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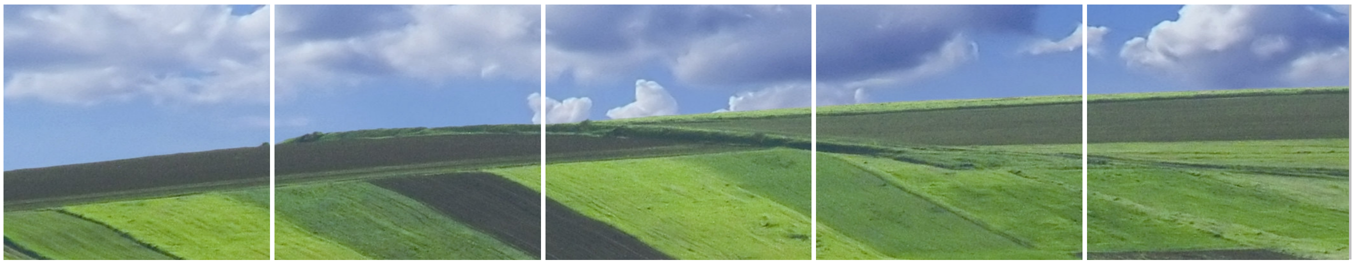

QA/QC Data Ratification Report for the Automatic Urban and Rural Network, January-March 2011, and Intercalibration Report, Winter 2011

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

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

Tel: 0870 190 6465
Fax: 0870 190 6608

AEA is a business name of AEA Technology plc

AEA is certificated to ISO9001 and ISO14001

Author	Name	Stewart Eaton
Approved by	Name	Rachel Yardley
	Signature	
	Date	August 2011

Executive summary

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

Ratified hourly average data capture for the network averaged 91.4% for all pollutants (O_3, NO_2, SO_2, CO, PM_{10} and $PM_{2.5}$) during the 3-month reporting period January-March 2011. Data capture for all pollutants except PM_{10} and $PM_{2.5}$ were above 90%. There were 36 sites with data capture less than 90% for the period.

The number of monitoring sites in the AURN during this quarter was 135, of which 71 are Local Authority owned sites affiliated to the national network. Some are co-located and separately named gravimetric particulate analysers at sites with automatic analysers. Many affiliated sites have additional Defra-funded analysers installed on site.

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

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1 Introduction

This quarterly report covers the Quality Assurance and Control (QA/QC) activities undertaken by AEA to ratify automatic monitoring data from Defra and the Devolved Administrations' urban and rural air quality monitoring network (AURN) for the period January-March 2011. During this period there were 135 operational monitoring sites in the Network of which there are 98 urban sites, 27 rural sites and a further 8 sites in the London Air Quality Monitoring Network (LAQN) which are affiliated into the national network. There are currently 62 Defra-funded sites and 71 affiliate sites, although many affiliate sites have fully-funded PM_{10} and/or $PM_{2.5}$ analysers. Eleven sites have non-automatic particulate samplers (Partisols); some of these are collocated with FDMS analysers at Auchencorth Moss, Harwell, London North Kensington and Marylebone Road for both PM_{10} and $PM_{2.5}$.Port Talbot Margam has a Partisol, which was converted from $PM_{2.5}$ to PM_{10} during February 2010.

1.1 Overview of Network Performance

Ratified hourly average data capture for the network averaged 91.4% for all pollutants (O_3, NO_2, SO_2, CO, PM_{10} and $PM_{2.5}$) during the 3 month reporting period January-March 2011 (see Table 1.1). All gaseous pollutants achieved 90% or higher data capture. Data capture rates are calculated using the actual data capture as hourly averages (daily for Partisol) against the total number of hours (or days) in the relevant period; service and maintenance are counted as lost data. For sites starting or closing, the data capture is based on the actual date starting or closing.

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

	CO	PM_{10}	$PM_{2.5}$	NO_2	O_3	SO_2	Mean
Q1 2011	95.7	80.5	84.9	93.4	95.0	92.7	91.4

Overall, 337 out of the 413 analysers (77%) achieved data capture levels above the required 90% target during this reporting period (See Table 1.2).

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

Total Number Of Analysers		Q1 Jan-Mar 2011 (No. below 90%)
CO	24	2
NO_2	117	13
O_3	82	7
PM_{10} [1]	68	24
$PM_{2.5}$ [1]	76	24
SO_2	46	6
Total <90%		76

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

In total, 37 out of the 134 operational network sites (excluding Birmingham Acocks Green) in the quarter (26.7%) had an average data capture rate below the required 90% level for the January-March 2011 period. This is influenced by the fact that new analysers at existing sites have data capture figures calculated from the start date of the quarter, not from the start of the analyser itself. The main site operational and QA/QC issues giving rise to data capture below the required 90% level are summarised in Section 4.

1.2 Status of Ratified Data

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

CO

Middlesbrough	Reprocessed October to December 2010 data

NO/NO_2/NO_x

Birmingham Tyburn	Converter rescale applied to NO2 and NOx data between services 16/08/10 to 17/03/11
Horely	Reprocessed data due to an uncertified cylinder (autocal)
Hull Freetown	Converter rescale applied to NO_2 and NOx data 21/07/10 - 07/02/11.
London Bloomsbury	Reprocessed October to December 2010.
London Westminster	Reprocessed September to December 2010.
Newcastle Cradlewell	Reprocessed December 2010 data.
St Osyth	Data still provisional as suspect sampling fault. Possible rejection
Scunthorpe	Reprocessed October and November 2010 data
York Fishergate	Reprocessed December 2010 Data

O_3

London Westminster	Reprocessed December 2010 data
Salford Eccles	Sensitivity rescale applied from August 2010 to the end of May 2011
Yarner Wood	Sensitivity reset back to 1.00. Incorrectly post service August 10 to March 11 sensitivity updated

PM_{10}

Chesterfield Roadside	PM_{10} data from 1 June 2009 to 31 December 2010 due to low volatiles in comparison with Chesterfield
Leamington Spa	Unusually high data (temperature related) 27 to 31 December 2010. Data Rejected.

PM_{25}

Leamington Spa	Unusually high data (temperature related) 27 to 31 December 2010. Data rejected.
Norwich Lakenfields.	Data rejected from 24 November to 9 December 2010 due to regional outlier
Plymouth Centre	Volatiles low in December. Data rejected 29 to 31 December.
Wigan Centre	$PM_{2.5}$ volatiles are consistently too high up to gap in March/April. $PM_{2.5}$ data rejected from September 2010 to March 2011.

SO_2

No changes made to the 2010 data

2 Changes in the Network for Directive Compliance

Six new analysers at three sites were installed in the network during the first quarter of 2011

Site	Pollutant	Date Installed
Birmingham Acocks Green	NO_2 SO_2 O_3 $PM_{2.5}$	18/3/11
Canterbury	O_3	15/3/11
Southwark A2 Old Kent Road	NO_2 PM_{10}	1/1/11

In 2011 the UK will be undertaking a full assessment of the AURN in accordance with Articles V to VII of the Air Quality Directive (2008/50/EC). It is expected that the results of this will be available by the end of the year. It will review the number and locations of sites and equipment required for monitoring.

The Glasgow City Chambers site closed on 16 March due to building refurbishment; the site was not required for Directive compliance.

3 Generic Data Quality Issues

4 Site Specific Issues

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

4.1 London

4.1.1 Data Capture

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

Table 4.1: Data capture for London: January-March 2011

Network Data Capture for 01/01/2011 to 31/03/2011 from start date of any new site

Site	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
England							
Camden Kerbside	-	91.9	84.1	99.2	-	-	91.7
Haringey Roadside	-	56.6	86.3	84.0	-	-	75.7
London Bexley	99.4	-	98.8	99.3	-	99.1	99.2
London Bloomsbury	98.2	94.3	94.7	90.7	98.3	97.9	95.7
London Cromwell Road 2	90.7	-	-	87.4	-	90.6	89.6
London Eltham	-	-	68.8	94.6	97.6	-	87.0
London Haringey	-	-	-	52.0	99.6	-	75.8
London Harlington	-	16.5	94.9	93.4	94.4	-	74.8
London Harrow Stanmore	-	-	97.9	-	-	-	97.9
London Hillingdon	-	-	-	98.3	98.4	-	98.3
London Marylebone Road	97.5	92.5	97.1	96.9	80.5	94.6	93.2

Site	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
London Marylebone Road PARTISOL	-	**34.4**	**80.0**	-	-	-	**57.2**
London N. Kensington	97.9	97.0	92.1	97.2	95.2	97.3	96.1
London N. Kensington PARTISOL	-	**98.9**	**98.9**	-	-	-	**98.9**
London Teddington	-	-	64.3	87.7	88.0	-	80.0
London Westminster	98.1	-	**93.3**	97.9	98.1	97.6	**97.0**
Southwark A2 Old Kent Road	-	75.7	-	58.1	-	-	66.9
Tower Hamlets Roadside	91.5	-	-	91.6	-	-	91.6
Number of sites	7	9	13	15	9	6	18
Number of sites < 90%	0	4	5	5	2	0	8
Network Mean (%)	96.2	73.1	88.6	88.5	94.5	96.2	87.0

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

4.1.2 Site Specific Issues

Haringey Roadside
There were several periods during February and March where PM_{10} concentrations were less than the $PM_{2.5}$. The LSO turned the NOx analyser off on 14 March due to a flow fault and a strong smell of ozone in the cabin.

London Cromwell Road 2
A number of communications faults resulted in some data loss.

London Eltham
The $PM_{2.5}$ FDMS unit suffered loss of software on three occasions resulting in data loss. The sample head was found to be unattached to the sample inlet on 18 March; data from 4 March to the engineers visit have been deleted.

London Haringey
A damaged filter holder glass caused a leak, resulting in a leak. Data have been deleted from 7 to 31 January. The analyser suffered from a photomultiplier fault on 13 May; data were lost up to service on 12 May.

London Harlington
This site has consistently shown PM_{10} concentrations below those for $PM_{2.5}$ since December 2010. Much of the PM_{10} data have been deleted for this quarter. The analyser was eventually replaced in June 2011 which improved the data.

London Marylebone Road Partisol
The sampler was removed for repair on 18 January to 12 March-see Appendix 2.

4.2 England (excluding London)

4.2.1 Data Capture

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

Table 4.2 Data Capture January-March 2011: England

Network Data Capture for 01/01/2011 to 31/03/2011 from start date of any new site

Site	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
England							
Barnsley 12	-	-	-	-	-	98.3	98.3
Barnsley Gawber	-	-	-	83.0	95.7	94.8	91.2
Bath Roadside	-	-	-	96.7	-	-	96.7
Billingham	-	-	-	94.3	-	-	94.3
Birmingham Tyburn	-	99.0	97.1	98.9	99.5	99.4	98.8
Birmingham Tyburn Roadside	-	0.0	0.0	97.5	98.1	-	48.9
Blackburn Darwen Roadside	-	-	-	99.5	-	-	99.5
Blackpool Marton	-	-	76.2	80.1	70.9	-	75.7
Bottesford	-	-	-	-	99.2	-	99.2
Bournemouth	-	-	**50.0**	98.2	98.3	-	**82.2**
Brighton Preston Park	-	-	**46.7**	98.3	98.6	-	**81.2**
Bristol Old Market	98.5	-	-	98.2	-	-	98.4
Bristol St Paul's	98.2	98.1	91.9	97.8	98.4	98.1	97.1
Bury Roadside	98.6	91.5	98.0	91.5	-	-	94.9
Cambridge Roadside	-	-	-	98.5	-	-	98.5
Canterbury	-	-	-	97.3	97.5	-	97.4
Carlisle Roadside	-	93.7	95.7	97.4	-	-	95.6
Charlton Mackrell	-	-	-	66.5	95.9	-	81.2
Chatham Centre Roadside	-	99.4	99.4	99.5	-	-	99.5
Chesterfield	-	89.2	91.9	99.5	-	-	93.5
Chesterfield Roadside	-	0.0	97.1	94.4	-	-	63.9
Coventry Memorial Park	-	-	89.1	98.3	98.4	-	95.3
Eastbourne	-	42.5	98.9	42.9	-	-	61.4
Exeter Roadside	-	-	-	99.0	99.4	-	99.2
Glazebury	-	-	-	**97.8**	98.0	-	**97.9**
Great Dun Fell	-	-	-	-	96.6	-	96.6
Harwell	-	31.0	92.8	96.3	97.0	96.3	82.7
Harwell PARTISOL	-	**78.9**	**98.9**	-	-	-	**88.9**
High Muffles	-	-	-	97.7	97.2	-	97.5
Horley	-	-	-	98.8	-	-	98.8
Hull Freetown	97.1	96.8	95.2	93.1	97.2	96.7	96.0
Ladybower	-	-	-	91.7	97.2	90.3	93.0
Leamington Spa	-	72.5	72.5	97.8	99.3	98.5	88.1
Leeds Centre	90.0	97.2	96.8	93.1	97.2	97.1	95.2
Leeds Headingley Kerbside	-	92.7	98.5	96.4	-	-	95.9
Leicester Centre	98.1	95.3	94.5	94.2	98.6	98.2	96.5
Leominster	-	-	-	97.9	98.2	98.3	98.1
Liverpool Queen's Drive Roadside	-	-	-	98.2	-	-	98.2
Liverpool Speke	97.5	96.2	93.5	97.5	97.5	97.4	96.6
Lullington Heath	-	-	-	98.6	98.9	98.1	98.5
Manchester Piccadilly	-	-	92.6	98.4	98.5	98.5	97.0

