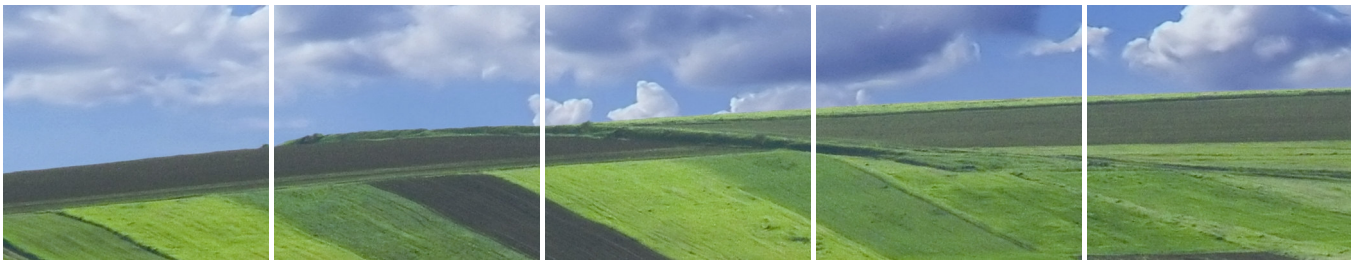
AEA



QA/QC Data Ratification Report for the Automatic Urban and Rural Network, October-December 2008, and Annual Review for 2008

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

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Executive summary

Part A Data Ratification for October-December 2008

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 92.6% for all pollutants (O_3, NO_2, SO_2, CO, PM_{10} and $PM_{2.5}$) during the 3-month reporting period October-December 2008. Data capture rates for all pollutants were above 90%. There were 25 sites with data capture less than 90% for the period.

The number of monitoring sites in the AURN during this quarter was 126, of which 61 are Local Authority owned sites affiliated to the national network. Some are colocated gravimetric particulate analysers at sites with automatic analysers. Some significant changes have taken place in the network during 2008.

The main reasons for data loss at the sites have been provided and these were predominantly due to instrument faults, response instability or sites out of service for relocation or refurbishment. A summary of recommendations given in this report to help improve network performance is given in Appendix A1.

Substantial changes have been made to the AURN network from the end of September 2007, and these are summarised in this report. The changes are necessary to ensure compliance with the new European Air Quality Directive. Considerable progress has been made in implementing these changes though they will still take some time to complete.

Part B 2008 Annual Review

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The network has continued to undergo changes as a result of the requirements of the European Air Quality Directive. A number of new sites have been affiliated into the network, and a programme of upgrading TEOM particle analysers to FDMS has made significant progress, A considerable number of FDMS $PM_{2.5}$ analysers have also been installed. Full details are given in Part B. There were a total of 131 sites operating during the year.

The overall data capture for 2008 was 91.1%, with all pollutants more than 90%. There were 39 sites with data capture less than 90%

Problems have been identified with gravimetric particulate measurements over recent years. There has been considerable investigation carried out into the apparent overestimation of concentrations. As a result, the gravimetric data remained provisional for the whole of 2008. The issues have now been resolved and the data published as ratified.

QA/QC Unit continues to maintain a watching brief on new methodologies and technical advances in air quality measurement in order to keep pace with any changes that may be required in the coming years, particularly in view of the recently published European CEN standards. Procedures used in the UK network intercomparison now fully conform to the CEN requirements. In addition, the QA/QC Unit has undertaken a series of meetings with the Equipment Support Units (ESUs) to discuss data quality issues and to highlight changes required to fully implement CEN procedures

Table of contents

PART A DATA RATIFICATION REPORT JULY/SEPTEMBER 2008

Annual Review 2008

Appendices

PART A

QA/QC Data Ratification Report for the Automatic Urban and Rural Network, October-December 2008

1 Introduction

Part A of this quarterly report covers the Quality Assurance and Control (QA/QC) activities undertaken by AEA to ratify automatic monitoring data from Defra and the Devolved Administrations' urban and rural air quality monitoring network (AURN) for the period October-December 2008. During this period there were 126 monitoring sites in the Network of which there are 92 urban sites, 26 rural sites and a further 8 sites in the London Air Quality Monitoring Network (LAQN) which are affiliated into the national network. There are currently 62 Defra-funded sites and 69 affiliate sites. Auchencorth Moss, Harwell, London North Kensington and Marylebone Road have both Partisol and FDMS analysers for both PM_{10} and PM_{25}.

1.1 Recent changes in the network

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

Table 1.1 Changes in the Network, October-December 2008

Site		Pollutant	Date started	Date stopped
Birmingham Tyburn	Affiliate	$PM_{2.5}$	15/12/2008	-
Chesterfield	Affiliate	$PM_{2.5}$	17/12/2008	-
Coventry Memorial Park	DEFRA	$PM_{2.5}$	16/12/2008	-
Leamington Spa	Affiliate	$PM_{2.5}$	22/12/2008	-
Leeds Centre	DEFRA	$PM_{2.5}$	02/12/2008	-
London Harrow Stanmore	Affiliate	$PM_{2.5}$	16/1/22008	-
London N. Kensington	Affiliate	$PM_{2.5}$	17/12/2008	-
London Teddington	Affiliate	$PM_{2.5}$	08/12/2008	-
London Westminster	DEFRA	$PM_{2.5}$	25/12/2008	-
Middlesbrough	Affiliate	$PM_{2.5}$	13/11/2008	-
Nottingham Centre	DEFRA	$PM_{2.5}$	19/12/2008	-
Oxford St Ebbes	Affiliate	$PM_{2.5}$	18/12/2008	-
Portsmouth	Affiliate	$PM_{2.5}$	23/12/2008	-
Salford Eccles	Affiliate	$PM_{2.5}$	26/11/2008	-
Sheffield Centre	DEFRA	$PM_{2.5}$	10/12/2008	-
Southampton Centre	DEFRA	$PM_{2.5}$	05/11/2008	-
Stoke-on-Trent Centre	DEFRA	$PM_{2.5}$	05/11/2008	-
Sunderland Silksworth	Affiliate	$PM_{2.5}$	09/12/2008	-
Warrington	Affiliate	PM_{10}	01/11/2008	-
Warrington	Affiliate	$PM_{2.5}$	27/11/2008	-
Warrington	Affiliate	NO_2	21/10/2008	-
Wigan Centre	Affiliate	$PM_{2.5}$	27/11/2008	-
York Bootham	Affiliate	$PM_{2.5}$	03/12/2008	-
Belfast Centre	DEFRA	$PM_{2.5}$	01/10/2008	-
Edinburgh St Leonards	DEFRA	$PM_{2.5}$	01/10/2008	-
Glasgow Centre	DEFRA	$PM_{2.5}$	16/12/2008	-
Grangemouth	Affiliate	$PM_{2.5}$	03/12/2008	-
Newport	Affiliate	$PM_{2.5}$	12/12/2008	-
Stewartby	Affliiate	SO_2	-	31/12/2008

Manchester Piccadilly SO_2 has been reaffiliated into the AURN from 1 October 2007.

The QA/QC unit has also liased closely with the CMCU to update the LSO manual for Partisol and FDMS analysers and LSOs with these analysers at their sites should now follow these new procedures.

Further details of the new sites, including locations, are given in Appendix A5.

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

1.2 Overview of Network Performance

Ratified hourly average data capture for the network averaged 92.6% for all pollutants (O_3, NO_2, SO_2, CO, PM_{10} and $PM_{2.5}$) during the 3 month reporting period October-December 2008 (see Table 1.4 below). All pollutants were 90% or higher data capture,. All Partisol data remained provisional until April 2009-see section 3.1. Data capture rates are calculated using the actual data capture as hourly averages (daily for Partisol) against the total number of hours (or days) in the relevant period; service and maintenance are counted as lost data. For sites starting or closing, the data capture is based on the actual date starting or closing.

Table 1.2: AURN Ratified Data Capture (%) by Quarter, 2008 (Using the start date of any new site)

	CO	PM_{10}	$PM_{2.5}$	NO_2	O_3	SO_2	Mean
Data capture Q1 2008	93.3%	91.3%	92.8%	92.4%	93.6%	89.8%	91.7%
Data capture Q2 2008	91.7%	89.7%	95.8%	91.2%	96.5%	92.7%	91.3%
Data capture Q3 2008	85.0%	88.1%	82.7%	91.8%	95.7%	93.8%	90.3%
Data capture Q4 2008	93.7%	90.7%	90.8%	94.2%	95.4%	95.5%	92.6%

Overall, 313 out of the 376 analysers (83%) achieved data capture levels above the required 90% target during this reporting period (See Table 1.3).

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

Total Number Of Analysers [2]		Q1 Jan-Mar 2008 (No. below 90%)	Q2 Apr-June 2008 (No. below 90%)	Q3 July-Sept 2008 (No. below 90%)	Q3 Oct-Dec 2008 (No. below 90%)
CO	26	6	5	7	3
NO_2	107	16	17	24	15
O_3	77	12	8	9	7
PM_{10}	71[1]	13	16	18	15
$PM_{2.5}$	53[1]	2	1	11	16
SO_2	44	6	6	7	5
Total <90%	376	55	53	76	63

1. Includes TEOM, FDMS, BAM and Partisol analysers.
2. Figures for Quarter 4.

In total, 25 out of the 126 operational network sites in the quarter (28%) had an average data capture rate below the required 90% level for the October-December 2008 period. Note that new analysers at existing sites will have data capture figures calculated from the start date of the quarter, not from the start of the analyser itself. The sites with overall data capture below 90% are listed in Table 1.4. The main site operational and QA/QC issues giving rise to data capture below the required 90% level are summarised in Section 4.

Table 1.4: Sites with Average Data Capture < 90%, October-December 2008

Site	Owner	Site Average	Principle Reason for Data Loss
England			
Bury Roadside	Affiliate	75.6	Unstable CO baseline from August 08
Carlisle Roadside	Affiliate	89.7	Suspected power cuts
Exeter Roadside	Affiliate	75.0	Site closed for refurbishment
Haringey Roadside	Affiliate	49.7	Poor TEOM performance
Leamington Spa	Affiliate	87.6	Poor SO_2 and PM_{10} data
London Harlington	Affiliate	85.1	Clock fault resulted in lost data
London Teddington	Affiliate	84.0	$PM_{2.5}$ started 8 Dec 08
Lullington Heath	DEFRA	85.9	Frequent poor SO2 data in 2008
Plymouth Centre	DEFRA	37.3	Site closed for refurbishment
Preston	DEFRA	81.9	Various NOx faults and power cuts, PM_{10} drier failure
Scunthorpe Town	Affiliate	64.7	SO_2 UV lamp fault
Sibton	DEFRA	0.0	Leaking 3-way valve
Southwark Roadside	Affiliate	0.0	Site closed
Stockton-on-Tees Eaglescliffe	Affiliate	85.4	Negative $PM_{2.5}$ data
Sunderland Silksworth	Affiliate	89.9	$PM_{2.5}$ started 9 Dec 08
Wigan Centre	Affiliate	87.1	$PM_{2.5}$ started 27 Nov 08
Yarner Wood	DEFRA	82.3	Power cuts
Ireland			
N Ireland			
Lough Navar	DEFRA	88.0	Power cut corrupted logger
Scotland			
Aberdeen Union Street Roadside	Affiliate	89.3	Some unstable baseline
Glasgow Centre	DEFRA	88.9	NOx converter failure
Strath Vaich	DEFRA	76.2	Power cuts
Wales			
Newport	Affiliate	88.6	PM_{10} drier fault
Port Talbot Margam $PM_{2.5}$	Affiliate	88.0	
Number of sites		24	
Number of sites < 90%		24	
Network Mean (%)		73.0	

1.3 LSO Manual

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

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

Air Quality Archive http://www.aeat.co.uk/netcen/airqual/reports/lsoman/lsoman.html

1.4 AURN Hub

The AURN project information hub has recently been moved to a new web address located at[1]:

[1] Password protected site: username and password available from stephen.bird@aeat.co.uk

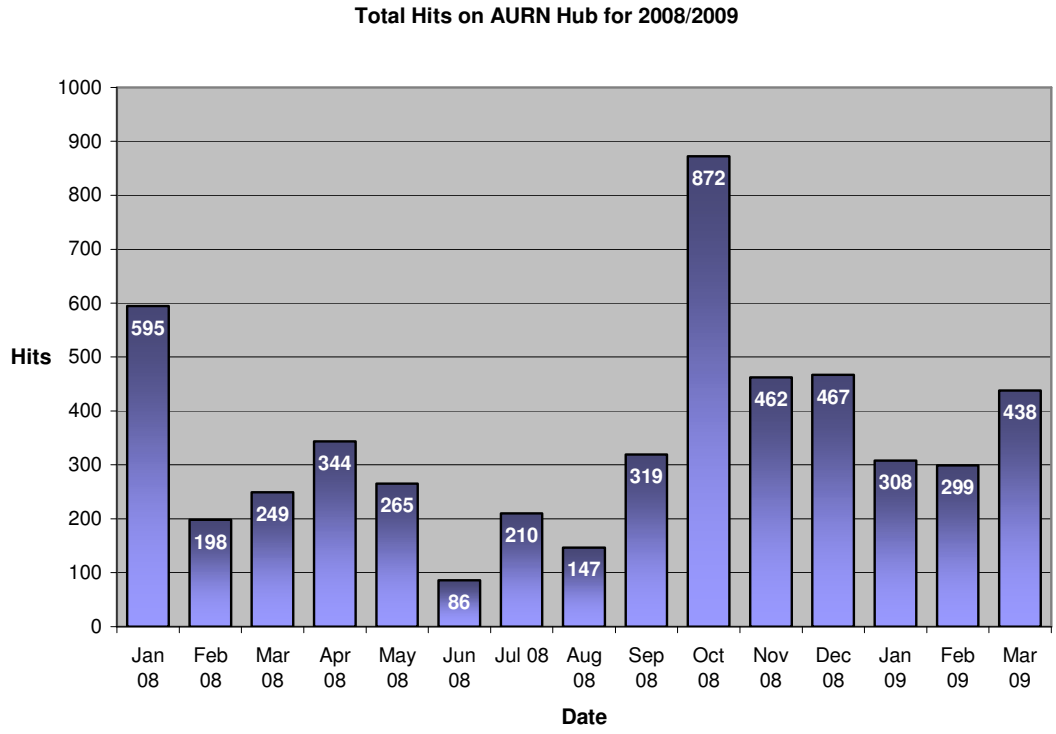
http://www.aurnhub.co.uk/ This is a new location due to a change of host server; the user names and password remain unchanged.

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

- Monthly PM_{10} (Gravimetric) exceedences up to February 2009 (provisional);
- QA/QC Unit's Data Ratification and Intercalibration Report July-September 2008;
- Recent Management Unit reports (April-June 2008); and
- Updated version of the LSO manual.

