

Report

**QA/QC Data Ratification Report and
Annual Review for the Automatic
Urban and Rural Network,
October–December 2003**

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

AEAT/ENV/R/1761 Issue 1
May 2004

UNRESTRICTED

=

**QA/QC Data Ratification Report and Annual
Review for the Automatic Urban and Rural
Network, October-December 2003**

Jane Vallance-Plews

May 2004

UNRESTRICTED

Title	QA/QC Data Ratification Report and Annual Review for the Automatic Urban and Rural Network, October - December 2003
Customer	Department for Environment, Food and Rural Affairs, Scottish Executive, Welsh Assembly Government and the DoE in Northern Ireland
Customer reference	
Confidentiality, copyright and reproduction	Unrestricted Copyright AEA Technology plc All rights reserved. Enquiries about copyright and reproduction should be addressed to the Commercial Manager, AEA Technology plc.
File reference	ENET 45077010
Report number	AEAT/ENV/R/1761 Issue 1

Jane Vallance-Plews
 AEA Technology
 National Environmental Technology Centre
 Culham E4/26
 Abingdon
 Oxfordshire OX14 3ED
 Telephone 0870 190 6587
 Facsimile 0870 190 6607

AEA Technology is the trading name of AEA Technology plc
 AEA Technology is certificated to BS EN ISO9001 2000

	Name	Signature	Date
Authors	Jane Vallance-Plews		
Reviewed by	Ken Stevenson		
Approved by	Geoff Dollard		

Executive Summary

Netcen 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) and the Devolved Administrations. This report provides a review of data ratification issues for the 3-month period October to December 2003 (Part A) and includes an annual overview of network performance and QA/QC Unit activities for 2003 (Part B).

The network has undergone significant changes since it was first established in 1992. Site numbers increased to 121 sites to date, of which 61 are Local Authority owned sites which are affiliated to the national network. The further addition of 4 new sites in 2004 will bring the total number of AURN sites to 125.

Network average data capture for 2003 was 91%, which although above the 90% target level, is slightly lower than seen in previous years (typically 93%). This slight reduction in overall data capture reflects the fact that 2003 has been an especially active year in terms of network expansion and up grading. Integration of additional NO_x and O₃ analysers to meet the requirements of the third Daughter Directive was completed at 12 out of the 13 requisite sites. The last remaining site at Eskdalemuir is currently being up-graded to accommodate the new analysers. A major equipment replacement programme also took place during the summer of 2003, with over 100 of the older or more unstable analysers being replaced at 34 direct funded sites. In addition, four site relocations were carried out during the year. In all these activities the network Management Units, QA/QC Unit and the equipment support units have worked closely together to ensure minimum disruption to the smooth running of the network. Encouragingly, average data capture in the final quarter of 2003 (October-December) rose to 93%, indicating that network performance is on target again with the new equipment installed and operating satisfactorily.

Two new gravimetric PM₁₀ (Partisol) analysers were commissioned at London Westminster and Brighton Roadside, making a total of seven gravimetric PM₁₀ sites in the network. Data capture from these analysers was lower than expected in 2003, with only three out of the seven sites achieving 90% data capture for the year. To improve this, measures have now been taken to connect the Partisol analysers to telemetry giving the advantages of remote data collection and regular operational status checking.

PM_{2.5} measurements at four sites have also been included in the network for the first time. Historic PM_{2.5} data from 1998 have been checked by QA/QC Unit and the analysers incorporated into the routine QA/QC data ratification and intercalibration programme from October 2003.

A summary of QA/QC Unit's activities and the main data quality issues identified during the ratification of the 2003 data set is provided. Further details can also be found in each of the quarterly data ratification reports already issued for 2003.

Results of the 6-monthly intercalibrations showed that the data quality objectives in terms of measurement accuracy, precision and consistency were within acceptable limits. Out of the 400 analysers tested approximately 80% were shown to be performing satisfactorily. Audits of local site operator (LSO) performance during 2003 showed that the LSOs carried out their duties competently and in accordance with the site operator's manual. The skilled input and calibration information provided by the site operators has been a major contributing factor to ensuring the continued high performance of the network.

QA/QC Unit continues to maintain a watching brief on new methodologies and technical advances in air quality in order to keep pace with any changes that may be required in the coming years, particularly in view of the proposed European CEN standards.

In general the network has continued to provide high quality data which is an essential part of the Department and DA's commitment to providing the public with rapid and reliable air quality data as well as meeting their statutory reporting requirements. This has been achieved as a result of the co-operative action of all participants in the network.

PART A: DATA RATIFICATION	OCTOBER–DECEMBER 2003	1
1 INTRODUCTION		2
1.1	Recent Changes in the Network	3
1.2	Overview of Network Performance	5
1.3	AURN Hub Updates	7
1.4	Equipment Replacement Programme	8
2 GENERIC DATA QUALITY ISSUES		9
2.1	Progress on Monitoring Requirements of the EU Daughter Directives	9
2.2	PM ₁₀ Episodes	10
2.3	Data Capture for Critical Sites in Zones and Agglomerations	11
2.4	Gravimetric PM ₁₀ Data Ratification	13
2.5	NO ₂ Converter Efficiencies	15
2.6	Ozone Outliers	16
2.7	TEOM k ₀	16
2.8	Auto-Calibration Run-ons	17
2.9	PM _{2.5} Data Checking	18
2.10	Use of Site Cylinders for Automatic Daily Span Checks	18
2.11	Long Term Data Ratification Checks	18
3 SITE SPECIFIC ISSUES		20
3.1	Belfast Centre, Liverpool and Newcastle CO	20
3.2	Zero Response Truncation	20
3.3	Stoke on Trent PM ₁₀	21
3.4	Blackpool SO ₂	22
3.5	Narberth PM ₁₀ and SO ₂	23
4 SITES WITH DATA CAPTURE BELOW 90%		24
4.1	Gravimetric PM ₁₀ Sites with Data Capture Below 90%	32
5 RATIFIED DATA CAPTURE STATISTICS		33

PART B: ANNUAL REVIEW 2003	39
6 OVERVIEW OF NETWORK PERFORMANCE	40
6.1 Network Expansion	40
6.1.1 New Sites/Analysers	40
6.1.2 Site Relocations	41
6.2 Network Data Capture	41
7 REVIEW OF QA/QC UNIT ACTIVITIES	43
7.1 Reporting	43
7.2 Network Intercalibrations	43
7.3 LSO Audits and Training	44
7.4 Investigation of spurious data, 2003	44
7.4.1 Bristol Old Market High NO ₂	45
7.4.2 London Bloomsbury PM ₁₀	45
7.4.3 London Bloomsbury NO ₂	45
7.4.4 Redcar CO	45
7.4.5 Suppressed CO Response	45
7.4.6 BAM PM ₁₀ Data Anomalies	45
7.4.7 Autocalibration Run-on	46
7.4.8 Camden Roadside NO _x	46
7.5 LSO Manual	46
7.6 AURN Hub	47
7.7 Annual LSO Meetings	47
7.8 Cylinder Inventory	48
7.9 International Harmonisation	48
7.10 ISO 17025 Accreditation	48
7.11 The Year Ahead	49
APPENDIX A1	List of recommended equipment for up-grading
APPENDIX A2	Critical Sites in the AURN
APPENDIX A3	AURN Equipment Replacement Programme
APPENDIX A4	Inventory of Defra owned Equipment

PART A: Data Ratification October–December 2003

1 Introduction

This quarterly report covers the Quality Assurance and Control (QA/QC) activities undertaken by **netcen** to ratify automatic monitoring data from Defra and the Devolved Administrations' automatic urban and rural air quality monitoring network (AURN) for the period October to December 2003. During this period there were 120 monitoring sites in the Network of which 83 are urban sites, 23 rural network sites and 14 sites in the London Air Quality Monitoring Network (LAQN) which are affiliated into the national network. A new site at London Harlington was affiliated on 1 January 2004 bring the total number of AURN sites to 121 to date.

This final quarterly report for the year also includes an annual review of network performance and QA/QC Unit's activities for 2003. The report is therefore divided into two parts as follows:

Part A: Data Ratification

- Section 1: Introduction including recent changes that have taken place in the network and a general overview of network performance.
- Section 2: Data capture review
- Section 2: Generic data quality issues and recommendations for improving or resolving these issues.
- Section 3: Site specific issues
- Section 4: Reasons for data loss at sites where data capture falls below 90%.
- Section 5: Data capture statistics for October-December 2003 and the complete year presented in tables.

Part B: Annual Review

- Section 6: Overview of network performance
Network expansion and data capture
- Section 7: Review of QA/QC Unit activities
Reporting
Network intercalibrations, audits and training
Investigations of spurious data quality
LSO manual and AURN hub
Cylinder inventory
Annual LSO meetings
International harmonisation and accreditation
The year ahead

- Appendix A1: Recommendations for replacing or up-grading equipment (compiled in conjunction with CMCUs)
- Appendix A2: List of critical sites in the AURN
- Appendix A3: Equipment Replacement Programme
- Appendix A4: Inventory of Department-owned equipment used by QA/QC Unit

Detailed quarterly data ratification reports have been published for the 2003 data set highlighting the main data quality issues and reasons for data loss. Results of the winter and summer 2003 network intercalibrations have also been published in conjunction with the 1st and 3rd ratification reports. Copies of these reports are available on the Quality Archive and AURN Hub web sites at:

Air Quality Archive

http://www.airquality.co.uk/archive/reports/reports.php?action=category§ion_id=5

AURH Hub

<http://www.aeat.co.uk/com/AURNHUB/aunhubPUBLIC-23.htm>

1.1 Recent Changes in the Network

The AURN currently consists of 121 monitoring sites of which 60 are directly funded by the Department and DAs, with the remaining 61 sites owned by other organisations (mainly Local Authorities) and affiliated to the national network.

An overview of the main changes relating to sites in the AURN between January 2003 to May 2004 is presented below with a summary given in Table 1.1.

Liverpool Centre/Liverpool Speke

The Liverpool Centre site was closed on 23rd September 2002 for health and safety reasons and was relocated approximately 10 miles away to the vacated hydrocarbon site in Speke. A new set of analysers was installed in April and the site resumed operation on 20th May 2003 following QA/QC Unit's commissioning audit. The performance of the new CO analyser is currently under review (See Section 3.1)

London Southwark

NO₂ monitoring at London Southwark ceased on 20th October 2002 due to analyser breakdown. The analyser was considered to be beyond economical repair, therefore a new analyser was purchased by the Local Authority and installed on 4th April 2003.

Southwark Roadside

CO monitoring at Southwark Roadside ceased on 15th April 2003 for six months because the analyser was too old to be repaired. A new CO analyser was installed on 21st October 2003.

Edinburgh Centre

Relocation of the Edinburgh Centre site to Edinburgh St Leonards was completed on 25th November 2003. Since April 2002, a replacement mobile station owned by Edinburgh City Council was used to provide monitoring data during the relocation process. This mobile station was closed from November 2002 and re-started on 20th April 2003 after a 5-month delay due to repair of the ground near the site. The new site at Edinburgh St Leonards has been equipped with a new set of analysers as part of the network equipment up-grading programme. QA/QC unit carried out a commissioning audit of the new site and equipment on 19th November 2003.

Hounslow Roadside/Brentford Roadside

Hounslow Roadside site was closed on November 16th 2002 because the building in which the monitors were housed was being sold. The site has been relocated to a cabin at the roadside of the A4 adjacent to the M4 flyover. Because the site is now located outside the building where the previous monitoring equipment was housed it has been re-named Brentford Roadside. Monitoring at this new location started on 20th June 2003 and the site was commissioned by QA/QC Unit during the summer intercalibration exercise in July 2003. There were, however, no CO data from this site until 29th August as it was not possible to calibrate the analyser due to a faulty regulator. Also the NO_x data could not be scaled satisfactorily until the first reliable calibration on 1st August 2003.

Reading Centre/Reading New Town

The monitoring station at Reading Centre closed on 6th February 2003 as the lease for the site had expired. Consequently there are no data for this site during this period. The site was relocated to a cemetery approximately 1 mile away and has been named Reading New Town. There was a long delay in the relocation of this site due to power supply problems. These have now been resolved and the site commenced operation on 17th October 2003.

London Westminster

Gravimetric PM₁₀ sampling started on 19th February 2003. At QA/QC Unit's commissioning audit however, it was discovered that a component was missing from the analyser resulting in internal sampling. The repair was carried out and PM₁₀ monitoring recommenced on 19th March 2003.

Brighton Roadside PM₁₀

Gravimetric PM₁₀ (Partisol) monitoring commenced at Brighton Roadside on 28th February 2003. This site is located approximately 30m further along the pavement from the "Brighton Roadside" automatic site so it has been given a separate site name "Brighton Roadside PM₁₀".

Market Harborough

A new rural site at Market Harborough monitoring NO_x, CO and O₃ was integrated into the network on 10th December 2003.

London Harlington

An affiliated site at London Harlington (Heathrow Airport) measuring NO₂, O₃, CO and PM₁₀ was integrated into the network from 1 January 2004.

Scunthorpe

Due to health and safety issues the Scunthorpe site (Cottage Beck Road) was closed on 18th March 2004 and relocated to nearby site in Roland Road. The site has been re-named Scunthorpe Town.

PM_{2.5} Sites

TEOM analysers monitoring PM_{2.5} have been integrated into the network at 4 existing sites, London Marylebone Road, London Bloomsbury, Rochester and Harwell (PM_{2.5} and PM₁₀). QA/QC Unit has checked five and a half years worth of historical data (since April 1998) from these analysers. From October 2003 the PM_{2.5} analysers have been routinely incorporated into the network data ratification, intercalibration and reporting procedures.

Requirements of the Third EU Daughter Directive

Additional ozone and rural NO_x analysers have been installed in the network in order to comply with the Third Daughter Directive (DD3) which came into force on 9th September 2003. Installation and commissioning of the analysers has been completed at 12 out of the 13 selected sites. Plans to install NO_x and PM₁₀ analysers at the remaining site (Eskdalemuir) are underway and it is anticipated that this will be completed by end of June 2004. Arrangements are also being made to add a further 4 new DD3 sites at Brighton Preston Park, Fort William, Sunderland Silkworth and Leominster. Progress on the affiliation of the DD3 analysers is summarised in Table 1.1 and discussed in more detail in Section 2.1.

Table 1.1 Changes to the AURN between January 2003 to May 2004

Sites	Date Commenced	Pollutants
New sites		
Brentford Roadside	20/6/03	NO ₂ CO
Liverpool Speke	20/5/03	NO ₂ SO ₂ CO O ₃ PM ₁₀
Brighton Roadside PM ₁₀	28/2/03	PM ₁₀ (Gravimetric)
Reading New Town	17/10/03	NO ₂ SO ₂ CO O ₃ PM ₁₀
Edinburgh St Leonards	25/11/03	NO ₂ SO ₂ CO O ₃ PM ₁₀
Market Harborough	10/12/03	NO _x CO O ₃
London Harlington	1/1/04	NO ₂ O ₃ CO PM ₁₀
Additional CO monitoring (DD2)		
Grangemouth	17 th January 2003	CO

Sites	Date Commenced	Pollutants
Additional Gravimetric PM₁₀ (Partisol) monitoring		
London Westminster	Started 19 th February 2003	PM ₁₀
Brighton Roadside PM ₁₀	Started 28 th February 2003	PM ₁₀
Additional O₃ and/or NO_x (DD3)		
Portsmouth	Commenced 15 th April 2003	O ₃
Cwmbran	Commenced 30 th April 2003	O ₃
Somerton	Commenced 28 th April 2003	NO _x
Bournemouth	Commenced 27 th Feb 2003	O ₃
Northampton	Commenced 17 th March 2003	O ₃
Wigan Leigh	Commenced 15 th May 2003	O ₃
Aberdeen	Commenced 1 st August 2003	O ₃
Aston Hill	Commenced 21 st Oct 2003	NO _x
Yarner Wood	Commenced 16 th Sept 2003	NO _x
High Muffles	Commenced 20 th Oct 2003	NO _x
Bush	Commenced 6 th Oct 2003	NO _x
Glazebury	Commenced 26 th Jan 2004	NO _x
Eskdalemuir	Scheduled for June 2004	NO _x and PM ₁₀
Monitoring suspended		
Data loss		
Grangemouth – site up grade	1 st Aug 2002 – 17 th Jan 2003	All
Edinburgh mobile site re-instated on 20 th April 2003. Permanent site at Edinburgh St Leonards commenced on 25 November 2003.	Mobile unit closed 19/11/02 to 20/4/03. Mobile unit re-instated 20/4/03	All
Liverpool Centre closed. Relocated to Liverpool Speke	Closed from 23 rd September 2002. Liverpool Speke started 20 th May 2003	All
Reading Centre closed. Relocated to Reading New Town	Closed 6 th February 2003. Reading New Town started 17 th October 2003.	All
Hounslow Roadside closed. Relocated to Brentford Roadside.	Closed 16 th November. Brentford Roadside started 20 th June 2003. No CO data for this period. NO _x data from August 2003.	All
London Southwark NO _x	NO _x analyser off site from 20 October 2002 to 4 April 2003	NO _x
Southwark Roadside CO	CO analyser off site from 15 th April until new analyser installed on 21 October 2003	CO
Scunthorpe site closed 18 March 2004. Relocated to Scunthorpe Town	Monitoring commenced after commissioning audit on 22 April 04.	PM ₁₀ SO ₂

1.2 Overview of Network Performance

Ratified hourly average data capture for the network averaged 93% for all pollutants (O₃, NO₂, SO₂, CO, PM₁₀ and PM_{2.5}) during the 3-month reporting period October to December 2003 (see Table 1.2 below). In terms of data capture, this was a good period compared with the previous quarter when average data capture was down to 90.5%. However, some improvement is to be expected as there were no service or intercalibration exercises during this period. This is also the first quarter in which the average, data capture was

above the 90% target for all of the individual pollutant species in 2003. Note also this is the first period to include ratified PM_{2.5} data from 4 sites.

Table 1.2 AURN Ratified Data Capture (%) January to December 2003
(Using the start date of any new site)

Data Capture (%)	CO	NO ₂	O ₃	PM ₁₀	PM _{2.5}	SO ₂	Average
Q1 Jan - March 03	90.2	88.6	93.9	88.2	-	92.4	90.7
Q2 Apr – June 03	85.5	90.2	94.9	93.3	-	94.1	91.6
Q3 July – Sept 03	87.8	89.4	94.3	89.3	-	91.4	90.5
Q4 Oct – Dec 03	90.6	93.4	95	93.0	98.3	92	93
Calendar Year 2003	89	90.2	94.4	90.1	96.7	91.1	91.3

Overall, 352 out of the 420 analysers (83.8%) achieved data capture levels above the required 90% target during this reporting period (See Table 1.3). This is much higher than in the previous quarter when only 75% of analysers achieved the data capture target.

