
18-Feb	London Westminster	12.4	9.5	16.4	13.5	14
14-Jan	Manchester South	12.4			13.5	14
13-Jan	Middlesbrough	12.8	9.5	16.1	13.5	14
12-Jan	Newcastle Centre	11.8	13.9	12.8	10.5	10.5
12-Jan	Newcastle Cradlewell Roadside				10.5	10.5
21-Jan	Oxford Centre Roadside				10.5	10.5
21-Jan	Oxford St Ebbes				10.5	10.5
12-Feb	Plymouth Centre	10.7			10	10

Date	Site	O3	CO	SO2	NOx	NO
04-Mar	Sandwell West Bromwich	8.7		13.9	11.8	11.8
17-Feb	Sandy Roadside				13.5	14
13-Jan	Scunthorpe Town			14.4		
19-Jan	Sibton	12.4				
24-Feb	Southampton Centre	11.8	13.9	11	10.5	10.5
05-Mar	Stanford-le-Hope Roadside			14	13.5	14
25-Feb	Thurrock	12.4		13.4	13.5	14
20-Jan	Wicken Fen	12.4		14.1	13.5	14
26-Jan	Yarner Wood	12.4			13.5	14
24-Feb	Mace Head	10.7				
23-Feb	Derry	12.4		14.7	13.5	14
04-Feb	Aberdeen	12.4			13.5	14
04-Feb	Aberdeen Union Street Roadside				13.5	14
10-Dec	Auchencorth Moss	12.4				
21-Jan	Dumfries				13.5	14
23-Jan	Eskdalemuir	12.4			13.5	14
21-Jan	Fort William				13.5	14
05-Feb	Inverness				13.5	14
26-Feb	Strath Vaich	12.4				
28-Jan	Aston Hill	12.4			10.5	10.5
17-Feb	Cardiff Centre	12.4	9.5	14.2	13.5	14
18-Feb	Port Talbot Margam		9.5	14.2		
18-Feb	Swansea Roadside				13.5	14
10-Feb	Wrexham			13.4	13.5	14

This table will be extended to include upgraded sites and PM measurements in future intercomparison exercises. The method for calculation of uncertainties has been agreed with UKAS for reporting on the certificate (See Appendix 6).

12 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. It is not possible to measure flows at the sample inlet at the following sites:

Table 12.1 Actions Required for Safe Roof Access

Site	Action required
Camden Kerbside	Needs ladder restraints
Haringey Roadside	Needs ladder restraints
London Harlington	Needs ladder restraints
London North Kensington	Needs ladder restraints
London Westminster (Partisol)	Needs ladder restraints
Teddington	Will need ladder restraints
Birmingham Centre	Needs ladder restraints
Sandwell	Needs ladder restraints
Bury Roadside	Needs ladder restraints
Salford Eccles	Needs restraints
Liverpool Speke	Has half barrier - needs full barrier
Bristol St Paul's	Needs ladder restraints
Middlesborough	Roof access required, needs barrier
Bournemouth (Partisol)	Needs ladder restraints
Coventry Memorial Park	Sloping roof - access not possible
Hull Freetown	Needs ladder restraints
Southampton Centre	Needs ladder restraints
Southend on Sea	Sloping roof - access not possible
Glasgow Kerbside	needs new ladder support or railings
Swansea Roadside (FDMS TEOM)	Needs restraints
Thurrock	Sloping roof - access not possible
Plymouth Centre	Roof access required, needs barrier
Northampton (TEOM + Partisol)	Needs ladder restraints
Scunthorpe Town	Needs ladder restraints
Leamington Spa	Needs ladder restraints
Sunderland Silksworth	Needs ladder restraints
Grangemouth	needs ladder supports or railings
Aberdeen	needs ladder supports or railings
Cwmbran	Needs ladder restraints

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

In addition, all new $PM_{2.5}$ installations will need to be checked to ensure safe access to the inlets can be achieved. At present, none of the newly installed FDMS $PM_{2.5}$ analysers have had ladder restraints installed.

These issues were discussed at meetings between the QA/QC Unit, CMCU and the relevant ESUs during the summer of 2009, and progress is now being managed by CMCU.

13 Certification

The Network Certificate of Calibration is presented in Appendix B1. 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.

14 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 2008 to March 2009.

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 July 2009	Priority	Action
30	All permanently pressurised cylinder calibration systems to be fitted with passivated stainless steel tubing	Medium	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**
26	It is recommended that the Bush NOx analyser be replaced.	High	CMCU
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 April 2007		
22	Safe roof access needs to be provided for sites where FDMS TEOMs are to be deployed	High	ESU/CMCU
	Recommendations January 2007		
22	ESUs to ensure all NOx converter software settings to be 100%.	High	ESUs to check at service
	Recommendations July 2006		
19	Weybourne O_3 analyser should be upgraded to allow monthly LSO calibrations and daily autocalibrations	Medium	ESU to provide CMCU with quotation for necessary work
	Recommendations January 2006		
17	The performance of CO analysers needs close attention by all parties, and poorly performing analysers replaced or upgraded	High	LSOs and CMCU to check performance carefully; ESU's to action repairs promptly
	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 2009

01/01/2009 to 31/03/2009 Gaps in 15-minute table >= 6 hours and data capture <= 90%

Pollutant	Data Capture (%)	Start date	End date	Reason	Comments	No. of days	No. of hours
England							
Birmingham Centre							
PM25	12.50%	12-Jan-09	31-Jan-09	Site closed for relocation		19.5	468
NO2	12.40%	12-Jan-09	31-May-09	Site closed for relocation		140	3348
O3	12.50%	12-Jan-09	31-May-09	Site closed for relocation		140	3348
Birmingham Tyburn							
PM10	78.70%	09-Jan-09	23-Jan-09	Monitoring suspended	New FDMS PM10 ystem Installed	14.6	350
		14-Feb-09	18-Feb-09	ESU service	power cut + Service + TEOM tests	4	97
Birmingham Tyburn Roadside							
PM25	75.20%	11-Feb-09	11-Feb-09	Analyser installed		0.5	11
		24-Feb-09	24-Feb-09	Instrument fault	Poor Response	0.3	8
		07-Mar-09	08-Mar-09	Instrument fault	Poor Response	0.3	8
		21-Mar-09	31-Mar-09	Instrument fault	ENG C/O PM2.5 FDMS Cooler fault. Removed for repair	10.2	245
Blackpool Marton							
PM10	27.80%	07-Jan-09	09-Jan-09	Communication fault	Comms or power failure	2.3	55
		28-Jan-09	31-Jan-09	Monitoring suspended	ENG C/O Made preparation for the PM10 to PM2.5 conversion	3.5	85
PM25	57.90%	28-Jan-09	23-Feb-09	FDMS volatile recovery or noisy	Volatile PM too high until service	26.4	634
Brighton Preston Park							
PM25	78.90%	15-Jan-09	15-Jan-09		See Appendix 4	1	24
		25-Jan-09	06-Feb-09			13	312
		08-Mar-09	11-Mar-09			4	96
		27-Mar-09	27-Mar-09			1	24
Camden Kerbside							
PM10	47.30%	04-Feb-09	23-Mar-09	Instrument fault	Leak in TEOM	47.1	1130
Carlisle Roadside							
PM10	89.90%	25-Feb-09	26-Feb-09	No mV data collected	Power fault caused by bad weather	0.9	22
		07-Mar-09	09-Mar-09	No mV data collected	Power fault caused by bad weather	1.6	39
		11-Mar-09	16-Mar-09	No mV data collected	Power fault caused by bad weather	4.8	115
		17-Mar-09	18-Mar-09	Instrument fault	FDMS PM10 and PM2.5 installed	1	24
PM25	89.70%		18-Mar-09	Instrument fault	PM2.5 installed		

Great Dun Fell							
O3	67.60%	07-Jan-09	11-Jan-09	Flat response	Deleted flat period until 10th	3.2	77
		27-Feb-09	24-Mar-09	No mV data collected	Instrument removed - no data	25.1	603
Haringey Roadside							
PM10	45.10%	31-Aug-08	18-Feb-09	Instrument fault	Offline then major leak found at Feb 09 audit	171	4104
		12-Mar-09	12-Mar-09	Unstable response	able repsonse following calibration	0.3	6
PM25	0.00%	18-Feb-09	01-Apr-09	High noise	Installation 18/02 Replaced sensor&control unit 01/04	43	1031
NO2	78.90%	11-Feb-09	16-Feb-09	ESU service	Service followed by call out replaced bench fan	5.5	131
		19-Mar-09	31-Mar-09	Instrument fault	ENG C/O NOx PM temp fault. needs sensor	12.8	308
Harwell PARTISOL							
PM10	80.00%	19-Jan-09	20-Jan-09		See Appendix 4	2	48
		12-Feb-09	18-Feb-09			7	168
		04-Mar-09	10-Mar-09			7	168
		12-Mar-09	12-Mar-09			1	24
		23-Mar-09	23-Mar-09			1	24
High Muffles							
O3	88.70%	22-Jan-09	24-Jan-09	QAQC audit		2.6	63
		17-Feb-09	18-Feb-09	ESU service		1.2	28
		17-Mar-09	23-Mar-09	Instrument fault	ENG C/O Reseated chips on mico processor board	6.1	146
Hull Freetown							
PM25	86.10%	12-Jan-09	13-Jan-09	QAQC audit		0.4	10
		21-Jan-09	22-Jan-09	No mV data collected	No information	1.2	29
		17-Mar-09	18-Mar-09	No mV data collected	LSO C/O	0.6	14
		22-Mar-09	01-Apr-09	FDMS volatile recovery or noisy	Unstable volatiles	10.5	252
Liverpool Speke							
PM10	61.80%	09-Jan-09	10-Feb-09	Communication fault	ENG C/O FDMS PM10 software corrupted	32.2	772
		02-Mar-09	04-Mar-09	ESU service		2.1	51
PM25	77.90%	09-Jan-09	26-Jan-09	Power cut	ENG C/O Power failure and rejection of data	17.3	414
		02-Mar-09	04-Mar-09	ESU service		2.1	51
London Bexley							
CO	81.90%	16-Feb-09	04-Mar-09	Instrument fault	ENG C/O CO analyser source warning - replaced sync. motor	16	384
London Bloomsbury							
CO	75.10%	19-Jan-09	09-Feb-09	Pump fault	ENG C/O Replaced seized pump	21	505
		26-Feb-09	27-Feb-09	ESU service		1.2	28
PM25	69.00%	11-Feb-09	11-Mar-09	FDMS drier	Cooler Fault fuses keep blowing to drier.	27.6	663
London Cromwell Road 2							