The Hub has continued to provide a valuable source of information for interested organisations see Figure 1.1. The increase in usage in October corresponded with a user survey sent to all users.

Figure 1.1: AURN Hub Hits 2008/2009



2 Changes in the Network for Directive Compliance

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

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

Table 2.1: Sites Added to the AURN Since 1 January 2008

Site	Pollutants	Site type	Start date
York Bootham	PM_{10}	Urban background	01/01/2008
York Fishergate	NO_2 PM_{10}	Roadside	01/01/2008
Oxford St Ebbes	NO_2 PM_{10}	Urban background	01/01/2008
Chepstow A48	NO_2 PM_{10}	Roadside	01/01/2008
Liverpool Queen's Drive Roadside	NO_2	Roadside	01/01/2008
Aberdeen Union Street Roadside	NO_2	Roadside	01/01/2008
Stanford-le-Hope Roadside	NO_2 SO_2 PM_{10}	Roadside	22/01/2008
Carlisle Roadside	NO_2 PM_{10}	Roadside	14/02/2008
Leeds Headingley Kerbside	NO_2 PM_{10}	Kerbside	17/02/2008
Newcastle Cradlewell Roadside	NO_2	Roadside	10/03/2008
Chesterfield Roadside	NO_2 PM_{10}	Roadside	11/03/2008
Chesterfield	NO_2 PM_{10}	Urban background	13/03/2008
Port Talbot Margam $PM_{2.5}$ (FDMS)	PM_{25}	Urban Industrial	23/04/2008
London Marylebone Road PARTISOL	PM_{25}	Kerbside	02/05/2008
London Harrow Stanmore	$PM_{2.5}$	Urban background	16/12/2008
London N. Kensington PARTISOL	PM_{25}	Urban background	13/05/2008
Harwell PARTISOL	PM_{25}	Rural	04/07/2008
Sandy Roadside	NO_2	Roadside	28/07/2008
Saltash Roadside	PM_{10}	Roadside	30/07/2008
Charlton Mackrell	NO_2 O_3	Rural	03/09/2008
Warrington	NO_2	Urban background	21/10/2008

In addition, several existing sites have had additional analysers (mainly $PM_{2.5}$) installed to ensure compliance. The analysers are listed in Table 2.2:

Table 2.2: Additional Analysers installed for Directive Compliance from 1 Jan 2008

Site	Pollutant	Date started
Port Talbot Margam	PM_{25}	See above
Derry	PM_{25}	21/02/2008
London Bexley	PM_{25}	25/02/2008
London N. Kensington PARTISOL	PM_{25}	13/05/2008
London Eltham	PM_{25}	15/05/2008
London Marylebone Road PARTISOL	PM_{25}	22/05/2008
Brighton Preston Park	PM_{25}	30/05/2008
Harwell PARTISOL	PM_{25}	04/07/2008
Cardiff Centre	PM_{25}	12/08/2008
Bristol St Paul's	PM_{25}	12/08/2008
Newcastle Centre	PM_{25}	25/08/2008
Hull Freetown	PM_{25}	27/08/2008
Leicester Centre	PM_{25}	01/09/2008
Birmingham Centre	PM_{25}	03/09/2008
London Harlington	PM_{25}	16/09/2008
Liverpool Speke	PM_{25}	17/09/2008
Reading New Town	PM_{25}	25/09/2008
Belfast Centre	PM_{25}	01/10/2008
Edinburgh St Leonards	PM_{25}	01/11/2008
Southampton Centre	PM_{25}	05/11/2008
Sunderland Silkworth	SO_2	01/04/2008
Stoke-on-Trent Centre	PM_{25}	05/11/2008

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

3 Generic Data Quality Issues

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

Seven Gravimetric PM_{10} analysers and seven gravimetric $PM_{2.5}$ analysers (Partisol 2025s) are currently located at seven sites in the network. These are listed below. Ratified data capture for the gravimetric PM_{10} (Partisol) analysers for the period October-December 2008 is given in Table 3.1. Six of the gravimetric analysers for which data are available did not reach the 90% data capture target in this quarter.

Table 3.1: Gravimetric PM_{10} and $PM_{2.5}$ Data Capture (%) October-December 2008

Site	Ratified Data Capture, October-December 2008
Auchencorth Moss PM_{10}	99%
Auchencorth Moss $PM_{2.5}$	85%
Bournemouth PM_{10}	96%
Brighton Preston Park $PM_{2.5}$	78%
Harwell $PM_{2.5}$	100%
Inverness PM_{10}	100%
London Marylebone Road PM_{10}	96%
London Marylebone Road $PM_{2.5}$	99%
London N Kens PM_{10}	100%
London N Kens $PM_{2.5}$	87%
London Westminster PM_{10}	83%
Northampton $PM_{2.5}$	88%
Port Talbot Margam $PM_{2.5}$	87%
Wrexham PM_{10}	98%

The reasons for data loss in the gravimetric analysers are given in Appendix A4. Bureau Veritas has supplied the measured data, undertaken the filter weighing and calculated the particulate concentrations. Final ratification of these Partisol data was delayed until the outcome of the current detailed investigations on all previous UK Partisol data are completed. These are described in "Analysis of Trends in Gravimetric Particulate Mass Measurements in the United Kingdom" published by CMCU in May 2008, available from:

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

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

- Participation of both AEA and BV in the Workplace Analysis Scheme for Proficiency (WASP) run by HSL. Participants send in pre-weighed filters, which are spiked with sodium borate solution, dried and returned to participants to reweigh. (The dried borate is thus a surrogate for real particulate on a filter);
- Round-robin of blank filter weighings between BV, AEA and NPL. Three sets of filters are weighed by all three organisations. This may be repeated at regular intervals;
- Each batch of 14 days' filters now include a travel (field) blank in the cannister, which is treated exactly the same as the other filters in the batch, but not exposed;
- Each batch of pre-weighed filters has an associated lab blank, which does not go to the site but stays in a sealed container at the lab for the duration of the exposure period, and is weighed again when the final weighings are done; and

- Both field and lab blank values are communicated to the QA/QC Unit, who monitor them on a long-term basis and check for any step changes, trends, or deviations from the typical spread of results.

The implementation of these initiatives is complete, and the outcome will be reported in future QA/QC reports.

As a result of these investigations, Emfab filters are now used for gravimetric sampling in Partisols from 1 January 2009. These are also blank-corrected, although the effect of this is less significant than for quartz filters.

3.2 Auto-calibration Run-on

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

The Equipment Service Units (ESUs) have investigated the autocalibration run-ons at many of the sites and tried different ways to resolve the problem including thorough cleaning of the solenoid valves and installation of Permapure or silica gel driers. In most cases this has improved the situation but it has not always eliminated the problem completely.

The 22 sites (23 analysers) showing continuing problems with the autocalibration run-on during October-December 2008 are given in Table 3.2. Any autocalibration run-on data that look visibly significant have been deleted from these data sets during ratification.

Table 3.2: Autocalibration Run-ons: October-December 2008

Site	Pollutant	Run-On Conc (ppb)	Autocal Conc (ppb)	Hours lost	Months
Glasgow Centre	CO	0.1	33	1	Oct to Dec
Aberdeen Union St	NO_2	8	550	1	Oct
Aston Hill	NO_2	1.9	50	2	Oct to Dec
Barnsley Gawber	NO_2	2	200	2	Oct to Dec
Belfast Centre	NO_2	7	200	2	Oct to Dec
Birmingham Centre	NO_2	4	350	2	Oct
				1	Nov to Dec
Bush Estate	NO_2	1.7	450	2	Oct
				1	Nov to Dec
Eskdalemuir	NO_2	0.4	500	2	Oct to Nov
				1	Dec
Glazebury	NO_2	7.4	150	1	Oct to Nov
				2	Dec
Liverpool Speke	NO_2	2	250	1	Oct to Nov
Narberth	NO_2	0.3	90	1	Oct to Dec
Newcastle Centre	NO_2	4	300	1	Oct to Dec
Preston	NO_2	2	250	1	Oct to Nov
Rochester Stoke	NO_2	2.5	200	1	Oct to Dec
St Osyth	NO_2	1.3	10	1	Oct to Dec
Walsall Willenhall	NO_2	2	250	1	Oct to Dec

Wicken Fen	NO_2	1.3	200	1	Oct to Dec
Yarner Wood	NO_2	1.2	200	1	Oct to Dec
Leominster	O_3	-2	250	1	Oct to Dec
Stoke-on-Trent Centre	O_3	-2	1000	1	Oct to Dec
Harwell	SO_2	0.1	175	1	Oct
Scunthorpe Town	SO_2	1	500	1	Oct to Dec
Wicken Fen	SO_2	0.3	500	1	Oct to Dec

4 Site Specific Issues

In this section, we now discuss in turn specific site issues for sites in the following geographic groupings – London, England (except London), Scotland, N. Ireland and Wales. Note that many analysers, particularly $PM_{2.5}$ and PM_{10} were commissioned during the period, and the stated data capture for these instruments is calculated from the date of commissioning.

4.1 London

4.1.1 Data Capture

The data capture for sites in London (within the M25) for the period October-December 2008 is given in Table 4.1:

Table 4.1: Data capture for London: October-December 2008

Site	Owner	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
London								
Camden Kerbside	Affiliate	-	95.5	-	87.1	-	-	91.3
Haringey Roadside	Affiliate	-	0.0	-	99.5	-	-	49.7
London Bexley	Affiliate	99.7	-	85.7	99.7	-	99.6	96.2
London Bloomsbury	DEFRA	99.9	98.9	98.9	99.8	96.2	99.8	98.9
London Cromwell Road 2	DEFRA	99.0	-	-	80.8	-	93.3	91.0
London Eltham	Affiliate	-	-	99.5	99.5	99.3	-	99.4
London Haringey	Affiliate	-	-	-	99.7	93.3	-	96.5
London Harlington	Affiliate	-	97.7	45.7	98.2	98.6	-	85.1
London Hillingdon	DEFRA	-	-	-	98.6	99.7	-	99.2
London Marylebone Road	Affiliate	99.7	91.2	87.9	99.3	99.5	99.3	96.1
London Marylebone Road PARTISOL	DEFRA	-	95.7	98.9	-	-	-	97.3
London N. Kensington	Affiliate	96.7	99.1	95.8	89.6	97.8	99.1	96.4
London N. Kensington PARTISOL	DEFRA	-	100.0	94.6	-	-	-	97.3
London Teddington	Affiliate	-	-	59.7	95.8	96.5	-	84.0
London Westminster	DEFRA	91.7	89.4	100.0	99.4	99.4	93.2	95.5
Southwark Roadside	Affiliate	-	-	-	0.0	-	-	0.0
Tower Hamlets Roadside	Affiliate	96.8	-	-	91.5	-	-	94.2
Number of sites		7	9	10	15	9	6	17
Number of sites < 90%		0	2	4	4	0	0	4
Network Mean (%)		97.7	85.3	86.7	89.2	97.8	97.4	86.4

Shaded boxes are for data capture < 90%

4.1.2 Site Specific Issues

London Cromwell Road 2
The NOx analyser showed considerable drift during December 2008 and data were deleted from 15 December to 10 January.

Haringey Roadside
The TEOM at Haringey Roadside performed poorly during the quarter, producing very noisy data. Significant leaks were found at the QA/QC audit, and so the data were deleted from 31 August up to the end of the year.Further data may be deleted in 2009.

London Harlington
The $PM_{2.5}$ unit perfomed poorly during the quarter, and was removed for repair by the ESU on 15 October. The nature of the fault was not recorded.

London Teddington
The $PM_{2.5}$ analyser was commissioned on 8 December, but the air conditioning unit was noted as insufficiently effective. This needs to be attended to before summer.

4.2 England (excluding London)

4.2.1 Data Capture

The data capture for sites in England for the period October-December 2008 is given in Table 4.2:

Table 4.2: Data capture for England (except London): October-December 2008

Network Data Capture for 01/10/2008 to 31/12/2008 from start date of any new site

Site	Owner	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
England								
Barnsley 12	DEFRA	-	-	-	-	-	99.8	99.8
Barnsley Gawber	Affiliate	-	-	-	95.3	99.8	99.6	98.2
Bath Roadside	Affiliate	-	-	-	98.8	-	-	98.8
Billingham	DEFRA	-	-	-	99.9	-	-	99.9
Birmingham Centre	DEFRA	-	98.1	97.3	94.0	99.2	-	97.2
Birmingham Tyburn	Affiliate	-	96.8	93.4	97.2	97.2	97.2	96.4
Blackpool Marton	DEFRA	-	99.9	-	99.5	99.9	-	99.8
Bottesford	Affiliate	-	-	-	-	99.0	-	99.0
Bournemouth	DEFRA	-	94.6	-	99.7	100.0	-	98.1
Brighton Preston Park	DEFRA	-	-	76.1	97.5	97.5	-	90.4
Brighton Roadside	Affiliate	-	-	-	99.5	-	-	99.5
Bristol Old Market	Affiliate	98.3	-	-	99.1	-	-	98.7
Bristol St Paul's	DEFRA	95.0	99.6	99.5	99.6	100.0	99.5	98.9
Bury Roadside	Affiliate	46.4	90.7	-	89.8	-	-	75.6
Cambridge Roadside	Affiliate	-	-	-	99.7	-	-	99.7
Canterbury	Affiliate	-	-	-	99.8	-	-	99.8
Carlisle Roadside	Affiliate	-	85.7	-	93.7	-	-	89.7