Table 1.3 Number of Analysers with Data Capture below 90%

	Total Number of Analysers	Analysers with Data Capture <90% Q4 Oct - Dec 2003	Analysers with Data Capture <90% January – Dec 2003
CO	79	18 (23%)	28 (35%)
NO ₂	105	22 (21%)	33 (32%)
O ₃	84	10 (12%)	13 (16%)
PM ₁₀	71	7 (10%)	20 (28%)
PM _{2.5}	4	0	0
SO ₂	77	11 (14%)	19 (25%)
All sites	420	68 (16%)	113 (27%)

A more detailed breakdown of the hourly data capture statistics for each site is presented in Section 5, Table 5.1. In total, 28 out of the 120 network sites (23%) had an average data capture rate below the required 90% level for the October to December 2003 period. (See Table 1.4). Data capture statistics for the year are presented in Table 5.2 and discussed in more detail in Section 6.2. 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 2003
(Data capture calculated from site start date)

Site	Owner	Site Average Data Capture (%) Q4 Oct-Dec
ENGLAND		
Blackpool	Defra	78.8
Brighton Roadside PM ₁₀	Affiliate	81.5
Bristol Old Market	Affiliate	84.5
Coventry Memorial Park	Defra	72.0
Haringey Roadside	Affiliate	86.7
Leicester Centre	Defra	84.0
London Bexley	Affiliate	89.6
London Bloomsbury	Defra	86.4
London Bromley	Affiliate	80.4
London Haringey	Affiliate	74.7

London Westminster	Defra	72.4
Market Harborough	Defra	89.6
Northampton PM ₁₀	Affiliate	79.3
Nottingham Centre	Defra	83.5
Salford Eccles	Affiliate	87.3
Sibton	Defra	70.9
Southampton Centre	Defra	87.4
Southwark Roadside	Affiliate	58.5
Stoke-on-Trent Centre	Defra	75.2
Walsall Alumwell	Defra	86.6
Wicken Fen	Defra	89.0
NORTHERN IRELAND		
Lough Navar	Defra	82.3
SCOTLAND		
Edinburgh Centre	Defra	87.8
Edinburgh St Leonards	Defra	86.1
Glasgow Centre	Defra	79.2
Grangemouth	Affiliate	74.8
Strath Vaich	Defra	69.6
WALES		
Narberth	Affiliate	52.8

Netcen carried out the winter intercalibration and site audits at 121 urban and rural sites during January to March 2004. Results from this intercalibration exercise have been used to assess the accuracy and consistency of the data for this reporting period. Details of the winter 2004 intercalibration will be provided in the next quarterly report (January-March 2004).

The summer intercalibration is scheduled to start on at the beginning of July 2004. A full schedule of QA/QC Unit audits and ESU service visits will be posted on the AURN Hub in the near future. To reduce the risk of sites being audited or serviced during the summer high pollution episodes, the Air Quality Communications Unit are now issuing twice weekly updates on UK air pollution forecasts to the Equipment Support Units. It may, however, not always be feasible for ESUs to reschedule service visits and any decisions taken based on the forecasts must involve the CMCUs and QA/QC Unit of the network as well as the ESUs.

1.3 AURN Hub Updates

The AURN Hub web site has been recently been updated with the following information:

- Presentations from the London AURN Affiliate Local Site Operator's Meeting, April 04
- Link to ERG's Preliminary Air Quality in London 2003 Report
- QA/QC Unit's Winter 2004 intercalibration and audit schedule
- ESU's Winter service schedules (where provided)
- QA/QC Unit's quarterly ratification report July-September 2003
- Recent Management Unit reports (October-December 2003)

The AURN project information hub web site is located at¹.

<http://www.aeat.co.uk/com/AURNHUB/index.html>.

¹ Password protected site: username and password available from Jane.vallance-plews@aeat.co.uk

1.4 Equipment Replacement Programme

A major programme took place during the summer of 2003 to replace aged and/or problematic equipment at 40 sites in the AURN. This programme was funded by Defra and the DAs and managed by CMCU (Casella Stanger). Primarily, older equipment was replaced at the original EUN and rural network sites. Where possible new equipment was installed by the Equipment Support Units during their scheduled summer service visits. To date, replacement equipment has been installed at 35 out of the 40 selected sites. New equipment sets for Leeds and Leicester are scheduled to be installed in time for the next summer service/audit exercise. The last two remaining sets of new equipment will be installed, when the appropriate location for them has been agreed. A table showing all of the sites where new equipment has been installed and commissioned is given in Appendix A3. QA/QC Unit undertook commissioning audits shortly after the new analysers were installed in order to ensure they were operating satisfactorily. Site operators were also given additional training where necessary.

As part of the data ratification process, QA/QC Unit has carefully examined the datasets at all the sites where new analysers have been installed in order to identify any data quality issues arising from the change over to the new equipment. To ensure continuity in data from the site the following details have been checked:

- Correct calibration factors for the new analyser have been applied
- Continuity in baseline/ambient levels with no obvious step changes in data
- Satisfactory response stability of the new analysers after installation
- Autocalibrations operational and correctly configured.

In general, the change over from the old to new equipment proceeded smoothly without significant impact on data capture. A few operational "teething" problems were initially experienced at some sites as discussed in the previous ratification report. On the whole, these problems were quickly resolved by the ESUs and the majority of new analysers performed well during this last quarter.

Some local authorities have also taken steps to up-grade their own equipment at affiliated sites. For example new analyser have been installed at London Bexley, London Brent and Birmingham East. Commissioning audits of all new equipment at affiliated sites has also been undertaken.

Despite some initial disruption caused by the up-grading exercise, there are hopefully significant advantages to be gained in the long run in terms of instrument performance and reliability.

2 Generic Data Quality Issues

2.1 Progress on Monitoring Requirements of the EU Daughter Directives

In order to comply with the third Daughter Directive (DD3 implementation date 9th September 2003), an additional 6 ozone and 7 rural NO_x monitors were required at a number of existing sites in the network. Further details on the third Daughter Directive can be found at:

<http://www.defra.gov.uk/environment/consult/air-23daughter/index.htm>

The majority of these analysers have now been installed and commissioning audits carried out by QA/QC Unit (See Table 2.1). There was a delay in commissioning the NO_x analyser at Glazebury as the site power supply had to be up-graded in order to accommodate the additional equipment. All the necessary re-cabling and associated trenching has now been completed and the new NO_x analyser was commissioned at the Winter audit on 26th January 2004. There still remains one site (Eskdalemuir) where outstanding issues have delayed the installation of the analysers. A new air conditioning unit is required before the NO_x and PM₁₀ analysers can be installed and this is scheduled to be completed by the end of June 2004.

Table 2.1 Progress on Installation of Analysers for DD3, May 2004

Site	Pollutant	Installed	Start Date	Comment
Wigan Leigh	O ₃	Yes	15/05/2002	Completed
Bournemouth	O ₃	Yes	27/02/2003	Completed
Northampton	O ₃	Yes	13/03/2003	Completed
Portsmouth	O ₃	Yes	15/04/2003	Completed
Cwmbran	O ₃	Yes	29/04/2003	Completed
Somerton	NO _x	Yes	29/04/2003	Completed
Aberdeen	O ₃	Yes	29/07/2003	Completed
Yarner Wood	NO _x	Yes	16/09/2003	Completed
Bush	NO _x	Yes	13/10/2003	Completed
High Muffles	NO _x	Yes	20/10/2003	Completed
Aston Hill	NO _x	Yes	21/10/2003	Completed
Glazebury	NO _x	Yes	26/1/2004	Completed Site power up-graded and commissioning audit undertaken on 26/1/04
Eskdalemuir	NO _x + PM ₁₀	No	To be arranged	Scheduled for end June 2004

In order to satisfy the requirements of DD3 there are also plans to commission 3 new direct-funded NO_x and O₃ sites and affiliate one Local Authority owned site at the following locations:

- Brighton Preston Park (Brighton/Worthing/Littlehampton agglomeration)
- Fort William (Highland zone)
- Leominster (Midlands zone).
- Sunderland Silkworth (North East zone) – Sunderland City Council

A summary of progress on the affiliation of these new sites is given in Table 2.2.

Brighton Preston Park is scheduled to commence at the end of June 2004. It is currently awaiting completion of the provision of utility services followed by installation of the equipment rack.

Lease agreement for the site at Fort William is almost finalised and progress with installation of the base and utility services will then proceed. CMCU are still waiting for the lease agreement for the site at Leominster.

In the North East zone a suitable alternative to the proposed Ashington site was identified and plans are now in progress to affiliate the NO_x analyser and install a new ozone instrument at Sunderland City Council's site at Silkworth sports complex. Adjustments need to be made to the new ozone analyser output in order to interface with the existing site logger. This should be completed by the end of June 2004.

Two additional sites have also recently been integrated into the network. A direct funded rural site at Market Harborough (East Midlands zone) measuring NO_x, O₃ and high sensitivity CO was integrated on 10th December 2003 and an affiliate site at London Harlington (Heathrow airport) measuring NO₂, O₃ CO and PM₁₀ starting on 1st January 2004.

Table 2.2 New DD3 Monitoring Stations, May 2004

New Site	Pollutants	Progress to date	Expected integration date
Brighton Preston Park	O ₃ and NO _x	Provision of utility services to be completed followed by equipment installation	End June 2004
Fort William	O ₃ and NO _x	Land lease nearly finalised. Installation of base and utilities to follow	Summer 2004
Leominster	O ₃ and NO _x	Land lease negotiations on-going. Application for planning permission to follow.	Summer 2004
Sunderland Silkworth	O ₃ and NO _x	Arrangements in hand to affiliate Local Authority NO _x analyser and install a new O ₃ analyser.	End June 2004

2.2 PM₁₀ Episodes

There were more exceedences of the 50 µg/m³ PM₁₀ daily standard in 2003 than has been seen for several years. Most monitoring sites recorded exceedences in August 2003 during the hot weather and associated photochemical pollution and in some cases this continued well into September. The London Marylebone Road site recorded far more exceedences than anywhere else across the UK.

The following sites exceeded the Air Quality Objective of 35 days > 50µg/m³, to be achieved by 31/12/2004 based on the final ratified 2003 monitoring results:

161 days - London Marylebone Road (Kerbside)

95 days - Scunthorpe (Industrial)

54 days - Bury Roadside (Roadside)

53 days - Cardiff Centre (Construction)
47 days - Camden Roadside (Kerbside)
47 days - Glasgow Kerbside (Kerbside)
46 days - Stockton-on-Tees Yarm (Industry)
43 days - Port Talbot (Industry)
42 days - London A3 Roadside ((Roadside)
38 days - Thurrock (Construction/Local source)
37 days - Bristol Centre (Urban Centre)

The sites that recorded the highest number of days with exceedences of $50\mu\text{g}/\text{m}^3$ from January to the end of April 2004 are as follows:

26 days - London Marylebone Road (Kerbside)
18 days - Camden Roadside (Kerbside)
16 days - Glasgow Kerbside (Kerbside)
14 days - Port Talbot (Industry)
12 days - Bury Roadside (Roadside)
7 days - London A3 Roadside ((Roadside)
7 days - Stockton-on-Tees Yarm (Industry)

Further information on the extent and duration of the episodes and monthly PM_{10} exceedence statistics are presented on the Air Quality Archive and AURN hub at <http://www.aeat.co.uk/com/AURNHUB/aunhubPUBLIC-399.htm>.

2.3 Data Capture for Critical Sites in Zones and Agglomerations

In order to meet the requirements of the Daughter Directives, any zone or agglomeration² with an exceedence of the limit value must be formally reported to the Commission. The critical sites are those which, if data capture falls below 90%, there will be insufficient data for the whole zone or agglomeration. In most cases the critical sites are those where there is only one site in the zone or agglomeration. However, for some pollutants (especially ozone) monitoring is required at several sites in each zone or agglomeration and hence these may all need to be classified as critical sites for that pollutant. The list of the critical sites in the Network has been revised to reflect the requirements of the First, Second and Third Daughter Directives (see Appendix A2). In total 61 sites have been identified as critical for DD1, DD2 or DD3. (25 sites in agglomerations and 36 in zones).

Critical sites with less than 90% data capture during the 12-month period January to December 2003 are given in Table 2.3. Note in this table that data capture is calculated from 1st January rather than from the official site start date. As the new DD3 NO_x and O_3 analysers were installed shortly before the Directive came into force in September, there is no data for the first 8 months of the year. Other reasons for data loss at these sites are given in Section 4. In total 81 out of the 189 critical site analysers (43%) did not meet the required 90% data capture during 2003.

² A definition of zones and agglomerations can be found under "Article 5 Assessment Zones and Agglomerations Monitoring Maps" at <http://www.defra.gov.uk/environment/airquality/index.htm>

Table 2.3 Data Capture at Critical Sites in Agglomerations and Zones, January - December 2003
(Data capture calculated from 1st January to 31st December 2003)

Site	CO	NO ₂	O ₃	PM ₁₀	SO ₂	Comments
Critical Sites in Agglomerations						
Belfast Centre	79.3	✓	✓			
Blackpool	✓	✓	✓	✓	54.9	SO ₂ high noise response
Bournemouth	✓	✓	83.5	✓	✓	O ₃ started 27/2/03
Brighton Roadside PM ₁₀			-	75.1	-	Gravimetric PM ₁₀ started 28/2/03
Bristol Centre		87.5	✓	✓	✓	
Cardiff Centre	88	87.5	87.1	89.6	88.9	Site switched off – air conditioning problems
Coventry Memorial Park	85.4	87.4	89.9	81.6	86.9	
Edinburgh Centre	33.8	45.8	45.7	44.1	44.1	Closed for relocation
Edinburgh St Leonards	10.4	10.4	10.4	3.4	10.4	New site started 24/11/03
Glasgow Centre		42.6	✓		81	NO _x converter fault
Hove Roadside			-	-	✓	
Hull Freetown	84.4	✓	✓	88.7	✓	Empty CO cylinder
Leicester Centre	80.3	✓	✓	88.8	✓	
Liverpool Speke	56.8	56.9	56.9	56.9	51	Site started 21 st May 2003
Newcastle Centre	76.4	✓	89.9	✓	✓	
Nottingham Centre	✓	78.7	✓	91	✓	
Portsmouth	✓	✓	67.2	✓	81.9	O ₃ started 15/4/03
Preston	✓	✓	✓	✓	✓	
Reading Centre	9.3	9.2	9.3	9.2	9.3	Closed on 6/2/03 for relocation. Reading New Town started 17/10/03
Reading New Town	20.5	20.4	19.1	20.4	13.7	New site started 17/10/03
Sheffield Centre				✓		
Southampton Centre	73.6	✓	✓	88.6	✓	
Southend-on-Sea	86.5	82.6	86.6	83.5	81.6	Temperature/power faults
Stoke-on-Trent Centre	✓	✓	✓	✓	✓	
Swansea	✓					
Wirral Tranmere	✓	✓	✓	✓	✓	
Critical Sites in Zones						
Aberdeen	✓	88.4	39.8	✓	✓	O ₃ started 1/8/03
Aston Hill	-	18.7	✓	-	-	NO ₂ started 21/10/03
Barnsley Gawber	✓	✓	✓	-		
Bush Estate	-	22.1	✓	-	-	NO ₂ started 9/10/03
Canterbury	-		-	✓	-	
Cwmbran	✓	87.7	66.7	✓	✓	O ₃ started 29/4/03
Derry	✓	✓	✓	✓	✓	
Dumfries	✓	✓	-	✓	-	
Eskdalemuir	-	-	✓	-	-	
Glazebury	-	-	88.7	-	-	
Grangemouth	52.7	✓	-	✓	✓	CO started 17/1/03
Great Dun Fell	-	-	✓	-	-	
High Muffles	-	18.5	✓	-	-	NO ₂ started 20/10/03
Inverness		✓	-	✓	-	

Site	CO	NO ₂	O ₃	PM ₁₀	SO ₂	Comments
Ladybower	-	✓	✓	-		Site no longer critical after Market Harborough affiliated
Leamington Spa	✓	66.5	✓	85.8	81.7	
Lough Navar	-	-	63.7		-	
Narberth	-		88.6			
Northampton	✓	✓	77.5	✓	✓	O ₃ started 13/3/03
Norwich Centre		✓	✓			
Oxford Centre	✓		-	-	✓	
Plymouth Centre				✓		
Scunthorpe	-	-	-	✓		
Sibton	-	-	✓	-	-	
Somerton	-	40.4	✓	-	-	NO _x installed 29/4 but rejected until 31 July 2003
Stockton-on-Tees Yarm	✓	88.9	-	✓	-	
Strath Vaich	-	-	86.6	-	-	
Sunderland	-	-	-	-	✓	
Thurrock		✓	✓			
Wicken Fen	-	59.8	✓	-		
Wigan Leigh	✓	✓	✓	✓	86.5	
Wrexham	✓	✓	-	86.6	✓	
Yarner Wood	-	29.4	✓	-	-	NO ₂ started 15/9/03
Number of Sites < 90%	14	21	18	15	13	

Key Pollutant not critical at this site
 ✓ Data capture for critical pollutant >90%
 - Not monitored

Note that critical sites where monitoring has not yet commenced are not included in the above table.

RECOMMENDATION

Every effort should be made to ensure that data capture is maximised for the critical sites. LSOs and ESUs should undertake call-outs and repairs as soon as possible to avoid unnecessary data loss at these sites.

2.4 Gravimetric PM₁₀ Data Ratification

Gravimetric PM₁₀ analysers (Partisols) are located at seven sites in the network (Bournemouth, Northampton, Wrexham, Dumfries, Inverness, London Westminster and Brighton Roadside PM₁₀). PM₁₀ monitoring commenced at London Westminster on 19th February 2003 and at Brighton Roadside PM₁₀ on 28th February 2003.

The gravimetric PM₁₀ analyser at Northampton is also co-located with a TEOM analyser which provides a useful check that both techniques are operating correctly. Gravimetric PM₁₀ concentrations and the daily mean TEOM scaled by 1.3 at Northampton are shown in Figure 2.1. The Partisol has always shown good agreement with the TEOM and continues to do so, although there were significant differences in the peak values during the high pollution episodes in February and March 2003. Unfortunately, due to operational problems the gravimetric PM₁₀ data capture was very low at Northampton over the summer period. This analyser was subsequently replaced in September 2003 and data capture during October to December 2003 has improved (79%) but is still below the 90%

target level. Since January 2004 the Partisol unit has been connected to remote telemetry which should enable operational problems to be identified more quickly.

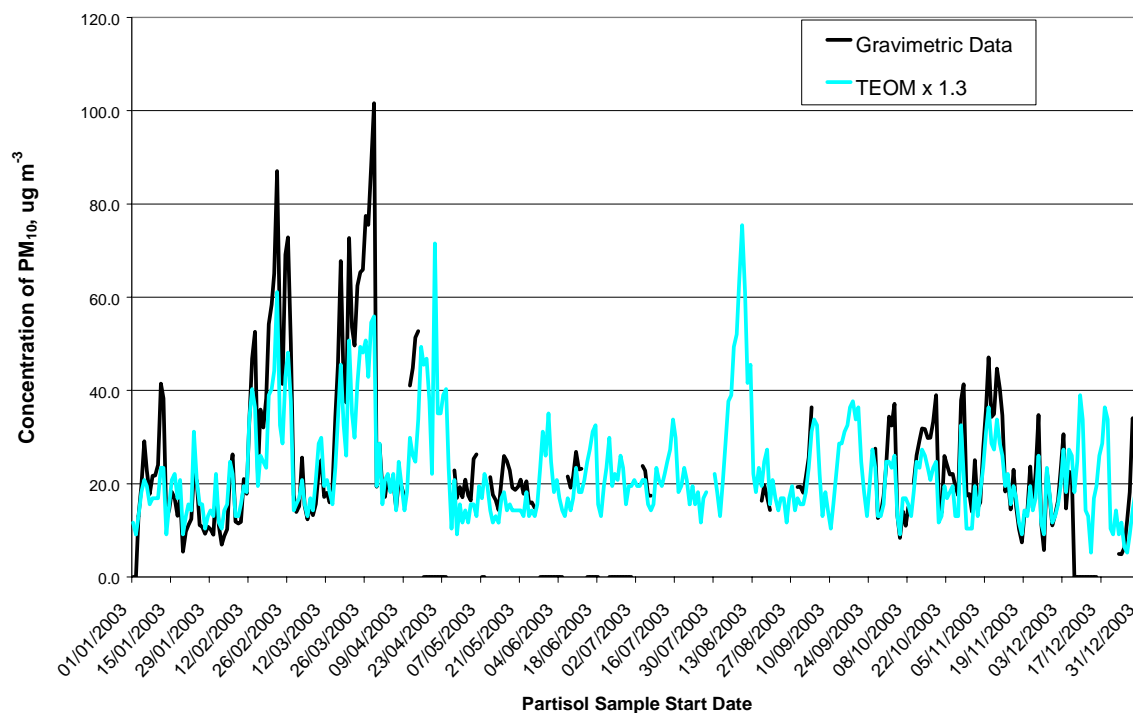


Figure 2.1 Partisol and TEOM (x1.3) Concentrations at Northampton (Jan-Dec 2003)

Data capture for the gravimetric PM₁₀ (Partisol) analysers for this period (October - December) and for the complete year is given in Table 2.4. Five out of the seven operational gravimetric PM₁₀ analysers met the required 90% data capture target for this reporting period. The average data capture for the gravimetric PM₁₀ analysers during 2003 was 84.6%. Details of data loss associated with each site are given in Section 4.1.