NO2	53.10%	15-Dec-08	11-Feb-09	Instrument fault	PMT failure and data rejection (AURN QC action)	58.7	1408
London Eltham							
NO2	64.90%	13-Jan-09	13-Feb-09	Pump fault		31.1	746
London Harlington							
PM10	84.20%	17-Jan-09	30-Jan-09	Instrument fault	Removed Teom PM10 Control Unit	12.4	298
		03-Mar-09	04-Mar-09	Unstable response	Period of unstable and negative data deleted	0.4	9
		31-Mar-09	01-Apr-09	Switched out-of-service	TEOM upgraded to FDMS	0.8	18
London Marylebone Road							
PM25	86.60%	19-Mar-09	30-Mar-09	Sampling fault	High noise after FDMS went online	11.5	275
London Marylebone Road PARTISOL							
PM10	86.70%	25-Jan-09	26-Jan-09		See Appendix 4	2	48
		03-Feb-09	04-Feb-09			2	48
		05-Mar-09	05-Mar-09			1	24
		11-Mar-09	12-Mar-09			2	48
		14-Mar-09	16-Mar-09			3	72
		22-Mar-09	23-Mar-09			2	48
PM25	72.20%	02-Jan-09	02-Jan-09		See Appendix 4	1	24
		08-Jan-09	08-Jan-09			1	24
		27-Jan-09	28-Jan-09			2	48
		31-Jan-09	18-Feb-09			19	456
		04-Mar-09	04-Mar-09			1	24
		11-Mar-09	11-Mar-09			1	24
London N. Kensington PARTISOL							
PM25	76.70%	11-Jan-09	12-Jan-09		See Appendix 4	2	48
		29-Jan-09	09-Feb-09			12	288
		11-Feb-09	16-Feb-09			6	144
		16-Mar-09	16-Mar-09			1	24
London Teddington							
NO2	29.10%	27-Jan-09	01-Apr-09	Instrument fault	Hot swap instrument also had faults	64.3	1543
London Westminster							
PM25	85.60%	08-Jan-09	19-Jan-09		See Appendix 4	12	288
		13-Mar-09	13-Mar-09			1	24
O3	88.40%	17-Feb-09	24-Feb-09	High noise	Audit + noisy +ervice	7	167
		15-Mar-09	18-Mar-09	Instrument fault	ENG C/O Very unstable. Replaced UV lamp	3.2	76
Manchester Piccadilly							
PM10	14.90%	14-Jan-09	15-Jan-09	No calibrations	Unstable after audit	1.6	39
NO2	76.50%	19-Dec-08	21-Jan-09	NO2 converter fault	Converter failure	33.1	795
Market Harborough							
CO	61.30%	20-Jan-09	09-Feb-09	Instrument fault	Analyser fault following SERVICE	20.3	487
		05-Mar-09	19-Mar-09	Instrument fault	IR Source fault following powercut	14.1	339
O3	89.50%	20-Jan-09	21-Jan-09	ESU service		1	25

		03-Mar-09	10-Mar-09	Sampling fault	Sample pump failure & powercut	6.5	157
		23-Mar-09	24-Mar-09	Sampling fault	Noisy data - sample filter fault	0.8	19
		25-Mar-09	25-Mar-09	Sampling fault	Noisy data - sample filter fault	0.3	8
Middlesbrough							
PM25	68.50%	21-Jan-09	17-Feb-09	ESU service		27.2	652
Newcastle Centre							
O3	58.30%	03-Feb-09	12-Mar-09	Instrument fault	HIgh data following Service	37.2	893
Northampton							
PM25	90.00%	18-Jan-09	22-Jan-09		See Appendix 4	5	120
		07-Feb-09	09-Feb-09			3	72
		23-Mar-09	23-Mar-09			1	24
Nottingham Centre							
PM25	89.50%	03-Jan-09	04-Jan-09	FDMS delta dew point < 4C	Delta dew was low	1	24
		05-Jan-09	07-Jan-09	FDMS delta dew point < 4C	Delta dew was low	1.5	35
		01-Feb-09	01-Feb-09	FDMS dew point too warm	external sample due point fell below 4 deg	0.3	7
		01-Feb-09	02-Feb-09	FDMS dew point too warm	external sample due point fell below 4 deg	0.3	8
		04-Feb-09	05-Feb-09	FDMS dew point too warm	external sample due point fell below 4 deg	0.4	10
		05-Feb-09	07-Feb-09	FDMS dew point too warm	external sample due point fell below 4 deg	1.4	34
		08-Feb-09	08-Feb-09	FDMS dew point too warm	external sample due point fell below 4 deg	0.3	8
		09-Feb-09	11-Feb-09	ESU service		2	47
		12-Feb-09	12-Feb-09	FDMS delta dew point < 4C	Delta dew too low	0.5	12
		29-Mar-09	29-Mar-09	Air Conditioning or Temp fault	external sample due point fell below 4 deg	0.6	14
Oxford St Ebbes							
PM10	67.70%	31-Dec-08	27-Jan-09	No mV data collected	FDMS started on 27th January	26.7	641
		30-Jan-09	31-Jan-09	Service		0.6	15
		01-Feb-09	02-Feb-09	FDMS volatile recovery or noisy	period of unstable data deleted	0.6	14
		06-Feb-09	06-Feb-09	FDMS volatile recovery or noisy	period of unstable data deleted	0.5	12
Plymouth Centre							
PM10	0.00%	04-Nov-08	30-Jun-09	Instrument fault	ENG C/O Found & cured leaks on both the main & aux. flows.	239	5725
NO2	64.00%	04-Nov-08	30-Jan-09	Monitoring suspended	ENG C/O Calibrated NOx and O3. Removed for upgrade	87.2	2092
		12-Feb-09	13-Feb-09	QAQC audit		0.7	16
O3	64.70%	04-Nov-08	30-Jan-09	Monitoring suspended	ENG C/O Calibrated NOx and O3. Removed for upgrade	87.1	2090
Preston							
PM10	29.30%	27-Jan-09	31-Jan-09	Monitoring suspended	Site finished end January 2009	4.6	110
PM25	62.80%	27-Jan-09	19-Feb-09	Instrument fault	Major leak at Feb 09 audit	23.5	563
NO2	41.70%	01-Dec-08	18-Feb-09	High noise	High noise unstable data unstable	79.5	1909

					baseline		
		26-Feb-09	28-Feb-09	Unstable response	Unstable baseline	3	72
		03-Mar-09	03-Mar-09	Unstable response	Unstable after power supply adjustment	0.6	15
		29-Mar-09	29-Mar-09	Unstable response	Unstable baseline	0.3	7
Rochester Stoke							
NO2	28.40%	15-Jan-09	19-Mar-09	NO2 converter fault	Converter fault - nulled by QC	63.1	1515
Salford Eccles							
NO2	68.70%	26-Jan-09	27-Jan-09	ESU service	GAP ALSO FOR SO2 CO O3 PM10	1	25
		26-Feb-09	03-Mar-09	No mV data collected	eng c/o FDMS installation	4.7	113
		10-Mar-09	31-May-09	Pump fault	Pressure too high and NO baseline too high	83	1992
Sandy Roadside							
PM10	67.30%	01-Jan-09	28-Jan-09	No mV data collected	ENG C/O TEOM PM10 System - FDMS UPGRADE Installed	27.4	658
		10-Feb-09	10-Feb-09	FDMS volatile recovery or noisy	Spurious volatile data	0.4	9
		17-Feb-09	18-Feb-09	QAQC audit	Rejection of unstable data.	1.3	31
Scunthorpe Town							
PM10	68.80%	09-Oct-08	27-Jan-09	Instrument fault	Major leak at audit	110	2639
		29-Mar-09	30-Mar-09	No mV data collected	No information	0.8	20
Sheffield Centre							
CO	75.00%	01-Jan-09	05-Jan-09	Instrument fault	Data very low and flat until Eng visit-deleted	4.6	110
		02-Feb-09	13-Feb-09	Instrument fault	Replaced with hot swop analyser	11.1	266
SO2	84.30%	31-Dec-08	08-Jan-09	Pump fault	pump fault reported 2nd Jan	8.3	199
		02-Feb-09	04-Feb-09	ESU service		2	48
		21-Mar-09	23-Mar-09	Flat response	Flat negative data deleted	1.8	44
		25-Mar-09	26-Mar-09	Switched out-of-service	ENG C/O system upgrade	1.3	30
		30-Mar-09	31-Mar-09	Instrument fault	Spurious data deleted	0.9	22
Sibton							
O3	84.70%	17-Sep-08	09-Jan-09	Sampling fault	3-Way valve fault - Nulled by QC	114	2741
		05-Feb-09	06-Feb-09	ESU service		1.1	26
		22-Mar-09	26-Mar-09	Unstable response	High erratic data deleted	4	96
Southend-on-Sea							
PM10	31.90%	30-Jan-09	31-Jan-09	Switched out-of-service	No information	2	48
Southwark Roadside							
NO2	0.00%	01-Jan-09	02-Jul-09		Site out of commission	183	4392
Stockton-on-Tees Eaglescliffe							
NO2	88.50%	01-Dec-07	26-Jan-09	Monitoring suspended	Site installed	423	10149
		25-Mar-09	26-Mar-09	ESU service	Converter borderline and Rcell very corroded	1.3	30
		31-Mar-09	03-Apr-09	ESU service	replaced converter and reaction cell	3.3	79