Site	Owner	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
Charlton Mackrell	Affiliate	-	-	-	99.7	99.9	-	99.8
Chesterfield	Affiliate	-	88.5	82.8	99.5	-	-	90.2
Chesterfield Roadside	Affiliate	-	98.1	-	98.8	-	-	98.4
Coventry Memorial Park	DEFRA	-	99.1	95.6	99.8	99.9	-	98.6
Exeter Roadside	Affiliate	-	-	-	75.0	75.0	-	75.0
Glazebury	DEFRA	-	-	-	90.9	95.5	-	93.2
Great Dun Fell	DEFRA	-	-	-	-	95.4	-	95.4
Harwell	DEFRA	-	98.9	84.6	98.7	98.7	97.4	95.7
Harwell PARTISOL	Affiliate	-	96.7	100.0	-	-	-	98.4
High Muffles	DEFRA	-	-	-	96.5	95.1	-	95.8
Horley	Affiliate	-	-	-	99.7	-	-	99.7
Hull Freetown	DEFRA	93.6	99.5	99.2	99.7	99.7	99.5	98.6
Ladybower	DEFRA	-	-	-	99.9	99.9	99.9	99.9
Leamington Spa	Affiliate	-	80.9	91.7	99.6	99.7	66.0	87.6
Leeds Centre	DEFRA	99.8	99.0	96.7	99.6	99.8	96.5	98.6
Leeds Headingley Kerbside	Affiliate	-	99.7	-	82.6	-	-	91.1
Leicester Centre	DEFRA	99.8	99.7	98.3	99.8	99.8	98.9	99.4
Leominster	DEFRA	-	-	-	99.2	95.7	99.9	98.3
Liverpool Queen's Drive Roadside	Affiliate	-	-	-	100.0	-	-	100.0
Liverpool Speke	DEFRA	99.5	99.8	96.7	96.7	99.5	99.5	98.6
Lullington Heath	DEFRA	-	-	-	98.2	98.5	61.0	85.9
Manchester Piccadilly	DEFRA	-	99.5	-	86.1	99.8	98.3	95.9
Manchester South	Affiliate	-	-	-	99.6	100.0	-	99.8
Market Harborough	DEFRA	99.8	-	-	99.7	97.9	-	99.1
Middlesbrough	Affiliate	96.2	90.7	73.0	99.4	99.7	99.6	93.1
Newcastle Centre	DEFRA	100.0	99.5	99.6	95.7	99.8	92.2	97.8
Newcastle Cradlewell Roadside	Affiliate	-	-	-	100.0	-	-	100.0
Northampton	Affiliate	-	-	88.0	80.7	95.1	99.8	90.9
Nottingham Centre	DEFRA	-	98.4	95.5	99.6	99.5	99.6	98.5
Oxford Centre Roadside	Affiliate	-	-	-	99.7	-	-	99.7
Oxford St Ebbes	Affiliate	-	99.6	91.4	99.5	-	-	96.8
Plymouth Centre	DEFRA	-	37.3	-	37.4	37.3	-	37.3
Portsmouth	Affiliate	-	96.5	92.1	99.5	99.7	-	96.9
Preston	DEFRA	-	82.7	-	63.2	99.9	-	81.9
Reading New Town	DEFRA	-	94.6	95.9	98.6	98.7	-	96.9
Rochester Stoke	Affiliate	-	98.9	96.5	95.1	99.3	98.8	97.7
Salford Eccles	Affiliate	93.9	92.3	97.3	93.6	93.9	93.6	94.1
Saltash Roadside	Affiliate	-	99.9	-	-	-	-	99.9
Sandwell West Bromwich	Affiliate	-	-	-	99.7	99.8	99.8	99.8
Sandy Roadside	Affiliate	-	99.7	-	95.1	-	-	97.4
Scunthorpe Town	Affiliate	-	9.1	-	99.1	-	85.8	64.7

Site	Owner	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
Sheffield Centre	DEFRA	99.8	99.9	95.1	99.7	99.7	98.2	98.7
Sheffield Tinsley	DEFRA	-	-	-	93.0	-	-	93.0
Sibton	DEFRA	-	-	-	-	0.0	-	0.0
Southampton Centre	DEFRA	93.1	89.2	99.0	89.4	96.2	96.0	93.8
Southend-on-Sea	DEFRA	-	99.9	-	99.7	99.7	-	99.8
St Osyth	DEFRA	99.8	-	-	95.7	99.9	-	98.5
Stanford-le-Hope Roadside	Affiliate	-	99.5	-	91.2	-	98.5	96.4
Stewartby	Affiliate	-	-	-	-	-	99.1	99.1
Stockton-on-Tees Eaglescliffe	Affiliate	-	84.0	86.8	-	-	-	85.4
Stoke-on-Trent Centre	DEFRA	-	85.1	94.8	96.2	92.4	-	92.1
Sunderland Silksworth	Affiliate	-	-	92.0	95.2	95.3	77.0	89.9
Thurrock	Affiliate	-	98.9	-	99.4	99.5	91.6	97.3
Walsall Willenhall	Affiliate	-	-	-	95.6	-	-	95.6
Warrington	Affiliate	-	91.7	97.6	84.5	-	-	91.3
Weybourne	Affiliate	-	-	-	-	99.6	-	99.6
Wicken Fen	DEFRA	-	-	-	95.2	99.6	95.4	96.7
Wigan Centre	Affiliate	-	-	68.0	99.0	94.3	-	87.1
Wirral Tranmere	DEFRA	-	92.2	-	99.3	99.3	-	96.9
Yarner Wood	DEFRA	-	-	-	80.6	84.1	-	82.3
York Bootham	Affiliate	-	99.8	94.4	-	-	-	97.1
York Fishergate	Affiliate	-	99.4	-	99.8	-	-	99.6
Number of sites		14	44	30	69	50	28	79
Number of sites < 90%		1	10	7	10	4	4	13
Network Mean (%)		93.9	90.1	92.3	95.0	94.5	94.3	93.0

Shaded boxes are for data capture < 90%

4.2.2 Site Specific Issues

Bury Roadside
The CO analyser baseline was unstable for much of the period; data was deleted from 22 August to 6 November, and again from 5 to 18 December as a result of a software problem.

Manchester Piccadilly
The NO_2 analyser suffered from a number of faults, including converter failure. As a result, the data were deleted from 19 Dec (ESU c/o) to 21 January (service)

Plymouth Centre
The PM_{10} analyser suffered from poor pump performance and a stolen PM_{10} head. In addition, the site was closed for refurbishment on 4 November, restarting on 30 January 2009.

Preston
A fault with the NOx analyser resulted in data being deleted from 1 December. This will also affect 2009 data.

Sibton
A leaking main valve resulted in data being deleted from 17 September to 9 January.

Yarner Wood
The site suffered frequent power cuts during the quarter

4.3 Scotland

4.3.1 Data Capture

The data capture for sites in Scotland for the period October-December 2008 is given in Table 4.3.

Table 4.3: Data Capture for Scotland October-December 2008

Network Data Capture for 01/10/2008 to 31/12/2008 from start date of any new site

Site	Owner	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
Scotland								
Aberdeen	Affiliate	-	99.6	-	99.7	99.8	-	99.7
Aberdeen Union Street Roadside	Affiliate	-	-	-	89.3	-	-	89.3
Auchencorth Moss	DEFRA	-	98.9	84.8	-	99.5	-	94.4
Auchencorth Moss PM_{10} PM_{25} (FDMS)	DEFRA	-	90.7	97.9	-	-	-	94.3
Bush Estate	DEFRA	-	-	-	93.9	99.5	-	96.7
Dumfries	DEFRA	-	-	-	97.8	-	-	97.8
Edinburgh St Leonards	DEFRA	99.6	90.6	66.3	94.2	99.5	99.5	91.6
Eskdalemuir	DEFRA	-	-	-	92.9	99.7	-	96.3
Fort William	DEFRA	-	-	-	99.6	99.6	-	99.6
Glasgow Centre	DEFRA	95.1	81.8	96.9	61.1	99.2	99.2	88.9
Glasgow City Chambers	DEFRA	-	-	-	99.9	-	-	99.9
Glasgow Kerbside	DEFRA	-	99.4	-	98.5	-	-	98.9
Grangemouth	Affiliate	-	97.9	87.6	99.7	-	99.6	96.2
Inverness	DEFRA	-	100.0	-	99.7	-	-	99.9
Lerwick	DEFRA	-	-	-	-	99.5	-	99.5
Strath Vaich	DEFRA	-	-	-	-	76.2	-	76.2
Number of sites		2	8	5	12	9	3	16
Number of sites < 90%		0	1	3	2	1	0	3
Network Mean (%)		97.3	94.9	86.7	93.9	97.0	99.4	94.9

Shaded boxes are for data capture < 90%

4.3.2 Site Specific Issues

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

Glasgow Centre NO_2
The NOx analyser had a converter fault from 26 November to 30 January 2009.

Strathvaich
This site continues to be adversely affected by power cuts.

4.4 Wales

4.4.1 Data Capture

The data capture for sites in Wales for the period October-December 2008 is given in Table 4.4.

Table 4.4 Data Capture for Wales, October-December 2008

Network Data Capture for 01/10/2008 to 31/12/2008 from start date of any new site

Site	Owner	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
Wales								
Aston Hill	DEFRA	-	-	-	92.7	99.7	-	96.2
Cardiff Centre	DEFRA	93.6	99.6	99.5	99.7	100.0	99.9	98.7
Chepstow A48	Affiliate	-	100.0	-	99.3	-	-	99.6
Cwmbran	Affiliate	-	-	-	99.7	95.1	-	97.4
Narberth	DEFRA	-	96.6	-	93.3	97.2	97.3	96.1
Newport	Affiliate	-	71.8	94.8	99.3	-	-	88.6
Port Talbot Margam	Affiliate	83.2	98.7	98.8	88.7	88.8	88.7	91.2
Port Talbot Margam $PM_{2.5}$ (Partisol)	Affiliate	-	-	88.0	-	-	-	88.0
Swansea Roadside	Affiliate	-	99.8	96.5	99.9	-	-	98.7
Wrexham	DEFRA	-	97.8	-	98.4	-	98.3	98.2
Number of sites		2	7	5	9	5	4	10
Number of sites < 90%		1	1	1	1	1	1	2
Network Mean (%)		88.4	94.9	95.5	96.8	96.2	96.0	95.3

4.4.2 Site Specific Issues

Newport PM_{10}
The Newport PM_{10} analyser suffered from persistent mass transducer faults and unstable volatile mass fraction during the quarter, QA/QC Unit deleted most of the data.

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 October-December 2008 is given in Table 4.5.

Table 4.5: Data Capture for Ireland, October-December 2008

Network Data Capture for 01/10/2008 to 31/12/2008 from start date of any new site

Site	Owner	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
N Ireland								
Belfast Centre	DEFRA	66.6	97.3	97.4	95.4	99.0	99.5	92.6
Derry	Affiliate	-	99.7	77.9	99.8	100.0	99.7	95.4
Lough Navar	DEFRA	-	87.8	-	-	88.2	-	88.0
Ireland								
Mace Head	Affiliate	-	-	-	-	100.0	-	100.0
Number of sites		1	3	2	2	4	2	4
Number of sites < 90%		1	1	1	0	1	0	1
Network Mean (%)		66.6	94.9	87.6	97.6	96.8	99.6	94.0

Shaded boxes are for data capture < 90%

4.5.2 Site Specific Issues

Belfast Centre
Faults with the CO analyser were reported in the previous quarter.

Derry
Faults with the $PM_{2.5}$ analyser were reported in the previous quarter. Problems continued during the fourth quarter, and into 2009.

Lough Navar
Frequent power cuts resulted in the logger losing its programme

4.6 Sites Highlighted in Previous Reports

Several analysers have been highlighted recently as being of concern to the QA/QC unit. An update is given in Table 4.6.

Table 4.6: Status of Analysers Highlighted in Previous Reports

Site	Analyser	Fault	Current status
Auchencorth Moss	FDMS PM_{10} and $PM_{2.5}$		Negative data still observed, particularly $PM_{2.5}$
Belfast Centre	CO	Data flat	Now fixed
Bury Roadside	CO	Unstable data	
Derry	PM_{10} $PM_{2.5}$	Poor performance	Pumps repaired
Dumfries	NOx		Now fixed
Exeter Roadside	Site	Closed for building work	Restarted, but work still continuing
Glazebury	NOx	Converter fault	Now fixed
Leamington Spa	PM_{10}	Poor performance	Now fixed
Leeds Headingley RS	NOx	Converter fault	Now fixed
London Haringey RS	PM_{10}	Poor performance	Now fixed
London Harlington	$PM_{2.5}$	Fault	Now fixed
Newport	$PM_{2.5}$	Unstable data; transducer faults	Now fised

Site	Analyser	Fault	Current status
Port Talbot Margam	PM_{10}	Unstable volatile	Q3 remains provisional, analyser now fixed
Saltash RS	Site	Power problems	Now fixed
Sheffield Tinsley	NOx	Converter fault	Now fixed
St Osyth	Site	Air conditioning	No progress reported
Weybourne	O_3	No manual calibrations or IZS	No progress reported
Rural CO analysers	CO	Baseline drift	Drift still evident
Various	Rural ozone analysers	Temporary instruments installed some of which have no autocals	Two analysers have been upgraded by the manufacturer and are currently under test by the ESU.

4.7 FDMS Issues

There have been a number of issues affecting the collection of valid data from FDMS analysers as these have been introduced into the network. The CMCU, QA/QC and ESUs have put considerable effort into solving these issues.

A description of the issues is given in Part B.

5 Sites with Data Capture below 90%

A summary of the main site analyser operational problems, which have resulted in data capture below the required 90% level during the reporting period October-December 2008 is given in Appendix 2. The number of days and hours of data lost for each cause is also given. In some cases the data gap extends beyond this three-month reporting period. The table lists all gaps of 6 hours or more for each pollutant.

6 Data Capture Statistics

Table 6.1 provides a summary of the data capture figures for the network for the 3-month period October-December 2008.

Table 6.1 Data Capture Statistics October-December 2008

Site	CO	PM_{10}	$PM_{2.5}$	NO_2	O_3	SO_2	Site Average
Number of sites	26	70	52	107	77	44	126
Number of sites < 90%	3	15	16	17	7	5	25
Network Mean (%)	93.7	91.8	90.6	94.2	95.4	95.5	92.6

Table 6.2 provides a summary of the data capture figures for the network for the 12-month period January-December 2008.

Table 6.2 Data Capture Statistics January-December 2008

Site	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
Number of sites	27	77	52	111	80	44	131
Number of sites < 90%	8	20	15	24	15	9	38
Network Mean (%)	90.7	90.0	90.1	92.2	94.9	92.6	91.1

Some data remain provisional at time of writing.

Part B Annual Review 2008

7 Introduction

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

Recommendations for equipment and site upgrades and replacements have also been made. A list of the reports for 2008 is given in Table 7.1.

Table 7.1 QA/QC Data Ratification and Intercalibration Reports, 2008

	Type	Report Title	Reference
1	Ratification and Intercalibration	QA/QC Data Ratification and Intercalibration Report for the Automatic Urban and Rural Network, January-March 2008	AEAT/ENV/R/2659
2	Ratification	QA/QC Data Ratification Report for the Automatic Urban and Rural Network, April-June 2008	AEAT/ENV/R/2690
3	Ratification and Intercalibration	QA/QC Data Ratification and Intercalibration Report for the Automatic Urban and Rural Network July-September 2008	AEAT/ENV/R/2734
4	Ratification and Annual Review	QA/QC Data Ratification Report for the Automatic Urban and Rural Network October-December 2008 and Annual Review for 2008.	AEAT/ENV/R/2790

All reports are available on the Air Quality Information Archive (www.airquality.co.uk) and on the AURN Hub.

Data are routinely ratified on a 3-monthly basis. It should however be noted that there are occasionally circumstances where data which have been flagged as “Ratified” could be subject to further revision. This may be for example where:

- A QA/QC audit has detected a problem which affects data back into an earlier ratification period.
- Long-term analysis has detected an anomaly between expected and measured trends which requires further investigation and possible data correction. This was the case with 2000 –2008 gravimetric particulate monitoring data in the UK national network.
- Further research comes to light which indicates that new or tighter QA/QC criteria are required to meet the data quality objectives. This may require review and revision of historical data by applying the new criteria.