Site	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
Manchester South	-	-	-	98.4	99.0	-	98.7
Market Harborough	-	-	-	93.8	91.9	-	92.8
Middlesbrough	98.3	98.0	97.7	97.3	98.3	98.3	98.0
Newcastle Centre	97.5	96.9	97.3	96.9	97.3	97.4	97.2
Newcastle Cradlewell Roadside	-	-	-	98.8	-	-	98.8
Northampton	-	-	**98.9**	99.4	99.7	92.3	**97.6**
Norwich Lakenfields	-	98.0	81.4	94.1	98.3	98.2	94.0
Nottingham Centre	-	94.4	78.5	95.8	95.0	95.3	91.8
Oxford Centre Roadside	-	-	-	97.2	-	-	97.2
Oxford St Ebbes	-	91.3	94.1	94.6	-	-	93.3
Plymouth Centre	-	99.2	29.5	98.1	98.2	-	81.3
Portsmouth	-	1.1	98.2	95.0	98.8	-	73.3
Preston	-	-	97.8	97.8	98.4	-	98.0
Reading New Town	-	92.4	83.8	93.8	98.3	-	92.1
Rochester Stoke	-	55.8	92.7	98.1	97.6	78.1	84.5
Salford Eccles	96.0	96.8	94.6	97.5	97.5	81.3	94.0
Sandwell West Bromwich	-	-	-	98.3	98.6	98.3	98.4
Sandy Roadside	-	35.6	70.0	98.5	-	-	68.0
Scunthorpe Town	-	99.6	-	93.9	-	65.9	86.5
Sheffield Centre	97.3	97.1	97.7	93.1	97.2	97.3	96.6
Sheffield Tinsley	-	-	-	98.3	-	-	98.3
Sibton	-	-	-	-	99.8	-	99.8
Southampton Centre	84.3	97.6	97.5	93.2	97.5	97.3	94.6
Southend-on-Sea	-	-	52.6	56.7	56.4	-	55.2
St Osyth	-	-	-	**98.9**	99.1	-	**99.0**
Stanford-le-Hope Roadside	-	98.0	97.9	98.3	-	96.9	97.8
Stockton-on-Tees Eaglescliffe	-	97.3	98.5	98.4	-	-	98.1
Stoke-on-Trent Centre	-	**66.0**	89.9	94.7	95.0	-	**86.4**
Storrington Roadside	-	98.3	98.7	99.9	-	-	99.0
Sunderland Silksworth	-	-	98.5	94.1	96.1	74.1	90.7
Thurrock	-	99.0	-	69.6	94.4	95.5	89.6
Warrington	-	98.4	99.4	99.5	-	-	99.1
Weybourne	-	-	-	-	90.7	-	90.7
Wicken Fen	-	-	-	97.7	98.2	97.5	97.8
Wigan Centre	-	-	0.0	97.0	88.4	-	61.8
Wirral Tranmere	-	-	89.2	94.1	98.7	-	94.0
Yarner Wood	-	-	-	98.2	98.1	-	98.1
York Bootham	-	94.8	93.1	-	-	-	93.9
York Fishergate	-	36.1	-	**81.4**	-	-	**58.8**
Number of sites	12	39	47	73	52	29	80
Number of sites < 90%	1	12	15	7	3	4	20
Network Mean (%)	95.9	79.9	85.0	94.2	96.1	93.9	91.2

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

Sites and instruments established between 01/01/2011 and 31/03/2011
Canterbury,O3,15/03/2011

Birmingham Acocks Green data will be ratified and reported with the Quarter 2 data.

4.2.2 Site Specific Issues

Birmingham Tyburn Roadside
Measured concentrations of both $PM_{2.5}$ and PM_{10} are significantly lower than the nearby Tyburn background site. All data for 2011 have been deleted. This was discussed in more detail in the October-December 2010 report. Investigations are still ongoing as of July 2011.

Blackpool Marton
The Blackpool Marton site was recomissioned in December 2010 following repair to the cabin. However, problems with the installation of the equipment and sampling system, as well as a lack of calibrations, meant that no valid data were collected until mid-January.

Chesterfield Roadside
PM_{10} data from this site has been persistently lower than the Chesterfield site. All data have been deleted back to June 2009. This was discussed in more detail in the October-December 2010 report. The fault was rectified at an engineer callout in May although it is not known what the source of the problem was.

Eastbourne
The PM_{10} data has been of poor quality in the previous quarter, and a hotspare sensor unit was installed. The original was replaced at the service in February, no fault having been found with the original. However, data remained poor, with $PM_{2.5}$ concentrations greater than the PM_{10}. Much of the PM_{10} data have therefore been deleted. In addition, the NO_2 analyser was sampling internally up to the QA/QC audit on 8 February 2011.

Harwell
Following a switching valve fault, the PM_{10} FDMS analyser was removed for workshop repair on 1 December 2010. It was eventually reinstalled at the service on 1 March.

Harwell Partisol
The PM_{10} sampler developed several faults during the period-see Appendix 2.

Leamington Spa
Both FDMS units had excessively high periods of volatile component during the quarter and these were deleted. A leak in the shuttle valve (PM_{10}) also contributed to data loss.

Plymouth Centre
The $PM_{2.5}$ data were low and erratic at the end of December 2010, resulting in the removal of the sensor unit for workshop repair in January.

Portsmouth
A new PM_{10} analyser was installed in March following persistent poor performance of the previous analyser. All PM_{10} data from 30 June 2010 to 30 March 2011 have been deleted.

Rochester Stoke
The volatile concentrations for PM_{10} were anomalously low during much of the quarter and much have been deleted. The PM_{10} was removed for workshop repair in January. No information on the nature of the fault is available. In addition, the SO_2 lamp failed on 29 January, repaired at the service on 15 February.

Sandy Roadside
The $PM_{2.5}$ concentrations have been consistently higher than the PM_{10} following LSO calibration on 5 November 2010. The analysers were removed for workshop repair but still performed poorly when reinstalled on site. The air conditioning has also been unreliable, and the continuing situation between the landowner and local authority has hampered access.

Scunthorpe Town
The SO_2 analyser suffered from several flow and lamp faults during the quarter starting in November 2010.

Southend on Sea
The Southend site was closed on 21 February to enable the roof on the building to be replaced. Monitoring restarted in June.

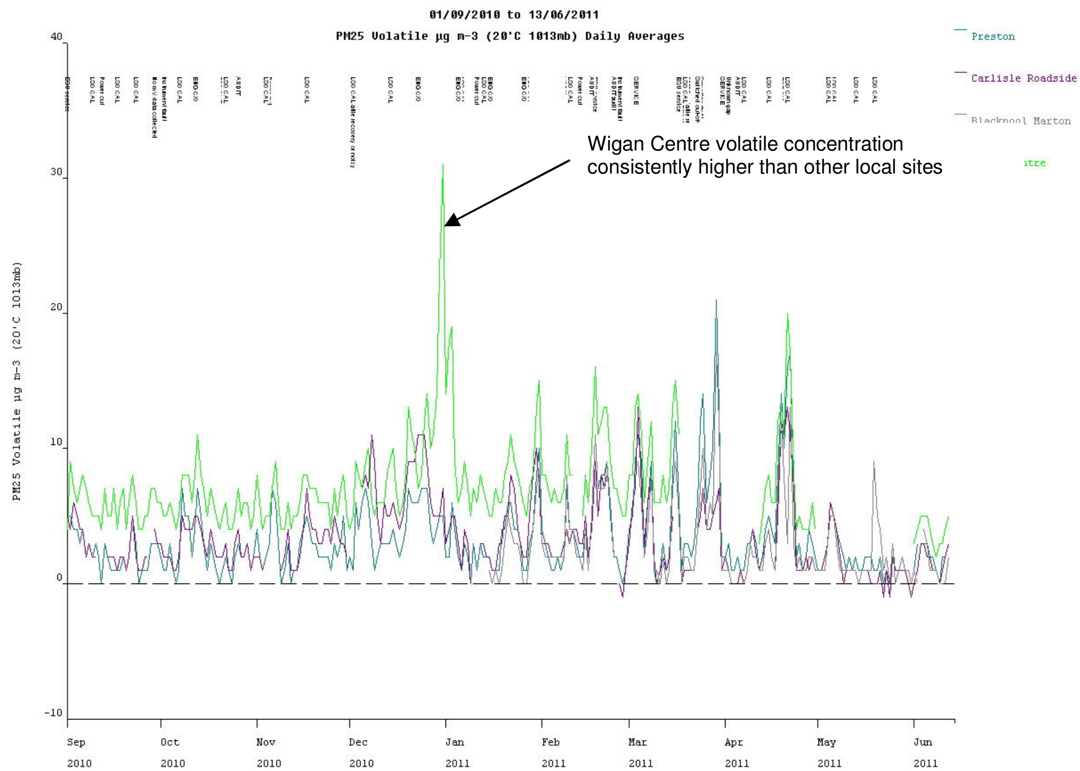
Stoke on Trent Centre
Two instances of leaks occurred during the quarter-both due to a loose sample filter holder. A leak in the valve block also resulted in lost data.

Thurrock
The NO_2 analyser suffered erratic and low response from the calibration on 11 November and was ultimately removed for repair; data have been deleted up to repair in January.

Walsall Willenhall
The Walsall Willenhall site was destroyed by fire on 3 February 2010. Work on commissioning a replacement site is under way.

Wigan Centre
The $PM_{2.5}$ volatile concentration has been anomalously high for some time. Data have been deleted from September 2010 to 31 March 2011. See Figure 4.1.

Figure 4.1 $PM_{2.5}$ Volatiles, Wigan Centre



York Fishergate

York Fishergate was closed from mid February to early March while a new enclosure was installed. The NOx and PM_{10} FDMS analyser were promptly reinstalled but the $PM_{2.5}$ FDMS took longer to install (still not installed in August 2011)

4.3 Scotland

4.3.1 Data Capture

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

Table 4.3 Data Capture January-March 2011: Scotland

Site	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
Scotland							
Aberdeen	-	97.3	71.4	90.0	91.5	-	87.6
Aberdeen Union Street Roadside	-	-	-	97.8	-	-	97.8
Auchencorth Moss	-	**91.1**	**95.6**	-	99.4	-	**95.4**
Auchencorth Moss PM_{10} PM_{25} (FDMS)	-	**82.3**	97.9	-	-	-	**90.1**
Bush Estate	-	-	-	96.6	96.9	-	96.7
Dumbarton Roadside	-	-	-	98.4	-	-	98.4
Dumfries	-	-	-	99.3	-	-	99.3
Edinburgh St	97.0	97.2	97.0	97.1	97.3	96.9	97.1

Site	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
Leonards							
Eskdalemuir	-	-	-	95.8	98.5	-	97.1
Fort William	-	-	-	98.5	98.5	-	98.5
Glasgow Centre	97.0	97.0	97.3	93.1	96.3	97.2	96.3
Glasgow City Chambers	-	-	-	97.9	-	-	97.9
Glasgow Kerbside	-	33.3	88.6	98.0	-	-	73.3
Grangemouth	-	96.3	96.2	96.0	-	95.9	96.1
Grangemouth Moray	-	-	-	98.6	-	-	98.6
Inverness	-	**80.0**	**90.0**	96.3	-	-	**88.8**
Lerwick	-	-	-	-	98.1	-	98.1
Peebles	-	-	-	97.0	98.3	-	97.7
Strath Vaich	-	-	-	-	88.7	-	88.7
Number of sites	2	8	8	15	10	3	19
Number of sites < 90%	0	3	2	0	1	0	4
Network Mean (%)	97.0	84.3	91.7	96.7	96.3	96.7	94.4

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

4.3.2 Site Specific Issues

Aberdeen
A leak was found on auxiliary flow line due to a damaged v-seal on shuttle valve in PM_{10} FMDS. Data have been rejected from 24 Oct 10 to 21 Jan 11.

Glasgow Kerbside
Noisy and suspiciously low data resulted in a succession of engineers visits. The PM_{10} sensor was ultimately removed for workshop repair. The air conditioning unit has been a particular source of problems during the quarter.

Inverness
The PM_{10} Partisol suffered many instances of filter exchange failures during the period.

Strath Vaich
10 days data were lost from 1 February due to failure of the sample manifold fan.

4.4 Wales

4.4.1 Data Capture

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

Table 4.4 Data Capture January-March 2011: Wales

Site	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
Wales							
Aston Hill	-	-	-	98.3	98.5	-	98.4
Cardiff Centre	98.1	87.0	97.9	94.0	98.2	98.1	95.6
Chepstow A48	-	61.1	99.3	99.4	-	-	86.6
Cwmbran	-	-	-	98.2	98.9	-	98.6
Mold	-	-	-	98.4	98.7	-	98.5

Site	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
Narberth	-	32.8	-	93.9	98.4	98.3	80.8
Newport	-	99.0	97.9	99.3	-	-	98.7
Port Talbot Margam	82.4	99.4	98.8	98.1	94.7	98.1	95.2
Port Talbot Margam PM_{10} $PM_{2.5}$ (Partisol)	-	**95.6**	-	-	-	-	**95.6**
Swansea Roadside	-	98.1	0.0	98.4	-	-	65.5
Wrexham	-	**94.4**	**97.8**	98.8	-	98.8	**97.4**
Number of sites	2	8	6	10	6	4	11
Number of sites < 90%	1	3	1	0	0	0	3
Network Mean (%)	90.3	83.4	81.9	97.7	97.9	98.3	91.9

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

4.4.2 Site Specific Issues

Chepstow A48
The PM_{10} data from Chepstow has been unreliable and often below the $PM_{2.5}$ concentrations. Much of the data have been deleted; the problem continues into Q1 2011. Both analysers were removed for workshop repair during summer 2011.

Narberth
The Narberth site has suffered from temperature related problems for some time, affecting mainly the PM_{10} analyser. The air conditioning unit ultimately failed in April, and although a repair was carried out, it is likely a more powerful unit is required.

Swansea Roadside
The Swansea Roadside FDMS, particularly the $PM_{2.5}$ have been lower than other local sites for the entire quarter. Investigations into the performance of both analysers have taken place in June 2011 and the $PM_{2.5}$ data have been deleted for the whole of the quarter.

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 2011 is given in Table 4.5.

Table 4.5 Data Capture January-March 2011: IrelandIreland

Site	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
N Ireland							
Armagh Roadside	-	99.6	-	99.2	-	-	99.4
Ballymena	-	-	-	-	-	99.8	99.8
Belfast Centre	97.1	83.3	95.4	96.9	97.3	97.1	94.5
Derry	-	**80.2**	**82.7**	98.7	98.8	83.5	**88.8**
Lough Navar	-	98.5	-	-	98.4	-	98.4
Ireland							
Mace Head	-	-	-	-	99.4	-	99.4
Number of sites	1	4	2	3	4	3	5
Number of sites < 90%	0	2	1	0	0	1	1
Network Mean (%)	97.1	90.4	89.1	98.3	98.2	93.5	96.2

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

4.5.2 Site Specific Issues

Derry
There was a step change in PM_{10} concentrations following the service in March, when the FDMS unit was replaced.