Sunderland Silksworth							
NO2	89.40%	27-Dec-08	05-Jan-09	Logger fault	No data collected	8.8	211
		15-Jan-09	15-Jan-09	QAQC audit		0.3	6
		19-Jan-09	20-Jan-09	No mV data collected	Suspected logger fault	1.3	31
		26-Jan-09	28-Jan-09	No mV data collected	Suspected logger fault	2	48
		16-Feb-09	17-Feb-09	Manifold fault		1	25
O3	89.40%	27-Dec-08	05-Jan-09	Logger fault	No data collected	8.8	210
		15-Jan-09	15-Jan-09	QAQC audit		0.3	6
		19-Jan-09	20-Jan-09	No mV data collected	Suspected logger fault	1.3	31
		26-Jan-09	28-Jan-09	No mV data collected	Suspected logger fault	2	48
		16-Feb-09	17-Feb-09	No mV data collected	Suspected logger fault	1	25
SO2	88.50%	11-Dec-08	05-Jan-09	High noise	Noisy	25.6	615
		05-Jan-09	06-Jan-09	Logger fault	ENG C/O Fixed logger	0.8	19
		15-Jan-09	15-Jan-09	QAQC audit		0.3	6
		19-Jan-09	20-Jan-09	No mV data collected	some negative data	1.3	31
		26-Jan-09	28-Jan-09	No mV data collected	Suspected logger fault	2	48
		16-Feb-09	17-Feb-09	No mV data collected	Suspected logger fault	1	25
Warrington							
PM10	76.00%	16-Feb-09	24-Feb-09	Power cut	Power cut then PM10 memory lost	8.3	198
		15-Mar-09	27-Mar-09	Power cut	C/O fixed PM10 memory loss after power cut	12.1	290
PM25	85.60%	16-Feb-09	19-Feb-09	Power cut		3.6	86
		15-Mar-09	23-Mar-09	Power cut		8.3	199
NO2	86.30%	16-Feb-09	20-Feb-09	Power cut		3.7	89
		15-Mar-09	23-Mar-09	Power cut		8.1	195
Wigan Centre							
PM25	46.90%	13-Jan-09	26-Feb-09	FDMS volatile recovery or noisy	Volatiles low after audit until repair 26 Feb	44.6	1071
		27-Mar-09	30-Mar-09	Instrument fault	Instrument fault following LSO visit	3	71
Wirral Tranmere							
PM10	30.50%	28-Jan-09	31-Jan-09	No mV data collected	Analyser converted to PM2.5	3.4	81
Yarner Wood							
NO2	78.10%	03-Jan-09	05-Jan-09	Power cut		1.7	40
		07-Jan-09	08-Jan-09	Power cut		1.2	29
		13-Jan-09	13-Jan-09	Power cut		0.3	6
		16-Jan-09	23-Jan-09	Power cut		7.2	173
		05-Mar-09	06-Mar-09	ESU service		1	25
O3	86.80%	03-Jan-09	05-Jan-09	Power cut		1.6	39
		07-Jan-09	08-Jan-09	Power cut		1.2	29
		13-Jan-09	13-Jan-09	Power cut		0.3	6
		16-Jan-09	23-Jan-09	Power cut		7.2	173
		05-Mar-09	06-Mar-09	ESU service		1	25

N Ireland

Belfast Centre

PM10	89.20%	06-Jan-09	13-Jan-09	High noise	High noise due to sample pump fault	7.2	172
		17-Feb-09	19-Feb-09	ESU service		2.3	54

Derry

PM25	0.00%	01-Sep-08	28-Feb-09	FDMS volatile recovery or noisy	Drier fault suspected	181	4344
NO2	59.40%	23-Feb-09	09-Apr-09	QAQC audit		44.8	1076

Scotland

Aberdeen

PM25	57.40%		28-Feb-09		Site started		
		03-Mar-09	03-Mar-09	High noise	Noisy response	0.6	14
		04-Mar-09	05-Mar-09	High noise	Noisy response	1.1	27
		13-Mar-09	13-Mar-09	High noise	Noisy response	0.4	9
		16-Mar-09	21-Mar-09	ESU service		5	119
		31-Mar-09	31-Mar-09	High noise	Noisy response	0.3	8
O3	84.00%	18-Feb-09	03-Mar-09	Instrument fault	Eng c/o for pump fault	13	313
		16-Mar-09	17-Mar-09	ESU service		1.1	26

Bush Estate

NO2	72.30%	12-Jan-09	26-Jan-09	Sampling fault	internal samplng after service.	14.1	338
		06-Feb-09	13-Feb-09	Instrument fault	NOx baseline low after LSO cal	7.1	170

Edinburgh St Leonards

CO	89.00%	06-Jan-09	08-Jan-09	ESU service		1.9	45
		19-Feb-09	27-Feb-09	Instrument fault	Unreliable data following LSO cal.	7.9	189

Fort William

NO2	60.50%	28-Jan-09	04-Mar-09	ESU service	Internal sampling	35.2	844
O3	60.60%	28-Jan-09	04-Mar-09	ESU service	Internal sampling	35.2	845

Glasgow Centre

CO	84.90%	28-Jan-09	30-Jan-09	ESU service		2	48
		18-Feb-09	27-Feb-09	Instrument fault	ENG C/O System Upgrade.	9.1	219
PM10	30.10%	16-Dec-08	04-Mar-09	Monitoring suspended	FDMS installed at site upgrade	78.3	1878
NO2	65.00%	26-Nov-08	30-Jan-09	NO2 converter fault	NOx converter failure	65	1559
		26-Feb-09	28-Feb-09	Instrument fault	Eng C/O for system upgrade - erroneous data	1.6	39

Wales

Aston Hill

NO2	84.50%	19-Mar-09	21-Mar-09	Power cut		2.3	56

Cardiff Centre

CO	85.00%	26-Dec-08	11-Jan-09	Autocal run-on	CO pump fault	16.6	399
		23-Feb-09	25-Feb-09	ESU service		2.2	52

Narberth

NO2	88.40%	19-Jan-09	22-Jan-09	Switched out-of-service	Ambirack pc replaced	2.6	62
		03-Mar-09	05-Mar-09	ESU service		2	49

		19-Mar-09	20-Mar-09	Power cut	Suspect powercut - info requested from BV.	0.7	17
Swansea Roadside							
PM25	77.60%	03-Jan-09	04-Jan-09	FDMS delta dew point < 4C	Data deleted	1.3	31
		05-Jan-09	07-Jan-09	FDMS delta dew point < 4C	Data deleted	1.9	46
		01-Feb-09	02-Feb-09	FDMS delta dew point < 4C	Data deleted	1.3	30
		18-Feb-09	04-Mar-09	Instrument fault	Failed leak test. Tube to splitter was loose after audit.	14	337
		29-Mar-09	29-Mar-09	FDMS delta dew point < 4C	Data deleted	0.8	18

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, March 2009

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 (now beyond economic repair) 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 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 2009

AURN Partisol Data: January-March 2009

Partisol data were reviewed for the following sites and measurement periods. As of August 2009 the first quarter 2009 Partisol data has not been fully ratified.

Site	Start date	End date	Provisional Data Capture, %
Auchencorth Moss PM_{10}	1st Jan	31st Mar	94.4
Auchencorth Moss $PM_{2.5}$	1st Jan	31st Mar	97.7
Bournemouth $PM_{2.5}$	1st Jan	31st Mar	97.7
Brighton Preston Park $PM_{2.5}$	1st Jan	31st Mar	80.0
Harwell PM_{10}	1st Jan	31st Mar	80.0
Harwell $PM_{2.5}$	1st Jan	31st Mar	92.2
Inverness PM_{10}	1st Jan	31st Mar	95.5
Inverness $PM_{2.5}$	1st Jan	31st Mar	96.6
London Marylebone Road PM_{10}	1st Jan	31st Mar	86.6
London Marylebone Road $PM_{2.5}$	1st Jan	31st Mar	72.2
London N Kens PM_{10}	1st Jan	31st Mar	96.6
London N Kens $PM_{2.5}$	1st Jan	31st Mar	76.6
London Westminster $PM_{2.5}$	1st Jan	31st Mar	86.5
Northampton $PM_{2.5}$	1st Jan	31st Mar	90.0
Port Talbot Margam $PM_{2.5}$	1st Jan	31st Mar	98.8
Wrexham PM_{10}	1st Jan	31st Mar	95.6

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 PM_{10} and $PM_{2.5}$ datasets "track" each other.
- 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.

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.

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 1out 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".

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 m^3/h) and the leakage must be < 5%.

Site Audits – Winter 2008 and Summer 2009 periods.

Site	Audit date	Flowrate m^3/h	% out from 16.7 m^3/h	Leak test %
Auchencorth Moss PM_{10} (serial no. 21550)	10 Dec 2008 1 Jul 2009	16.7 17.2	0 3.42	Not recorded
Auchencorth Moss $PM_{2.5}$ (serial no. 21548)	10 Dec 2008 1 Jul 2009	0 16.6	100 -0.54	Not recorded
Bournemouth PM_{10} (serial no. 21257)	06 Aug 2008 11 Feb 2009	16.64 16.90	-0.18 1.38	Not recorded
Brighton Preston Park $PM_{2.5}$	02 Sep 2008 02 Mar 2009	Partisol not audited. 16.62	- -0.3	- "pass"
Harwell PM_{10}	23 Feb 2009	16.99	1.92	"pass"
Harwell $PM_{2.5}$	26 Aug 2008 23 Feb 2009	16.7 16.86	- 1.14	- "pass"
Inverness PM_{10} (serial no. 21255)	25 Jun 2008 05 Feb 2009	16.76 16.7	0.54 0	"pass" not recorded
Inverness $PM_{2.5}$ (serial no. 21861)	25 Jun 2008 05 Feb 2009	16.58 16.7	0.78 0	"pass" not recorded
London Marylebone Road PM_{10} (serial no. 21306)	11 Aug 2008 17 Feb 2009	Partisols not working. 17.2	- 2.9	- Not recorded
London Marylebone Road $PM_{2.5}$ (serial no. 21493)	11 Aug 2008 17 Feb 2009	Partisols not working. PM_{10} Partisol not working.	- -	- -
London N Kens PM_{10} (serial no. 21722)	22 Jul 2008 6 Mar 2009	Partisol not audited? Not tested ladder access unsafe	-	-
London N Kens $PM_{2.5}$	22 Jul 2008 6 Mar 2009	Partisol not audited "Not tested ladder access unsafe"	- -	- -
London Westminster PM_{10}	13 Aug 2008 18 Feb 2009	16.10 not tested – ladder access unsafe.	-3.42 not tested	NOT RECORDED Not tested.
Northampton $PM_{2.5}$	19 Feb 2009	Not tested ladder access unsafe.	-	-
Port Talbot Margam $PM_{2.5}$	15 Jul 2008 19 Feb 2009	17.17 not tested	2.80 not tested	"pass" not tested
Wrexham (serial no. 212240)	11 Aug 2008 10 Feb 2009	15.93 not tested	-4.44 not tested	NOT RECORDED Broke down

Where Partisols were audited, the results were normal. However, not all Partisols were actually audited in the winter 2009 round, and few were leak-tested.