Table 2.4 Gravimetric PM₁₀ Data Capture (%) in 2003
(Calculated from site start date)

Site	Data Capture (%) Q4 Oct - Dec 2003	Annual Data Capture (%) 2003
Bournemouth	92.4	93.4
Brighton Roadside PM ₁₀	81.5	89.3
London Westminster	92.4	74.4
Northampton	79.3	61.9
Dumfries	97.8	93.4
Inverness	100	93.4
Wrexham	91.3	86.6
Average	90.7	84.6

Progress continues towards the installation of remote dial up facilities at all Partisol sites. Three sites are now connected to telemetry (Brighton Roadside, Northampton and Wrexham) and installation at Dumfries, Inverness and London Westminster is imminent. The Bournemouth site needs to be connected via a separate mobile phone unit as the existing site line is not compatible with the Partisol software. In the meantime the LSO downloads the data from the Partisol onto a laptop computer and e-mails the data to CMCU.

2.5 NO₂ Converter Efficiencies

Provisional results of the Winter 2004 intercalibration exercise identified 15 NO_x converter failures. This is a relatively high number compared to the previous summer audit where only 7 faulty converters were identified. However, of the 15 outliers 10 were considered to be borderline cases and there was no significant impact on data quality or capture. Details of these converter faults and the resulting effect on data quality are given in Table 2.5 below.

Table 2.5 Converter faults identified at the Winter 2004 Intercalibration Exercise

Site	Date Tested	Converter Efficiency (%)	Effect on data quality
Blackpool	26/2/04	89.6	1-minute calibration data reviewed and a drop in calibration sensitivity was seen in late February. 2 weeks data to be deleted from 26/2/04 until service on 9/3/04 when the converter was replaced
Dumfries	3 /2/04	94.6	Borderline – no data loss
Edinburgh St Leonards	9/2/04	93.1	Borderline - converter satisfactory at site commissioning audit in November. No data loss in 2003.
London Bromley	25/2/04	93.7	Borderline – no data loss
London Marylebone Road	13/2/04	94.5	Borderline – no data loss
London Westminster	10/2/04	83.1	Poor quality data deleted from 25 th November 2003 until service on 13 Feb 2004 when the converter was replaced (2.5 months)
Manchester Piccadilly	27/1/04	93.8	Borderline – no data loss
Manchester South	12/2/04	92.8	Borderline – no data loss
Nottingham Centre	13/1/04	90.8	Calibrations span falling from October onwards. Data deleted from 22 October until service on 16 January 2004 when the converter was replaced. (3 months)
Redcar	17/2/04	94.7	Borderline – no data loss
Rotherham	1/4/04	93.3	Borderline – no data loss
Sheffield Centre	12/3/04	93.1	Borderline – no data loss
Southwark Roadside	17/3/04	89	2003 data appear unaffected and converter okay (97%) at service in November. There may be possible rejection of data in 2004.
Tower Hamlets	2/4/04	93.9	Borderline – no data loss
Wirral Tranmere	24/2/04	92.1	Data to be deleted from 24/2/04 until ESU call-out on in 3 rd March 2004 (1 week).

It is likely that the pass requirements for NO_x converters will become tighter in future, as a result of proposed European CEN standards. It is suggested that a NO_x converter must be 98% efficient at concentrations of 600 ppb NO_x and 250 ppb NO₂, which may have significant implications for future data capture. As a result of this proposal, QA/QC Unit

undertook converter tests at these concentrations during the winter 2004 intercalibration exercise.

RECOMMENDATION

The ESUs have already replaced or repaired the converters at all of the above sites during the winter 2004 service exercise. ESUs should ensure the converters are performing satisfactorily at the summer 2004 service.

LSOs should continue to pay careful attention to the short-term stability of the NO₂ calibration response and notify the CMCU if a declining NO₂ span response is recorded during the calibration. Full details of this check can be found in the "Trouble-shooting" section of the Site Operator's Manual.

(<http://www.aeat.co.uk/netcen/airqual/reports/lsoman/lsoman.html>)

2.6 Ozone Outliers

22 out of 85 ozone analysers (26%) were identified as outliers during QA/QC Unit's winter 2004 intercalibration exercise (see Table 2.6). Where appropriate, the data from these sites have been rescaled accordingly during the ratification process.

Table 2.6 Ozone Outliers Identified at the Winter 2004 Intercalibration Exercise

Site	Test Date	Winter 2004
Barnsley Gawber	18/3/04	-25.1%
Birmingham East	30/3/04	+7.7%
Bolton	6/2/04	+31.7%
Coventry Memorial Park	9/1/04	-21%
Derry	10/3/04	-20.1%
Edinburgh St Leonards	9/2/04	-7.5%
Glazebury	26/1/04	-7.7
Harwell	8/1/04	-14.1%
Leamington Spa	30/3/04	+6.8%
Leeds Centre	10/3/04	-7.3%
London N Kensington	19/1/04	+5.9%
London Teddington	1/3/04	-8%
Lullington Heath	5/3/04	+6.2%
Manchester Piccadilly	27/1/04	+6.5%
Reading New Town	4/2/04	-31.8%
Redcar	17/2/04	+10.6%
Rochester	8/3/04	-18.9%
Southend-on-Sea	25/3/04	-10.2%
St Osyth	22/1/04	-8.4%
Stoke-on-Trent	1/2/04	-20.8%
Cwmbran	19/3/04	+5.7%
Lough Navar	11/3/03	+9.4%

2.7 TEOM k₀

Only 1 out of the 67 TEOM instruments tested during the Winter 2004 intercalibration was found to be operating with a calibration constant (k₀) outside the acceptable $\pm 2.5\%$

deviation. This was at Sheffield Centre where the k_0 deviation was -3.1% . In addition, 12 TEOMs were found to be operating outside of the expected flow rates. Full details of the outliers will be provided in the next intercalibration report to be published in July 2004.

In order to meet CEN requirements, changes to network operation of the TEOMs may be required in the future. It is likely that all network TEOMs will need to be standardised with respect to flow rates, ambient temperature and pressure and correction factors. However, at the moment there are no plans to make any changes in the network until the outcome of the PM_{10} equivalency testing programme has been finalised and a strategic decision about future operation of the AURN TEOMs has been made by Defra and the DAs. The PM_{10} equivalency testing programme is being undertaken in 2004 by Casella Stanger on behalf of Defra and the DAs.

RECOMMENDATION

CMCUs, ESUs and AURN site operators are instructed NOT to make changes to TEOM settings or operation until results of the PM_{10} equivalency testing programme have been completed.

2.8 Auto-Calibration Run-ons

A problem has been seen in some data sets when auto-calibration gas remains in the sampling system after the autocalibration cycle has finished (autocalibration run-on). As a result of this the ambient measurements usually between 0130 and 0200 are invalid and must be removed during data ratification. This problem can occur if the solenoid valves in the pneumatic system do not close fully after the zero and span cycle. Calibration gas may then leak into the instrument during the ambient measurement period. This problem can be a serious source of data loss resulting in one hour out of twenty-four being lost, which is 4% of the annual data capture.

The ESUs have investigated this problem at many of the sites and thorough cleaning of the solenoid valves has, in most cases, resolved the problem. Other measures have also been tried such as installing perma pure dryers. Autocalibration run-ons were seen at 25 sites during this period, resulting in a loss of an additional hour of data each day (4% data loss). (See Table 2.7)

Table 2.7 Estimate of Spike or Dip due to Auto-calibration Run-on (Hourly average)

Site	Pollutant	Effect on hourly mean	Data lost
Aston Hill	NO ₂	3 ppb	1 hour
Belfast Centre	NO ₂	7 ppb	1 hour
Bournemouth	NO ₂	3 ppb	1 hour
Bristol Centre	NO ₂	8 ppb	1 hour
Bury Roadside	NO ₂	9 ppb	1 hour Nov to Dec
Exeter Roadside	NO ₂	7 ppb	1 hour
Harwell	NO ₂	2 ppb	1 hour Nov - Dec
High Muffles	NO ₂	7 ppb	2 hours Nov - Dec
Leamington Spa	NO ₂	8 ppb	1 hour
London A3 Roadside	NO ₂	7 ppb	1 hour
London Bexley	NO ₂	4 ppb	1 hour
London Brent	NO ₂	5 ppb	1 hour

Lullington Heath	NO ₂	3 ppb	1 hour
Middlesbrough	NO ₂	4 ppb	1 hour
Narberth	NO ₂	2 ppb	1 hour
Plymouth Centre	NO ₂	2 ppb	1 hour
Preston	NO ₂	4ppb	1 hour
Somerton	NO ₂	3 ppb	1 hour
St Osyth	NO ₂	4 ppb	1 hour
Stoke-on-Trent	NO ₂	4 ppb	1 hour
Wicken Fen	NO ₂	4 ppb	1 hour Oct-Nov
Narberth	SO ₂	1.1 ppb	1 hour
Reading New Town	SO ₂	3 ppb	1 hour
Rotherham	SO ₂	1 ppb (zero run-on)	1 hour Dec only
Wigan Leigh	SO ₂	1 ppb	1 hour

RECOMMENDATION

The CMCU and ESUs should continue to monitor the situation and initiate service visits to clean/repair solenoid valves were necessary.

We suggest that, where possible, the autocalibration span concentration is lowered to approximately 100ppb. This may help to reduce the magnitude of the over-run, especially at the rural sites where small run-ons are very visible in the ambient data.

2.9 PM_{2.5} Data Checking

TEOM PM_{2.5} data collected at Harwell, London Bloomsbury, London Marylebone Road and Rochester are now being sent to the European Commission as part of the UK submission of air quality data in the annual EC Air Quality questionnaire. It has therefore become appropriate for these data to be incorporated into the AURN QA/QC programme. A backlog of data covering 6 years from April 1998 until September 2003 has been checked and "cleaned up" by QA/QC Unit. In addition PM₁₀ data from Harwell have also been included. There were no intercalibration checks and very little calibration/service information available for the historic data and hence they are not considered as fully ratified and remain provisional on the archive. However, from October 2003 these 5 additional analysers have been incorporated into the normal network QA/QC ratification and intercalibration schedules and the fully ratified data reported on the archive.

2.10 Use of Site Cylinders for Automatic Daily Span Checks

As some sites the analysers are configured to perform daily automatic span checks using gas from the certified site calibration cylinders and this has increased the cylinder usage considerably. In order to strike a balance between conserving costly calibration gas and maximising data capture/quality, it is recommended that overnight autocalibrations need only take place once every three days at these sites as the instruments are generally stable enough to allow this.

2.11 Long Term Data Ratification Checks

QA/QC Unit has introduced some improvements and additions to the current data ratification procedures in order to help identify any longer term data problems. Often it is

only possible to see changes in pollutant patterns or analyser response in the context of one or more years worth of data. These additional checks include:

- Site specific emission based projection plots of annual average concentrations of NO_x, NO₂, CO and PM₁₀. These plots can be used to identify, for further investigation, any sites where the concentrations appear to be falling outside of the “expected” range. (See for example Section 3.3).
- The use of NO_x/NO₂ ratio plots to identify changes in site characteristics or possible instrument faults.
- Additional information from the air quality forecasting team acquired as part of their investigation of episodes which can usefully be fed back into the data ratification process. Examples of this include specific site information which CMCU may obtain from an LSO to explain unusual local concentrations and information on sites with unusually high concentrations during episodes which could be usefully investigated as part of both the ratification and/or the site audit procedures.

These additional long term analyses of the data are now examined for all sites in the network as part of the routine data ratification and quality circle process. Further information on site specific emissions based projections can be found in the following report “Baseline PM₁₀ and NO_x projections for PM₁₀ objective analysis” at <http://www.airquality.co.uk/archive/laqm/tools.php?tool=year>

3 Site Specific Issues

3.1 Belfast Centre, Liverpool and Newcastle CO

New Monitor Labs CO analysers were installed at five sites as part of the equipment replacement programme during the summer 2003. Initially there was some concern over the apparent “suppressed” ambient CO levels recorded at three of the sites, Belfast Centre (up-graded 1st May), Newcastle Centre (up-graded 25th April) and Liverpool Speke (up-graded 16th April). Site investigations were carried out by the ESU however, no obvious reason for the suppressed response was found.

QA/QC Unit installed a parallel CO monitor at Liverpool Centre on 21st November 2003 in order to assess the magnitude of the problem. Preliminary analysis of the data from both analysers indicated a difference of 0.2 to 0.3 ppm during low concentration periods, with the ML analyser recording more frequent periods of flat baseline response. This indicated a possible baseline truncation problem. At higher concentrations both analysers agreed reasonably well. The ESU reconfigured the ML CO analyser on 29th December 2003, when the analogue output was changed from 1V to 10V full scale and a 10% zero offset applied. Further analysis following this adjustment showed acceptable agreement between the parallel monitors. The period of parallel monitoring was, however, undertaken in the winter time when ambient CO levels were generally higher and it is possible that any baseline clipping would not been seen so well.

On the basis of this comparison, there was no evidence to suggest that the measurements made by the new ML analysers were erroneous and therefore all CO data previously kept as provisional have now been fully ratified. It is likely that the seemingly “suppressed” measurements were due to a combination of the old analysers being excessively noisy prior to replacement (hence needing to be replaced) and, that fact that the change took place during the summer when ambient levels were very low.

Similar ML CO analysers were installed as part of the equipment up-grade programme at Hull Freetown (up-graded 23 July) and Southampton (up-graded 22 August) but no obvious suppressed response characteristics were noted at these sites. There were, however, some initial operational problems with the new CO analyser at Southampton resulting in 2 months data rejection from when the new analyser was installed on 22nd August until it was repaired on 13th November 2003.

3.2 Zero Response Truncation

There were a few sites where significant periods of data were lost due to zero truncation (or baseline clipping). This occurs when the analyser response drifts downwards until it falls below the minimum response threshold resulting in extended periods of Oppb (or Oppm) response. This problem can occur if the analyser is not configured to output negative voltages, or if the logger cannot record a response below a certain voltage threshold. Cases of zero response truncation resulting in data loss during this reporting period were seen at the following sites:

- Wicken Fen NO_x December 2003 – March 2004 (3 months)
- Leicester Centre CO mid October- early December (8 weeks)
- Grangemouth CO October – December (3 months)

Recommendation

To reduce the risk of possible baseline truncation we recommend that, wherever possible, all analysers are routinely set up after the service to have elevated zero baseline offsets of 20-50mV. Special attention should be given to the zero baseline levels at the sites mentioned above in order to ensure they do not drift downwards over time and fall below the minimum voltage threshold of the analyser.

3.3 Stoke on Trent PM₁₀

Examination of the Stoke-on-Trent PM₁₀ data during ratification showed that levels appeared to be lower from July 2003 compared with other nearby sites at Wolverhampton and Nottingham. Although this is not very obvious from the time series plot (see Figure 3.1), a new data analysis technique now being used by QA/QC Unit to help identify long-term data anomalies, showed the problem more clearly. In this case the measured PM₁₀ concentrations showed a large deviation from the annual mean projection of PM₁₀ based on emission projections (see Figure 3.2). The drop in concentration levels corresponded with a service visit in July 2003. The QA/QC audit in February 2004 also identified a major leak with the TEOM main flow being 30% lower than expected. Seven months data have therefore been deleted from July until the repair at the service in February 2004.

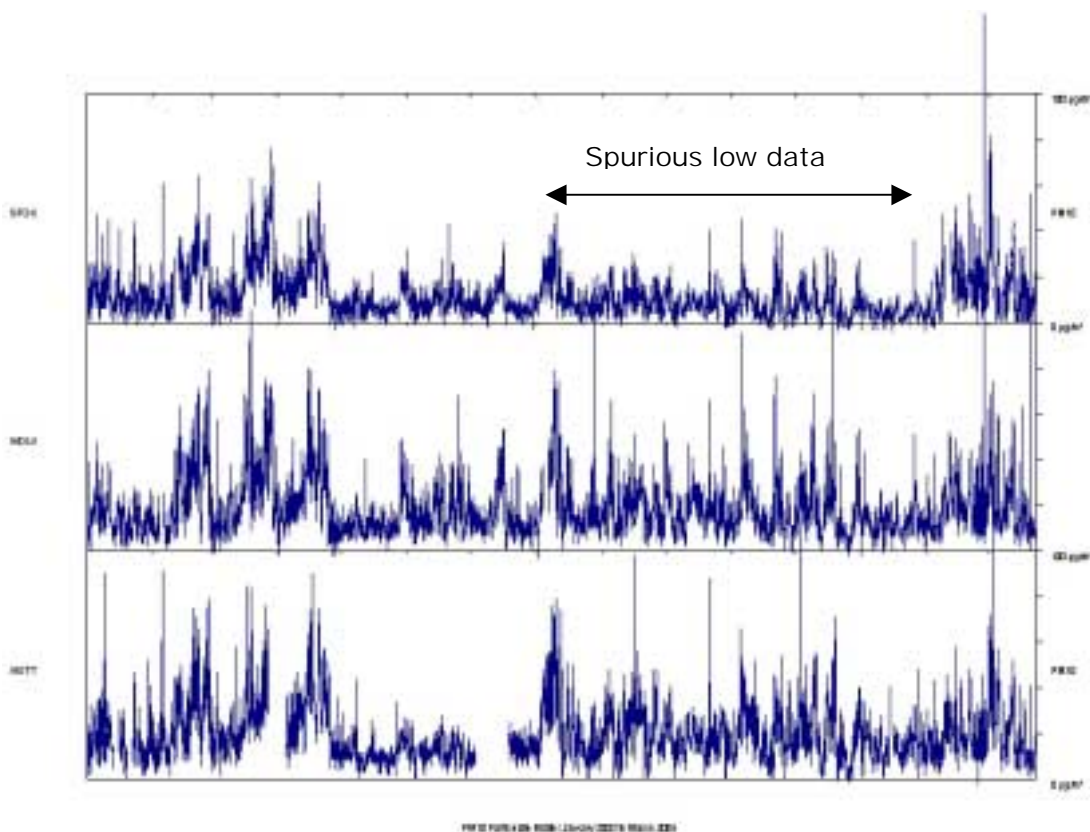


Figure 3.1 Stoke-on-Trent PM₁₀ compared to nearby sites, January-March 2003

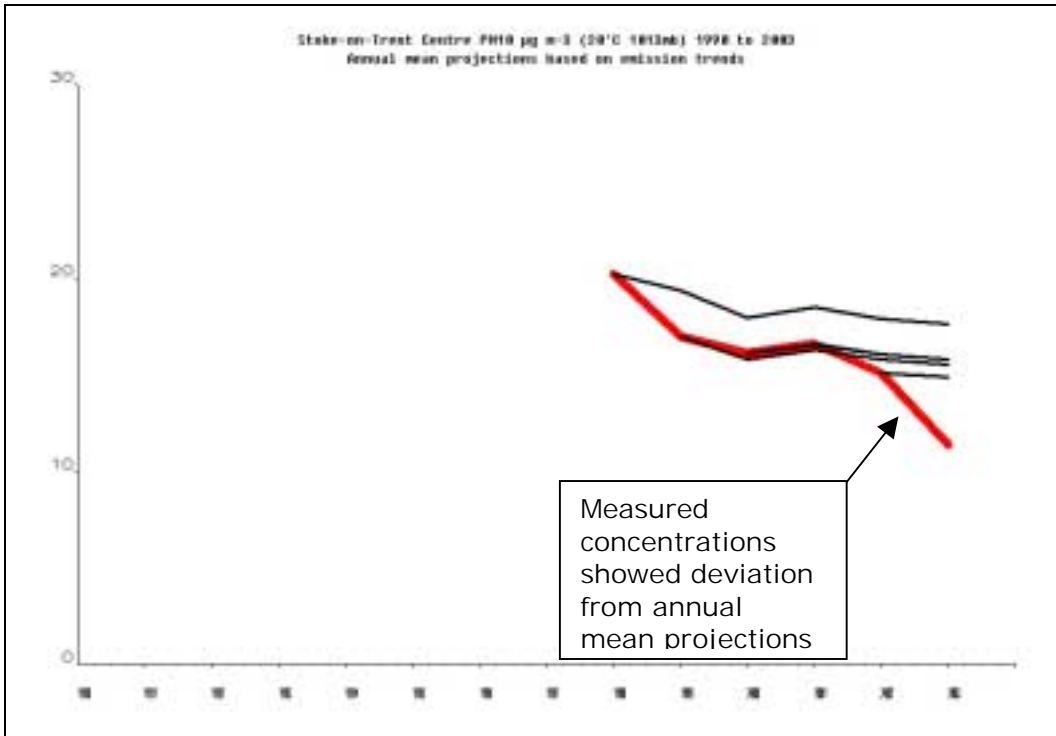


Figure 3.2 Stoke-on-Trent Annual Mean PM₁₀ projections 1998-2003

3.4 Blackpool SO₂

Following the service in August 2003 the SO₂ analyser at Blackpool has shown unacceptable levels of high noise response (+/-7ppb). It was also not possible to accurately scale the data due to high zero calibration response above the minimum ambient levels recorded. Consequently 7 months data from 11 August 2003 until the following service in March 2004 have been deleted (See Figure 3.3).

