Report

# QA/QC Data Ratification Report and Annual Review for the Automatic Urban and Rural Network,

# October – December 2004

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

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# QA/QC Data Ratification Report and Annual Review for the Automatic Urban and Rural Network, October - December 2004

Jane Vallance-Plews

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# 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 (DAs). This report provides a review of data ratification issues for the 3-month period October to December 2004 (Part A) and includes an annual overview of network performance and QA/QC Unit activities for 2004 (Part B).

The network has undergone significant changes since it was first established in 1992. Site numbers have increased to 123 sites to date, of which 62 are Local Authority owned sites which are affiliated to the national network. The further addition of 4 new sites in 2005 will bring the total number of AURN sites to 127.

In general this has been a good year for the AURN with a network average data capture of 93% being achieved for 2004. This is an improvement on the previous year (2003) when network data capture was slightly lower at 91%. The slight reduction in overall data capture in 2003 reflected the fact that this was an especially active year in terms of network expansion and equipment up-grading. However, it is encouraging to see that the network data capture has risen again in 2004, demonstrating that network performance has once more reached its steady-state level with the new equipment installed and operating satisfactorily.

Although overall network data capture was high at 93%, there were a number of critical site/analysers that missed the 90% threshold. The main reason for data loss at these sites has been provided and these were mainly due to instrument faults or response instability. A summary of recommendations given in this report to help improve network performance is given in Appendix A4.

Integration of additional $NO_x$ and $O_3$ analysers to meet the requirements of the third Daughter Directive (DD3) is now complete at all 13 of the requisite sites. In addition two new DD3 sites have been commissioned (Brighton Preston Park and Sunderland Silksworth) and progress is underway with the installation of the remaining two new sites at Leominster and Fort William. A Local Authority site at London Harlington was also integrated into the network in January 2004 and five site relocations have carried out. 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.

A significant improvement in gravimetric $PM_{10}$ data capture has been achieved following the connection of six out of the seven Partisol analysers to telemetry systems. For the first time, all seven of the Partisol analysers achieved data capture above 90% during the 3-month reporting period October to December 2004, which clearly demonstrates the advantages of remote data collection and regular operational status checking.

In Part B of this report, an annual overview of QA/QC Unit's activities and the main data quality issues identified during the ratification of the 2004 data set is provided. Further details can also be found in each of the individual quarterly data ratification reports already issued for 2004.

Results of the 6-monthly intercalibrations carried out in 2004 showed that the data quality objectives in terms of measurement accuracy, precision and consistency were within acceptable limits. Out of the 423 analysers tested approximately 80% were shown to be performing satisfactorily.

Audits of local site operator (LSO) performance during 2004 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 achieving 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. New long-term data checking tools have been incorporated into the routine data ratification process and further measures to assist with the identification of consistent poorly performing sites are being developed.

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.

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# PART A: DATA RATITFICATION, OCTOBER - DECEMBER 2004

# PART B ANNUAL REVIEW 2004

# PART A: Data Ratification October - December 2004

# 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' urban and rural air quality monitoring network (AURN) for the period October to December 2004. During this period there were 123 monitoring sites in the Network of which there are 87 urban sites, 22 rural sites and a further 14 sites in the London Air Quality Monitoring Network (LAQN) which are affiliated into the national network.

Included in this report is an annual review of network performance and QA/QC Unit activities during 2004. The report is therefore divided in to 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: 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 to December 2004 and for the complete year presented in tables.

**PART B: Annual Review**
Section 6: Overview of network performance including network expansion and data capture.
Section 7: Review of QA/QC Unit activities including;
Reporting,
Network intercalibrations, audits and training,
Investigations of spurious data quality,
Site Operator's manual,
AURN project information hub,
Cylinder inventory,
Annual LSO meetings,
International harmonisation and accreditation,
Development of QA/QC practises,
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 Inventory of Department-owned equipment used by QA/QC Unit.
Appendix A4 Summary of recommendations

## 1.1 Recent Changes in the Network

This section gives an overview of the main changes that have recently taken place in the network, including site closures, relocations or the addition of any new sites to the network. A summary of changes in the AURN for the year to date is given in Table 1.1.

QA/QC Unit has been working closely with Casella Stanger and the Local Authorities regarding the following site commissionings and relocations:

**London Harlington**
An affiliated site at London Harlington (Heathrow airport) measuring $NO_2$, $O_3$, CO and $PM_{10}$ was integrated into the network from 1st January 2004.

**Scunthorpe/Scunthorpe Town**
Due to health and safety reasons the site at Scunthorpe was closed on 18th March 2004 and relocated to a nearby site in Rowland Road. The new site commenced monitoring on 6th June 2004 and has been renamed Scunthorpe Town.

**Wigan Leigh/Wigan Centre**
The Wigan Leigh site was closed on 28th September 2004 due to the necessary redevelopment of the Police Station. The Defra and DA's funded instruments were relocated to an existing site at Deanery School and the site renamed "Wigan Centre". The site commissioning audit was carried out on 6th October 2004 and the new site commenced operation on 8th October 2004.

**Birmingham East and Centre**
The Birmingham East site closed on 4th August 2004 as the school was unable to renew the lease for the site. QA/QC Unit worked closely with Birmingham County Council to identify another suitable site. The new site at Birmingham Tyburn commenced operation on August 16th 2004. The Birmingham Centre site was also going to be relocated due to redevelopment, however this may no longer be necessary and there are no immediate plans to move the site.

**Norwich Roadside**
In early February 2005, short notice was given to vacate the office where the Norwich Roadside $NO_x$ analyser was located. The equipment was quickly relocated to a similar roadside location at City Hall. The new site was renamed Norwich Roadside Forum and monitoring commenced following the commissioning audit on April 1st 2005.

**Blackpool**
The site at Blackpool ceased operation on 10th November 2004 due to redevelopment in the area. The housing has been moved to a new location at Stanley school and the station is now awaiting provision of the electricity supply. It is anticipated that the site will commence operation at the end of June 2005.

**Cwmbran**
The site at Cwmbran will be temporarily relocated prior to construction activity taking place at the school in January 2005. A suitable site close to the original site and in similar surroundings has been identified. This will be a temporary move and the site will eventually be returned to its original location.

**Middlesbrough**
The site at Middlesbrough will be relocated due to redevelopment in the area around the school. Groundwork started in early December 2004, giving rise to elevated $PM_{10}$ concentrations. Another suitable site, 17 metres from the existing location, has been identified and the monitoring cabin will be moved on 19th May 2005.

**Stockport Shaw Heath**
There are plans to demolish the building housing the Stockport Shaw Heath site. The LSO is currently investigating the possibility of setting up a site across the road, using a groundhog enclosure.

**Bradford Centre, Bath Roadside and Bristol Centre**
Preliminary discussions are underway regarding possible relocation of the above sites.

**Oxford Centre Roadside**
The Oxford Centre site has been renamed Oxford Centre Roadside in order to clarify that is a roadside site.

**DD3 Requirements**
Installation of additional ozone and rural $NO_x$ analysers at existing sites in the network in order to comply with the Third Daughter Directive (DD3) is now complete. The final $NO_x$ analyser was installed at Eskdalemuir on 13th October 2004. There was some initial delay whilst operational problems were resolved and monitoring finally commenced on 9th December 2004.

Two of the four new sites required for compliance with the Third Daughter Directive (DD3) have now been commissioned as follows:

**Brighton Preston Park**
A new DD3 ($NO_x$ and $O_3$) site at Brighton Preston Park commenced monitoring on November 3rd 2004.

**Sunderland Silksworth**
A new Local Authority site at Sunderland Silksworth measuring $NO_x$ and $O_3$ (for DD3) was affiliated into the network on 9th December 2004.

Progress is being made to commission the remaining two new DD3 sites at Fort William and Leominster and further details are given in Section 2.1 of this report.

**Equipment Replacement**
New equipment sets (Horiba) were installed at Leeds Centre and Leicester Centre during the summer service exercise. Commissioning audits of the new equipment and LSO training have been carried out. The remaining two sets of Horiba equipment were installed at Norwich Centre and Southend-on-Sea in March 2005 and commissioning audits and training will be carried out when the installation is completed.

**Table 1.1 Changes to the AURN between January 2004 to May 2005**

| Sites | Date Commenced | Pollutants |
|---|---|---|
| **New sites** | | |
| London Harlington | 1/01/04 | $NO_2$ CO $O_3$ $PM_{10}$ |
| Brighton Preston Park | 3/11/04 | $NO_2$ and $O_3$ |
| Sunderland Silksworth | 9/12/04 | $NO_2$ and $O_3$ |
| | | |
| **Site Relocations** | | |
| Scunthorpe relocated to Scunthorpe Town | Scunthorpe closed 18/3/04 Scunthorpe Town started 6th June 2004 | $SO_2$ $PM_{10}$ |
| Wigan Leigh relocated to | Wigan Leigh closed on 28th | $NO_x$ $O_3$ CO $SO_2$ and |

| Sites | Date Commenced | Pollutants |
|---|---|---|
| Wigan Centre | September 2004. Wigan Centre started on 8th October 2004 | $PM_{10}$ |
| Birmingham East relocated to Birmingham Tyburn | Birmingham East closed on 4th August 2004. Relocated to Birmingham Tyburn starting on August 16th 2004 | $NO_x$ $O_3$ CO $SO_2$ and $PM_{10}$ |
| Norwich Roadside relocated to Norwich Roadside Forum | Norwich Roadside closed on 14 February 2004. Norwich Roadside Forum started on 1st April 2005. | NOx |
| Blackpool relocation in progress | Blackpool closed in November 10th 2004 and relocation is underway. | $NO_x$ $O_3$ CO $SO_2$ and $PM_{10}$ |
| Oxford Centre renamed | Change of name only in Feb 2005 to Oxford Centre Roadside. | All |
| **Additional $O_3$ and/or $NO_x$ (DD3)** | | |
| Glazebury | NOx analyser commissioned on 26th January 2004 | $NO_x$ |
| Eskdalemuir | $NO_x$ analyser commissioned on 9th December 2004. | $NO_x$ |

## 1.2 Overview of Network Performance

Ratified hourly average data capture for the network averaged 95% for all pollutants ($O_3$, $NO_2$, $SO_2$, CO, $PM_{10}$ and $PM_{2.5}$) during the 3-month reporting period October to December 2004 (see Table 1.2 below). This has again been another very good quarter in terms of network performance with average data capture for all the pollutants being above the 90% target level. The annual average network data capture for the calendar year 2004 was 93%.

**Table 1.2 AURN Ratified Data Capture (%) January - December 2004**
(Using the start date of any new site)

| Data Capture (%) | CO | $NO_2$ | $O_3$ | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | Network Average |
|---|---|---|---|---|---|---|---|
| Q1 Jan - March 2004 | 92.0 | 90.3 | 92.0 | 90.9 | 97.9 | 91.6 | 92 |
| Q2 April – June 2004 | 93.2 | 93.5 | 95.1 | 93.2 | 98.1 | 93.1 | 94 |
| Q3 July – Sept 2004 | 93.9 | 91.8 | 94.4 | 93.7 | 95.0 | 93.3 | 94 |
| Q4 Oct – Dec 2004 | 95.0 | 95.6 | 94.6 | 93.6 | 97.8 | 92.4 | 95 |
| **Calendar Year 2004** | **93.6** | **92.8** | **93.8** | **93.7** | **97.2** | **92.5** | **93** |

Overall, 368 out of the 425 analysers (87%) achieved data capture levels above the required 90% target during this reporting period (See Table 1.3). The figures shown in Table 1.3 also demonstrate that the high level of network performance has been consistently maintained throughout the year and across all analyser types in the network. Only a relatively small proportion of analysers (13-20%) failed to meet the 90% data capture target, which is reasonable in a network of this size and complexity.

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

| Total Number of Analysers | | Analysers with Data Capture <90% in 2004 | | | | |
|---|---|---|---|---|---|---|
| | | **Q1 Jan–Mar** | **Q2 Apr - June** | **Q3 July-Sept** | **Q4 Oct - Dec** | **Year 2004** |
| CO | 79 | 16 (20%) | 13 (16%) | 12 (15%) | 13 (16%) | 13 |
| $NO_2$ | 109 | 26 (25%) | 18 (17%) | 24 (23%) | 12 (11%) | 23 |
| $O_3$ | 86 | 14 (16%) | 10 (12%) | 11 (13%) | 13 (15%) | 14 |
| $PM_{10}$ | 71 | 12 (17%) | 11 (16%) | 10 (14%) | 6 (12%) | 7 |
| $PM_{2.5}$ | 4 | 0 | 0 | 0 | 0 | 0 |
| $SO_2$ | 76 | 16 (21%) | 15 (19%) | 12 (16%) | 13 (17%) | 20 |
| All sites | 425 | 84 (20%) | 67 (16%) | 69 (16%) | 57 (13%) | 77 (18%) |

A more detailed breakdown of the hourly data capture statistics for each site is presented in Section 5, Table 5.1 (October – December 2004) and Table 5.2 (January - December 2004). In total, 14 out of the 123 network sites (11%) had an average data capture rate below the required 90% level for the October – December 2004 period. These sites are listed in Table 1.4. The main site operational and QA/QC issues giving rise to data capture below the required 90% level are summarised in Section 4. A summary of the main recommendations made in this report to help improve network performance is given in Appendix A4.

**Table 1.4 Sites with Average Data Capture < 90%, October - December 2004**
(Data capture calculated from site start date)

| | Site | Owner | Site Average Data Capture (%) |
|---|---|---|---|
| | **England** | | |
| 1 | Birmingham Centre | Defra | 81.7 |
| 2 | Camden Kerbside | Affiliate | 80.3 |
| 3 | Leeds Centre | Defra | 88.8 |
| 4 | London Brent | Affiliate | 78.0 |
| 5 | Manchester South | Affiliate | 80.2 |
| 6 | Plymouth Centre | Defra | 86.4 |
| 7 | Rotherham Centre | Affiliate | 82.4 |
| 8 | Stockport Shaw Heath | Affiliate | 70.4 |
| 9 | Tower Hamlets Roadside | Affiliate | 68.3 |
| 10 | Wolverhampton Centre | Defra | 89.9 |
| | **Scotland** | | |
| 11 | Aberdeen | Affiliate | 77.9 |
| 12 | Eskdalemuir | Defra | 83.7 |
| 13 | Strath Vaich | Defra | 77.4 |
| | **Wales** | | |
| 14 | Narberth | Affiliate | 56.9 |
| | **Number of sites < 90%** | | 14 |

Netcen carried out the Winter intercalibration and site operator audits during January to April 2005. Results from this intercalibration exercise have been used to assess the accuracy and consistency of the data for this reporting period. Provisional results of the Winter 2005 intercalibration are discussed in Sections 2.5 to 2.8 of this report and the final

results will be reported in conjunction with the next quarterly report (January – March 2005).

The summer intercalibration is scheduled to start at the beginning of July 2005. 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 LSO Manual

Copies of the Local Site Operator's manual on disc (CD) were distributed to the network participants at the annual LSO meeting in December 2004. If LSOs have not received a copy or further copies are required please contact Andy.Cook@aeat.co.uk. The manual is also available electronically on the 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

## 1.4 AURN Hub Updates

The AURN project information hub web is located at[1]:
http://www.aeat.co.uk/com/AURNHUB/index.html.

The site is regularly up-dated and some of the more recent information includes:

- Up-dated site lists (December 2004)
- Monthly $PM_{10}$ (Gravimetric) exceedences for April 2005
- QA/QC Unit's data ratification and intercalibration report, July - September 2004
- Recent Management Unit reports (January – March 2005)
- All presentations given at the AURN Site Operator's meeting on Dec 1st 2004
- Edition 8 of the Network Newsletter (issued December 2004)

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

# 2 Generic Data Quality Issues

## 2.1 Progress on Monitoring Requirements of the EU Daughter Directives

Installation of all of the additional $NO_x$ and $O_3$ analysers required to comply with the Third Daughter Directive has now been completed. The final $NO_x$ analyser was installed at Eskdalemuir on 13th October 2004 and, after further attention to the $NO_x$ analyser, monitoring commenced on 9th December 2004. Further details on the third Daughter Directive can be found at:
http://www.defra.gov.uk/environment/consult/air-23daughter/index.htm

Two of the four new sites also needed to meet the requirements of DD3 are now operational (Brighton Preston Park and Sunderland Silkworth). Progress is underway to install the remaining two sites and details are given in Table 2.1.

**Table 2.1 New DD3 Monitoring Stations, October 2004**

| New Site | Pollutants | Progress to date | Expected integration date |
|---|---|---|---|
| Brighton Preston Park | $O_3$ and $NO_x$ | The site commenced operation on November 3rd 2004. | Completed |
| Sunderland Silkworth | $O_3$ and $NO_x$ | Following installation of a new $O_3$ analyser, the site was affiliated on 9th December 2004. | Completed |
| Fort William | $O_3$ and $NO_x$ | Planning consent and lease agreement completed. Site installation in progress. | End June 2005 |
| Leominster | $O_3$ and $NO_x$ | Installation of all equipment is complete and awaiting connection of telephone line. | End June 2005 |

## 2.2 $PM_{10}$ Episodes

There have been far fewer exceedences of the daily mean gravimetric $PM_{10}$ standard recorded in 2004 compared to last year. The sites that have recorded the highest number of days with exceedences of 50µg/m$^3$ during 2004 (January to the end of December 2004) based on the final ratified monitoring data are given below:

97 days - London Marylebone Road (Kerbside) – above objective
42 days - Camden Kerbside (Kerbside) – above objective
38 days - Port Talbot (Industry) – above objective
31 days - Glasgow Kerbside (Kerbside)
30 days - Bury Roadside (Roadside)
24 days – Scunthorpe Town (Industrial)

Three of the above sites have exceeded the Air Quality Objective of 35 days > 50µg/m$^3$, to be achieved by 31/12/2004 based on the **ratified** 2004 monitoring results.

The sites that recorded the highest number of days with exceedences of 50μg/m$^3$ from January to the end of April 2005 based on **provisional** results are as follows:

32 days - London Marylebone Road (Kerbside)
23 days - Camden Kerbside (Kerbside)
18 days - Glasgow Kerbside (Kerbside)
13 days – Leeds Centre (Urban background)
8 days - Port Talbot (Industry)
8 days – Bury Roadside (Roadside)

The Leeds Centre site had 7 days exceedences in April 2005, which is unusual for an urban background site. This is likely to be a result of the extensive rebuilding works in the area which are planned to continue for several months.

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 agglomeration[2] 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 necessary to meet the requirements of the First, Second and Third Daughter Directives is given in Appendix A2. In total 61 sites (185 analysers) have been identified as critical for DD1, DD2 or DD3 (25 sites in agglomerations and 36 in zones).

Data capture for all 61 of the critical sites during the 12-month period January to December 2004 is given in Section 5, Table 5.3. The critical sites with less than 90% data capture and the main reasons for data loss at these sites are given in Table 2.2 below. In total, 44 out of the 185 critical site analysers (24%) did not meet the required 90% data capture during 2004 (shown in red in Table 2.2). Note in this period, Scunthorpe was relocated to Scunthorpe Town so both sites now appear in the Table. For the purposes of this analysis these have been counted as one site.

