

Report

**QA/QC Data Ratification Report for
the Automatic Urban and Rural
Network,
July – September 2002**

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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1. Introduction

This is the first in a new series of quarterly reports covering the Quality Assurance and Control (QA/QC) activities undertaken by netcen to ratify automatic monitoring data from Defra's urban and rural air quality monitoring network (AURN). The move from 6-monthly to quarterly reporting has a number of benefits including:

- Faster notification of QA/QC issues.
- More frequent feed back to the Network managers, site operators and service engineers.
- Compatibility with the 3-month ratification schedule.

In addition to the 82 urban sites this report includes for the first time, 22 rural network sites and 14 sites in the London Air Quality Monitoring Network (LAQN) which are affiliated into the national network, bringing the total number of sites to 118. This data ratification report covers the 3-month period July-September 2003 and contains the following information:

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 presented in tables
Appendix A:	Recommendations for replacing or up-grading equipment (compiled in conjunction with CMCUs).
Appendix B:	Critical sites in the AUN

1.1 Recent Changes in the Network

Following award of new contracts in October 2002, netcen have undertaken the role of QA/QC Unit for the urban, rural and London Network monitoring sites. Casella Stanger continue to be the Central Management and Co-ordination Unit (CMCU) for the urban and rural sites with Environmental Research Group (ERG, King's College London) undertaking the management role for the London Air Quality Network. Messer UK Ltd is now responsible for the supply and delivery of gas calibration cylinders to all network sites.

An overview of the main changes relating to sites in the AURN between January to December 2002 is given in Table 1.1.

The installation of additional CO analysers has now been completed to fulfil the requirements of the Second European Daughter Directive (DD2) which came into force in the UK on 13th December 2002. During this period CO analysers were installed at Barnsley Gawber (8th July), Bournemouth (19th July), and Stockton on Tees Yarm (14th August). The start of CO monitoring at Grangemouth was delayed until January 17th 2003 because the site infrastructure was being up-graded.

Monitoring at Hull Centre was suspended on 17th January 2002 because of nearby demolition work associated with the redevelopment of the area. This site was relocated to Hull Freetown and monitoring commenced on 8th November 2002. The Stockport site was also relocated on 11th October 2002 to Stockport Shaw Heath.

The Grangemouth site resumed operation on 17th January 2003 following a 6-month closure to up-grade the site infrastructure.

The Liverpool Centre Site was closed on 23rd September 2002 for health and safety reasons, however relocation of this site approximately 10 miles away to the vacated hydrocarbon site in Speke is in progress.

The Edinburgh Centre site was closed in April 2002 due to necessary redevelopment of the Princes Street Gardens area. A mobile station operated by Edinburgh City Council was co-located approximately 90 metres north east of the original site. A period of parallel monitoring demonstrated satisfactory continuity between the site locations. The mobile station was operating from April 24th until late November when it had to be closed because of preparations for the Hogmanay celebrations. It is anticipated that monitoring at the temporary mobile station will be restored in the near future. In the meantime, plans are underway to relocate the original site approximately 1 mile away to Richmond Gardens.

Gravimetric PM₁₀ monitoring at London Westminster commenced on 15th January 2003. The Partisol analyser at Brighton Roadside has now been installed following delays due to planning restrictions and it is anticipated that monitoring will start in the near future.

The monitoring station at Reading will be closed at the end of January 2003 when the lease for the site expires. Arrangements are being made to relocate the site approximately 1 mile away at Junction Cemetery.

Table 1.1 Changes to the AURN between January to December 2002

Sites	Date Commenced	Pollutants
New sites		
Wrexham	6 March 2002	NO ₂ CO SO ₂
ADDITIONAL CO MONITORING (DD2)		
Wrexham	6 March 2002	CO
Cwmbran	12 March 2002	CO
Northampton	12 March 2002	CO
Portsmouth	21 March 2002	CO
Wigan Leigh	15 th May 2002	CO and O ₃
Barnsley Gawber	8 th July 2002	CO
Dumfries	17 th July 2002	CO
Inverness	17 th July 2002	CO
Bournemouth	19 th July 2002	CO
Stockton-on-Tees Yarm	14 th August 2002	CO
Grangemouth	17 th January 2003	CO
Additional Gravimetric PM₁₀ (Partisol) monitoring		
Inverness	13 th February 2002 (restarted after vandalism)	PM ₁₀
Wrexham	6 th March 2002	PM ₁₀
London Westminster	15 th January 2003	PM ₁₀
Brighton Roadside	Installed – not operational	PM ₁₀
Monitoring suspended		
Data Loss		
Hull Centre relocated to Hull Freetown	17 Jan 2002 - 8 th Nov 2002	All
Grangemouth – site up grade	1 st August 2002 – 17 th January 2003	All
Inverness – vandalised	30 th September 2001 to 13 th February 2002	PM ₁₀ (Gravimetric)

Sites	Date Commenced	Pollutants
London Bloomsbury relocation	4 Feb 2002 to 5 March 2002	All
Edinburgh mobile site temporarily closed.	Late November 2002 onwards	PM ₁₀
Stockport relocated to Stockport Shaw Heath	8 th –11 th October 2002	All
Liverpool Centre closed. Relocation to Speke in progress	23 rd September on-going	All
Reading closed. Relocation to Junction Cemetery in progress	To be closed at end of January 2003	All

1.2 Overview of Network Performance

Ratified hourly average data capture for the network averaged 92.4% for all pollutants (O₃, NO₂, SO₂, CO and PM₁₀) during the 3-month reporting period July-September 2002. Note that the rural and LAQN sites have been incorporated into the ratification system for this period and hence are included in the network data capture figures presented here.

The overall Network data capture has been reduced slightly compared with previous periods mainly as a result of lower CO and SO₂ data capture. (Table 1.2). The Network average CO data capture was just below the 90% target level at 89.7% and the SO₂ data capture was on the borderline at 90.0%.

Table 1.2 AURN Ratified Data Capture (%) July – September 2002

(Using the start date of any new site)

Pollutant	O ₃	NO ₂	CO	PM ₁₀	SO ₂	Average
Data Capture (%)	93.8	92.7	89.7	93.6	90.0	92.4

Overall, 317 out of the 389 analysers (81.4%) achieved data capture levels above the required 90% target during this period. Table 1.3 shows the number of analysers in the network that did not achieve 90% data capture. From this it can be seen that a relatively high proportion of CO analysers (28%) in the network failed to meet the target. The reason for this was mainly due to analyser malfunction, high response noise and baseline truncation (See Section 4 for details). Over 21% of the SO₂ analysers in the network did not achieve 90% data capture and this was mainly due to response instability problems. The main site operational and QA/QC issues giving rise to data capture below the required 90% level are summarised in Section 4.

Table 1.3 Number of Analysers with Data Capture below 90% (July-September 2002)

	Total Number Of Analysers	Analysers with Data Capture < 90%	Analysers with Data Capture < 80%
CO	75	21	11
NO ₂	97	15	7
O ₃	76	13	3
PM ₁₀	66	7	5
SO ₂	75	16	8
All sites	389	72	31

All data capture figures given in this report now include the gravimetric PM₁₀ data. Note that there are two PM₁₀ instruments at Northampton: a TEOM and a Partisol. Data from the Northampton TEOM instrument have been used to calculate the data capture. QA/QC Unit has developed data ratification procedures for the gravimetric analysers and an additional section on gravimetric PM₁₀ data ratification has been included in this report (Section 4.1).

A more detailed breakdown of the hourly data capture statistics for each site is presented in Section 5, Table 5.1. In total, 22 out of the 118 sites (18.6%) had an average data capture rate below the required 90% level for the July to September 2002 period. (See Table 1.4)

Table 1.4 Sites with Average Data Capture < 90%, July to September 2002
(data capture from site start date)

Site	Status	Average Data Capture (%)
Leeds Centre	defra	89.4
Stoke-on-Trent	defra	87.8
Wicken Fen	defra	86.0
Wrexham	defra	84.4
Birmingham Centre	defra	83.4
Leicester Centre	defra	82.3
Lullington Heath	defra	82.2
Reading	defra	81.7
Liverpool Centre	defra	77.0
Wolverhampton Centre	defra	74.5
Southampton Centre	defra	59.1
Great Dun Fell	defra	30.8
Weybourne	Affiliate	89.0
Bournemouth	Affiliate	88.5
London Hackney	Affiliate	88.1
Manchester South	Affiliate	87.4
Rochester	Affiliate	86.8
London Bexley	Affiliate	86.0
Coventry Memorial Park	Affiliate	75.4
Southwark Roadside	Affiliate	65.0
Bristol Old Market	Affiliate	51.6
Grangemouth	Affiliate	33.3

Netcen carried out the summer intercalibration and site audits at 82 urban sites during July-September 2002. NPL undertook similar intercalibrations at the Rural and London network sites. Results from these intercalibration exercises have been used to assess the accuracy and consistency of the data for this reporting period. Details of the summer 2002 intercalibrations have been reported separately (Netcen Report AEAT/ENVR/R/1367 (AUN), NPL reports RS1002 Rural and RS1002 London). In future, the intercalibration reports will be issued in conjunction with two of the quarterly data ratification reports.

QA/QC Unit's data ratification and intercalibration reports are now available on the Air Quality Archive web site at the following address:

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

and also on the AURN project information hub web site (see below).

1.3 The AURN Project Information Hub

With rapid growth in the use of internet technology as a communication channel, netcen has developed the AURN project information Hub in order to assimilate, store and share project information with all network participants. The Hub is based on a branch diagram which links different topic areas within the project. (see Figure 1.1).