8 Network Review

The QA/QC Unit and the CMCU Unit in conjunction with Defra and the DAs have carried out a major review of the monitoring network. This was necessary to ensure the network is compliant with the new European Air Quality Directive. There is a requirement for a minimum level of monitoring in each agglomeration and zone, and there is a need to measure $PM_{2.5}$ at many sites. The need for additional monitoring has been met by affiliating suitable sites from other organisations, adding additional analysers at existing sites, or in a small number of cases, installing new sites. This process is still ongoing.

Sites that are no longer necessary for compliance have, in a number of cases, been closed down, or individual analysers at sites have been de-affiliated. Many of these closures occurred in 2007.

The new site locations are selected in line with the requirements of the EC Air Quality Directive (2008/50/EC)as described below:

AGREED REQUIREMENTS FOR NEW SITES: (for modelling and Directive compliance (ANNEX 3))

ROADSIDE: Must be on A road - preferably with “simple” layout. Traffic-orientated sampling probes shall be at least 25 m from the edge of major junctions and no more than 10 m from the kerbside. The flow around the inlet sampling probe shall be unrestricted (free in an arc of at least 270m) without any obstructions affecting the airflow in the vicinity of the sampler, normally some metres away from buildings, balconies, trees and other obstacles and at least 0,5 m from the nearest building in the case of sampling points (representing air quality at the building line).

URBAN BACKGROUND: Locations shall be located so that their pollution level is influenced by the integrated contribution from all sources upwind of the station. The pollution level should not be dominated by a single source unless such a situation is typical for a larger urban area. Those sampling points shall, as a general rule, be representative for several square kilometres.

For the purposes of deciding where new sites are to be located, the Directive is interpreted as requiring that $PM_{2.5}$ exposure reduction sites in zones should be in conurbations (pop. 100,000 - 250,000)- but there is no explicit requirement for this.

9 Network Intercalibrations

Two complete network intercomparisons were carried out at 6-monthly intervals during 2008. These are an important part of the overall QA/QC programme for the AURN network. The purpose of these intercomparisons is to determine the network measurement accuracy, consistency and intercomparability across the entire network. The latest exercise covered 120 sites (except Norwich Centre and Southwark Roadside, which has been closed for some time). The procedures used, and a summary of the results obtained, are provided in the January-March and July-September QA/QC reports.

A summary of the number of analysers in the network found to be providing provisional data outwith the defined accuracy limits (the "outlier" sites) is given in Figure 9.1. A full definition of what constitutes an outlier site for the different pollutants is given in the appropriate Quarterly Reports .Note also that, for the vast majority of these outlier sites, the data will have been fully corrected as part of the subsequent data ratification process.

Figure 9.1 Outliers identified during 2008 intercalibration exercises.

Analyser	Winter 2008 intercalibration			Summer 2008 intercalibration		
CO	25	4	16%	25	3	12%
SO_2	39	5	5%	43	9	21%
Ozone	78	14	18%	78	15	19%
TEOM & BAM articles	34 TEOM PM_{10} 22 FDMS PM_{10} 4 TEOM $PM_{2.5}$ 1 FDMS $PM_{2.5}$	4 flow	7%	34 TEOM PM_{10} 29 FDMS PM_{10} 4 TEOM $PM_{2.5}$ 6 FDMS $PM_{2.5}$	3 Ko 3 flow	8%
Gravimetric particles	5 PM_{10} 1 $PM_{2.5}$	0	0%	5 PM_{10} 1 $PM_{2.5}$	0	0%

The overall fraction of outliers has remained fairly constant during 2008.

Sites which have been commissioned, recommissioned in new locations or have had new analysers installed have been audited by the QA/QC Unit prior to the publication of the data from the site.

The intercalibration visits are also used to ensure information about network sites and analysers are correct and up to date. For example, at recent network intercalibration exercises, information has been gathered on the sample manifold systems used at all sites, the detailed set-up parameters for the TEOM particle analysers, and how site locations compare to the requirements listed in the EC Directives.

In addition to the network intercalibrations, the QA/QC Unit carries out pre-commissioning audits on new sites and analysers introduced to the network. Although these audits are not included in the summary above, these provide a vital role in ensuring the overall data quality; data are not disseminated from new sites or analysers until a satisfactory performance has been verified by the QA/QC Unit. The installation timetable for FDMS PM_{10} and $PM_{2.5}$ analysers, and new CEN-compliant gas analysers has meant the QA/QC Unit has had to make numerous replicate visits to sites to ensure data may be disseminated in time for Directive Compliance, for example.

10 ESU, CMCU, LSO and QA/QC Meetings

During 2008, the QA/QC Unit continued to liase closely with the ESUs to ensure optimal performance of the network through service and maintenance arrangements. The QA/QC Unit have provided the ESUs with spreadsheets to calculate various analyser performance parameters (eg converter efficiency, linearity) in line with the CEN requirements; ESUs have been requested to integrate the principles into their routine site tests.

All parties were in agreement that work undertaken by the ESUs is a vitally important part of the overall data quality management process for the network, and it is planned to repeat the meetings at regular intervals.

The QA/QC Unit has worked closely with the CMCU to agree the specification of the new contracts for LSO and ESU contracts awarded in spring 2009.

The QA/QC Unit has attended the AURN LSO meeting, and presented network updates as appropriate. These presentations are available on the AURN Hub.

The QA/QC Unit has continued to provide ESUs with ozone photometer calibrations prior to the start of each 6-monthly service schedule. In addition, weighed TEOM filters have been supplied to ESUs as required, to enable reliable Ko measurements to be made.

11 TEOM Upgrades to FDMS and Installation of new FDMS

The initial upgrade programme for TEOMs has been completed, and there are now 83 operational FDMS analysers, of which. 50 of these units (as at April 2009) are configured for $PM_{2.5}$. The average data capture for these analysers was 94%. The FDMS units installed in 2008 are listed in Table 12.1 (see later)

The upgrade programme was generally very good, although problems with analyser performance did delay the dissemination of data from several sites. A description of some of the faults encountered is given in Section 12.2. In several cases, however, there were delays in installing new FDMS units and so In order to meet the requirements of the Directive, some PM_{10} analysers were converted to $PM_{2.5}$ at the end of 2008. Where appropriate, the new FDMS (configured as PM_{10}) are being installed as resources allow. Whilst this has ensured most of the required $PM_{2.5}$ sites have been installed in time, it has meant that the QA/QC Unit has had to make repeated commissioning visits to many sites. The installation of new gaseous analysers, and training of new LSOs has further compounded this situation.

There has been significant discussion and debate on problems encountered during commissioning and operation of FDMS analysers. The QA/QC Unit has gratefully received valuable input from the Management Units, ESUs, the manufacturer and from INERIS in France.

12 Network Data Capture

The overall network data capture for 2008 was 91.2%, which is above the 90% target level. However, not all sites achieved >90% and a table of data capture for the 38 sites with less than 90% capture is given in Table 12.1.

Table 12.1 Sites with Annual Average Data Capture Below 90%for 2008

Site	Owner	Site Average
England		
Bolton	Affiliate	61.7
Brighton Preston Park	DEFRA	87.2
Brighton Roadside PM_{10}	Affiliate	82.0
Bury Roadside	Affiliate	88.0
Chesterfield	Affiliate	89.8
Exeter Roadside	Affiliate	87.3
Glazebury	DEFRA	69.5
Haringey Roadside	Affiliate	82.3
Ladybower	DEFRA	88.8
Leamington Spa	Affiliate	84.7
Leeds Headingley Kerbside	Affiliate	83.1
Leominster	DEFRA	84.7
London Cromwell Road 2	DEFRA	88.4
London Harlington	Affiliate	84.9
London N. Kensington PARTISOL	DEFRA	85.8
London Teddington	Affiliate	85.0
Lullington Heath	DEFRA	75.9
Middlesbrough	Affiliate	88.0
Oxford St Ebbes	Affiliate	89.5
Plymouth Centre	DEFRA	77.7
Portsmouth	Affiliate	**89.2**
Saltash Roadside	Affiliate	86.4
Scunthorpe Town	Affiliate	86.5
Sheffield Tinsley	DEFRA	34.4
Sibton	DEFRA	68.8
Southwark Roadside	Affiliate	0.0
St Osyth	DEFRA	81.3
Stockton-on-Tees Eaglescliffe	Affiliate	85.9
Wigan Centre	Affiliate	88.0
Yarner Wood	DEFRA	85.2
Ireland		
N Ireland		
Belfast Centre	DEFRA	85.1
Derry	Affiliate	**85.8**
Scotland		
Strath Vaich	DEFRA	84.7
Wales		
Aston Hill	DEFRA	84.8
Cwmbran	Affiliate	87.6
Narberth	DEFRA	88.8
Newport	Affiliate	86.0
Port Talbot Margam $PM_{2.5}$	Affiliate	89.3
Number of sites < 90%		38

Numbers in bold indicate some or all data remain provisional pending further investigation

A summary of data capture by pollutant for the year 2008 is given in Table 12.2

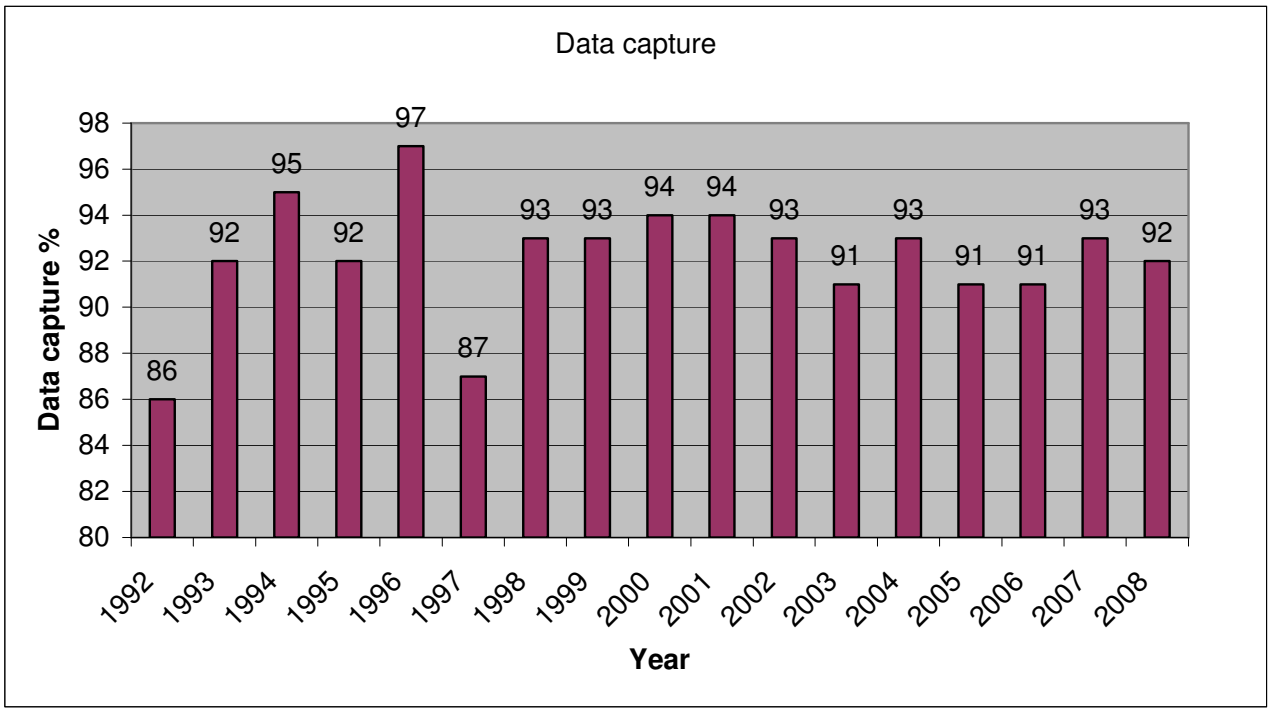
Table 12.2 Summary of data capture by pollutant, 2008

Site	CO	PM_{10}	PM_{25}	NO_2	O_3	SO_2	Site Average
Number of sites	27	77	52	111	80	44	131
Number of sites < 90%	8	20	15	24	15	9	38
Network Mean (%)	90.7	90.9	89.8	92.2	94.9	92.6	91.2

For these sites, pollution statistics calculated for analysers with data capture above 75% or modelled data have to be used. However, neither of these approaches is entirely satisfactory. Hence, the QA/QC unit continues to make the recommendation that greater attention needs to be paid to minimising data loss from all sites.

The network annual average data capture of 92.6% is close to the previous year. The network is clearly operating in a steady-state level of operation, despite some ageing analysers and sites closed, sometimes for extended periods, for relocation or refurbishment. Figure 12.1 shows the annual network data capture since the start of the AURN in 1992.

Figure 12.1 Annual Average Data Capture 1992-2008



12.1 Investigation of Spurious Data

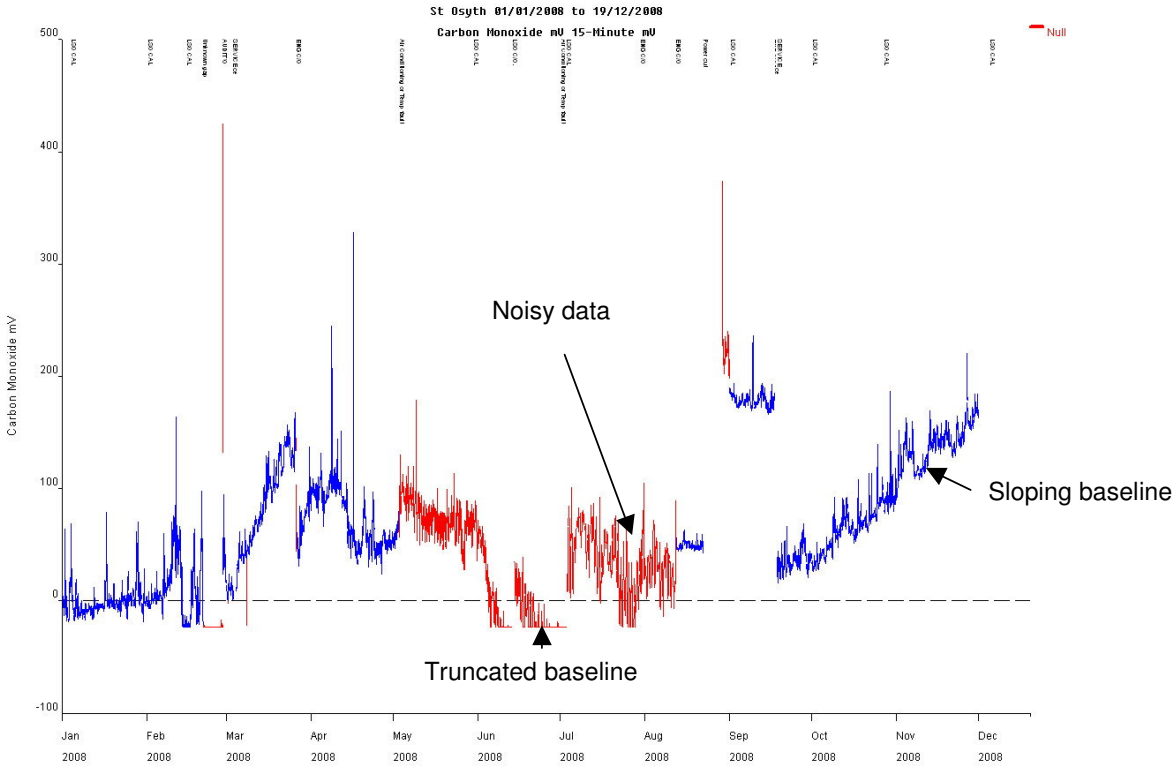
The data ratification process involves checking many millions of 15-minute average concentrations every year. Although the majority of analysers operate satisfactorily, there are inevitably some problems that require more detailed investigation by the QA/QC unit during the ratification process. The QA/QC Unit works closely with the LSOs, the ESUs and the CMCU in order to resolve these issues and process the data accordingly. All parties involved are encouraged to provide sufficient information to streamline this process as much as possible. Unfortunately, there are still instances where instruments faults remain undetected and large quantities of data are lost. Summaries of the more common reasons for data loss are discussed below.