[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 2.2 Critical sites with <90% data capture, January – December 2004**
(Data capture calculated from 1st January to 31st December 2004)

| Critical Sites | | CO | $NO_2$ | $O_3$ | $PM_{10}$ | $SO_2$ | Reason |
|---|---|---|---|---|---|---|---|
| **AGGLOMERATIONS** | | | | | | | |
| Blackpool | DEFRA | 82.4 | 77.7 | 82.6 | 83.5 | 60.4 | Site closed for relocation 10/11/04<br>$SO_2$ pump fault |
| Glasgow Centre | DEFRA | | 88.5 | 97.5 | | 86.6 | Air conditioning fault |
| Hull Freetown | DEFRA | 95.9 | 89.3 | 93.9 | 95.6 | 88.1 | $NO_x$ ozone generator fault<br>$SO_2$ high noise |
| Leicester Centre | DEFRA | 84.9 | 85.5 | 97.8 | 95.6 | 97.3 | Unstable analysers – up-graded in June 04 |
| Newcastle Centre | DEFRA | 85.0 | 81.9 | 90.3 | 92.6 | 83.7 | Air conditioning fault |
| Reading New Town | DEFRA | 94.4 | 93.2 | 86.0 | 96.2 | 88.9 | $SO_2$ lamp faults<br>$O_3$ sample leak after service |
| Southend-on-Sea | DEFRA | 51.6 | 91.5 | 97.4 | 95.7 | 95.2 | High noise response |
| Stoke-on-Trent Centre | DEFRA | 94.2 | 93.2 | 98.0 | 78.2 | 86.6 | TEOM response instability. Analyser replaced.<br>$SO_2$ baseline response instability |
| **ZONES** | | | | | | | |
| Aston Hill | DEFRA | - | 87.0 | 89.4 | - | - | Erratic $O_3$ response due to faulty IZS.<br>$NO_2$ internal sampling and pump fault |
| Eskdalemuir | DEFRA | - | 5.9 | 90.5 | - | - | $NO_x$ started Dec 9th 04 |
| Glazebury | DEFRA | - | 87.3 | 95.9 | - | - | $NO_x$ started 26th Jan 04. |
| Grangemouth | Affiliate | 81.2 | 98.5 | - | 98.3 | 98.6 | CO zero baseline truncation |
| High Muffles | DEFRA | - | 70.1 | 99.2 | - | - | $NO_x$ autocal run-on |
| Leamington Spa | Affiliate | 88.8 | 93.8 | 98.7 | 98.2 | 98.4 | CO baseline response truncation |
| Lough Navar | DEFRA | - | - | 74.8 | | - | Sample manifold fan fault |
| Narberth | Affiliate | - | | 0.0 | | | $O_3$ sampling fault |
| Northampton | Affiliate | 90.4 | 87.1 | 87.2 | 89.8 | 89.3 | Disruption to telemetry and mobile phone service |
| Scunthorpe* | Affiliate | - | - | - | 20.5 | 20.8 | Closed for relocation on 18/3/04 |
| Scunthorpe Town* | Affiliate | - | - | - | 54.4 | 55.5 | New site started 6/6/04 |
| Somerton | Affiliate | - | 88.8 | 95.6 | - | - | $NO_x$ autocal run-on |
| Strath Vaich | DEFRA | - | - | 83.9 | - | - | $O_3$ erratic analyser response |
| Thurrock | Affiliate | | 89.8 | 98.4 | | | $NO_x$ analyser response drift |
| Wicken Fen | DEFRA | - | 73.1 | 93.2 | - | | $NO_x$ baseline truncation |
| Wigan Leigh | Affiliate | 72.0 | 71.4 | 70.2 | 72.4 | 51.4 | Site closed for relocation on 28th Sept 2004<br>$SO_2$ unstable baseline |
| Wrexham | DEFRA | 98.4 | 95.7 | - | 93.7 | 89.0 | $SO_2$ baseline response instability due to air conditioning fault |
| **Number of sites < 90%** | | 7 | 14 | 8 | 5 | 10 | |

Key ▨ Pollutant monitored but not critical at this site

\- Not monitored

*Note Scunthorpe and Scunthorpe Town only counted as one site.

**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 $PM_{10}$ Data Ratification

Gravimetric $PM_{10}$ analysers (Partisols) are located at seven sites in the network (Bournemouth, Northampton, Wrexham, Dumfries, Inverness, London Westminster and Brighton Roadside $PM_{10}$). The gravimetric $PM_{10}$ analyser at Northampton is also co-located with a TEOM analyser which provides a useful check that both techniques are operating correctly. Gravimetric $PM_{10}$ concentrations and the daily mean TEOM scaled by 1.3 at Northampton for the 12-month period January-December 2004 are shown in Figure 2.1. In general, the agreement between the analysers is good, although a problem with the site telemetry resulted in an extended period of TEOM data loss during September.

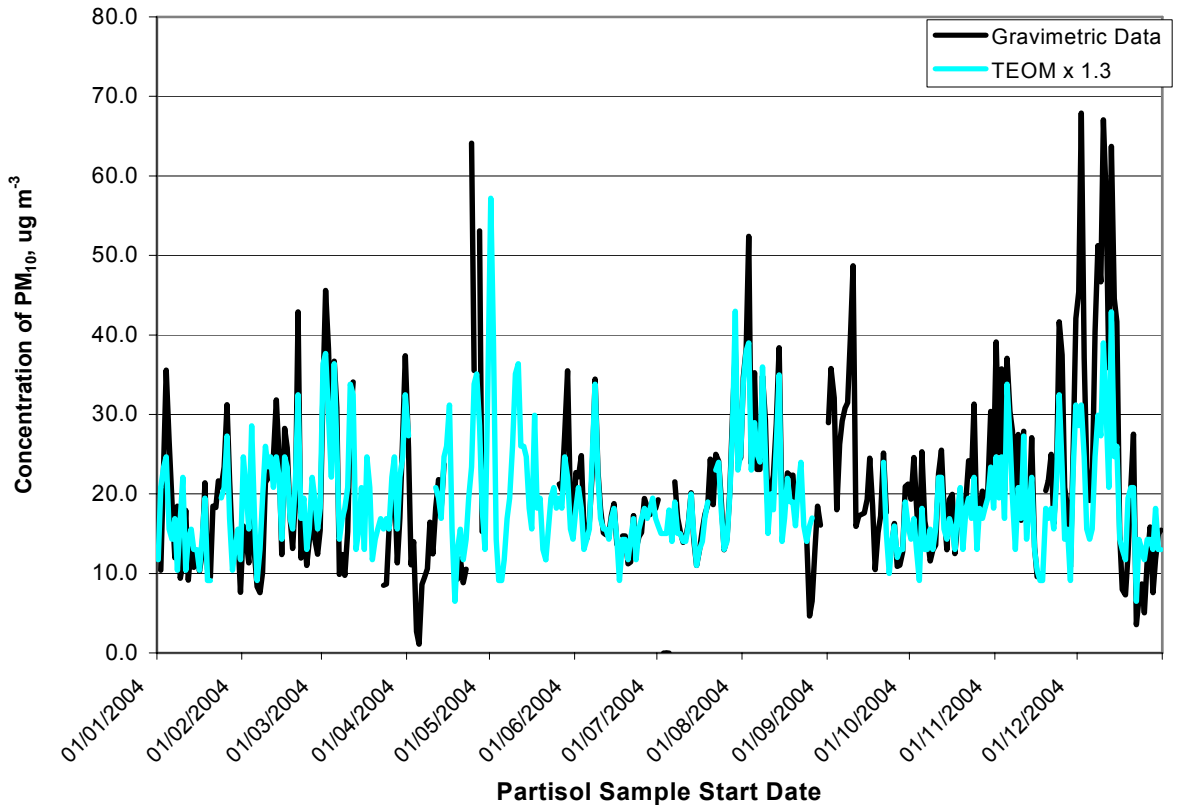



**Figure 2.1 Partisol and TEOM (x1.3) Concentrations at Northampton (January – December 2004)**

Data capture for the gravimetric $PM_{10}$ (Partisol) analysers for the period October - December 2004 and for the total year January – December 2004 is given in Table 2.3. All seven of the gravimetric $PM_{10}$ analysers achieved data capture above the required 90% target for the October - December reporting period. This is the first quarter that all the gravimetric analysers have achieved this. These improved performance levels are likely to reflect the benefits of having installed telemetry systems at 6 out of the seven sites. The

telemetry allows the exposure data and filter numbers to be downloaded automatically and regular checks on the operational status of the analyser can be carried out remotely. Bournemouth is the one remaining Partisol unit that still needs to be connected to telemetry via a separate mobile phone system, as the existing line is not compatible with the Partisol software.

**Table 2.3 Gravimetric $PM_{10}$ Data Capture (%) January – December 2004**
(Calculated from site start date)

| Site | Data Capture (%) October - Dec 2004 | 9-months Data Capture (%) January – Dec 2004 |
|---|---|---|
| Bournemouth | 100.0 | 94.5 |
| Brighton Roadside $PM_{10}$ | 100.0 | 93.7 |
| London Westminster | 94.6 | 94.0 |
| Northampton | 97.8 | 89.8 |
| Dumfries | 100.0 | 91.8 |
| Inverness | 98.9 | 95.1 |
| Wrexham | 98.9 | 93.7 |
| **Average** | **98.6** | **93.2** |

## 2.5 $NO_2$ Converter Efficiencies

Provisional results of the winter 2005 intercalibration exercise identified two converter failures. This was an improvement from the previous audit when 8 converter faults were reported. Both of the converter faults identified were considered to be borderline cases and there was no resulting effect on data quality or capture. The $NO_x$ analyser at Bush Estate failed during the audit so the converter could not be tested. A summary of all the converter faults and the resulting effect on data quality is given in Table 2.4 below.

**Table 2.4 Converter faults identified at the Winter 2005 Intercalibration Exercise (Jan - March 2005)**

| Site | Audit date | Converter Efficiency | Resulting Effect on Data Quality |
|---|---|---|---|
| Lullington Heath | 26/2/05 | 94.2% | Borderline case - no data loss |
| Southwark Roadside | 28/1/05 | 94.9% | Borderline case - no data loss |

**Recommendations**

The ESUs should have already replaced or repaired the faulty converters listed in Table 2.4 during the Winter 2005 service exercise in order to ensure satisfactory performance of the analysers.

The LSOs should continue to pay careful attention to the short-term stability of the $NO_2$ calibration response and notify CMCU if a declining $NO_2$ span is recorded during the calibration. (See trouble-shooting section of the LSO manual for further details).

QA/QC Unit has been taking measures to ensure procedures used in the AURN will comply with any CEN requirements before they become mandatory. The finalised CEN standards set a requirement to ensure that the $NO_x$ converter efficiency is better than 98% for type approval and better than 95% in field operation. $NO_2$ data will have to be rescaled for converter efficiencies between 95-100%, but rejected if below 95%. These are tougher

requirements than currently used where "borderline failures" are accepted. It is, therefore, especially important that the borderline cases also get adequate attention at the service in order to ensure they are set up to operate satisfactorily for the next 6-month period.

**Recommendation**

We recommend that all $NO_x$ analysers should be set up after service with converters operating at 98% or above. This will help to ensure that the converter efficiency remains at a satisfactory level for the next 6-month period ahead.

In order to ensure consistent procedures are adopted throughout the network, QA/QC Unit have recently developed a $NO_x$ converter efficiency calculator spreadsheet, which can be used by the Equipment Support Units as part of their routine 6-monthly service exercise. The spreadsheet provides instructions for testing converters according to CEN methodology and will calculate and warn of results outside acceptable limits. This converter efficiency calculator will shortly be issued to Equipment Support Units for use in the field.

## 2.6 $NO_x$ Switching Valve Leaks

QA/QC Unit now routinely reports potential problems with NOx switching valve leaks as part of the 6-monthly intercalibration checks. If a significant leak in the $NO_x$ /NO channel switching valve is present it may lead to $NO_2$ concentrations being under reported. Results of the checks carried out during the Winter 2005 intercalibration will be reported in the next quarterly report. The Equipment Support Units are notified of any sites with potential switching valve leak problems and it is recommended that the valves are cleaned and checked during each service.

## 2.7 Ozone Outliers

Provisional results showed that 23 out of 84 ozone analysers tested (27%) were identified as outliers during QA/QC Unit's winter 2005 intercalibration exercise (See Table 2.5). This is consistent the previous Summer intercalibration where 26% of the analysers tested were identified as outliers. Where appropriate, the data from these sites have been rescaled accordingly during the ratification process.

**Table 2.5 Ozone outliers identified at the winter 2005 intercalibration**

| | Site | Summer 2004 Outlier |
|---|---|---|
| 1 | Barnsley Gawber | -6% |
| 2 | Birmingham Tyburn | +27% |
| 3 | Coventry Memorial Park | +10% |
| 4 | Derry | -44% |
| 5 | Glazebury | +8% |
| 6 | Leeds Centre | -8% |
| 7 | London Hillingdon | +22% |
| 8 | London Lewisham | =38% |
| 9 | London Southwark | +21% |
| 10 | London Teddington | -19% |
| 11 | London Wandsworth | -8% |
| 12 | Manchester Piccadilly | +13% |
| 13 | Manchester South | +8% |

| | | |
|---|---|---|
| 14 | Narberth | -13% |
| 15 | Northampton | +10% |
| 16 | Plymouth Centre | +30% |
| 17 | Portsmouth | +7.5% |
| 18 | Preston | -6% |
| 19 | Salford Eccles | +9% |
| 20 | Sibton | -25% |
| 21 | Stoke-on-Trent | -16% |
| 22 | St Osyth | -8% |
| 23 | Strath Vaich | +12% |

## 2.8 TEOM $k_0$

Three out of the 67 TEOM instruments tested during the Winter 2005 intercalibration were found to be operating with a calibration constant ($k_0$) outside the acceptable ± 2.5% deviation. These were at London A3 Roadside, Portsmouth and Glasgow Kerbside. In all cases the value of the calibration constant stamped on the sensor unit was found to be different from the value stored in the control unit. (See Table 2.6). Details of the resulting effect on data quality data is also provided in Table 2.6.

In addition, the following four TEOM analysers were also found to be operating outside of the expected flow rates during the audits. These were at:

- Norwich Centre (main flow +11%)
- Southend-on-Sea (auxiliary flow –23%)
- London Brent (auxiliary flow –13%)
- Narberth (main/auxiliary flow settings)

It is unlikely that these flow outliers will have a significant effect on the resulting data quality, however this will be examined in detail during the next ratification period. At Narberth there was a discrepancy in the flows stated by the instrument (3 l/min main and 13.6 l/min auxiliary) and the actual flow rates measured at the audit (1.73 l/min main and 14.5 l/min auxiliary). Consequently the mass concentrations recorded during the 3-month period that this instrument was in place (November 8th 2004 until 3rd February 2005) were erroneous and have been deleted.

As part of the winter intercalibration exercise, QA/QC Unit completed the task of gathering additional information on the operational configuration of $PM_{10}$ analysers in the network. Full details of this will be reported in the next intercalibration report.

**Table 2.6 TEOM $k_0$ issues identified at the Winter 2005 Intercalibration**

| Site | Problems identified at audit | Effect on data quality |
|---|---|---|
| Portsmouth | $k_0$ values were found to be different on sensor unit and in the control unit software at the Summer audit and again at the Winter audit on 10/1/05 ($k_0$ +4.5%) | Data rescaled from 1 January 2004 until service on 18th January 2005. ESU to confirm that the control unit was reset to agree with sensor at the service. |
| London A3 Roadside | $k_0$ on sensor and control unit different by 10% at summer audit on 8/7/04. The TEOM was exchanged on 24 July 2004. | Data rescaled from when the replacement TEOM was installed on 21st April until the ESU visit on 23rd July 2004 to |

| | | |
|---|---|---|
| | At the following Winter 2005 audit the $k_0$ on sensor and control unit was found different again. ($k_0$ + 3.3%). | exchange the TEOM. Further data rescaling was required to reduce the data by 3.3% from 24th July until the service in January 2005. ESU to confirm that the control unit was reset to agree with sensor at the service. |
| Glasgow Kerbside | $K_0$ on sensor and control unit different by –16% at winter audit on 9/3/05. | This TEOM has shown a history of response instability problems after filter changes and the large $k_0$ deviation may be due to this. A new TEOM sensor and controller were fitted on 29/3/04. Any necessary data rescaling from January 2005 until the repair will be carried during the next ratification period. |

**Recommendations**

The ESUs need to confirm that the necessary changes have been made to re-set the TEOM $k_0$ at Portsmouth and London A3 roadside. In these cases the value of the calibration constant stamped on the sensor unit was found to be different from the value stored in the control unit. Neglecting to rectify any TEOM $k_0$ differences identified at the audits causes unnecessary complications during ratification with additional effort being required to retrospectively rescale many months of data.

## 2.9 Zero Response Truncation

There were no sites where significant periods of data were lost due to zero truncation (or baseline clipping) during the period October – December 2004. This is a good result and shows that the analysers are being configured correctly and response drifts are being carefully monitored over time. Zero response truncation can occur when the analyser response drifts downwards until it falls below the minimum response threshold resulting in extended period of 0mV response. This problem can arise if the analyser is not configured to output negative voltages or if the logger cannot record a response below a certain voltage threshold.

**Recommendation**

We continue to recommend that, wherever possible, all analysers are routinely set up after the service with zero baseline offsets of 20-50mV.

## 2.10 Auto-Calibration Run-ons

Autocalibration ”run-on” is a generic problem affecting many analysers in the network and is due to autocalibration gas leaking into the sampling system during the ambient measurement period immediately after the autocalibration cycle. The problem can be identified by examining the diurnal variation of $NO_2$ concentrations for the individual sites. Invalid measurements (usually between 01:30 and 02:00) have been removed during data ratification. This can be a serious source of data loss resulting in one hour out of twenty

four being deleted, which is 4% of the annual data capture. At some sites significantly more data are being lost resulting in data capture below the 90% data capture target for the period.

The ESUs have investigated the autocalibration run-ons at many of the sites and tried different ways to resolve the problem including thorough cleaning of the solenoid valves and installation of permapure driers. In most cases this has improved the situation but it has not always eliminated the problem completely. The 37 sites showing continuing problems with the autocalibration run-on during October to December 2004 are given in Table 2.7. Any autocalibration run-on data that look visibly significant have been deleted from these data sets during ratification.

**Table 2.7 Estimate of Spike or Dip due to Auto-calibration Run-on (15-minute average) July – September 2004**

| Site | Pollutant | Run-on (ppb) | Data loss (Hours per day) | Autocal span concentration (ppb) |
|---|---|---|---|---|
| **Aberdeen** | $NO_2$ | 6 | 2 | 200 |
| **Birmingham Centre** | $NO_2$ | 7 | 1 | 750 |
| Blackpool | $NO_2$ | 3 | 1 | 400 |
| **Bury Roadside** | $NO_2$ | 6 | 1 | 700 |
| **Bush Estate** | $NO_2$ | 3.4 | 2 | 240 |
| Derry | $NO_2$ | 4 | 1 | 300 |
| **Dumfries** | $NO_2$ | 6 | 1 | 700 |
| **Eskdalemuir** | $NO_2$ | 1.5 | 2 | 500 |
| **Exeter Roadside** | $NO_2$ | 9 | 1 | 500 |
| **Glazebury** | $NO_2$ | 6.2 | 2 | 190 |
| **Harwell** | $NO_2$ | 2 | 2 | 200 |
| **High Muffles** | $NO_2$ | 2 | 5 | 500 |
| **Ladybower** | $NO_2$ | 3.4 | 2 | 300 |
| **Leamington Spa** | $NO_2$ | 6 | 2 | 750 |
| **Lullington Heath** | $NO_2$ | 2.1 | 2 | 300 |
| London Teddington | $NO_2$ | 3.9 | 1 | 500 |
| **Manchester Town Hall** | $NO_2$ | 7 | 2 | 450 |
| **Market Harborough** | $NO_2$ | 3 | 2 | 350 |
| **Middlesbrough** | $NO_2$ | 4 | 2 | 450 |
| **Narberth** | $NO_2$ | 2.2 | 3 | 150 |
| Newcastle Centre | $NO_2$ | 4 | 1 | 300 |
| Norwich Centre | $NO_2$ | 3 | 1 | 300 |
| Preston | $NO_2$ | 4 | 1 | 500 |
| Reading New Town | $NO_2$ | 4 | 1 | 250 |
| **Somerton** | $NO_2$ | 1.5 | 2 | 200 |
| Southampton Centre | $NO_2$ | 5 | 1 | 850 |
| Southend-on-Sea | $NO_2$ | 3 | 1 | 200 |
| St Oysth | $NO_2$ | 2.9 | 1 | 300 |
| **Stoke-on-Trent** | $NO_2$ | 5 | 1 | 335 |
| Wrexham | $NO_2$ | 3 | 1 | 350 |
| London Brent | $NO_2$ | 4 | 1 | 1400 |
| Bournemouth | $SO_2$ | 0.1 | 1 | 300 |
| London Brent | $SO_2$ | 1 | 1 | 900 |
| Narberth | $SO_2$ | 0.2 | 1 | 500 |
| **Reading New Town** | $SO_2$ | 1 | 2 | 600 |
| Stoke-on-Trent | $SO_2$ | 1 | 1 | 650 |
| Narberth | $O_3$ | -3 | 1 | zero run-on |

**Recommendations**

ESU to investigate and minimise effect where possible, especially at sites with large autocalibration run-ons or where data loss is in excess of 1 hour. These sites are shown in **bold** in Table 2.7.

QA/QC Unit and CMCU are currently arranging meetings with the Equipment Support Units to discuss the autocalibration run-ons and to identify ways to resolve the problem.

In the meantime, we recommend that the autocalibration devices be adjusted at the problem sites to reduce the concentration of the span gas. It is strongly advised that $NO_2$ autocalibration span concentrations of less than 200ppb (urban sites) and 100ppb (rural sites) are used throughout the network.

At High Muffles where the autocalibration run-on is causing up to 50% data loss at a critical site, we recommend that the autocalibration span is switched off and with just the autocalibration zeros being recorded for data validation purposes, until a satisfactory solution can be found.

# 3 Site Specific Issues

## 3.1 Manchester South $SO_2$

The $SO_2$ analyser at Manchester South has shown a history of high noise response over the last year which is likely to be related to temperature instability. The noise levels increased following an ESU visit on 16th November and two months of poor quality data from 16th November 2004 until the service on 19th January 2005 have been deleted. (See Figure 3.1) This analyser is also currently configured to operate on a more sensitive range of 0.2ppb/mV which might also contribute to the increased response noise recorded.