4.6 Overall Data Capture

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

Table 4.6: Data Capture by Pollutant, Entire Network

Site	CO	PM_{10}	$PM_{2.5}$	NO_2	O_3	SO_2	Site Average
Number of sites	24	68	76	117	82	46	135
Number of sites < 90%	2	24	25	13	7	6	36
Network Mean (%)	95.7	80.5	84.9	93.4	95.0	92.7	91.4

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

Part B: Intercalibration Report, Winter 2011

5 Introduction

In January to March 2011, AEA undertook an intercalibration of 135 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 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 ESU visits, to allow the performance of the sites to be quantified for the six month period prior to the visit. During the QA/QC visit, the LSO usually attends to demonstrate their competence in performing routine calibrations.

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

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

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

6 Scope of Intercalibration Exercise

The QA/QC visits fulfil a number of important functions:

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

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

1. Analyser accuracy and precision. These are basic checks to ensure analysers respond to

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

Once all data have been collected, a "Network Intercomparison" is conducted. This utilises the audit gas cylinders transported to each site in the Network. These cylinders are recently calibrated by the Gas Standards 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 and the web. It also provides input into the ratification process by highlighting sites where close scrutiny of datasets is likely to be required.

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

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

7 Results

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

7.1 National Network Overview

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

Table 7.1 - Summary of audited analyser performance – 135 UK stations

Parameter	Number of outliers	Number in network	% outliers in total
NOx analyser	19	114	17%
CO analyser	2	26	8%
SO_2 analyser	7	45	16%
Ozone analyser	16	81	20%
TEOM and BAM analysers	3 k_0, 4 flow	4 TEOM PM_{10} 54 FDMS PM_{10} 1 BAM PM_{10} 0 TEOM $PM_{2.5}$ 68 FDMS $PM_{2.5}$ 1 BAM $PM_{2.5}$	5%
Gravimetric PM analysers	0	7 PM_{10} 9 $PM_{2.5}$	0%
Total	51	408	12%

Two of the 135 sites were not in operation at the time of the intercalibration. The building housing Walsall Willenhall was destroyed in a fire in 2010 and is still awaiting identification of a suitable replacement site. The site at Saltash had to be removed as a result of site development plans, a replacement in the SW zone is currently being investigated. The Brighton Roadside site has been permanently closed as it is no longer required to comply with the Directive requirements. A site at Southwark has finally been recommissioned: Southwark A2 Old Kent Road began operation in early 2011.

The number of analyser outliers identified continues to improve. At the Summer 2010 intercalibration 14% of the analysers in use were identified as outliers.

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

7.2 Network Intercomparisons

The concentration of the audit cylinders was calculated averaged across all monitoring sites using the zero and scaling factors provided by the CMCU on the day of audit. How close the result is to the stated cylinder concentration is a good indication of the accuracy of the results across the entire network. The results are given in Table 7.2. Certified cylinder concentrations are normalised for this purpose as several cylinders are used.

Table 7.2 Calculation of audit cylinder concentration across network

Parameter	Network Mean	Audit reference concentration	Network Accuracy %	%Std Dev
NO	500 ppb	495 ppb	1.0	4.7
CO	20.3 ppm	20.2 ppm	0.6	3.4
SO_2	150 ppb	146 ppb	3.0	4.9

- Oxides of Nitrogen.

  A total of 19 outliers (17%) were identified during this intercalibration. This is better than the previous Summer exercise where 22% of the analysers were identified as outliers.

  The NO_2 intercomparison test was unsuccessful, as a result of using three audit cylinders that were later identified as unstable. Data for the remaining site tests have not been presented, as the population of sites is not sufficiently high for meaningful statistical analyses to be performed

  There were 6 converters which initially fell outside the ±5% acceptance limits, and a further 16 where the initial result was outside the ±2% trigger for NO_2 rescaling. Additional testing showed that three of these converters required rescaling to be undertaken while a further three will be reassessed at the summer 2011 audit.

- Carbon Monoxide

  Two analysers were identified as outliers at this intercalibration. This result is identical to the Summer exercise.

- Sulphur Dioxide

  A total of 7 outliers (16%) were identified at this intercalibration. This is identical to the Summer exercise. All m-xylene interference tests were less than 23ppb.

- Ozone

  A total of 16 outliers (20%) were identified during the winter exercise. This is slightly worse than the previous intercalibration, where 14 analysers were found to be outside the ±5% acceptance criterion.

- Particulate Analysers

  Three calculated TEOM and FDMS k0 determinations were outside the required ±2.5% of their stated values. This is worse than the previous exercise - one outlier was identified in the Summer intercalibration

  Four TEOM main flows were found to be outside the ±10% acceptance limits, identical to the Summer exercise.
  No Partisol analyser total flows were outside the acceptance limits.

- Site Cylinder Concentrations

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

7.3 London Sites

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

Table 7.3 - Summary of audited analyser performance – London Sites

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

7.4 Scottish Sites

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

Table 7.4 - Summary of audited analyser performance – Scottish Sites

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

7.5 Welsh Sites

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

Table 7.5 - Summary of audited analyser performance – Welsh Sites

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

7.6 Northern Ireland Sites (incl. Mace Head)

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

Table 7.6 - Summary of audited analyser performance – Northern Irish Sites

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

7.7 English Sites

The results of the intercomparison for the 87 English sites are summarised below:

Table 7.7 - Summary of audited analyser performance – English Sites

Parameter	Number of outliers	Number in region
NOx analyser	13	73
NOx converter	4	
CO analyser	1	14
SO_2 analyser	6	28
Ozone analyser	13	52
TEOM and BAM analysers	2 k_0, 2 flow	2 TEOM PM_{10} 34 FDMS PM_{10}

		1 BAM PM_{10} 0 TEOM $PM_{2.5}$ 52 FDMS $PM_{2.5}$ 1 BAM $PM_{2.5}$
Gravimetric PM analysers	0	2 PM_{10} 4 $PM_{2.5}$
Cylinders	8	179

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

8 Site Cylinder Concentrations

During the intercalibration, the concentrations of the on-site cylinders were evaluated using the audit cylinder standards. The calculated results showed that 11 of the 299 cylinders (~3.5%) used to scale analyser data into concentrations (NO, CO and SO_2) were outside the ±10% acceptance criterion. This is worse than the Winter exercise, where 2% (6) of the scaling cylinders were outside the acceptance limits. There were 8 NO cylinders and 3 SO_2 cylinders identified as outliers.

In addition, the concentrations of 29 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 40 of the 299 cylinders (13%) were outside the acceptance limits. This is better than the previous intercalibration, where 16% of the total cylinder population (46 in total) were found to be out of specification.

3 of the 8 NO cylinders (Liverpool Queen's Drive, London Eltham, Norwich Lakenfields) appear to have been contaminated; a significant oxidation of the NO into NO_2 has occurred since the last intercalibration. These have been replaced and the performance of the new cylinders will be closely monitored at subsequent audits.

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

9 Site Information

All site information is now uploaded to CMCU and the UK Air Information Resource (UK-AIR, http://uk-air.defra.gov.uk/) 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.

10 CEN

The European Committee for Normalisation (CEN) have prepared a series of documents prescribing how analysers must be operated, to produce datasets that conform to the Data Quality Objectives of the EC Directives. The CEN documents for operation of air pollution analysers; BS EN14211:2005 (NOx), BS EN14212:2005 (SO_2), BS EN14626:2005 (CO) and BS EN14625:2005 (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 incorporated into the requirements of the air quality Directive 2008/50/EC. Member States had until June 2010 to ensure their monitoring networks are compliant.

Older, non-compliant equipment still on site after this date will need to be replaced before June 2013. AEA have taken steps to ensure the procedures used in the UK comply with the requirements ahead of any imposed deadlines. To this end, the procedures used for the intercomparisons have been fully compliant with the CEN protocols since January 2006.

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

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

Table 10.1 – Analyser measurement uncertainties (%)

Date	Site	O_3	CO	SO_2	NOx	NO
01-Mar	Barnsley 12			13.4		
01-Mar	Barnsley Gawber	10.7		13.4	10	10
21-Jan	Bath Roadside				13.5	14
26-Jan	Billingham				13.5	14
03-Feb	Birmingham Tyburn	8.7		12.3	11.8	11.8
09-Mar	Birmingham Tyburn Roadside	12.4			13.5	14
09-Feb	Blackpool Marton	10.7			10	10
11-Jan	Bournemouth	12.4			13.5	14
08-Feb	Brighton Preston Park	12.4			13.5	14
19-Jan	Bristol Old Market		9.5		13.5	14
17-Jan	Bristol St Paul's	12.4	9.5	13.4	13.5	14
09-Feb	Canterbury				13.5	14
23-Feb	Carlisle Roadside				10.5	10.5
16-Feb	Charlton Mackrell	12.4			13.5	14
09-Feb	Chatham Centre Roadside				13.5	14
19-Jan	Coventry Memorial Park	10.7			10	10
08-Feb	Eastbourne				13.5	14
28-Feb	Exeter Roadside	8.7			11.8	11.8
16-Feb	Glazebury	12.4			13.5	14
09-Mar	Great Dun Fell	12.4				
25-Feb	Harwell	12.4		13.4	13.5	14
20-Feb	High Muffles	12.4			13.5	14
02-Feb	Horley				10.5	10.5
01-Feb	Hull Freetown	10.7	9.5	15.3	10	10
08-Mar	Ladybower	12.9		13.5	13.5	14
02-Feb	Leeds Centre	10.7	10.7	13.4	10	10
10-Mar	Leicester Centre	10.7	9.5	13.4	10	10
07-Mar	Leominster	12.4		13.6	13.5	14
07-Feb	Liverpool Queen's Drive Roadsi				13.5	14
07-Feb	Liverpool Speke	10.7	9.5	13.7	10	10
10-Feb	London Bexley		9.5	13.4	13.5	14
14-Feb	London Bloomsbury	12.4	9.5	13.4	13.5	14
01-Mar	London Cromwell Road 2		9.5	13.4	13.5	14
31-Jan	London Haringey	-			13.5	14
06-Jan	London Harlington	12.4			13.5	14
14-Jan	London Hillingdon	10.7			10	10
24-Jan	London Marylebone Road	12.4	9.5	13.4	13.5	14
25-Jan	London N. Kensington	12.4	9.5	13.4	13.5	14
27-Jan	London Teddington	12.4			13.5	14
20-Jan	London Westminster	12.4	9.5	13.4	13.5	14
15-Feb	Lullington Heath	12.4		13.4	13.5	14
15-Feb	Manchester Piccadilly	10.7		-	10	10
15-Feb	Manchester South	12.4			13.5	14
07-Mar	Market Harborough	10.7			10	10
25-Jan	Middlesbrough	12.4	9.5	13.4	13.5	14
24-Jan	Newcastle Centre	10.7	9.5	13.4	13.5	14
26-Jan	Northampton	8.7		-	11.8	11.8
22-Feb	Norwich Lakenfields	10.7		13.4	10	10
17-Jan	Nottingham Centre	10.7		13.4	10	10
14-Feb	Oxford Centre Roadside				10.5	10.5
14-Feb	Oxford St Ebbes				10.5	10.5
28-Feb	Plymouth Centre	10.7			10	10

Date	Site	O_3	CO	SO_2	NOx	NO
10-Jan	Portsmouth	10.7			11.8	11.8
08-Feb	Preston	10.7			10	10
18-Feb	Reading New Town	10.7			10	10
22-Feb	Rochester Stoke	-		13.4	13.5	14
01-Feb	Sandwell West Bromwich	8.7		12.4	11.8	11.8
23-Feb	Sandy Roadside				13.5	14
02-Feb	Scunthorpe Town			13.5	13.5	14
28-Feb	Sheffield Centre	10.7	9.5	13.6	10	10
28-Feb	Sheffield Tinsley				13.5	14
23-Feb	Sibton	12.4				
13-Jan	Southampton Centre	10.7	9.5	13.8	10	10
17-Feb	Southend-on-Sea	10.7			10	10
19-Jan	Southwark A2 Old Kent Road				13.5	14
25-Jan	St Osyth	10.7			10	10
24-Jan	Stanford-le-Hope Roadside			13.4	13.5	14
26-Jan	Stockton-on-Tees Eaglescliffe				13.5	14
18-Jan	Stoke-on-Trent Centre	10.7			10	10
25-Jan	Sunderland Silksworth	12.4		-	-	-
24-Jan	Thurrock	12.4		14.3		
11-Feb	Tower Hamlets Roadside		9.5		-	-
22-Feb	Weybourne	10.7				
24-Feb	Wicken Fen	12.4		13.4	13.5	14
16-Feb	Wigan Centre	10.7			-	-
08-Feb	Wirral Tranmere	10.7			10	10
01-Mar	Yarner Wood	12.4			13.5	14
16-Feb	Armagh Roadside				10.5	10.5
23-Feb	Ballymena			13.5		
01-Mar	Belfast Centre	10.7	9.5	13.6	10	10
21-Feb	Derry	12.4		13.4	13.5	14
14-Feb	Lough Navar	12.4				
31-Jan	Aberdeen	12.4			13.5	14
01-Feb	Aberdeen Union Street Roadside				13.5	14
12-Jan	Auchencorth Moss	12.4				
12-Jan	Bush Estate	12.4			13.5	14
23-Feb	Dumfries				13.5	14
11-Jan	Edinburgh St Leonards	12.4	9.5	13.7	13.5	14
10-Mar	Eskdalemuir	12.4			13.5	14
12-Jan	Fort William	12.4			13.5	14
18-Jan	Glasgow Centre	-	9.5	13.4	13.5	14
18-Jan	Glasgow City Chambers				13.5	14
18-Jan	Glasgow Kerbside				10	10
03-Feb	Inverness				13.5	14
02-Feb	Lerwick	12.4				
11-Jan	Peebles	12.4			13.5	14
09-Feb	Strath Vaich	12.4				
07-Mar	Aston Hill	12.4			13.5	14
11-Mar	Cardiff Centre	12.4	9.5	13.5	13.5	14
20-Jan	Cwmbran	10.7			11.8	11.8
24-Feb	Mold	12.4			13.5	14
07-Feb	Narberth	12.4		13.4	13.5	14
02-Feb	Newport				10.5	10.5
03-Feb	Port Talbot Margam	10.7	9.5	13.4	10	10
03-Feb	Swansea Roadside				13.5	14
24-Feb	Wrexham			13.4	13.5	14

11 Safety

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

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

Table 11.1 Actions Required for Safe Roof Access

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

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

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

12 Certification

The Network Certificate of Calibration is presented in Appendix 4. This certificate presents the results of the individual analyser scaling factors on the day of the audit, as calculated by AEA using the audit cylinder standards, in accordance with our ISO17025 accreditation.