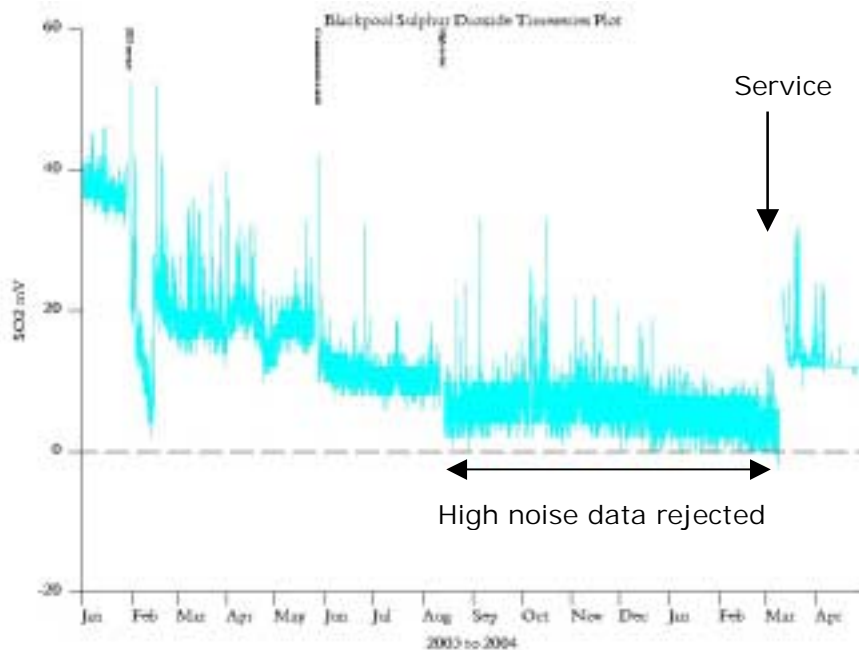


Figure 3.3 Blackpool SO₂ high noise response August 2003 – March 2004

3.5 Narberth PM₁₀ and SO₂

The Ambirack SO₂ analyser at Narberth has shown a prolonged history of response noise and instability (see Figure 3.4). The site has also suffered from frequent power cuts due to water getting into the site's power supply unit housing. The Local authority agreed to fund an equipment and site infrastructure up-grade and the mains power supply problem was resolved on 20th February 2004 by replacement of the connection box attached to the site mobile trailer. A temporary Ambirack unit was installed at the site on 3rd September 2003 to enable continuation of the monitoring whilst the original unit was being up-graded. Even with the temporary Ambirack in place the SO₂ response was still unstable and over 10 months data have therefore been deleted from January until the up-graded Ambirack unit was re-instated at the service on 20th November.

Unfortunately the interface between the TEOM and the temporary Ambirack was not configured correctly resulting in a spuriously low PM₁₀ baseline from September 2003. When the up-graded Ambirack was re-instated on 20th November the PM₁₀ measurements continued to remain low until the Ambirack was re-configured by the ESU on March 24th 2004. There was insufficient information to rescale the data during ratification, therefore 6.5 months of PM₁₀ data from 3rd September until 24th March have also been deleted.

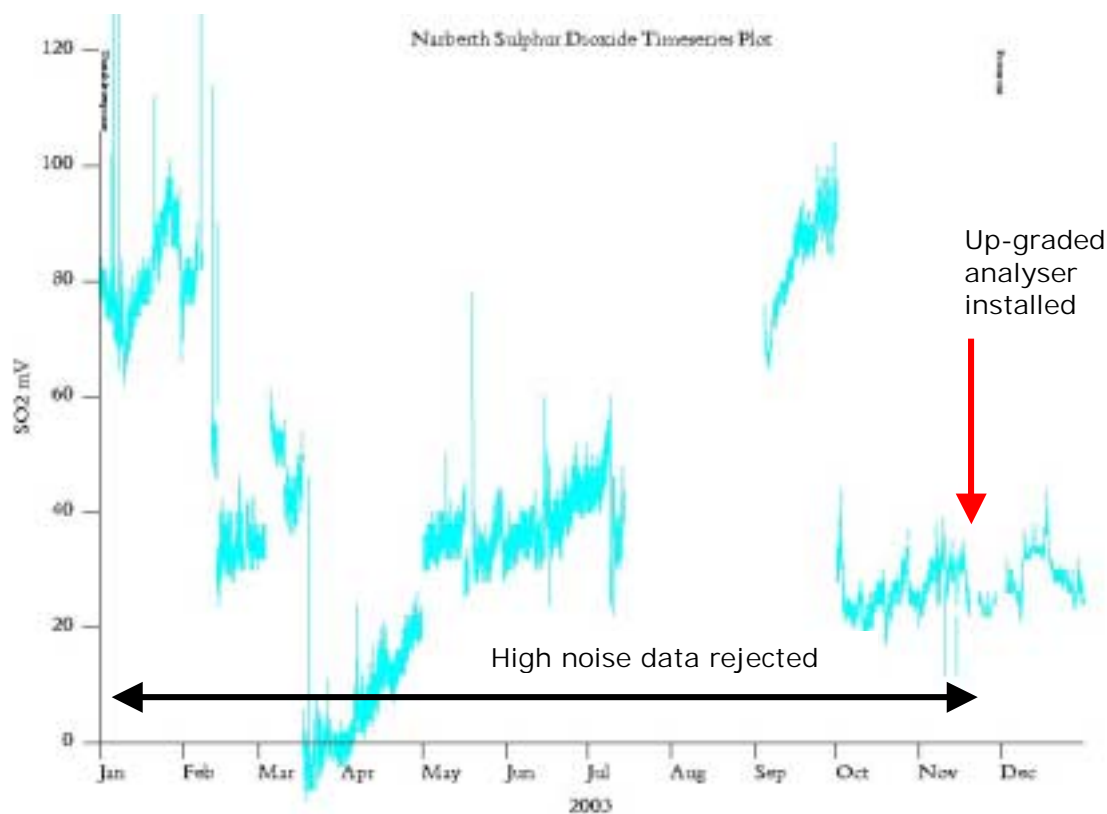


Figure 3.4 Narberth SO₂ high noise data, January-November 2003

4 Sites with Data Capture Below 90%

The following section provides a summary of the main site operational problems which have resulted in data capture below the required 90% level during the reporting period October to December 2003 (Table 4.1). The number of days and hours of data lost for each site is also given. In some cases the data gap extends beyond this three-month reporting period.

Table 4.1 Sites with data capture below 90% October to December 2003
(Using the start date of any new site or end date of site closed)

Data Capture (%)	Start date	End date	Reason	Comments	Days	Hours	
ENGLAND							
Bath Roadside							
CO	87.8%	02-Oct-03	13-Oct-03	Instrument fault	IR lamp fault.	11.0	264
Blackpool							
SO ₂	0.0%	11-Aug-03	14-Mar-04	High noise	High noise data rejected during ratification (See Section 3.4)	217.0	5198
Bradford Centre							
CO	68.6%	27-Aug-03	29-Oct-03	High noise response	2 months high noise data rejected. CO pump replaced and optical balance reset.	63.4	1522
Bristol Centre							
CO	87.7%	23-Oct-03	28-Oct-03	Unstable response	Drift in baseline response of new analyser due to IR source fault. Replacement box installed.	5.5	132
		28-Nov-03	01-Dec-03	Power cut	Missing data following power cut.	2.9	69
		26-Dec-03	28-Dec-03	Instrument fault	Spurious data deleted. Original analyser reinstalled after repair.	2.5	59
Bristol Old Market							
NO ₂	69.6%	17-Sep-03	28-Oct-03	Analyser removed	Analyser removed for repair. Repair delayed due to shipment of component from USA.	41.6	998
Camden Kerbside							
NO ₂	86.5%	16-Oct-03	28-Oct-03	Unstable response	Rapid sensitivity change and analyser over-heating	12.2	292
Coventry Memorial Park							
General		08-Dec-03	31-Dec-03	Switched out-of-service	Old analysers switched off and new Horiba instruments installed on 30 th Dec. No mV data until commissioning audit on 9 th January 2004.	23.6	566
CO	72.0%	25-Oct-03	26-Oct-03	No mV data	No mV data collected. No reason given.	1.8	43
		08-Dec-03	31-Dec-03	Switched out-of-service	Old analyser decommissioned and new instruments installed. No mV data until January.	23.6	566
NO ₂	72.0%	25-Oct-03	26-Oct-03	No mV data	No mV data collected. No reason given.	1.8	43

Data Capture (%)		Start date	End date	Reason	Comments	Days	Hours
		08-Dec-03	31-Dec-03	Switched out-of-service	New analyser installed	23.6	566
O ₃	72.1%	25-Oct-03	26-Oct-03	No mV data	No mV data collected. No reason given.	1.8	43
		08-Dec-03	31-Dec-03	Switched out-of-service	New analyser installed	23.6	566
PM ₁₀	72.0%	25-Oct-03	26-Oct-03	No mV data	No mV data collected. No reason given.	1.8	43
		08-Dec-03	31-Dec-04	Switched out-of-service	Analyser switched off (TEOM not up-graded).	23.6	566
SO ₂	72.0%	25-Oct-03	26-Oct-03	No mV data	No mV data collected. No reason given.	1.8	43
		08-Dec-03	31-Dec-03	Switched out-of-service	New analyser installed	23.6	566
Haringey Roadside							
NO ₂	77.4%	25-Oct-03	04-Nov-03	Instrument fault	Photomultiplier tube fault. Loan analyser installed	10.1	242
		10-Nov-03	11-Nov-03	Instrument fault	Chopper motor fault. Original site analyser reinstalled	1.4	33
		16-Dec-03	17-Dec-03	Air conditioning	Erratic hut temperatures due to air conditioning fault effecting analyser response.	0.6	14
		23-Dec-03	31-Dec-03	Sampling fault	Sample pressure fault caused by a kink in tubing	8.2	197
Harwell							
NO ₂	84.8%	23-Oct-03	03-Nov-03	Air conditioning	Air conditioning problems causing fluctuating rack temperatures and NO ₂ analyser response instability.	11.1	267
Leamington Spa							
NO ₂	86.2%	11-Aug-03	09-Oct-03	Unstable response	As seen in the previous period, data rejected due to excessive changes in calibration response sensitivity ($\pm 25\%$).	59.4	1425
		12-Nov-03	12-Nov-03	ESU call-out	Engineer replaced pump and board	0.3	6
Leicester Centre							
CO	36.4%	14-Oct-03	10-Dec-03	Baseline truncated	Baseline drifting downward resulting in truncated zero response. New CO analyser installed on 10 th December and offset applied.	57.7	1384
NO ₂	85.2%	06-Nov-03	18-Nov-03	Instrument fault	Chopper belt broken	12.4	298
London A3 Roadside							
NO ₂	89.4%	12-Dec-03	17-Dec-03	Logger fault	New PC installed.	5.3	127
London Bexley							
CO	89.1%	02-Oct-03	09-Oct-03	Instrument fault	Baseline drift and leak found on drier canister.	7.5	180
		20-Oct-03	21-Oct-03	Unstable response	Sudden step change in zero baseline.	1.0	24
		07-Nov-03	08-Nov-03	Communication fault	Communications disrupted when car park was being dug up.	1.2	29
NO ₂	76.4%	06-Nov-03	24-Nov-03	Unstable response	Rapid change in response sensitivity (20% per week) caused by pump fault.	18.1	435
SO ₂	85.9%	09-Oct-03	20-Oct-03	Instrument fault	Noisy response and unstable baseline. Removed for repair.	11.4	273

Data Capture (%)	Start date	End date	Reason	Comments	Days	Hours	
	07-Nov-03	08-Nov-03	Communications fault	Communications disrupted when car park was being dug up.	1.2	29	
London Bloomsbury							
CO	87.7%	07-Dec-03	18-Dec-03	Pump fault	Sample flow and pump fault. Pump replaced.	10.8	258
O ₃	44.3%	21-Oct-03	11-Dec-03	Sampling fault	Internal sampling leak with analyser drawing in ozone from NO _x analyser exhaust.	51.0	1225
London Brent							
NO ₂	89.4%	08-Oct-03	09-Oct-03	Operator error	Analyser left in span mode after routine calibration	1.1	27
		11-Nov-03	15-Nov-03	Communication fault	Communications fault	4.5	109
London Bromley							
CO	63.0%	09-Oct-03	10-Oct-03	Power cut	Power cut	1.0	24
		19-Oct-03	13-Nov-03	Logger fault	Found fault with logger/analyser connection. Repairs made but noisy response. Analyser replaced.	24.4	585
		23-Dec-03	31-Dec-03	Sampling fault	Pump fault	8.5	203
London Haringey							
O ₃	74.7%	13-Oct-03	05-Nov-03	Sampling fault	Sample Inlet filter causing flow restriction.	23.2	557
London Westminster							
NO ₂	48.0%	17-Oct-03	21-Oct-03	No mV data collected	Replacement NO _x analyser installed but faulty	3.6	87
		28-Oct-03	04-Nov-03	Instrument fault	Original site analyser re-installed but problems with autocalibration so removed again.	7.1	171
		25-Nov-03	13-Feb-04	Converter fault	Low NO _x converter efficiency at audit (83%). Data rejected to repair at service in Feb 04	80.3	1928
SO ₂	22.7%	10-Sep-03	11-Dec-03	Sampling fault	Blocked sample valve and UV lamp fault	92.0	2208
Market Harborough							
CO	89.2%	01-Jan-03	09-Dec-03	Switched out-of-service	Site commissioned on 10 th December 2003	343.0	8232
		29-Dec-03	31-Dec-03	No mV data	Missing data after routine calibration	2.1	50
NO ₂	88.6%	01-Jan-03	09-Dec-03	Switched out-of-service	Site started 10 th December 2003	343.0	8232
		29-Dec-03	31-Dec-03	No mV data	Missing data after routine calibration	2.5	60
Middlesbrough							
NO ₂	81.5%	30-Sep-03	14-Oct-03	Instrument fault	High voltage power supply fault	13.7	328
Newcastle Centre							
O ₃	84.1%	02-Oct-03	16-Oct-03	Instrument fault	Low analyser response due to possible software fault. Analyser reset.	14.3	344
Norwich Centre							
SO ₂	75.0%	26-Nov-03	18-Dec-03	Instrument fault	PC based operating system failed	22.4	538

Data Capture (%)	Start date	End date	Reason	Comments	Days	Hours
				26-28 November. New PC installed on 11 December. SO ₂ analyser software and other faults resulting in replacement of chopper motor and flow sensor		
Nottingham Centre						
NO ₂	23.3%	22-Oct-03	31-Dec-03	Converter fault	Data rejected due to low NO ₂ converter efficiency (90% at audit on 13/1/04). Converter replaced at service on 14/1/04	70.4 1690
Preston						
NO ₂	89.4%	13-Nov-03	18-Nov-03	Air Conditioning	Air conditioning unit frozen up so unit replaced.	5.5 132
O ₃	77.9%	20-Oct-03	04-Nov-03	Instrument fault	Erratic data rejected. Detector replaced.	15.5 371
		13-Nov-03	18-Nov-03	Air Conditioning	Air conditioning unit frozen	4.6 111
Reading New Town						
SO ₂	65.6%	01-Jan-03	16-Oct-03	Switched out-of-service	Site relocated from Reading Centre. New site commissioned on 17 October 2003.	289.0 6936
		13-Nov-03	13-Nov-03	No mV data	No mV data collected	0.4 9
		09-Dec-03	02-Jan-04	Instrument fault	Lamp fault causing rapid baseline drift. Pre amp board and photomultiplier tube high voltage reset.	24.5 589
Redcar						
CO	74.2%	20-Oct-03	21-Oct-03	Instrument fault	Intermittent response instability. Spurious high response data deleted.	0.6 15
		22-Oct-03	23-Oct-03	Instrument fault	Faulty analyser replaced	0.9 22
		20-Nov-03	12-Dec-03	Instrument fault	Original analyser re-installed but fault developed again giving spurious high response spikes. Analyser replaced again on 12 th December.	22.0 527
Salford Eccles						
SO ₂	52.9%	03-Oct-03	13-Oct-03	Unstable response	Generally poor SO ₂ analyser performance in this period due to internal temperature faults, PMT cooler and lamp faults.	10.2 245
		18-Oct-03	18-Oct-03	Unstable response	Intermittent data deleted	0.6 14
		03-Nov-03	04-Nov-03	Unstable response	Intermittent data deleted	0.5 11
		05-Nov-03	06-Nov-03	Unstable response	Intermittent data deleted. Thermo cooler repaired.	1.3 30
		20-Nov-03	21-Nov-03	Unstable response	Intermittent data deleted. New thermo cooler installed.	1.6 38
		26-Nov-03	24-Dec-03	Unstable response	UV lamp fault	28.4 681
Sandwell West Bromwich						
CO	75.3%	16-Sep-03	23-Oct-03	Instrument fault	Instrument power supply fault. Analyser removed for repair. Loan analyser installed but noisy response due to correlation wheel fault.	37.5 900