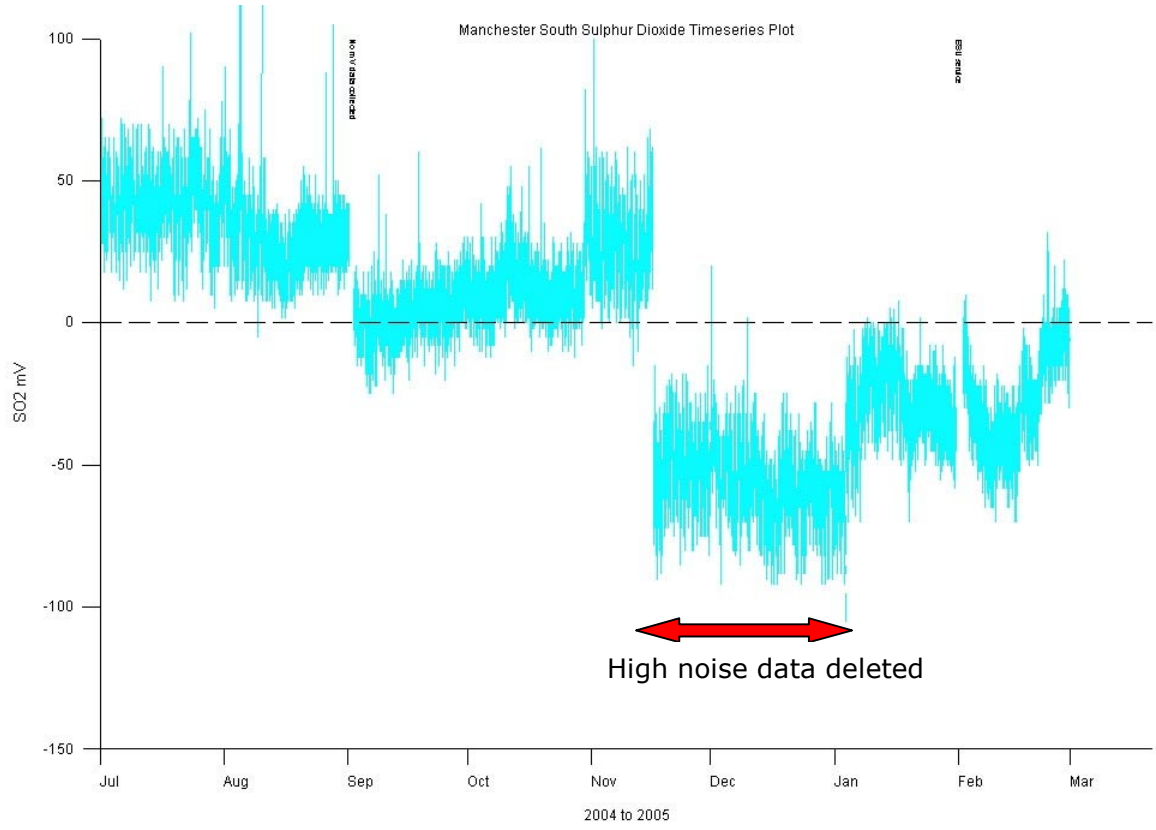


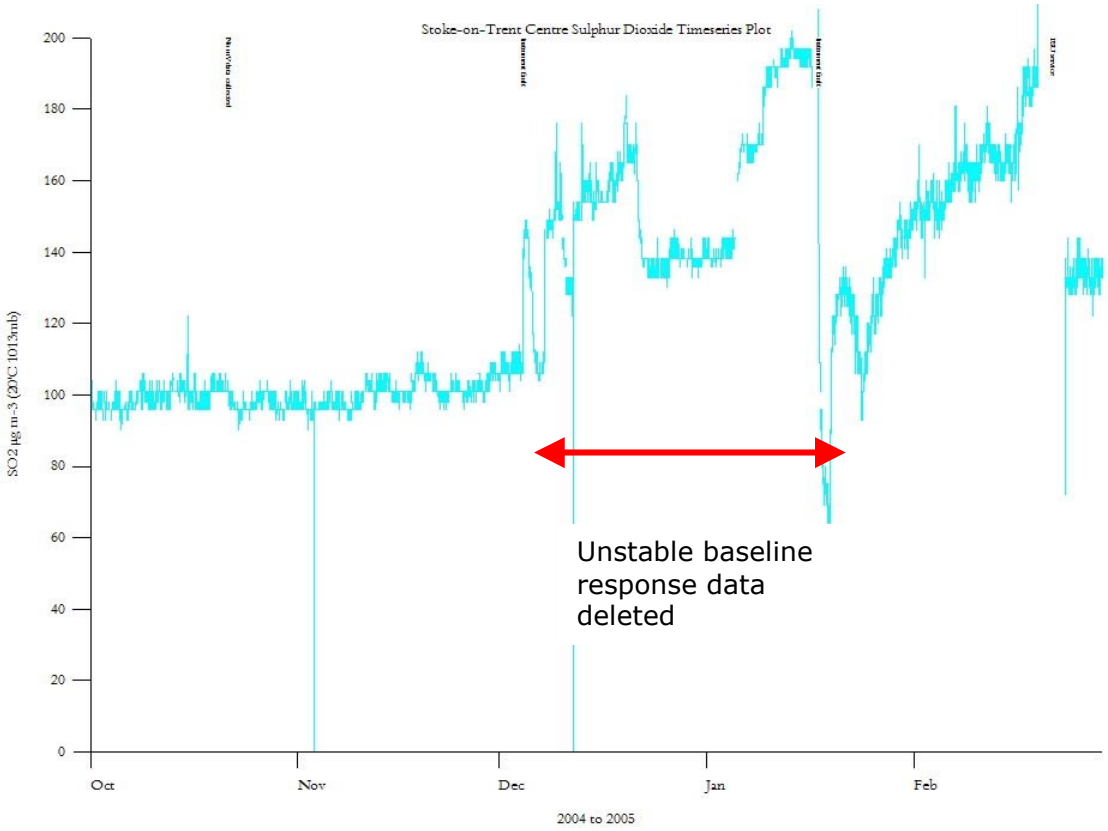

**Figure 3.1 Manchester South $SO_2$ High Response Noise, Nov 2004 – Jan 2005**

**Recommendation**

| |
|---|
| We recommend that the $SO_2$ analyser at Manchester South should be up-graded or repaired. The ESU should also investigate the temperature instability within the site/analyser enclosure and consider operating the analyser on a less sensitive running range (e.g. 0.5 ppb/mv). |

## 3.2 Stoke-on-Trent $SO_2$

The $SO_2$ analyser at Stoke-on-Trent showed erratic baseline response resulting in 7 weeks data rejection from 4th December until 27th January 2005 (See Figure 3.2). Despite the analyser's UV lamp being replaced on 10th December and optical filter replaced on 17th January 2005, the baseline response drift continued. Further data loss is likely as provisional data for February and March 2005 indicate that the problem may be on-going.




s

**Figure 3.2 Stoke-on-Trent $SO_2$ unstable baseline response, Dec 2004 – Feb 05**

**Recommendation**

| |
|---|
| The $SO_2$ baseline response problem at Stoke-on-Trent should be investigated by the ESU as soon as possible, if not already repaired, as this is a critical site. |

## 3.3 Camden Kerbside NOx

There has already been considerable $NO_x$ data loss at this site from 19th January until 5th May 2004 (3.5 months) due to a blocked ozone orifice causing low readings for both NO and $NO_2$. Details of this problem were documented fully in the January-March 2004 data ratification report. On 15th July the $NO_x$ analyser was replaced because the multiplexer in the analyser had failed. There followed a number of operational problems with the vacuum pump and an ozone generator fault occurred on 21st October 2004. As a result, three months of data from 21st July until the repaired analyser was reinstated on 28th

October have been deleted due to a combination of operational faults and unacceptably large deviations in calibration response over this period. (See Figure 3.3).

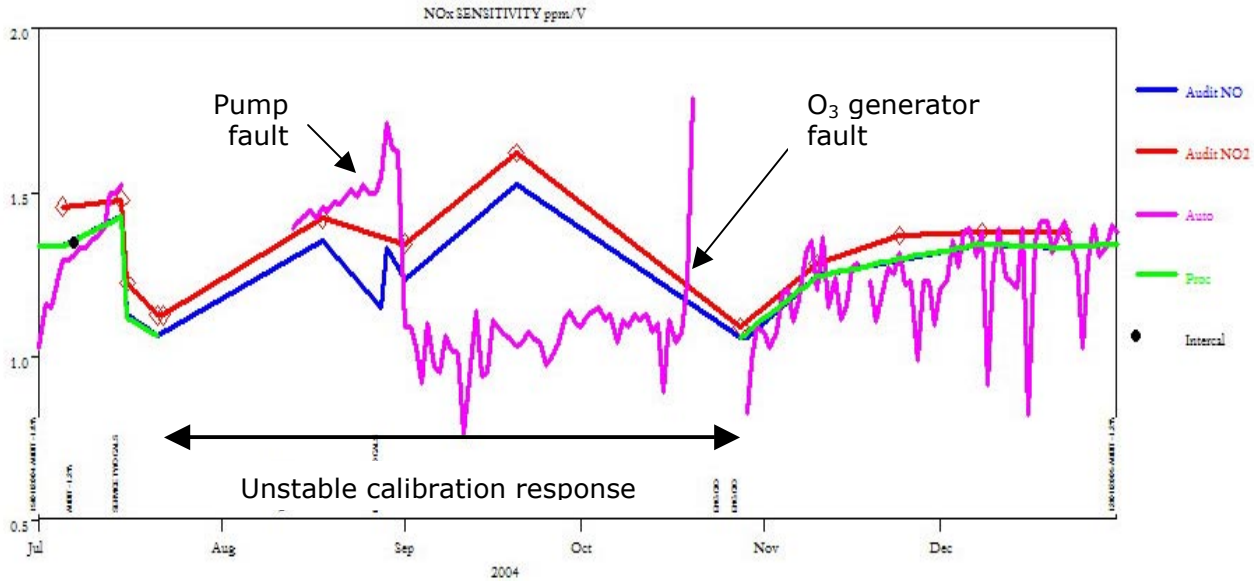



**Figure 3.3 Camden Kerbside $NO_x$ calibration response deviations July-Dec 2004**

## 3.4 Exeter Roadside CO

The CO analyser at Exeter Roadside has shown a prolonged history of baseline response instability which continued throughout this period (See Figure 3.4). Although in this case the amount of data rejected was not great (2 weeks in this period), considerable additional effort is required to process the data from instruments showing this degree of response instability over extended time periods. QA/QC Unit are currently developing a long-term performance checking system to help identify individual analysers such as this one, where improvements could be made. (See Section 3.6).

**Recommendation**

| |
|---|
| We recommend that the ESU investigate the cause of the CO baseline response instability at Exeter Roadside and either repair or up-graded the analyser. |

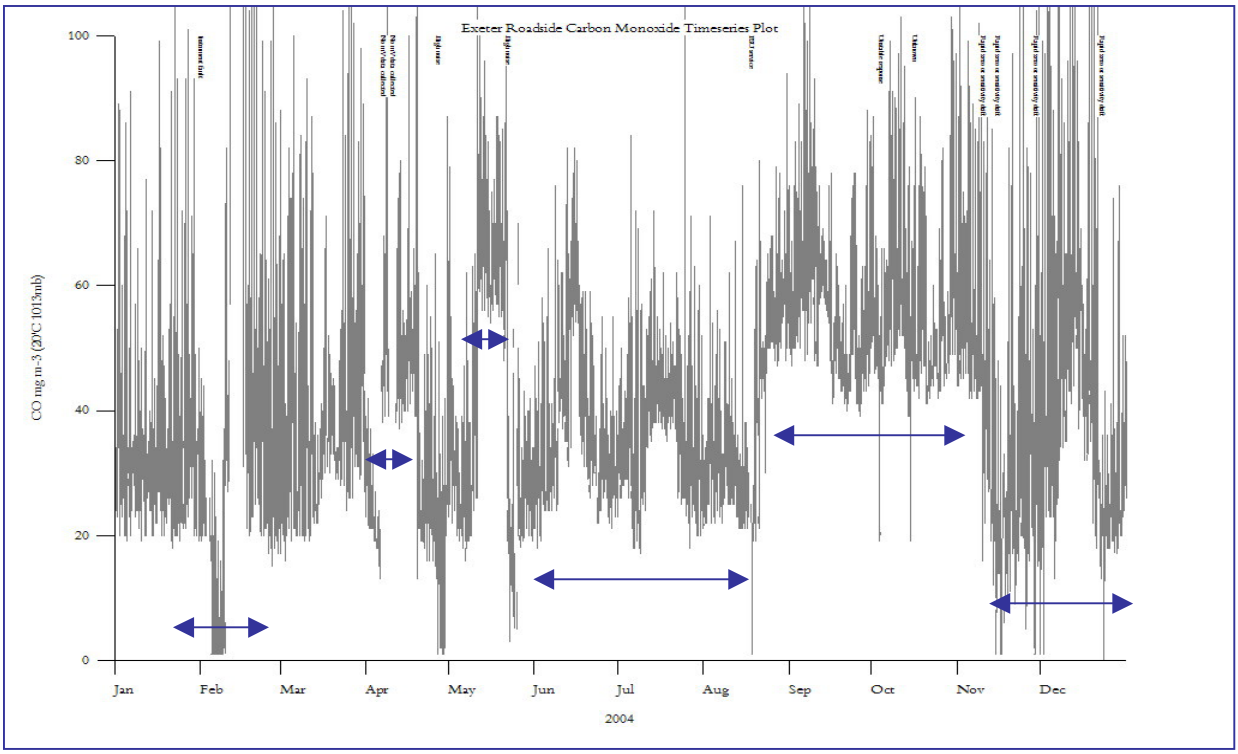



**Figure 3.4 Exeter Roadside CO baseline response instability, Jan-Dec 2004**

## 3.5 Ozone Analyser Faults

There have been a number of operational issues with some of the new API M400 ozone analysers that were installed in the AURN, as part of the major equipment replacement programme that took placed in summer 2003. Some of these problems appear to have extended beyond a reasonable "teething period" and are now having a detrimental impact on the resulting data quality and time taken to ratify the data set. In general the faults have resulted in intermittent periods of spurious high concentration spikes being recorded. Recent examples seen are given in Table 3.1 below and shown in Figure 3.5:

**Table 3.1 Examples of ozone analyser problems, 2004**

| Site | Problem | Date of Occurrences |
|---|---|---|
| Aston Hill | Fault associated with IZS cycle. Analyser replaced six times over the 2-month period August – Sept | April, June, August-Sept 2004 |
| Strath Vaich | Intermittent fault giving erratic false high ozone spike. Analyser replaced end of October. | August, Sept, October 2004 |
| Eskdalemuir | Response instability. Analyser replaced in July. | June |
| Sibton | Intermittent fault giving false high ozone spikes. Analyser replaced twice in October. | June, October |
| Glazebury | Occasional spurious high spikes. Power supply fault in May. | January–March, May, June, August |
| Harwell | Problems with $O_3$ thermistor board. Analyser replaced in October with a faulty analyser that gave erratic high response | October 2004 |

It appears that the ESU has made a considerable effort to attend to these problems. However, the unreliable performance of the instruments and high frequency at which the analysers are being removed from site for repair is not satisfactory, considering that these are "new" instruments located at the more distant rural sites. At many of these sites the problem API M400 analysers have now been removed and replacement instruments installed in their place. Where replacement analysers have been installed, it has often not been possible to configure the autocalibration systems and therefore analysers have been left operating without daily calibration checks. This is also clearly unsatisfactory in terms of operational performance checking and for data ratification purposes (e.g. checking zero response stability and span drift between photometer calibrations).

**Recommendation**

| |
|---|
| QA/QC Unit would like to seek clarification from the Equipment Support Unit/manufacturer as to the current situation regarding the reason for the problems and what plans are in place to resolve them. We recommend that immediate attention is given to this issue as the majority of these instruments are located at critical sites. |

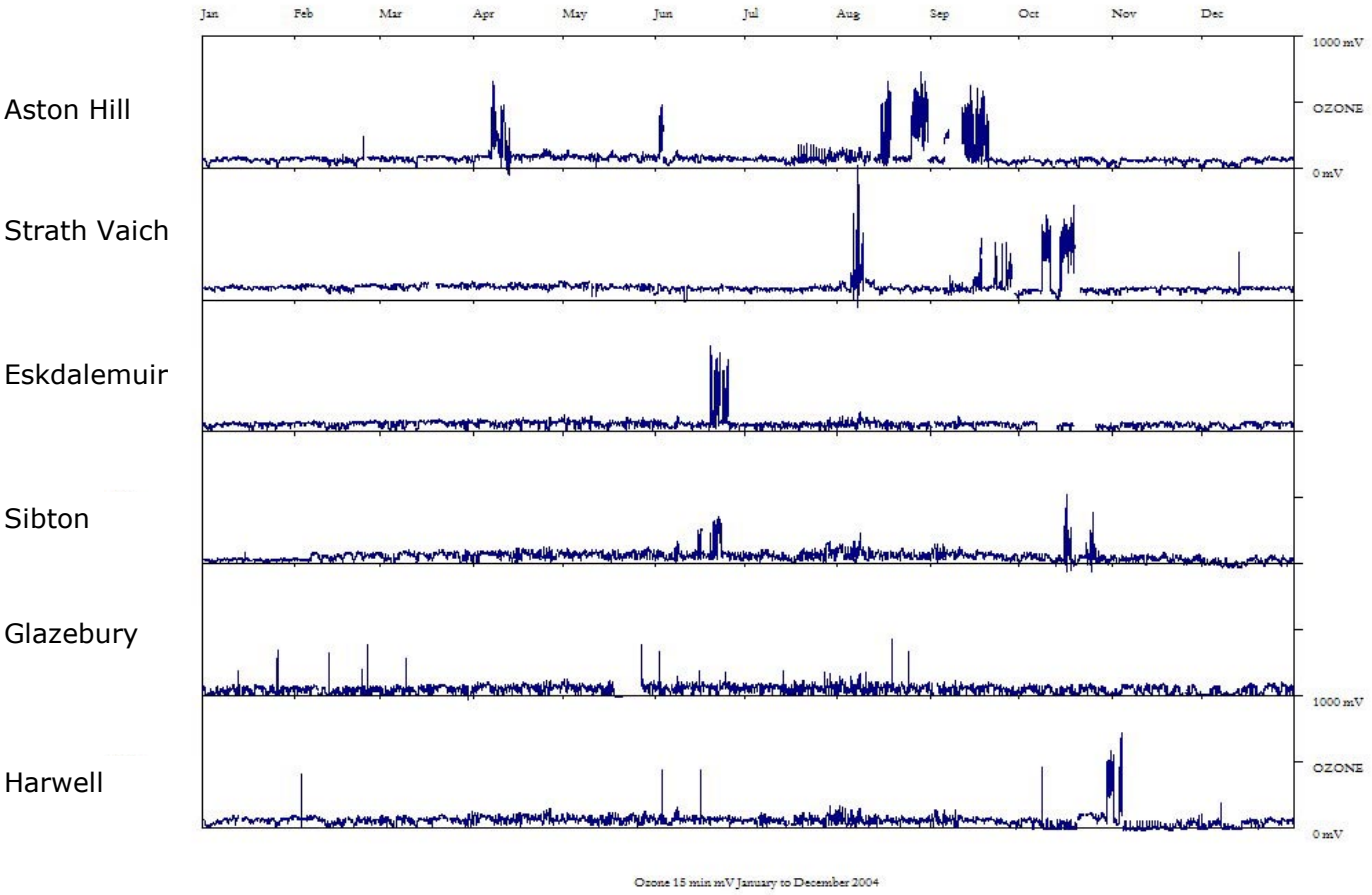



**Figure 3.5 Spurious high ozone response data (raw Mv data 15-min average) January – December 2004**

## 3.6 Long–term Performance Checking

QA/QC Unit is currently developing long-term performance checking tools to help identify problematic analysers in the network. With over 425 instruments operating continuously, there are inevitably going to be instrument breakdowns and problems with response drift and instability over time. A successful system of "emergency call-outs" is in place to deal with these problems and for the most part the data loss is minimised. In general, approximately 20% of the instruments do not achieve the 90% data capture target during each data ratification period. In order for QA/QC Unit to make recommendations to improve network performance it important to be able determine whether it is the same 20% of analysers that are repeatedly causing the problems, or whether in fact the problems are just sporadic one-off cases. A new method of reviewing analyser performance over time to get an indication of how the sites are performing and help identify the "worst cases" is being developed and an example of this is shown in Figure 3.6. These time series plots show the monthly data capture for each instrument at a selection of AURN sites. It can be seen that some sites immediately stand out as having consistently low data capture (e.g. Narberth and Plymouth Centre). This type of analysis will also be able to show the benefits of any future improvements that have been made at some of the historically bad sites. A full analysis of all sites/analysers will be carried out and reported separately some time in the near future.