13 Summary

The intercalibration exercise has demonstrated its value as an effective tool in determining overall site performance and assessing the reliability and traceability of air quality measurements from a large scale network. The results from this intercalibration have been used to assess data quality during the ratification of the network datasets for the period October 2010 to March 2011.

Appendices

Appendix 1: Recommendations for Upgrade or Replacement of Equipment

Appendix 2: Partisol Data Report

Appendix 3: Information for New Sites

Appendix 4:Certificate of Calibration

Appendix 1

Recommendations for Upgrade or Replacement of Equipment

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

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

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

	Recommendations January 2011	Priority	Action
30	All permanently pressurised cylinder calibration systems to be fitted with passivated stainless steel tubing	High	ESU
	Recommendations August 2008	**Priority**	**Action**
27	Many sites require modifications to permit safe roof access for measuring PM analyser flows	High	CMCU
	Recommendations January 2008	**Priority**	**Action**
25	It is recommended that LSOs continue to pay particular attention to the NO_2 calibration results, to see whether the NO response is significantly higher (>10ppb) than that obtained for the zero calibration. These observations should be reported to CMCU as soon as possible	High	LSO
24	It is strongly recommended that ESUs clean all NOx analyser switching valves during servicing, and ensure the valve is leak checked afterwards. Suspect leaking valves are highlighted by the QA/QC Unit during audits	High	ESU
	Recommendations January 2007		
22	ESUs to ensure all NOx converter software settings to be 100%.	High	ESUs to check at service
	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)**	Medium	Many sites now cured, but some need attention at next ESU visit

Appendix 2

Partisol Data: January-March 2011

Ratification was carried out for all sites for the period 1st Jan to 31st Mar 2011.

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.
- Do a rough comparison of ambient concentrations with those from co-located or nearby FDMS-TEOM sites.

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

QA/QC 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.
- Adjusting measured concentrations where the flowrate is >3% out from $16.67 l min^{-1}$ at 6-monthly audits

Auchencorth Moss PM_{10} (serial number 21550).

Flow checks for PM_{10}:

Service/audit	Service/ Audit date	Partisol reading, litres/min	Tested Flowrate litres/min	% out from 16.67 litres/min	% out from stated
Audit	23/06/2010	16.7	17.41	4.43	4.24
Service (post-service check)	06/07/2010	16.7	16.42	-	-1.68
Audit	12/01/2011	16.7	16.92	1.53	1.34
Service (pre - service check)	28/01/2011	16.7	16.20	-	-2.99
Service (post-service check)	28/01/2011	16.7	16.45	-	-1.50

Data Capture: **91%**. Data losses –

- 3rd Jan: PM_{10} was negative and less than $PM_{2.5}$. PM_{10} only deleted.
- 5th Jan: filter apparently unexposed.
- 14th Jan: PM_{10} less than $PM_{2.5}$. As it was not clear which value was correct, both were rejected.
- 15th Jan: filter apparently unexposed.
- 28th Jan: scheduled service reduced sampling time to < 18h.
- 30th Jan: PM_{10} less than $PM_{2.5}$. Again, both rejected.
- 9th Feb: < 18h sampling (area power disruption)
- 27th Mar: PM_{10} less than $PM_{2.5}$. Both rejected.

Auchencorth Moss $PM_{2.5}$ (serial number 21548).

Flow checks for $PM_{2.5}$:

Service/audit	Service/ Audit date	Partisol reading, litres/min	Tested Flowrate litres/min	% out from 16.7 litres/min	% out from stated
Audit	23/06/2010	16.7	17.09	2.54	2.35
Service (post-service check)	06/07/2010	16.7	16.58	-0.72	-0.72
Audit	12/01/2011	16.7	16.50	1.02	1.20
Service (pre - service check)	28/01/2011	16.7	16.64	-0.36	-0.36
Service (post-service check)	28/01/2011	16.7	16.58	-0.72	-0.72

Data capture **96%**. Data losses as follows:

- 14th Jan: PM_{10} less than $PM_{2.5}$.
- 28th Jan: scheduled service reduced sampling time to < 18h.
- 30th Jan: PM_{10} less than $PM_{2.5}$.
- 27th Mar: PM_{10} less than $PM_{2.5}$.

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Bournemouth $PM_{2.5}$ (serial number 21863)

Flow checks for $PM_{2.5}$:

Service/audit	Service/ Audit date	Partisol reading, litres/min	Tested Flowrate litres/min	% out from 16.67 litres/min	% out from stated
Audit	20/08/2010	16.7	16.38	-1.76	-1.94
Service (post-service check)	23/08/2010	16.7	16.72	0.12	0.12
Audit	11/01/2011	16.67	16.67	0.00	0.00
Service (pre-service check)	20/01/2011	16.7	16.97	1.62	1.62
Service (post-service check)	20/01/2011	16.7	16.78	0.48	0.48

Data capture was **50%** for this quarter. Data losses:

- 20th Jan: suspected double-exposed filter.
- 29th -21st Jan: routine service, < 18h sampling.
- 21st Jan: Partisol left in "service" mode by ESU.
- 22nd Jan – 9th Feb, Partisol not recognising the presence of filters, ban on work at the site prevented repair.
- 18th – 22nd Feb: filter exchange failure. Fixed when LSO checked pneumatic line, it could then be remotely re-set by CMCU.
- 24th Feb – 8th Mar: double-exposed filters due to LSO error.
- 26th – 31st Mar: double exposed filters.

Significant data losses this quarter due to equipment faults and human errors.

Brighton Preston Park $PM_{2.5}$ (serial number 21896)

Flow checks:

Service/audit	Service/ Audit date	Partisol reading, litres/min	Tested Flowrate litres/min	% out from 16.67 litres/min	% out from stated
Audit	09/08/2010	16.7	17.46	4.71	4.52
Service (post-service check)	25/08/2010	16.7	16.80	0.60	0.60
Audit	08/02/2011	16.7	20.02	**21.10**	**20.88**
Service (pre-service check)	14/02/2011	16.7	21.2	**26.9**	**26.9**
Service (post-service check)	15/02/2011	16.7	16.6	-0.60	-0.60

Data capture was 47%, after rejection of all data up to February service. The main data loss was due to flow rate being outside the acceptable range. The AEA site audit on 8th Feb found that although the Partisol was displaying a flow of 16.7 l/min the actual flow rate recorded by a BIOS flowmeter was 21.10 l/min. At the service, the initial checks revealed a flow rate of 26.9 l/min, and the Partisol also failed the leak test. The Partisol flow sensor was replaced and the flow re-calibrated and checked. All data in Q1 up to the time of this service have been rejected because it is not possible to say with confidence when the problem began. Other data losses:

- 14th -15th and 17th Feb: < 18h sampling.
- 24th Feb: incorrect time.

Harwell PM_{10} (serial number 20143)

Flow checks:

Service/audit	Service/ Audit date	Partisol reading, litres/min	Tested Flowrate litres/min	% out from 16.67 litres/min	% out from stated
Audit	20/08/2010	16.7	16.53	-1.40	1.22
Service	09/09/2010				
Callout	06/01/2011			0.00	0.00
Callout	31/01/2011	16.7	17.24	3.23	3.23
Callout	31/01/2011	16.7	16.60	-0.60	-0.60
Audit	25/02/2011	15	14.94	**-8.76**	1.39
Service	01/03/2011	Partisol apparently not tested.			
	Flow rate correction: ramped flow rate correction applied from 20/08/2010 (-1.40%) to 31/01/2011 (3.23%). Then a separate flow rate correction was calculated for the period 31st Jan – 25th Feb. Thereafter, used value from the audit (1.39%). Note: the low flow seen at the audit appears to have been short-term as the average recorded for that day was 16.7 l/min.				

Data capture was 79%. Data losses:

- 4th – 6th Jan: faulty motherboard.
- 6th – 20th Jan: comms problem – could not download data.
- 31st Jan: repair by ESU.
- 25th Feb: < 18h sampling due to audit.

Lots of problems,

Harwell $PM_{2.5}$

Flow checks:

Service/audit	Service/ Audit date	Partisol reading, litres/min	Tested Flowrate litres/min	% out from 16.67 litres/min	% out from stated
Audit	20/08/2010	16.7	17.07	2.40	2.22
Service	09/09/2010	Partisol apparently not tested.			
Audit	25/02/2011	16.7	17.63	**7.13**	**6.94**
Service	01/03/2011	Partisol apparently not tested.			
	Flow correction applied from audit on 20th Aug 2010 (2.22%) to audit on 25th Feb 2011 (6.94%).				

Data capture was 99%. Data losses:

- 4th Jan: date and time correction.

Good performance.

Inverness PM_{10} (Serial number 21255)

Flow checks:

Service/audit	Service/ Audit date	Partisol reading, litres/min	Tested Flowrate litres/min	% out from 16.67 litres/min	% out from stated
Audit	23/07/2010	16.7	17.24	3.44	3.25
Service	?	Awaiting service records from Casella.			
Audit	03/02/2011	16.7	17.21	3.27	3.08
Service	17/02/2011	Awaiting service records from Casella.			
	Flow correction applied from audit on 23rd Jul 2010 (3.25%) to audit on 3rd Feb 2011 (3.08%).				

Data capture 80%. Data losses as follows:

- 3rd Jan: Filter exchange failure (FEF).
- 11th Jan: ran out of filters.
- 17th Feb: scheduled service: < 18h sampling.
- 19th Feb – 1st Mar, 22nd Mar & 28th Mar: FEF's.

Lots of FEFs at this site, as was the case last quarter.

Inverness $PM_{2.5}$ (Serial number 21861)

Flow checks:

Service/audit	Service/ Audit date	Partisol reading, litres/min	Tested Flowrate litres/min	% out from 16.67 litres/min	% out from stated
Audit	23/07/2010	16.7	16.54	-0.75	-0.93
Service	?	Awaiting service records from Casella.			
Audit	03/02/2011	16.7	16.67	0.01	-0.17
Service	17/02/2011	Awaiting service records from Casella.			
	Flow correction: measured flow rate remained within +/- 3% of 16.67, so **no ramped flow rate correction applied** from audit on 23rd Jul 2010 (-0.93%) to audit on 3rd Feb 2011 (-0.17%).				

Data capture 90%. Data losses as follows:

- 5th Jan: $PM_{2.5}$ > PM_{10}: $PM_{2.5}$ suspect.
- 11th -17th Feb: Filter exchange failure (FEF).
- 17th Feb: scheduled service: < 18h sampling.
- 17th Feb: $PM_{2.5}$ > PM_{10}: $PM_{2.5}$ suspect.

Lots of FEFs at this site, as was the case last quarter. Both Partisols appear to be affected.

London Marylebone Road PM_{10}

Flow checks:

Service/audit	Service/ Audit date	Partisol reading, litres/min	Tested Flowrate litres/min	% out from 16.7 litres/min	% out from stated
Audit	09/08/2010	16.67	16.54	0.8%	0.8%
Service	?	Awaiting service records from ESU.			
Audit	24/01/2011	Partisol not working on day of audit, so not tested.			
Service	?	Awaiting service records from ESU.			

Data capture was 34%. Data losses:

- FEF 12th – 18th Jan, immediately followed by -
- Water ingress on 18th Jan. Off-site repair required. Re-started on 12th Mar.

Major problems this quarter.

London Marylebone $PM_{2.5}$

Flow checks:

Service/audit	Service/ Audit date	Partisol reading, litres/min	Tested Flowrate litres/min	% out from 16.7 litres/min	% out from stated
Audit	**09/08/2010**	**$PM_{2.5}$ Partisol had a known fault at the time of this audit (it was leaking due to a missing connector). So the result of this audit was not used.**			
Service	08/09/2010	Partisol re-started after repair. Flowrate assumed to be 16.67 li/min at this point.			
Audit	24/01/2011	16.6	17.27	3.61	4.05
Service	?	Awaiting service records from ESU.			
	Ramped flow rate correction from 0 on 8th Sep 2010 to 4.05% on 24th Jan 2011, thereafter the value from the Jan 2011 audit.				

Data capture was 80%. Data losses:

- 8th – 11th Jan: flow halted, cause not clear.
- 18th Jan, 14th Feb: power failures, < 18h sampling.
- 20th – 21st Feb: flow halted, cause not clear.
- 23rd – 24th Feb: flow and temperature problems.
- 28th Feb – 3rd Mar: flow and temperature problems, fixed by ESU on 3rd Mar.
- 18th – 21st Mar: breakdown, cause not clear.

Numerous breakdowns and problems this quarter

London North Kensington PM_{10} (serial number 21015)

Flow checks:

Service/audit	Service/ Audit date	Partisol reading, litres/min	Tested Flowrate litres/min	% out from 16.67 litres/min	% out from stated
Audit	23/08/2010	16.7	16.02	**-3.90**	-4.07
Service	?	Awaiting service records from ESU.			
Audit	25/01/2010	16.7	16.86	1.15	0.97
Service	?	Awaiting service records from ESU.			
	Flow correction applied from audit on 23rd Aug 2010 (-4.07%) to audit on 25th Feb 2011 (0.97%).				

Data capture was 99%. Data losses:

- 14th Feb: power interruption.

This Partisol operated normally and reliably throughout.

London North Kensington $PM_{2.5}$ (serial number 21015)

Flow checks:

Service/audit	Service/ Audit date	Partisol reading, litres/min	Tested Flowrate litres/min	% out from 16.67 litres/min	% out from stated
Audit	23/08/2010	16.7	16.16	-3.06	-3.23
Service	?	Awaiting service records from ESU.			
Audit	25/01/2010	16.7	16.27	-2.414	-2.59
Service	?	Awaiting service records from ESU.			
	Flow correction applied from audit on 23rd Aug 2010 (-3.23%) to audit on 25th Feb 2011 (-2.59%). From then on used value from last audit.				