- Brighton Preston Park: Partisol not included in August site audit, on advice of LSO.
- Neither of the London Marylebone Rd. Partisols not working at time of August site audit. The $PM_{2.5}$ Partisol was not working at the time of the winter 2009 audit.
- London N. Ken. Partisols were not checked at either audit, because ladder access was deemed to be unsafe by the member of the field team.
- London Westminster: leak test result not recorded at August audit. Not checked at winter 2009 audit because ladder access was deemed to be unsafe.
- Northampton: not checked at winter 2009 audit because ladder access was deemed to be unsafe.
- Port Talbot Margam not tested (reason not recorded).
- Wrexham: Partisol broke down during winter 2009 leak test.

It is recommended that if a test is missed for any reason, the reason should be recorded on the audit sheet. It is a matter of some concern that there is no safe ladder access at so many of the Partisol sites. Also, leak test results should be recorded, not just pass/fail.

Auchencorth Moss

The filter material was changed from quartz to Emfab on 22nd Jan.

PM_{10}: Data capture was 94.4% for this quarter. Data losses as follows:

- 11th Jan – filter mass increase < field blank , so no corrected value.
- 14th Jan - < 18h sampling.
- 2nd – 4th Feb – Partisol not operating.

$PM_{2.5}$: Data capture was 97.7% for this quarter.

- 6th Jan, 14th Jan - < 18m^3 sampled.
- 8th Mar – filter mass increase < field blank, so no corrected value.

This is the 2nd consecutive quarter with <90% data capture for the $PM_{2.5}$ Partisol at this site, due to filter exchange failures etc.

Field blank corrected value after change to Emfab filters followed co-located FDMS closely for both $PM_{2.5}$ and PM_{10}.

Bournemouth

This Partisol was formerly measuring PM_{10} but was converted to $PM_{2.5}$ at the end of 2008. Data capture was 97.7% for this quarter. Data losses as follows:

- 23rd & 26th Feb: vol < 1m^3 or time < 18h.

$PM_{2.5}$ levels at this site track those at Southampton FDMS.

Brighton Preston Park

$PM_{2.5}$ only: Data capture was 80% for this quarter. The filter material changed to Emfab on 25th Jan, but the first valid data using Emfab filters was 7th Feb (at the end of a breakdown period due to vandalism).

- 15th Jan - < 18h sampled
- 25th Jan – 5th Feb – unit vandalised.
- 3rd – 11th Mar – Delayed filter change
- 27th Mar - < 18h sampling.

$PM_{2.5}$ levels at this site also track those at Southampton FDMS.

Harwell

The filter material changed to Emfab on 29th Jan.

PM_{10}: Data capture 80%. Data losses:

- 19th – 20th Jan: Partisol malfunction.
- 13th – 18th Feb: comms problem.
- 4th – 10th Mar: unspecified Partisol fault.
- 12th & 23rd Mar: < 18m^3 sampled

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

- 15th Jan: < 18m^3 sampled
- 29th Jan – 2nd Feb – filter jam
- 12th Mar: < 18m^3 sampled

Both PM parameters track those at Oxford St Ebbes, despite the latter being an urban site and Harwell being rural.

Inverness

Filter material changed to Emfab on 21st Jan.

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

- 5th – 6th Feb: delayed filter change
- 6th Mar: errors in initial weighing

$PM_{2.5}$: Data capture = 97%. Data losses:

- 5th – 6th Feb: delayed filter change
- 6th Mar: < 18m^3 sampled

Much better reliability this quarter than last. Reasonable correlation with FDMS TEOM at Edinburgh St Leonards: peaks correspond.

London Marylebone Road

Filter material changed to Emfab on 22nd Jan.

PM_{10}: Data capture = 87%. Data losses:

- 25th – 26th Jan: unspecified Partisol fault, <.18m^3 sampled
- 3rd – 4th Feb: filter exchange failure.
- 5th, 11th – 12th Mar & 14th – 16th Mar, 23rd – 24th Mar: unspecified Partisol fault, < 18m3/18h.

$PM_{2.5}$: Data capture 72%. Data losses:

- 27th – 28th Jan: unspecified Partisol fault, < 18m^3 sampled
- 31st Jan – 18th Feb – filter exchange failure & flow failure.
- 4th & 11th Mar: unspecified Partisol fault, <.18m^3 sampled

Good match with co-located FDMS data.

London North Kensington

Filters changed to Emfab on 15th Jan.
PM_{10}: data capture 97%. Data losses:

- 13th Feb delayed filter changeover
- 15th & 16th Mar Partisol apparently not functioning.

Note: no blank filters available until 12th Feb.

$PM_{2.5}$: Data capture was 77%. Data losses:

- 11th – 12th Jan: Partisol apparently not functioning.
- 29th Jan – 18th Feb: filter exchange failure & pump bearing failure.
- 16th Mar: unspecified Partisol fault, < 18m3/18h.

Both parameters showed a good match with co-located FDMS.

London Westminster

Filters changed to Emfab on 23rd Jan. This Partisol now measures $PM_{2.5}$ not PM_{10}. Data capture = 87%. Data losses:

- 8th – 19th Jan: Partisol not functioning.
- 13th Mar: < 18m^3 sampled

No blank correction 5th – 19th Feb, and 6th Mar onwards. Tracks London Bloomsbury FDMS very well.

Northampton

Filters changed to Emfab on 21st Jan.
$PM_{2.5}$: Data capture was 90%. Data losses:

- 18th – 22nd Jan: Partisol not functioning.
- 7th – 9th Feb: Partisol not functioning.
- 23rd Mar : error in initial weighing.

Peaks in $PM_{2.5}$ track those at Nottingham Centre.

Port Talbot Margam

Filters changed to Emfab on 22nd Jan.
$PM_{2.5}$ only: data capture = 99%. Data losses:

- 25th Feb – filter exchange failure.

Data match co-located FDMS well.

Wrexham

Filters changed to Emfab on 4th Feb. Data capture was 96%. Data losses:

- 20th Jan: < 18m^3 sampled
- 10th Feb – sand on filter
- 31st Mar: unspecified fault.

Data track Warrington FDMS.

Appendix 5

Site Details for New Sites

Site Name	DEFRA	Pollutants	Grid	East	North	Latitude	Longitude	Altitude m	Type	Agglomeration
Birmingham Tyburn Roadside	Affiliated	NO_2 O_3 PM_{10} $PM_{2.5}$	SP 11556 90456	411556	290456	52 30 43.9N	01 49 51.1W	93	ROAD SIDE	West Midlands Urban Area

Appendix 6

Certificate of Calibration

AEA

CERTIFICATE OF CALIBRATION

551.11, Harwell, Didcot, Oxfordshire OX11 0QJ. Telephone 0870 1906465 Fax 0870 1906377

UKAS CALIBRATION 0401

Certificate Number: 02128
AEA Identification Number: ED42523030

Approved Signatories: K. Stevenson
S. Eaton

Signed:

Date of issue: 10 September 2009

Customer Name and Address: Dr Emily Nicholl

AEQ Division Area 3C Ergon House
C/O Nobel House
17 Smith Square
London SW1P 3JR

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

1. Northern Ireland Sites (including Mace Head)

Carbon Monoxide

Date Year = 2009	Site	Analyser number	[1]Zero output	Uncertainty (ppm)	[2]Calibration Factor	Uncertainty (%)	*Maximum Residual (%)
10-Feb	Belfast Centre	m1811-m491	50	0.3	0.051	3	2.3

Sulphur Dioxide

Date Year =2009	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)	*m-xylene interference (ppb)
10-Feb	Belfast Centre	m637	285	4	0.211	6.8	0.7	24.3
23-Feb	Derry	1697	18	4.2	1.099	7.1	2.7	17.8

Ozone

Date Year =2009	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)
10-Feb	Belfast Centre	m1626-m335	230	5	0.104	3.1	2.3
23-Feb	Derry	1586	0	5	0.974	3.3	1.2
06-Feb	Lough Navar	337	-1	5	0.538	4.0	1.0
24-Feb	Mace Head	77490-386	1	5	0.996	3.1	0.6

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.

The certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceabililty of measurement to recognised national standards, an d to units of measurements 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.

CERTIFICATE OF CALIBRATION

0401

551.11, Harwell, Didcot, Oxfordshire OX11 0QJ. Telephone 0870 1906465 Fax 0870 1906377

Certificate Number: 02128
AEA Identification Number: ED42523030

Oxides of Nitrogen

Date Year =2009	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
10-Feb	Belfast Centre	NO NOx	m1804- m733	248 255	5 5.3	0.405 0.413	5 5.1	2.5 3.4	96.0
23-Feb	Derry	NO NOx	2130	4 12	5 5.6	1.258 1.316	5 5	0.4 0.1	97.5

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 (%)
10-Feb	Belfast Centre	PM10	24423	14263	1	0.5	3.00	2.2	15.95	2.2
10-Feb	Belfast Centre	PM25	26565	15574	1	-1.0	3.05	2.2	16.02	2.2
23-Feb	Derry	PM10	21313	10797	1	-0.9	3.05	2.2	15.54	2.2
23-Feb	Derry	PM25	Not in	operation						
06-Feb	Lough Navar	PM10	21196	12890	1	0.6	not	measured	15.51	2.2

2. Scottish Sites

Carbon Monoxide

Date Year = 2009	Site	Analyser number	[1]Zero output	Uncertainty (ppm)	[2]Calibration Factor	Uncertainty (%)	*Maximum Residual (%)
17-Dec	Edinburgh St Leonards	240	-1	0.3	1.040	3	1.2
26-Jan	Glasgow Centre	241	14	Not evaluated	0.053	not	evaluated

Sulphur Dioxide

Date Year =2009	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)	*m-xylene interference (ppb)
17-Dec	Edinburgh St Leonards	71	13	4.1	0.883	5	0.6	17.5
26-Jan	Glasgow Centre		11	4.2	0.199	7.3	5.2	0.9
28-Jan	Grangemouth	703B-274	0	4.4	0.897	15.2	5.1	15.1

Ozone

Date Year =2009	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)
04-Feb	Aberdeen	800	0	5	1.032	3.8	0.8
10-Dec	Auchencorth Moss	721	0	5	0.975	3.1	2.8
16-Dec	Bush Estate	77087-385	11	5	0.503	3.1	0.6
17-Dec	Edinburgh St Leonards	136	-2	5	1.278	3.1	0.6
23-Jan	Eskdalemuir	158	23	5	0.445	3.2	1.2
04-Mar	Fort William	1023	0	5	0.993	3.2	0.5
26-Jan	Glasgow Centre		0	5	0.194	3.2	1.9
25-Feb	Lerwick	841B-176	-1	5	0.905	3.6	2.9
26-Feb	Strath Vaich	801	0	5	1.011	3.1	0.6