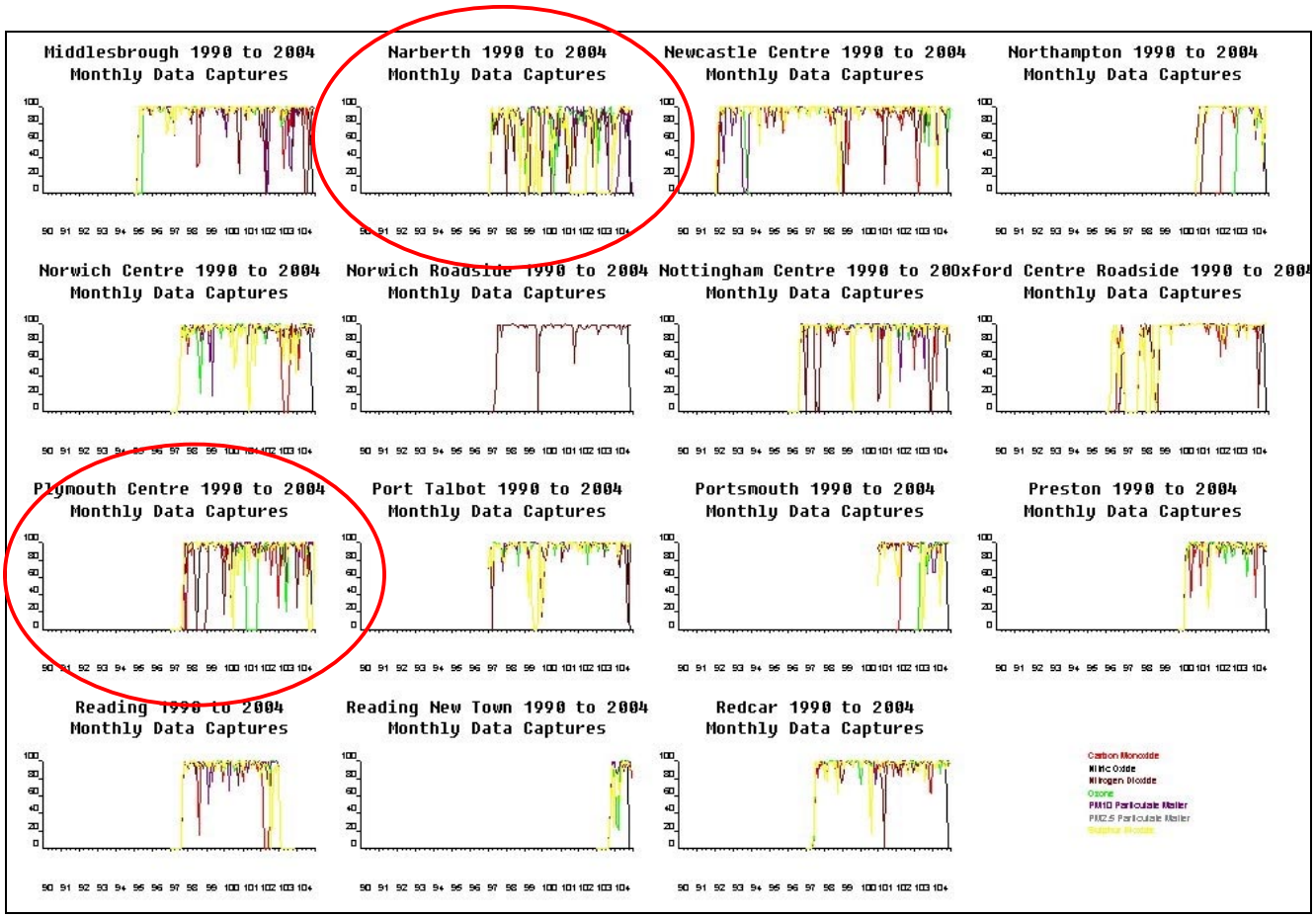



**Figure 3.6 Example time series plots of monthly data capture for AURN sites**

# 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 2004 (Table 4.1). The number of days and hours of data lost for each cause is also given. In some cases the data gap extends beyond this three-month reporting period.

**Table 4.1 Sites with data capture below 90% October to December 2004**
(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** | | | | | | | |
| **Birmingham Centre** | | | | | | | |
| General | | 30-Oct-04 | 12-Nov-04 | Telemetry | Disruption to telemetry caused by change from mobile phone to land line resulted in intermittent data loss for all pollutants from 30th October to 12th November (10 days in total). | | |
| CO | 79.9% | 22-Oct-04 | 06-Nov-04 | Instrument fault and Telemetry | IR detector fault followed by pump fault and then telemetry problems. | 15.3 | 367 |
| | | 08-Nov-04 | 09-Nov-04 | Telemetry | Telemetry problem | 1.6 | 39 |
| | | 11-Nov-04 | 12-Nov-04 | Telemetry | As above | 0.9 | 22 |
| $NO_2$ | 81.2% | 30-Oct-04 | 06-Nov-04 | Telemetry | As above | 7.6 | 183 |
| | | 08-Nov-04 | 09-Nov-04 | Telemetry | As above | 1.6 | 39 |
| | | 11-Nov-04 | 12-Nov-04 | Telemetry | As above | 0.9 | 22 |
| | | 20-Dec-04 | 23-Dec-04 | Telemetry | As above | 3 | 71 |
| $O_3$ | 76.1% | 19-Oct-04 | 06-Nov-04 | Instrument fault And Telemetry | Spurious low concentration data rejected followed by telemetry problem. | 18.7 | 449 |
| | | 08-Nov-04 | 09-Nov-04 | Telemetry | Telemetry problem | 1.6 | 39 |
| | | 11-Nov-04 | 12-Nov-04 | Telemetry | As above | 0.9 | 22 |
| $PM_{10}$ | 88.3% | 30-Oct-04 | 06-Nov-04 | Telemetry | As above | 7.6 | 183 |
| | | 08-Nov-04 | 09-Nov-04 | Telemetry | As above | 1.6 | 39 |
| | | 11-Nov-04 | 12-Nov-04 | Telemetry | As above | 1 | 25 |
| $SO_2$ | 82.8% | 30-Oct-04 | 06-Nov-04 | Telemetry | As above | 7.6 | 183 |
| | | 08-Nov-04 | 09-Nov-04 | Telemetry | As above | 1.6 | 39 |
| | | 11-Nov-04 | 12-Nov-04 | Telemetry | As above | 0.9 | 22 |
| | | 11-Dec-04 | 16-Dec-04 | Sampling fault | Pump fault | 5 | 120 |
| **Blackpool** | | | | | | | |
| CO | 42.7% | 12-Oct-04 | 14-Oct-04 | ESU service | ESU 6-monthly service | 2.1 | 51 |
| | | 11-Nov-04 | 31-Dec-04 | Monitoring suspended | Site closed on 11th November due to redevelopment in the area. To be relocated at nearby Stanley School. | 50.5 | 1213 |
| $NO_2$ | 40.8% | 12-Oct-04 | 14-Oct-04 | ESU service | Service | 2.1 | 51 |
| | | 11-Nov-04 | 31-Dec-04 | Monitoring suspended | Site closed for relocation | 50.6 | 1214 |
| $O_3$ | 42.8% | 12-Oct-04 | 14-Oct-04 | ESU service | Service | 2.1 | 51 |
| | | 11-Nov-04 | 31-Dec-04 | Monitoring suspended | Site closed for relocation | 50.5 | 1213 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $PM_{10}$ | 42.6% | 12-Oct-04 | 14-Oct-04 | ESU service | Service | 2.1 | 51 |
| | | 11-Nov-04 | 31-Dec-04 | Monitoring suspended | Site closed for relocation | 50.5 | 1213 |
| $SO_2$ | 42.7% | 12-Oct-04 | 14-Oct-04 | ESU service | Service | 2.1 | 51 |
| | | 11-Nov-04 | 31-Dec-04 | Monitoring suspended | Site closed for relocation | 50.5 | 1213 |
| **Bradford Centre** | | | | | | | |
| CO | 88.5% | 27-Oct-04 | 27-Oct-04 | PC fault | Computer/communications fault. PC replaced. | 0.4 | 9 |
| | | 22-Dec-04 | 14-Jan-05 | Instrument fault | Instrument response instability caused by internal temperature sensor fault | 23.1 | 555 |
| **Brighton Preston Park** | | | | | | | |
| General | | | | | New DD3 site started on 3rd November 2004 | | |
| $O_3$ | 89.5% | 11-Dec-04 | 16-Dec-04 | Unstable response | Instrument response instability. Fault cleared itself after auto calibration cycle on 16th Dec. | 5.5 | 133 |
| **Camden Kerbside** | | | | | | | |
| $NO_2$ | 69.5% | 21-Jul-04 | 28-Oct-04 | Unstable response | Unstable analyser response due to pump and $O_3$ generator faults. Data deleted from last stable calibration on 21 July until repair on 28th October. (See Section 3.3) | 99.1 | 2379 |
| **Exeter Roadside** | | | | | | | |
| General | | | | | CO analyser has shown a history of unstable baseline response. Excessive response drift continued during this period resulting in short periods of data rejection. (See section 3.4) | | |
| CO | 88.5% | 03-Oct-04 | 04-Oct-04 | Unstable response | Response instability | 0.3 | 7 |
| | | 15-Oct-04 | 15-Oct-04 | Unstable response | As above | 0.3 | 6 |
| | | 09-Nov-04 | 10-Nov-04 | Unstable response | As above | 0.8 | 18 |
| | | 14-Nov-04 | 18-Nov-04 | Unstable response | As above | 3.1 | 74 |
| | | 28-Nov-04 | 02-Dec-04 | Unstable response | As above | 4.1 | 98 |
| | | 22-Dec-04 | 24-Dec-04 | Unstable response | Ad above | 1.7 | 41 |
| **Harwell** | | | | | | | |
| General | | | | | The $O_3$ analyser showed repeated faults throughout Oct and Nov resulting in missed or erratic data. (See section 3.5) | | |
| $O_3$ | 67.6% | 04-Oct-04 | 05-Oct-04 | Instrument fault | Analyser "locked up" and not responding | 1.4 | 34 |
| | | 08-Oct-04 | 04-Nov-04 | Instrument fault | Analyser locked up. Faulty heater board replaced. | 27.3 | 654 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | 14-Dec-04 | 14-Dec-04 | Unstable response | Problems continued until replacement analyser installed<br>Spurious data rejected | 0.3 | 6 |
| **High Muffles** | | | | | | | |
| $NO_2$ | 85.6% | 01-Nov-04 | 30-Nov-04 | Autocal run-on | Extreme autocalibration run-on problem resulting in up to 6 hours data loss per day. (See Section 2.10) | 0.3 | 6 |
| **Leeds Centre** | | | | | | | |
| General | | | | | CO and $_{SO2}$ analysers are old and unstable. Site was up-graded with new analysers in April 2005. | | |
| CO | 82.4% | 27-Oct-04 | 11-Nov-04 | Instrument fault | Correlation wheel motor fault | 15.3 | 368 |
| $SO_2$ | 63.8% | 29-Nov-04 | 31-Dec-04 | Unstable response | Unstable baseline response due to pump fault. | 33 | 791 |
| **Leicester Centre** | | | | | | | |
| CO | 82.6% | 02-Nov-04 | 17-Nov-04 | Unstable response | Spurious large (33%) step change in sensitivity possibly due to a flow fault. | 15 | 361 |
| | | 13-Dec-04 | 14-Dec-04 | No mV data collected | No reason provided | 0.5 | 13 |
| **London Brent** | | | | | | | |
| General | | | | | Site temporarily closed from 19-29th Nov due to building refurbishment at the school. | | |
| CO | 53.7% | 19-Nov-04 | 17-Jan-05 | Instrument fault | Analyser fault after site resumed operation on 29th Nov. Rapid baseline drift causing response to go off-scale. Analyser repaired and chopper wheel replaced on 17th January 05 | 58.9 | 1414 |
| $NO_2$ | 83.4% | 19-Nov-04 | 01-Dec-04 | Monitoring suspended | Site temporarily closed | 11.5 | 277 |
| $O_3$ | 88.5% | 19-Nov-04 | 29-Nov-04 | Monitoring suspended | As above | 10.2 | 244 |
| $PM_{10}$ | 86.2% | 19-Nov-04 | 01-Dec-04 | Monitoring suspended | As above | 12.3 | 295 |
| $SO_2$ | 78.3% | 13-Nov-04 | 14-Nov-04 | Unstable response | Short period of high noise and negative data deleted | 1.3 | 30 |
| | | 19-Nov-04 | 01-Dec-04 | Monitoring suspended | Monitoring restarted after building refurbishment. | 12.1 | 290 |
| | | 06-Dec-04 | 07-Dec-04 | Switched out-of-service | | 1 | 23 |
| | | 23-Dec-04 | 25-Dec-04 | Instrument fault | Very noisy data deleted. UV lamp replaced in January | 2.3 | 56 |
| **London Eltham** | | | | | | | |
| $PM_{10}$ | 89.3% | 26-Oct-04 | 04-Nov-04 | Response instability | TEOM high noise data deleted. ESU re-tuned amplifier board. | 9.2 | 221 |
| London Hackney | | | | | | | |
| CO | 88.1% | 23-Oct-04 | 03-Nov-04 | Instrument fault | Unstable high noise data deleted due to IR lamp fault. New lamp fitted | 10.7 | 256 |
| $O_3$ | 86.4% | 07-Sep-04 | 11-Oct-04 | Instrument fault | Internal temperature sensor | 34.4 | 826 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | fault giving rise to intermittent periods of flat response. | | |
| | | 18-Oct-04 | 19-Oct-04 | No mV data collected | No information provided | 1 | 24 |
| **London Harlington** | | | | | | | |
| $O_3$ | 81.4% | 14-Oct-04 | 28-Oct-04 | ESU service | Analyser temperature fault at service. Instrument removed for repair. | 14.2 | 341 |
| | | 15-Nov-04 | 17-Nov-04 | No mV data collected | Telemetry fault | 2.5 | 61 |
| **London Lewisham** | | | | | | | |
| $O_3$ | 84.9% | 20-Oct-04 | 29-Oct-04 | Sampling fault | Sample pump failed to restart after brief power cut. Repaired at service on 29/10/04. | 9.2 | 221 |
| | | 05-Nov-04 | 09-Nov-04 | Power cut | Site power failure due to electrical work taking place. | 4.2 | 101 |
| **London Marylebone Road** | | | | | | | |
| $SO_2$ | 89.4% | 30-Sep-04 | 10-Oct-04 | Sampling fault | Pump fault followed by contamination of sampling system by permeation tube. | 10.3 | 248 |
| **London Westminster** | | | | | | | |
| CO | 83.2% | 11-Nov-04 | 26-Nov-04 | Instrument fault | Chopper wheel motor fault | 15 | 360 |
| $SO_2$ | 84.9% | 10-Oct-04 | 14-Oct-04 | Sampling fault | Pump failure and contamination of sampling system by permeation tube. | 3.8 | 92 |
| | | 04-Dec-04 | 13-Dec-04 | Sampling fault | Flow blockage in 3-way solenoid valve. | 9.6 | 230 |
| **Manchester South** | | | | | | | |
| $SO_2$ | 50.3% | 16-Nov-04 | 19-Jan-05 | High noise | $SO_2$ data rejected after ESU visit due to increased high noise response. (See Section 3.1) | 64.1 | 1538 |
| **Nottingham Centre** | | | | | | | |
| $NO_2$ | 89.0% | 11-Oct-04 | 14-Oct-04 | Monitoring suspended | Site closed for 3 days to remove graffiti from hut. Solvents in use so monitoring suspended. | 3.1 | 74 |
| | | 08-Dec-04 | 14-Dec-04 | Instrument fault | Erratic response data deleted. Analyser's optics cleaned. | 6.1 | 147 |
| **Plymouth Centre** | | | | | | | |
| $SO_2$ | 34.1% | 09-Aug-04 | 30-Nov-04 | Sampling fault | Spurious low data rejected following service on 9/8/04. ESU investigation found no flow from manifold to analyser. | 113 | 2715 |
| **Rotherham Centre** | | | | | | | |
| $SO_2$ | 51.4% | 17-Nov-04 | 28-Feb-05 | High noise | $SO_2$ pump failure followed by logger fault to 13$^{th}$ December. After repair the analyser showed unacceptable high noise response resulting in | 103 | 2482 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | further data deletion until the service. | | |
| **Salford Eccles** | | | | | | | |
| CO | 88.9% | 30-Sep-04 | 01-Oct-04 | ESU service | Service | 1.1 | 27 |
| | | 20-Nov-04 | 29-Nov-04 | Instrument fault | Flat 0mV response. no further information provided | 8.6 | 207 |
| | | 11-Dec-04 | 11-Dec-04 | No mV data collected | No reason given | 0.3 | 7 |
| $O_3$ | 81.7% | 30-Sep-04 | 01-Oct-04 | ESU service | Service | 1.1 | 27 |
| | | 28-Oct-04 | 12-Nov-04 | Operator error | Not connected to manifold between LSO visits | 14.9 | 357 |
| | | 11-Dec-04 | 11-Dec-04 | No mV data collected | No reason given | 0.3 | 7 |
| **Sheffield Tinsley** | | | | | | | |
| $NO_2$ | 86.9% | 05-Nov-04 | 16-Nov-04 | Unstable response | Large variation in calibration response. Photomultiplier tube and high voltage power supply replaced | 11.7 | 281 |
| **Somerton** | | | | | | | |
| $NO_2$ | 89.7% | Daily | | Autocal run-on | $NO_2$ autocal run-on (6 ppb) resulting in 3 hours data loss each day. | | 3 hr/day |
| | | 12-Oct-04 | 12-Oct-04 | Power cut | Intermittent power and telemetry problem | 0.3 | 6 |
| | | 12-Nov-04 | 13-Nov-04 | Power cut | As above | 1 | 23 |
| | | 10-Dec-04 | 13-Dec-04 | Power cut | As above | 2.5 | 60 |
| | | 17-Dec-04 | 18-Dec-04 | Power cut | As above | 1.1 | 26 |
| | | 26-Dec-04 | 27-Dec-04 | Power cut | As above | 1.6 | 38 |
| **Southwark Roadside** | | | | | | | |
| $SO_2$ | 85.7% | 02-Dec-04 | 15-Dec-04 | Pump fault | Pump failure. | 12.9 | 310 |
| **Stockport Shaw Heath** | | | | | | | |
| CO | 79.1% | 04-Aug-04 | 11-Oct-04 | Instrument fault | Intermittent reference voltage fault continued from previous period. Problem investigated by ESU on several occasions in September and replacement detector assembly fitted on October 11th 2004. Further intermittent data loss occurred indicating recurrence of fault. | 68 | 1633 |
| | | 13-Oct-04 | 13-Oct-04 | No mV data | Intermittent data loss | 0.3 | 7 |
| | | 17-Oct-04 | 18-Oct-04 | No mV data | As above | 0.8 | 19 |
| | | 22-Oct-04 | 22-Oct-04 | No mV data | As above | 0.3 | 7 |
| | | 23-Oct-04 | 23-Oct-04 | No mV data | As above | 0.3 | 8 |
| | | 03-Nov-04 | 04-Nov-04 | No mV data | As above | 0.5 | 13 |
| | | 03-Dec-04 | 04-Dec-04 | No mV data | As above | 0.9 | 22 |
| | | 04-Dec-04 | 04-Dec-04 | No mV data | As above | 0.4 | 10 |
| | | 08-Dec-04 | 09-Dec-04 | No mV data | As above | 0.7 | 16 |
| | | 15-Dec-04 | 16-Dec-04 | No mV data | As above | 0.8 | 20 |
| | | 22-Dec-04 | 23-Dec-04 | No mV data | As above. Fault investigated and need for replacement detector assembly identified. | 0.8 | 18 |
| | | 31-Dec-04 | 31-Dec-04 | No mV data | Intermittent data loss | 1 | 24 |
| $SO_2$ | 10.2% | 09-Jun-04 | 21-Dec-04 | ESU service | UV lamp board failure. Delay | 195 | 4691 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | whilst awaiting provision of new UV lamp driver boards. First board replaced on 12th August but fault persisted. Second replacement driver board installed on 13th Dec but subsequent flow fault resulted in data loss until 21st December when the pump was replaced. | | |
| | | 31-Dec-04 | 31-Dec-04 | No mV data collected | Telemetry problem | 1 | 24 |
| **Stockton-on-Tees Yarm** | | | | | | | |
| CO | 86.1% | 12-Nov-04 | 25-Nov-04 | Instrument fault | IR source fault repaired on 22nd November but fault persisted. Replacement analyser installed. | 12.7 | 304 |
| **Stoke-on-Trent Centre** | | | | | | | |
| $SO_2$ | 66.8% | 21-Oct-04 | 21-Oct-04 | No mV data collected | Missing data. No further information provided. | 0.3 | 6 |
| | | 04-Dec-04 | 27-Jan-05 | Unstable response | Erratic baseline response. UV lamp replaced (10/12/04) and optical filter replaced (17/1/05) however baseline drift continued. (See Section 3.2) | 53.8 | 1292 |
| **Tower Hamlets Roadside** | | | | | | | |
| CO | 37.1% | 18-Oct-04 | 31-Oct-04 | ESU service and analyser fault | After the service a fault with the electronic components gave rise to response instability. Data collection from site was suspended whilst the communications card (RS232) was removed for repair. | 13.5 | 324 |
| | | 05-Nov-04 | 05-Nov-04 | Communication fault | Telemetry fault | 0.6 | 15 |
| | | 18-Nov-04 | 19-Jan-05 | Unstable response | Spurious CO data. ESU visit on 19/1/05 to calibrate flow sensor, clean optical bench, sensor and IR source. Provisional data indicates that the problem was not resolved until service on 21/2/05 | 62.1 | 1490 |
| **Wolverhampton Centre** | | | | | | | |
| $NO_2$ | 55.0% | 13-Sep-04 | 04-Nov-04 | Instrument fault | Data rejected due to spurious low response, large step changes in calibration sensitivity (30-50%) and a combination of instrument faults resulting in 4 ESU call-outs over this period. | 52.1 | 1250 |
| | | 15-Dec-04 | 21-Dec-04 | Unstable response | Analyser removed from site for further investigation of baseline response instability. Faulty pre-amp card replaced. | 6.5 | 157 |