Data Capture (%)	Start date	End date	Reason	Comments	Days	Hours	
Sibton							
O ₃	70.9%	05-Nov-03	21-Nov-03	Instrument fault	Photomultiplier tube power supply fault. Replacement analyser installed on 14 November but pump then seized.	16.3	391
		14-Dec-03	25-Dec-03	Instrument fault	Flat response. Analyser replaced on 23 December.	10.3	247
Southampton Centre							
CO	49.5%	19-Aug-03	13-Nov-03	Instrument fault	New analyser installed on 21 August. No calibration for data scaling until early October. CO analyser zero scrubber and CO/CO ₂ converter problems causing unstable response and data loss. Data from new analyser rejected until the response stabilised after repair in November	86.3	2072
		23-Nov-03	25-Nov-03	Instrument fault	Reference voltage adjusted	2.3	56
Southwark Roadside							
CO	41.4%	15-Apr-03	21-Oct-03	Monitoring suspended	IR source fault. Unable to find replacement part due to age of analyser. Monitoring was suspended until LA had sufficient funds available for new analyser. CO monitoring started again on 21 October when repaired analyser was re-instated.	190.0	4550
		06-Nov-03	07-Nov-03	ESU service	ESU service	1.1	26
		17-Nov-03	19-Dec-03	Logger	Logger configuration lost after LSO calibration on 17 th November. Reconfigured on 15 December. New CO analyser installed on 19 th December.	31.9	766
NO ₂	68.0%	06-Nov-03	07-Nov-03	ESU service	ESU service	1.2	28
		17-Nov-03	15-Dec-03	Logger	Logger configuration lost after calibration	27.8	668
SO ₂	66.1%	02-Oct-03	04-Oct-03	Unstable response	Unstable response due to high cabin temperature	2.0	47
		06-Nov-03	07-Nov-03	ESU service	ESU service	1.1	26
		17-Nov-03	15-Dec-03	Logger	Logger configuration lost after calibration	27.8	668
Stockton-on-Tees Yarm							
NO ₂	88.3%	28-Oct-03	05-Nov-03	Sampling fault	Pump failure	8.2	197
PM ₁₀	88.9%	24-Nov-03	01-Dec-03	Logger fault	Badly seated filter followed by logger fault resulting in missed output on PM ₁₀ channel only. Logger reconfigured.	7.0	167
		09-Dec-03	12-Dec-03	Sampling fault	Unstable response. Flow fault cleared by filter change on 12 Dec	3.0	71
Stoke-on-Trent Centre							
PM ₁₀	0.0%	29-Jul-03	31-Dec-03	Sampling fault	TEOM main flow 30% low and leak found at audit on 2/2/04. 6 months data rejected from previous service due to unstable response with spurious negative data possibly caused by flow problems	156.0	3735

Data Capture (%)	Start date	End date	Reason	Comments	Days	Hours	
Thurrock							
SO ₂	86.5%	06-Nov-03	18-Nov-03	Sampling fault	Pump fault. New pump installed.	12.0	288
Walsall Alumwell							
NO ₂	86.6%	20-Dec-03	05-Jan-04	Instrument fault	Ozone generator fault so analyser switched out of service. No access to site possible during school holidays so repair slightly delayed to 5 th January 2004.	16.5	396
Wicken Fen							
NO ₂	75.8%	12-Dec-03	17-Mar-04	Instrument fault and zero truncation	Instrument power supply fault. Analyser removed for repair. When returned to site analyser showed unstable response and zero baseline truncation. Data deleted until zero offset applied in March 04.	95.7	2296
Wirral Tranmere							
O ₃	89.0%	01-Dec-03	09-Dec-03	Instrument fault	Response fault following site power cut.	7.8	186
		21-Dec-03	23-Dec-03	Sampling fault	Sample flow fault. Pump replaced	2.2	53
Wolverhampton Centre							
CO	83.3%	25-Nov-03	09-Dec-03	Unstable response	Unstable response between calibrations and random step changes in zero base line.	14.3	342
NORTHERN IRELAND							
Lough Navar							
O ₃	64.8%	29-Nov-03	14-Jan-04	Instrument fault	Instrument power supply fault. Replacement analyser installed on 3 rd December gave spurious low readings. Analyser was not calibrated against photometer prior to removal on 14 January so data scaling not possible.	46.3	1110
SCOTLAND							
Edinburgh Centre							
CO	8.8%	03-Oct-03	08-Oct-03	Instrument fault	Data deleted due to baseline skipping after autocalibration cycle	4.2	101
		13-Oct-03	28-Feb-04	Site relocation	Site closed down on 13 th October. Relocated to Edinburgh St Leonards	139.0	3326
NO ₂	13.4%	13-Oct-03	28-Feb-04	Site relocation	Site closed down for relocation	139.0	3326
O ₃	13.3%	13-Oct-03	28-Feb-04	Site relocation	Site closed down for relocation	139.0	3326
PM ₁₀	13.0%	13-Oct-03	28-Feb-04	Site relocation	Site closed down for relocation	139.0	3326
SO ₂	13.5%	13-Oct-03	28-Feb-04	Site relocation	Site closed down for relocation	139.0	3326
Edinburgh St Leonards							
PM ₁₀	32.8%	01-Jan-03	19-Dec-03	Site Start	New site commissioned on 24 th November 2003. Delay in PM ₁₀ monitoring as older TEOM E not compatible with code activated switches/logging system.	353.0	8461

Data Capture (%)	Start date	End date	Reason	Comments	Days	Hours	
Glasgow Centre							
CO	30.8%	29-Oct-03	06-Jan-04	Unstable response	Data deleted due to step changes in zero baseline caused by chopper motor fault and lack of calibrations over the 3 month period	69.0	1656
NO ₂	88.5%	04-Sep-03	01-Oct-03	Unstable response	Unstable response and ozone generator fault.	27.1	650
		12-Nov-03	14-Nov-03	Unstable response	Unstable response data deleted when fair ground operating near site. Single chamber analyser response time was changed to a faster setting.	2.0	47
		24-Dec-03	01-Jan-04	Operator Error	Site accidentally left out of service after routine calibration. Followed by power cut on 30 December.	7.4	178
SO ₂	89.1%	30-Sep-03	02-Oct-03		ESU site visit. No details	2.6	62
		24-Dec-03	07-Jan-04	Operator Error and High noise	Site left out of service after calibration and power cut on 30 th December. SO ₂ high noise response after power cut.	14.1	338
Glasgow Kerbside							
CO	89.3%	05-Oct-03	14-Oct-03	Instrument fault	Chopper motor fault.	9.5	228
Grangemouth							
CO	0.0%	01-Oct-03	31-Dec-03	Zero Truncation	History of zero baseline truncation. Offsets applied but baseline fell again causing truncated response from October onwards.	92.0	2208
Strath Vaich							
O ₃	69.6%	06-Oct-03	14-Oct-03	Power cut	Analyser power supply unit fault after site power cut.	7.6	182
		06-Nov-03	26-Nov-03	Power cut	Power cut again triggered an analyser fault	20.1	483
WALES							
Cardiff Centre							
O ₃	85.6%	09-Oct-03	16-Oct-03	Unstable response	Very unstable response due to photo reference warning. Replacement analyser installed	7.4	178
		13-Nov-03	18-Nov-03	Unstable response	Unstable response from replacement analyser. Second replacement analyser installed. Original site analyser re-instated after repair on 28 th Jan 2004.	5.4	130
Narberth							
				General	Site continued to have power cuts due to water ingress into the site power supply box. Equipment upgraded by LA in November 2003 and power supply problem repaired in Feb 2004.		
NO ₂	83.7%	10-Nov-03	10-Nov-03	Power cut	Power cut	0.5	11
		14-Nov-03	16-Nov-03	Power cut	Power cut	2.3	56
		19-Nov-03	23-Nov-03	ESU service	Service	4.1	99
		29-Nov-03	03-Dec-03	Power cut	Power cut	4.0	97
PM ₁₀	0.0%	03-Sep-03	20-Nov-03	Logger fault	Problem with low PM ₁₀ baseline and negative data after	78.0	1872

Data Capture (%)	Start date	End date	Reason	Comments	Days	Hours	
SO ₂	36.8%	01-Jan-03	22-Nov-03	Unstable response	replacement Ambirack installed on 3 rd September. Analyser/logger configuration fault and insufficient information to rescale data correctly Data deleted due to unstable response until replacement Ambirack installed. (See Section 3.5)	326.0	7824
		29-Nov-03	02-Dec-03	Power cut	Power cut	3.4	81

4.1 Gravimetric PM₁₀ Sites with Data Capture Below 90%

This section gives details of the main operational problems which have resulted in gravimetric PM₁₀ data capture below the required 90% level during the reporting period October to December 2003. Casella Stanger has supplied the measured data and, since mid January 2003, they have also undertaken the filter weighing and calculated the particulate concentrations.

Data capture from the Partisols during October-December 2003 was satisfactory with 5 out of the 7 operational sites achieving data capture above 90%. On average the Partisol data capture was 90.6 %, which was significantly higher than seen in the previous period when it was 73.4%. Three Partisol sites (Brighton Roadside, Wrexham and Northampton) are now successfully connected to telemetry thereby allowing CMCU to download the data directly from the site. The operational status of these Partisols was being checked twice weekly by CMCU as daily automatic dial up was not initially possible due to software limitations. However, the necessary protocols have now been put in place to facilitate daily checks. This will enable critical operational faults to be detected quickly, the most likely causes being power failures and filter jams. In both cases it is possible to clear the status and reset the units remotely. However, for filter jams a call-out is usually necessary to manually remove the jammed filter.

Details of the reasons for data loss at the 2 sites with data capture below 90% are given below:

Brighton Roadside (Data Capture 82%)

Month	Comment	Data Loss
December	9 – 23 rd unit failure	15 days

Northampton (Data Capture 79 %)

The Partisol analyser at this site was replaced in September 2003 and connected to telemetry in January 2004.

Month	Comment	Data Loss
October	9 th – no reason given.	1 day
December	7 th – 22 nd filter jam.	16 days

5 Ratified Data Capture Statistics

Table 5.1 provides the ratified data capture figures for each site for the 3-month period October to December 2003. Data capture values below 90% are shown in the shaded boxes.

Table 5.1 AURN Ratified Data Capture (%) for October to December 2003
(Using the start date of any new site or end date of site closed)

SITE NAME	CO	NO ₂	O ₃	PM ₁₀	PM _{2.5} *	SO ₂	Site Average
ENGLAND							
Barnsley 12	-	-	-	-	-	99.5	99.5
Barnsley Gawber	99.5	99.2	99.6	-	-	99.4	99.4
Bath Roadside	87.8	99.3	-	-	-	-	93.5
Billingham	-	97.4	-	-	-	-	97.4
Birmingham Centre	95.8	91.9	95.3	96.1	-	95.9	95.0
Birmingham East	98.1	98.0	96.6	98.3	-	98.1	97.8
Blackpool	99.5	99.2	99.9	95.1	-	0.0	78.8
Bolton	99.1	99.1	99.0	99.4	-	99.0	99.2
Bottesford	-	-	99.6	-	-	-	99.6
Bournemouth	99.0	91.8	99.1	92.4	-	99.2	96.3
Bradford Centre	68.6	98.9	99.3	99.5	-	99.1	93.1
Brentford Roadside	99.6	99.6	-	-	-	-	99.6
Brighton Roadside	98.4	97.0	-	-	-	-	97.7
Brighton Roadside PM10	-	-	-	81.5	-	-	81.5
Bristol Centre	87.7	94.4	98.7	97.5	-	91.3	93.9
Bristol Old Market	99.4	69.6	-	-	-	-	84.5
Bury Roadside	98.5	95.6	98.6	96.2	-	98.3	97.4
Cambridge Roadside	-	99.5	-	-	-	-	99.5
Camden Kerbside	-	86.5	-	98.2	-	-	92.3
Canterbury	-	99.4	-	99.6	-	-	99.5
Coventry Memorial Park	72.0	72.0	72.1	72.0	-	72.0	72.0
Exeter Roadside	92.3	94.2	98.6	-	-	98.1	95.8
Glazebury	-	-	97.7	-	-	-	97.7
Great Dun Fell	-	-	97.1	-	-	-	97.1
Haringey Roadside	-	77.4	-	96.0	-	-	86.7
Harwell	-	84.8	91.8	100.0	100.0	99.5	95.2
High Muffles	-	92.4	99.6	-	-	-	96.0
Hove Roadside	99.1	95.7	-	-	-	91.9	95.6
Hull Freetown	99.0	92.5	99.0	98.3	-	98.6	97.5
Ladybower	-	99.1	99.3	-	-	99.3	99.3
Leamington Spa	99.3	86.2	99.6	99.5	-	99.6	96.9
Leeds Centre	97.1	91.5	97.2	97.3	-	97.2	96.1
Leicester Centre	36.4	85.2	99.5	99.1	-	99.7	84.0
Liverpool Speke	99.0	99.4	99.4	99.3	-	99.4	99.3
London A3 Roadside	93.7	89.4	-	93.7	-	-	92.2
London Bexley	89.1	76.4	98.3	98.1	-	85.9	89.6
London Bloomsbury	87.7	97.2	44.3	98.3	97.9	92.8	86.4
London Brent	94.4	89.4	94.2	92.1	-	93.0	92.6
London Bromley	63.0	97.9	-	-	-	-	80.4
London Cromwell Road 2	92.3	92.3	-	-	-	92.3	92.3
London Eltham	-	91.8	98.9	98.4	-	95.9	96.3
London Hackney	98.8	99.2	98.0	-	-	-	98.6
London Haringey	-	-	74.7	-	-	-	74.7

SITE NAME	CO	NO ₂	O ₃	PM ₁₀	PM _{2.5} *	SO ₂	Site Average
London Hillingdon	99.4	99.0	99.4	94.4	-	99.5	98.3
London Lewisham	-	99.7	99.5	-	-	99.6	99.6
London Marylebone Road	97.5	99.2	97.2	99.1	96.4	97.3	97.8
London N. Kensington	99.7	99.6	99.7	98.6	-	99.7	99.5
London Southwark	96.4	96.5	96.5	-	-	96.3	96.4
London Teddington	-	99.5	99.6	-	-	99.6	99.6
London Wandsworth	-	99.4	99.0	-	-	-	99.2
London Westminster	99.5	48.0	99.4	92.4	-	22.7	72.4
Lullington Heath	-	92.7	98.9	-	-	98.9	96.8
Manchester Piccadilly	99.2	99.1	99.3	99.4	-	99.3	99.3
Manchester South	-	99.4	97.4	-	-	99.4	98.7
Manchester Town Hall	98.1	99.3	-	-	-	-	98.7
Market Harborough	89.2	88.6	90.9	-	-	-	89.6
Middlesbrough	99.9	81.5	99.8	97.7	-	99.6	95.7
Newcastle Centre	90.4	99.6	84.1	99.5	-	93.6	93.4
Northampton	99.7	99.6	99.7	99.8	-	99.7	99.7
Northampton PM10	-	-	-	79.3	-	-	79.3
Norwich Centre	96.3	96.2	96.2	96.7	-	75.0	92.1
Norwich Roadside	-	99.4	-	-	-	-	99.4
Nottingham Centre	98.5	23.3	98.6	98.8	-	98.1	83.5
Oxford Centre	97.4	99.4	-	-	-	93.8	96.9
Plymouth Centre	99.5	96.6	99.5	99.0	-	99.4	98.8
Portsmouth	93.8	94.0	94.9	98.1	-	93.8	94.9
Preston	94.7	89.4	77.9	94.9	-	93.0	90.0
Reading New Town	98.5	98.2	91.8	98.1	-	65.6	90.4
Redcar	74.2	98.6	98.3	99.2	-	99.4	93.9
Rochester	-	99.0	99.0	99.0	99.0	91.3	97.5
Rotherham Centre	-	99.1	99.4	-	-	95.2	97.9
Salford Eccles	97.8	94.1	97.8	93.8	-	52.9	87.3
Sandwell West Bromwich	75.3	99.7	99.0	-	-	99.6	93.4
Scunthorpe	-	-	-	98.6	-	99.7	99.2
Sheffield Centre	99.6	91.3	99.6	99.1	-	99.6	97.9
Sheffield Tinsley	93.7	99.6	-	-	-	-	96.6
Sibton	-	-	70.9	-	-	-	70.9
Somerton	-	94.7	99.1	-	-	-	96.9
Southampton Centre	49.5	99.2	90.1	99.4	-	98.9	87.4
Southend-on-Sea	98.6	99.0	98.6	96.8	-	94.8	97.5
Southwark Roadside	41.4	68.0	-	-	-	66.1	58.5
St Osyth	99.5	92.8	99.5	-	-	-	97.3
Stockport Shaw Heath	90.1	99.5	-	99.9	-	99.6	97.3
Stockton-on-Tees Yarm	99.8	88.3	-	88.9	-	-	92.3
Stoke-on-Trent Centre	95.2	94.1	91.3	0.0	-	95.4	75.2
Sunderland	-	-	-	-	-	92.1	92.1
Thurrock	99.6	84.8	99.5	99.5	-	86.5	94.0
Tower Hamlets Roadside	99.5	99.6	-	-	-	-	99.5
Walsall Alumwell	-	86.6	-	-	-	-	86.6
Walsall Willenhall	-	99.7	-	-	-	-	99.7
West London	99.5	99.4	-	-	-	-	99.5
Weybourne	-	-	97.8	-	-	-	97.8
Wicken Fen	-	75.8	99.3	-	-	91.9	89.0
Wigan Leigh	97.6	97.8	97.0	98.3	-	94.2	97.0
Wirral Tranmere	99.5	99.4	89.0	99.5	-	91.2	95.7
Wolverhampton Centre	83.3	99.0	99.0	99.7	-	98.2	95.9
Yarner Wood	-	99.6	99.6	-	-	-	99.6
NORTHERN IRELAND							
Belfast Centre	99.6	95.3	99.6	98.8	-	99.5	98.6
Belfast Clara St	-	-	-	94.9	-	-	94.9
Belfast East	-	-	-	-	-	99.4	99.4

SITE NAME	CO	NO ₂	O ₃	PM ₁₀	PM _{2.5} *	SO ₂	Site Average
Derry	99.5	99.0	99.4	98.9	-	99.4	99.2
Lough Navar	-	-	64.8	99.8	-	-	82.3
SCOTLAND							
Aberdeen	100.0	93.8	95.7	99.8	-	99.7	97.8
Bush Estate	-	96.2	98.8	-	-	-	97.5
Dumfries	96.4	99.4	-	97.8	-	-	97.9
Edinburgh Centre	62.5	94.9	94.2	92.0	-	95.2	87.8
Edinburgh St Leonards	99.5	99.5	99.5	32.8	-	99.5	86.1
Eskdalemuir	-	-	99.8	-	-	-	99.8
Glasgow Centre	30.8	88.5	93.8	93.5	-	89.1	79.2
Glasgow City Chambers	99.3	99.2	-	-	-	-	99.3
Glasgow Kerbside	89.3	99.2	-	93.6	-	-	94.0
Grangemouth	0.0	99.7	-	99.8	-	99.7	74.8
Inverness	99.5	97.2	-	100.0	-	-	98.9
Strath Vaich	-	-	69.6	-	-	-	69.6
WALES							
Aston Hill	-	94.7	99.5	-	-	-	97.1
Cardiff Centre	99.6	99.3	85.6	99.5	-	99.4	96.7
Cwmbran	99.9	90.6	100.0	99.9	-	99.9	98.1
Narberth	-	83.7	90.6	0.0	-	36.8	52.8
Port Talbot	-	99.0	99.0	99.0	-	99.3	99.1
Swansea	93.1	98.5	99.5	99.5	-	99.5	98.0
Wrexham	99.3	99.2	-	91.3	-	99.1	97.2
Number of sites	79	105	84	71	4	77	
Number of sites < 90%	18	22	10	7	0	11	28
Network Mean (%)	90.6	93.4	95.0	93.0	98.3	92.0	93

*Note: Ratified PM_{2.5} data from 1/10/03 onwards. PM_{2.5} data on the archive from 1998 to October 2003 are provisional.

Sites and instruments established between 01/10/2003 and 31/12/2003

Site	Status	Instruments	Start Date
High Muffles	Defra	NO ₂	20/10/2003
Market Harborough	Defra	CO NO ₂ O ₃	10/12/2003
Reading New Town	Defra	CO NO ₂ O ₃ PM ₁₀ SO ₂	17/10/2003
Bush Estate	Defra	NO ₂	09/10/2003
Edinburgh St Leonards	Defra	CO NO ₂ O ₃ PM ₁₀ SO ₂	24/11/2003
Aston Hill	Defra	NO ₂	21/10/2003

Table 5.2 provides the ratified data capture figures for each site for the year January to December 2003. Data capture values below 90% are shown in the shaded boxes.