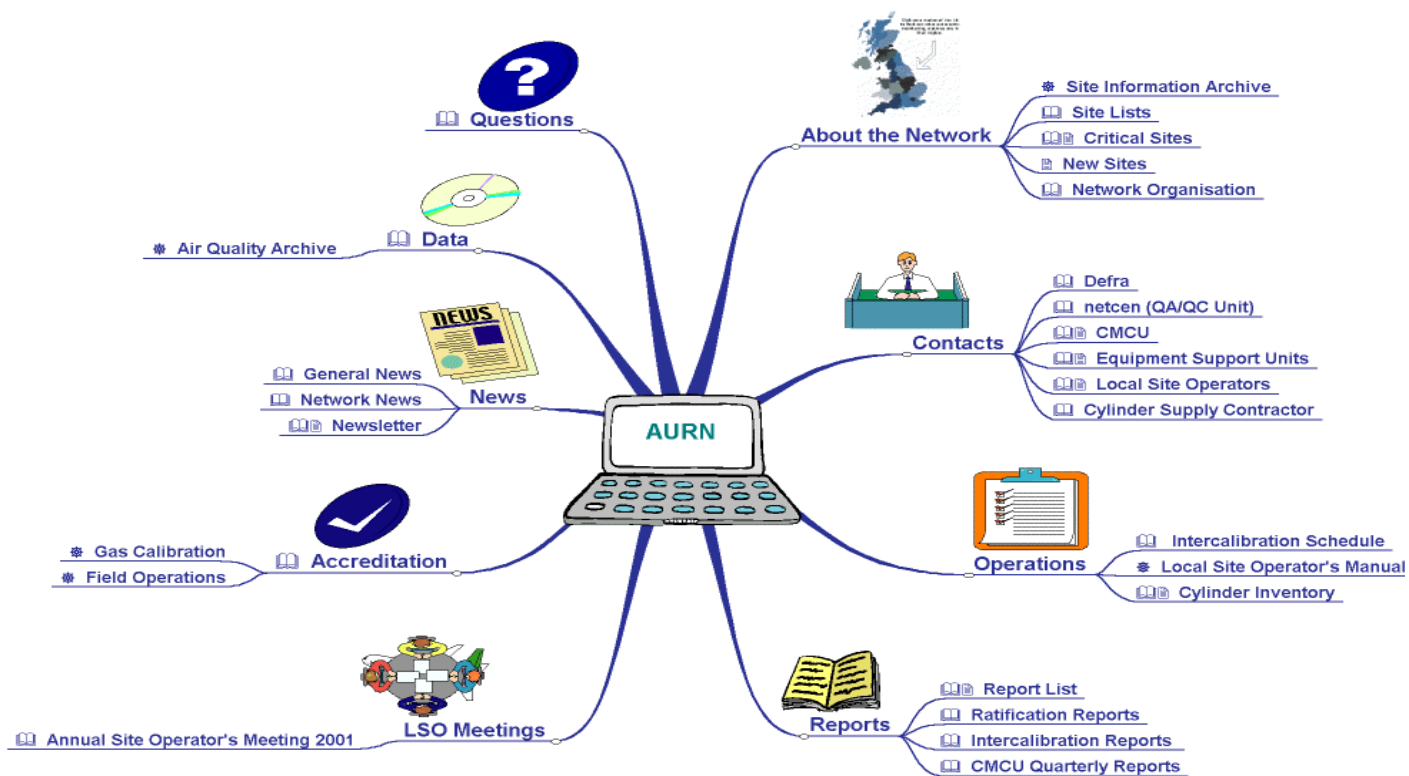


Figure 1.1 The AURN Project Information Hub

Currently the Hub has been developed as a password protected* Internet site containing documents and hyperlinks related mainly to the QA/QC Unit's role in the AURN. The AURN project information hub can be found at the following address:
<http://www.aeat.co.uk/com/AURNHUB/index.html>.

This web site provides an effective new forum for promoting communication between the Network participants, as well as being a particularly cost-effective way of distributing and up-dating network documentation.

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

2. Generic Data Quality Issues

2.1 Progress on the Affiliation of New Sites

The programme to install additional CO monitors to comply with the EU DD2 Directive for CO monitoring was completed during this period. New CO monitors were commissioned at Barnsley Gawber (8th July 02), Bournemouth (19th July 02), Stockton on Tees Yarm (14th August 02) and Grangemouth (17th January 03).

Future expansion of the network to incorporate 7 additional ozone and 10 rural NO_x monitors will be required to comply with the third Daughter Directive which has an implementation date of 9th September 2003. It is anticipated that NO_x analysers will be installed at Aston Hill, Bush, Glazebury, High Muffles and Yarner Wood during the next 6 months. Further details on the second and third Daughter Directives can be found at: <http://www.defra.gov.uk/environment/consult/air-23daughter/index.htm>

2.2 Data Capture for Critical Sites in Zones and Agglomerations

In order to meet the requirements of the First Daughter Directive, any zone or agglomeration with an exceedence of the limit value during 2002 must be formally reported to the Commission. Data capture targets must be achieved, especially for the zones and agglomerations that rely on the results from a single monitoring station (i.e. critical sites). A list of the critical sites in the Network is given in Appendix B. Out of the 41 critical sites there were 20 sites where one or more of the critical pollutants did not meet the 90% data capture target during the 3-month period July to September 2002 (See Table 2.1). The reasons for data loss at these sites are provided in Section 4. Table 2.2 shows the critical sites with less than 90% data capture for the 9-month period January to September 2002. Any site with less than 86.5% data capture during this 9-month period will not achieve the 90% data capture target for the year.

Table 2.1 Critical Sites in Agglomerations and Zones* with < 90% data capture, July-September 2002

(All data captures are calculated from 1st July to 30th September 2002)

Critical Sites in Agglomerations		
Site	Pollutant	Data Capture(%)
Bournemouth	CO	82.6
	PM ₁₀	83.6
Coventry Memorial Park	CO	0 (noisy analyser)
	NO ₂	88.2
Brighton Roadside	PM ₁₀ (Gravimetric)	Not operational
Hull Centre	All	0 (Site closed)
Southampton Centre	CO	70.9
	NO ₂	77.6
	PM ₁₀	71.3
	SO ₂	13.7
Edinburgh Centre	CO	89.7
Cardiff Centre	CO	82.0
	NO ₂	88.9

* 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>

Critical Sites in Agglomerations		
Site	Pollutant	Data Capture(%)
Wirral Tranmere	CO	83.2
Leicester Centre	CO	80.4
	NO ₂	88.0
	PM ₁₀	65.4
	SO ₂	88.4
Liverpool Centre	CO	64.2
	NO ₂	81.5
	PM ₁₀	69.5
	SO ₂	87.3
Reading	CO	79.6
	SO ₂	44.9
Stoke-on-Trent Centre	CO	77.8
	NO ₂	89.5
	SO ₂	89.0
Swansea	CO	85.7
Critical Sites in Zones		
Aberdeen	PM ₁₀	71.6
Cwmbran	SO ₂	89.4
Grangemouth	CO	Not installed
	NO ₂	33.9
	PM ₁₀	32.2
	SO ₂	33.9
Wrexham	SO ₂	50.3
Wigan Leigh	SO ₂	89.7
Oxford Centre	CO	88.5
Plymouth Centre	CO	86.1

RECOMMENDATION

Every effort should be made to ensure that data capture is maximised for the critical sites identified in Tables 2.1 during the next 3 months. LSOs and ESUs should undertake call-outs and repairs as soon as possible to avoid further data loss.

Table 2.2 Critical Sites in Agglomerations and Zones* with <90% data capture, January to September 2002

(All data captures are calculated from 1st January to 30th September 2002)

Critical Site Name	CO	NO ₂	PM ₁₀	SO ₂	Comments
Critical Sites In Agglomerations					
Belfast Centre	✓	✓			
Blackpool	✓	✓	✓	✓	
Bournemouth ⁺	22.4	88.1	✓	✓	
Brighton Roadside ⁺			0		Not operational yet
Bristol Centre			✓	✓	
Cardiff Centre	85.8	✓	✓	85.3	
Coventry Memorial Park ⁺	24.5	85.5	✓	✓	
Edinburgh Centre	✓	✓	✓	✓	
Glasgow Centre				85.4	
Hove Roadside ⁺				✓	
Hull Centre	5.6	5.9	5.9	6.0	Site closed 17/1/02
Leicester Centre	✓	✓	73.9	✓	
Liverpool Centre	52.9	✓	✓	✓	
Newcastle Centre	88.3	✓	✓	✓	
Nottingham Centre	✓	✓	87.2	✓	
Portsmouth ⁺	69.0	✓	✓	✓	
Preston	✓	✓	✓	✓	
Reading	46.3	✓	✓	76.4	
Sheffield Centre			✓		
Southampton Centre	83.5	✓	88.5	58.5	
Southend-on-Sea	✓	✓	✓	✓	
Stoke-on-Trent Centre	✓	✓	✓	✓	
Swansea ⁺	74.5				
Wirral Tranmere	66.9	✓	✓	✓	
Critical Sites in Zones					
Aberdeen ⁺	✓	✓	63.3	✓	
Barnsley Gawber ⁺	30.1	82.3			
Canterbury ⁺			✓		
Cwmbran ⁺	68.4	✓	✓	✓	
Derry ⁺	✓	✓	✓	✓	
Dumfries	✓	✓	✓		
Grangemouth ⁺	0	76.6	76.6	76.6	CO started 17/1/03
Inverness		✓	54		PM ₁₀ vandalised
Leamington Spa ⁺	✓	✓	✓	✓	
Northampton ⁺	42.7	✓	✓	✓	
Oxford Centre ⁺	89.9			✓	
Plymouth Centre			✓		
Scunthorpe ⁺			79.2		
Stockton-on-Tees Yarm ⁺	17.7	✓	✓		
Sunderland				✓	
Wigan Leigh ⁺	50.5	✓	✓	✓	
Wrexham	74.5	71.9	70.6	59.4	
Number of sites <86.5%	17	5	8	7	

Key Pollutant not critical at this site
 ✓ Data capture for critical pollutant >90%
 + Affiliate site

2.3 Gravimetric PM₁₀ Data Ratification

Gravimetric PM₁₀ analysers (Partisols) are located at seven sites in the network (Bournemouth, Northampton, Wrexham, Dumfries, Inverness, London Westminster and Brighton Roadside). PM₁₀ monitoring at London Westminster started on 15th January 2003. The analyser at Brighton Roadside has been installed but is not fully operational yet.

The Partisol instrument differs from the TEOM and BAM (Belfast Clara Street) by using a filter that must be manually weighed in a laboratory. Also, the Partisol is configured to automatically change the sample filters every 24-hours while the other two instruments can record hourly mean concentrations.

Care must be exercised when comparing PM₁₀ concentrations made using these three techniques. Analysis has shown that measurements made using the gravimetric PM₁₀ (Partisol) instruments are approximately 1.3 times higher than the TEOM. One difference is that the TEOM sample filter is maintained at 50°C to keep the filter dry, while the other two techniques sample at ambient temperature.

The Northampton Partisol is also co-located with a TEOM which provides a useful check that both techniques are operating correctly. Gravimetric PM₁₀ concentrations and the daily mean TEOM scaled by 1.3 at Northampton are shown in Figure 2.1. This shows good agreement between the two techniques during the periods when the Partisol was operational.