**NORTHERN IRELAND**

**Belfast Centre**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $NO_2$ | 89.4% | 18-Oct-04 | 25-Oct-04 | ESU service and instrument fault | Data deleted after service due to pressure sensor and pump problems. | 7 | 168 |
| | | 20-Nov-04 | 22-Nov-04 | Monitoring suspended | Site operations suspended due to demolition of nearby building by controlled explosion. | 2.1 | 50 |

**SCOTLAND**

**Aberdeen**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| General | | | | Monitoring suspended | Monitoring suspended as site hit by a truck causing power and telephone lines to be severed | | |
| CO | 79.2% | 28-Nov-04 | 17-Dec-04 | Monitoring suspended | As above | 19 | 457 |
| $NO_2$ | 75.7% | 28-Nov-04 | 17-Dec-04 | Monitoring suspended | As above | 19.1 | 458 |
| $O_3$ | 79.2% | 28-Nov-04 | 17-Dec-04 | Monitoring suspended | As above | 19.1 | 459 |
| $PM_{10}$ | 79.3% | 28-Nov-04 | 17-Dec-04 | Monitoring suspended | As above | 19 | 455 |
| $SO_2$ | 76.0% | 28-Nov-04 | 20-Dec-04 | Monitoring suspended | An extra 3 days data were lost due when monitoring resumed due to contamination of the sample system by the permeation tube. | 22 | 529 |

**Edinburgh St Leonards**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $O_3$ | 85.9% | 08-Oct-04 | 20-Oct-04 | Instrument fault | Analyser fault causing response instability. Detector, pre-amp board and UV lamp driver boards replaced. Fault reoccurred and analyser removed to workshop for repair. Replacement analyser installed on 20th October. | 12.6 | 303 |

**Eskdalemuir**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| O3 | 74.2% | 06-Oct-04 | 13-Oct-04 | Instrument fault | Analyser power supply failure. Original site analyser reinstalled after repair on 13th October. | 7.1 | 170 |
| | | 18-Oct-04 | 03-Nov-04 | Logger fault and internal sampling | Logger fault (8 days) followed by internal sampling due to manifold fan seizing up. | 15.6 | 375 |
| | | 21-Dec-04 | 21-Dec-04 | Communication/ loggers fault | Communications/logger fault | 0.4 | 10 |

**Glasgow Centre**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $SO_2$ | 84.4% | 10-Nov-04 | 24-Nov-04 | Unstable response | Unexplained step change in baseline between LSO calibrations | 14 | 337 |

**Strath Vaich**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $O_3$ | 77.4% | 07-Sep-04 | 21-Oct-04 | Instrument fault | Analyser continued to show problems of high noise and erratic response as seen in | 44.3 | 1062 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | previous period. Replacement analyser installed on 21 Oct. (See Section 3.5) | | |
| **WALES** | | | | | | | |
| **Cardiff Centre** | | | | | | | |
| $PM_{10}$ | 84.5% | 29-Sep-04 | 01-Oct-04 | ESU service | Service | 2.3 | 56 |
| | | 22-Oct-04 | 25-Oct-04 | Unstable response | Data rejected due to high noise and response instability | 3.2 | 77 |
| | | 16-Nov-04 | 17-Nov-04 | No mV data collected | No mV data recorded immediately after LSO visit. | 1.4 | 34 |
| **Narberth** | | | | | | | |
| $O_3$ | 0.0% | 01-Jan-04 | 09-Feb-05 | Instrument fault | Spurious low data recorded. Reason unknown. Provisional data shows concentrations return to normal ambient levels after service on 9th February 2005 | 405 | 9730 |
| $PM_{10}$ | 41.0% | 08-Nov-04 | 09-Feb-05 | Sampling fault | Incorrect flow settings found at audit. Data deleted from 8th November until replacement analyser installed at service 9th February 2005. (See section 2.8) | 92.7 | 2224 |
| **Port Talbot** | | | | | | | |
| $NO_2$ | 82.9% | 03-Sep-04 | 15-Oct-04 | Response instability | Analyser unable to maintain stable span response during calibrations. Data rejected from last stable calibration on 3/9/04 until the analyser was re-instated after repair on 15 October 2004. | 42 | 1008 |

## 4.1 Gravimetric $PM_{10}$ Sites with Data Capture Below 90%

This section gives details of the main operational problems which have resulted in gravimetric $PM_{10}$ data capture below the required 90% level during the reporting period October to December 2004. Casella Stanger has supplied the measured data, undertaken the filter weighing and calculated the particulate concentrations.

In this quarter all seven gravimetric Partisol analysers achieved data capture above 90% and there no major problems to report. The improved data capture levels reflect the recent benefits of having the Partisol units connected to telemetry giving the advantage of being able to undertake daily remote operational checks. All sites except Bournemouth are now on telemetry.

# 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 2004. Data capture values below 90% are shown in the shaded boxes.

**Table 5.1 AURN Ratified Data Capture (%) for October to December 2004**
(Using the start date of any new site or end date of site closed)

| Site | CO | $NO_2$ | $O_3$ | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | Site Average |
|---|---|---|---|---|---|---|---|
| **England** | | | | | | | |
| Barnsley 12 | - | - | - | - | - | 99.4 | 99.4 |
| Barnsley Gawber | 99.4 | 98.7 | 99.5 | - | - | 98.7 | 99.1 |
| Bath Roadside | 99.7 | 99.6 | - | - | - | - | 99.6 |
| Billingham | - | 99.7 | - | - | - | - | 99.7 |
| Birmingham Centre | 79.9 | 81.2 | 76.1 | 88.3 | - | 82.8 | 81.7 |
| Birmingham Tyburn | 99.6 | 95.2 | 99.6 | 99.7 | - | 99.6 | 98.8 |
| Blackpool | 93.6 | 89.3 | 93.7 | 93.3 | - | 93.5 | 92.6 |
| Bolton | 98.3 | 98.7 | 98.8 | 99.0 | - | 98.9 | 98.7 |
| Bottesford | - | - | 96.3 | - | - | - | 96.3 |
| Bournemouth | 99.7 | 99.5 | 99.9 | 100.0 | - | 97.0 | 99.2 |
| Bradford Centre | 88.5 | 97.6 | 94.1 | 93.6 | - | 92.3 | 93.2 |
| Brentford Roadside | 90.8 | 99.5 | - | - | - | - | 95.1 |
| Brighton Preston Park | - | 97.6 | 89.5 | - | - | - | 93.6 |
| Brighton Roadside | 99.5 | 99.3 | - | - | - | - | 99.4 |
| Brighton Roadside PM10 | - | - | - | 100.0 | - | - | 100.0 |
| Bristol Centre | 99.6 | 99.6 | 93.3 | 99.9 | - | 99.7 | 98.4 |
| Bristol Old Market | 99.9 | 99.6 | - | - | - | - | 99.8 |
| Bury Roadside | 99.7 | 95.5 | 99.6 | 95.3 | - | 99.6 | 97.9 |
| Cambridge Roadside | - | 99.6 | - | - | - | - | 99.6 |
| Camden Kerbside | - | 69.5 | - | 91.0 | - | - | 80.3 |
| Canterbury | - | 99.6 | - | 95.8 | - | - | 97.7 |
| Coventry Memorial Park | 96.4 | 96.8 | 96.9 | 99.0 | - | 97.5 | 97.3 |
| Exeter Roadside | 88.5 | 95.3 | 99.4 | - | - | 99.5 | 95.7 |
| Glazebury | - | 95.5 | 98.9 | - | - | - | 97.2 |
| Great Dun Fell | - | - | 99.2 | - | - | - | 99.2 |
| Haringey Roadside | - | 98.1 | - | 99.0 | - | - | 98.6 |
| Harwell | - | 96.0 | 67.6 | 98.7 | 98.8 | 92.2 | 90.7 |
| High Muffles | - | 85.6 | 99.6 | - | - | - | 92.6 |
| Hove Roadside | 99.4 | 97.4 | - | - | - | 90.9 | 95.9 |
| Hull Freetown | 99.2 | 99.3 | 99.5 | 98.9 | - | 99.3 | 99.2 |
| Ladybower | - | 93.7 | 93.3 | - | - | 99.1 | 95.3 |
| Leamington Spa | 99.2 | 95.1 | 99.5 | 98.0 | - | 99.0 | 98.2 |
| Leeds Centre | 82.4 | 98.9 | 99.2 | 99.5 | - | 63.8 | 88.8 |
| Leicester Centre | 82.6 | 98.9 | 98.6 | 98.5 | - | 98.8 | 95.5 |
| Liverpool Speke | 98.6 | 98.4 | 97.9 | 90.5 | - | 98.3 | 96.7 |
| London A3 Roadside | 93.8 | 98.4 | - | 99.5 | - | - | 97.2 |
| London Bexley | 99.9 | 99.5 | 99.5 | 99.6 | - | 99.7 | 99.7 |
| London Bloomsbury | 99.5 | 99.3 | 98.6 | 99.5 | 99.3 | 99.5 | 99.3 |
| London Brent | 53.7 | 83.4 | 88.5 | 86.2 | - | 78.3 | 78.0 |
| London Bromley | 99.4 | 99.6 | - | - | - | - | 99.5 |
| London Cromwell Road 2 | 98.1 | 98.1 | - | - | - | 98.1 | 98.1 |
| London Eltham | - | 97.7 | 98.4 | 89.3 | - | 99.5 | 96.2 |
| London Hackney | 88.1 | 99.5 | 86.4 | - | - | - | 91.3 |

| Site | CO | $NO_2$ | $O_3$ | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | Site Average |
|---|---|---|---|---|---|---|---|
| London Haringey | - | - | 99.4 | - | - | - | 99.4 |
| London Harlington | 98.4 | 98.4 | 81.4 | 99.2 | - | - | 94.3 |
| London Hillingdon | 99.3 | 99.1 | 99.4 | 99.5 | - | 99.4 | 99.3 |
| London Lewisham | - | 92.6 | 84.9 | - | - | 94.1 | 90.5 |
| London Marylebone Road | 99.5 | 99.6 | 99.5 | 99.0 | 95.8 | 89.4 | 97.2 |
| London N. Kensington | 99.4 | 99.1 | 98.6 | 99.0 | - | 99.4 | 99.1 |
| London Southwark | 99.0 | 97.2 | 99.5 | - | - | 99.6 | 98.8 |
| London Teddington | - | 94.0 | 98.3 | - | - | 98.3 | 96.9 |
| London Wandsworth | - | 99.6 | 99.6 | - | - | - | 99.6 |
| London Westminster | 83.2 | 90.0 | 99.6 | 94.6 | - | 84.9 | 90.4 |
| Lullington Heath | - | 95.0 | 98.3 | - | - | 99.0 | 97.4 |
| Manchester Piccadilly | 98.3 | 99.4 | 99.4 | 99.3 | - | 56.1 | 90.5 |
| Manchester South | - | 94.4 | 96.1 | - | - | 50.3 | 80.2 |
| Manchester Town Hall | 97.2 | 95.3 | - | - | - | - | 96.3 |
| Market Harborough | 90.4 | 90.9 | 94.9 | - | - | - | 92.1 |
| Middlesbrough | 93.1 | 96.6 | 99.6 | 99.4 | - | 97.7 | 97.3 |
| Newcastle Centre | 99.7 | 95.5 | 90.1 | 99.7 | - | 99.6 | 96.9 |
| Northampton | 99.7 | 99.1 | 99.7 | 99.9 | - | 99.7 | 99.6 |
| Northampton PM10 | - | - | - | 97.8 | - | - | 97.8 |
| Norwich Centre | 99.5 | 92.3 | 99.5 | 99.5 | - | 99.5 | 98.0 |
| Norwich Roadside | - | 99.3 | - | - | - | - | 99.3 |
| Nottingham Centre | 97.1 | 89.0 | 97.1 | 97.3 | - | 91.5 | 94.4 |
| Oxford Centre Roadside | 99.4 | 99.4 | - | - | - | 99.4 | 99.4 |
| Plymouth Centre | 99.1 | 99.5 | 99.7 | 99.4 | - | 34.1 | 86.4 |
| Portsmouth | 99.3 | 99.3 | 99.9 | 99.0 | - | 99.4 | 99.4 |
| Preston | 97.0 | 90.5 | 97.1 | 97.1 | - | 97.2 | 95.8 |
| Reading New Town | 92.3 | 94.3 | 99.4 | 98.7 | - | 90.7 | 95.1 |
| Redcar | 96.5 | 99.5 | 98.4 | 99.7 | - | 99.5 | 98.7 |
| Rochester | - | 97.3 | 97.3 | 96.9 | 97.4 | 97.2 | 97.2 |
| Rotherham Centre | - | 98.0 | 98.0 | - | - | 51.4 | 82.4 |
| Salford Eccles | 88.9 | 97.9 | 81.7 | 98.2 | - | 97.9 | 92.9 |
| Sandwell West Bromwich | 97.6 | 97.4 | 97.4 | - | - | 97.4 | 97.4 |
| Scunthorpe Town | - | - | - | 97.9 | - | 95.8 | 96.9 |
| Sheffield Centre | 99.6 | 99.4 | 99.5 | 98.7 | - | 95.9 | 98.6 |
| Sheffield Tinsley | 99.6 | 86.9 | - | - | - | - | 93.2 |
| Sibton | - | - | 92.6 | - | - | - | 92.6 |
| Somerton | - | 89.7 | 92.6 | - | - | - | 91.1 |
| Southampton Centre | 99.2 | 95.3 | 99.4 | 99.7 | - | 99.6 | 98.7 |
| Southend-on-Sea | 96.1 | 93.8 | 98.6 | 94.6 | - | 98.2 | 96.3 |
| Southwark Roadside | 99.6 | 98.5 | - | - | - | 85.7 | 94.6 |
| St Osyth | 99.5 | 95.2 | 99.5 | - | - | - | 98.1 |
| Stockport Shaw Heath | 79.1 | 98.5 | - | 93.8 | - | 10.2 | 70.4 |
| Stockton-on-Tees Yarm | 86.1 | 100.0 | - | 94.8 | - | - | 93.6 |
| Stoke-on-Trent Centre | 99.5 | 94.4 | 99.4 | 98.9 | - | 66.8 | 91.8 |
| Sunderland | - | - | - | - | - | 99.4 | 99.4 |
| Sunderland Silksworth | - | 100.0 | 99.8 | - | - | - | 99.9 |
| Thurrock | 99.3 | 99.3 | 99.4 | 99.7 | - | 97.0 | 98.9 |
| Tower Hamlets Roadside | 37.1 | 99.4 | - | - | - | - | 68.3 |
| Walsall Alumwell | - | 91.9 | - | - | - | - | 91.9 |
| Walsall Willenhall | - | 99.8 | - | - | - | - | 99.8 |
| West London | 99.8 | 99.8 | - | - | - | - | 99.8 |
| Weybourne | - | - | 95.6 | - | - | - | 95.6 |
| Wicken Fen | - | 99.5 | 98.8 | - | - | 99.5 | 99.3 |
| Wigan Centre | 99.2 | 95.4 | 99.3 | 99.5 | - | 95.4 | 97.8 |
| Wirral Tranmere | 97.1 | 96.3 | 97.2 | 96.9 | - | 97.1 | 96.9 |
| Wolverhampton Centre | 98.5 | 55.0 | 98.6 | 98.8 | - | 98.6 | 89.9 |

| Site | CO | $NO_2$ | $O_3$ | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | Site Average |
|---|---|---|---|---|---|---|---|
| Yarner Wood | - | 99.6 | 99.7 | - | - | - | 99.7 |
| **N Ireland** | | | | | | | |
| Belfast Centre | 95.0 | 89.4 | 95.1 | 95.2 | - | 94.9 | 93.9 |
| Belfast Clara St | - | - | - | 94.5 | - | - | 94.5 |
| Belfast East | - | - | - | - | - | 98.0 | 98.0 |
| Derry | 99.3 | 95.0 | 99.4 | 99.2 | - | 99.3 | 98.4 |
| Lough Navar | - | - | 99.0 | 99.0 | - | - | 99.0 |
| **Scotland** | | | | | | | |
| Aberdeen | 79.2 | 75.7 | 79.2 | 79.3 | - | 76.0 | 77.9 |
| Bush Estate | - | 94.2 | 99.8 | - | - | - | 97.0 |
| Dumfries | 99.7 | 95.5 | - | 100.0 | - | - | 98.4 |
| Edinburgh St Leonards | 99.7 | 98.7 | 85.9 | 99.7 | - | 99.6 | 96.7 |
| Eskdalemuir | - | 93.1 | 74.2 | - | - | - | 83.7 |
| Glasgow Centre | 99.4 | 99.5 | 99.5 | 97.5 | - | 84.4 | 96.0 |
| Glasgow City Chambers | 99.5 | 98.9 | - | - | - | - | 99.2 |
| Glasgow Kerbside | 99.4 | 99.6 | - | 98.9 | - | - | 99.3 |
| Grangemouth | 99.7 | 99.6 | - | 99.6 | - | 99.7 | 99.7 |
| Inverness | 99.5 | 99.5 | - | 98.9 | - | - | 99.3 |
| Strath Vaich | - | - | 77.4 | - | - | - | 77.4 |
| **Wales** | | | | | | | |
| Aston Hill | - | 97.8 | 97.5 | - | - | - | 97.6 |
| Cardiff Centre | 99.1 | 98.9 | 99.3 | 84.5 | - | 98.5 | 96.1 |
| Cwmbran | 99.9 | 99.9 | 100.0 | 99.8 | - | 99.9 | 99.9 |
| Narberth | - | 90.9 | 0.0 | 41.0 | - | 95.6 | 56.9 |
| Port Talbot | - | 82.9 | 98.3 | 98.6 | - | 98.8 | 94.6 |
| Swansea | 97.0 | 96.0 | 96.9 | 93.5 | - | 97.0 | 96.1 |
| Wrexham | 98.1 | 95.8 | - | 98.9 | - | 98.6 | 97.9 |
| | | | | | | | |
| **Number of sites** | 79 | 109 | 86 | 71 | 4 | 76 | 123 |
| **Number of sites < 90%** | 13 | 12 | 13 | 6 | 0 | 13 | 14 |
| **Network Mean (%)** | 95.0 | 95.6 | 94.6 | 96.3 | 97.8 | 92.4 | 95 |

Sites and instruments established between 01/10/2004 and 31/12/2004

| Site | Status | Pollutants | Start Date |
|---|---|---|---|
| Brighton Preston Park | Defra | $NO_2$ $O_3$ | 3/11/2004 |
| Wigan Centre | Affiliate | CO $NO_2$ $O_3$ $PM_{10}$ $SO_2$ | 8/10/2004 |
| Sunderland Silkworth | Affiliate | $NO_2$ $O_3$ | 9/12/2004 |
| Eskdalemuir | Defra | $NO_2$ | 9/12/2004 |

Table 5.2 provides the ratified data capture figures for each site for the year January to December 2004. Data capture values below 90% are shown in the shaded boxes.