NOx converters
At each QA/QC intercomparison, a small number of NOx converters are found to be less than the required 95% efficient. Where this is the case, the information from ESU service and repairs are checked to try to find the last date at which an acceptable converter test result has been obtained, or to identify an event which may indicate when the fault actually occurred (eg substitution of a replacement analyser). In some cases, no relevant information is available, and in the worst-case situation, data will be rejected back to the previous service visit (often 6 months previous). To minimise the risk of this, the QA/QC Unit has repeatedly requested that ESU's carry out converter tests at all service visits, and at relevant repair call-outs.

In a limited number of cases, the analyser software has been altered by the ESU to correct the NO_2 output where the measured converter efficiency is less than 100%. This does not correctly scale both NOx and NO channels, and could potentially lead to erroneous data which cannot be corrected. ESU's have been asked to ensure settings (where adjustable) are set to 100%.

Noisy analyser outputs
There are several analysers on the network that produce very noisy signal outputs. Many of these have been highlighted in previous reports, and ESUs have been made aware of them. The most common offenders are CO and SO_2 analysers. An example is shown in Figure 12.2

Figure 12.2 Example of Poor Quality Data



Rapid drifts or erratic changes in zero or calibration factor
Some analysers have a tendancy to drift over time. In most cases, these can be accommodated using manual calibration values, assisted by daily autocalibration data. However, some drift so rapidly that it is difficult to establish where the signal baseline actually lies. Figure 13.2 also shows erratic changes in baseline, both step-changes and baseline drift.

Leaks
Both gaseous and particle analysers are susceptible to leaks. The analysers are tested for this at 6-month QA/QC visits, and at ESU visits. Where leaks are identified, information is sought as to when this might have occurred, and an assessment is made of the likely effect on data quality. Small leaks are unlikely to have a major effect on measured data; where the leak is more substantial, the effect is often visible in the measured data, particularly when compared with data from other nearby sites.

Leaks in the bypass flow on a TEOM analyser may affect the particle size fraction of the analyser inlet.

Air conditioning faults
Most of the sites have air conditioning units to control internal temperature. If these units fail, the internal temperature may rise significantly, or may vary by an unacceptable degree. Varying temperatures often cause analysers output signal to change, and the reliability of analysers is significantly reduced when exposed to elevated temperatures. CO analysers in particular suffer from signal drift when the temperature is not well controlled. The relatively poor summer in 2008 did mean that data losses were lower than might have been expected. In other cases, the failure of the air conditioning unit causes frequent or prolonged disruption to the site power supply.

Automatic calibration run-on
As described in Section 2.4, there have been persistent problems across the network with the daily span checks for NO_2 (and less so for SO_2) causing run-on into the ambient data. This only occurs where the span check is provided by a permeation tube, and commonly results in the loss of up to one

hour's data each day. This problem has been raised with the ESUs, and considerable progress has been made to reduce the problem. In many cases, the run-on is reduced to acceptable levels by reducing the concentration of the span check gas, and several ESUs are now installing permeation tubes with lower permeation rates.

12.2 FDMS Data

There have been a number of issues affecting the collection of valid data from FDMS analysers as these have been introduced into the network. The CMCU, QA/QC and ESU have put considerable effort into solving these issues.

These issues may be summarised in the following general areas:

- Poor pump performance. The vacuum is critical to maintaining correct analyser function, and it is noted that some pumps have failed prematurely. These were found to be of the incorrect mains frequency, and the supplier is working on replacing these with units more appropriate to UK mains supply. It is also important that where $PM_{2.5}$ and PM_{10} FDMS units are co-located, the flows must be within 3% of each other. This is now checked at QA/QC audits.

- Filter changes during reference cycle. It was found that opening the FDMS unit during the reference cycle allowed excessive moisture to enter the cooler unit, resulting in considerable analyser instability. The procedures have been updated to ensure the unit is locked in base mode whilst the door is open. LSOs have been issued with spare filter cartridges to allow filter changes to be carried out more rapidly.

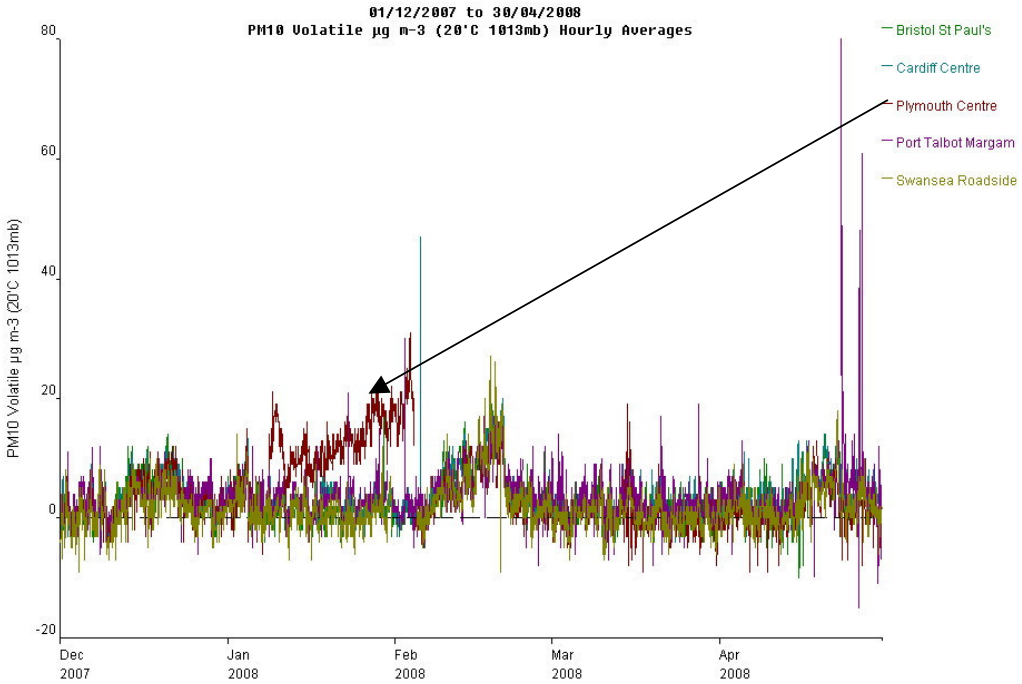
- Temperature instability. There have been several issues with air conditioning and heating being inadequate to maintain a constant temperature.

- $PM_{10}/PM_{2.5}$ comparison. With the introduction of $PM_{2.5}$ analysers, it is possible to compare concentrations with PM_{10}. In some cases, measured $PM_{2.5}$ concentrations have been higher than the PM_{10}, which is of course illogical. Careful examination of the data are required to establish which, if either, is correct.

- The performance of the FDMS drier is also critical to the quality of data. In some cases these have failed, resulting in poor quality data. The performance of the drier needs to be carefully monitored to ensure optimal data quality. The measured sample dew point must always be below –2C, and there must be a minimum of 10C between the ambient temperature and the sample dewpoint. As the drier fails, these parameters are frequently not met, and the measured volatile concentration may be seen to be anomalously high. This is easier to spot where $PM_{2.5}$ and PM_{10} instruments are collocated.

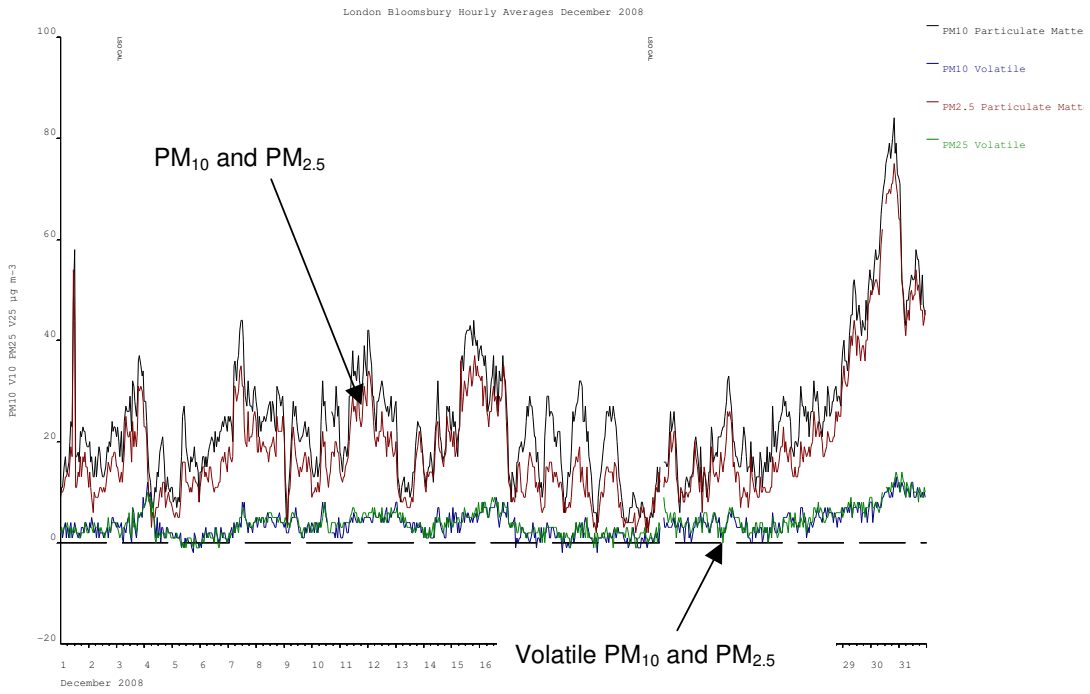
- Anomalous volatile concentrations. The concentration of the volatile component varies relatively little between local sites, and is mainly in the $PM_{2.5}$ fraction, so a comparison between two collocated FDMS instruments is a useful way to check analyser problems. A comparison of sites enabled the identification of a fault at Plymouth in February 2008-see Figure 12.3

Figure 12.3: Volatile Measurements showing a PM_{10} fault at Plymouth



An example of a good site is shown in Figure 12.4. This shows the close agreement expected between the volatile fraction of $PM_{2.5}$ and PM_{10}, and good correlation between the peaks for the two size fractions.

Figure 12.4 FDMS PM_{10} and $PM_{2.5}$ Mass Concentration and Volatiles Concentrations, December 2008 at Bloomsbury



12.3 Partisol Gravimetric Particulate Data

During 2008, an analysis of Partisol gravimetric particulate matter data showed a over-read of measured concentrations from 2006 and 2007, particularly at sites where concentrations are low. A thorough investigation by Bureau Veritas (as filter weighing contractor) led to the 2008 data being held as provisional until April 2009. A full description of the findings is given in "Trends in Gravimetric Particulate Matter in the United Kingdom" which can be found at http://www.airquality.co.uk/archive/reports/cat09/0901221659_Trends_in_Gravimetric_PM_Measurements_in_the_UK_v210109.pdf

Potential reasons considered for the discrepancy between gravimetric and other methods of particle measurements include:

- Filter media used
- Environmental conditions used for conditioning the filters
- Storage conditions in the sampler
- Differences in equipment used

As a result of the investigation, the following actions have been taken:

1. A field blank sent in the cartridge with sample filters. This allows correction of Partisol data for blank values obtained from blank filters conditioned alongside the sample filters but not themselves exposed. Correction of 2008 data has been carried out during ratification.
2. Increased QA/QC of Partisol data through weighing intercomparisons and participation in WASP QA scheme

3. Round-robin of filter weighings between BV, AEA and NPL, where a set of filters is conditioned and weighed by each organisation.
4. Long-term analysis of blank filter weight data by QA/QC Unit to establish any trends, step changes or deviations
5. Change of filter medium used from quartz to Emfab (PTFE coated glassfibre) with effect from January 2009

12.4 Site calibration cylinders

The site cylinder concentrations are reassessed at each QA/QC audit. Any outliers (>10% from certified value) are investigated and where necessary, replaced. If the recalculated concentration casts doubt on the validity of the calibrations, the cylinders may be returned to the QA/QC Unit for recertification; alternatively, the site audit may be repeated. Not all outliers are due to cylinder drift; noisy or faulty analysers can give results which cast doubt on cylinder concentrations. In extreme cases, reanalysis of the cylinder is the only reliable way to confirm the nature of the problem.

Following the summer 2008 intercalibration exercise, a small number of cylinders were returned to AEA for recalibration. Unfortunately, several more cylinders were already empty before recertification could take place.

Although many NO_2 cylinders are identified as outliers during the intercalibration exercise, these are not recalibrated as the concentrations are not used directly for data scaling purposes.

13 CEN

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

By way of example, the performance of an analyser in the field must pass a number of tests, including:

- Linearity – the analyser must have a maximum error at any point of less than 6% of the predicted value. AEA now reports maximum residuals from linearity tests, to evaluate the performance of current analysers against these tougher requirements.

- NOx converter efficiency must be better than 95%. Data must be rescaled for efficiencies between 95 and 99.9%, but rejected if below 95%. Again, this is tighter than currently, where we accept "borderline" failures.In addition, specific procedures for undertaking converter efficiencies tests have been prescribed; AEA already use the CEN method for undertaking converter tests.