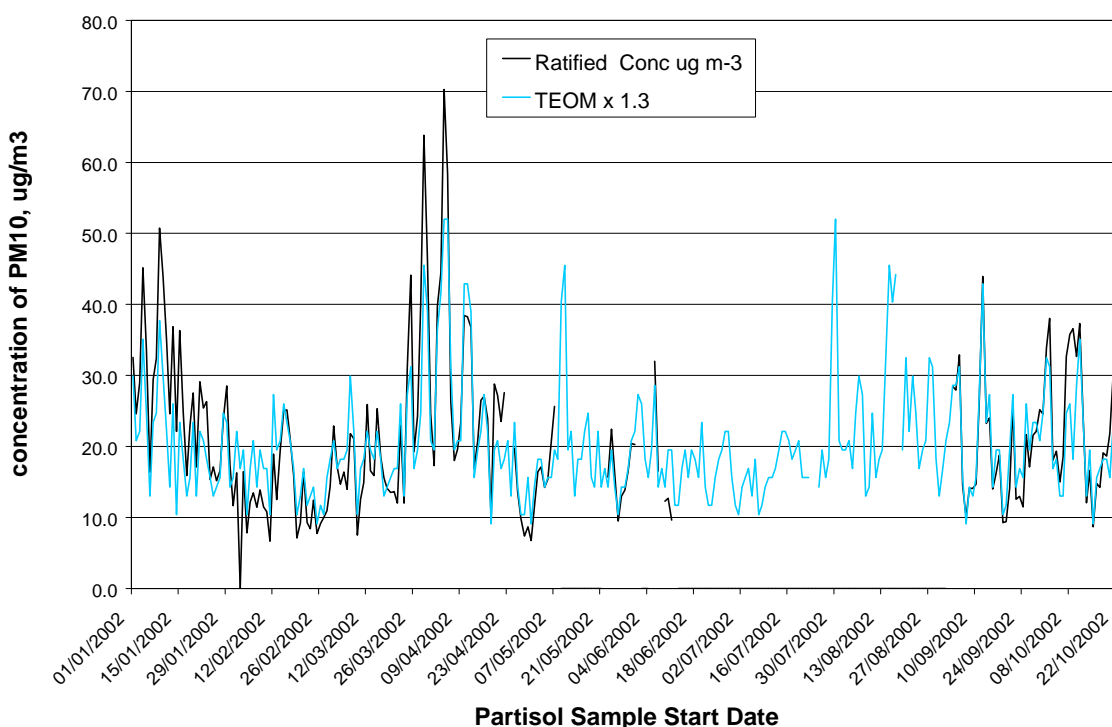


Figure 2.1 Partisol and TEOM (x1.3) Concentrations at Northampton

Data capture for the gravimetric PM₁₀ (Partisol) analysers during July to September 2002 was below the required 90% level for two out of the five operational sites. This shows an overall improvement in performance compared to the previous ratification period where 4 out of the 5 analysers had data capture below 90%. The average data capture for the

gravimetric PM₁₀ analysers (Partisols) during July-September 2002 was 81.7%. Details of data loss associated with each site are given in Section 4.1. Table 2.3 also shows the running total gravimetric PM₁₀ data capture for the 9-month period January- September 2002.

Table 2.3 Gravimetric PM₁₀ Data Capture

Site	July-September 02	January-September 02
Bournemouth	83.6	93
Dumfries	100	92
Inverness*	94.6	54
Northampton	30.4	61
Wrexham (Started 1 st March 02)	100	71
Average	81.7	74

* site restarted 13/2/02 after being vandalised

In the previous ratification report the QA/QC unit recommended that remote collection of instrument diagnostics and alarms would be beneficial, since as much as 2 weeks (4%) data can be lost between sites visits. CMCU are currently in the process of making arrangements for the Partisol analysers to be connected to a telemetry system.

2.4 NO₂ Converter Efficiencies

No converter failures were identified during QA/QC Unit's summer 2002 intercalibration exercise. The reduction in the number of converter failures identified may reflect the extra vigilance of the LSOs in detecting early warning signs of converter faults as well as the effort made by the ESUs to rectify converter faults as soon as they are identified.

A NO_x converter efficiency fault was, however, reported by the Equipment Support Unit at Bristol Old Market in August and the converter was replaced. The converter was tested again in September and found to be low at 84%, so the analyser was removed from site for further investigation. The converter problems at this site resulted in data rejection from 17th July to 25th September (2.5 months).

NPL undertook the summer intercalibrations at the rural sites and reported a low NO_x converter at Ladybower (85%). Further investigation by QA/QC Unit in December identified an instrument configuration problem relating to the NO₂ channel output only. Since the NO₂ channel is not recorded by the logger (as NO₂ is calculated from the difference of the NO_x and NO channels) there has been no resulting effect on data quality. The analyser has been now been correctly re-configured.

RECOMMENDATION

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

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

2.5 Ozone Outliers

14 out of 46 (30%) ozone analysers were identified as outliers during QA/QC Unit's summer 2002 intercalibration exercise. NPL also carried out the summer intercalibrations at the rural and LAQN sites and 8 outliers were identified. (See Table 2.4). Full details

are provided in the relevant intercalibration reports. Data from these sites have been corrected accordingly during the ratification process.

Table 2.4 Ozone Outliers Identified at the Intercalibration Exercises

Summer 2002 (AUN)		Summer 2002 Rural and LAQN	
Site	Outlier (%)	Site	Outlier (%)
Barnsley Gawber	-14	Lullington Heath	29
Birmingham East	5.9	Narberth	-8
London Brent	-6.5	Aston Hill	-7
Bristol Centre	-25	Glazebury	7
Derry	-12	Yarner Wood	7
Redcar	8	London Haringey	18
Thurrock	7	Lewisham	11
Wigan Leigh	8	Marylebone Road	-7
Wolverhampton	-7		
Wirral Tranmere	-21		
Preston	-20		
Sheffield Centre	5.7		
Swansea	6.1		
Bradford	-57		

2.6 TEOM k_0

The TEOM instruments in the AURN use a k_0 constant to determine PM_{10} concentrations. Each TEOM sensor unit has a k_0 determined by the manufacture and is stamped on the sensor unit. This value must be entered into the TEOM software to correctly calculate the concentrations. Errors can occur if the sensor unit is replaced without the software being updated. This is checked during the intercalibration exercise by the use of pre-weighted filters to determine the k_0 . The measured, stamped and software values of k_0 are then compared. Deviations within $\pm 2.5\%$ are considered acceptable. Table 2.5 shows the sites where there were large deviations between the measured and stamped k_0 values.

Table 2.5 TEOM k_0 Deviations identified at the Intercalibration Exercises

Site	k_0 Deviation (%)	Test Date
Belfast Centre	2.6	19 th August 2002
Wigan Leigh	2.8	6 th August 2002
Leicester Centre	27.6	21 August 2002

As the k_0 deviation was borderline at Belfast Centre and Wigan Leigh, no corrections have been made to the data during ratification. The large deviation in k_0 at Leicester Centre arose because the k_0 value stamped on the side of the unit did not match the value stored in the software. The k_0 value will be checked again at the winter 2003 audit and data will be rescaled as appropriate during next ratification period.

RECOMMENDATION

ESUs should continue to ensure that the correct k_0 value is entered into the analyser software whenever the sensor unit is repaired or replaced.

2.7 Auto-Calibration Run-ons

This problem is seen when auto-calibration gas introduced between 0045 and 0115 remains in the instrument until about 0200. The ambient measurements between 0130 and 0200 are therefore invalid and must be removed during data ratification. This

problem can occur if the solenoid valves in the pneumatic system do not close fully after the zero and span cycle. Calibration gas may then leak into the instrument during the ambient measurement period. This problem can be a serious source of data loss resulting in one hour out of twenty-four being lost, which is 4% of the annual data capture.

The ESUs have investigated this problem at many of the sites and thorough cleaning of the solenoid valves has, in most cases, resolved the problem. Any autocalibration run-on data that look visibly significant have been deleted from the data sets during ratification resulting in a loss of an additional hour of data each day (4% data loss).

RECOMMENDATION

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

2.8 ESU Call-out and Service Documentation

The ESU call-out and service records contain vital calibration information that is required for data ratification. It is therefore important that these records are sent to the QA/QC Unit (via e-mail or fax) within at least 7 days of a call-out or service taking place. Please could we remind LSOs and ESU, particularly those involved in the Rural and London Networks, to send their site records to QA/QC Unit (netcen) at the following address: Geoff.Broughton@aeat.co.uk. or Fax: 01235 463235.

3. Site Specific Issues

3.1 Sunderland SO₂

The SO₂ analyser at Sunderland shows an unusual baseline response cycling problem. From the raw mV data it can be seen that the baseline appears to rise and fall over the course of a month (see Figure 3.1). This drift can, however, be corrected for during the ratification process and has no significant effect on data quality, providing reliable zero calibrations are obtained frequently.

RECOMMENDATION

We recommend that the ESU investigated the cause of SO₂ baseline response drift at Sunderland.

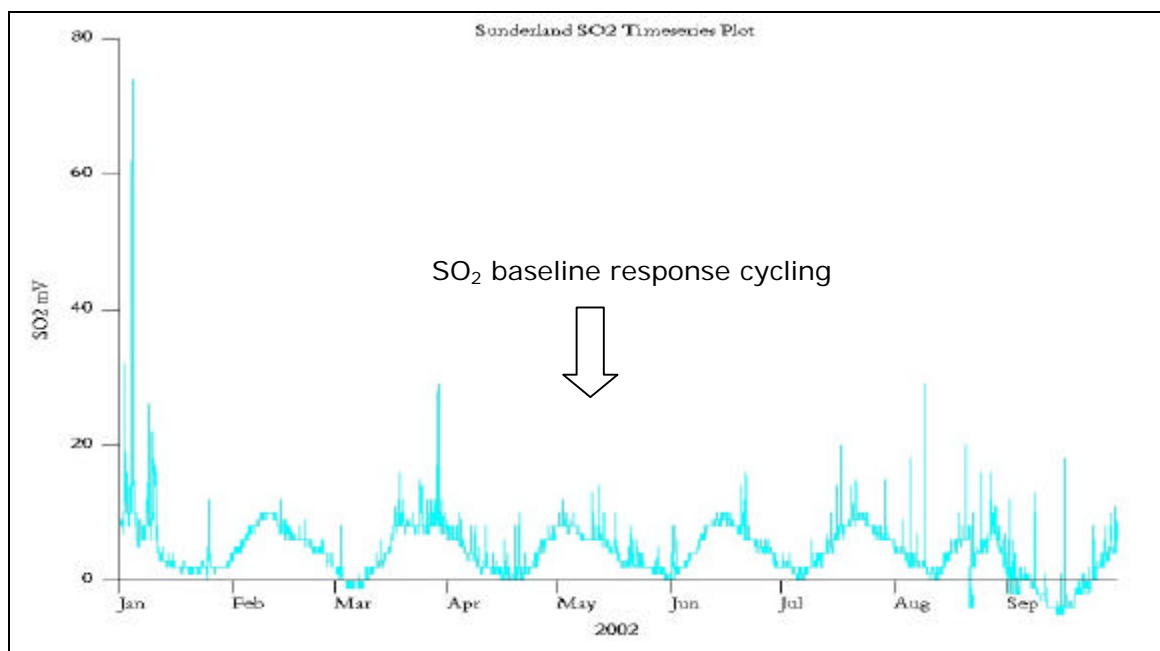


Figure 3.1 Sunderland SO₂ Baseline Response Cycling (15-minute mean mV)

3.2 Bristol Old Market NO_x – provisional data

The unusually high NO₂ concentrations reported previously at Bristol Old Market site are still under investigation. High levels have been recorded since April 2002 (see Figure 3.2) and despite extensive site investigations, no reason has been found for the elevated concentrations. Although it is likely that the periods of high data are an artefact of a sampling fault, no action has yet been taken to delete the data. The data have therefore been kept as provisional and will be reassessed after the site has been relocated and a sufficient period of data has been collected from the instrument in its new location.