**Table 5.2 AURN Ratified Data Capture (%) for January to December 2004**
(Using the start date of any new site or end date of site closed)

| Site | CO | $NO_2$ | $O_3$ | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | Site Average |
|---|---|---|---|---|---|---|---|
| **England** | | | | | | | |
| Barnsley 12 | - | - | - | - | - | 98.9 | 98.9 |
| Barnsley Gawber | 96.5 | 95.9 | 96.2 | - | - | 96.6 | 96.3 |
| Bath Roadside | 99.0 | 98.3 | - | - | - | - | 98.6 |
| Billingham | - | 99.1 | - | - | - | - | 99.1 |
| Birmingham Centre | 91.6 | 88.9 | 88.4 | 94.4 | - | 86.0 | 89.9 |
| Birmingham East | 98.5 | 90.8 | 97.9 | 97.4 | - | 98.5 | 96.6 |
| Birmingham Tyburn | 99.6 | 96.7 | 99.6 | 99.7 | - | 99.5 | 99.0 |
| Blackpool | 95.5 | 90.0 | 95.7 | 96.7 | - | 69.9 | 89.6 |
| Bolton | 97.5 | 94.1 | 97.6 | 97.0 | - | 97.6 | 96.8 |
| Bottesford | - | - | 98.7 | - | - | - | 98.7 |
| Bournemouth | 98.6 | 96.4 | 98.9 | 94.5 | - | 97.6 | 97.2 |
| Bradford Centre | 94.5 | 95.8 | 96.8 | 95.9 | - | 96.0 | 95.8 |
| Brentford Roadside | 95.2 | 92.0 | - | - | - | - | 93.6 |
| Brighton Preston Park | - | 97.6 | 89.5 | - | - | - | 93.6 |
| Brighton Roadside | 98.9 | 98.9 | - | - | - | - | 98.9 |
| Brighton Roadside PM10 | - | - | - | 93.7 | - | - | 93.7 |
| Bristol Centre | 97.7 | 96.7 | 91.3 | 97.6 | - | 95.8 | 95.8 |
| Bristol Old Market | 71.9 | 98.7 | - | - | - | - | 85.3 |
| Bury Roadside | 93.6 | 91.6 | 91.9 | 92.2 | - | 75.9 | 89.0 |
| Cambridge Roadside | - | 96.5 | - | - | - | - | 96.5 |
| Camden Kerbside | - | 39.4 | - | 95.7 | - | - | 67.5 |
| Canterbury | - | 96.9 | - | 98.3 | - | - | 97.6 |
| Coventry Memorial Park | 98.3 | 97.6 | 98.0 | 92.4 | - | 98.3 | 96.9 |
| Exeter Roadside | 87.4 | 95.8 | 97.0 | - | - | 84.9 | 91.3 |
| Glazebury | - | 93.7 | 95.9 | - | - | - | 94.8 |
| Great Dun Fell | - | - | 99.0 | - | - | - | 99.0 |
| Haringey Roadside | - | 98.2 | - | 98.9 | - | - | 98.5 |
| Harwell | - | 95.7 | 90.2 | 97.7 | 96.2 | 96.4 | 95.2 |
| High Muffles | - | 70.1 | 99.2 | - | - | - | 84.6 |
| Hove Roadside | 98.5 | 94.3 | - | - | - | 96.0 | 96.2 |
| Hull Freetown | 95.9 | 89.3 | 93.9 | 95.6 | - | 88.1 | 92.6 |
| Ladybower | - | 89.9 | 85.1 | - | - | 97.1 | 90.7 |
| Leamington Spa | 88.8 | 93.8 | 98.7 | 98.2 | - | 98.4 | 95.6 |
| Leeds Centre | 79.4 | 92.1 | 82.7 | 97.8 | - | 85.5 | 87.5 |
| Leicester Centre | 84.9 | 85.5 | 97.8 | 95.6 | - | 97.3 | 92.2 |
| Liverpool Speke | 98.2 | 98.1 | 97.8 | 95.3 | - | 97.9 | 97.5 |
| London A3 Roadside | 96.9 | 96.8 | - | 98.0 | - | - | 97.2 |
| London Bexley | 94.9 | 96.1 | 95.5 | 92.6 | - | 95.8 | 95.0 |
| London Bloomsbury | 97.0 | 97.5 | 97.1 | 98.1 | 98.0 | 97.6 | 97.6 |
| London Brent | 86.2 | 91.0 | 95.0 | 94.3 | - | 88.7 | 91.1 |
| London Bromley | 96.1 | 98.4 | - | - | - | - | 97.3 |
| London Cromwell Road 2 | 97.7 | 98.7 | - | - | - | 98.6 | 98.4 |
| London Eltham | - | 97.2 | 96.4 | 91.4 | - | 99.0 | 96.0 |
| London Hackney | 94.7 | 99.4 | 88.4 | - | - | - | 94.2 |
| London Haringey | - | - | 94.2 | - | - | - | 94.2 |

| Site | CO | $NO_2$ | $O_3$ | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | Site Average |
|---|---|---|---|---|---|---|---|
| London Harlington | 92.2 | 99.0 | 94.7 | 99.4 | - | - | 96.3 |
| London Hillingdon | 97.8 | 97.6 | 92.6 | 98.0 | - | 97.9 | 96.8 |
| London Lewisham | - | 97.8 | 87.8 | - | - | 97.8 | 94.5 |
| London Marylebone Road | 96.2 | 98.3 | 98.1 | 98.0 | 95.9 | 92.0 | 96.4 |
| London N. Kensington | 98.9 | 98.9 | 97.9 | 95.8 | - | 97.3 | 97.8 |
| London Southwark | 94.6 | 88.1 | 94.8 | - | - | 94.8 | 93.1 |
| London Teddington | - | 93.8 | 96.1 | - | - | 96.1 | 95.3 |
| London Wandsworth | - | 99.3 | 99.3 | - | - | - | 99.3 |
| London Westminster | 90.4 | 78.3 | 93.7 | 94.0 | - | 90.7 | 89.4 |
| Lullington Heath | - | 92.8 | 95.6 | - | - | 89.1 | 92.5 |
| Manchester Piccadilly | 97.2 | 93.8 | 97.6 | 97.6 | - | 84.2 | 94.1 |
| Manchester South | - | 87.4 | 95.4 | - | - | 85.8 | 89.5 |
| Manchester Town Hall | 81.0 | 94.7 | - | - | - | - | 87.8 |
| Market Harborough | 93.2 | 90.4 | 93.5 | - | - | - | 92.4 |
| Middlesbrough | 91.7 | 64.5 | 99.1 | 97.8 | - | 98.6 | 90.3 |
| Newcastle Centre | 85.0 | 81.9 | 90.3 | 92.6 | - | 83.7 | 86.7 |
| Northampton | 90.4 | 87.1 | 87.2 | 89.8 | - | 89.3 | 88.8 |
| Northampton $PM_{10}$ | - | - | - | 84.2 | - | - | 84.2 |
| Norwich Centre | 94.2 | 90.7 | 97.2 | 97.2 | - | 96.4 | 95.1 |
| Norwich Roadside | - | 97.7 | - | - | - | - | 97.7 |
| Nottingham Centre | 91.3 | 90.9 | 97.1 | 97.1 | - | 95.7 | 94.4 |
| Oxford Centre Roadside | 97.2 | 86.5 | - | - | - | 99.1 | 94.2 |
| Plymouth Centre | 88.8 | 89.1 | 97.8 | 97.3 | - | 67.6 | 88.1 |
| Portsmouth | 96.7 | 98.1 | 98.9 | 93.1 | - | 90.7 | 95.5 |
| Preston | 93.0 | 94.3 | 98.3 | 98.0 | - | 98.2 | 96.3 |
| Reading New Town | 94.4 | 93.2 | 86.0 | 96.2 | - | 88.9 | 91.7 |
| Redcar | 97.0 | 97.7 | 96.3 | 97.7 | - | 97.7 | 97.3 |
| Rochester | - | 96.4 | 98.6 | 98.1 | 98.7 | 98.6 | 98.1 |
| Rotherham Centre | - | 96.9 | 90.0 | - | - | 75.5 | 87.5 |
| Salford Eccles | 93.9 | 96.2 | 87.4 | 96.0 | - | 90.1 | 92.7 |
| Sandwell West Bromwich | 97.8 | 98.2 | 97.9 | - | - | 98.1 | 98.0 |
| Scunthorpe | - | - | - | 96.3 | - | 97.4 | 96.9 |
| Scunthorpe Town | - | - | - | 95.3 | - | 97.2 | 96.2 |
| Sheffield Centre | 98.1 | 97.1 | 98.0 | 98.0 | - | 80.1 | 94.3 |
| Sheffield Tinsley | 97.3 | 95.7 | - | - | - | - | 96.5 |
| Sibton | - | - | 96.3 | - | - | - | 96.3 |
| Somerton | - | 88.8 | 95.6 | - | - | - | 92.2 |
| Southampton Centre | 91.0 | 95.2 | 90.9 | 96.7 | - | 96.4 | 94.1 |
| Southend-on-Sea | 51.6 | 91.5 | 97.4 | 95.7 | - | 95.2 | 86.3 |
| Southwark Roadside | 98.6 | 75.4 | - | - | - | 95.4 | 89.8 |
| St Osyth | 98.9 | 91.0 | 99.0 | - | - | - | 96.3 |
| Stockport Shaw Heath | 78.3 | 90.9 | - | 88.6 | - | 45.8 | 75.9 |
| Stockton-on-Tees Yarm | 93.9 | 98.7 | - | 96.9 | - | - | 96.5 |
| Stoke-on-Trent Centre | 94.2 | 93.2 | 98.0 | 78.2 | - | 86.6 | 90.1 |
| Sunderland | - | - | - | - | - | 92.1 | 92.1 |
| Sunderland Silksworth | - | 100.0 | 99.8 | - | - | - | 99.9 |
| Thurrock | 96.1 | 89.8 | 98.4 | 95.3 | - | 97.8 | 95.5 |
| Tower Hamlets Roadside | 83.8 | 96.3 | - | - | - | - | 90.0 |
| Walsall Alumwell | - | 93.0 | - | - | - | - | 93.0 |
| Walsall Willenhall | - | 92.1 | - | - | - | - | 92.1 |
| West London | 98.8 | 98.8 | - | - | - | - | 98.8 |
| Weybourne | - | - | 97.1 | - | - | - | 97.1 |
| Wicken Fen | - | 73.1 | 93.2 | - | - | 93.5 | 86.6 |

| Site | CO | $NO_2$ | $O_3$ | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | Site Average |
|---|---|---|---|---|---|---|---|
| Wigan Centre | 99.2 | 95.4 | 99.3 | 99.5 | - | 95.4 | 97.8 |
| Wigan Leigh | 96.9 | 96.1 | 94.4 | 97.4 | - | 69.1 | 90.8 |
| Wirral Tranmere | 94.9 | 94.0 | 98.4 | 97.8 | - | 95.8 | 96.2 |
| Wolverhampton Centre | 93.4 | 80.4 | 97.7 | 97.8 | - | 97.8 | 93.4 |
| Yarner Wood | - | 98.5 | 97.5 | - | - | - | 98.0 |
| **N Ireland** | | | | | | | |
| Belfast Centre | 96.4 | 91.8 | 96.4 | 96.1 | - | 95.1 | 95.2 |
| Belfast Clara St | - | - | - | 92.4 | - | - | 92.4 |
| Belfast East | - | - | - | - | - | 96.5 | 96.5 |
| Derry | 97.4 | 92.0 | 97.5 | 97.0 | - | 95.8 | 95.9 |
| Lough Navar | - | - | 74.8 | 99.3 | - | - | 87.1 |
| **Scotland** | | | | | | | |
| Aberdeen | 93.0 | 90.0 | 94.0 | 93.3 | - | 93.0 | 92.7 |
| Bush Estate | - | 93.6 | 98.4 | - | - | - | 96.0 |
| Dumfries | 98.5 | 96.6 | - | 91.8 | - | - | 95.7 |
| Edinburgh St Leonards | 98.1 | 91.0 | 93.9 | 98.7 | - | 98.5 | 96.0 |
| Eskdalemuir | - | 93.1 | 90.5 | - | - | - | 91.8 |
| Glasgow Centre | 92.1 | 88.5 | 97.5 | 66.6 | - | 86.6 | 86.3 |
| Glasgow City Chambers | 98.9 | 98.0 | - | - | - | - | 98.4 |
| Glasgow Kerbside | 98.2 | 96.0 | - | 94.9 | - | - | 96.3 |
| Grangemouth | 81.2 | 98.5 | - | 98.3 | - | 98.6 | 94.1 |
| Inverness | 98.5 | 98.1 | - | 95.1 | - | - | 97.2 |
| Strath Vaich | - | - | 83.9 | - | - | - | 83.9 |
| **Wales** | | | | | | | |
| Aston Hill | - | 87.0 | 89.4 | - | - | - | 88.2 |
| Cardiff Centre | 96.0 | 97.5 | 91.1 | 93.9 | - | 97.0 | 95.1 |
| Cwmbran | 98.0 | 99.4 | 99.5 | 99.4 | - | 96.9 | 98.7 |
| Narberth | - | 89.4 | 0.0 | 55.1 | - | 90.5 | 58.8 |
| Port Talbot | - | 83.9 | 97.2 | 96.1 | - | 97.2 | 93.6 |
| Swansea | 97.7 | 91.5 | 97.0 | 23.5 | - | 97.6 | 81.5 |
| Wrexham | 98.4 | 95.7 | - | 93.7 | - | 89.0 | 94.2 |
| | | | | | | | |
| **Number of sites** | 81 | 111 | 88 | 74 | 4 | 79 | 126* |
| **Number of sites < 90%** | 13 | 23 | 14 | 7 | 0 | 20 | 25 |
| **Network Mean (%)** | 93.6 | 92.8 | 93.8 | 93.7 | 97.2 | 92.5 | 93 |

*Overall site count of 126 due to site relocations. The following sites in both the old and new locations are included in the above table:
Birmingham East and Birmingham Tyburn
Scunthorpe and Scunthorpe Town
Wigan Leigh and Wigan Centre

Sites and instruments established between 01/1/2004 and 31/12/2004

| Site | Status | Pollutants | Start Date |
|---|---|---|---|
| Glazebury | Defra | $NO_2$ | 26/01/2004 |
| London Harlington | Affiliate | $NO_2$ CO $O_3$ $PM_{10}$ | 01/01/2004 |
| Scunthorpe Town | Affiliate | $SO_2$ $PM_{10}$ | 06/06/2004 |
| Birmingham Tyburn | Affiliate | $NO_2$ CO $O_3$ $PM_{10}$ $SO_2$ | 16/08/2004 |
| Wigan Centre | Affiliate | CO $NO_2$ $O_3$ $PM_{10}$ $SO_2$ | 8/10/2004 |
| Brighton Preston Park | Defra | $NO_2$ $O_3$ | 3/11/2004 |
| Sunderland Silkworth | Affiliate | $NO_2$ $O_3$ | 9/12/2004 |
| Eskdalemuir | Defra | $NO_2$ | 9/12/2004 |

Table 5.3 shows the ratified AURN data capture for the 61 **critical sites** in the network for the year January to December 2004. Sites with less than 90% data capture are shaded.

**Table 5.3 AURN Ratified Data Capture (%) for CRITICAL SITES January to December 2004 (Calculated from 1/1/04)**

| Critical Sites | | CO | $NO_2$ | $O_3$ | $PM_{10}$ | $SO_2$ |
|---|---|---|---|---|---|---|
| **AGGLOMERATIONS** | | | | | | |
| Belfast Centre | DEFRA | 96.4 | 91.8 | 96.4 | | |
| Blackpool[1] | DEFRA | 82.4 | 77.7 | 82.6 | 83.5 | 60.4 |
| Bournemouth | Affiliate | 98.6 | 96.4 | 98.9 | 94.5 | 97.6 |
| Brighton Roadside $PM_{10}$ | Affiliate | - | - | - | 93.7 | - |
| Bristol Centre | DEFRA | | 96.7 | 91.3 | 97.6 | 95.8 |
| Cardiff Centre | DEFRA | 96.0 | 97.5 | 91.1 | 93.9 | 97.0 |
| Coventry Memorial Park | DEFRA | 98.3 | 97.6 | 98.0 | 92.4 | 98.3 |
| Edinburgh St Leonards | DEFRA | 98.1 | 91.0 | 93.9 | 98.7 | 98.5 |
| Glasgow Centre | DEFRA | | 88.5 | 97.5 | | 86.6 |
| Hove Roadside | Affiliate | | | - | - | 96.0 |
| Hull Freetown | DEFRA | 95.9 | 89.3 | 93.9 | 95.6 | 88.1 |
| Leicester Centre | DEFRA | 84.9 | 85.5 | 97.8 | 95.6 | 97.3 |
| Liverpool Speke | Affiliate | 98.2 | 98.1 | 97.8 | 95.3 | 97.9 |
| Newcastle Centre | DEFRA | 85.0 | 81.9 | 90.3 | 92.6 | 83.7 |
| Nottingham Centre | DEFRA | 91.3 | 90.9 | 97.1 | 97.1 | 95.7 |
| Portsmouth | Affiliate | 96.7 | 98.1 | 98.9 | 93.1 | 90.7 |
| Preston | DEFRA | 93.0 | 94.3 | 98.3 | 98.0 | 98.2 |
| Reading New Town | DEFRA | 94.4 | 93.2 | 86.0 | 96.2 | 88.9 |
| Sheffield Centre | DEFRA | | | | 98.0 | |
| Southampton Centre | DEFRA | 91.0 | 95.2 | 90.9 | 96.7 | 96.4 |
| Southend-on-Sea | DEFRA | 51.6 | 91.5 | 97.4 | 95.7 | 95.2 |
| Stoke-on-Trent Centre | DEFRA | 94.2 | 93.2 | 98.0 | 78.2 | 86.6 |
| Swansea | Affiliate | 97.7 | | | | |
| Wirral Tranmere | DEFRA | 94.9 | 94.0 | 98.4 | 97.8 | 95.8 |
| **ZONES** | | | | | | |
| Aberdeen | Affiliate | 93.0 | 90.0 | 94.0 | 93.3 | 93.0 |
| Aston Hill | DEFRA | - | 87.0 | 89.4 | - | - |
| Barnsley Gawber | Affiliate | 96.5 | 95.9 | 96.2 | - | |
| Bush Estate | DEFRA | - | 93.6 | 98.4 | - | - |
| Canterbury | Affiliate | - | | - | 98.3 | - |
| Cwmbran | Affiliate | 98.0 | 99.4 | 99.5 | 99.4 | 96.9 |
| Derry | Affiliate | 97.4 | 92.0 | 97.5 | 97.0 | 95.8 |
| Dumfries | DEFRA | 98.5 | 96.6 | - | 91.8 | - |
| Eskdalemuir | DEFRA | - | 5.9 | 90.5 | - | - |
| Glazebury | DEFRA | - | 87.3 | 95.9 | - | - |
| Grangemouth | Affiliate | 81.2 | 98.5 | - | 98.3 | 98.6 |
| Great Dun Fell | DEFRA | - | - | 99.0 | - | - |
| High Muffles | DEFRA | - | 70.1 | 99.2 | - | - |
| Inverness | DEFRA | | 98.1 | - | 95.1 | - |
| Leamington Spa | Affiliate | 88.8 | 93.8 | 98.7 | 98.2 | 98.4 |
| Lough Navar | DEFRA | - | - | 74.8 | | - |
| Narberth | Affiliate | - | | 0.0 | | |
| Northampton | Affiliate | 90.4 | 87.1 | 87.2 | 89.8 | 89.3 |
| Norwich Centre | DEFRA | | 90.7 | 97.2 | | |
| Oxford Centre Roadside | Affiliate | 97.2 | | - | - | 99.1 |
| Plymouth Centre | DEFRA | | | | 97.3 | |
| Scunthorpe[2] | Affiliate | - | - | - | 20.5 | 20.8 |
| Scunthorpe Town[2] | Affiliate | - | - | - | 54.4 | 55.5 |
| Sibton | DEFRA | - | - | 96.3 | - | - |

| Critical Sites | | CO | $NO_2$ | $O_3$ | $PM_{10}$ | $SO_2$ |
|---|---|---|---|---|---|---|
| Somerton | Affiliate | - | 88.8 | 95.6 | - | - |
| St Osyth | DEFRA | 98.9 | 91.0 | 99.0 | - | - |
| Stockton-on-Tees Yarm | Affiliate | 93.9 | 98.7 | - | 96.9 | - |
| Strath Vaich | DEFRA | - | - | 83.9 | - | - |
| Sunderland | DEFRA | - | - | - | - | 92.1 |
| Thurrock | Affiliate | | 89.8 | 98.4 | | |
| Wicken Fen | DEFRA | - | 73.1 | 93.2 | - | |
| Wigan Leigh[3] | Affiliate | 72.0 | 71.4 | 70.2 | 72.4 | 51.4 |
| Wrexham | DEFRA | 98.4 | 95.7 | - | 93.7 | 89.0 |
| Yarner Wood | DEFRA | - | 98.5 | 97.5 | - | - |
| | | | | | | |
| Number of critical analysers | | 32 | 42 | 44 | 35 | 32 |
| **Number of sites < 90%** | | 7 | 14 | 8 | 6 | 11 |

Key ▨ Pollutant monitored but not critical at this site
- Not monitored
[1] Blackpool site closed on 10/11/04 to be relocated.
[2] Scunthorpe site closed on 18/3/04 and relocated to Scunthorpe Town where monitoring commenced on 6/6/04
[3] Wigan Leigh site closed on 28/9/04 and relocated to Wigan Centre where monitoring commenced on 8/10/04

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.