Data capture was 99%. Data losses:

- 14th Feb: power interruption.

This Partisol also operated normally and reliably throughout.

London Westminster $PM_{2.5}$

Flow checks

Service/audit	Service/ Audit date	Partisol reading, litres/min	Tested Flowrate litres/min	% out from 16.67 litres/min	% out from stated
Audit	26/08/2010	16.7	16.44	-1.40	-1.58
Service (post-service check)	09/09/2010	16.7	17.10		2.40
Audit – fault began during audit.	*20/01/2011*	*0.01*	*0*	*-100*	*-100*
Service (pre - service check)	08/02/2011	16.7	16.95		1.50
Service (post-service check)	08/02/2011	16.7	17.02	1.92	1.92

Data capture **93%**. Data losses as follows:

- 20th – 24th Jan: fault which started during audit.
- 8th Feb: scheduled service.

Generally good performance apart from January breakdown.

Northampton $PM_{2.5}$ (serial number 21013)

Flow checks:

Service/audit	Service/ Audit date	Partisol reading, litres/min	Tested Flowrate litres/min	% out from 16.67 litres/min	% out from stated
Audit	24/08/2010	16.7	16.93	1.54	1.36
Service	?	Awaiting service records from ESU.			
Audit	25/01/2010	16.7	17.5	4.98	4.98
Service	23/02/2011	Awaiting service records from ESU.			
	Flow correction applied from audit on 24th Aug 2010 (1.54%) to audit on 25th Jan 2011 (4.98%). From then on used value from last audit. Will amend when service records are received.				

Data capture was 99%. Data losses:

- .23rd Feb: routine service reduced sampling time to < 18h.

This Partisol also operated normally and reliably throughout.

Port Talbot PM_{10} (Serial number 22588)

Flow checks:

Service/audit	Service/ Audit date	Partisol reading, litres/min	Tested Flowrate litres/min	% out from 16.67 litres/min	% out from stated
Audit	14/07/2010	16.7	16.81	0.8	0.8
Callout (response to low flow)	08/09/2010	16.7	16.63	-0.40	-0.40
Service	?	Awaiting service records from ESU.			
Audit	03/02/2011	16.7	16.40	-1.62	-1.62
Service	17/02/2011	Awaiting service records from ESU.			

Data capture 99%. Data losses as follows:

- 2nd Mar: sampling time < 18h. Possibly something to do with inlet clean on that day?

Partisol operating well.

Wrexham PM_{10} (Serial number 21224)

Flow checks:

Service/audit	Service/ Audit date	Partisol reading, litres/min	Tested Flowrate litres/min	% out from 16.67 litres/min	% out from stated
Audit	17/08/2010	16.7	15.87	**-4.77**	-4.94
Service	07/09/2010	16.70	16.70	0.00	0.00
Audit	24/02/2011	16.7	Flowmeter not working – flow not measured.		
Service	10/03/2011	Await service records from ESU.			

Data capture 97%. Data losses as follows:

- 7th Feb: $PM_{2.5}$ > PM_{10}: PM_{10} suspect as it was negative.
- 1st Mar: sampling time < 18h. Possibly something to do with inlet clean on that day?
- 10th Mar: scheduled service: < 18h sampling.

Wrexham $PM_{2.5}$ (Serial number 21224)

Flow checks:

Service/audit	Service/ Audit date	Partisol reading, litres/min	Tested Flowrate litres/min	% out from 16.67 litres/min	% out from stated
Audit	17/08/2010	16.7	15.73	-5.67	-5.84
Service	07/09/2010	16.70	(reportedly within spec but no measurement given)		
Audit	24/02/2011	16.7	Flowmeter not working – flow not measured.		
Service	10/03/2011	Await service records from ESU.			
	No flow correction made, because flow rate was not reported in Sep 2010 service report and could not be tested at Feb 2011 audit. Correction may be applied if service records (when available) indicate that it is appropriate.				

Data capture 99%. Data losses as follows:

- 4th Jan: inlet clean, < 18h sampling.
- 10th Mar: scheduled service: < 18h sampling.

Appendix 3

Site Details for New Sites

Site Name	Pollutants	Region Name	Grid	Altitude m	Type
Birmingham Acocks Green	NO_2 O_3 SO_2 $PM_{2.5}$	W Midlands	SP11606 82183	133	Background Urban
Southwark A2 Roadside[r1]	No2 PM10	London	TQ34844 77515	10	Traffic Urban

Appendix 4

Certificate of Calibration

AEA

CERTIFICATE OF CALIBRATION

The Gemini Building, Fermi Avenue, Harwell, Didcot, Oxfordshire OX11 0QR.
Telephone: 0870 1906465 Fax: 0870 1906377

UKAS CALIBRATION 0401

Certificate Number: 02449
AEA Identification Number: ED57002030

Approved Signatories: B Stacey
S. Eaton

Signed:

Date of issue: 19 May 2011

Customer Name and Address: Dr Emily Connolly

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

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

1. Northern Ireland Sites (including Mace Head)

Carbon Monoxide

Date Year = 2011	Site	Analyser number	[1]Zero output	Uncertainty (ppm)	[2]Calibration Factor	Uncertainty (%)	*Maximum Residual (%)
01-Mar	Belfast Centre	462	0	0.3	1.000	3	1.8

Sulphur Dioxide

Date Year =2011	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)	*m-xylene interference (ppb)
23-Feb	Ballymena	m1744-m668	3	4	0.899	8.9	3.3	14.5
01-Mar	Belfast Centre	1766	8	4	0.918	5	1.3	1.1
21-Feb	Derry	1697	8	4	0.973	5	1.6	-4.2

Ozone

Date Year =2011	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)
01-Mar	Belfast Centre	cm08060038	1	5	1.059	3.4	1.2
21-Feb	Derry	1586	2	5	0.984	3.1	0.6
14-Feb	Lough Navar	1640	2	5	1.010	3.1	0.8
15-Feb	Mace Head	77086-385	1	5	1.021	3.1	0.2

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.

The Gemini Building, Fermi Avenue, Harwell, Didcot, Oxfordshire OX11 0QR.
Telephone: 0870 1906465 Fax: 0870 1906377

Oxides of Nitrogen

Date Year =2011	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
16-Feb	Armagh Roadside	NO	?	0	5	1.105	5	1.1	
		NOx		4	5	1.119	5	0.2	96.5
01-Mar	Belfast Centre	NO	08050074	-1	5	1.117	5	1.7	
		NOx		-1	5	1.103	5	1.6	98.3
21-Feb	Derry	NO	2130	1	5	1.138	5	0.5	
		NOx		3	5	1.111	5	0.6	99.2

Particulate Analysers

Date Year =2011	Site		Analyser number	Calculated Spring Constant k_0	Uncertainty (%)	[4]k_0 accuracy (%)	[3]Measured Main Flow (l/min)	Uncertainty (%)	[3]Measured Total Flow /**Aux Flow** (l/min)	Uncertainty (%)
16-Feb	Armagh Roadside	PM10	2000	13643	1	0.5	2.91	2.2	15.88	2.2
01-Mar	Belfast Centre	PM10	24423	14342	1	1.1	3.02	2.2	15.76	2.2
01-Mar	Belfast Centre	PM25	26565	15679	1	-0.3	2.96	2.2	15.44	2.2
21-Feb	Derry	PM10	21313	11048	1	1.5	**2.97**	**2.2**	**13.36**	**2.2**
21-Feb	Derry	PM25	2701	16158	1	2.2	**2.61**	**2.2**	**13.53**	**2.2**
14-Feb	Lough Navar	PM10	21196	13045	1	1.8	**3.06**	**2.2**	16.39	2.2

2. Scottish Sites

Carbon Monoxide

Date Year = 2011	Site	Analyser number	[1]Zero output	Uncertainty (ppm)	[2]Calibration Factor	Uncertainty (%)	*Maximum Residual (%)
11-Jan	Edinburgh St Leonards	240	-0.3	0.3	1.000	3	3.3
18-Jan	Glasgow Centre	241	0.7	0.3	0.962	3	2.6

Sulphur Dioxide

Date Year =2011	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)	*m-xylene interference (ppb)
11-Jan	Edinburgh St Leonards	84	-38	4	1.029	5.3	1.3	17.3
18-Jan	Glasgow Centre	1630	1	4	0.929	5	1.5	9.6
10-Jan	Grangemouth	703b-274	2	4	1.131	6.9	1.5	16.2

Ozone

Date Year =2011	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)
31-Jan	Aberdeen	800	-1	5	1.044	3.2	0.2
12-Jan	Auchencorth Moss	646	-1	5	1.016	3.1	0.1
12-Jan	Bush Estate	1645	0	5	1.004	3.1	0.8
11-Jan	Edinburgh St Leonards	136	1	5	0.998	3.1	0.5
10-Mar	Eskdalemuir	14342	1	5	1.032	3.7	3.2
12-Jan	Fort William	1023	-1	5	1.031	3.2	0.5
18-Jan	Glasgow Centre	8060029		Analyser	failed	leak	test
02-Feb	Lerwick	1643	1	5	1.018	3.1	0.2
11-Jan	Peebles	437	-3	5	1.169	3.2	1.2
09-Feb	Strath Vaich	721	-27	5	0.887	3.1	0.7

CERTIFICATE OF CALIBRATION

The Gemini Building, Fermi Avenue, Harwell, Didcot, Oxfordshire OX11 0QR.
Telephone: 0870 1906465 Fax: 0870 1906377

Oxides of Nitrogen

Date Year =2011	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
31-Jan	Aberdeen	NO	519	3	5	1.122	5	0.6	
		NOx		3	5	1.117	5	0.4	98.1
01-Feb	Aberdeen Union Street Roadside	NO	984	1	5	1.054	5	0.9	
		NOx		2	5	1.026	5	1.6	95.4
12-Jan	Bush Estate	NO	2244	1	5	1.023	5	1.7	
		NOx		1	5	1.024	5	0.9	99.2
13-Jan	Dumbarton Roadside	NO	311001	0	5	0.998	5	1.4	
		NOx		0	5	0.977	5	0.9	98.8
23-Feb	Dumfries	NO	12189	1	5	1.126	5	1.6	
		NOx		-4	5	1.117	5	1.2	96.5
11-Jan	Edinburgh St Leonards	NO	73	0	5	1.232	5	1.1	
		NOx		1	5	1.178	5	1.4	97.1
10-Mar	Eskdalemuir	NO	14899	1	5	1.012	5	1.5	
		NOx		-1	5	0.986	5	1.0	100.0
12-Jan	Fort William	NO	344	1	5	1.061	5	0.9	
		NOx		0	5	1.049	5	1.0	99.6
18-Jan	Glasgow Centre	NO	1713	1	5	1.142	5	0.5	
		NOx		1	5	1.134	5	0.3	100.5
18-Jan	Glasgow City Chambers	NO	575	0	5	0.906	5	0.2	
		NOx		4	5	0.916	5	0.2	99.0
18-Jan	Glasgow Kerbside	NO	08050061	-1	5	0.963	5	2.4	
		NOx		-1	5	0.943	5	2.2	100.0
10-Jan	Grangemouth	NO	700b-312	0	0	1.095	0	0.7	
		NOx		3	0	1.108	0	0.8	100.9
10-Jan	Grangemouth Moray	NO	912011	0	5	1.055	5	0.7	
		NOx		0	5	1.009	5	0.7	98.0
03-Feb	Inverness	NO	1489	0	5	1.258	5	0.8	
		NOx		0	5	1.239	5	1.1	100.5
11-Jan	Peebles	NO	2213	7	5	1.071	5	1.0	
		NOx		4	5	1.068	5	2.0	99.6

Particulate Analysers

Date Year =2011	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 (%)
31-Jan	Aberdeen	PM10	24427	11733	1	1.4	**2.92**	**2.2**	**13.40**	**2.2**
31-Jan	Aberdeen	PM25	27368	12247	1	0.2	**2.97**	**2.2**	**13.40**	**2.2**
12-Jan	Auchencorth Moss	PM10	20639	12924	1	-2.0	2.55	2.2	16.28	2.2
12-Jan	Auchencorth Moss	PM25	26033	13693	1	-2.3	2.96	2.2	16.28	2.2
12-Jan	Auchencorth Moss Partisol	PM10	21550						16.92	2.2
12-Jan	Auchencorth Moss Partisol	PM25	21548						16.50	2.2
11-Jan	Edinburgh St Leonards	PM10	27227	13554	1	-1.0	3.05	2.2	16.67	2.2
11-Jan	Edinburgh St Leonards	PM25	27233	16774	1	-1.4	3.13	2.2	16.71	2.2
18-Jan	Glasgow Centre	PM10	27331	10013	1	0.6	3.02	2.2	16.13	2.2
18-Jan	Glasgow Centre	PM25	22980	13247	1	1.2	3.03	2.2	16.24	2.2
18-Jan	Glasgow Kerbside	PM10	27344	15051	1	0.2	**3.11**	**2.2**	**13.82**	**2.2**
18-Jan	Glasgow Kerbside	PM25	27337	15187	1	0.4	**3.05**	**2.2**	**13.31**	**2.2**
10-Jan	Grangemouth	PM10	27228	16009	1	0.6	2.99	2.2	17.37	2.2
10-Jan	Grangemouth	PM25	27259	13715	1	-0.3	3.00	2.2	15.44	2.2
03-Feb	Inverness	PM10	21255						17.21	2.2
03-Feb	Inverness	PM25	21861						16.67	2.2

3. Welsh Sites

Carbon Monoxide

Date Year = 2011	Site	Analyser number	[1]Zero output	Uncertainty (ppm)	[2]Calibration Factor	Uncertainty (%)	*Maximum Residual (%)
11-Mar	Cardiff Centre	14333	0	0.3	0.995	3	3.5
03-Feb	Port Talbot Margam	1	-0.1	0.3	0.985	3	2.4