Table 5.2 AURN Ratified Data Capture (%) for January to December 2003
(Using the start date of any new site or end date of site closed)

Site	Status	CO	NO ₂	O ₃	PM ₁₀	PM _{2.5}	SO ₂	Site Average
England								
Barnsley 12	Defra	-	-	-	-	-	98.8	98.8
Barnsley Gawber	Affiliate	97.2	97.2	96.6	-	-	97.2	97.1
Bath Roadside	Affiliate	92.9	94.5	-	-	-	-	93.7
Billingham	Defra	-	96.6	-	-	-	-	96.6
Birmingham Centre	Defra	90.0	87.6	90.2	85.7	-	89.7	88.6
Birmingham East	Affiliate	69.7	93.0	94.8	29.0	-	94.6	76.2
Blackpool	Defra	95.5	93.7	93.0	96.3	-	54.9	86.7
Bolton	Affiliate	94.1	97.9	97.8	98.1	-	97.9	97.2
Bottesford	Affiliate	-	-	98.9	-	-	-	98.9
Bournemouth	Affiliate	98.3	93.0	98.9	93.4	-	97.6	96.3
Bradford Centre	Defra	79.7	93.6	95.4	96.6	-	96.3	92.3
Brentford Roadside	Affiliate	63.7	77.9	-	-	-	-	70.8
Brighton Roadside	Affiliate	97.0	86.6	-	-	-	-	91.8
Brighton Roadside PM10	Affiliate	-	-	-	89.3	-	-	89.3
Bristol Centre	Defra	85.8	87.5	95.6	93.2	-	92.4	90.9
Bristol Old Market	Affiliate	93.4	63.5	-	-	-	-	78.4
Bury Roadside	Affiliate	97.8	89.1	98.0	97.4	-	91.9	94.8
Cambridge Roadside	Affiliate	-	89.3	-	-	-	-	89.3
Camden Kerbside	Affiliate	-	43.6	-	99.0	-	-	71.3
Canterbury	Affiliate	-	99.0	-	99.3	-	-	99.2
Coventry Memorial Park	Defra	82.0	87.4	89.9	81.6	-	86.9	85.6
Exeter Roadside	Affiliate	89.7	95.3	97.5	-	-	98.3	95.2
Glazebury	Defra	-	-	88.7	-	-	-	88.7
Great Dun Fell	Defra	-	-	99.0	-	-	-	99.0
Haringey Roadside	Affiliate	-	87.9	-	97.9	-	-	92.9
Harwell	Defra	-	87.1	96.1	97.5	98.7	98.0	95.5
High Muffles	Defra	-	92.4	98.7	-	-	-	95.5
Hove Roadside	Affiliate	98.0	96.2	-	-	-	96.7	97.0
Hull Freetown	Defra	84.4	93.7	97.6	88.7	-	94.7	91.8
Ladybower	Defra	-	97.8	98.1	-	-	89.7	95.2
Leamington Spa	Affiliate	98.3	66.5	98.6	85.8	-	81.7	86.2
Leeds Centre	Defra	86.7	86.2	93.6	97.1	-	91.8	91.1
Leicester Centre	Defra	80.3	93.4	97.9	88.8	-	98.2	91.7
Liverpool Speke	Affiliate	92.2	92.3	92.4	92.3	-	82.8	90.4
London A3 Roadside	Defra	97.0	80.3	-	96.5	-	-	91.3
London Bexley	Affiliate	94.5	88.6	97.6	96.5	-	91.3	93.7
London Bloomsbury	Defra	93.2	67.8	82.3	58.2	96.5	94.2	82.0
London Brent	Affiliate	96.9	95.1	89.8	95.6	-	96.6	94.8
London Bromley	Affiliate	76.1	97.4	-	-	-	-	86.8
London Cromwell Road 2	Defra	88.9	93.3	-	-	-	88.4	90.2
London Eltham	Affiliate	-	97.6	91.9	99.1	-	98.6	96.8
London Hackney	Affiliate	95.2	91.2	96.4	-	-	-	94.3
London Haringey	Affiliate	-	-	93.3	-	-	-	93.3
London Hillingdon	Defra	95.5	82.6	97.9	88.9	-	98.1	92.6
London Lewisham	Affiliate	-	99.6	97.9	-	-	99.6	99.0
London Marylebone Road	Affiliate	98.4	93.7	96.3	98.7	93.3	96.1	96.1
London N. Kensington	Affiliate	92.0	94.1	98.7	98.4	-	98.9	96.4
London Southwark	Affiliate	97.5	73.2	98.2	-	-	98.0	91.7
London Teddington	Affiliate	-	95.6	98.9	-	-	99.0	97.8
London Wandsworth	Affiliate	-	91.3	89.8	-	-	-	90.6
London Westminster	Defra	97.4	68.9	95.5	74.4	-	69.2	81.1

Lullington Heath	Defra	-	88.3	95.5	-	-	85.8	89.9
Manchester Piccadilly	Defra	96.8	97.8	97.9	98.0	-	93.1	96.7
Manchester South	Affiliate	-	98.4	96.7	-	-	93.8	96.3
Manchester Town Hall	Defra	96.3	98.6	-	-	-	-	97.5
Market Harborough	Defra	89.2	88.6	90.9	-	-	-	89.6
Middlesbrough	Affiliate	87.4	92.6	94.9	85.5	-	96.4	91.4
Newcastle Centre	Defra	76.4	92.7	89.9	96.2	-	96.7	90.4
Northampton	Affiliate	97.4	99.3	96.2	99.4	-	99.3	98.3
Northampton PM10	Affiliate	-	-	-	61.9	-	-	61.9
Norwich Centre	Defra	55.9	94.4	96.7	96.9	-	82.8	85.3
Norwich Roadside	Affiliate	-	97.9	-	-	-	-	97.9
Nottingham Centre	Defra	94.0	78.7	97.5	91.0	-	96.5	91.6
Oxford Centre	Affiliate	98.5	98.2	-	-	-	96.7	97.8
Plymouth Centre	Defra	89.6	91.7	86.6	97.7	-	97.5	92.6
Portsmouth	Affiliate	94.5	95.2	94.0	97.0	-	81.9	92.5
Preston	Defra	97.1	93.2	91.3	96.7	-	95.3	94.7
Reading	Defra	91.4	91.2	91.6	91.2	-	91.3	91.4
Reading New Town	Defra	98.5	98.2	91.8	98.1	-	65.6	90.4
Redcar	Affiliate	91.1	96.4	97.3	97.9	-	95.4	95.6
Rochester	Affiliate	-	98.1	98.8	76.4	98.4	96.6	93.7
Rotherham Centre	Affiliate	-	96.7	98.3	-	-	90.9	95.3
Salford Eccles	Affiliate	97.4	96.3	97.7	96.1	-	86.2	94.7
Sandwell West Bromwich	Affiliate	73.1	85.7	94.1	-	-	93.8	86.7
Scunthorpe	Affiliate	-	-	-	98.8	-	96.0	97.4
Sheffield Centre	Defra	95.4	94.8	98.1	97.6	-	92.7	95.7
Sheffield Tinsley	Defra	57.3	96.6	-	-	-	-	77.0
Sibton	Defra	-	-	91.8	-	-	-	91.8
Somerton	Affiliate	-	59.5	97.3	-	-	-	78.4
Southampton Centre	Defra	73.6	95.0	92.7	91.3	-	95.9	89.7
Southend-on-Sea	Defra	86.5	82.6	86.6	83.5	-	81.6	84.2
Southwark Roadside	Affiliate	38.4	91.2	-	-	-	90.5	73.4
St Osyth	Defra	98.5	93.4	98.6	-	-	-	96.8
Stockport Shaw Heath	Affiliate	72.1	98.2	-	98.8	-	98.0	91.8
Stockton-on-Tees Yarm	Affiliate	99.1	88.9	-	96.0	-	-	94.7
Stoke-on-Trent Centre	Defra	91.1	94.6	94.9	56.3	-	96.8	86.7
Sunderland	Defra	-	-	-	-	-	94.8	94.8
Thurrock	Affiliate	98.1	93.5	97.5	98.1	-	91.1	95.7
Tower Hamlets Roadside	Affiliate	97.9	97.5	-	-	-	-	97.7
Walsall Alumwell	Defra	-	95.3	-	-	-	-	95.3
Walsall Willenhall	Affiliate	-	97.3	-	-	-	-	97.3
West London	Defra	94.9	96.4	-	-	-	-	95.7
Weybourne	Affiliate	-	-	99.4	-	-	-	99.4
Wicken Fen	Defra	-	59.8	98.6	-	-	94.9	84.4
Wigan Leigh	Affiliate	97.2	92.3	96.8	97.9	-	86.5	94.2
Wirral Tranmere	Defra	94.1	95.6	95.3	97.0	-	91.7	94.7
Wolverhampton Centre	Defra	85.6	95.8	98.1	98.2	-	97.9	95.1
Yarner Wood	Defra	-	99.4	98.8	-	-	-	99.1
N Ireland								
Belfast Centre	Defra	79.3	94.8	96.9	97.3	-	91.1	91.9
Belfast Clara St	Affiliate	-	-	-	94.7	-	-	94.7
Belfast East	Defra	-	-	-	-	-	96.7	96.7
Derry	Affiliate	97.5	95.4	93.1	97.2	-	96.7	96.0
Lough Navar	Defra	-	-	63.7	98.5	-	-	81.1
Scotland								
Aberdeen	Affiliate	96.9	88.4	94.2	98.4	-	97.7	95.1
Bush Estate	Defra	-	96.2	98.5	-	-	-	97.3
Dumfries	Defra	97.4	97.9	-	93.4	-	-	96.2
Edinburgh Centre	Defra	43.1	58.4	58.4	56.3	-	56.3	54.5
Edinburgh St Leonards	Defra	99.5	99.5	99.5	32.8	-	99.5	86.1
Eskdalemuir	Defra	-	-	96.4	-	-	-	96.4

Glasgow Centre	Defra	80.4	42.6	95.9	96.2	-	81.0	79.2
Glasgow City Chambers	Defra	97.3	95.6	-	-	-	-	96.4
Glasgow Kerbside	Defra	96.3	98.7	-	93.1	-	-	96.0
Grangemouth	Affiliate	55.1	99.3	-	98.2	-	99.3	88.0
Inverness	Defra	98.9	98.3	-	93.4	-	-	96.9
Strath Vaich	Defra	-	-	86.8	-	-	-	86.8
Wales								
Aston Hill	Defra	-	94.7	99.1	-	-	-	96.9
Cardiff Centre	Defra	88.0	87.5	87.1	89.6	-	88.9	88.2
Cwmbran	Affiliate	99.3	87.7	98.5	99.2	-	91.5	95.2
Narberth	Affiliate	-	79.4	88.6	59.0	-	9.3	59.0
Port Talbot	Affiliate	-	96.8	97.3	98.4	-	98.3	97.7
Swansea	Affiliate	96.2	97.5	97.8	97.8	-	97.8	97.4
Wrexham	Defra	98.7	97.6	-	86.6	-	98.6	95.4
Network Mean (%)								
		89.0	90.2	94.4	90.1	96.7	91.1	91.3

Sites and instruments established between 01/1/2003 and 31/12/2003

Site	Status	Pollutant	Start date
Grangemouth	Affiliate	CO	17/01/2003
London Westminster	Defra	Gravimetric PM ₁₀	19/02/2003
Bournemouth	Affiliate	O ₃	27/02/2003
Brighton Roadside PM ₁₀	Affiliate	Gravimetric PM ₁₀	28/02/2003
Northampton	Affiliate	O ₃	13/03/2003
Portsmouth	Affiliate	O ₃	15/04/2003
Somerton	Affiliate	NO ₂	28/04/2003
Cwmbran	Affiliate	O ₃	29/04/2003
Liverpool Speke	Affiliate	CO NO ₂ O ₃ PM ₁₀ SO ₂	21/05/2003
Brentford Roadside	Affiliate	CO, NO ₂	20/06/2003
Aberdeen	Affiliate	O ₃	01/08/2003
Yarner Wood	Defra	NO ₂	15/09/2003
Bush Estate	Defra	NO ₂	09/10/2003
Reading New Town	Defra	CO NO ₂ O ₃ PM ₁₀ SO ₂	17/10/2003
High Muffles	Defra	NO ₂	20/10/2003
Aston Hill	Defra	NO ₂	21/10/2003
Edinburgh St Leonards	Defra	CO NO ₂ O ₃ PM ₁₀ SO ₂	24/11/2003
Market Harborough	Defra	CO NO ₂ O ₃	10/12/2003

PART B: Annual Review 2003

6 Overview of Network Performance

This section provides an annual overview of network performance and a summary of QA/QC Unit’s activities during 2003. More detailed ratification reports have been published each quarter of 2003 highlighting the main data quality issues and reasons for data loss.

6.1 Network Expansion

The number of sites in the automatic monitoring network has increased rapidly since the Enhanced Urban Network (EUN) was first commissioned in 1992 (See Figure 6.1). To date, the AURN consists of 121 automatic monitoring sites of which 60 are directly funded by the Defra and the DAs, with the remaining 61 sites owned by other organisations (mainly Local Authorities) and affiliated to the national network. Site numbers in the current AURN are summarised in Table 6.1. Progress is underway to commission a further 4 new sites in 2004 bringing the total number of AURN sites to 125.

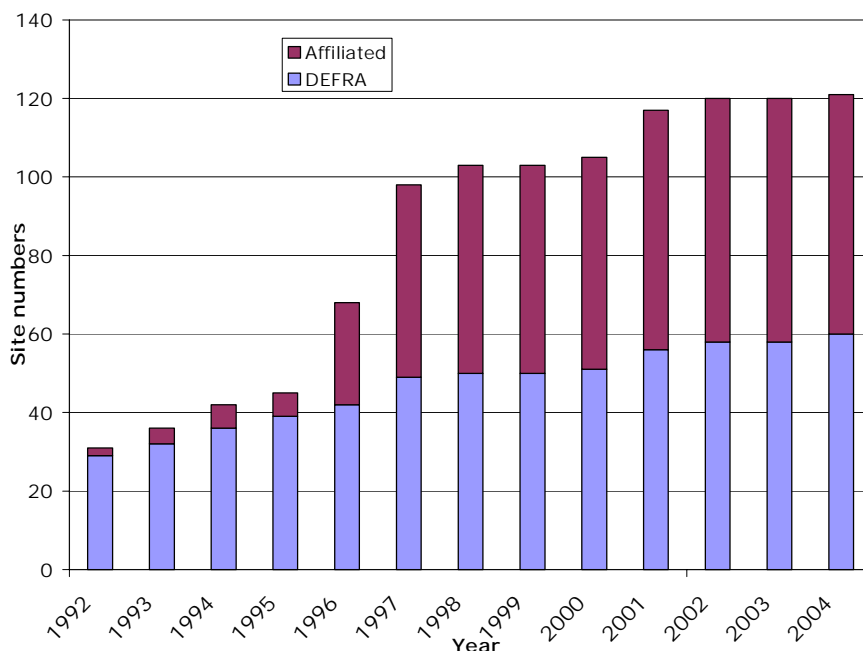


Figure 6.1 Automatic Monitoring Site Numbers in the AURN since 1992

Table 6.1 Site Numbers in the AURN, May 2004

	Urban	Rural	LAQN	AURN Total
Direct funded sites	44	16	0	60
Affiliate sites	41	6	14	61
Totals	85	22	14	121

6.1.1 New Sites/Analysers

A number of new sites and analysers have been added to the network over the last few years in order to comply with the first, second and third European Air Quality Daughter Directives (DD1, DD2 and DD3). These are as follows:

- 2001 12 new sites for DD1 (implementation date 19th July 01)
+ 3 Gravimetric PM₁₀ Partisol analysers

2002 11 additional CO analysers for DD2 (implementation date 13th December 02)
+ 2 Gravimetric PM₁₀ Partisol analysers

2003 7 NO_x and 6 O₃ analysers at rural sites for DD3 (implementation date 9th Sept 03)
+ 2 Gravimetric PM₁₀ Partisol analysers

QA/QC Unit worked closely with CMCU and the Equipment Support Units to ensure that as many as possible of the new analysers were commissioned before the Daughter Directives came into force. A full list of the new sites and analyser commissioned during 2003 is given in Section 5 at the end of Table 5.2.

6.1.2 Site Relocations

A few site relocations have been necessary mainly because the site leases have expired or the building in which the sites are located have been vacated or sold.

The following five sites have been relocate during 2003/4:

- Liverpool Centre ⇨ Liverpool Speke (May 2003)
- Hounslow Roadside ⇨ Brentford Roadside (June 2003)
- Reading Centre ⇨ Reading New Town (October 2003)
- Edinburgh Centre ⇨ Edinburgh St Leonards (Nov 2003)
- Scunthorpe Centre ⇨ Scunthorpe Town (March 2004)

Blackpool is also scheduled to be relocated in 2004.



New site at Scunthorpe Town

6.2 Network Data Capture

The network average data capture for 2003 was 91.3 % which, although above the target 90% level, was slightly lower than seen in previous years (see Figure 6.3). In total 34 out of the 120 sites (28%) had an average data capture below 90%. (See Table 6.2). Of these, 19 are "critical sites" where, if data capture falls below 90% there will be insufficient data for the whole zone or agglomeration.

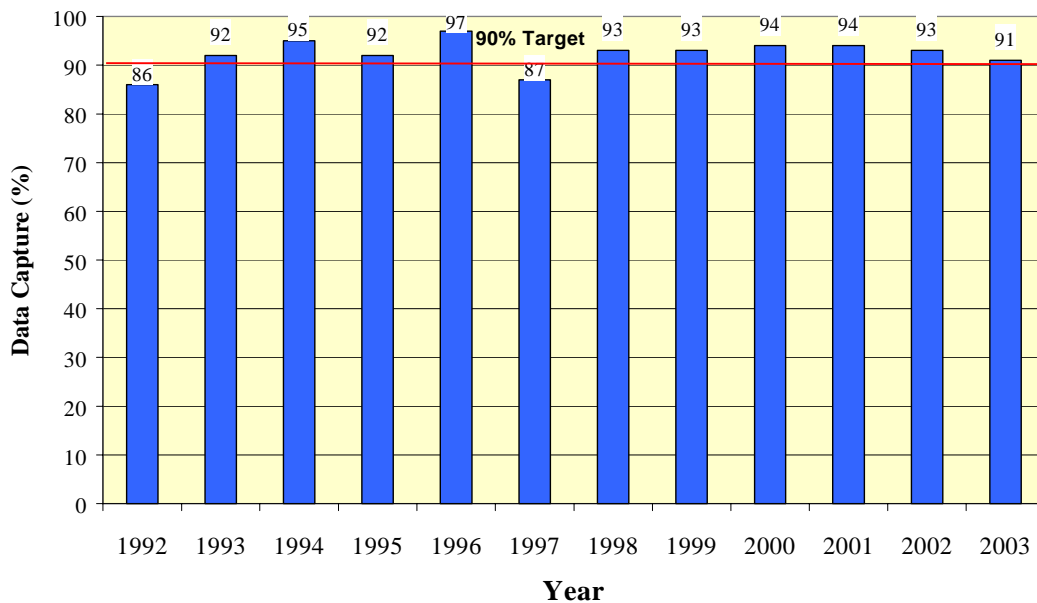


Figure 6.2 Annual Average Network Data Capture 1992 to 2003 (Data capture calculated from site start date)

The slightly reduced data capture in 2003 reflects the fact that it has been a busy year for the network, with increased activity giving rise to data loss that has not effected previous years to such an extent. In particular data loss has occurred due to site relocations, temporary site closure in order to up-grade the site infrastructure to accommodate new analysers, as well as a major exercise to replace over 100 aged or unreliable analysers at 40 of the sites. It encouraging to note however, that data capture in the last quarter of 2003 increased to 93%, indicating that network performance is reaching its steady-state level again.