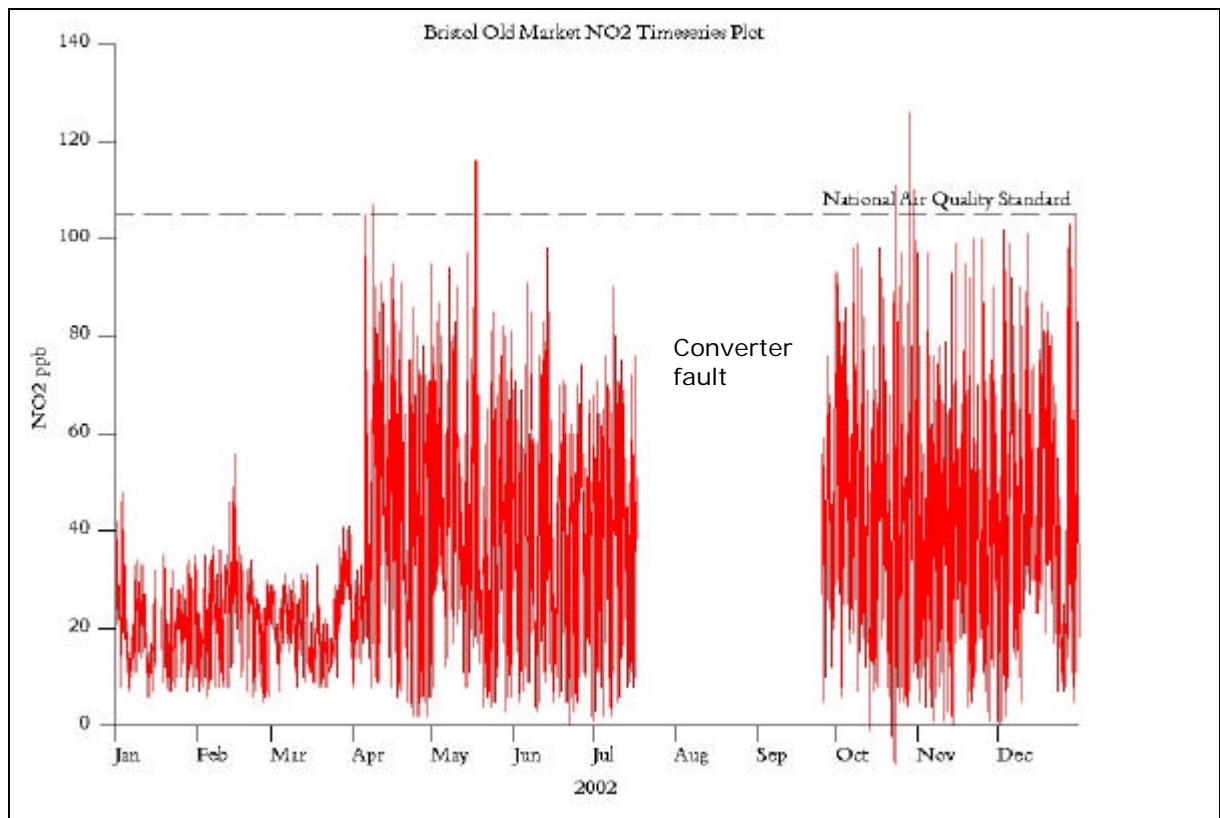


Figure 3.2 High NO₂ Concentrations at Bristol Old Market

3.3 Coventry Memorial Park CO

The CO analyser at Coventry Memorial Park showed unacceptably high levels of response noise from March 2002 onwards (Figure 3.3). Over 6 months data have been rejected from 12th March to 5th November when the analyser was repaired. This is a critical site for CO and it is therefore important that the performance of this analyser is satisfactory.

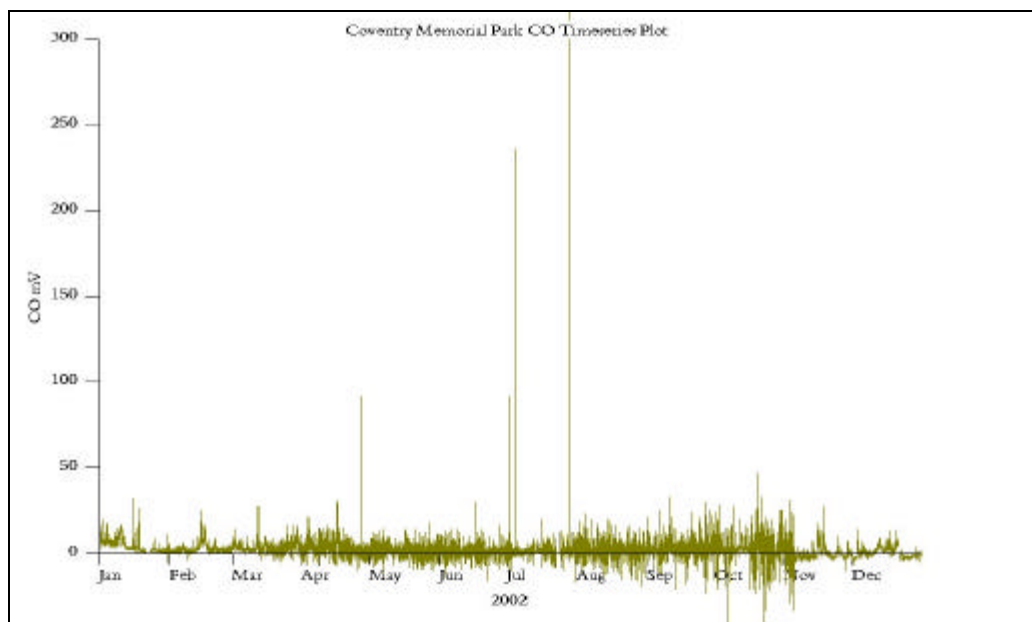


Figure 3.3 Coventry Memorial Park CO high noise response

3.4 Wolverhampton CO and SO₂

The CO analyser at Wolverhampton showed unacceptably high levels of noise and baseline response instability from 20th May to 5th July 2002 (Figure 3.4). A further period of high noise response was seen again after the service on 7th August until 25th September. The ESU made several attempts to install replacement analysers however, it was subsequently discovered that the response problems were due to vibration from the sample pump. The periods of poor data quality have been rejected during ratification resulting in over 3 month's data loss.

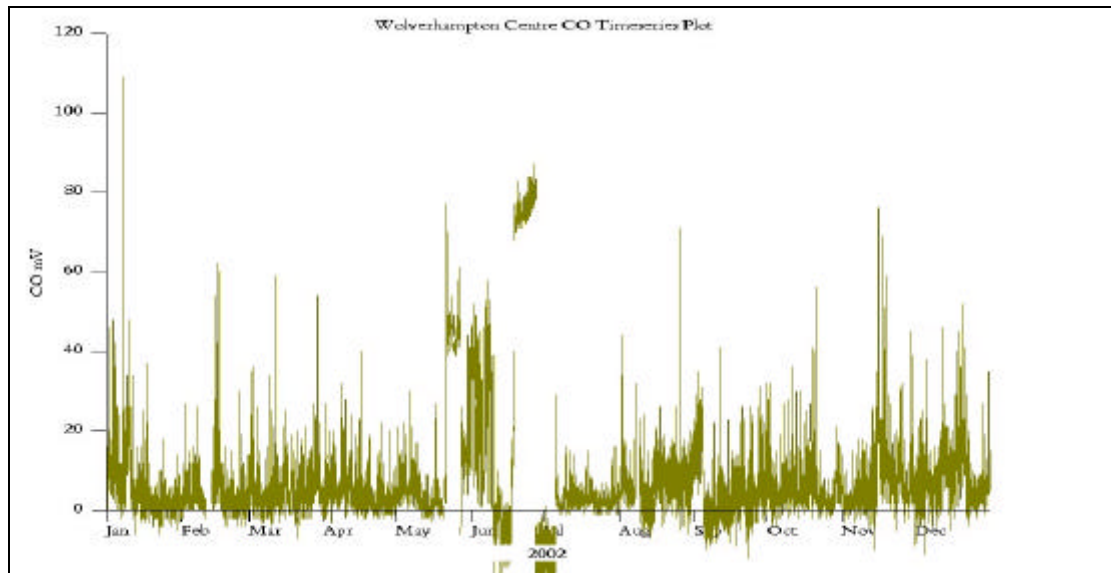


Figure 3.4 Wolverhampton CO high noise and response instability

The SO₂ analyser at Wolverhampton has also shown a history of high noise and response sensitivity drifts due to UV source problems (Figure 3.5). Over 2 months of data from 15th August until 25th October have been rejected due to these problems. A replacement analyser was installed on 25th October. This replacement analyser also shows a rapid baseline response drift but it is likely that this can be corrected for during ratification.

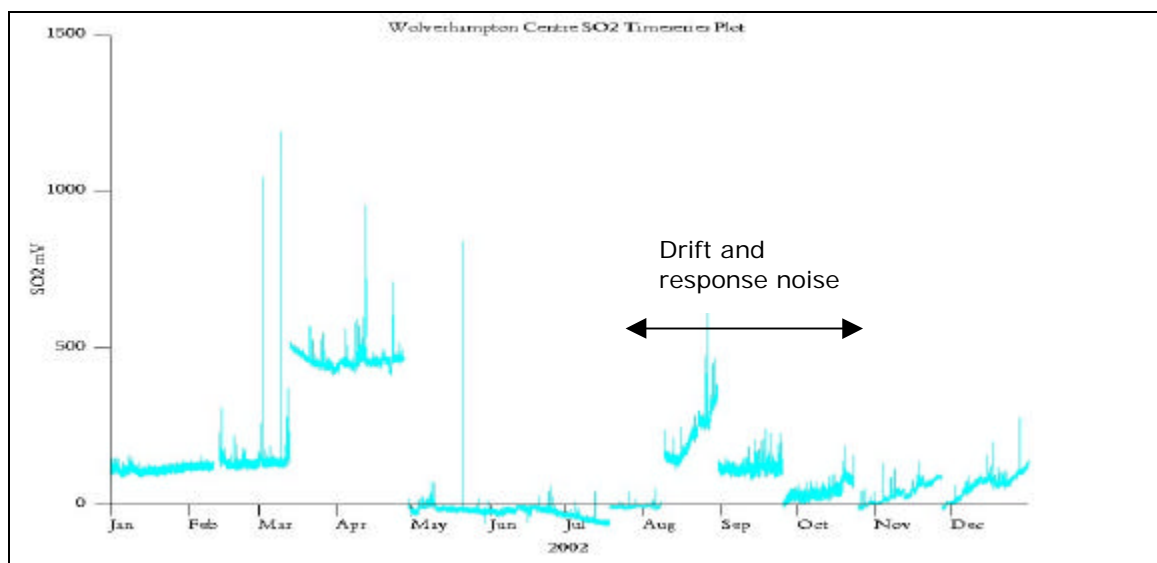


Figure 3.5 Wolverhampton SO₂ response drift and noise

3.5 Narberth SO₂ - provisional data

The SO₂ analyser at Narberth has shown erratic baseline response and random step changes in sensitivity since January 2002 (Figure 3.6). The site SO₂ cylinder was also not calibrated so it was not possible to accurately scale the data during this period. All data from January to June have already been deleted during ratification by NPL. The data from July onwards has been kept as provisional until the cylinder calibration result is obtained. It is likely however, that a further 4 months data from July to October will be rejected due to the unstable analyser response.