Sulphur Dioxide

Date Year =2011	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)	*m-xylene interference (ppb)
11-Mar	Cardiff Centre	14319	24	4	0.808	5	2.9	11.3
07-Feb	Narberth	14896	1	4	0.980	5	1.6	11.8
03-Feb	Port Talbot Margam	2	2	4	0.810	5	1.3	5.7
24-Feb	Wrexham	1181	-1	4	0.813	5	1.0	11.8

AEA

CERTIFICATE OF CALIBRATION

The Gemini Building, Fermi Avenue, Harwell, Didcot, Oxfordshire OX11 0QR.
Telephone: 0870 1906465 Fax: 0870 1906377

UKAS CALIBRATION

Certificate Number: 02449
AEA Identification Number: ED57002030

Ozone

Date Year =2011	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)
07-Mar	Aston Hill	14337	0	5	1.018	3.1	0.4
11-Mar	Cardiff Centre	14348	-2	5	1.017	3.1	0.5
20-Jan	Cwmbran	60043	-2	5	0.965	3.2	3.2
24-Feb	Mold	1642	1	5	1.015	3.1	2.3
07-Feb	Narberth	10280	0	5	1.056	3.1	0.3
03-Feb	Port Talbot Margam	3	0	5	1.010	3.4	1.7

Oxides of Nitrogen

Date Year =2011	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
07-Mar	Aston Hill	NO	17677	1	5	1.234	5	0.7	
		NOx		2	5	1.243	5	0.3	100.1
11-Mar	Cardiff Centre	NO	14325	2	5	1.340	5	1.8	
		NOx		2	5	1.326	5	1.5	101.7
20-Jan	Chepstow A48	NO	1	98	5	1.218	5	2.6	
		NOx		104	5	1.250	5	2.2	101.5
20-Jan	Cwmbran	NO	1	0	5	1.073	5	1.4	
		NOx		1	5	1.054	5	2.2	100.5
24-Feb	Mold	NO	345	0	5	1.089	5	0.9	
		NOx		1	5	1.115	5	0.3	96.0
07-Feb	Narberth	NO	14311	1	5	1.316	5	1.5	
		NOx		2	5	1.305	5	1.7	98.5
		NO	m671	-1	5	0.940	5	2.5	
		NOx		3	5	0.964	5	2.2	98.4
03-Feb	Port Talbot Margam	NO	12811	1	5	1.083	5	0.4	
		NOx		2	5	1.089	5	0.4	99.1
03-Feb	Swansea Roadside	NO	16695	2	5	1.178	5	0.6	
		NOx		2	5	1.130	5	0.6	99.5
24-Feb	Wrexham	NO	1490	-1	5	0.966	5	1.4	
		NOx		-1	5	0.973	5	1.3	100.8

Particulate Analysers

Date Year =2011	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 (%)
11-Mar	Cardiff Centre	PM10	26499	13762	1	-0.8	2.86	2.2	15.71	2.2
11-Mar	Cardiff Centre	PM25	24449	11046	1	0.5	2.81	2.2	15.47	2.2
20-Jan	Chepstow A48	PM10	27232	18152	1	-0.5	**3.03**	**2.2**	**13.94**	**2.2**
20-Jan	Chepstow A48	PM25	27223	15908	1	-0.5	**2.94**	**2.2**	**13.84**	**2.2**
07-Feb	Narberth	PM10							not	tested
02-Feb	Newport	PM10	22589	13759	1	-1.6	**3.01**	**2.2**	**13.81**	**2.2**
02-Feb	Newport	PM25	27252	15984	1	-0.3	2.90	2.2	15.02	2.2
03-Feb	Port Talbot Margam	PM10	27217	13977	1	0.3	2.90	2.2	14.53	2.2
03-Feb	Port Talbot Margam	PM25	25081	10508	1	-0.5	**2.94**	**2.2**	14.66	2.2
03-Feb	Port Talbot Margam Partisol	PM10	1						16.40	2.2
03-Feb	Swansea Roadside	PM10	26293	15420	1	-1.1	**2.95**	**2.2**	**12.77**	**2.2**
03-Feb	Swansea Roadside	PM25							not	tested
24-Feb	Wrexham	PM10	21224						not	tested
24-Feb	Wrexham	PM25	21011						not	tested

The reported 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.

4. London Sites

Carbon Monoxide

Date Year = 2011	Site	Analyser number	[1]Zero output	Uncertainty (ppm)	[2]Calibration Factor	Uncertainty (%)	*Maximum Residual (%)
10-Feb	London Bexley	14871	0.3	0.3	1.020	3	0.8
14-Feb	London Bloomsbury	14330	0.3	0.3	0.983	3	3.9
01-Mar	London Cromwell Road 2	10776	0.4	0.3	0.962	3	2.2
24-Jan	London Marylebone Road	651	-0.1	0.3	0.995	3	3.5
25-Jan	London N. Kensington	2313	0	0.3	1.005	3	4.8
20-Jan	London Westminster	10777	-0.3	0.3	1.036	3	3.2
11-Feb	Tower Hamlets Roadside	14728	0	0.3	1.020	3	1.1

Sulphur Dioxide

Date Year =2011	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)	*m-xylene interference (ppb)
10-Feb	London Bexley	114869	8	4	0.770	5	1.0	17.8
14-Feb	London Bloomsbury	14323	9	4	0.859	5	0.6	15.3
01-Mar	London Cromwell Rd 2	10779	8	4	0.974	5	0.2	3.1
24-Jan	London Marylebone Rd	2644	0	4	1.047	5	5.2	15.8
25-Jan	London N. Kensington	2576	2	4	1.075	5	5.8	13.7
20-Jan	London Westminster	10780	-3	4	1.043	5	1.5	12.5

Ozone

Date Year =2011	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)
14-Feb	London Bloomsbury	14907	0	5	1.054	3.1	14-Feb
04-Mar	London Eltham	375	8	5	1.038	4.7	04-Mar
31-Jan	London Haringey	538	20	5	1.024	3.1	31-Jan
06-Jan	London Harlington	14309	-2	5	1.026	3.1	06-Jan
14-Jan	London Hillingdon	8060034	0	5	1.034	3.3	14-Jan
24-Jan	London Marylebone Road	2432	3	5	1.119	3.1	24-Jan
25-Jan	London N. Kensington	2372	1	5	1.019	3.2	25-Jan
27-Jan	London Teddington	19191	-3	5	1.024	3.2	27-Jan
20-Jan	London Westminster	10444	0	5	1.019	3.1	20-Jan

Oxides of Nitrogen

Date Year =2011	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
28-Feb	Camden Kerbside	NO	67	3	5	1.022	5	2.3	
		NOx		2	5	1.260	5	2.0	101.0
31-Jan	Haringey Roadside	NO	397	2	5	0.890	5	2.7	
		NOx		3	5	0.859	5	1.5	95.4
10-Feb	London Bexley	NO	14870	1	5	1.187	5	2.2	
		NOx		2	5	1.174	5	2.1	98.7
14-Feb	London Bloomsbury	NO	14328	3	5	0.973	5	1.0	
		NOx		4	5	0.953	5	1.0	93.4
01-Mar	London Cromwell Road 2	NO	10775	2	5	0.983	5	0.3	
		NOx		1	5	0.980	5	0.7	95.7
04-Mar	London Eltham	NO	307	2	5	1.063	5	1.4	

CERTIFICATE OF CALIBRATION

The Gemini Building, Fermi Avenue, Harwell, Didcot, Oxfordshire OX11 0QR.
Telephone: 0870 1906465 Fax: 0870 1906377

Certificate Number: 02449
AEA Identification Number: ED57002030

Date Year =2011	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
		NOx		9	5	1.028	5	0.7	101.2
31-Jan	London Haringey	NO	11392	6	5	1.104	5	2.7	
		NOx		7	5	1.064	5	2.3	96.7
06-Jan	London Harlington	NO	11491	1	5	1.253	5	0.7	
		NOx		1	5	1.258	5	1.0	98.3
14-Jan	London Hillingdon	NO	8050017	1	5	0.928	5	0.6	
		NOx		1	5	0.923	5	0.6	101.9
24-Jan	London Marylebone Road	NO	3366	2	5	1.222	5	6.2	
		NOx		-1	5	1.219	5	4.4	101.6
25-Jan	London N. Kensington	NO	3273	0	5	1.009	5	5.5	
		NOx		-2	5	1.014	5	5.1	100.0
27-Jan	London Teddington	NO	19205	0	5	1.134	5	1.0	
		NOx		1	5	1.127	5	1.5	99.1
20-Jan	London Westminster	NO	10439	1	5	1.144	5	0.9	
		NOx		1	5	1.149	5	1.5	99.5
19-Jan	Southwark A2 Old Kent Road	NO	1954	2	5	1.523	5	1.5	
		NOx		5	5	1.503	5	1.6	89.7
11-Feb	Tower Hamlets Roadside	NO	306	2	5	1.450	5	2.0	
		NOx		5	5	1.495	5	2.9	100.0

Particulate Analysers

Date Year =2011	Site		Analyser number	Calculated Spring Constant k_0	Uncertainty (%)	[4]k_0 accuracy (%)	[3]Measured Main Flow (l/min)	Uncertainty (%)	[3]Measured Total Flow /**Aux Flow** (l/min)	Uncertainty (%)
28-Feb	Camden Kerbside	PM10	21159	12098	1	0.9	3.33	2.2	17.43	2.2
28-Feb	Camden Kerbside	PM25	21391	13012	1	2.0	**3.17**	**2.2**	**14.54**	**2.2**
31-Jan	Haringey Roadside	PM10	2000	15272	1	0.1	2.85	2.2	15.07	2.2
31-Jan	Haringey Roadside	PM25	27278	14666	1	-0.7	3.08	2.2	15.96	2.2
10-Feb	London Bexley	PM25	25007	11554	1	-0.3	3.04	2.2	14.84	2.2
14-Feb	London Bloomsbury	PM10	24446	13704	1	-0.3	**3.08**	**2.2**	**13.14**	**2.2**
14-Feb	London Bloomsbury	PM25	27240	14644	1	-0.8	**3.00**	**2.2**	**12.79**	**2.2**
04-Mar	London Eltham	PM25	27048	14075	1	1.9	3.07	2.2	16.28	2.2
06-Jan	London Harlington	PM10	22835	14262	1	0.4	3.03	2.2	15.90	2.2
06-Jan	London Harlington	PM25	23959	12829	1	0.2	3.06	2.2	15.84	2.2
21-Feb	London Harrow Stanmore	PM25	27274	16100	1	-0.9	2.99	2.2	15.49	2.2
24-Jan	London Marylebone Road	PM10	27230	16845	1	-0.6	3.21	2.2	16.76	2.2
24-Jan	London Marylebone Road	PM25	27239	13115	1	2.4	3.16	2.2	17.05	2.2
24-Jan	London Marylebone Road Partisol	PM10			Analyser	fault	no flow			
24-Jan	London Marylebone Road Partisol	PM25	21036						17.27	2.2

The reported 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

CERTIFICATE OF CALIBRATION

The Gemini Building, Fermi Avenue, Harwell, Didcot, Oxfordshire OX11 0QR.
Telephone: 0870 1906465 Fax: 0870 1906377

UKAS CALIBRATION 0401

Certificate Number: 02449
AEA Identification Number: ED57002030

Date Year =2011	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 (%)
25-Jan	London N. Kensington	PM10	27391	12705	1	0.3	2.91	2.2	15.92	2.2
25-Jan	London N. Kensington	PM25	21342	15840	1	0.3	2.91	2.2	15.64	2.2
25-Jan	London N. Kensington Partisol	PM10	22650						16.86	2.2
25-Jan	London N. Kensington Partisol	PM25	21015						16.27	2.2
27-Jan	London Teddington	PM25	25023	15272	1	-0.6	2.99	2.2	6.12	2.2
20-Jan	London Westminster	PM25				Analyser	fault	no flow		
19-Jan	Southwark A2 Old Kent Roa	PM10	2000	12914	1	0.7	3.03	2.2	16.91	2.2

5. English Sites

Carbon Monoxide

Date Year = 2011	Site	Analyser number	[1]Zero output	Uncertainty (ppm)	[2]Calibration Factor	Uncertainty (%)	[*]Maximum Residual (%)
19-Jan	Bristol Old Market	10429	-0.6	0.3	0.999	3	3.2
17-Jan	Bristol St Paul's	14417	0	0.3	1.005	3	2.6
02-Mar	Bury Roadside	1357	0	0.3	1.014	3	3.5
01-Feb	Hull Freetown	1499	0.1	0.3	0.967	3	2.3
02-Feb	Leeds Centre	1501	0	0.3	1.091	5.2	3.5
10-Mar	Leicester Centre	14868	0.9	0.3	0.783	3	1.1
07-Feb	Liverpool Speke	14329	0.2	0.3	0.988	3	1.1
25-Jan	Middlesbrough	14202	0.6	0.3	0.966	3	0.9
24-Jan	Newcastle Centre	14866	-4.7	0.3	0.777	3	3.0
14-Feb	Salford Eccles	2386	0	0.3	0.967	3	3.5
28-Feb	Sheffield Centre	459	-0.4	0.3	0.990	3	1.8
13-Jan	Southampton Centre	14865	0.3	0.3	1.000	3	3.6

Sulphur Dioxide

Date Year =2011	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	[*]Max Residual (%)	[*]m-xylene interference (ppb)
01-Mar	Barnsley 12	706	-2	4	0.832	5	1.5	15.8
01-Mar	Barnsley Gawber	90	12	4	0.911	5	0.7	6.1
03-Feb	Birmingham Tyburn	eh937000	1	4	1.070	5	2.9	0.5
17-Jan	Bristol St Paul's	14322	11	4	0.965	5	2.4	17.5
25-Feb	Harwell	83	8	4	0.875	5	0.8	14.7
01-Feb	Hull Freetown	342	0	4	1.152	8.6	3.9	17.6
08-Mar	Ladybower	12180	0	4	0.609	5	1.9	not tested
24-Feb	Leamington Spa	1793	-6	4	0.883	5	5.9	19.1
02-Feb	Leeds Centre	08050084	14	4	1.059	5	1.0	10.6
10-Mar	Leicester Centre	14321	-1	4	0.969	5	1.1	4.4
07-Mar	Leominster	14352	0	4	0.887	5	2.8	not tested
07-Feb	Liverpool Speke	17509	2	4	1.005	5.3	2.0	10.3

The reported 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.