- The sampling system that delivers air to the analyser must remove no more than 2% of the pollutant to be analysed. AEA continue to evaluate systems to calibrate sampling systems, but this is not currently undertaken on a routine basis in the UK.
  A report on the evaluation of methodologies to test losses of gases to sampling manifolds has been completed by QA/QC Unit and this is available on the AURN Hub and Air Quality Archive. "Evaluation of Methodologies to Test Losses of Gases to Sampling Systems" B Stacey, netcen/ED45077030/R/1820/Issue1, August 2004

- The concentration of the site cylinders will need to be determined every six months, and the revised values used to scale ambient data. This is a change to our current procedures, where no action is taken until a cylinder deviates from its stated value by more than 10%. AEA have introduced a new procedure for handling drifting cylinder concentrations. In future, the uncertainty of these calculations will need to be substantially lower than the current 10% limit (in the order of 4-5% maximum).

- The determination of an SO_2 analyser response to meta xylene will not be required for ongoing field tests. For the AURN, AEA will continue to assess the performance of the hydrocarbon kickers, but action will not be recommended unless the result is very high (greater than 50ppb response to a 1ppm m xylene cylinder), indicating that the kicker has failed completely.

The CEN operating methodologies are now finalised and published and are, at present, being incorporated into the requirements of the Directive. Member States will have 2 years to ensure their monitoring networks are compliant. AEA have taken steps to ensure the procedures used in the UK comply with the requirements ahead of any imposed deadlines. To this end, the procedures used for the network intercomparison were fully compliant with the CEN protocols. ESU's have also been instructed to ensure pre and post service tests are compliant with the procedure; AEA have supplied them with spreadsheets to ensure the correct data are recorded.

14 Site Closures, Refurbishments and Infrastructural Repairs

During 2008, a significant amount of data were lost through site closures for relocation or refurbishment. The sites worst affected are given in Table 14.1

Table 14.1 Sites Subject to Closure or Relocation, 2008

Site	Monitoring stopped	Monitoring restarted	Reason
Norwich Centre	14 May 2008	-	Site to be relocated
Stewartby	31 Dec 2008	-	Site closed
Southwark Roadside	21 Feb 06	-	Site expected to be re-commissioned with NOx only

Whilst some degree of data loss was inevitable in these cases, all possible efforts should be made in future to minimise the data loss due to site closures.

15 Changes to the Network

There have been several changes to network sites during 2008. Most of these were as a result of the network review (see Section 8). Other changes are listed in Table 15.1

Table 15.1 Significant Changes to the Network, 2008

Site		Pollutants	Date started
Birmingham Centre	DEFRA	$PM_{2.5}$	03/09/2008
Birmingham Tyburn	Affiliate	$PM_{2.5}$	15/12/2008
Brighton Preston Park	DEFRA	$PM_{2.5}$	30/05/2008
Bristol St Paul's	DEFRA	$PM_{2.5}$	12/08/2008
Carlisle Roadside	Affiliate	PM_{10} NO_2	14/02/2008
Charlton Mackrell	Affiliate	NO_2 O_3	03/09/2008
Chesterfield	Affiliate	PM_{10} NO_2	13/03/2008
		$PM_{2.5}$	17/12/2008
Chesterfield Roadside	Affiliate	PM_{10} NO_2	11/03/2008
Coventry Memorial Park	DEFRA	$PM_{2.5}$	16/12/2008
Harwell PARTISOL	Affiliate	PM_{10}	01/09/2008
		$PM_{2.5}$	04/07/2008
Hull Freetown	DEFRA	$PM_{2.5}$	02/09/2008
Leamington Spa	Affiliate	$PM_{2.5}$	22/12/2008
Leeds Centre	DEFRA	$PM_{2.5}$	02/12/2008
Leeds Headingley Kerbside	Affiliate	PM_{10} NO_2	17/02/2008
Leicester Centre	DEFRA	$PM_{2.5}$	01/09/2008
Leominster	DEFRA	SO_2	06/02/2008
Liverpool Queen's Drive Roadside	Affiliate	NO_2	01/01/2008
Liverpool Speke	DEFRA	$PM_{2.5}$	17/09/2008
London Bexley	Affiliate	$PM_{2.5}$	25/02/2008
London Eltham	Affiliate	$PM_{2.5}$	15/05/2008
London Harlington	Affiliate	$PM_{2.5}$	16/09/2008
London Marylebone Road PARTISOL	DEFRA	PM_{10}	02/05/2008
		$PM_{2.5}$	22/05/2008
London N. Kensington	Affiliate	$PM_{2.5}$	17/12/2008
London N. Kensington PARTISOL	DEFRA	PM_{10} $PM_{2.5}$	13/05/2008
London Teddington	Affiliate	$PM_{2.5}$	08/12/2008
London Westminster	DEFRA	$PM_{2.5}$	25/12/2008
Middlesbrough	Affiliate	$PM_{2.5}$	13/11/2008
Newcastle Centre	DEFRA	$PM_{2.5}$	24/08/2008
Newcastle Cradlewell Roadside	Affiliate	NO_2	10/03/2008
Northampton	Affiliate	$PM_{2.5}$	05/09/2008
Nottingham Centre	DEFRA	$PM_{2.5}$	19/12/2008
Oxford St Ebbes	Affiliate	PM_{10}	01/01/2008
Oxford St Ebbes	Affiliate	$PM_{2.5}$	18/12/2008
Oxford St Ebbes	Affiliate	NO_2	01/01/2008
Portsmouth	Affiliate	$PM_{2.5}$	23/12/2008
Reading New Town	DEFRA	$PM_{2.5}$	25/09/2008
Salford Eccles	Affiliate	$PM_{2.5}$	26/11/2008
Saltash Roadside	Affiliate	PM_{10}	30/07/2008
Sandy Roadside	Affiliate	PM_{10}	28/07/2008
Sandy Roadside	Affiliate	NO_2	28/07/2008
Scunthorpe Town	Affiliate	NO_2	10/01/2008
Sheffield Centre	DEFRA	$PM_{2.5}$	10/12/2008

Site		Pollutants	Date started
Southampton Centre	DEFRA	$PM_{2.5}$	05/11/2008
Stanford-le-Hope Roadside	Affiliate	PM_{10} NO_2 SO_2	22/01/2008
Stockton-on-Tees Eaglescliffe (BAM)	Affiliate	PM_{10} $PM_{2.5}$	01/09/2008
Stoke-on-Trent Centre	DEFRA	$PM_{2.5}$	05/11/2008
Sunderland Silksworth	Affiliate	$PM_{2.5}$	09/12/2008
Sunderland Silksworth	Affiliate	SO_2	01/04/2008
Warrington	Affiliate	PM_{10}	01/11/2008
		$PM_{2.5}$	27/11/2008
		NO_2	21/10/2008
Wigan Centre	Affiliate	$PM_{2.5}$	27/11/2008
York Bootham	Affiliate	PM_{10}	01/01/2008
		$PM_{2.5}$	03/12/2008
York Fishergate	Affiliate	PM_{10} NO_2	01/01/2008
Belfast Centre	DEFRA	$PM_{2.5}$	01/10/2008
Derry	Affiliate	$PM_{2.5}$	21/02/2008
Aberdeen Union Street Roadside	Affiliate	NO_2	01/01/2008
Edinburgh St Leonards	DEFRA	$PM_{2.5}$	01/10/2008
Glasgow Centre	DEFRA	$PM_{2.5}$	16/12/2008
Grangemouth	Affiliate	$PM_{2.5}$	03/12/2008
Cardiff Centre	DEFRA	$PM_{2.5}$	13/08/2008
Chepstow A48	Affiliate	PM_{10} NO_2	01/01/2008
Newport	Affiliate	$PM_{2.5}$	12/12/2008
		NO_2	01/01/2008
Port Talbot Margam	Affiliate	CO	01/01/2008
Port Talbot Margam (Partisol)	Affiliate	$PM_{2.5}$	23/04/2008
Port Talbot Margam $PM_{2.5}$ (FDMS)	Affiliate	$PM_{2.5}$	01/01/2008

Many of the changes have involved upgrade or installation of FDMS analysers at existing sites. A list of these installed in 2008 is given in Table 15.2

Table 15.2 2008 Installation Dates for AURN FDMS Units

Belfast Centre	PM_{10}	01/10/2008
	PM_{25}	01/10/2008
London Bexley	PM_{25}	21/10/2008
Birmingham Tyburn	PM_{25}	15/12/2008
Birmingham Centre	PM_{25}	03/09/2008
Bristol St Paul's	PM_{25}	12/08/2008
Cardiff Centre	PM_{25}	13/08/2008
Chesterfield	PM_{10}	17/12/2008
	PM_{25}	17/12/2008
London Bloomsbury	PM_{10}	18/11/2008
	PM_{25}	18/11/2008
Coventry Memorial Park	PM_{25}	16/12/2008
Derry	PM_{10}	21/02/2008
	PM_{25}	21/02/2008
Salford Eccles	PM_{25}	26/11/2008
Edinburgh St Leonards	PM_{25}	01/10/2008
Glasgow Centre	PM_{10}	02/12/2008
	PM_{25}	16/12/2008
Grangemouth	PM_{25}	03/12/2008

Hull Freetown	PM_{25}	02/09/2008
London N. Kensington	PM_{25}	17/12/2008
Leamington Spa	PM_{10}	18/12/2008
	PM_{25}	22/12/2008
Leeds Centre	PM_{10}	02/12/2008
	PM_{25}	02/12/2008
Leicester Centre	PM_{25}	01/09/2008
London Eltham	PM_{25}	15/05/2008
Liverpool Speke	PM_{25}	17/09/2008
Middlesbrough	PM_{10}	13/11/2008
	PM_{25}	13/11/2008
Newcastle Centre	PM_{25}	24/08/2008
	PM_{25}	19/12/2008
Newport	PM_{10}	01/01/2008
	PM_{25}	12/12/2008
Oxford St Ebbes	PM_{25}	18/12/2008
Portsmouth	PM_{10}	07/07/2008
	PM_{25}	23/12/2008
Port Talbot Margam	PM_{25}	23/04/2008
Reading New Town	PM_{25}	25/09/2008
Sandy Roadside	PM_{10}	27/01/2009
Sheffield Centre	PM_{25}	10/12/2008
Southampton Centre	PM_{25}	05/11/2008
Stoke-on-Trent Centre	PM_{25}	05/11/2008
Sunderland Silksworth	PM_{25}	09/12/2008
London Teddington	PM_{25}	08/12/2008
Warrington	PM_{10}	27/11/2008
	PM_{25}	27/11/2008
Wigan Centre	PM_{25}	27/11/2008
York Bootham	PM_{25}	03/12/2008

16 Port Talbot Particulate Intercomparison

In conjunction with Bureau Veritas, an intercomparison of particulate monitoring methods was organised with the Joint research Centre, Ispra, at the Port Talbot Margam AURN site from 22 April to 22 May 2008. This was part of an intercomparison at 18 EU Member States. At Port Talbot, the following measurement methods were installed:

JRC -

2x SEQ/47 PM_{10} reference samplers
1x SEQ/47 $PM_{2.5}$ reference sampler
1x SEQ/47 PM_{1} reference sampler
1x FDMS PM_{10} (type B drier)
Sunset EC/OC analyser

AEA/Bureau Veritas

FDMS PM_{10} (type C drier) (existing AURN analyser)
FDMS $PM_{2.5}$ (type C drier) (existing AURN analyser)
Partisol 2025 PM_{10} Quartz (BV weighing)
Partisol 2025 $PM_{2.5}$ Quartz (BV weighing) (existing AURN analyser)
Partisol 2025 PM_{10} Emfab (BV weighing)
Partisol 2025 $PM_{2.5}$ Emfab (BV weighing)
Partisol 2025 PM_{10} Emfab (AEA weighing)

Two AEA-weighed Partisol PM10 analysers were operated; one with 72 hour filter conditioning, and one with 96 hours.

A full analysis of the data will be formally reported by JRC in due course.

17 ISO17025 Accreditation

The QA/QC Unit has maintained its ISO17025 accreditation for 6-monthly site calibrations and calibration of ambient gas mixtures. A copy of the schedule can be found at http://www.ukas.org.uk/calibration/lab_detail.asp?lab_id=902&vMenuOption=3

A total of four surveillance and assessment visits were carried out by UKAS- two at monitoring sites, one at Harwell and one at Glengarnock.

18 Usage of AURN Data

The primary aims and objectives of the AURN are listed as follows:

- Meeting statutory requirements (e.g. EC Directives)
- Informing the public about air quality
- Providing information for local air quality review and assessment
- Identifying long term trends
- Assessment of policy effectiveness

The data collected from the AURN sites in 2008 have now been fully ratified and quality assured. – this ensures that the data are of high quality and reliable and hence can be used to fulfil these objectives.

The data will be assessed in relation to the EC Air Quality Directives to determine any areas of exceedence of limit values etc, which will be reported to the European Commission in September 2009, as required by the Directives. In addition, the full dataset for 2008 will be uploaded to the European Air Quality database http://airbase.eionet.eu.int/

The public has been kept informed of air quality concentrations through direct access to the AURN data via the UK Air Quality Information website (www.airquality.co.uk). Provisional data are updated onto this website every hour and the ratified data are uploaded every 3-months following the quarterly ratification cycle described in these Data Ratification reports. A full annual summary of the data for 2008 will also be published later in 2009 as part of the "Air Pollution in the UK" series of reports.

The data are widely used by Local Authorities as part of their review and assessment process. Data from individual stations are used in the specific local area and the full AURN dataset is used within the preparation of the Pollution Climate maps of the UK which provide background concentration maps for the whole of the UK.

Occasionally, data marked as ratified may be returned to provisional status if some material fact comes to light which casts doubt over the reliability of the data. The data will be clearly identified on the archive. Some data were affected in this way in 2008, mainly PM_{10} and $PM_{2.5}$ data. Gravimetric data has been held as provisional for some time-see Section 12.3.

Long-term trend analysis is included in the Air Pollution in the UK series of reports and the AURN data are also used to calculate the UK Air Quality Indicator for Sustainable Development. The indicators based on the final dataset for 2008 are available at http://www.defra.gov.uk/news/2007/070501a.htm .

Previous years AURN data were extensively used in the development and current updating of the UK Air Quality Strategy. In addition, AURN data, along with other UK data sets, have been extensively used by the UK Air Quality Expert Group (AQEG) in the development of a series of reports –
Trends in primary nitrogen dioxide in the UK - December 2007
Air quality and climate change: a UK perspective - April 2007
Particulate Matter in the UK – 2005
Nitrogen Dioxide in the UK – 2004

AQEG has circulated a further report for consultation on Ozone in the UK and this will also make extensive use of AURN data.

19 Safety

Safety is clearly an important aspect of network operation. 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. Any items deemed to pose an unacceptable risk are brought to the attention of the site owner or the CMCU.

There are no issues identified that presented significant risk during the winter 2008 intercalibration exercise. The issue of safe roof access, to audit PM_{10} analyser flow rates has largely been worked around. This has been achieved either by installing ladder securing points on the outside of the huts, or by auditing flow rates inside the monitoring station. However, performing flow measurements inside means that we are unable to perform satisfactory leak tests on the entire sampling systems of these analysers.