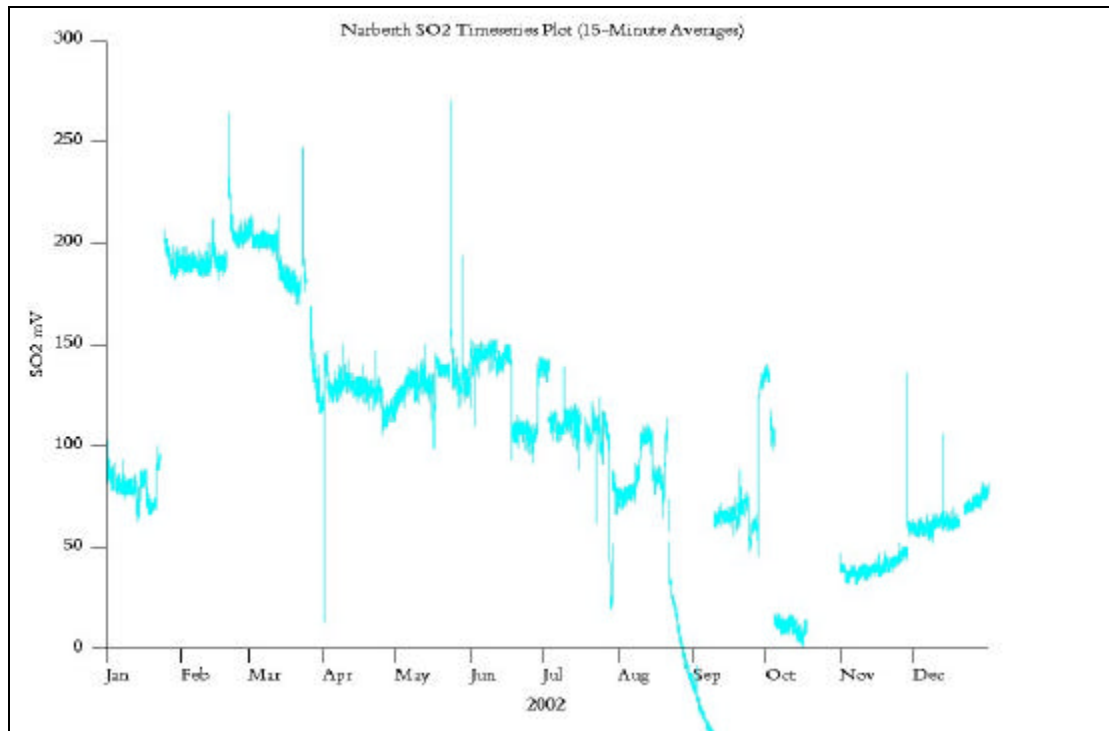


Figure 3.6 Narberth SO₂ analyser response instability and high noise

RECOMMENDATION

ESU to ensure response instability of the SO₂ analyser at Narberth has been rectified or a replacement analyser installed.

3.6 Glasgow Centre SO₂

The SO₂ analyser at Glasgow Centre shows a history of response instability with random step changes in baseline response (Figure 3.7). Most of these response changes can be corrected for during the ratification process, however as this is a critical site for SO₂ we would recommend that the reason for the response instability is investigated and rectified.

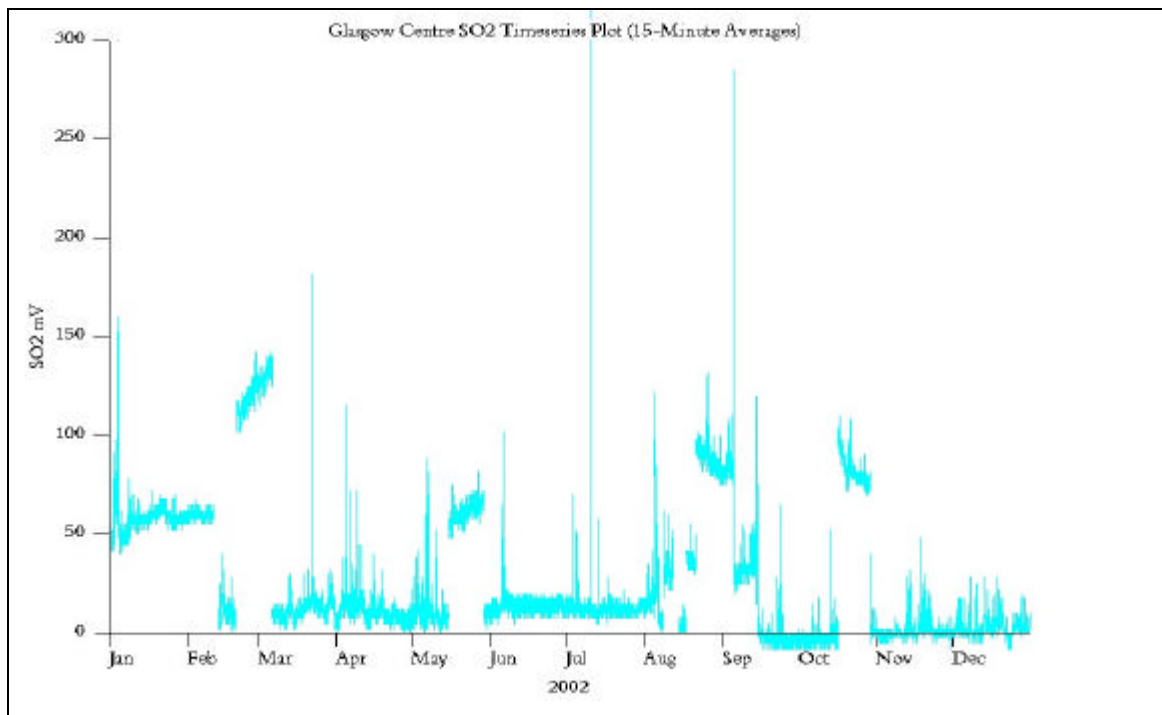


Figure 3.7 Glasgow Centre SO₂ random step changes in baseline response

RECOMMENDATION

ESU to investigate random step changes in SO₂ baseline response at Glasgow Centre (critical site)

3.7 Southampton SO₂

The Southampton SO₂ analyser has shown high noise response with spurious negative data resulting in data rejection from 1 June to 24th August. (Figure 3.8).

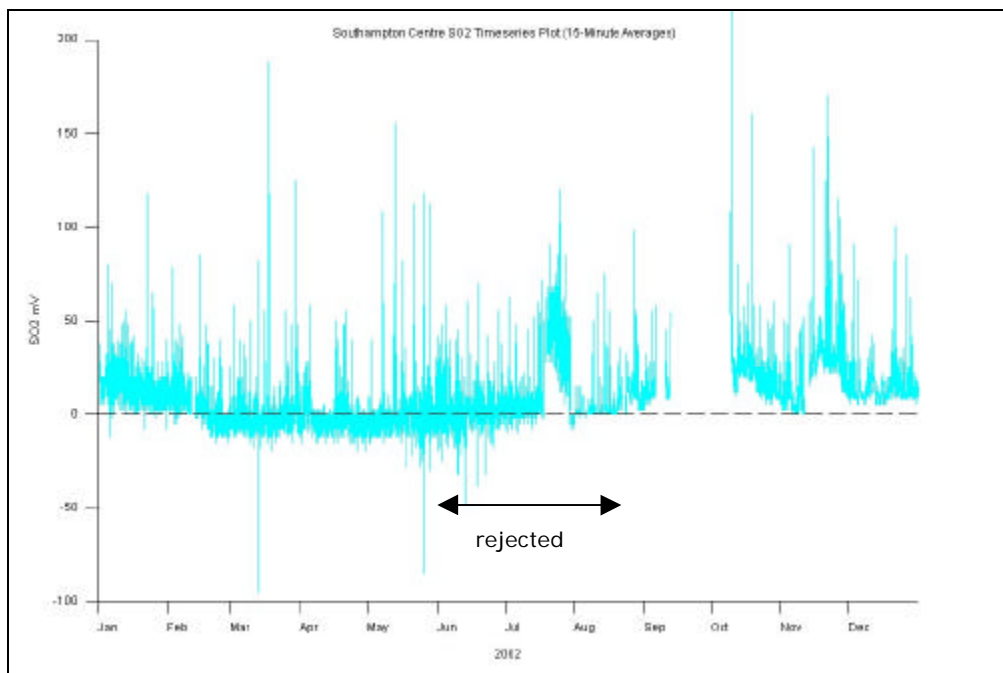


Figure 3.8 Southampton Centre high noise SO₂ response

3.8 London Lewisham SO₂ - provisional data

There have been no routine SO₂ calibrations at London Lewisham since early July when the SO₂ gas cylinder ran out. The autocalibrations show stable response until mid August when these also ceased. Data from August onwards has been kept as provisional until further site calibrations are obtained.