Date Year =2011	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)	*m-xylene interference (ppb)
15-Feb	Lullington Heath	12181	1	4	0.887	5	0.7	5.6
15-Feb	Manchester Piccadilly	G-RA0477-013	0	4	0.903	5	1.9	16.6
25-Jan	Middlesbrough	14166	5	4	1.183	5	1.0	2.8
24-Jan	Newcastle Centre	14897	0	4	1.167	5	0.6	-1.6
26-Jan	Northampton	apsa	1	4	0.984	5	1.3	11.8
22-Feb	Norwich Lakenfields	12	8	4	1.000	5	0.8	9.0
17-Jan	Nottingham Centre	19066	2	4	0.928	5	1.5	9.3
22-Feb	Rochester Stoke	2800	8	4	0.954	5	3.4	17.2
14-Feb	Salford Eccles	2346	0	4	1.083	7.7	3.4	8.7
01-Feb	Sandwell West Bromwich	g0100pld	3	4	0.870	5	3.5	0.1
02-Feb	Scunthorpe Town	468	3	4	0.972	5	1.1	22.4
28-Feb	Sheffield Centre	1180	25	4	0.714	5	2.3	1.3
13-Jan	Southampton Centre	14895	-5	4	2.655	5	2.3	10.9
24-Jan	Stanford-le-Hope Roadside	14188	2	4	0.758	5	1.0	14.7
25-Jan	Sunderland Silksworth	996b382	-4	4	0.929	5.3	1.1	13.9
24-Jan	Thurrock	555	15	4	0.623	5.8	2.7	2.6
24-Feb	Wicken Fen	14349	1	4	0.966	5	2.5	11.6

AEA

CERTIFICATE OF CALIBRATION

The Gemini Building, Fermi Avenue, Harwell, Didcot, Oxfordshire OX11 0QR.
Telephone: 0870 1906465 Fax: 0870 1906377

UKAS CALIBRATION 0401

Certificate Number: 02449
AEA Identification Number: ED57002030

Ozone

Date Year =2011	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	[*]Max Residual (%)
01-Mar	Barnsley Gawber	70	-2	5	1.023	3.1	1.5
03-Feb	Birmingham Tyburn	wb6ag7tm	1	5	0.958	3.1	1.5
09-Mar	Birmingham Tyburn Roadside	19188	-1	5	1.004	3.1	0.3
09-Feb	Blackpool Marton	cm08060037	0	5	0.955	3.1	1.4
17-Jan	Bottesford	61689/332	4	5	1.006	3.3	1.0
11-Jan	Bournemouth	17503	0	5	1.014	3.7	0.5
08-Feb	Brighton Preston Park	542	-3	5	0.973	3.5	2.9
17-Jan	Bristol St Paul's	14358	-1	5	1.007	3.1	0.3
16-Feb	Charlton Mackrell	95249	-1	5	0.989	3.2	0.5
19-Jan	Coventry Memorial Park	cm08060044	1	5	1.028	3.1	0.4
28-Feb	Exeter Roadside		1	5	0.958	3.1	1.6
16-Feb	Glazebury	138	-2	5	1.031	3.1	0.8
09-Mar	Great Dun Fell	17496	-1	5	1.177	3.4	1.3
25-Feb	Harwell	1648	-1	5	1.032	3.1	0.5
20-Feb	High Muffles	17502	2	5	1.120	3.3	0.5
01-Feb	Hull Freetown	CM08060045	-1	5	0.916	3.1	0.5
08-Mar	Ladybower	#017498	1	5	1.047	6.2	3.2
24-Feb	Leamington Spa	1459	-1	5	0.758	3.2	0.8
02-Feb	Leeds Centre	CM08060036	1	5	1.008	3.1	1.0
10-Mar	Leicester Centre	2	0	5	1.074	3.2	1.2
07-Mar	Leominster	14470	4	5	0.993	3.1	0.5
07-Feb	Liverpool Speke	cm08060041	0	5	1.005	3.1	0.8
15-Feb	Lullington Heath	17494	-1	5	1.005	3.1	0.2
15-Feb	Manchester Piccadilly	CM08060039	0	5	1.017	3.1	0.7
15-Feb	Manchester South	1317	-3	5	1.013	3.1	0.7
07-Mar	Market Harborough	60031	-2	5	1.015	3.1	0.2
25-Jan	Middlesbrough	14203	-1	5	1.066	3.3	1.6
24-Jan	Newcastle Centre	cm08060033	0	5	0.946	3.1	1.2
26-Jan	Northampton	apoa	-1	5	0.864	3.1	2.2
22-Feb	Norwich Lakenfields	10	4	5	1.381	4.5	3.9
17-Jan	Nottingham Centre	60032	2	5	0.848	3.1	2.2
28-Feb	Plymouth Centre	CM08060027	0	5	1.048	3.1	0.6
10-Jan	Portsmouth	1	-1	5	1.017	3.1	1.4
08-Feb	Preston	cm08060042	1	5	1.015	3.3	2.4
18-Feb	Reading New Town	18505	0	5	1.014	3.2	0.3
22-Feb	Rochester Stoke	378	2	5	1.031	3.1	1.3
14-Feb	Salford Eccles	2363	6	5	0.931	3.1	2.0
01-Feb	Sandwell West Bromwich	g02002ft	1	5	0.985	3.1	1.8
28-Feb	Sheffield Centre	CM08060024	0	5	0.999	3.1	0.2
23-Feb	Sibton	146	-1	5	1.018	3.1	2.6
13-Jan	Southampton Centre	8060021	0	5	1.050	3.1	0.4
17-Feb	Southend-on-Sea	60017	0	5	1.076	3.1	1.4
25-Jan	St Osyth	cm08060035	0	5	1.001	3.1	1.0
18-Jan	Stoke-on-Trent Centre	cm08060026	0	5	1.087	3.2	0.8
25-Jan	Sunderland Silksworth	14908	1	5	0.963	3.1	0.4
24-Jan	Thurrock	1040	1	5	0.510	3.6	2.2
22-Feb	Weybourne	30	0	5	1.021	3.1	1.5
24-Feb	Wicken Fen	14345	-2	5	1.002	3.1	0.5
16-Feb	Wigan Centre	CM08060018	-2	5	0.953	3.1	1.6
08-Feb	Wirral Tranmere	cm08060040	0	5	1.025	3.2	3.7
01-Mar	Yarner Wood	14456	-1	5	1.012	3.1	0.3

Oxides of Nitrogen

The reported 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.

Date Year =2011	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
01-Mar	Barnsley Gawber	NO	75	0	5	0.711	5	1.1	
				1	5	0.716	5	1.3	99.5
21-Jan	Bath Roadside	NO	12758	8	5	1.140	5	3.2	
		NOx		8	5	1.141	5	2.4	97.6
26-Jan	Billingham	NO	574	0	5	1.144	5	0.4	
		NOx		3	5	1.161	5	0.3	100.4
03-Feb	Birmingham Tyburn	NO	y7acc7mg	0	5	0.996	5	3.2	
		NOx		0	5	0.984	5	2.5	99.5
09-Mar	Birmingham Tyburn Roadside	NO	14324	2	5	1.569	5	1.0	
		NOx		2	5	1.590	5	1.1	92.7
14-Feb	Blackburn Darwen Roadside	NO	688b-303	1	5	1.051	5	1.0	
		NOx		1	5	1.051	5	0.6	98.3
09-Feb	Blackpool Marton	NO	08050075	1	5	0.982	5	1.6	
		NOx		1	5	0.982	5	1.5	99.3
11-Jan	Bournemouth	NO	17507	1	5	1.172	5	0.4	
		NOx		2	5	1.133	5	0.8	100.0
08-Feb	Brighton Preston Park	NO	2222	3	5	1.158	5	5.6	
		NOx		2	5	1.170	5	5.1	98.2
19-Jan	Bristol Old Market	NO	10510	1	5	1.260	5	3.4	
		NOx		1	5	1.240	5	3.3	95.0
17-Jan	Bristol St Paul's	NO	14353	0	5	2.996	5	1.8	
		NOx		0	5	2.974	5	1.7	98.0
02-Mar	Bury Roadside	NO	1710	-1	5	2.495	5	2.9	
		NOx		-10	5.1	2.391	5	1.8	98.1
23-Feb	Cambridge Roadside	NO	42c-303	-1	5	1.339	5	1.7	
		NOx		0	5	1.332	5	1.7	98.9
09-Feb	Canterbury	NO	1147	3	5	1.320	5	2.5	
		NOx		-1	5	1.325	5	2.6	98.2
23-Feb	Carlisle Roadside	NO	9841b	-2	5	1.374	5	2.3	
		NOx		-2	5	1.431	5	3.2	98.9
16-Feb	Charlton Mackrell	NO	12895	1	5	0.995	5	0.8	
		NOx		-2	5	0.995	5	0.6	98.5
09-Feb	Chatham Centre Roadside	NO	3393	1	5	1.438	5	1.9	
		NOx		2	5	1.405	5	1.8	100.6
01-Mar	Chesterfield	NO	M1228-M528	2	5	1.165	5	0.5	
		NOx		3	5	1.158	5	1.1	100.0
01-Mar	Chesterfield Roadside	NO	765B-342	102	5	1.592	5	1.7	
		NOx		102	5	1.614	5	1.7	100.6
19-Jan	Coventry Memorial Park	NO	08030109	0	5	1.000	5	3.5	
		NOx		0	5	1.007	5	3.2	99.2
08-Feb	Eastbourne	NO	3363	1	5	1.038	5	2.4	
08-Feb	Eastbourne	NOx		0	5	1.068	5	2.9	98.4
28-Feb	Exeter Roadside	NO		-1	5	1.031	5	1.3	
28-Feb	Exeter Roadside	NOx		3	5	1.008	5	1.4	98.7
16-Feb	Glazebury	NO	78	0	5	1.948	5	0.6	
		NOx		0	5	1.880	5	0.9	94.4
25-Feb	Harwell	NO	79	2	5	1.211	5	0.9	
		NOx		4	5	1.223	5	2.2	97.2
20-Feb	High Muffles	NO	12553	1	5	1.195	5	2.4	
		NOx		0	5	1.189	5	2.3	96.2
02-Feb	Horley	NO	m525	0	5	0.958	5	1.1	
		NOx		1	5	0.967	5	1.2	98.2
01-Feb	Hull Freetown	NO	08050056	1	5	0.890	5	0.9	
		NOx		1	5	0.934	5	0.9	110.8
08-Mar	Ladybower	NO	#014326	0	5	0.731	5	1.0	
		NOx		2	5	0.741	5	1.6	100.6
24-Feb	Leamington Spa	NO	1705	2	5	1.308	5	1.1	
		NOx		2	5	1.328	5	0.9	100.0

AEA

CERTIFICATE OF CALIBRATION

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Telephone: 0870 1906465   Fax: 0870 1906377

UKAS CALIBRATION

Certificate Number: 02449
AEA Identification Number: ED57002030

Date Year =2011	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
02-Feb	Leeds Centre	NO	08050066	0	5	0.977	5	2.4	
		NOx		0	5	0.975	5	2.2	98.9
03-Feb	Leeds Headingley	NO	696B-308	50	5	1.009	5	0.6	
	Kerbside	NOx		51	5	1.011	5	0.8	99.2
10-Mar	Leicester Centre	NO	1	-2	5	0.743	5	1.2	
		NOx		-2	5	0.738	5	1.0	100.9
07-Mar	Leominster	NO	14863	1	5	0.926	5	1.1	
		NOx		2	5	0.895	5	1.3	99.0
07-Feb	Liverpool Queen's	NO	16927	1	5	1.095	5	3.2	
	Drive Roadside	NOx		3	5	1.161	5	2.1	99.5
07-Feb	Liverpool Speke	NO	cm0850069	0	5	0.971	5	0.5	
		NOx		-1	5	0.964	5	0.6	99.3
15-Feb	Lullington Heath	NO	14313	1	5	1.081	5	1.0	
		NOx		1	5	1.054	5	0.4	93.3
15-Feb	Manchester	NO	08050065	0	5	0.875	5	2.0	
	Piccadilly	NOx		0	5	0.941	5	1.8	102.2
15-Feb	Manchester South	NO	2115	6	5	0.944	5	1.7	
		NOx		7	5	0.925	5	1.5	100.4
07-Mar	Market	NO	50068	-1	5	1.090	5	2.2	
	Harborough	NOx		0	5	1.094	5	1.7	99.6
25-Jan	Middlesbrough	NO	13160	-4	5	1.163	5	1.0	
		NOx		-19	5	1.106	5	1.0	98.7
24-Jan	Newcastle Centre	NO	08050063	-8	5	1.003	5	1.8	
		NOx		0	5	1.004	5	1.7	100.4
24-Jan	Newcastle	NO	m2106-	2	5	0.853	5	2.1	
	Cradlewell Road	NOx	m860	10	5	0.865	5	0.5	101.5
26-Jan	Northampton	NO	apna	-1	5	1.024	5	3.8	
26-Jan	Northampton	NOx		0	5	1.002	5	3.6	99.1
22-Feb	Norwich	NO	13	0	5	1.424	5	2.7	
	Lakenfields	NOx		1	5	1.405	5	2.7	99.4
17-Jan	Nottingham	NO	50072	1	5	1.009	5	2.3	
	Centre	NOx		2	5	1.011	5	2.8	100.9
14-Feb	Oxford Centre	NO	m947	102	5	1.309	5	1.1	
	Roadside	NOx		104	5	1.428	5	0.6	98.2
14-Feb	Oxford St Ebbes	NO	1	102	5	1.042	5	4.0	
		NOx		100	5	1.044	5	3.9	97.0
28-Feb	Plymouth Centre	NO	08050062	0	5	0.988	5	2.3	
		NOx		1	5	0.992	5	2.5	100.8
10-Jan	Portsmouth	NO	1	0	5	1.016	5	1.3	
		NOx		0	5	1.017	5	1.2	98.2
08-Feb	Preston	NO	08050064	1	5	0.897	5	0.7	
		NOx		1	5	0.941	5	0.6	100.7
18-Feb	Reading	NO	18504	-1	5	0.971	5	2.1	
	New Town	NOx		-1	5	0.965	5	2.0	99.3
22-Feb	Rochester Stoke	NO	3095	-3	5	1.068	5	3.8	
		NOx		-6	5	1.065	5	3.3	100.0
14-Feb	Salford Eccles	NO	2381	-1	5	1.165	5	1.3	
		NOx		-1	5	1.218	5	1.6	98.5
01-Feb	Sandwell	NO	g0400fu6	0	5	0.983	5	2.0	
	West Bromwich	NOx		2	5	0.984	5	1.9	97.8
23-Feb	Sandy Roadside	NO	2585	not	tested	audit	abandoned		
		NOx							
02-Feb	Scunthorpe Town	NO	m1225-	35	5	2.520	5	0.7	
		NOx	m526	47	5	2.556	5	1.4	100.0
28-Feb	Sheffield Centre	NO	08050055	0	5	0.979	5	1.5	
		NOx		1	5	0.938	5	3.0	98.4
28-Feb	Sheffield Tinsley	NO	847	-11	5	1.157	5	0.4	
		NOx		-24	5	1.116	5	1.6	100.0