It is important that safe access to the TEOM head is possible where FDMS TEOMs are employed, as it is not possible to fully leak check the system from inside the monitoring enclosure. As at April 2009, there are a number of sites where this is not the case. The access to roof-mounted equipment should be considered when acquiring or upgrading monitoring stations.

Recommendation

Safe roof access to the TEOM head should be provided at sites where FDMS units are deployed

The Gas Supply Contractor undertakes regular inspection and maintenance of the gas regulators on site to ensure compliance with the relevant pressure systems regulations.

20 Suitability Assessments

AEA carry out an annual Suitability Assessment of air quality monitoring carried out by Local Authorities at sites which are not part of the national network, but which have reported an exceedence of an applicable EU Limit Value.

The objectives of this Suitability Assessment are as follows:

1. To identify exceedences of EU Limit Values at sites outside the AURN; such exceedences may be reported to the European Commission as part of the UK formal data submission in compliance with Air Quality EU Directive requirements.
2. To identify Local Authority monitoring sites which may be suitable candidates for affiliation into the AURN.

The Suitability Assessment also provides important input into the Defra Pollution Climate Mapping project, the objective of which is to provide Defra and the Devolved Administrations with the best possible understanding of current (and predicted future) air quality.

Potential exceedences are identified via two routes: firstly, by screening data already available to AEA (either from sites whose data are managed by AEA, or publicly-available datasets). Secondly, exceedences reported by Local Authorities in their annual Local Air Quality Management Review and Assessment reports, produced by the end of April each year. Air Quality Consultants (AQC) are responsible for appraisal of these reports and collating a list of reported exceedences.

In all cases, the data are used (and exceedences reported) with permission of the Local Authorities concerned.

AEA's data management team undertake a review of the data sets. This includes the following checks and processes for each data set:

- Site Summary based on visual inspection of the data and site information.
- Data Ratification Report to determine the data capture and any data anomalies
- Time-series plots of data sets and nearby sites for comparison
- Statistical Analysis Summary.

The aim of this is to assess the reliability of the data, and the extent to which we can be confident that what was reported is in fact a genuine exceedence.

Each potential exceedence is assessed on the basis of data capture, ratification status, data quality issues and site location. A suitability score is assigned for each of the above criteria. A summary is produced to a strict deadline at the end of September each year, so that the findings can be included in the UK's submission to the European Commission if required. A final report is subsequently produced for Defra and the Devolved Administrations.

Last year, AEA carried out Suitability Assessment for 166 potential exceedences from Local Authority-operated monitoring stations.

21 Other QA/QC Activities

21.1 AQUILA (EU Association of National reference Laboratories)

Ken Stevenson has actively participated in the 2 AQUILA meetings held in 2008. A brief presentation on some FDMS operational issues encountered in the UK was provided to the November meeting. We have also assisted in the preparation of working documents - in particular, providing the QA/QC chapter for the AQUILA document on "Roles and Responsibilities of NRLs" .

21.2 AQEG

During 2008, AQEG published the report "Ozone in the UK". The QA/QC unit actively input to AQEG on measurement methods etc for the preparation of this report.

21.3 CEN Membership

Brian Stacey has been appointed to the CEN committee TC264 EH/2/3 Working Group 12 and 15 on air pollution standards. This allows the QA/QC Unit to have direct input into the European air quality standards, and help ensure the QA/QC unit is fully compliant with the requirements of these standards.

Appendices

Appendix 1

Recommendations for Upgrade or Replacement of Equipment

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

Priority	Definition	Time-scale
High*	Immediate action necessary to avoid compromising data capture/quality or safety. Critical sites should be treated as high priority.	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 2009	Priority	Action
29	None		
	Recommendations October 2008	**Priority**	**Action**
28	The analysers at Narberth should be replaced as soon as possible, as performance of the current analysers has been poor (Ozone replaced Feb 09)	High	CMCU
	Recommendations August 2008	**Priority**	**Action**
27	Many sites require modifications to permit safe roof access for measuring PM analyser flows	High	CMCU
	Recommendations January 2008	**Priority**	**Action**
26	It is recommended that the Bush NOx analyser be replaced.	High	CMCU
25	It is recommended that LSO's continue to pay particular attention to the NO_2 calibration results, to see whether the NO response is significantly higher (>10ppb) than that obtained for the zero calibration. These observations should be reported to CMCU as soon as possible	High	LSO
24	It is strongly recommended that ESU's clean all NOx analyser switching valves during servicing, and ensure the valve is leak checked afterwards.	High	ESU
	Recommendations August 2007		
	None		
	Recommendations April 2007		
22	Safe roof access needs to be provided for sites where FDMS TEOMs are to be deployed	High	ESU/CMCU
	Recommendations January 2007		
22	ESUs to ensure all NOx converter software settings to be 100%.	High	ESUs to check at service
	Recommendations July 2006		
19	Weybourne O_3 analyser should be upgraded to allow monthly LSO calibrations and daily autocalibrations	Medium	ESU to provide CMCU with quotation for necessary work

	Recommendations April 2006		
	None		
	Recommendations January 2006		
17	The performance of CO analysers needs close attention by all parties, and poorly performing analysers replaced or upgraded	High	LSOs and CMCU to check performance carefully; ESU's to action repairs promptly
	Recommendations July 2005		
13	Continuing problems with some autocal run-ons causing loss of up to 2 hours per day-see Section 3.2 **CMCU to ensure ESUs are asked to attend to offending sites (Action May 2008)**	High	Many sites now cured, but some need attention at next ESU visit

Appendix 2

Gaps listing October-December 2008

01/10/2008 to 31/12/2008 Gaps in 15-minute table >= 6 hours and data capture <= 90%

Pollutant	Data Capture (%)	Start date	End date	Reason	Comments	Number of days	Number of hours
England							
Brighton Preston Park							
PM25	0.00%	06-Oct-08	21-Oct-08		See Appendix 4	16	384
		24-Oct-08	28-Oct-08			5	120
		30-Oct-08	30-Oct-08			1	24
Bury Roadside							
CO	46.40%	22-Aug-08	06-Nov-08	Unstable response	Deleted because of unstable baseline	76.6	1839
		05-Dec-08	18-Dec-08	Communication fault	ENG C/O Call out Had lost comms and reset. Reprogrammed	12.5	301
NO2	89.80%	05-Dec-08	10-Dec-08	Communication fault		4.6	110
		13-Dec-08	18-Dec-08	Communication fault		4.7	113
Camden Kerbside							
NO2	87.10%	01-Oct-08	07-Oct-08	Pump fault	Pump was intermittently stalling. Replaced	5.8	140
		16-Dec-08	22-Dec-08	Communication fault		5.7	137
Carlisle Roadside							
PM10	85.70%	08-Oct-08	09-Oct-08	Operator error	Data deleted following filter change	1	25
		20-Oct-08	21-Oct-08	No mV data collected		1.2	29
		03-Dec-08	09-Dec-08	No mV data collected		6.3	150
		18-Dec-08	22-Dec-08	No mV data collected		4.2	100
Chesterfield							
PM10	88.50%	25-Nov-08	01-Dec-08	No mV data collected	No data collected after LSO Visit	6	144
		16-Dec-08	20-Dec-08	Unstable response	FDMS installed. Deleted warming up period	4	96
Coventry Memorial Park							
PM10	82.90%	17-Dec-08	31-Jan-09	QAQC audit	Aux Flow only 4.47l/min. Vacuum too low at 18	46	1104
Exeter Roadside							
NO2	75.00%	10-Sep-08	23-Oct-08	Switched out-of-service	Offline during construction work	43.2	1037
O3	75.00%	10-Sep-08	23-Oct-08	Switched out-of-service	Offline during construction work	43.2	1037
Haringey Roadside							
PM10	0.00%	31-Aug-08	18-Feb-09	Instrument fault	Offline then major leak at Feb 09 audit	171	4098

Harwell							
PM25	84.60%	04-Oct-08	05-Oct-08	Power cut		0.9	21
		15-Oct-08	28-Oct-08	High noise	Noisy data deleted	13.1	315
Leamington Spa							
PM10	80.90%	02-Dec-08	18-Dec-08	Instrument fault	FDMS installed. Deleted warming up period	16.7	400
SO2	66.00%	01-Oct-08	31-Oct-08	Unstable response	Spurious data deleted	31	744
Leeds Headingley Kerbside							
NO2	82.60%	10-Jul-08	02-Oct-08	NO2 converter fault	Converter failure at audit .	84	2016
		03-Nov-08	17-Nov-08	Instrument fault	High and unstable response	14.1	339
London Bexley							
PM25	85.70%	08-Oct-08	21-Oct-08	No mV data collected	FDMS upgrade.	13	313
London Cromwell Road 2							
NO2	80.80%	15-Dec-08	11-Feb-09	Instrument fault	PMT failure, data deleted	58.7	1408
London Harlington							
PM25	45.70%	01-Dec-07	19-Nov-08	Monitoring suspended	Installed equipment in new enclosure	355	8509
London Marylebone Road							
PM25	87.90%	01-Oct-08	07-Oct-08	Sampling fault	Instrument fault-delayed callout	6.2	148
		14-Nov-08	18-Nov-08	Sampling fault	Sampling fault	3.8	90
		08-Dec-08	09-Dec-08	Sampling fault	Erroneous data - M & T fault	0.8	20
London N. Kensington							
NO2	89.60%	02-Oct-08	03-Oct-08	Instrument fault	Solenoid Valve for Span/Zero permenently on.	0.7	17
		15-Oct-08	16-Oct-08	Power cut		0.9	21
		29-Oct-08	05-Nov-08	Instrument fault	Noisy data	7.2	172
London Westminster							
PM10	83.00%	17-Oct-08	20-Oct-08		See Appendix 4	4	96
		10-Nov-08	10-Nov-08			1	24
		29-Nov-08	01-Dec-08			3	72
		24-Dec-08	31-Dec-08			8	192
Lullington Heath							
SO2	61.00%	15-Sep-08	03-Nov-08	Power cut		49	1177
		24-Nov-08	26-Nov-08	Power cut		1.1	27
		12-Dec-08	13-Dec-08	Unstable response	Block of erratic data.	0.4	10
Manchester Piccadilly							
NO2	86.10%	19-Dec-08	21-Jan-09	NO2 converter fault	Converter failure	33.1	795
Northampton							
NO2	80.70%	08-Oct-08	16-Oct-08	No mV data collected	Horiba on site	8	193
		01-Dec-08	10-Dec-08	No mV data collected	New motherboard fitted to	9.1	218

					analyser.		
Nottingham Centre							
PM10	85.60%	22-Nov-08	23-Nov-08	ESU service		0.6	14
		19-Dec-08	31-Jan-09	Switched out-of-service	Site finished	43.4	1042
Plymouth Centre							
NO2	37.40%	04-Nov-08	30-Jan-09	Monitoring suspended		87.2	2092
O3	37.30%	04-Nov-08	30-Jan-09	Monitoring suspended		87.1	2090
PM10	37.30%	04-Nov-08	31-Mar-09	Monitoring suspended		148	3541
Preston							
NO2	63.20%	01-Dec-08	11-Jan-09	Unstable response	Unstable performance	42	1008
PM10	82.70%	28-Oct-08	29-Oct-08	FDMS delta dew point < 4C	Delta dew point < 4C	0.4	10
		29-Oct-08	30-Oct-08	FDMS delta dew point < 4C	Delta dew point < 4C	0.8	18
		31-Oct-08	14-Nov-08	Unstable response	ENG C/O	14.3	344
Scunthorpe Town							
PM10	9.10%	09-Oct-08	27-Jan-09	Instrument fault	Major leak at Jan 09 audit	110	2639
SO2	85.80%	04-Nov-08	05-Nov-08	ESU service		0.7	17
		14-Nov-08	20-Nov-08	Instrument fault	analyser lamp fault	5.8	140
		21-Dec-08	23-Dec-08	No mV data collected		2.5	59
Sibton							
O3	0.00%	17-Sep-08	09-Jan-09	Sampling fault	3-Way valve fault - Deleted by QA/QC	114	2741
Southampton Centre							
NO2	89.40%	12-Oct-08	21-Oct-08	Power cut		9.5	228
PM10	89.20%	05-Oct-08	15-Oct-08	No mV data collected	Rejection of unstable PM10	9.7	233
Stockton-on-Tees Eaglescliffe							
PM10	84.00%	02-Nov-08	14-Nov-08	Power cut		11.8	284
		24-Nov-08	27-Nov-08	Power cut		2.8	67
PM25	86.80%	29-Sep-08	01-Oct-08	Instrument fault	Deleted negative PM data	1.6	38
		05-Nov-08	14-Nov-08	Instrument fault	Instrument off line	9	217
Stoke-on-Trent Centre							
PM10	85.10%	22-Nov-08	05-Dec-08	Instrument fault	Massive filter leak	13.4	321
Sunderland Silksworth							
SO2	77.00%	11-Dec-08	05-Jan-09	High noise	Noisy data deleted	25.6	615
Wigan Centre							
PM25	68.00%	01-Dec-07	06-Dec-08	ESU service		372	8925
		07-Dec-08	07-Dec-08	High noise	Noisy data deleted	0.3	6
		08-Dec-08	08-Dec-08	High noise	Noisy data deleted	0.4	9
Yarner Wood							

NO2	80.60%	04-Oct-08	06-Oct-08	Power cut		1.9	45
		30-Oct-08	31-Oct-08	Power cut		1.1	26
		19-Nov-08	26-Nov-08	Power cut		6.8	162
		29-Nov-08	01-Dec-08	Power cut		1.8	43
		02-Dec-08	03-Dec-08	Power cut		1	24
		14-Dec-08	15-Dec-08	Power cut		1.2	28
		20-Dec-08	20-Dec-08	Power cut		0.7	17
O3	84.10%	04-Oct-08	06-Oct-08	Power cut		1.9	45
		30-Oct-08	31-Oct-08	Power cut		1.1	26
		19-Nov-08	26-Nov-08	Power cut		6.8	162
		29-Nov-08	01-Dec-08	Power cut		1.8	43
		02-Dec-08	03-Dec-08	Power cut		1	24
		14-Dec-08	15-Dec-08	Power cut		1.2	28
		20-Dec-08	20-Dec-08	Power cut		0.7	17
N Ireland							
Belfast Centre							
CO	66.60%	30-Apr-08	31-Oct-08	Instrument fault	IR Source correlation wheel & chopper faults	184	4413
Derry							
PM25	77.90%	30-Nov-08	19-Dec-08	No mV data collected	Deleted long warming up period after powercut	19.8	476
Lough Navar							
O3	88.20%	09-Oct-08	09-Oct-08	Power cut		0.5	12
		09-Nov-08	10-Nov-08	Power cut		0.4	10
		24-Nov-08	24-Nov-08	Power cut		0.5	12
		28-Nov-08	05-Dec-08	Power cut	ENG C/O logger corrupted	7.1	170
		06-Dec-08	07-Dec-08	Power cut		1.9	45
PM10	87.80%	09-Oct-08	09-Oct-08	Power cut		0.5	12
		09-Nov-08	10-Nov-08	Power cut		0.4	10
		24-Nov-08	24-Nov-08	Power cut		0.5	12
		28-Nov-08	07-Dec-08	Power cut	ENG C/O Odessa logger was completely corrupted. Hot spare install	9.4	225
Scotland							
Aberdeen Union Street Roadside							
NO2	89.30%	27-Oct-08	28-Oct-08	Instrument fault	Baseline skipped down after LSO cal	0.5	12
		19-Nov-08	26-Nov-08	Sampling fault	Sample line unattached	6.8	164
Auchencorth Moss							
PM25	85.00%	27-Nov-08	27-Nov-08		See Appendix 4	1	24
		04-Dec-08	05-Dec-08			2	48
		08-Dec-08	15-Dec-08			8	192
		17-Dec-08	19-Dec-08			3	72
Edinburgh St Leonards							
PM25	66.30%	01-Dec-07	31-Oct-08	Monitoring suspended	PM2.5 starts after a period of instability.	336	8057