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 July to September 2002 (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% July to September 2002
(Using the start date of any new site)

Data Capture (%)	Start	Comments	Days	Hours
ENGLAND				
Birmingham Centre				
SO ₂ 39.0%	01-Aug-02 26-Sep-02	8 weeks data rejected due to high noise and response instability.	55.9	1342
Birmingham East				
NO ₂ 88.5%	08-Jul-02 09-Jul-02	Power cut	0.8	19
	14-Aug-02 15-Aug-02	Power cut	0.9	22
	04-Sep-02 06-Sep-02	Service	2.1	50
	09-Sep-02 11-Sep-02	Air conditioning fault.	2.2	52
Bournemouth				
CO 82.6%	01-Jan-02 19-Jul-02	Analyser commissioned 19 th July for DD2	199	4783
	24-Jul-02 26-Jul-02	Service	2.2	52
	29-Jul-02 30-Jul-02	Power cut	0.8	19
	05-Aug-02 05-Aug-02	Undocumented data loss.	0.3	7
PM ₁₀ (Partisol) 83.6		See Section 4.1		
Bradford Centre				
O ₃ 84.3%	01-Jul-02 05-Jul-02	Low response due to a possible leak	4.1	98
	13-Jul-02 13-Jul-02	Power supply fault	0.8	20
	03-Sep-02 10-Sep-02	No data due to an internal leak inside analyser	7.1	171
	23-Sep-02 25-Sep-02	Service.	2.1	50
Bristol Old Market				
CO 79.70%	17-Jun-02 19-Jul-02	Leaking sample inlet filter	32.3	776
NO ₂ 23.60%	07-Jul-02 25-Sep-02	Converter efficiency fault in August (82%) and again in September (84%). Analyser removed for repair 3-25 th September.	70	1681
Coventry Memorial Park				
CO 0.0%	12-Mar-02 5-Nov-02	High noise data rejected as in previous period (See Section 3.3)	239	5727
NO ₂ 88.20%	22-Jul-02 24-Jul-02	Service	2	48
	23-Sep-02 27-Sep-02	Ozone generator fault.	4.5	107
Great Dun Fell				
O ₃ 30.8%	15-Jul-02 16-Jul-02	Analogue to digital card failure.	0.9	22
	30-Jul-02 10-Oct-02	Analogue to digital card failure. Instrument removed for repair. Replacement analyser faulty with lamp and solenoid valve problems.	70.5	1691

Data Capture (%)		Start	Comments	Days	Hours			
Leeds Centre								
CO	55.3%	10-Jul-02	16-Aug-02	Air conditioning fault. High temperature effecting analyser response.	37.4	897		
		25-Aug-02	27-Aug-02	Response drift	1.3	32		
		06-Sep-02	06-Sep-02	QA/QC audit	0.3	6		
Leicester Centre								
CO	80.4%	General		Air conditioning problems throughout period giving elevated cabin temperatures. CO data loss due to erratic baseline response and temperature instability				
		22-Jul-02	23-Jul-02	Unstable baseline	0.8	18		
		29-Jul-02	30-Jul-02	Unstable baseline	1	25		
		19-Aug-02	20-Aug-02	Missing & rejected data	0.7	16		
		30-Aug-02	30-Aug-02	Spurious data quality	0.3	7		
		09-Sep-02	10-Sep-02	QA/QC audit	0.3	6		
		10-Sep-02	17-Sep-02	Service and power cut	7	168		
		20-Sep-02	24-Sep-02	Unstable response	3.9	93		
		26-Sep-02	27-Sep-02	Unstable response	1.1	27		
		NO ₂	88.0%	10-Sep-02	12-Sep-02	Service	2.1	50
				16-Sep-02	17-Sep-02	Power cut - high cabin temperatures	0.9	21
				20-Sep-02	27-Sep-02	Photomultiplier tube temperature fault	7	168
		O ₃	89.1%	07-Aug-02	14-Aug-02	Sample flow fault. Pump replaced	6.6	159
10-Sep-02	12-Sep-02			Service	2.1	50		
16-Sep-02	17-Sep-02			Power cut - high cabin temperatures	0.9	21		
PM ₁₀	65.4%	27-Jun-02	04-Jul-02	Recurring intermittent response instability	7.3	175		
		17-Jul-02	23-Jul-02	TEOM control unit locked up	6.2	149		
		09-Sep-02	30-Sep-02	High noise and response cycling. TEOM removed from site for repair. Noisy data 27-30 th September rejected after repair.	21.4	513		
SO ₂	88.4%	10-Sep-02	20-Sep-02	Analyser switched off after service to minimise increasing hut temperature.	10	240		
Liverpool Centre								
CO	64.2%	23-Apr-02	22-Jul-02	Noisy data rejected due to optical bench and analyser fan faults.	89.9	2158		
		03-Sep-02	05-Sep-02	Service	2	49		
		16-Sep-02	18-Sep-02	Power failure	1.6	39		
		23-Sep-02	31-Dec-02	Site switched off due to local building works and decommissioned on 23 September.	99.5	2389		
NO ₂	81.5%	03-Sep-02	10-Sep-02	Service	7.1	171		
		16-Sep-02	18-Sep-02	Power failure	1.6	39		
		23-Sep-02	31-Dec-02	Site decommissioned	99.6	2391		
O ₃	69.5%	03-Sep-02	31-Dec-02	Unusually low data rejected after service. Site decommissioned on 23 September.	120	2879		
PM ₁₀	82.8%	03-Sep-02	04-Sep-02	Service	1.1	26		
		16-Sep-02	31-Dec-02	Site decommissioned	106	2547		
SO ₂	87.3%	03-Sep-02	05-Sep-02	Service	2	49		
		16-Sep-02	18-Sep-02	Power failure	1.6	39		
		23-Sep-02	31-Dec-02	Site decommissioned	99.5	2389		
London Bexley								
CO	69.7%	10-Jul-02	11-Jul-02	Telemetry fault	0.5	12		
		27-Jul-02	22-Aug-02	Analyser fault after service. Removed from site for repair. Replacement analyser also faulty.	26	623		
		18-Sep-02	19-Sep-02	Air conditioning unit accidentally turned off causing	0.9	21		

Data Capture (%)		Start		Comments	Days	Hours
high hut temperatures						
NO ₂	72.3%	10-Jul-02	11-Jul-02	Telemetry fault	0.5	12
		31-Jul-02	02-Aug-02	Service	1.9	46
		11-Aug-02	22-Aug-02	Photomultiplier tube cooling fan failure	10.9	261
		18-Sep-02	30-Sep-02	Air conditioning unit turned off. Excessive drift in zero baseline.	11.8	282
London Hackney						
CO	85.6%	26-Jul-02	29-Jul-02	Unstable baseline	3.5	84
		07-Aug-02	15-Aug-02	No power to site due to local building work	8	192
		27-Sep-02	27-Sep-02	Unstable baseline	0.5	12
O ₃	87.5%	07-Aug-02	14-Aug-02	No power to site due to local building work	7.3	175
London Cromwell Road						
SO ₂	83.4%	01-Jul-02	05-Jul-02	Instrument not connected to logger	4.3	103
		15-Jul-02	17-Jul-02	Spurious data effected by high hut temperature	1.6	38
		17-Jul-02	17-Jul-02	New logger installed	0.3	8
		25-Jul-02	31-Jul-02	High hut temperature	6.5	155
		16-Sep-02	17-Sep-02	Spurious data effected by high hut temperature	1.1	27
London Lewisham						
O ₃	88.4%	13-Aug-02	23-Aug-02	Flow blockage in sample inlet tubing.	10.4	249
London Westminster						
CO	80.3%	06-Jul-02	23-Jul-02	Sample flow fault. Pump diaphragm replaced.	16.5	397
		12-Aug-02	13-Aug-02	Service	1	24
SO ₂	86.4%	12-Aug-02	13-Aug-02	Service	1	24
		20-Sep-02	30-Sep-02	Sample flow fault.	11	264
Lullington Heath						
O ₃	74.7%	General		Site upgraded with new analysers on 16 th July. Further analyser modifications undertaken 25 th September and 5 th November.		
		08-Jul-02	09-Jul-02	No data	0.6	15
		16-Jul-02	31-Jul-02	Spurious low ozone levels – data rejected	15.5	373
		16-Aug-02	19-Aug-02	Fault after power cut. Analyser reprogrammed.	3.2	76
		09-Sep-02	10-Sep-02	No data	1	23
SO ₂	74.5%	08-Jul-02	09-Jul-02	No data	0.6	15
		16-Jul-02	02-Aug-02	Repeated problem with new instrument “locking-up” giving flat response.	16.6	398
		07-Aug-02	08-Aug-02	Analyser response locked-up	1.5	36
		09-Sep-02	11-Sep-02	Analyser response locked-up	1.4	33
		22-Sep-02	24-Sep-02	Analyser response locked-up	2.5	60
Manchester South						
NO ₂	78.5%	29-Jul-02	17-Aug-02	Converter solenoid valve fault	19.3	464
O ₃	87.8%	29-Jul-02	31-Jul-02	Service	2	47
		16-Aug-02	17-Aug-02	Site switched out of service during ESU call-out	1.3	32
		27-Aug-02	02-Sep-02	Scrubber solenoid valve leaking and intermittently failing to switch	6	144
		20-Sep-02	20-Sep-02	Noisy data rejected after autocalibration.	0.3	6
		29-Sep-02	18-Oct-02	Switching solenoid valve fault	18.8	450
Northampton						

Data Capture (%)		Start		Comments	Days	Hours
PM ₁₀ (Partisol)	30.4 %	12-Jun-02	2-Sep-02	Analyser breakdown (see Section 4.1)	82	
Oxford Centre						
CO	88.5%	30-Jul-02	09-Aug-02	No data - out of range voltage.	9.8	235
Plymouth Centre						
CO	86.1%	31-Jul-02	12-Aug-02	Noisy and drifting response after service	12.2	292
Reading						
CO	79.6%	01-Mar-02	19-Jul-02	High noise data rejected.	141	3373
SO ₂	44.9%	17-Jul-02	05-Sep-02	No calibrations for data scaling due to empty gas cylinder.	50.1	1202
Rochester						
PM ₁₀	48.7%	15-Aug-02	31-Dec-02	TEOM programme fault. Analyser removed from site and sent to USA for investigation and repair by manufacturers.	139	3334
Sandwell West Bromwich						
SO ₂	81.2%	29-Jul-02	31-Jul-02	Service	2.1	50
		14-Aug-02	28-Aug-02	Response sensitivity drift due to hydrocarbon kicker fault	14.4	346
Sheffield Centre						
CO	64.2%	07-Jun-02	31-Jul-02	Data rejected due to analyser response drift caused by a blockage on the outlet valve pressurising the system.	53.9	1293
		23-Sep-02	25-Sep-02	Service	2	48
Southampton Centre						
CO	70.9%	18-Jul-02	19-Jul-02	Power supply off	1.4	33
		06-Sep-02	09-Oct-02	Switched off due to air conditioning problems	33.7	808
NO ₂	77.6%	18-Jul-02	19-Jul-02	Power supply off	1.1	26
		07-Sep-02	08-Sep-02	Air conditioning fault	0.4	10
		12-Sep-02	09-Oct-02	Switched off due to air conditioning fault	26.8	642
O ₃	62.1%	18-Jul-02	19-Jul-02	Power supply off	1.1	26
		04-Aug-02	11-Aug-02	Thermistor unit fault	7.6	182
		13-Aug-02	14-Aug-02	Thermistor unit fault	0.7	17
		22-Aug-02	22-Aug-02	Engineer call-out	0.3	6
		06-Sep-02	09-Oct-02	Switched off due to air conditioning fault	33.3	800
PM ₁₀	71.3%	18-Jul-02	19-Jul-02	Power supply off	1.4	33
		06-Sep-02	09-Oct-02	Switched off due to air conditioning fault	33.3	799
SO ₂	13.7%	01-Jun-02	24-Aug-02	High noise data rejected. (See Section 3.7)	84.3	2024
		06-Sep-02	10-Oct-02	Switched off due to air conditioning fault	34.3	824
Southwark Roadside						
CO	61.2%	09-Jul-02	13-Aug-02	Site switched off due to an air conditioning fault. Response drift over 3 days when monitoring resumed.	34.7	833
NO ₂	67.8%	11-Jul-02	09-Aug-02	Switched off due to air conditioning fault.	29	696
SO ₂	66.1%	09-Jul-02	09-Aug-02	Switched off due to air conditioning fault.	30.8	738
Stockport						
NO ₂	81.2%	06-Aug-02	07-Aug-02	Service	1.1	26
		06-Sep-02	11-Sep-02	Communications fault	5.2	124