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

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UKAS CALIBRATION 0401

Certificate Number: 02128
AEA Identification Number: ED42523030

Oxides of Nitrogen

Date Year =2009	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
04-Feb	Aberdeen	NO	519	0	5	1.429	5	1.5	
		NOx		0	5.4	1.423	5	1.5	96.7
04-Feb	Aberdeen Union Street Roadside	NO	984	1	5	1.635	5	2.2	
		NOx		1	5.7	1.663	5	1.9	101.1
16-Dec	Bush Estate	NO	58112-316	12	5	0.963	5	1.8	
		NOx		12	5.3	0.955	5	2.0	98.0
21-Jan	Dumfries	NO	356	3	5	0.972	5	0.2	
		NOx		2	5.3	0.976	5	0.4	96.9
17-Dec	Edinburgh St Leonards	NO	73	0	8.2	7.836	5	1.7	
		NOx		0	9.6	8.065	5	1.2	100.0
23-Jan	Eskdalemuir	NO	347	9	5	1.070	5	2.5	
		NOx		9	5.5	1.181	5	2.5	97.9
21-Jan	Fort William	NO	344	2	5	0.747	5	1.5	
		NOx		1	5.3	0.747	5	1.1	99.1
26-Jan	Glasgow Centre	NO		-5	5	0.578	5	1.0	
		NOx		-10	5.2	0.579	5	0.6	90.4
27-Jan	Glasgow City Chambers	NO	575	-1	5	1.911	5	0.4	
		NOx		-1	5.6	1.923	5	0.6	97.8
26-Jan	Glasgow Kerbside	NO		-11	5	1.572	5	1.0	
		NOx		-11	6.3	1.590	5	1.0	96.4
28-Jan	Grangemouth	NO	700B-312	1	5	1.047	5	3.3	
		NOx		2	5.4	1.060	5	3.6	104.0
05-Feb	Inverness	NO	1489	0	5	1.121	5	2.1	
		NOx		2	5.5	1.129	5	2.0	95.1

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	Aberdeen	PM10	24427	11561	1	-0.1	**2.80**	2.2	**12.73**	2.2
10-Dec	Auchencorth Moss	PM10	26039	12985	1	-1.6	2.96	2.2	16.40	2.2
10-Dec	Auchencorth Moss	PM25	26033	13738	1	-2.0	2.93	2.2	15.59	2.2
10-Dec	Auchencorth Moss Partisol	PM10	21550						16.68	2.2
10-Dec	Auchencorth Moss Partisol	PM25	21548						Not in	service
17-Dec	Edinburgh St Leonards	PM10	21308	11490	1	-0.7	3.15	2.2	16.33	2.2
17-Dec	Edinburgh St Leonards	PM25	27233	16954	1	-0.3	3.21	2.2	16.40	2.2
26-Jan	Glasgow Centre	PM10	Not in	operation						
26-Jan	Glasgow Centre	PM25	22980	13098	1	-0.4	3.09	2.2	16.25	2.2
26-Jan	Glasgow Kerbside	PM10	21264	12540	1	-0.6	2.05	2.2	16.31	2.2
28-Jan	Grangemouth	PM10	22763	11212	1	-2.0	3.15	2.2	17.64	2.2
28-Jan	Grangemouth	PM25	27259	13569	1	-1.4	2.94	2.2	15.81	2.2
05-Feb	Inverness	PM10	21225						16.58	2.2

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0401

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Certificate Number: 02128
AEA Identification Number: ED42523030

3. Welsh Sites

Carbon Monoxide

Date Year = 2009	Site	Analyser number	[1]Zero output	Uncertainty (ppm)	[2]Calibration Factor	Uncertainty (%)	*Maximum Residual (%)
17-Feb	Cardiff Centre	14333	-1	0.3	1.020	3	3.1
18-Feb	Port Talbot Margam	10787	55	0.3	0.050	3	1.6

Sulphur Dioxide

Date Year =2009	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)	*m-xylene interference (ppb)
17-Feb	Cardiff Centre	14319	11	4.2	1.273	6.1	1.9	0.0
16-Feb	Narberth	aea26	64	4.1	0.672	5.7	1.8	6.1
18-Feb	Port Talbot Margam	11669	8	4.2	1.000	6.2	2.7	14.0
10-Feb	Wrexham	12183	2	4.2	0.957	5	0.4	10.4

Ozone

Date Year =2009	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)
28-Jan	Aston Hill	14337	9	5	0.488	3.1	0.8
17-Feb	Cardiff Centre	14348	-3	5	0.970	3.1	0.7
19-Feb	Cwmbran	2	1	5	0.983	3.1	1.4
16-Feb	Narberth	aea27	0	5	1.012	3.2	1.9
18-Feb	Port Talbot Margam	94754	3	5	0.498	3.1	3.0

Oxides of Nitrogen

Date Year =2009	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
28-Jan	Aston Hill	NO	m853	101	5	1.205	5	1.5	
		NOx		100	5.3	1.179	5	1.1	95.2
17-Feb	Cardiff Centre	NO	14325	1	5	1.342	5	3.9	
		NOx		2	5.4	1.341	5	0.3	102.3
21-Jan	Chepstow A48	NO		100	5	1.146	5	1.4	
		NOx		104	5.3	1.170	5	1.2	99.5
19-Feb	Cwmbran	NO	1	-1	5	1.002	5	1.5	
		NOx		-1	5.3	0.977	5	1.5	97.4
16-Feb	Narberth	NO	aea25	91	5	0.510	5	4.8	
		NOx		94	5.2	0.524	5	3.8	101.1
21-Jan	Newport	NO	M671	1	5	0.945	5	1.3	
		NOx		3	5.3	0.960	5	1.1	96.9
18-Feb	Port Talbot Margam	NO	94617	0	5	1.375	5	3.6	
		NOx		2	5.4	1.377	5	0.9	100.6
18-Feb	Swansea Roadside	NO	16695	1	5	1.197	5	0.4	
		NOx		3	5.3	1.165	5	1.6	99.5
10-Feb	Wrexham	NO	12185	3	5	1.296	5	0.5	
		NOx		6	5.4	1.325	5	0.4	98.2

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

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 (%)
17-Feb	Cardiff Centre	PM10	24449	10933	1	-0.6	3.05	2.2	15.32	2.2
17-Feb	Cardiff Centre	PM25	26499	13621	1	-1.9	3.01	2.2	15.57	2.2
21-Jan	Chepstow A48	PM10	2128	10647	1	0.1	**3.04**	2.2	**13.86**	2.2
16-Feb	Narberth	PM10	21143	12574	1	0.7	**2.87**	2.2	**14.86**	2.2
21-Jan	Newport	PM10	22589	11871	1	-1.0	**3.05**	2.2	**13.27**	2.2
21-Jan	Newport	PM25	27252	15843	1	-1.2	2.99	2.2	15.57	2.2
18-Feb	Port Talbot Margam	PM10	22588	14458	1	-0.2	2.90	2.2	15.76	2.2
18-Feb	Port Talbot Margam	PM25	25081	10448	1	-1.4	not	measured	16.10	2.2
18-Feb	Port Talbot Margam Partisol	PM10							17.30	2.2
18-Feb	Swansea Roadside	PM10	26293	15357	1	-1.5	**3.15**	2.2	**13.93**	2.2
18-Feb	Swansea Roadside	PM25	26292	14203	1	-1.6	**3.11**	2.2	**13.52**	2.2
10-Feb	Wrexham	PM10	40001	instrument	fault on	arrival				

4. London Sites

Carbon Monoxide

Date Year = 2009	Site	Analyser number	[1]Zero output	Uncertainty (ppm)	[2]Calibration Factor	Uncertainty (%)	*Maximum Residual (%)
23-Feb	London Bexley	14871	0	0.3	0.998	3	1.9
19-Feb	London Bloomsbury	14330	0	0.3	0.909	3	3.4
04-Feb	London Cromwell Road 2	10776	2	0.3	0.051	3	0.7
17-Feb	London Marylebone Road	10072	0	0.3	1.001	3	0.8
06-Mar	London N. Kensington	360	3	0.3	1.090	3	4.0
18-Feb	London Westminster	867	5	0.3	0.051	3	0.3
25-Feb	Tower Hamlets Roadside	272	12	0.3	0.793	3	2.4

Sulphur Dioxide

Date Year =2009	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)	*m-xylene interference (ppb)
23-Feb	London Bexley	14869	-4	4.3	1.034	5	1.0	17.1
19-Feb	London Bloomsbury	14323	14	4.2	1.157	6.3	1.7	12.7
04-Feb	London Cromwell Road 2	10779	-2	4.3	0.958	10.0	4.9	3.5
17-Feb	London Marylebone Road	10071	5	4.2	1.061	8.8	2.9	14.3
06-Mar	London N. Kensington	1020	60	4.3	1.536	5.6	2.5	29.2
18-Feb	London Westminster	705	-6	11.4	0.661	7.1	2.1	6.2

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0401

551.11, Harwell, Didcot, Oxfordshire OX11 0QJ. Telephone 0870 1906465 Fax 0870 1906377

Certificate Number: 02128
AEA Identification Number: ED42523030

Ozone

Date Year =2009	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)
19-Feb	London Bloomsbury	14907	-1	5	1.074	3.5	1.9
12-Feb	London Eltham	375	8	5	0.993	3.3	0.9
03-Feb	London Haringey	538	10	5	0.975	3.4	3.2
02-Feb	London Harlington	14309	0	5	1.077	3.2	0.9
20-Jan	London Hillingdon	12	5	5	0.092	5.6	5.1
17-Feb	London Marylebone Road	10074	-1	5	1.041	3.1	1.0
06-Mar	London N. Kensington	497	11	5	0.988	3.1	0.4
02-Mar	London Teddington	320	13	5	0.900	3.2	0.5
18-Feb	London Westminster	879	2	5	0.495	3.2	3.4