Table 6.2 Sites with Annual Average Data Capture < 90%, in 2003
(Data capture calculated from site start date)

Site	Critical Site	Owner	Site Average Data Capture (%) Year Jan-Dec 2003
Edinburgh Centre	✓	Defra	54.5
Narberth	✓	Affiliate	59.0
Northampton PM ₁₀	-	Affiliate	61.9
Brentford Roadside	-	Affiliate	70.8
Camden Kerbside	-	Affiliate	71.3
Southwark Roadside	-	Affiliate	73.4
Birmingham East	-	Affiliate	76.2
Sheffield Tinsley	-	Defra	77.0
Bristol Old Market	-	Affiliate	78.4
Somerton	✓	Affiliate	78.4
Glasgow Centre	✓	Defra	79.2
London Westminster	-	Defra	81.1
Lough Navar	✓	Defra	81.1
London Bloomsbury	-	Defra	82.0
Southend-on-Sea	✓	Defra	84.2
Wicken Fen	✓	Defra	84.4
Norwich Centre	✓	Defra	85.3
Coventry Memorial Park	✓	Defra	85.6
Edinburgh St Leonards	✓	Defra	86.1
Leamington Spa	✓	Affiliate	86.3
Blackpool	✓	Defra	86.7
Sandwell West Bromwich	-	Affiliate	86.7
Stoke-on-Trent Centre	✓	Defra	86.7
London Bromley	-	Affiliate	86.8
Strath Vaich	✓	Defra	86.8
Grangemouth	✓	Affiliate	88.0
Cardiff Centre	✓	Defra	88.2
Glazebury	✓	Affiliate	88.7
Birmingham Centre	-	Defra	88.8
Brighton Roadside PM ₁₀	✓	Affiliate	89.3
Cambridge Roadside	-	Affiliate	89.3
Market Harborough	-	Defra	89.6
Southampton Centre	✓	Defra	89.7
Lullington Heath	-	Defra	89.9

7 Review of QA/QC Unit Activities

7.1 Reporting

Detailed quarterly reports have been published for the 2003 data set highlighting the main data quality issues, reasons for data loss and data capture statistics. Since January 2003 the Network intercalibration results have also been combined with the first and third data ratification reports. (See Table 7.1).

Table 7.1 QA/QC Data Ratification and Intercalibration Reports, 2003

	Report Title	Reference
1	QA/QC Data Ratification and Intercalibration Report for the Automatic Urban and Rural Network, January-March 2003	AEAT/ENV/R/1540 July 2003
2	QA/QC Data Ratification Report for the Automatic Urban and Rural Network, April to June 2003	AEAT/ENV/R/1591 October 2003
3	QA/QC Data Ratification and Intercalibration Report for the Automatic Urban and Rural Network, July to September 2003	AEAT/ENV/R/1661 January 2004
4	QA/QC Data Ratification Report for the Automatic Urban and Rural Network, October to December 2003	AEAT/ENV/R/1453 Draft May 2003

Other unpublished reports have been provided which address some of the site specific data quality issues in more detail. These include:

- Camden Kerbside NO_x Letter report, 26 January 2004
- London Bloomsbury NO₂ and PM₁₀ Investigation, March 2002 through May 2003
netcen/ED45077/Issue 1, October 2003

Four short reports produced by the Air Quality Forecasting Unit are also available giving details of the air pollution episodes during one of the longest and hottest summers on record. These reports investigate high ozone air pollution in June, July, August and September 2003. They can be found on the Air Quality Archive at http://www.airquality.co.uk/archive/reports/cat12/o3_episode_july2003.pdf. In addition, two further reports have been produced giving details of the high PM₁₀ pollution in February, March and April 2003.

7.2 Network Intercalibrations

Network intercalibrations were undertaken at 6-monthly intervals with the aim of checking individual analyser performance to determine measurement accuracy, consistency and intercomparability across the entire network. Since January 2003, the intercalibration exercise has been conducted by Netcen to cover all 120 urban, rural and London network sites with over 400 analysers tested and 340 cylinders checked over a 10-week period.

The number of outlier* analysers identified at the winter and summer 2003 intercalibration exercises is shown in Figure 7.1. Full details of these intercalibrations have been reported in the first and third data ratification reports for 2003. (See Table 7.1). Out of the 384 analysers tested at the Winter audit 77 were found to be outliers (20%). In the Summer 2003 audit 400 analysers were tested and 71 were found to be outliers (18%). An inventory of manifold types used in the network was also been compiled and reported.

The results of these intercomparison exercises provide an important means of quantifying network performance and demonstrate that, on average, over 80% of the analysers tested were performing satisfactorily.

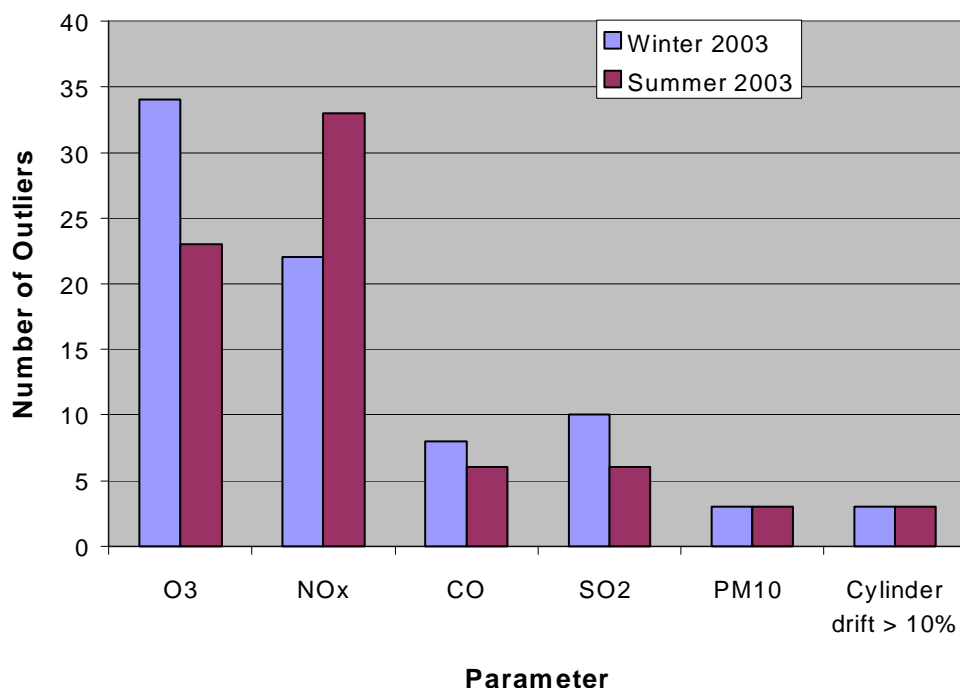


Figure 7.1 Number of Outliers identified at Intercalibrations, 2003

**An outlier is defined as an analyser that shows a deviation from the network mean of >10% for NO_x, CO, SO₂, >5% for O₃ and a k₀ deviation of more than 2.5% for TEOMs*

7.3 LSO Audits and Training

Regular audits of site operator performance were carried out by QA/QC Unit in conjunction with the 6-monthly intercalibration exercises. Results of the audits continue to demonstrate that the majority of LSOs are fully conversant with the routine site operations and follow the procedures documented in the manual. Competent site operators play a key role in achieving high data quality since the integrity of the data depends on their fortnightly calibrations of the analysers.

QA/QC Unit provided training in 2003 for a number of site operators either when new sites were starting (e.g. new gravimetric PM₁₀ Partisol sites) or if additional analysers had been installed at an existing site (e.g. new DD3 NO₂ and O₃ analysers). Also re-training was necessary due to the equipment replacement programme which took place during the summer as sites were often up-graded with equipment from a different manufacturer.

7.4 Investigation of spurious data, 2003

Data ratification involved processing and checking over 16 million 15-minute average measurements for the year. Although the majority of analysers operated satisfactorily, there were a number of data quality and operational issues that required further investigation in order to identify the reason for spurious data quality. In all these cases

QA/QC Unit has worked in close conjunction with CMCU and the ESUs to resolve the problems. However, because of the unknown or complex nature of the faults the remedial action has often taken a long time resulting in extended periods of data loss. A summary of some of the spurious data quality issues identified during 2003 is given below. Full details of these issues have been reported in the quarterly data ratification reports.

7.4.1 Bristol Old Market High NO₂

Unusually high NO₂ concentrations were recorded at Bristol Old Market and QA/QC Unit therefore installed a parallel monitor which also appeared to over-read. It was therefore concluded that the problem was due to a manifold sampling fault and the equipment was subsequently relocated to another housing with a completely new sample inlet manifold arrangement. 19 months of data were deleted (31/7/01 to 26/3/03).

7.4.2 London Bloomsbury PM₁₀

It was noticed during a Netcen modelling study using PM₁₀ /PM_{2.5} ratios, that the measured PM₁₀ concentrations at London Bloomsbury were high relative to previous years. A discrepancy in the TEOM ko factor was identified, however this alone did not account for the apparent offset in the data. The old TEOM "E" analyser was removed from site and a newer TEOM AB was installed in May 2003. 11 months data were rejected (25/6/2002 to 21/5/03)

7.4.3 London Bloomsbury NO₂

ERG initially raised concerns over the relatively low NO₂ concentrations measured at London Bloomsbury compared with other London sites. A parallel monitor was installed which confirmed the apparent under-read. On-site investigation by the ESU identified a significant leak in the analyser's NO_x/NO channel switching valve. The effect of the sample valve leak caused the NO data channel to over-read whilst the NO_x data channel was reading correctly. As a result the NO₂ readings (NO_x-NO) were being under reported. The start of the problem coincided with the relocation of the London Bloomsbury site in March 2002 and 13 months NO and NO₂ data were rejected from 5/3/2002 to 14/4/03. Due to the nature of the fault the NO_x data were unaffected. Potential problems with NO_x switching valve leaks are now routinely reported by QA/QC Unit as part of the 6-monthly intercalibration checks.

7.4.4 Redcar CO

Spurious high concentration spikes were recorded in February and March (maximum 15-minute average of 45 ppm) and again in September and October 2003. Hydrocarbon data were examined to see if a local source was possible but there was no strong evidence of this. The intermittent fault eventually lead to completed analyser failure and the analyser was replaced on 12th December 2003. All spurious high concentration spikes were subsequently deleted from the data set.

7.4.5 Suppressed CO Response

It was noticed that the ambient CO levels appeared suppressed during the summer of 2003 since the new Monitor Labs CO analysers were installed as part of the equipment replacement programme at Belfast Centre, Newcastle Centre and Liverpool Speke. A parallel monitor was installed at the Liverpool site and, following reconfiguration of the Monitor Labs analyser's zero and output voltage, good agreement with the parallel monitor was achieved during the Winter 2003. It was concluded therefore that the new analysers were performing satisfactorily and the step change in response profile was mainly due to a change in response characteristic from the very noisy older analysers to more stable ones.

7.4.6 BAM PM₁₀ Data Anomalies

It was noticed that spurious periods of data were recorded during 1998/9 and again in June 2003 which showed regular spikes of 40-50µg/m³ occurring daily from 11:15 to 12:00 noon. The spikes have been rejected although there is not yet a clear explanation from the ESU for their occurrence.

7.4.7 Autocalibration Run-on

A generic problem effecting many network sites was identified due to autocalibration gas leaking into the sampling system during the ambient measurement period. The problem was identified by calculating the diurnal variation of concentrations. Invalid ambient measurements (usually between 0130 and 0200) have been removed during data ratification. This can be a serious source of data loss resulting in one hour out of twenty-four being lost, which is 4% of the annual data capture. The ESUs have investigated this problem and thorough cleaning of the solenoid valves has, in most cases, resolved the problem.

7.4.8 Camden Roadside NO_x

ERG identified inconsistencies between NO₂ concentrations measured at Camden Roadside and other near-road measurements in the London Network. A parallel monitor was installed at the site which confirmed this. Further data analysis showed that the NO₂ concentrations measured at Camden Roadside were found to be unusually low between February 2002 and July 2003. The underlying cause was identified by examining historic calibration control charts, which showed that the NO_x zero baseline had drifted down below the response threshold (truncation or baseline clipping) in February 2002. 18 months of data were deleted from 1/2/02 to 11/7/03.

In a further improvement to its data ratification procedures, the QA/QC Unit has developed additional long-term data validation tools to help identify any possible outlying data sets for additional investigation.

7.5 LSO Manual

The AURN Site Operator's manual was up dated in November 2003 and the draft sent to out to a selection of network participants for consultation. The final edition of the manual was issued to network users at the Annual Site Operator's meeting in December 2003. An electronic version of the manual on disc will also be distributed to LSOs in the near future. The manual contains hands-on operating instructions for 11 different instrument types used in the network. New features of the manual include:

- Air quality legislation
- Map of UK zones and agglomerations
- AURN hub web site
- CEN and accreditation
- Electronic calibration sheet



The new manual is also available electronically on following web sites:

AURN Hub

<http://www.aeat.co.uk/com/AURNHUB/lsoman.html>

Air Quality Archive

<http://www.aeat.co.uk/netcen/airqual/reports/lsoman/lsoman.html>

7.6 AURN Hub

QA/QC Unit has continued to develop the AURN project information hub in order to assimilate, store and share project information with all network participants. The hub is a password protected* Internet site containing documents and hyperlinks related all aspects of network operation. The AURN project information hub can be found at the following address:



<http://www.aeat.co.uk/com/AURNHUB/index.html>.

The AURN Hub was first launched in December 2002 and the number of visitors to the site (hits) has been monitored each month. (See Figure 7.2) A significant increase in interest was seen following the Hub presentation given at the Annual Site Operators meeting in early December 2003.

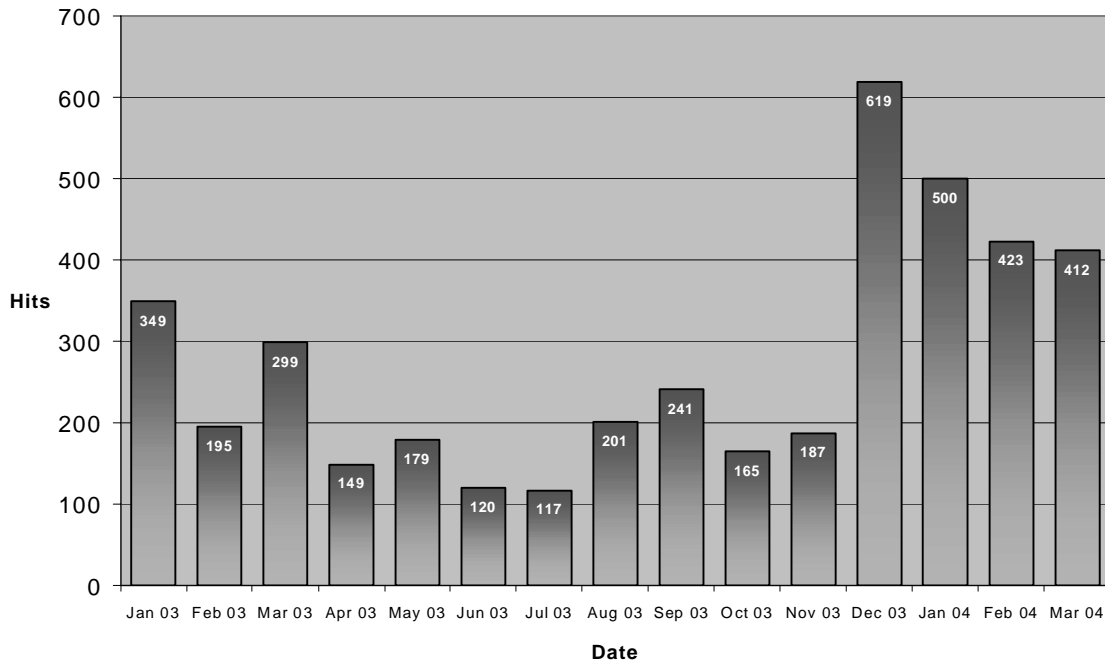


Figure 7.2 Total Hits on the AURN Hub in 2003/4

7.7 Annual LSO Meetings

QA/QC Unit attended the annual AURN Site Operator’s Meeting organised by Casella Stanger at Birmingham NEC in December 2003. Netcen gave presentations on data ratification, network intercalibrations and the summer 2003 PM₁₀ episodes. QA/QC Unit also attended ERG’s London Network Site Operator’s meeting in April 2004. All presentations given at these meetings are available on the AURN Hub.

* Password available for network participants from Jane.Vallance-plews@aeat.co.uk

7.8 Cylinder Inventory

To assist the network's cylinder supply contractor (Messer UK) with the identification of low pressure or empty cylinders, QA/QC Unit has provided a cylinder inventory for the network. Every fortnight, after the site calibrations by the LSO, details of the cylinder pressures are faxed or e-mailed to QA/QC Unit. This information is then consolidated into the cylinder inventory database which is made available to all network users via the AURN Hub. Messer then uses this information to see which cylinders are low and need replacing.

Initially when Messer took over the contract in November 2002 there was a backlog of empty and low pressure cylinders in the network. However, the number of empty cylinders in the network dropped dramatically after the first few months and it has now approached a stable position where there are very few low pressure and often no empty cylinders in the network. Over 200 gas calibration cylinders were replaced by Messer in 2003, with each cylinder being certified by Netcen to EN ISO 107025 accreditation standard.

7.9 International Harmonisation

Netcen staff attended the EU intercomparison exercise for the compounds SO₂, CO and NO_x held in Ispra at the Joint Research Centre, ERLAP from 7-11 April 2003. The programme focussed on the intercomparison of gas calibration standards, but also included tests on the influence of interferences. There were participants from 4 other European countries; Slovenia, Germany, Austria and Spain. The UK's results of the intercomparison exercise are available in the netcen report "JRC Intercomparison Results 2003, netcen/JRC2003/Issue 1" published in August 2003.



Netcen has also attended the Association of National Reference Laboratories (AQUILA) meetings at the Joint Research Centre (JRC) in Ispra on behalf of the Department and DAs in January 2003 and more recently in January 2004. The first of these meetings mainly covered progress reports from the CEN working groups. The latest AQUILA meeting was to discuss particulate measurements. Following this meeting a contribution has been provided to the proposed AQUILA input on the update of the first Daughter Directive to the CAFE Working Group. This interaction with other institutes responsible for network QA/QC throughout Europe has helped to ensure increased harmonisation of monitoring and data quality.

7.10 ISO 17025 Accreditation

Netcen maintained the scope of its ISO 17025 accreditation throughout the year. Routine surveillance visits were carried out by UKAS on three occasions in 2003, two at monitoring sites for calibrations and one at Netcen. Part of the site visit was to witness the revised TEOM flow measurement which has resulted in better uncertainties for this measurement.

The scope of accreditation covers the calibration of ozone photometers, either at sites or in the laboratory. This allows Netcen to offer traceable calibrations to the Equipment Support Units for their photometers used to set up field instruments. This is not intended to

replace QA/QC Unit calibrations, but will ensure analysers are set up accurately following service or repair. Ten ESU photometers were calibrated in this way in advance of the 6-monthly intercalibration/service exercises.

7.11 The Year Ahead

QA/QC Unit continues to investigate technical advances in air quality monitoring in order to keep pace with changing network requirements. As a result of the proposed European CEN standards, various new methodologies will need to be developed and phased into the routine operation of the network in the coming years. The first Daughter Directive (DD1) is currently under review and this may also possibly lead to additional changes in the network scale and operation in the future.