Data Capture (%)	Start	Comments	Days	Hours
	20-Sep-02 31-Dec-02	Internal sampling 20 th Sept to 3 rd October. Site closed 3 rd October. Relocated to Stockport Shaw Heath	103	2462
Stoke-on-Trent Centre				
CO	77.8%	16-Jul-02 17-Jul-02	Service	1.2 28
		17-Jul-02 05-Aug-02	Noisy response after service. Monitoring suspended due to air conditioning problems	18.9 454
NO ₂	89.5%	16-Jul-02 18-Jul-02	Service	2 48
		29-Jul-02 05-Aug-02	Site switched off due to air conditioning failure	7 168
O ₃	89.7%	16-Jul-02 18-Jul-02	Service	2 48
		29-Jul-02 05-Aug-02	Site switched off due to air conditioning failure	7 168
SO ₂	89.0%	16-Jul-02 18-Jul-02	Service	2 48
		26-Jul-02 26-Jul-02	Unstable baseline	0.3 7
		28-Jul-02 28-Jul-02	Unstable baseline	0.3 6
		29-Jul-02 05-Aug-02	Site turned off whilst awaiting new air conditioning unit	7 169
Weybourne				
O ₃	89.0%	26-Aug-02 05-Sep-02	Pump failure	10 240
Wicken Fen				
NO ₂	60.5%	17-Jul-02 24-Jul-02	Spurious data rejected after service. Permeation tube replaced.	7.2 173
		19-Aug-02 16-Sep-02	High noise response on NO channel	28 673
Wigan Leigh				
SO ₂	89.7%	21-Aug-02 30-Aug-02	No information provided	9 217
Wirral Tranmere				
CO	83.2%	16-Aug-02 21-Aug-02	No data for 3 days prior to service on 20 th August	4.5 108
		08-Sep-02 11-Sep-02	Pump replaced.	3.5 85
		20-Sep-02 26-Sep-02	Response fault. Chopper position adjusted and optics cleaned.	6.3 152
Wolverhampton Centre				
CO	41.2%	20-May-02 05-Jul-02	Intermittent fault and unstable response to calibration gas. Replacement analysers installed 10 th and 27 th June.	46.6 1119
		07-Aug-02 25-Sep-02	High noise data rejected from service on 7 th August. Several replacement analysers were installed but giving poor quality data. High noise due to pump vibration. (See Section 3.4)	49.1 1179
SO ₂	46.1%	07-Aug-02 09-Aug-02	Service	2 48
		15-Aug-02 25-Oct-02	UV source problem resulting in noisy and drifting response. (See Section 3.4)	71.5 1715
SCOTLAND				
Lough Navar				
O ₃	89.1%	06-Sep-02 09-Sep-02	Intermittent recurring instrument fault resulting in low response.	3.1 75
		14-Sep-02 20-Sep-02	Intermittent instrument fault	6 145
		25-Sep-02 26-Sep-02	Intermittent instrument fault. Analyser replaced	0.7 16
Aberdeen				
PM ₁₀	71.6%	06-Aug-02 06-Aug-02	QA/QC audit	0.3 8
		20-Aug-02 15-Sep-02	Response instability after service	25.6 615
Edinburgh Centre				

Data Capture (%)	Start	Comments	Days	Hours
CO 89.7%	21-Jul-02 26-Jul-02	Unstable response	5	119
	07-Aug-02 08-Aug-02	Undocumented data loss	0.3	7
	13-Aug-02 14-Aug-02	Service	1.2	29
	18-Aug-02 19-Aug-02	Undocumented data loss	0.3	7
	01-Sep-02 01-Sep-02	Unstable response	0.3	7
Glasgow Centre				
O ₃ 85.9%	12-Aug-02 14-Aug-02	Service	2	48
	25-Aug-02 03-Sep-02	Scrubber and switching valve problems	9.5	228
	09-Sep-02 09-Sep-02	Flat response. Engineer call-out	0.4	9
Grangemouth				
NO ₂ 33.9%	01-Aug-02 31-Dec-02	Site closed to upgrade facilities for CO analyser and LA equipment	153	3663
PM ₁₀ 33.9%	30-Jul-02 31-Dec-02	Site closed to upgrade facilities.	154	3705
SO ₂ 33.9%	01-Aug-02 31-Dec-02	Site closed to upgrade facilities.	153	3663
WALES				
Cardiff Centre				
CO 82.0%	02-Jul-02 02-Jul-02	Engineer call-out to investigated autocalibration run-on.	0.3	7
	17-Jul-02 29-Jul-02	Erratic zero baseline and noisy response.	12.3	295
NO ₂ 88.9%	22-Jul-02 29-Jul-02	Elevated baseline response. Faulty processor board.	7.1	170
Cwmbran				
SO ₂ 89.4%	08-Aug-02 12-Aug-02	Power cut followed by unstable baseline drift.	4.2	101
	24-Sep-02 24-Sep-02	QA/QC audit	0.3	6
Narberth				
NO ₂ 88.4%	16-Jul-02 18-Jul-02	Service	2	47
	18-Aug-02 22-Aug-02	Poor electrical connection on NOx pump	3.6	86
	16-Sep-02 17-Sep-02	Analyser temperature fault	0.8	20
	27-Sep-02 04-Oct-02	Analyser temperature fault. Thermo-cooler and fan replaced.	7.3	174
Port Talbot				
O ₃ 88.6%	18-Jul-02 26-Jul-02	Analyser power supply fault	7.8	187
	18-Sep-02 20-Sep-02	Service	2.2	53
Swansea				
CO 85.7%	11-Aug-02 22-Aug-02	Analyser overheating due to internal fan fault	10.7	256
	11-Sep-02 13-Sep-02	Service	2	48
Wrexham				
SO ₂ 50.3%	01-Jul-02 04-Jul-02	High noise due to UV lamp fault	3.2	77
	06-Jul-02 08-Jul-02	High noise due to UV lamp fault	2	49
	16-Jul-02 18-Jul-02	High noise due to UV lamp fault	1.7	40
	19-Jul-02 20-Jul-02	High noise due to UV lamp fault	0.8	18
	21-Jul-02 23-Jul-02	High noise due to UV lamp fault	1.5	37
	29-Jul-02 02-Sep-02	UV lamp replaced at service in August. High noise and large response sensitivity drift continued until lamp replaced again in September.	35	841

4.1 Gravimetric PM₁₀ Sites with Data Capture Below 90%

This section gives details of the main site operational problems which have resulted in gravimetric PM₁₀ data capture below the required 90% level during the reporting period July-September 2002. Details of the reasons for the data loss are given for each site below. There was no PM₁₀ data loss during this period at Dumfries and Wrexham (100% data capture).

Northampton (30.4 % data capture)

The Partisol unit malfunctioned and was out of operation for over two months from June 12th until 2nd September.

Month	Comment	Data Loss
July	Unit breakdown.	1 month
August	Unit breakdown.	1 month
September	Analyser re-started 2 nd September.	2 days

Bournemouth (83.6% data capture)

July	Power failures on 30 and 31 st July	2 days
August	Power failures on 6 th and 9 th August. Filter jam 24 th – 28 th August.	2 days 4 days
September	Missing filter weight on 3 rd September.	1 day

Inverness (94.6% data capture)

A spurious high PM₁₀ concentration for 8th October (>400 µg/m³) was identified as a data entry error. The filter was re-weighed and the concentration corrected.

July	Ok	
August	No exposure data recorded by LSO on 13 th August.	1 day
September	Damaged filter on 2 nd September Power failure on 8 th September	1 day 1 day

5. Ratified Data Capture Statistics

Table 5.1 provides the ratified data capture figures for each site for the 3-month period July to September 2002. Data capture values below 90% are shown in the shaded boxes.

Table 5.1 AUN Ratified Data Capture (%) for July to September 2002
(Using the start date of any new site)

Site	CO	NO ₂	O ₃	PM ₁₀	SO ₂	Site Average
ENGLAND						
Barnsley 12	-	-	-	-	98.3	98.3
Barnsley Gawber	96.7	96.7	97.2	-	96.3	96.8
Bath Roadside	92.3	95.4	-	-	-	93.9
Billingham	-	93.8	-	-	-	93.8
Birmingham Centre	96	92.9	97	91.8	39	83.4
Birmingham East	91.9	88.5	94.7	94.1	93.5	92.6
Blackpool	97.2	93.1	97.2	96.2	97.3	96.2
Bolton	95.1	97.5	97.5	97.7	97.4	97
Bottesford	-	-	99.4	-	-	99.4
Bournemouth	82.6	92.2	-	83.6	95.4	88.5
Bradford Centre	96.2	96	84.3	96.2	93.4	93.2
Brighton Roadside	97.1	92.5	-	-	-	94.8
Bristol Centre	95.5	92.9	96.7	95.6	96.8	95.5
Bristol Old Market	79.7	23.6	-	-	-	51.6
Bury Roadside	94.2	92.3	92.6	95.1	96.4	94.1
Cambridge Roadside	-	99.6	-	-	-	99.6
Camden Kerbside	-	99.5	-	98.5	-	99
Canterbury	-	98.3	-	99.1	-	98.7
Coventry Memorial Park	0	88.2	96.7	96.8	95.3	75.4
Exeter Roadside	98	92.6	97.9	-	97.9	96.6
Glazebury	-	-	97.2	-	-	97.2
Great Dun Fell	-	-	30.8	-	-	30.8
Haringey Roadside	-	99.6	-	99.6	-	99.6
Harwell	-	98.8	98.9	-	99.1	99
High Muffles	-	-	98.1	-	-	98.1
Hounslow Roadside	97.4	93.2	-	-	-	95.3
Hove Roadside	96	95.8	-	-	96.1	96
Ladybower	-	99.5	99.5	-	99.5	99.5
Leamington Spa	98.1	93.6	98.1	97.6	98.3	97.1
Leeds Centre	55.3	94.2	99	99.4	99	89.4
Leicester Centre	80.4	88	89.1	65.4	88.4	82.3
Liverpool Centre	64.2	81.5	69.5	82.8	87.3	77
London A3 Roadside	98.2	98.1	-	98.3	-	98.2
London Bexley	69.7	72.3	96.4	97.1	94.4	86
London Bloomsbury	95.6	97.2	96.9	95.8	94.7	96
London Brent	98.4	98	98.4	97.6	98.4	98.1