Oxides of Nitrogen

Date Year =2009	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
16-Feb	Camden Kerbside	NO NOx	623	2 8	5 5.7	1.151 0.930	5 5	0.4 0.7	97.5
03-Feb	Haringey Roadside	NO NOx	397	2 2	5 5.3	0.867 0.915	5 5	2.1 1.6	94.9
23-Feb	London Bexley	NO NOx	14870	2 5	5 5.5	0.882 0.886	5 5	1.6 1.7	98.0
19-Feb	London Bloomsbury	NO NOx	14328	1 3	5 5.5	1.127 1.124	5 5	1.1 1.8	95.6
04-Feb	London Cromwell Rd 2	NO NOx	10775	0 -1	6.2 7.8	5.709 5.750	5 5	2.4 3.2	97.5
12-Feb	London Eltham	NO NOx	307	2 8	5 5.2	0.705 0.633	5 5	0.2 1.3	100.3
03-Feb	London Haringey	NO NOx	11392	1 2	5 5.4	1.170 1.182	5 5	1.5 1.7	98.5
02-Feb	London Harlington	NO NOx	11491	0 -1	5 5.4	1.363 1.373	5 5	1.2 1.2	98.4
20-Jan	London Hillingdon	NO NOx	10	-115 -102	5 5.4	0.434 0.449	5 5	4.2 4.1	99.4
17-Feb	London Marylebone Rd	NO NOx	10072	1 0	5 5.6	1.966 1.989	5 5	5.2 4.8	95.6
06-Mar	London N. Kensington	NO NOx	459	3 6	5 5.4	1.079 1.075	5 5	1.4 1.0	100.4
02-Mar	London Teddington	NO NOx	13067	26 21	5 5.2	0.675 0.663	5 5	2.3 2.5	98.7
18-Feb	London Westminster	NO NOx	573	2 1	5 6.3	3.417 3.485	5 5	0.9 2.6	100.0
25-Feb	Tower Hamlets Roadside	NO NOx	306	2 8	5 5.4	1.122 1.021	5 5	1.1 2.0	97.3

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

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 (%)
16-Feb	Camden Kerbside	PM10	21152	16511	1	0.6	3.24	2.2	11.98	2.2
03-Feb	Haringey Roadside	PM10	9407	13730	1	0.5	2.87	2.2	7.45	2.2
23-Feb	London Bexley	PM25	25007	11615	1	0.2	3.05	2.2	16.33	2.2
19-Feb	London Bloomsbury	PM10	24446	13737	1	0.0	3.07	2.2	15.72	2.2
19-Feb	London Bloomsbury	PM25	no	analyser	deployed					
12-Feb	London Eltham	PM25	27048	13982	1	1.2	3.00	2.2	16.22	2.2
02-Feb	London Harlington	PM10	22835	14251	1	0.3	not	tested	not	tested
02-Feb	London Harlington	PM25	23959	instrument	fault	not	tested			
17-Feb	London Marylebone Road	PM10	21306	13402	1	0.5	3.31	2.2	16.38	2.2
17-Feb	London Marylebone Road	PM25	21493	17605	1	0.9	2.97	2.2	17.60	2.2
17-Feb	London Marylebone Road Partisol	PM10	414719 611						17.20	2.2
17-Feb	London Marylebone Road Partisol	PM25		analyser	fault					
06-Mar	London N. Kensington	PM10	21722	11273	1	-0.6	3.04	2.2	16.34	2.2
06-Mar	London N. Kensington	PM25	21342	15817	1	0.2	**2.98**	2.2	**13.37**	2.2
02-Mar	London Teddington	PM25	27265	15263	1	-0.7	3.03	2.2	15.43	2.2
18-Feb	London Westminster	PM25		analyser	not	tested	access	unsafe		

5. English Sites

Carbon Monoxide

Date Year = 2009	Site	Analyser number	[1]Zero output	Uncertainty (ppm)	[2]Calibration Factor	Uncertainty (%)	[*]Maximum Residual (%)
06-Mar	Bristol Old Market	10429	0	0.3	0.986	3	4.6
03-Mar	Bristol St Paul's	14417	0	0.3	0.996	3	3.7
12-Jan	Bury Roadside	277	-1	0.3	1.042	3	2.4
12-Jan	Hull Freetown	m1809-m409	52	0.3	0.051	3	0.9
14-Jan	Leeds Centre	207-003	0	0.3	1.029	3	1.4
03-Feb	Leicester Centre		0	0.3	1.032	3	0.3
09-Feb	Liverpool Speke	M1807-M487	50	0.3	0.050	3	1.0
15-Jan	Market Harborough	60893	240	0.3	0.005	6.9	0.4
13-Jan	Middlesbrough	14202	2	0.3	0.951	3	2.2
12-Jan	Newcastle Centre	m1808-m488	52	0.3	0.049	3	0.7
12-Jan	Salford Eccles	2386	0	0.3	0.994	3	5.7
26-Jan	Sheffield Centre	-6	4	0.3	0.062	3	1.2
24-Feb	Southampton Centre	me	7	0.3	0.048	3	2.8

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.

CERTIFICATE OF CALIBRATION

0401

551.11, Harwell, Didcot, Oxfordshire OX11 0QJ. Telephone 0870 1906465 Fax 0870 1906377

Certificate Number: 02128

AEA Identification Number: ED42523030

Date Year = 2009	Site	Analyser number	[1]Zero output	Uncertainty (ppm)	[2]Calibration Factor	Uncertainty (%)	*Maximum Residual (%)
26-Feb	St Osyth	60872	416	0.3	0.004	8.0	7.9

Sulphur Dioxide

Date Year =2009	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)	*m-xylene interference (ppb)
14-Jan	Barnsley 12	10781	1	4.2	1.077	5.7	0.5	10.8
14-Jan	Barnsley Gawber		99	4.5	1.318	7.2	2.4	17.5
12-Feb	Birmingham Tyburn		2	4.3	0.977	5.2	1.4	0.7
03-Mar	Bristol St Paul's	14332	21	4.2	1.059	5	1.0	12.7
23-Feb	Harwell	83	11	4.1	0.490	5.4	1.7	11.8
12-Jan	Hull Freetown	m686	248	4.1	0.191	7.6	4.9	9.9
29-Jan	Ladybower	mso3/05	54	4.1	0.728	6.4	2.5	24.0
28-Jan	Leamington Spa	1793	3	4.1	0.855	5.5	0.5	21.0
14-Jan	Leeds Centre	214004	1	4.2	1.203	5.9	0.8	1.4
03-Feb	Leicester Centre		1	4.1	0.937	5	3.0	1.2
28-Jan	Leominster	14352	1	4.2	1.050	6.5	3.7	9.5
09-Feb	Liverpool Speke	M626	263	4.4	0.318	9.1	3.7	14.5
09-Mar	Lullington Heath	m690	101	4.1	0.500	6.1	3.2	2.5
13-Jan	Middlesbrough	14166	9	4.2	0.984	9.5	2.8	12.6
12-Jan	Newcastle Centre	M689	50	4.4	1.101	7.4	5.0	21.5
19-Feb	Northampton	890563033	3	4.1	0.772	5	1.8	1.5
27-Jan	Nottingham Centre	a	8	4	0.193	5.5	0.4	3.3
05-Mar	Rochester Stoke	414	-5	4.4	1.255	5.4	3.1	9.0
12-Jan	Salford Eccles	2346	2	4.2	1.071	6.9	4.5	9.6
04-Mar	Sandwell West Bromwich	14322	1	4.2	1.032	7.8	2.2	6.4
13-Jan	Scunthorpe Town	468	-2	4.2	1.154	6.5	1.9	0.0
26-Jan	Sheffield Centre	-15	33	4	0.172	5	1.4	-0.9
24-Feb	Southampton Centre		524	4	0.073	5	1.2	18.0
05-Mar	Stanford-le-Hope Roadside	14188	3	4.2	1.092	5.6	0.2	6.6
15-Jan	Sunderland Silksworth	996b-382	2	4.4	1.169	8.4	5.0	22.8
25-Feb	Thurrock	10554	3	4.3	1.023	5	0.8	10.7
20-Jan	Wicken Fen	14349	-12	4.1	0.481	6.1	2.8	4.3

Ozone

Date Year =2009	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)
14-Jan	Barnsley Gawber		0	5	1.007	3.3	3.6
09-Jan	Birmingham Centre	14357	-13	5	0.107	3.2	0.8
12-Feb	Birmingham Tyburn		1	5	0.868	3.2	2.1
11-Feb	Blackpool Marton	a	1	5	0.946	3.3	2.4
26-Jan	Bottesford	EA357	0	5	1.231	3.1	0.3
11-Feb	Bournemouth	17503	-1	5	1.024	3.3	0.8

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AEA

CERTIFICATE OF CALIBRATION

551.11, Harwell, Didcot, Oxfordshire OX11 0QJ. Telephone 0870 1906465 Fax 0870 1906377

UKAS CALIBRATION 0401

Certificate Number: 02128
AEA Identification Number: ED42523030

Date Year =2009	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)
02-Mar	Brighton Preston Park	12461	3	5	0.538	3.4	4.2
03-Mar	Bristol St Paul's	14358	0	5	0.981	3.1	0.5
11-Feb	Charlton Mackrell	95249	0	5	0.952	3.1	2.5
29-Jan	Coventry Memorial Park		1	5	0.932	3.2	1.7
	Exeter Roadside	access to	site not	possible			
15-Jan	Glazebury	14335	11	5	0.544	3.3	2.0
16-Apr	Great Dun Fell	145	-2	5	0.522	3.2	1.1
23-Feb	Harwell	367	1	5	0.503	3.1	1.8
22-Jan	High Muffles	713b-158	2	5	0.968	3.1	1.5
12-Jan	Hull Freetown	m1819-m356	250	5	0.074	3.5	5.7
29-Jan	Ladybower	hsp06	51	5	0.440	3.1	2.2
28-Jan	Leamington Spa	1459	1	5	1.042	3.2	0.8
14-Jan	Leeds Centre	206003	-1	5	0.998	3.2	1.3
03-Feb	Leicester Centre		0	5	0.863	3.2	1.0
28-Jan	Leominster	14470	2	5	0.963	3.1	0.4
09-Feb	Liverpool Speke	M1584-M331	250	5	0.109	3.2	1.3
09-Mar	Lullington Heath	M377	102	5	0.471	3.3	0.5
14-Jan	Manchester Piccadilly	427	13	5	0.204	3.4	4.8
14-Jan	Manchester South	16954	-3	5	1.034	3.3	0.9
15-Jan	Market Harborough	60894	1	5	0.488	3.3	0.4
13-Jan	Middlesbrough	14203	-2	5	1.001	6.0	3.4
12-Jan	Newcastle Centre	m1820-m357	51	5	0.440	3.2	4.7
19-Feb	Northampton	8905240110	1	5	0.982	3.1	0.3
27-Jan	Nottingham Centre	427-011	-7	5	0.093	3.1	1.3
12-Feb	Plymouth Centre	60027	-1	5	1.015	3.2	2.5
19-Jan	Portsmouth	2	0	5	0.916	3.3	1.2
11-Feb	Preston	SP00656D	0	5	1.162	3.4	1.6
22-Jan	Reading New Town	2	2	5	0.999	9.2	5.9
05-Mar	Rochester Stoke	378	1	5	1.127	3.2	2.3
12-Jan	Salford Eccles	2363	-1	5	1.000	3.3	1.2
04-Mar	Sandwell West Bromwich	14358	0	5	0.964	3.3	0.6
26-Jan	Sheffield Centre	-10	18	5	0.093	3.3	1.2
19-Jan	Sibton	146	-13	5	0.614	3.1	1.3
24-Feb	Southampton Centre	me	234	5	0.107	3.8	2.9
26-Feb	Southend-on-Sea	can't access	1	5	0.845	3.3	0.6
26-Feb	St Osyth	60869	-2	5	0.500	3.3	0.8
13-Jan	Stoke-on-Trent Centre	ambirak	7	5	1.071	3.3	2.9
15-Jan	Sunderland Silksworth	m1211-m368	-2	5	1.260	3.5	1.9
25-Feb	Thurrock	10788	7	5	0.528	3.3	0.6
20-Jan	Weybourne	AEA0030	1	5	0.994	3.1	0.9
20-Jan	Wicken Fen	14345	-4	5	0.488	3.1	1.1
13-Jan	Wigan Centre	360	-1	5	1.009	3.3	1.5
10-Feb	Wirral Tranmere	l-ar-012	0	5	1.035	3.7	0.9
26-Jan	Yarner Wood	14456	29	5	0.509	3.1	0.3