# PART B: Annual Review 2004

# 6 Overview of Network Performance

This section provides an annual overview of network performance and a summary of QA/QC Unit's activities during 2004. More detailed ratification reports have been published for each quarter of the year 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 123 automatic monitoring sites of which 61 are directly funded by the Defra and the DAs, with the remaining 62 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 2005 bringing the total number of AURN sites to 127.

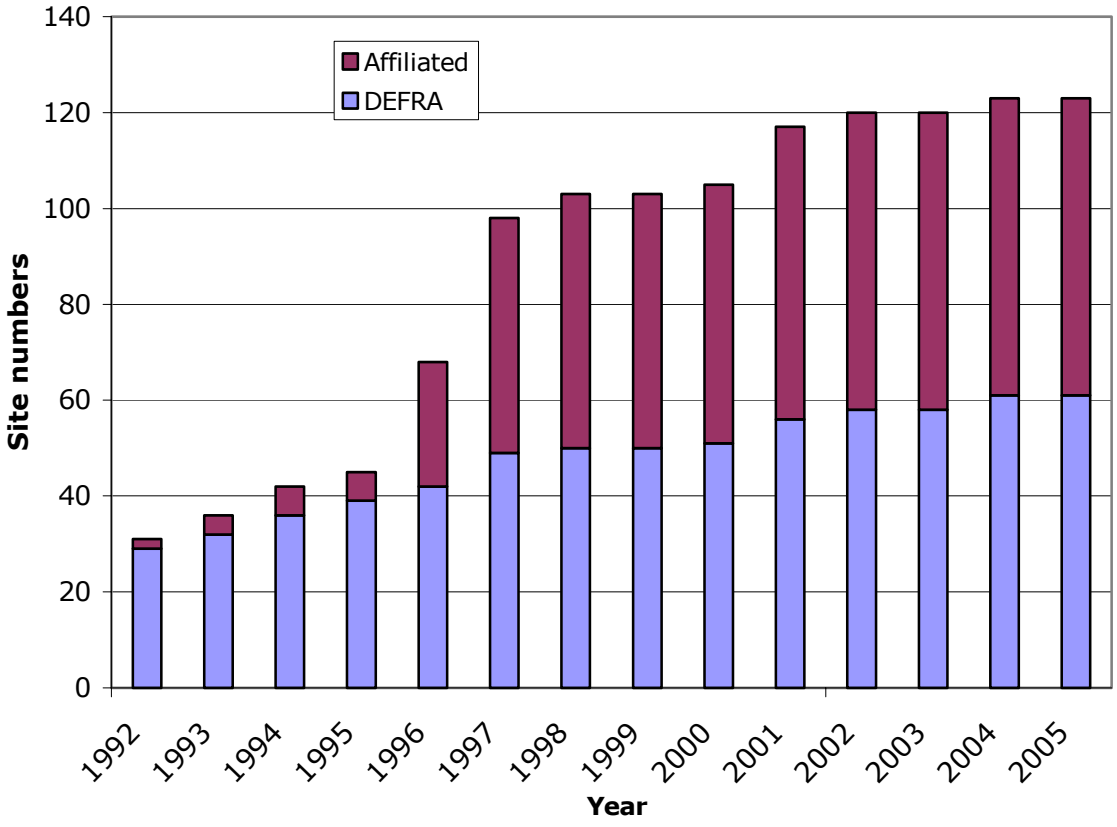



**Figure 6.1 Automatic Monitoring Site Numbers in the AURN since 1992**

**Table 6.1 Site Numbers in the AURN, May 2005**

| | Urban | Rural | LAQN | AURN Total |
|---|---|---|---|---|
| Direct funded sites | 45 | 16 | 0 | 61 |
| Affiliate sites | 42 | 6 | 14 | 62 |
| Totals | 87 | 22 | 14 | **123** |

**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 $PM_{10}$ Partisol analysers

2002 11 additional CO analysers for DD2 (implementation date 13th December 02)
2 Gravimetric $PM_{10}$ Partisol analysers

2003 5 $NO_x$ and 6 $O_3$ analysers at rural sites for DD3 (implementation date 9th Sept 03)
2 Gravimetric $PM_{10}$ Partisol analysers

2004 2 $NO_x$ analysers at rural sites for DD3
2 new DD3 sites ($NO_x$ and $O_3$) commissioned and a further 2 new sites underway

QA/QC Unit worked closely with CMCU and the Equipment Support Units to ensure that as many of the new analysers as possible were commissioned before the Daughter Directives came into force.

A new affiliate site at London Harlington (Heathrow Airport) was also integrated into the network in January 2004. A full list of the new sites and analyser commissioned during 2004 is given in Section 5 at the end of Table 5.2.

**Equipment Up-grading**
Continuation of the equipment replacement programme, which was funded by Defra and the DAs, took place with the installation of a further 2 new equipment sets (Horiba analysers) at Leicester and Leeds. QA/QC Unit carried out the site commissioning audits and LSO training at these sites in June 2004 and April 2005 respectively. The final two remaining sets of new equipment were installed at Norwich Centre and Southend-on-Sea in March 2005 and commissioning audits will be carried out following further instruction from CMCU.

Some Local Authority affiliate sites have also purchased new equipment (e.g. London Bexley, London Brent and Birmingham East) and QA/QC Unit has carried out the necessary site commissioning audits and training as required.

**Site Relocations**
A few site relocations have been required mainly because the site leases have expired, the building in which the sites are located have been vacated/sold or the local area is being redeveloped and local building work is taking place. The following five sites have been relocate during 2004/5:

- Scunthorpe Centre to Scunthorpe Town (June 04)
- Birmingham East to Birmingham Tyburn (Aug 04)

- Wigan Leigh to Wigan Centre (Sept 04)
- Norwich Roadside to Norwich Roadside Forum (April 05)
- Blackpool closed Nov 04 – relocation in progress

There are also plans to relocated a number of other sites in the near future as follows:

| | |
|---|---|
| Bradford Centre | (Summer 2005) |
| Bristol Centre | (next 18 months) |
| Middlesbrough | (May 2005) |
| Harwell | (Summer 05) |
| Cwmbran | (temporary move) |
| Bath Roadside | |

# 7 Review of QA/QC Unit Activities

## 7.1 Reporting

Detailed quarterly reports have been published for the 2004 data set highlighting the main data quality issues, reasons for data loss and data capture statistics. 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, 2004**

| | Report Type | Report Title | Reference |
|---|---|---|---|
| 1 | Ratification and Intercalibration | QA/QC Data Ratification and Intercalibration Report for the Automatic Urban and Rural Network, January-March 2004 | AEAT/ENV/R /1792 July 2004 |
| 2 | Ratification | QA/QC Data Ratification Report for the Automatic Urban and Rural Network, April to June 2004 | AEAT/ENV/R /1819 October 2003 |
| 3 | Ratification and Intercalibration | QA/QC Data Ratification and Intercalibration Report for the Automatic Urban and Rural Network, July to September 2004 | AEAT/ENV/R /1878 January 2005 |
| 4 | Ratification and Annual Review | QA/QC Data Ratification Report and Annual Review for the Automatic Urban and Rural Network, October to December 2004 | AEAT/ENV/R /1965 Draft May 2005 |

Other reports have also been provided to Defra and the DAs which address more specific areas of work that QA/QC Unit has undertaken during the year. These include:

- Evaluation of Methodologies to Test Losses of Gases to Sampling Systems AEAT/ENV/R/1820 Issue 1 http://www.airquality.co.uk/archive/reports/cat05/0411231002_Manifolds.pdf
- Measurement Uncertainties – An update on progress to date (Unpublished draft report)

A short report produced by the Air Quality Forecasting Unit is also available giving details of the high ozone air pollution episodes during July and August 2004. This can be found on the Air Quality Archive at:
http://www.airquality.co.uk/archive/reports/cat15/0409060809_03_episode_summer2004_final.pdf

QA/QC Unit also contributed an article on "Summer Smog 2004" in latest edition of "Network" the newsletter for the AURN (Issue 8). Copies of the newsletter can be found on AURN hub at:
http://www.aeat.co.uk/com/AURNHUB/NetworkIssue8.pdf

## 7.2 Network Data Capture

The network average data capture for 2004 was 93 % which is well above the 90% target level. This is better than in the previous year (2003) when overall data capture was slightly lower at 91%. (See Figure 7.1). 2003 was in fact a busy year for the network, with increased activity giving rise to data loss that had not effected previous years to such an extent. In particular data loss 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 see, however, that data capture in 2004 has risen to 93%, indicating that network performance has achieved its steady-state level of operation again.

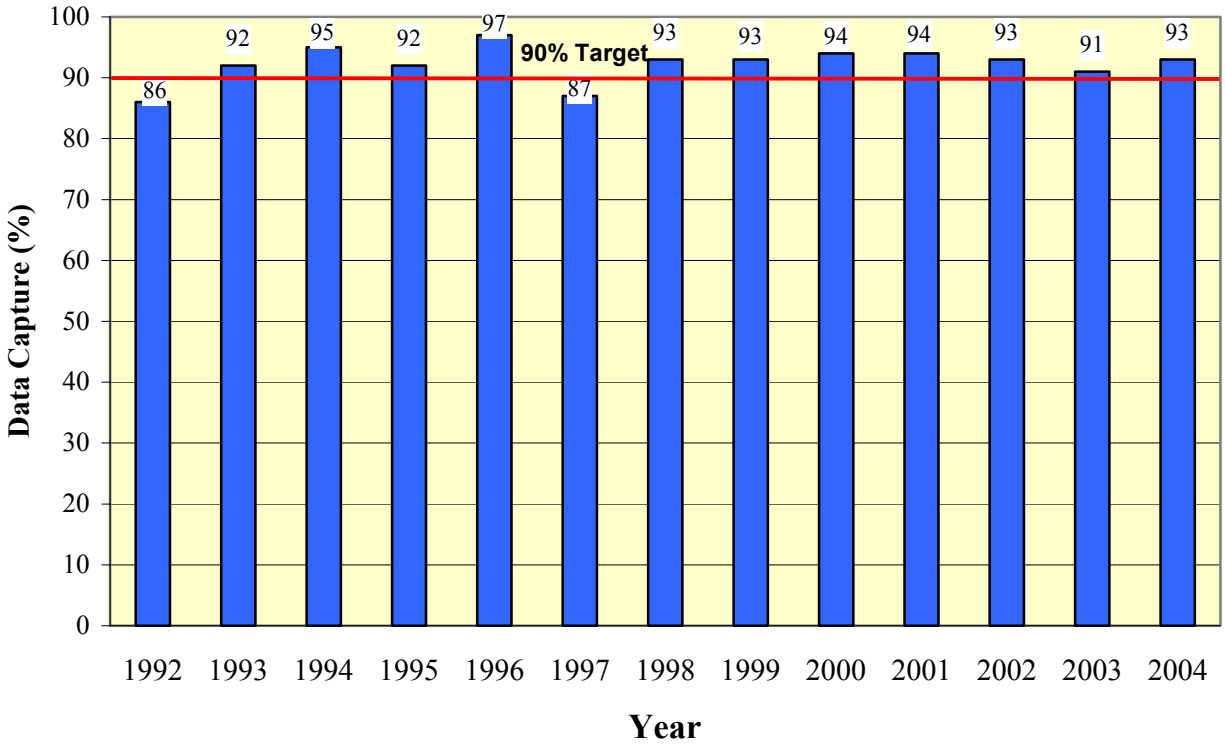



**Figure 7.1 Annual Average Network Data Capture 1992 to 2004 (Data capture calculated from site start date)**

In total 25 out of the 123 sites (20%) had an average data capture below the 90% threshold during 2004. (See Table 7.2). Of these, 14 are "critical sites" where, if data capture falls below 90% there will be insufficient data for the whole zone or agglomeration.

**Table 7.2 Sites with Annual Average Data Capture < 90%, in 2004**
(Data capture calculated from site start date)

| | Site | Critical Site | Owner | Site Average Data Capture (%) Year Jan-Dec 2004 |
|---|---|---|---|---|
| 1 | Birmingham Centre | | DEFRA | 89.9 |
| 2 | Southwark Roadside | | Affiliate | 89.8 |

| | Site | Critical Site | Owner | Site Average Data Capture (%) Year Jan-Dec 2004 |
|---|---|---|---|---|
| 3 | Blackpool | yes | DEFRA | 89.6 |
| 4 | Manchester South | | Affiliate | 89.5 |
| 5 | London Westminster | | DEFRA | 89.4 |
| 6 | Bury Roadside | | Affiliate | 89.0 |
| 7 | Northampton | yes | Affiliate | 88.8 |
| 8 | Aston Hill | yes | DEFRA | 88.2 |
| 9 | Plymouth Centre | yes | DEFRA | 88.1 |
| 10 | Manchester Town Hall | | DEFRA | 87.8 |
| 11 | Leeds Centre | yes | DEFRA | 87.5 |
| 12 | Rotherham Centre | | Affiliate | 87.5 |
| 13 | Lough Navar | yes | DEFRA | 87.1 |
| 14 | Newcastle Centre | yes | DEFRA | 86.7 |
| 15 | Wicken Fen | yes | DEFRA | 86.6 |
| 16 | Southend-on-Sea | yes | DEFRA | 86.3 |
| 17 | Glasgow Centre | yes | DEFRA | 86.3 |
| 18 | Bristol Old Market | | Affiliate | 85.3 |
| 19 | High Muffles | yes | DEFRA | 84.6 |
| 20 | Northampton $PM_{10}$ | | Affiliate | 84.2 |
| 21 | Strath Vaich | yes | DEFRA | 83.9 |
| 22 | Swansea | yes | Affiliate | 81.5 |
| 23 | Stockport Shaw Heath | | Affiliate | 75.9 |
| 24 | Camden Kerbside | | Affiliate | 67.5 |
| 25 | Narberth | yes | Affiliate | 58.8 |

In terms of reporting data to the Commission it is important to identify the data capture from the critical sites to see where there may be insufficient data capture for a particular zone or agglomeration. Overall there were 44 critical site analysers in 24 different zones/agglomerations with data capture below the 90% threshold during 2004. These are grouped by pollutant as follows:

**7 CO analysers:**

- Blackpool CO
- Leicester Centre CO
- Newcastle Centre CO
- Southend on Sea CO
- Grangemouth CO
- Leamington Spa CO
- Wigan Leigh/Centre CO

**14 $NO_2$ analysers:**

- Blackpool $NO_2$
- Glasgow Centre $NO_2$
- Hull Freetown $NO_2$
- Leicester Centre $NO_2$
- Newcastle Centre $NO_2$
- Aston Hill $NO_2$
- Eskdalemuir $NO_2$
- Glazebury $NO_2$

- High Muffles $NO_2$
- Northampton $NO_2$
- Somerton $NO_2$
- Thurrock $NO_2$
- Wicken Fen $NO_2$
- Wigan Leigh/Centre $NO_2$

**8 $O_3$ analysers**

- Blackpool $O_3$
- Reading New Town $O_3$
- Aston Hill $O_3$
- Lough Navar $O_3$
- Narberth $O_3$
- Northampton $O_3$
- Strath Vaich $O_3$
- Wigan Leigh/Centre

**5 $PM_{10}$ analysers**

- Blackpool $PM_{10}$
- Scunthorpe/Scunthorpe Town $PM_{10}$
- Northampton $PM_{10}$
- Stoke-on-Trent $PM_{10}$
- Wigan Leigh/Centre $PM_{10}$

**10 $SO_2$ analysers**

- Blackpool $SO_2$
- Glasgow Centre $SO_2$
- Hull Freetown $SO_2$
- Newcastle Centre $SO_2$
- Northampton $SO_2$
- Scunthorpe/Scunthorpe Town $SO_2$
- Stoke-on-Trent $SO_2$
- Reading New Town $SO_2$
- Wigan Leigh $SO_2$
- Wrexham $SO_2$

## 7.3 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. The intercalibration exercise has been conducted by Netcen to cover all 123 urban, rural and London network affiliate sites with over 420 analysers tested and 367 cylinders checked over a 10-week period.

The number of outlier* analysers identified at the winter and summer 2004 intercalibration exercises is shown in Figure 7.2. Full details of these intercalibrations have been reported in the first and third data ratification reports for 2004. (See Table 7.1). Out of the 419 analysers tested at the Winter audit, 88 were found to be outliers (21%). In the Summer 2004 audit 423 analysers were tested and 76 were found to be outliers (18%). During the course of these intercalibrations an inventory of manifold types used in the network was compiled and reported. Also details of the configuration of all the $PM_{10}$ analysers in

network has been recorded, with a view to ensuring that these are harmonised once the results of the $PM_{10}$ intercomparsion study (carried out by Casella Stanger) are finalised.

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.

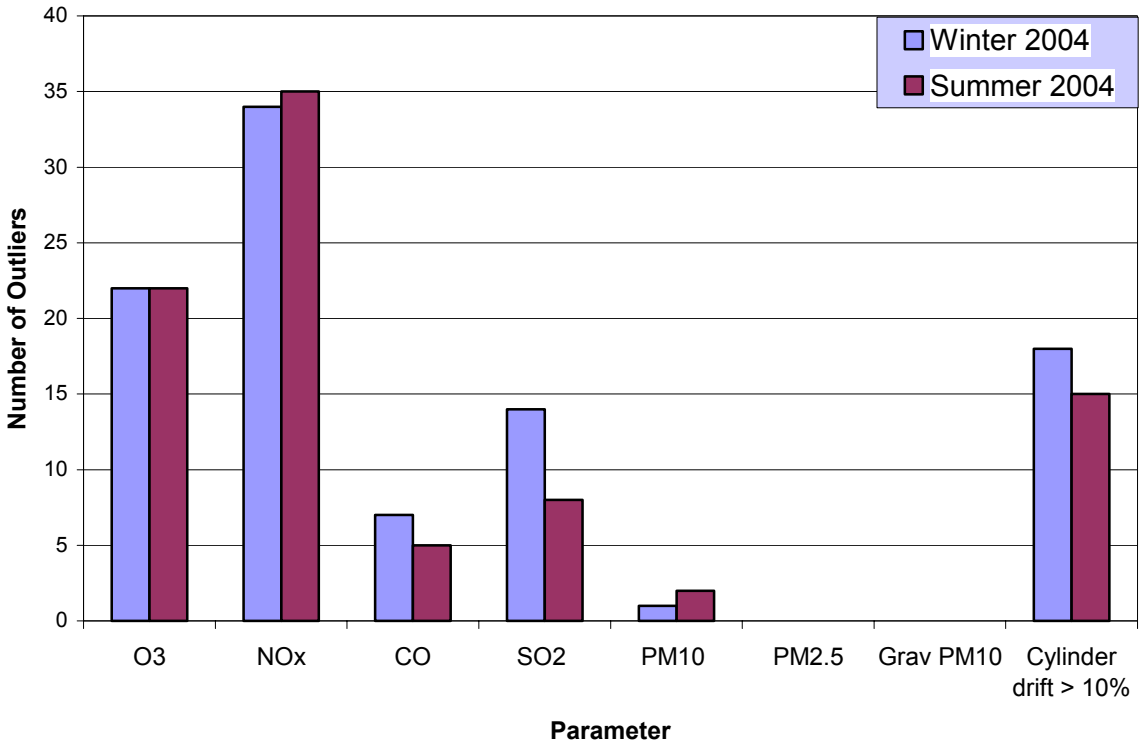



**Figure 7.2 Number of Outliers identified at Intercalibrations, 2004**

**An outlier is defined as an analyser that shows a deviation from the network mean of >10% for $NO_x$, CO, $SO_2$ and >5% for $O_3$. For $PM_{10}$ and $PM_{2.5}$ analysers the flow rates must be within 10% of the specified limits and have a $k_0$ deviation of no more than 2.5% for TEOMs. For Gravimetic $PM_{10}$ analysers the flow rates must be within 10% of the specified limits.*

## 7.4 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 2004 for a number of site operators either when new sites were starting or if additional analysers had been installed at an existing site (e.g. new DD3 $NO_2$ and $O_3$ analysers). Also re-training was carried out where sites were up-graded with equipment from a different manufacturer.

## 7.5 Investigation of spurious data

Data ratification involves processing and checking over 16 million 15-minute average measurements every year. Although the majority of analysers operate 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 the Management Units, Equipment Support Units and Site Operators 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 2004 is given below. Full details of these issues have been reported in the quarterly data ratification reports.