Appendix A1

As requested by the Department, QA/QC Unit has provided a list of suggestions for equipment that may need replacing or up grading in the network. The following provides a summary of the list and the actions taken to date. Recommendations have been prioritised from October 2000 as follows:

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

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

	Recommendations: October 1998	Action	
1	Replace old teflon-coated sample manifolds at former SUN sites	Completed	
2	Replace long sample line at Manchester Town Hall	Completed	
3	Use of 1 micron sample filters on API ozone analysers	In-hand at Defra sites	
4	Fitting all AUN sites with ladder securing clips	In hand	
5	Improving access to PM ₁₀ head at Scunthorpe (Affiliate site)	No action	
6	Safer access to Walsall Alumwell	Railings installed	
7	Installing temperature probes at sites without air-conditioning	Access to temp data from Ambirack sites now possible	
Recommendations: April 2000			
8	Consideration could be given to up-grading the "older generation" Ambirack system at Coventry in view of the problems identified at the audit.	Site relocated and analysers up-graded (February 2001)	
Recommendations: October 2000		Priority	Action
9	The site at Walsall Alumwell should be moved from school roof to ground level in order to improve site access and safety.	Medium	Railings installed
10	Safer access to PM ₁₀ head at Scunthorpe	Medium	Outstanding
11	Safer access to PM ₁₀ head at Stockport. Check that the recent fire damage to the next door building has not reduced the structural integrity of the shared flat roof.	Medium	Smoke damage only
12	The CO analyser at Birmingham Centre is very noisy (outside the ± 0.5 ppm acceptance level) and should be considered for replacement/up-grade	Medium	A new instrument was installed in March 2001
Recommendations April 2001		Priority	Action
13	Up-grade or repair noisy CO analyser at Birmingham Centre	Medium	New instrument installed March 01
Recommendations October 2001		Priority	Action

14	Up-grade or repair noisy CO analyser at Hull Centre	Medium	Site temporarily closed. Re-opened at Hull Freetown 8/11/02
Recommendations May 2002		Priority	Action
None			
Recommendations November 2002		Priority	Action
15	Up-grade or repair noisy CO analyser at Reading (Ambirak)	Critical Site	Repaired July 02
16	Up-grade or repair CO analyser (Environnement SA) at Liverpool (response noise and drift).	Critical Site	Site Closed
17	Up-grade or repair noisy analyser at Coventry Memorial Park (SO ₂ , and CO – Ambirak)	Critical Site	Scheduled for Winter Service
18	Up-grade or repair noisy PM ₁₀ analyser (TEOM) at Leicester Centre	Critical Site	To be replaced
19	Add remote dial up facility to collect instrument diagnostics for all Partisol analysers in the Network	Critical Sites	Phone lines installed – in hand
Recommendations February 2003		Priority	Action
20	Sunderland SO ₂ baseline response cycling	Medium	ESU investigated but no fault found. On-going
21	Investigate/repair SO ₂ analyser at Glasgow Centre (random step changes in sensitivity)	Critical Site	New analyser installed in September 03
22	Repair/replace Narberth SO ₂ analyser (response instability)	High	See below
Recommendations April 2003		Priority	Action
23	ESU to carry out a 3-month converter test at Sheffield Centre, London A3 Roadside, Bournemouth and Wolverhampton Centre.	Medium	Converters replaced by ESUs
24	Investigation of auto calibration run-on problem at sites identified in Table 2.7	Medium	Carried out at service
25	Investigate/repair unstable SO ₂ analyser at Narberth or replace analyser.	High	Temporary Ambirack installed September 03
26	Investigate/repair SO ₂ analyser at Glasgow Centre (random step changes in sensitivity)	Critical Site	UV lamp replaced 21/3/03
27	Casella Stanger and QA/QC Unit are currently working in conjunction to carry out a programme of site up-grades involving equipment replacement at a number of original EUN sites and rural sites in the network.	Some priority sites for new analysers have been identified	See Appendix A3
Recommendations July 2003		Priority	Action
	A major programme to install new equipment is underway.		See details in Appendix A3
Recommendations October 2003			
28	New Horiba analysers at Birmingham East are configured for daily autocalibrations using site cylinders. It is recommended that gas usage is monitored carefully. If necessary autocalcs may need to be re-configured for once every 3 days.		Autocalcs re-configured to once every 3 days

29	Coventry Memorial Park CO noisy response from April onwards. Recommend priority site for installing new analysers (Horiba).	Critical Site	New Horiba analysers installed
Recommendations January 2004			
30	Advice on requirements for further AURN equipment up-grades has been given to CMCU (20/1/04)		
31	Recommend up-grade/modifications to SO ₂ Ambirack bench at Blackpool and Norwich Centre to improve response noise. (already done at Wirral Tranmere and Preston)	Blackpool Critical Site	Improved analyser response after Winter 2004 service at both sites
Recommendation May 2004			
32	Bristol Old Market CO history of high response noise and baseline drift. Recommend up-grading analyser.	Affiliate	
33	Leicester Centre CO on-going problem of noisy response and unstable baseline.	Defra Critical site	Scheduled to be up-graded in Summer 2004
34	Wolverhampton Centre CO on-going noise problems and baseline skipping. Recommend up-grading analyser	Defra	

=

APPENDIX A2

CRITICAL SITES IN THE AURN (May 2004)

Table A1 Critical Sites in Agglomerations

Site Name	Agglomeration	Critical Pollutants		
		DD1	DD2 ⁷	DD3
Belfast Centre	Belfast Urban Area	NO ₂	CO	NO ₂ O ₃
Wirral Tranmere	Birkenhead Urban Area	NO ₂ PM ₁₀ SO ₂	CO	NO ₂ O ₃
Blackpool	Blackpool Urban Area	NO ₂ PM ₁₀ SO ₂	CO	NO ₂ O ₃
Bournemouth+	Bournemouth Urban Area	NO ₂ PM ₁₀ SO ₂	CO	NO ₂ O ₃
Brighton Preston Park	Brighton/Worthing/Littlehampton			NO ₂ ⁶ O ₃ ⁶
Brighton Roadside PM ₁₀ +	Brighton/Worthing/Littlehampton	PM ₁₀		
Hove Roadside+	Brighton/Worthing/Littlehampton	SO ₂		
Bristol Centre	Bristol Urban Area	PM ₁₀ SO ₂		NO ₂ O ₃
Cardiff Centre	Cardiff Urban Area	NO ₂ PM ₁₀ SO ₂	CO	NO ₂ O ₃
Coventry Memorial Park+	Coventry/Bedworth	NO ₂ PM ₁₀ SO ₂	CO	NO ₂ O ₃
Edinburgh St Leonards	Edinburgh Urban Area	NO ₂ PM ₁₀ SO ₂	CO	NO ₂ O ₃
Glasgow Centre	Glasgow Urban Area	SO ₂		NO ₂ O ₃
Hull Freetown	Kingston upon Hull	NO ₂ PM ₁₀ SO ₂	CO	NO ₂ O ₃
Leicester Centre	Leicester Urban Area	NO ₂ PM ₁₀ SO ₂	CO	NO ₂ O ₃
Liverpool Speke	Liverpool Urban Area	NO ₂ PM ₁₀ SO ₂	CO	NO ₂ O ₃
Nottingham Centre	Nottingham Urban Area	NO ₂ PM ₁₀ SO ₂	CO	NO ₂ O ₃
Portsmouth+	Portsmouth Urban Area	NO ₂ PM ₁₀ SO ₂	CO	NO ₂ O ₃
Preston	Preston Urban Area	NO ₂ PM ₁₀ SO ₂	CO	NO ₂ O ₃
Reading New Town	Reading/Wokingham Urban Area	NO ₂ PM ₁₀ SO ₂	CO	NO ₂ O ₃
Sheffield Centre	Sheffield Urban Area	PM ₁₀		
Southampton Centre	Southampton Urban Area	NO ₂ PM ₁₀ SO ₂	CO	NO ₂ O ₃
Southend-on-Sea	Southend Urban Area	NO ₂ PM ₁₀ SO ₂	CO	NO ₂ O ₃
Swansea+	Swansea Urban Area		CO	
Stoke-on-Trent Centre	The Potteries	NO ₂ PM ₁₀ SO ₂	CO	NO ₂ O ₃
Newcastle Centre	Tyneside	NO ₂ PM ₁₀ SO ₂	CO	NO ₂ O ₃

"+" indicates Affiliate site"

Note 2: PM₁₀ monitored by Gravimetric and TEOM

Note 3: DD3 Critical as Rural Background station

Note 4: If NO₂ at West Midlands is Suburban then NO₂ at Leamington Spa is no longer critical for DD1

Note 6: Not Affiliated/Monitoring yet.

Note 7: Addresses CO, Benzene not included here

=

Table A2 Critical Sites in Zones

Site Name	Zone	Critical Pollutant		
		DD1	DD2 ⁷	DD3
Grangemouth+	Central Scotland	NO ₂ PM ₁₀ SO ₂	CO	
Bush Estate	Central Scotland			NO ₂ O ₃
Northampton+	East Midlands	NO ₂ PM ₁₀ ² SO ₂	CO	NO ₂ O ₃
Sibton	Eastern			O ₃ ³
St Osyth	Eastern			NO ₂ O ₃
Norwich Centre	Eastern			NO ₂ O ₃
Wicken Fen	Eastern			NO ₂ O ₃
Thurrock	Eastern			NO ₂ O ₃
Fort William	Highland			NO ₂ ⁶ O ₃ ⁶
Strath Vaich	Highland			O ₃ ³
Inverness	Highland	NO ₂ PM ₁₀		
Sunderland Silkworth+	North East			NO ₂ ⁶ O ₃ ⁶
Stockton-on-Tees Yarm+	North East	NO ₂ PM ₁₀	CO	
Sunderland	North East	SO ₂		
Aberdeen+	North East Scotland	NO ₂ PM ₁₀ SO ₂	CO	NO ₂ O ₃
Aston Hill	North Wales			NO ₂ O ₃
Wrexham	North Wales	NO ₂ PM ₁₀ SO ₂	CO	
Great Dunn Fell	North West & Merseyside			O ₃ ³
Wigan Leigh+	North West & Merseyside	NO ₂ PM ₁₀ SO ₂	CO	NO ₂ O ₃
Glazebury	North West & Merseyside			NO ₂ O ₃
Lough Navar	Northern Ireland			O ₃ ³
Derry+	Northern Ireland	NO ₂ PM ₁₀ SO ₂	CO	NO ₂ O ₃
Eskdalemuir	Scottish Borders			NO ₂ ⁶ O ₃
Dumfries	Scottish Borders	NO ₂ PM ₁₀	CO	
Canterbury+	South East	PM ₁₀		
Oxford Centre+	South East	SO ₂	CO	
Narberth	South Wales			O ₃ ³
Cwmbran+	South Wales	NO ₂ PM ₁₀ SO ₂	CO	NO ₂ O ₃
Somerton	South West			NO ₂ O ₃
Yarner Wood	South West			NO ₂ O ₃
Plymouth Centre	South West	PM ₁₀		
Leominster	West Midlands			NO ₂ ^{4 & 6} O ₃ ⁶
Leamington Spa+	West Midlands	NO ₂ PM ₁₀ SO ₂	CO	NO ₂ O ₃
Barnsley Gawber+	Yorkshire & Humberside	NO ₂	CO	NO ₂ O ₃
High Muffles	Yorkshire & Humberside			NO ₂ O ₃
Scunthorpe+	Yorkshire & Humberside	PM ₁₀		

Total of 61 Critical Sites (25 in Agglomerations and 36 in Zones)
 51% of network stations critical under one or more Daughter Directives
 "+ indicates Affiliate site"

Note 2: PM₁₀ monitored by Gravimetric and TEOM

Note 3: DD3 Critical as Rural Background station

Note 4: If NO₂ at Leominster is Suburban then NO₂ at Leamington Spa is no longer critical for DD1

Note 6: Not Affiliated/Monitoring yet

Note 7: Addresses CO, Benzene not included here

=

APPENDIX A3

AURN EQUIPMENT REPLACEMENT PROGRAMME - May 2004

PART A Replacement at Critical Defra Sites						
	Site	New Instrument	Scheduled w/c	Installed	QA/QC commissioned	Notes
1	Blackpool Centre	TEOM	11/08/2003	yes	yes 16/9	<i>Completed</i>
2	Glasgow Centre	TEI 43C SO ₂ }	04/08/2003	yes	Yes 6/10	<i>Completed</i>
3	Preston	Modified SO ₂ bench fitted	31/7/2003	yes	Yes 16/9	<i>Completed</i>
4	Wirral Tranmere	Modified SO ₂ bench fitted	1/7/2003	Yes	Yes 15/9	<i>Completed</i>
5	Reading New Town	Ambirak CO bench		Yes	Yes 9/10	<i>Completed</i>
6	Sunderland	API M100 SO ₂	14/08/2003	Yes	Yes 17/10	<i>Completed</i>
7	Plymouth	TEI 43C SO ₂ TEOM	21/07/2003	Yes	Yes 22/9	<i>Completed</i>
PART B Replacement at Non-Critical Defra Sites						
8	Glasgow Kerbside	TEOM	04/08/2003	Yes	Yes 6/9	<i>Completed</i>
9	London A3	TEOM	07/07/2003	Yes	Yes 19/1	<i>Completed</i> Analyser failed initial commissioning tests. Repaired analyser re-audited 19/1/04
10	London Hillingdon	TEI 43C SO ₂ TEOM	14/07/2003	Yes	Yes 24/9	<i>Completed</i>
11	Wolverhampton	TEI 43C SO ₂	04/08/2003	Yes	Yes 20/10	<i>Completed</i>
PART C Replacement at Critical Affiliate Sites						
12	Coventry Memorial Park	HORIBA NO _x , SO ₂ , O ₃ , CO (TEOM)		Yes	Yes 9/1/04	<i>Completed</i> <i>TEOM not up-graded*</i>
13	Aberdeen	TEOM	28/07/2003	Yes	Yes 8/10	<i>Completed</i>
PART D Replacement of Original EUN Network						
14	London Bloomsbury	API NO _x , SO ₂ , O ₃ , CO TEOM	09/07/2003	yes	Yes 25/9	<i>Completed. TEOM replaced by ETI on 21/5/03.</i>
15	Bristol Centre	API NO _x , SO ₂ , O ₃ , CO TEOM	21/07/2003	yes	Yes 22/9	<i>Completed</i>
16	Edinburgh St Leonards	API NO _x , SO ₂ , O ₃ , CO TEOM		yes	Yes 19/11	<i>Relocation and installation of new analysers completed.</i>
17	Cardiff Centre	API NO _x , SO ₂ , O ₃ , CO TEOM	18/08/2003	yes	Yes 22/9	<i>Completed</i>
18	Birmingham Centre	API NO _x , SO ₂ , O ₃ , CO (TEOM)	08/09/2003	yes	Yes 7/10	<i>Completed</i> <i>TEOM not up-graded*</i>
19	Newcastle	ML NO _x , SO ₂ , O ₃ , CO, TEOM	25/04/2003	yes	Yes 15/5	<i>Completed</i>
20	Liverpool Speke	ML NO _x , SO ₂ , O ₃ , CO, TEOM	16/4/2003	yes	Yes 20/5	<i>Completed</i>
21	Belfast Centre	ML NO _x , SO ₂ , O ₃ , CO, TEOM	01/05/03	yes	Yes 21/5	<i>Completed</i>
22	Southampton	ML NO _x , SO ₂ , O ₃ , CO TEOM	04/08/2003	yes	Yes 6/10	<i>Completed</i>
23	Hull	ML NO _x , SO ₂ , O ₃ , CO TEOM	21/07/2003	yes	Yes 16/10	<i>Completed. TEOM replaced by ETI on 13/5/03. Others replaced during service.</i>
24	Leeds	HORIBA NO _x , SO ₂ , O ₃ , CO TEOM		No	TBA	<i>Scheduled for Summer 2004</i>
25	Leicester	HORIBA NO _x , SO ₂ , O ₃ , CO TEOM		TEOM only	TBA	<i>TEOM replaced by ETI on 23/4/03. Others scheduled for Summer 2004</i>
26	Ambirack Sites	HORIBA NO _x , SO ₂ , O ₃ , CO		No	TBA	<i>Unidentified as yet</i>

27	Ambirack Sites	HORIBA NOx, SO2, O3, CO		No	TBA	<i>Unidentified as yet</i>
PART E Replacement of Aged Rural Network Equipment						
28	Aston Hill	API M400 O3 (NOx DD3)	28/07/2003	yes	Yes 7/10	<i>Completed and LSO training provided</i>
29	Bush	API M400 O3 (NOx DD3)	14/07/2003	yes	Yes 7/10	<i>Completed</i>
30	Eskdalemuir	API M400 O3 (NOx DD3)	January 04	No	TBA	<i>Scheduled for end June 04</i>
31	Glazebury	API M400 O3 (NOx DD3)	30/06/2003	Yes	Yes 26/1/04	<i>Completed Delay due to power up-grade to site.</i>
32	Great Dun Fell	API M400 O3	17/09/2003	yes	Yes 18/11	<i>Completed</i>
33	Harwell	API M400 O3, NOx, SO2	14/07/2003	Yes	Yes 22/9	<i>Completed</i>
34	High Muffles	API M400 O3 (NOx DD3)	25/08/2003	Yes	Yes 5/8	<i>Completed</i>
35	Ladybower	API M400 O3, NOx, SO2	28/07/2003	yes	Yes 1/9	<i>Completed and LSO training provided</i>
36	Lough Navar	API M400 O3	TBC	Yes	Yes 10/9	<i>Completed</i>
37	Sibton	API M400 O3	14/07/2003	Yes	Yes 30/9	<i>Completed</i>
38	Strath Vaich	API M400 O3	28/07/2003	Yes	Yes 11/1/04	<i>New analyser not working at first audit. Completed in January 2004</i>
39	Wicken Fen	API M400 O3, NOx, SO2	18/08/2003	Yes	Yes 29/9	<i>Completed</i>
40	Yarner Wood	API M400 O3 (NOx DD3)	21/07/2003	yes	Yes 22/9	<i>Completed and LSO training provided.</i>
DD3 Requirements						
			Scheduled	Installed	Commissi oned	
1	Portsmouth	O ₃	27/02/2003	Yes	15/4/2003	<i>Completed</i>
2	Cwmbran	O ₃		Yes	29/4/2003	<i>Completed</i>
3	Somerton	NOx		Yes	28/4/2003	<i>Completed</i>
4	Aberdeen	O ₃		Yes	29/7/2003	<i>Completed</i>
5	Northampton	O ₃		Yes	13/3/2003	<i>Completed</i>
6	Bournemouth	O ₃		Yes	27/2/2003	<i>Completed</i>
7	Aston Hill	NOx	28/07/2003	Yes	14/8/2003	<i>Completed</i>
8	Bush	NOx	14/07/2003	Yes	6/10/2003	<i>Completed</i>
9	Eskdalemuir	NOx		No	TBA	<i>Scheduled for end June 2004</i>
10	Glazebury	NO _x (+ PM ₁₀ to be installed)	30/06/2003	Yes	26/1/2004	<i>Completed</i>
11	High Muffles	NO _x	14/07/2003	Yes	7/8/2003	<i>Completed</i>
12	Yarner Wood	NO _x	30/06/2003	yes	25/7/2003	<i>Completed</i>
13	Wigan Leigh	O ₃	15/5/2002	yes	15/5/2002	<i>Completed at same time as DD2 CO</i>

TBA = to be arranged

w/c = week commencing

* TEOM not yet up-graded as new TEOM AB analysers deployed on FDMS tests at Belfast and Harwell

Appendix A4

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, May 2004

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	1 intercalibration equipment set (includes mass flow controllers and read-out unit) A second intercalibration kit (commissioned January 2001) UV photometers: API model M401- purchased April 1999 (on temporary loan) ML model 9812 – purchased April 1999 (to be written off) API model 401 - purchased October 2000 (on temporary loan) API model 401 – purchased December 2002 (on temporary loan) 4 API model 401 – purchased March 2004 Mass flow controllers - purchased April 2002 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
Zero air pumps	6 spare zero air pumps for routine maintenance/repair of zero air generators in the AUN.
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)