The reported 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

CERTIFICATE OF CALIBRATION

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Telephone: 0870 1906465 Fax: 0870 1906377

UKAS CALIBRATION 0401

Certificate Number: 02449
AEA Identification Number: ED57002030

Date Year =2011	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
13-Jan	Southampton Centre	NO NOx	301006	1 2	5 5	0.918 0.902	5 5	2.5 1.9	101.1
17-Feb	Southend-on-Sea	NO NOx	50071	1 0	5 5	0.927 0.931	5 5	2.6 2.7	99.6
25-Jan	St Osyth	NO NOx	08050073	0 0	5 5	0.910 0.908	5 5	3.2 3.7	101.0
24-Jan	Stanford-le-Hope Roadside	NO NOx	14189	2 2	5 5	1.203 1.213	5 5	0.9 0.9	94.9
26-Jan	Stockton-on-Tees Eaglescliffe	NO NOx	10445	1 1	5 5	1.637 1.654	5 5	3.1 3.3	98.0
18-Jan	Stoke-on-Trent Centre	NO NOx	08050070	1 1	5 5	0.962 0.980	5 5	5.3 5.7	100.7
08-Feb	Storrington Roadside	NO NOx	analyser	not	audited				
25-Jan	Sunderland Silksworth	NO NOx	734b-322	0 1	5 5	0.808 0.803	5 5	2.5 1.6	98.7
24-Jan	Thurrock	NO NOx			Analyser	removed	for	repair	
	Walsall Willenhall	NO NOx	Site	not	in	operation	at	audit	visit
02-Mar	Warrington	NO NOx	450b-198	1 2	5 5	1.039 1.063	5 5	0.7 0.8	99.6
24-Feb	Wicken Fen	NO NOx	13069	-1 -8	5 5	1.386 1.344	5 5	1.8 3.1	98.3
16-Feb	Wigan Centre	NO NOx	805005	-1 3	5 5	0.993 0.989	5 5	0.7 0.8	99.6
08-Feb	Wirral Tranmere	NO NOx	08050060	1 1	5 5	0.871 0.934	5 5	1.8 1.4	100.7
01-Mar	Yarner Wood	NO NOx	12554	3 3	5 5	0.998 1.008	5 5	0.5 0.8	98.1
02-Feb	York Fishergate	NO NOx	622b-272	-1 0	5 5	1.156 1.167	5 5	2.6 1.1	99.1

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Telephone: 0870 1906465 Fax: 0870 1906377

UKAS CALIBRATION

0401

Particulate Analysers

Date Year =2011	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 (%)
03-Feb	Birmingham Tyburn	PM10	27255	14780	1	-1.1	2.94	2.2	15.07	2.2
03-Feb	Birmingham Tyburn	PM25	21372	14575	1	-0.7	2.85	2.2	14.71	2.2
09-Mar	Birmingham Tyburn Roadside	PM10	26034	12153	1	-1.8	2.50	2.2	15.84	2.2
09-Mar	Birmingham Tyburn Roadside	PM25	26567	13985	1	-0.6	3.04	2.2	16.58	2.2
09-Feb	Blackpool Marton	PM25	24424	13010	1	0.9	2.85	2.2	16.46	2.2
11-Jan	Bournemouth	PM25							16.67	2.2
08-Feb	Brighton Preston Park	PM25	21865						20.19	2.2
17-Jan	Bristol St Paul's	PM10	24426	13170	1	-0.1	**2.97**	**2.2**	**14.27**	**2.2**
17-Jan	Bristol St Paul's	PM25	26495	13598	1	-2.3	**3.05**	**2.2**	**13.57**	**2.2**
02-Mar	Bury Roadside	PM10	27335	16096	1	-0.6	2.74	2.2	15.24	2.2
02-Mar	Bury Roadside	PM25	27334	15002	1	-0.4	3.04	2.2	15.75	2.2
23-Feb	Carlisle Roadside	PM10	27257	14301	1	-1.3	3.06	2.2	15.58	2.2
23-Feb	Carlisle Roadside	PM25	27320	13743	1	-1.3	2.99	2.2	15.72	2.2
09-Feb	Chatham Centre Roadside	PM10	27343	14399	1	-0.9	3.06	2.2	15.62	2.2
09-Feb	Chatham Centre Roadside	PM25	27271	15916	1	-0.5	3.05	2.2	15.62	2.2
01-Mar	Chesterfield	PM10	27316	16187	1	-0.3	**2.94**	**2.2**	16.07	2.2
01-Mar	Chesterfield	PM25	27314	12450	1	0.1	3.01	2.2	16.22	2.2
01-Mar	Chesterfield Road	PM10	22299	11180	1	-1.5	2.99	2.2	16.47	2.2
01-Mar	Chesterfield Road	PM25	27339	15383	1	-0.3	2.90	2.2	16.12	2.2
19-Jan	Coventry Memorial Park	PM25	0	0	1	0.0	**2.91**	**2.2**	**12.78**	**2.2**
08-Feb	Eastbourne	PM10	2000	12131	1	1.1	3.01	2.2	16.12	2.2
08-Feb	Eastbourne	PM25	27244	14795	1	-0.3	3.01	2.2	16.27	2.2
25-Feb	Harwell	PM10		analyser	not	present	at	audit		
25-Feb	Harwell	PM25	21366	12354	1	-0.3	2.93	2.2	15.79	2.2
25-Feb	Harwell Partisol	PM10	239802						15.21	2.2
25-Feb	Harwell Partisol	PM25	209902						17.86	2.2
01-Feb	Hull Freetown	PM10	24445	14122	1	0.1	3.10	2.2	16.94	2.2
01-Feb	Hull Freetown	PM25	26498	13932	1	-1.8	3.00	2.2	16.72	2.2
24-Feb	Leamington Spa	PM10	27295	14813	1	-1.2	3.03	2.2	15.81	2.2
24-Feb	Leamington Spa	PM25	27248	14091	1	-0.6	3.07	2.2	15.43	2.2
02-Feb	Leeds Centre	PM10	24451	13379	1	-0.1	3.13	2.2	15.96	2.2
02-Feb	Leeds Centre	PM25	27254	16914	1	-0.7	3.13	2.2	16.08	2.2
03-Feb	Leeds Headingley Kerbside	PM10	27287	analyser	fault	memory	lost			
03-Feb	Leeds Headingley Kerbside	PM25	27249	14572	1	-0.9	2.85	2.2	15.37	2.2
10-Mar	Leicester Centre	PM10	24442	14351	1	-0.7	**3.02**	**2.2**	**13.01**	**2.2**
10-Mar	Leicester Centre	PM25	26500	14860	1	-0.7	2.97	2.2	15.89	2.2
07-Feb	Liverpool Speke	PM10	24450	15874	1	0.4	3.01	2.2	15.71	2.2
07-Feb	Liverpool Speke	PM25	28607	14866	1	-0.3	3.00	2.2	16.02	2.2
15-Feb	Manchester Piccadilly	PM25	26038	13901	1	-0.9	3.05	2.2	15.92	2.2
25-Jan	Middlesbrough	PM10	24325	13982	1	-1.1	**3.09**	**2.2**	**13.46**	**2.2**
25-Jan	Middlesbrough	PM25	27195	16449	1	2.8	3.06	2.2	16.46	2.2
24-Jan	Newcastle Centre	PM10	24448	13941	1	0.9	2.91	2.2	15.58	2.2
24-Jan	Newcastle Centre	PM25	24447	14986	1	1.0	3.02	2.2	16.14	2.2
26-Jan	Northampton	PM25	21013						17.50	2.2
22-Feb	Norwich Lakenfields	PM10	21495	14026	1	-0.6	3.00	2.2	16.08	2.2

AEA

CERTIFICATE OF CALIBRATION

The Gemini Building, Fermi Avenue, Harwell, Didcot, Oxfordshire OX11 0QR.
Telephone: 0870 1906465   Fax: 0870 1906377

UKAS CALIBRATION 0401

Certificate Number: 02449
AEA Identification Number: ED57002030

Date Year =2011	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 (%)
22-Feb	Norwich Lakenfields	PM25	27328	15600	1	0.0	3.01	2.2	15.70	2.2
17-Jan	Nottingham Centre	PM10	25025pm2.5	12129	1	-0.5	3.16	2.2	16.82	2.2
17-Jan	Nottingham Centre	PM25	27369 pm10	15411	1	-1.1	3.07	2.2	17.22	2.2
14-Feb	Oxford St Ebbes	PM10	27296	14817	1	0.0	2.92	2.2	15.97	2.2
14-Feb	Oxford St Ebbes	PM25	27235	17209	1	0.2	**2.95**	**2.2**	**13.34**	**2.2**
28-Feb	Plymouth Centre	PM10	24428	12177	1	-0.8	2.88	2.2	15.69	2.2
28-Feb	Plymouth Centre	PM25	27221	12759	1	-1.5	3.09	2.2	16.36	2.2
10-Jan	Portsmouth	PM10	2000	13213	1	-0.8	3.11	2.2	15.90	2.2
10-Jan	Portsmouth	PM25	21358	18404	1	-0.8	**3.12**	**2.2**	**13.65**	**2.2**
08-Feb	Preston	PM25	22281	12937	1	-0.1	3.04	2.2	16.30	2.2
18-Feb	Reading New Town	PM10	21315	13189	1	-0.1	2.96	2.2	16.15	2.2
18-Feb	Reading New Town	PM25	25090	13801	1	-2.4	2.99	2.2	16.39	2.2
22-Feb	Rochester Stoke	PM10	27241	14750	1	-1.1	3.11	2.2	15.83	2.2
22-Feb	Rochester Stoke	PM25	27258	15860	1	-0.5	3.05	2.2	15.77	2.2
14-Feb	Salford Eccles	PM10	21168	14574	1	1.1	3.04	2.2	16.27	2.2
14-Feb	Salford Eccles	PM25	27205	14546	1	-0.6	3.05	2.2	15.75	2.2
23-Feb	Sandy Roadside	PM10	22018	13780	1	-1.2	3.06	2.2	16.34	2.2
23-Feb	Sandy Roadside	PM25	27260	13006	1	-0.9	2.93	2.2	15.34	2.2
02-Feb	Scunthorpe Town	PM10	27366	14941	1	-0.4	3.11	2.2	15.67	2.2
28-Feb	Sheffield Centre	PM10	25024	12106	1	-1.2	3.02	2.2	16.18	2.2
28-Feb	Sheffield Centre	PM25	27253	15584	1	-0.4	2.97	2.2	15.49	2.2
13-Jan	Southampton Centre	PM10	24448	14044	1	1.2	**3.06**	**2.2**	**14.07**	**2.2**
13-Jan	Southampton Centre	PM25	27256	16633	1	0.7	**3.13**	**2.2**	**14.09**	**2.2**
17-Feb	Southend-on-Sea	PM25	22927	12221	1	-1.7	**3.08**	**2.2**	**13.07**	**2.2**
24-Jan	Stanford-le-Hope Roadside	PM10	24397	13419	1	-0.1	3.04	2.2	16.34	2.2
24-Jan	Stanford-le-Hope Roadside	PM25	27226	15345	1	-1.1	3.20	2.2	16.54	2.2
26-Jan	Stockton-on-Tees Eaglescliffe	PM10	17691						15.20	2.2
26-Jan	Stockton-on-Tees Eaglescliffe	PM25	17805						15.92	2.2
18-Jan	Stoke-on-Trent Centre	PM10	25028	12409	1	-0.8	2.64	2.2	16.30	2.2
18-Jan	Stoke-on-Trent Centre	PM25	27262	13338	1	-1.2	3.07	2.2	16.08	2.2
08-Feb	Storrington Roadside	PM10	27236	15684	1	0.0	3.16	2.2	15.84	2.2
08-Feb	Storrington Roadside	PM25	27229	12764	1	0.1	3.00	2.2	15.54	2.2
25-Jan	Sunderland Silksworth	PM25	27247	15734	1	-0.4	**2.90**	**2.2**	**12.72**	**2.2**
24-Jan	Thurrock	PM10	273329	13876	1	-1.2	**3.01**	**2.2**	**13.53**	**2.2**
02-Mar	Warrington	PM10	27183	17200	1	-1.3	2.97	2.2	14.85	2.2
02-Mar	Warrington	PM25	27269	16184	1	-1.1	3.01	2.2	13.94	2.2
16-Feb	Wigan Centre	PM25	27291	15089	1	-0.8	2.96	2.2	15.10	2.2
08-Feb	Wirral Tranmere	PM25	22883	13365	1	0.5	2.97	2.2	15.90	2.2
02-Feb	York Bootham	PM10	218877	14557	1	-1.2	3.11	2.2	15.34	2.2
02-Feb	York Bootham	PM25	27209	16379	1	-1.5	2.70	2.2	14.81	2.2
02-Feb	York Fishergate	PM10	22101	Analyser	failed	during	test			

The reported 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.

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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 (in g/s^2 units) to the manufacturer's specified value of k_0.

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

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

AEA group
The Gemini Building
Fermi Avenue
Harwell
Didcot
Oxfordshire
OX11 0QR
Tel: 0870 190 6465
Fax: 0870 190 6608