**$PM_{10}$ Flow Leaks**
Major leaks were identified in the TEOM analyser flow systems at two critical sites during QA/QC Unit's intercalibration exercises, resulting in extended periods of data rejection. At Stoke-on-Trent the TEOM main flow was found to be 38% lower than expected. Investigation of the data showed a drop in ambient concentration levels corresponding to a service visit in July 2003. 6.5 months data were deleted (29/7/03 to 12/2/04).

At Swansea, major flow leaks were found at two successive audits with the main flows being 60% and 45% low. The first leak was due to a cracked plastic fitting at the mass flow controller and the second due to a cracked disposable filter unit (DFU). Due to the magnitude of the leaks and resulting effect on $PM_{10}$ sampling efficiency, over nine months data were deleted (1/1/04 to 4/10/04).

**Camden Kerbside $NO_x$**
During ratification of the Camden Kerbside $NO_x$ data a problem with the stability of NO calibration response was identified. The NO channel response was seen to drift rapidly over a 4-month period whist the $NO_x$ channel response remained stable. As no fault with the analyser had been reported, QA/QC Unit recalled the site cylinder as it was possible that the response drift could be an indication of oxidation of the NO cylinder. However, results of the cylinder recalibration showed the NO concentration in the cylinder was stable and agreed well with the original certification. The response problem was later found to be due to an instrument sampling fault caused by a blocked ozone orifice. 4 months data were rejected (5/1/04 to 5/5/04). A second un-related problem occurred following the installation of a replacement $NO_x$ analyser in July resulting in a further 3 months data deletion (21/7/04 to 28/10/04).

**Noisy CO analysers**
An important part of the data ratification process is to identify specific sites where the analyser performance is unacceptable so that recommendations can be made to repair or up-grade the analysers. A number of CO analysers in the network showed unacceptably high noise or unstable baseline response resulting in data capture below 90% and these were reported in the second data ratification report. Following on from a request made by Defra, QA/QC Unit are currently investigating ways of analysing instrument performance over time to help identify the "worst case" analysers so that targeted improvements can be made (See section 3.6).

**Autocalibration Run-ons**
A generic problem has been identified at many network sites 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 for the individual sites.

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 tried different ways to resolve it including thorough cleaning of the solenoid valves and installation of permapure driers. In many cases this has improved the situation but it has not always eliminated the problem completely. QA/QC Unit has made recommendations to reduce the concentration of the autocalibration span to 100ppb and further discussions are being carried out with CMCU and the ESUs regarding this issue.

## 7.6 Local Site Operator's Manual

The AURN Local Site Operator's manual contains hands-on operating instructions for 11 different instrument types used in the network, as well as general background information including:

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

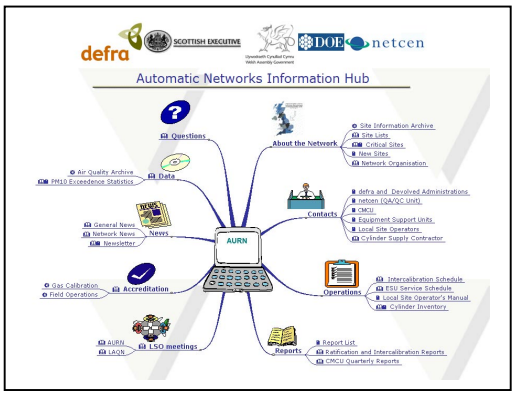

An electronic version of the Site Operator's Manual (Report Number AEAT/ENV/R1595, November 2003) has been made available on disc (CD). This was issued to all network participants at the annual LSO meeting in December 2004. If further copies are required please contact andy.cook@aeat.co.uk (Tel: 0870 190 6441). The manual is also available electronically on the 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

## 7.7 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. Figure 7.3 shows the number of hits over the last 2

* Password available for network participants from Jeff.Lampert@aeat.co.uk

years (2003 and 2004). This is a useful indicator of activity which shows a steady increase over time with the total number of hits rising by 75% in the last year. A significant increase in interest is usually seen following the Hub presentations given at the Annual Site Operator's meeting in early December.

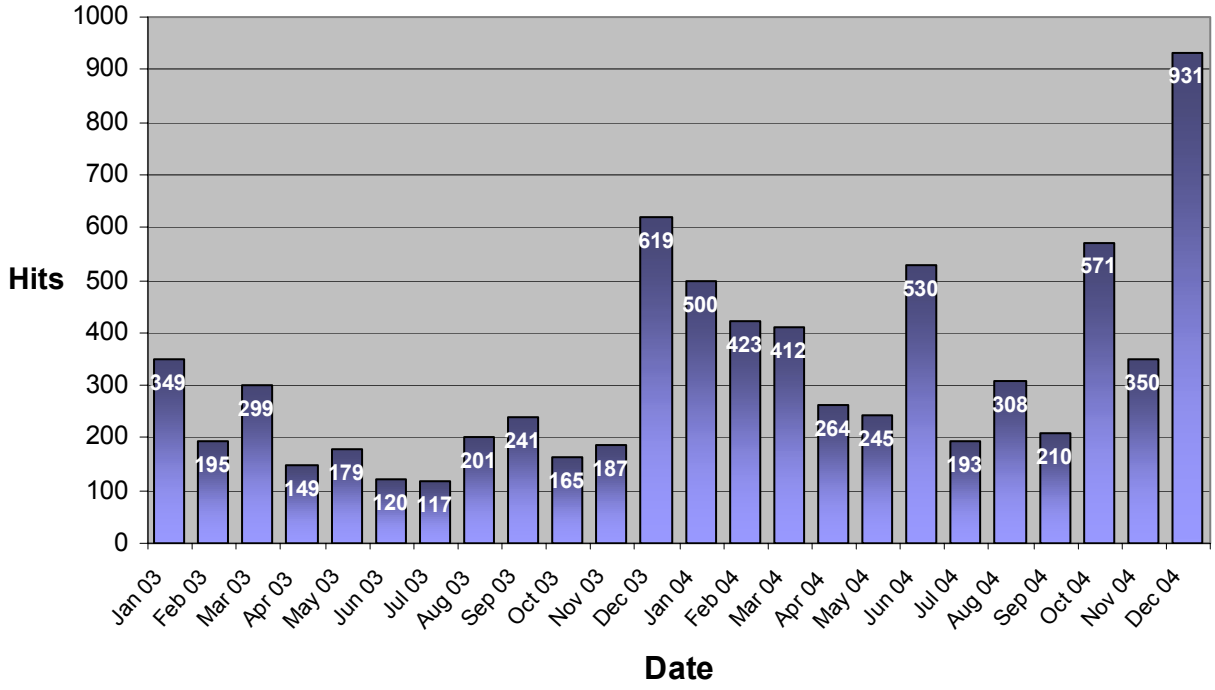



**Figure 7.3 Total Hits on the AURN Hub in 2003-4**

## 7.8 Annual LSO Meetings

QA/QC Unit attended the annual AURN Site Operator's Meeting organised by Casella Stanger at Birmingham NEC on 1st December 2004. Netcen gave presentations on recent data ratification and intercalibration issues as well as the role of AURN data in UK modelling assessment. QA/QC Unit also attended ERG's London Network Site Operator's meeting on 23rd April 2004. All presentations given at these meetings are available on the AURN Hub.

## 7.9 Cylinder Inventory

To assist the network's cylinder supply contractor (Air Liquide) 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. Air Liquide then uses this information to see which cylinders are low and need replacing. This inventory has been in place for over two years and cylinder supply has now reached a stable position where there are very few low pressure and often no empty cylinders in the network. Overall more than 200 gas calibration cylinders were replaced by

Air Liquide in 2004, with each cylinder being certified by Netcen to EN ISO 107025 accreditation standard.

## 7.10 International Harmonisation

QA/QC Unit has attended a bi-lateral intercomparison exercise with the Irish EPA in March 2005. Plans are also underway to attend the next EU intercomparison exercise for the compounds $SO_2$, CO and $NO_x$ to be held in Ispra at the Joint Research Centre, ERLAP from June 6-10$^{th}$ 2005. The programme will focus on the intercomparison of gas calibration standards, but also included tests on the influence of interferences of BTX, $CO_2$, NO, $NO_2$ and relative humidity. This interaction with other institutes responsible for network QA/QC throughout Europe has helped to ensure increased harmonisation of monitoring and data quality

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 2004 and most recently in April 2005. The first of these meeting was to discuss particulate measurements and following the meeting a contribution was provided to the proposed AQUILA input on the update of the first Daughter Directive to the CAFE Working Group. The second meeting mainly covered the EC CAFE final thematic strategy document and revision of First Daughter Directive (DD1). The next AQUILA meeting, scheduled for October 2005, will focus on the role of National Reference Laboratories in relation to Article 3 of Air Quality Framework Directive.

## 7.11 ISO 17025 Accreditation

Netcen maintained the scope of its ISO 17025 accreditation throughout the year. Routine surveillance visits were carried out by UKAS on 4 occasions in 2004, 2 at monitoring sites for calibrations and 2 at Netcen. One of these was related to the relocation of Netcen from Culham to Harwell. Overall, UKAS was very satisfied with the quality of the work carried out and a total of 18 minor non-conformities were raised.

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. The scope of accreditation has also been extended to include measurement of TEOM flows inside monitoring stations, where for reasons of health and safety, access to the roof is not possible.

## 7.12 Development of QA/QC Practises

It is recognised that QA/QC practises are not static and the aim is for continuous improvement within the overall QA/QC programme. As a result a number of measures have been introduced to improve the efficiency of QA/QC Unit operations and ultimately the overall quality of the data. These include:

- Long-term data checking and analysis
- Analyser performance checking
- Investigation of CO background concentrations
- Development of procedures to conform to CEN standards
- $NO_x$ converter calculator
- Investigation of manifold sample losses
- Uncertainty calculations
- Evaluation of dilution calibrator and photometer

A short description of each of these developments is given below:

**Long-term data checking**
In order to further improve the data ratification procedures, QA/QC Unit has developed additional long-term data validation tools to help identify any possible outlying data sets for additional investigation. These include site specific annual mean projections and long-term $NO_2/NO_x$ ratio plots. These additional data checking procedures are now routinely incorporated into the data ratification process.

**Analyser performance checking**
A method of checking the performance of the individual site analysers over many years of continuous operation is being developed to help identify the "worst case" sites. This analysis will help to provide sound information on which to base recommendations for any improvements need in the network in terms of equipment up-grading and/or maintenance. (See also section 3.5)

**Investigation of CO background Concentrations**
QA/QC Unit undertook an investigation of background CO concentrations in order to determine the best way to process CO data during ratification. Investigations made from satellite data and measurements made by gas chromatography at a remote site, showed that typical background CO concentrations in the UK were expected to be in the range 0.08 to 0.15 ppm. This information has been used to develop a new ratification procedure for CO zero baseline evaluation and hence, from 2004 onwards, CO data in the AURN will have a baseline of at least 0.07 ppm. Further details of this investigation were reported in Section 2.9 of the second data ratification report (April – June 2004).

**Development of procedures to conform to CEN standards**
The European Committee for Normalisation (CEN) has issued a series of documents prescribing how analysers must be operated, to produce datasets that conform to the Data Quality Objectives of the EC Directives. The CEN documents for operation of air pollution analysers; BS-EN14211:2005 (NOx), BS-EN14212:2005 ($SO_2$), BS-EN14626:2005 (CO) and BS-EN14625:2005 ($O_3$) set out a series of performance criteria for analysers which must be achieved, both in the field and under laboratory conditions. The CEN operating methodologies were formally published in February 2005, and will be adopted into the requirements of the Framework Directive in August 2005. It is understood that Member States will then have up to two years to ensure their monitoring networks are compliant. QA/QC Unit are taking steps to ensure the procedures used in the UK comply with the requirements ahead of any imposed deadlines.

**Sample Manifold Losses**
Earlier studies have shown that significant quantities of nitrogen dioxide and sulphur dioxide can be removed by sampling systems prior to analysis by the instruments on the sites. In order to meet the requirements of CEN, the sampling system that delivers air to the analyser must remove no more than 2% of the gas to be analysed. In addition, it will be necessary to test the performance of the sampling manifold systems at sites in the network every three years. QA/QC Unit has, therefore, carried out a study to determine an accurate, reliable and cost-effective technique for evaluating losses of gases to sampling manifold systems. The results of this development work have been reported and are available on the AURN hub website.

**Measurement Uncertainties**
The European Commission for Standardisation (CEN) has put forward operating methodologies for running air pollution instrumentation in National Monitoring Networks. To comply with these performance standards, every Member State will be required to regularly evaluated uncertainties in their measurements using prescribed calculations. The protocols allow for a maximum permitted uncertainty of ±15% at the relevant Limit Value for each gaseous pollutant. QA/QC Unit has undertaken a number of preliminary studies to evaluate the performance of the Automatic Urban and Rural Monitoring Network against the requirements of the protocols. This work has concentrated in the following areas:

- Calculation of the Protocol Uncertainty Budgets using maximum permitted individual performance criteria
- Evaluation of the performance of site sampling systems
- Recertification of site calibration cylinders
- Use of intercalibration results to compare against ratified data sets.

Further work to assess measurement uncertainty using typical analyser specifications is now underway.

**$NO_x$ Converter Calculator**
QA/QC Unit is currently developing a $NO_x$ converter efficiency calculator spreadsheet which provides instructions for testing converters according to CEN methodology. This will shortly be issued to the Equipment Support Units as a means of helping to ensure that consistent procedures are adopted throughout the network.

**Evaluation of Dilution Calibrator and Photometer**
Netcen maintain a watching brief on emerging technologies that may be relevant to the Network and QA/QC programme. Recently a new dilution calibrator, zero air generator and ozone photometer was purchased for evaluation in the laboratory and field. Tests on the new system will include comparability with existing equipment, accuracy, traceability and long-term reliability when transported around the country. If satisfactory, this system will offer the benefits of accurate and reliable measurement capabilities in an integrated lightweight system.

## 7.13 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 European CEN standards (final version published February 2005), 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.

Further network expansion is already planned with regard to increasing rural particulate monitoring. Two sequential gravimetric (Partisol) samples will be installed at Auchencorth

Moss for $PM_{10}$ and $PM_{2.5}$ monitoring. An additional ozone analyser will also be installed at the Meteorological Office observatory site in Lerwick in the Shetland Islands. Commissioning of the remaining two DD3 sites (Fort William and Leominster) will bring the total number of sites in the network to 127 in 2005.

# 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 since January 2004. Recommendations have been prioritised as follows:

| Priority | Definition | Time-scale |
|---|---|---|
| High* | Immediate action necessary to avoid compromising data capture/quality or safety.<br>Critical sites should be treated as high priority. | Within 2 weeks |
| Medium | Essential but not immediate | 3-6 months |
| Low | Desirable but not essential | As appropriate |

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

| | Recommendations May 2005 | Priority | Action |
|---|---|---|---|
| 12 | CO baseline response instability at Exeter Roadside needs to be investigated and the analyser repaired or up-graded. | Medium | |
| 11 | $SO_2$ analyser at Stoke-on-Trent shows severe baseline response drift. Recommend immediate repair/up-grading | High Critical Site | |
| 10 | The $SO_2$ analyser at Manchester South has shown a history of high noise response and should be up-graded or repaired. | Medium | |
| | **Recommendations January 2005** | | |
| 9 | Recommend the High Muffles $NO_x$ autocalibration system is repaired/up-graded or turned off (span off only) until a satisfactory solution to autocalibration run-on problem is found. | High Critical site | Autocal span turned off but accidentally reactivated after service. |
| 8 | As the Blackpool site is now closed, we recommend the opportunity be taken to install ladder securing points to allow safer access to the site roof, prior to the site being relocated. | High Critical site | Site relocation underway |
| | **Recommendations October 2004** | | |
| 7 | Recommend repair or up-grading of 11 unstable CO analysers detailed in Section 3.1 of this report. Of these, Barnsley Gawber (Affiliate) and Nottingham Centre (Defra) are critical for CO. | High Critical sites | On-going |
| 6 | Further advice for AURN equipment replacement and up-grading was given to CMCU on 8th September 2004. | | On-going |
| | **Recommendations July 2004** | | |
| 5 | Exeter Roadside CO unstable baseline. Recommend up-grading or repair. | Medium | On-going |
| 4 | Sheffield Tinsley CO noisy and drifting response. Recommend up-grade or repair | Medium | On-going |

| | | | |
|---|---|---|---|
| 3 | Recommend up-grading or modify $SO_2$ Ambirack bench at Reading New Town | Critical Site (Defra) | On-going |
| | **Recommendations January 2004** | **Priority** | **Action** |
| 2 | 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 | Blackpool - new $SO_2$ bench fitted 9th March 2004 |
| 1 | Advice on requirements for further AURN equipment up-grades has been given to CMCU (20/1/04) | | On-going |

# APPENDIX A2

## CRITICAL SITES IN THE AURN (May 2005)

### 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 | | | $NO_2$ $O_3$ |
| 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: $PM_{10}$ monitored by Gravimetric and TEOM
Note 3: DD3 Critical as Rural Background station
Note 4: If $NO_2$ at West Midlands is Suburban then $NO_2$ 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 | | | $NO_2$ $O_3$ |
| 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+/Centre[8] | 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 | | | $NO_2$ $O_3$ |
| Dumfries | Scottish Borders | $NO_2$ $PM_{10}$ | CO | |
| Canterbury+ | South East | $PM_{10}$ | | |
| Oxford Centre Roadside+ | 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] $O_3$ |
| 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 Town+ | 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: $PM_{10}$ monitored by Gravimetric and TEOM
Note 3: DD3 Critical as Rural Background station
Note 4: If $NO_2$ at Leominster is Suburban then $NO_2$ at Leamington Spa is no longer critical for DD1
Note 6: Not Affiliated/Monitoring yet
Note 7: Addresses CO, Benzene not included here
Note 8: Wigan Leigh relocated to Wigan Centre on 8th October 2004

# APPENDIX A3

## 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, April 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)<br>A second intercalibration kit (commissioned January 2001)<br>UV photometers:<br>API model M401- purchased April 1999 (on temporary loan)<br>ML model 9812 – purchased April 1999 (to be written off)<br>API model 401 - purchased October 2000 (on temporary loan)<br>API model 401 – purchased December 2002 (on temporary loan)<br>4 API model 401 – purchased March 2004<br>Mass flow controllers - purchased April 2002<br>3 Drycal flow meters - purchased September 2002<br>1 Mass flow controller read-out unit to be incorporated in the audit dilution apparatus – purchased September 2002.<br>A third intercalibration kit (commissioned May 2004)<br>Drycal flow meter – purchased March 2004<br>Sabio 2010 dilution calibrator – purchased February 2005<br>Sabio 2020 zero air generator – purchased February 2005<br>Sabio 2030 ozone photometer – purchased February 2005 |
| 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<br>TEI 43C $SO_2$ analyser<br>TEI 48C CO analyser<br>M265 chemiluminescent ozone analyser<br>(All of the above purchased on behalf of Defra by Casella Stanger in March 2003 and transferred to QA/QC Unit) |

# APPENDIX A4

## Summary of Recommendations

This appendix provides a summary of all the recommendations given in this report.

| | Need | Recommendation | Section | FAO |
|---|---|---|---|---|
| 1 | Routine converter efficiency checking | Pay careful attention to stability of fortnightly $NO_2$ calibration span response | 2.5 | LSOs |
| 2 | $NO_x$ converter set-up after service | Converter to operate at >98% after service | 2.5 | ESUs |
| 3 | TEOM $k_0$ outliers | Confirm $k_0$ at London A3 Roadside and Portsmouth have been correctly re-set after service | 2.8 | ESUs |
| 4 | Zero baseline truncation | Instrument zero baseline offsets of 20-50mV to be applied after service | 2.9 | ESUs |
| 5 | Autocalibration run-on | Investigate problem of autocalibration run on at sites given in Table 2.7.<br>Autocalibration span concentrations to be <200ppb for urban sites and <100ppb for rural sites.<br>High Muffles autocalibration span to be switched off (but zero to be continued). | 2.10 | ESUs |
| 6 | Manchester South $SO_2$ (Affiliate site) | Noisy analyser to be repaired or up-graded | 3.1 | LSO/ESU |
| 7 | Stoke-on-Trent $SO_2$ (Critical site analyser) | $SO_2$ analyser baseline response instability to be investigated/ repaired | 3.2 | CMCU/ ESU |
| 8 | Exeter Roadside CO (Affiliate site) | CO analyser baseline response instability to be investigated/repaired | 3.4 | LSO/ESU |
| 9 | Ozone analyser faults | Clarification needed on reason for generic faults and steps taken to resolve the problem | 3.5 | CMCU/ ESU |
| 10 | Critical site analysers | Ensure call-outs/repairs are carried out ASAP to maximise data capture | 5 | LSO/ESU |