Oxides of Nitrogen

Date Year =2009	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
14-Jan	Barnsley Gawber	NO NOx		12 12	5 6	1.365 1.389	5 5	0.8 1.6	87.7
04-Mar	Bath Roadside	NO NOx	12758	6 6	5 5.5	1.695 1.710	5 5	2.0 1.8	95.3
14-Jan	Billingham	NO NOx	574	1 2	5 5.6	1.819 1.832	5 5	0.0 0.2	99.3
09-Jan	Birmingham Centre	NO NOx	14324	1 8	5 5.2	0.539 0.545	5 5	0.8 0.4	97.2

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AEA

UKAS CALIBRATION

CERTIFICATE OF CALIBRATION

0401

551.11, Harwell, Didcot, Oxfordshire OX11 0QJ. Telephone 0870 1906465 Fax 0870 1906377

Certificate Number: 02128

AEA Identification Number: ED42523030

Date Year =2009	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
12-Feb	Birmingham Tyburn	NO NOx		0 3	5 5.3	0.960 0.929	5 5	0.4 0.4	95.4
11-Feb	Blackpool Marton	NO NOx	a	21 22	5 5.9	1.914 1.929	5 5	1.7 1.1	96.7
11-Feb	Bolton	NO NOx	17507	1 2	5 5.3	1.132 1.108	5 5	0.2 0.6	100.0
02-Mar	Bournemouth	NO NOx	13068	5 7	5 5.4	1.079 1.079	5 5	4.7 4.1	97.4
02-Mar	Brighton Preston Park	NO NOx	11885	0 0	5 5.4	1.375 1.365	5 5	1.8 2.3	98.3
06-Mar	Brighton Roadside	NO NOx	10510	2 4	5 5.3	1.219 1.227	5 5	1.9 2.5	97.5
03-Mar	Bristol Old Market	NO NOx	14353	1 3	5 5.3	0.837 0.832	5 5	2.7 0.6	97.0
12-Jan	Bristol St Paul's	NO NOx		-2 6	5 5.4	0.905 0.942	5 5	1.3 1.1	96.8
19-Jan	Bury Roadside	NO NOx	455355/303	-1 -2	5 5.4	1.042 1.047	5 5	0.4 0.3	99.1
14-Jan	Cambridge Roadside	NO NOx		12 12	5 6	1.365 1.389	5 5	0.8 1.6	87.7
03-Mar	Canterbury	NO NOx	11666	1 1	5 5.4	1.287 1.279	5 5	1.4 2.7	99.0
21-Jan	Carlisle Roadside	NO NOx		0 4	5 5.4	1.266 1.371	5 5	2.7 1.4	101.8
11-Feb	Charlton Mackrell	NO NOx	12895	1 2	5 5.3	1.187 1.193	5 5	1.3 2.1	98.5
27-Jan	Chesterfield	NO NOx	528	0 1	5 5.3	0.965 0.977	5 5	0.8 1.3	98.4
27-Jan	Chesterfield Roadside	NO NOx	342	103 105	5 5.3	0.968 0.992	5 5	1.3 0.8	99.2
29-Jan	Coventry Memorial Park	NO NOx		0 1	5 5.3	1.017 0.965	5 5	0.1 0.2	100.7
	Exeter Roadside	NO NOx	Access to	site	not	possible			
15-Jan	Glazebury	NO NOx	14354	-7 -5	5 5.2	0.547 0.550	5 5	1.7 0.7	98.0
23-Feb	Harwell	NO NOx	79	6 4	5 5.4	1.075 1.088	5 5	0.9 2.3	100.0
22-Jan	High Muffles	NO NOx	1783	1 1	5 5.2	0.561 0.586	5 5	0.8 2.4	100.0
04-Feb	Horley	NO NOx	525	0 0	5 5.4	1.099 1.109	5 5	1.3 0.5	99.0
12-Jan	Hull Freetown	NO NOx	m1803-m732	248 263	5 5.2	0.384 0.395	5 5	1.1 2.6	98.3
29-Jan	Ladybower	NO NOx	14326	0 0	5 5.3	0.948 0.978	5 5	1.7 1.8	95.4
28-Jan	Leamington Spa	NO NOx	1705	0 2	5 5.3	1.134 1.154	5 5	1.0 1.0	102.4
14-Jan	Leeds Centre	NO NOx	210005	-1 0	5 5.3	0.991 0.983	5 5	1.8 1.1	97.0
14-Jan	Leeds Headingley Kerbside	NO NOx	696b-308	51 54	5 5.3	1.036 1.058	5 5	2.7 1.4	100.0
03-Feb	Leicester Centre	NO		-1	5	1.004	5	1.4	

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UKAS CALIBRATION 0401

Certificate Number: 02128
AEA Identification Number: ED42523030

Date Year =2009	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
		NOx		-3	5.3	0.971	5	1.0	99.1
28-Jan	Leominster	NO	14863	1	5	0.745	5	0.6	
		NOx		4	5.2	0.747	5	0.8	100.6
09-Feb	Liverpool Queen's Drive Roadside	NO	16927	1	5	1.216	5	1.5	
		NOx		4	5.4	1.239	5	0.6	101.8
09-Feb	Liverpool Speke	NO	M1805-M734	248	5	0.448	5	2.3	
		NOx		259	6	0.458	5	1.7	96.3
09-Mar	Lullington Heath	NO	M1357	103	5	1.128	5	0.8	
		NOx	-m675	102	5.3	1.085	5	0.2	98.7
14-Jan	Manchester Piccadilly	NO	447-011	-23	5	0.445	5	2.2	
		NOx		-23	5.2	0.416	5	1.6	88.6
14-Jan	Manchester South		17311	2	5	1.024	5	1.3	
				3	5.4	1.018	5	1.1	99.6
15-Jan	Market Harborough	NO	61963	1	5	0.578	5	0.3	
		NOx		5	5.2	0.583	5	1.2	93.4
13-Jan	Middlesbrough	NO	13160	-1	5	1.284	5	1.6	
		NOx		-8	5.3	1.261	5	0.5	101.6
12-Jan	Newcastle Centre	NO	m1800-m730	56	5	2.078	5	1.7	
		NOx		68	5.6	2.196	5	4.2	96.5
12-Jan	Newcastle Cradlewell Road	NO	m2106-m860	-1	5	1.152	5	1.9	
		NOx		6	5.5	1.176	5	2.0	98.1
19-Feb	Northampton	NO	8.512E+09	1	5	0.997	5	1.9	
		NOx		2	5.3	0.971	5	1.7	99.6
27-Jan	Nottingham Centre	NO	G-RA0447-009	-29	5	0.549	5	0.9	
		NOx		-35	5.2	0.541	5	0.6	95.3
21-Jan	Oxford Centre Roadside	NO	m947	102	5	1.083	5	2.1	
		NOx		108	5.5	1.124	5	2.2	99.1
21-Jan	Oxford St Ebbes	NO		103	5	1.091	5	0.7	
		NOx		102	5.5	1.109	5	0.9	100.0
12-Feb	Plymouth Centre	NO	50062	0	5	1.034	5	3.1	
		NOx		1	5.3	1.049	5	3.3	102.1
19-Jan	Portsmouth	NO	1	0	5	1.105	5	0.1	
		NOx		0	5.3	1.165	5	0.0	94.5
11-Feb	Preston	NO	SP00656D	44	5	1.955	5	3.3	
		NOx		45	6	1.987	5	2.0	97.8
22-Jan	Reading New Town	NO	1	-4	5	1.608	5	1.6	
		NOx		-4	5.4	1.614	5	0.9	99.3
05-Mar	Rochester Stoke	NO	473	-2	5	1.162	5	2.2	
		NOx		-3	5.3	1.179	5	2.0	87.7
12-Jan	Salford Eccles	NO	2381	0	5	1.208	5	5.7	
		NOx		4	5.3	1.260	5	4.3	96.2
04-Mar	Sandwell West Bromwich	NO	14353	0	5	0.994	5	0.2	
		NOx		0	5.3	0.996	5	0.7	97.1
17-Feb	Sandy Roadside	NO	18006	0	5	1.335	5	0.5	
		NOx		4	5.4	1.345	5	0.6	97.1
13-Jan	Scunthorpe Town	NO	m1225-m526	31	5	2.262	5	1.9	
		NOx		46	6.3	2.473	5	1.4	99.1
26-Jan	Sheffield Centre	NO	-8	4	5	0.434	5	1.7	
		NOx		2	5.3	0.433	5	1.5	97.7
26-Jan	Sheffield Tinsley	NO	10772	1	5	2.269	5	1.7	
		NOx		1	5.7	2.402	5	0.0	99.0
24-Feb	Southampton Centre	NO		316	8.5	0.104	5	3.2	
		NOx		322	5.3	0.108	5	3.5	99.6
26-Feb	Southend-on-Sea	NO		0	5	0.972	5	2.9	
		NOx		1	5.4	0.926	5	2.9	98.9
26-Feb	St Osyth	NO	60988	-1	5	0.564	5	1.8	