Glasgow Centre							
NO2	61.10%	26-Nov-08	30-Jan-09	NO2 converter fault	NOx converter failure	65	1559
PM10	81.80%	03-Dec-08	04-Dec-08	ESU service	FDMS installation	1	24
		16-Dec-08	04-Mar-09	ESU service		78.3	1878
Grangemouth							
PM25	87.60%	01-Dec-07	06-Dec-08	High noise	ENG C/O New TEOM FDMS PM2.5 System Installed	371	8905
		18-Dec-08	18-Dec-08	No mV data collected	possible coms fault	0.3	7
Strath Vaich							
O3	76.20%	10-Oct-08	13-Oct-08	Power cut		3.3	79
		24-Oct-08	28-Oct-08	Power cut		3.7	88
		11-Nov-08	14-Nov-08	Power cut		3	72
		08-Dec-08	11-Dec-08	Power cut		3	73
		17-Dec-08	21-Dec-08	Power cut		4.4	106
		24-Dec-08	28-Dec-08	Power cut		4.2	100
Wales							
Newport							
PM10	71.80%	12-Jul-08	24-Oct-08	FDMS volatile recovery or noisy	Volatile fraction very unstable	103	2483
		25-Oct-08	26-Oct-08	FDMS dew point too warm	dew point too high	0.8	19
		15-Nov-08	16-Nov-08	FDMS dew point too warm	dew point too high	0.8	19
		22-Dec-08	22-Dec-08	FDMS dew point too warm	dew point too high	0.3	7
Port Talbot Margam							
CO	83.20%	09-Oct-08	14-Oct-08	Instrument fault	IR Source Fault. Replaced	4.7	112
		15-Dec-08	18-Dec-08	Communication fault	Phone line fault	3.2	76
		21-Dec-08	27-Dec-08	Communication fault	Phone line fault	6.4	154
NO2	88.70%	15-Dec-08	18-Dec-08	Communication fault	Phone line fault	3.2	76
		21-Dec-08	27-Dec-08	Communication fault	Phone line fault	6.4	154
O3	88.80%	15-Dec-08	18-Dec-08	Communication fault	Phone line fault	3.2	76
		21-Dec-08	27-Dec-08	Communication fault	Phone line fault	6.4	154
SO2	88.70%	15-Dec-08	18-Dec-08	Communication fault	Phone line fault	3.2	76
		21-Dec-08	27-Dec-08	Communication fault	Phone line fault	6.4	154
PM2.5	87.00%				See Appendix 4		

Appendix 3

Inventory of Defra owned Equipment

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

QA/QC Unit's inventory of Department-owned equipment, March 2009

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

Appendix 4

Partisol Data Ratification: October-December 2008

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

Site	Start date	End date	Ratified Data Capture, %
Auchencorth Moss PM_{10}	1st Oct	31st Dec	99%
Auchencorth Moss $PM_{2.5}$	1st Oct	31st Dec	85%
Bournemouth PM_{10}	1st Oct	31st Dec	96%
Brighton Preston Park $PM_{2.5}$	1st Oct	31st Dec	78%
Harwell PM_{10}	1st Oct	31st Dec	97%
Harwell $PM_{2.5}$	1st Oct	31st Dec	100%
Inverness PM_{10}	1st Oct	31st Dec	100%
London Marylebone Road PM_{10}	1st Oct	31st Dec	96%
London Marylebone Road $PM_{2.5}$	1st Oct	31st Dec	99%
London N Kens PM_{10}	1st Oct	31st Dec	100%
London N Kens $PM_{2.5}$	1st Oct	31st Dec	87%
London Westminster PM_{10}	1st Oct	31st Dec	83%
Northampton $PM_{2.5}$	1st Oct	31st Dec	88%
Port Talbot Margam $PM_{2.5}$	1st Oct	31st Dec	87%
Wrexham	1st Oct	31st Dec	98%

Measured data and ambient concentrations are supplied by Bureau Veritas. Data are now processed using the Foxpro-based HIS system. The ratification process includes checking of BV's calculated ambient PM_{10} concentration. It is noted that BV now carry out more detailed checks on the data, including checking for matching of filter numbers, dates and weights, also comparison of data with that from other nearby sites. Ratification is completed by comparing Partisol with nearby FDMS data.

Data Rejection

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

Measurement codes are shown below.
The measurement codes reported by BV are as follows:

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

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

Filter faults

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

Site Audits

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

The flowrate must be within +/-10% of the nominal value (16.7 m3/h) and the leakage must be < 5%.

Site Audits –Summer 2008 and Winter 2009 periods.

Site	Audit date	Flowrate m3/h	% out from 16.7 m3/h	Leak test %
Auchencorth Moss PM_{10} (serial no. 21550)	19 Jun 2008 10 Dec 2008	16.7 16.7	0 0	
Auchencorth Moss $PM_{2.5}$ (serial no. 21548)	19 Jun 2008 10 Dec 2008	16.7 0	0 100	
Bournemouth PM_{10} (serial no. 21257)	06 Aug 2008	16.64	-0.18	NOT RECORDED
Brighton Preston Park $PM_{2.5}$	02 Sep 2008	Partisol not audited.	-	-
Harwell $PM_{2.5}$	26 Aug 2008	16.7	-	-
Inverness PM_{10} (serial no. 21255)	25 Jun 2008 05 Feb 2009	16.76 16.7	0.54 0	"pass" not recorded
Inverness PM2.5 (serial no. 21861)	25 Jun 2008 05 Feb 2009	16.58 16.7	0.78 0	"pass" not recorded
London Marylebone Road PM_{10} (serial no. 21306)	11 Aug 2008 17 Feb 2009	Partisols appeared not working. 17.2	- 2.9	- Not recorded
London Marylebone Road $PM_{2.5}$ (serial no. 21493)	11 Aug 2008 17 Feb 2009	Partisols not working. PM_{10} Partisol not working.	- -	- -
London N Kens PM_{10} (serial no. 21722)	22 Jul 2008 6 Mar 2009	Partisol not audited? Not tested ladder access unsafe	-	-
London N Kens $PM_{2.5}$	22 Jul 2008 6 Mar 2009	Partisol not audited Not tested ladder access unsafe	- -	- -
London Westminster PM_{10}	13 Aug 2008 18 Feb 2009	16.10 not tested – ladder access unsafe.	-3.42 not tested	NOT RECORDED Not tested.
Northampton $PM_{2.5}$	19 Feb 2009	Not tested ladder access unsafe.	-	-
Port Talbot Margam $PM_{2.5}$	15 Jul 2008 19 Feb 2009	17.17 not tested	2.80 not tested	"pass" not tested
Wrexham (serial no. 212240)	11 Aug 2008 10 Feb 2009	15.93 not tested	-4.44 not tested	NOT RECORDED Failed during leak test

Where Partisols were audited, the results were normal. However, very few of the Partisols were actually audited in the winter 2009 round, and none were leak-tested.

- Brighton Preston Park: Partisol not included in August site audit, on advice of LSO.

- Neither of the London Marylebone Rd. Partisols not working at time of August site audit. The PM2.5 Partisol was not working at the time of the winter 2009 audit.
- London N. Ken. Partisols were not checked at either audit, because ladder access was deemed to be unsafe by the member of the field team.
- London Westminster: leak test result not recorded at August audit. Not checked at winter 2009 audit because ladder access was deemed to be unsafe.
- Northampton: not checked at winter 2009 audit because ladder access was deemed to be unsafe.
- Port Talbot Margam not tested (reason not recorded).
- Wrexham: Partisol failed during winter 2009 leak test.

It is a matter of some concern that there is no safe ladder access at so many of the Partisol sites.

Site Specific Issues

Auchencorth Moss
PM_{10}: Data capture was 99% for this quarter. Data losses as follows:
- 27th Dec, value of 65 ug m-3 rejected by BV as unusually high.

$PM_{2.5}$: Data capture was 84% for this quarter.
- 27th Nov, 5th Dec, 8th – 15th Dec, filter exchange failures.
- 4th Dec, unspecified fault (vol = 0)
- 17th – 19th Dec – pump failure.

This is the 2nd consecutive quarter with <90% data capture for the PM2.5 Partisol at this site, due to filter exchange failures etc.

Bournemouth
PM_{10}: Data capture was 96% for this quarter. Data losses as follows:
- 27th Nov – 1st Dec: filter exchange failure.

Note: this Partisol was converted to PM2.5 at the end of 2008.

Brighton Preston Park
$PM_{2.5}$ only: Data capture was 78% for this quarter: the 2nd quarter running with poor data capture.
- 6th – 21st Oct, power and comms failure (again).
- 24th – 28th Oct power failure
- 30th Oct engineers visit (< 18h sampling).

Harwell
$PM_{2.5}$: 100% data capture (for 2nd consecutive quarter.)

PM_{10}: new site from 1st Oct. Data capture 97%.
- 14th Oct, 14th-15th Dec filter exchange failures.

Inverness
PM_{10}: Data capture = 100%

London Marylebone Road
PM_{10}: Data capture = 96%. Data losses:
- 15th Oct - filter exchange failure.
- 13th, 14th & 26th Nov - < 18m3 sampled.

$PM_{2.5}$: Data capture 99%. Data losses:
- 18th Nov < 18m3 sampled.

London North Kensington
PM_{10}: data capture 100%.

$PM_{2.5}$: Data capture was 96%. Data losses:
- 7th Oct system reset.

- 27th – 29th Oct & 11 Dec - filter exchange failure

London Westminster
PM_{10} only: Data capture = 83%. Data losses:
- 17th – 20th Oct filter exchange failures.
- 10th Nov, volume = 0
- 29th Nov – 1st Dec: vol = 0
- 24th Dec – Partisol converted to PM2.5 so no more PM10 data.

Northampton
$PM_{2.5}$: Data capture was 88%. Data losses:
- 16th – 19th Nov, 12th Dec, 24th – 29th Dec filter exchange failures.

This is a newly installed (reinstated) Partisol and it looks like it is prone to filter exchange failures.

Port Talbot Margam
$PM_{2.5}$ only: data capture = 87%. Data losses:
- 1st – 6th Oct – pump valve failure
- 11th – 13th Oct – ran out of filters early
- 29th – 30th Oct – vol = 0

Wrexham
Data capture was 98%. Data losses:
- 15th – 16th Dec: power failure.

Appendix 5

Site Details for New Sites

Site	Owner	Region	OS Ref	East	North	Latitude	Longitude	
York Bootham	Affliated	NE England	SE 59974 52278	459974	452278	53 57 47N	01 05 14W	URBAN BACKGR
York Fishergate	Affliated	NE England	SE 60744 51133	460744	451133	53 57 07N	01 04 33W	R/SIDE
Oxford St Ebbes	Affliated	Midlands	SP 51225 06009	451225	206009	51 45 0.8N	01 15 33.1W	URBAN BACKG
Newport	Affliated	Wales	ST 32471 89615	332471	189615	51 36 04N	02 58 37W	URBAN BACKGR
Chepstow A48	Affliated	Wales	ST 53126 93461	353126	193461	51 38 17.14N	02 40 43.43W	R/SIDE
Liverpool Queen's Drive Roadside	Affliated	NW England	SJ 36171 94956	336171	394956	53 26 49N	02 57 45W	R/SIDE
Aberdeen Union Street Roadside	Affliated	Scotland	NJ 96345 05947	396345	805947	57 08 40.4N	02 06 23.3W	R/SIDE
Stanford-le-Hope Roadside	Affliated	SE England	TQ 69400 82710	569400	182710	51 31 05N	00 26 22E	R/SIDE
Carlisle Roadside	Affliated	NW England	NY 39442 55956	339442	555956	54 53 41N	02 56 45W	R/SIDE
Leeds Headingley Kerbside	Affliated	NE England	SE 27991 36071	427991	436071	53 49 12N	01 34 35W	K/SIDE
Newcastle Cradlewell Roadside	Affliated	NE England	NZ 25989 65850	425989	565850	54 59 11N	01 35 55W	R/SIDE
Chesterfield Roadside	Affliated	Midlands	SK 36351 70682	436351	370682	53 13 54.2N	01 27 25.0W	R/SIDE
Chesterfield	Affliated	Midlands	SK 36351 70682	436351	370682	53 13 50.1N	01 26 1.0 W	URBAN BACKGR.
Port Talbot Margam PM2.5	Affliated	Wales	SS 77600 88500	277600	188500	51 35 02N	03 46 15W	URBAN IND.
London Marylebone Road PARTISOL	DEFRA	London	TQ 28120 82000	528120	182000	51 31 12N	00 09 17W	K/SIDE
London N. Kensington PARTISOL	DEFRA	London	TQ 24040 81740	524040	181740	51 31 16N	00 12 48W	URBAN BACKGR
Harwell PARTISOL	Affliated	SE England	SU 46772 86020	446772	186020	51 34 16N	01 19 36W	RURAL
Sandy Roadside	Affliated	East Anglia	TL 16450 49616	516450	249616	52 07 56.7N	00 18 01.1W	R/SIDE
Saltash Roadside	Affliated	SW England	SX 41613 59402	241613	59402	50 24 47.2N	04 13 49.2W	R/SIDE
Stockton-on-Tees Eaglescliffe	Affliated	NE England	NZ 41620 13673	441620	513673	54 31 00.00N	01 21 30.77W	R/SIDE
Charlton Mackrell	Affliated	SW England	ST 52235 28853	352235	128853	51 03 22.5N	02 41 0.42W	RURAL
Warrington	Affliated	NW England	SJ 59129 88219	359129	388219	53 23 21.15N	02 36 55.29W	URBAN BACKGR

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