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0401

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Certificate Number: 02128

AEA Identification Number: ED42523030

Date Year =2009	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
		NOx		-1	5.2	0.555	5	1.1	96.3
05-Mar	Stanford-le-Hope Roadside	NO	14189	1	5	1.247	5	1.4	
		NOx		1	5.5	1.245	5	1.3	99.5
	Stockton-on-Tees Eaglescliffe	NO NOx		site	not	operational			
13-Jan	Stoke-on-Trent Centre	NO		21	5	1.372	5	0.6	
		NOx		21	5.4	1.470	5	1.2	98.1
15-Jan	Sunderland Silksworth	NO	734b-322	1	5	1.046	5	0.6	
		NOx		3	5.4	1.059	5	0.3	99.1
25-Feb	Thurrock	NO	11004	1	5	1.174	5	0.6	
		NOx		1	5.3	1.176	5	0.4	95.3
26-Feb	Walsall Willenhall	NO	1337	0	5	0.963	5	0.6	
		NOx		3	5.3	0.976	5	1.0	99.2
20-Jan	Wicken Fen	NO	13069	14	5	0.400	5	2.3	
		NOx		10	5.2	0.380	5	1.4	97.6
13-Jan	Wigan Centre	NO	360	0	5	1.029	5	1.8	
		NOx		1	5.3	1.044	5	2.0	98.4
10-Feb	Wirral Tranmere	NO	l-ar-012	18	5	1.887	5	3.4	
		NOx		18	5.7	1.892	5	3.1	98.0
26-Jan	Yarner Wood	NO	12554	12	5	0.994	5	0.5	
		NOx		8	5.3	0.972	5	1.0	99.0
15-Jan	York Fishergate	NO	622b-272	-1	5	1.072	5	0.6	
		NOx		1	5.3	1.102	5	1.1	96.0

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 (%)
09-Jan	Birmingham Centre	PM10		analyser	not	present				
09-Jan	Birmingham Centre	PM25	26567	13873	1	-1.4	not	tested	not	tested
12-Feb	Birmingham Tyburn	PM10	27255	14826	1	-0.8	3.10	2.2	16.47	2.2
12-Feb	Birmingham Tyburn	PM25	21372	14656	1	-0.2	3.02	2.2	16.50	2.2
11-Feb	Blackpool Marton	PM25	24424	12955	1	0.5	2.74	2.2	15.91	2.2
11-Feb	Bournemouth	PM25	21257						16.90	2.2
02-Mar	Brighton Preston Park	PM25							16.62	2.2
03-Mar	Bristol St Paul's	PM10	24426	13266	1	0.7	2.98	2.2	15.30	2.2
03-Mar	Bristol St Paul's	PM25	26495	13670	1	-1.8	**3.05**	2.2	**13.15**	2.2
12-Jan	Bury Roadside	PM10	658	11663	1	0.6	not	tested	not	tested
21-Jan	Carlisle Roadside	PM10	25560	13912	1	-2.2	2.98	2.2	16.80	2.2
27-Jan	Chesterfield	PM10	22989	12605	1	-2.0	2.98	2.2	16.44	2.2
27-Jan	Chesterfield	PM25	27343	15955	1	-0.3	**2.97**	2.2	**13.54**	2.2
27-Jan	Chesterfield Roadside	PM10	22299	11196	1	-1.3	3.10	2.2	17.01	2.2

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

AEA

CERTIFICATE OF CALIBRATION

551.11, Harwell, Didcot, Oxfordshire OX11 0QJ. Telephone 0870 1906465 Fax 0870 1906377

UKAS CALIBRATION 0401

Certificate Number: 02128
AEA Identification Number: ED42523030

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 (%)
29-Jan	Coventry Memorial Park	PM25	25026	13157	1	-0.2	**3.06**	2.2	**4.47**	2.2
23-Feb	Harwell TEOM	PM10	21489	14541	1	-2.5	3.07	2.2	16.11	2.2
23-Feb	Harwell TEOM	PM25	21490	10834	1	-0.5	3.08	2.2	16.95	2.2
23-Feb	Harwell Partisol	PM10	1439802						16.99	2.2
23-Feb	Harwell Partisol	PM25	209902						16.86	2.2
12-Jan	Hull Freetown	PM10	24445	14286	1	1.3	3.00	2.2	not	tested
12-Jan	Hull Freetown	PM25	26498	14028	1	-1.2	2.92	2.2	not	tested
28-Jan	Leamington Spa	PM10	27295	14903	1	-0.6	2.99	2.2	16.00	2.2
28-Jan	Leamington Spa	PM25	27248	14168	1	-0.1	3.06	2.2	16.10	2.2
17-Dec	Leeds Centre	PM10	24451	13261	1	-1.0	3.06	2.2	15.54	2.2
17-Dec	Leeds Centre	PM25	27254	16838	1	-1.2	3.08	2.2	15.79	2.2
14-Jan	Leeds Headingley Kerbside	PM10	22048	13226	1	1.4	**1.95**	2.2	**13.76**	2.2
03-Feb	Leicester Centre	PM10	24442	14472	1	0.1	2.86	2.2	15.31	2.2
03-Feb	Leicester Centre	PM25	26500	14825	1	-0.9	3.02	2.2	16.33	2.2
09-Feb	Liverpool Speke	PM10		analyser	not	present				
09-Feb	Liverpool Speke	PM25	22222	14743	1	-1.1	3.07	2.2	17.34	2.2
14-Jan	Manchester Piccadilly	PM10		analyser	not	present				
14-Jan	Manchester Piccadilly	PM25	26038	12788	1	-2.3	2.88	2.2	15.15	2.2
13-Jan	Middlesbrough	PM10	24325	13804	1	-2.3	3	2.2	16.09	2.2
13-Jan	Middlesbrough	PM25	27915	15798	1	-1.3	2.92	2.2	16.11	2.2
12-Jan	Newcastle Centre	PM10	24448	13829	1	0.0	2.79	2.2	15.56	2.2
12-Jan	Newcastle Centre	PM25	24447	14875	1	0.3	3.08	2.2	15.63	2.2
19-Feb	Northampton	PM25							not	tested
27-Jan	Nottingham Centre	PM25	25025	12073	1	-0.9	**3.00**	2.2	**14.11**	2.2
21-Jan	Oxford St Ebbes	PM10	26145	13373	1	-2.1	not	tested	not	tested
21-Jan	Oxford St Ebbes	PM25	21348	14687	1	-0.5	not	tested	not	tested
12-Feb	Plymouth Centre	PM10		analyser	not	present				
19-Jan	Portsmouth	PM10	2000	13331	1	0.1	not	tested	unsafe	access
19-Jan	Portsmouth	PM25	21358	18328	1	-1.2	not	tested	unsafe	access
11-Feb	Preston	PM25	22881	12857	1	-0.8	2.45	2.2	15.17	2.2
22-Jan	Reading New Town	PM10	21315	13218	1	0.1	2.98	2.2	16.78	2.2
22-Jan	Reading New Town	PM25	25090	13936	1	-1.4	3.07	2.2	15.66	2.2
05-Mar	Rochester Stoke	PM10	24381	12096	1	0.4	2.97	2.2	15.67	2.2
05-Mar	Rochester Stoke	PM25	21491	13782	1	-1.1	3.13	2.2	16.06	2.2

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.

AEA

UKAS CALIBRATION

CERTIFICATE OF CALIBRATION

0401

551.11, Harwell, Didcot, Oxfordshire OX11 0QJ. Telephone 0870 1906465 Fax 0870 1906377

Certificate Number: 02128
AEA Identification Number: ED42523030

12-Jan	Salford Eccles	PM10	21168	14523	1	0.8	2.08	2.2	17.54	2.2
12-Jan	Salford Eccles	PM25	27205	14560	1	-0.5	3.00	2.2	16.45	2.2
12-Feb	Saltash Roadside	PM10	24328	13905	1	-1.7	**3.02**	2.2	**13.50**	2.2
17-Feb	Sandy Roadside	PM10	22018	13774	1	-1.2	3.01	2.2	16.21	2.2
17-Feb	Sandy Roadside	PM25	27260	13640	1	-1.2	3.01	2.2	15.77	2.2
13-Jan	Scunthorpe Town	PM10	2000	12456	1	-1.6	**3.15**	2.2	**4.60**	2.2
26-Jan	Sheffield Centre	PM10	25024	12134	1	-0.9	2.99	2.2	16.29	2.2
26-Jan	Sheffield Centre	PM25	27253	15529	1	-0.7	2.99	2.2	15.77	2.2
24-Feb	Southampton Centre	PM10	24448	13920	1	0.3	2.85	2.2	8.22	2.2
24-Feb	Southampton Centre	PM25	27256	16464	1	-0.4	3.11	2.2	16.19	2.2
26-Feb	Southend-on-Sea	PM25	22927	12350	1	-0.7	**3.16**	2.2	**13.66**	2.2
05-Mar	Stanford-le-Hope Roadside	PM10	24397	13527	1	-0.2	3.12	2.2	17.07	2.2
13-Jan	Stoke-on-Trent Centre	PM10	27262	12448	1	-0.4	2.99	2.2	15.94	2.2
13-Jan	Stoke-on-Trent Centre	PM25	1	13498	1	0.0	3.00	2.2	15.60	2.2
15-Jan	Sunderland Silksworth	PM25	27247	15634	1	-1.1	3.10	2.2	15.76	2.2
25-Feb	Thurrock	PM10	25039	12903	1	-0.5	**3.09**	2.2	**13.94**	2.2
13-Jan	Wigan Centre	PM25	27242	16115	1	-0.5	2.99	2.2	16.32	2.2
10-Feb	Wirral Tranmere	PM25	22883	13272	1	-0.2	3.11	2.2	16.84	2.2
13-Jan	York Bootham	PM10	21877	14654	1	-0.6	**3.06**	2.2	**13.53**	2.2
13-Jan	York Bootham	PM25	27209	16412	1	-1.3	not	tested	unsafe	access
15-Jan	York Fishergate	PM10	22101	13436	1	1.9	**3.17**	2.2	**14.73**	2.2

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

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 sometime and held by AEA at the above address. Hard copies are available on request.

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