Site	CO	NO ₂	O ₃	PM ₁₀	SO ₂	Site Average
London Bromley	99.5	98.4	-	-	-	98.9
London Cromwell Road 2	97.6	97.6	-	-	83.4	95.8
London Eltham	-	99.4	94.8	99.4	94.1	96.9
London Hackney	85.6	91.1	87.5	-	-	88.1
London Haringey	-	-	93.9	-	-	93.9
London Hillingdon	92.4	95.8	96.3	96	96.2	95.3
London Lewisham	-	99.5	88.4	-	99.5	95.8
London Marylebone Rd	99.5	99.4	99.6	99.1	96	98.7
London N. Kensington	99.2	99.4	99.5	99.5	99.4	99.4
London Southwark	93.9	93.8	90	-	94	92.9
London Teddington	-	97.9	99.4	-	99.4	98.9
London Wandsworth	-	99.2	99.2	-	-	99.2
London Westminster	80.3	98.2	98.3	-	86.4	90.8
Lullington Heath	-	91.7	80.3	-	74.5	82.2
Manchester Piccadilly	97.3	94.8	97.3	97.1	97.3	96.8
Manchester South	-	78.5	87.8	-	95.9	87.4
Manchester Town Hall	92.2	98.1	-	-	-	95.2
Middlesbrough	97	94	96.8	97.1	95.8	96.2
Newcastle Centre	94.8	92.9	97.1	97.1	97	95.8
Northampton	99	97.9	-	97.4	97.9	98.1
(Northampton Partisol)				30.4		
Norwich Centre	98.1	93.9	98.9	97.9	98.1	97.4
Norwich Roadside	-	98.1	-	-	-	98.1
Nottingham Centre	97	96.8	91.6	96.7	96.6	95.7
Oxford Centre	88.5	98.9	-	-	91.8	93
Plymouth Centre	86.1	96.3	96.9	96.6	96.2	94.4
Portsmouth	99.5	99.4	-	97.5	99.5	99
Preston	94	96.6	91.3	96.6	96	94.9
Reading	79.6	96.8	90.6	96.8	44.9	81.7
Redcar	93.8	93.9	93.9	93.8	91.9	93.5
Rochester	-	99.5	99.5	48.7	99.5	86.8
Rotherham Centre	-	94.1	98.3	-	98.3	96.9
Salford Eccles	97.8	97.9	97.8	94.8	96.5	96.9
Sandwell West Bromwich	97.2	96.8	96.7	-	81.2	93
Scunthorpe	-	-	-	99.1	90.2	94.7
Sheffield Centre	64.2	96.9	97	97	97	90.4
Sheffield Tinsley	98.3	96.9	-	-	-	97.6
Sibton	-	-	99.4	-	-	99.4
Somerton	-	-	96.4	-	-	96.4
Southampton Centre	70.9	77.6	62.1	71.3	13.7	59.1
Southend-on-Sea	96.2	96.5	97.1	95.3	96.8	96.4
Southwark Roadside	61.2	67.8	-	-	66.1	65
St Osyth	97.9	98.1	98.1	-	-	98.1
Stockport	93.4	81.2	-	94.6	93.4	90.6
Stockton-on-Tees Yarm	98.8	99.3	-	99.5	-	99.2
Stoke-on-Trent Centre	77.8	89.5	89.7	92.9	89	87.8
Sunderland	-	-	-	-	98.4	98.4
Thurrock	97.1	94.3	96.8	93.2	96.8	95.7
Tower Hamlets Roadside	99.4	96.2	-	-	-	97.8

Site	CO	NO ₂	O ₃	PM ₁₀	SO ₂	Site Average
Walsall Alumwell	-	97.6	-	-	-	97.6
Walsall Willenhall	-	91.6	-	-	-	91.6
West London	93.8	95.3	-	-	-	94.5
Weybourne	-	-	89	-	-	89
Wicken Fen	-	60.5	98.7	-	98.9	86
Wigan Leigh	99.5	98.4	99.3	99.3	89.7	97.2
Wirral Tranmere	83.2	94.3	92	94.6	90.2	90.8
Wolverhampton Centre	41.2	96.8	91.2	97.3	46.1	74.5
Yarner Wood	-	-	99.5	-	-	99.5
Northern Ireland						
Belfast Centre	97.1	96.4	96.9	97.3	97.1	97
Belfast Clara St	-	-	-	97.1	-	97.1
Belfast East	-	-	-	-	98.6	98.6
Derry	96.7	93.9	92.7	96.7	92.1	94.4
Lough Navar	-	-	89.1	99.5	-	94.3
SCOTLAND						
Aberdeen	98.6	98.2	-	71.6	98.3	91.7
Bush Estate	-	-	98.8	-	-	98.8
Dumfries	98.3	95.5	-	100	-	97.9
Edinburgh Centre	89.7	96.9	96	96.8	96.9	95.2
Eskdalemuir	-	-	98.9	-	-	98.9
Glasgow Centre	96.4	92.5	93.5	96.2	91.6	92.5
Glasgow City Chambers	97.4	93.2	-	-	-	95.3
Glasgow Kerbside	98.3	97.7	-	96.8	-	97.6
Grangemouth	-	33.9	-	32.2	33.9	33.3
Inverness	95.6	95.5	-	94.6	-	95.2
Strath Vaich	-	-	99.6	-	-	99.6
Aston Hill	-	-	99.7	-	-	99.7
WALES						
Cardiff Centre	82	88.9	99.4	99.3	98.2	93.6
Cwmbran	98.1	90.4	-	97.7	89.4	93.9
Narberth	-	88.4	96.1	96	94.3	93.7
Port Talbot	-	96.2	88.6	98.5	95.5	94.7
Swansea	85.7	97.1	97.3	96.8	97.1	94.8
Wrexham	95	92.1	-	100	50.3	84.4
Number of sites	75	97	76	66	75	
Network Mean (%)	89.7	92.7	93.8	93.6	90.0	92.4

Sites and instruments established between 01/07/2002 and 30/09/2002

Site	Instrument	Start Date
Barnsley Gawber	CO	08/07/2002
Bournemouth	CO	19/07/2002
Stockton-on-Tees Yarm	CO	14/08/2002

Appendix A

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

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

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

	Recommendations: October 1998	Action	
1	Replace old teflon-coated sample manifolds at former SUN sites	Completed	
2	Replace long sample line at Manchester Town Hall	Completed	
3	Use of 1 micron sample filters on API ozone analysers	In-hand at Defra sites	
4	Fitting all AUN sites with ladder securing clips	In hand	
5	Improving access to PM ₁₀ head at Scunthorpe (Affiliate site)	No action	
6	Safer access to Walsall Alumwell	Railings installed	
7	Installing temperature probes at sites without air-conditioning	Access to temp data from Ambirack sites now possible	
	Recommendations: April 2000		
8	Consideration could be given to up-grading the "older generation" Ambirack system at Coventry in view of the problems identified at the audit.	Site relocated and analysers up-graded (February 2001)	
	Recommendations: October 2000	Priority	Action
9	The site at Walsall Alumwell should be moved from school roof to ground level in order to improve site access and safety.	Medium	Railings installed
10	Safer access to PM ₁₀ head at Scunthorpe	Medium	Outstanding
11	Safer access to PM ₁₀ head at Stockport. Check that the recent fire damage to the next door building has not reduced the structural integrity of the shared flat roof.	Medium	Smoke damage only
12	The CO analyser at Birmingham Centre is very noisy (outside the ± 0.5 ppm acceptance level) and should be considered for replacement/up-grade	Medium	A new instrument was installed in March 2001
	Recommendations April 2001	Priority	Action
13	Up-grade or repair noisy CO analyser at Birmingham Centre	Medium	New instrument installed March 01
	Recommendations October 2001	Priority	Action
14	Up-grade or repair noisy CO analyser at Hull Centre	Medium	Site temporarily closed
	Recommendations May 2002	Priority	Action
None			

	Recommendations November 2002	Priority	Action
15	Up-grade or repair noisy CO analyser at Reading (Ambirak)	Critical Site	Repaired July 02
16	Up-grade or repair CO analyser (Environnement SA) at Liverpool (response noise and drift).	Critical Site	Site Closed
17	Up-grade or repair noisy analyser at Coventry Memorial Park (SO ₂ , and CO – Ambirak)	Critical Site	Scheduled for Winter Service
18	Up-grade or repair noisy PM ₁₀ analyser (TEOM) at Leicester Centre	Critical Site	Schedule for winter Service
19	Add remote dial up facility to collect instrument diagnostics for all Partisol analysers in the Network	Critical Sites	On-going
	Recommendation February 2003	Priority	Action
20	Sunderland SO ₂ baseline response cycling	Medium	
21	Investigate/repair SO ₂ analyser at Glasgow Centre (random step changes in sensitivity)	Critical Site	
22	Repair/replace Narberth SO ₂ analyser (response instability)	High	

APPENDIX B

Table B1 Critical Sites in the AUN (Updated 18/10/02)

Site Name	Agglomeration	Site Type	Critical Pollutant
Belfast Centre	Belfast Urban Area	URBAN CENTRE	CO NO ₂
Wirral Tranmere	Birkenhead Urban Area	URBAN BACKGROUND	CO NO ₂ PM ₁₀ SO ₂
Blackpool	Blackpool Urban Area	URBAN BACKGROUND	CO NO ₂ PM ₁₀ SO ₂
Bournemouth+	Bournemouth Urban Area	URBAN BACKGROUND	CO NO ₂ PM ₁₀ SO ₂
Brighton Roadside+	Brighton/Worthing/Littlehptn	ROADSIDE	PM ₁₀ ^a
Hove Roadside+	Brighton/Worthing/Littlehptn	ROADSIDE	SO ₂
Bristol Centre	Bristol Urban Area	URBAN CENTRE	PM ₁₀ SO ₂
Cardiff Centre	Cardiff Urban Area	URBAN CENTRE	CO NO ₂ PM ₁₀ SO ₂
Coventry Memorial Park+	Coventry/Bedworth	URBAN BACKGROUND	CO NO ₂ PM ₁₀ SO ₂
Edinburgh Centre	Edinburgh Urban Area	URBAN CENTRE	CO NO ₂ PM ₁₀ SO ₂
Glasgow Centre	Glasgow Urban Area	URBAN CENTRE	SO ₂
Hull Centre	Kingston upon Hull	URBAN CENTRE	CO NO ₂ PM ₁₀ SO ₂
Leicester Centre	Leicester Urban Area	URBAN CENTRE	CO NO ₂ PM ₁₀ SO ₂
Liverpool Centre	Liverpool Urban Area	URBAN CENTRE	CO NO ₂ PM ₁₀ SO ₂
Nottingham Centre	Nottingham Urban Area	URBAN CENTRE	CO NO ₂ PM ₁₀ SO ₂
Portsmouth+	Portsmouth Urban Area	URBAN BACKGROUND	CO NO ₂ PM ₁₀ SO ₂
Preston	Preston Urban Area	URBAN BACKGROUND	CO NO ₂ PM ₁₀ SO ₂
Reading	Reading/Wokingham Urban	URBAN BACKGROUND	CO NO ₂ PM ₁₀ SO ₂
Sheffield Centre	Sheffield Urban Area	URBAN CENTRE	PM ₁₀
Southampton Centre	Southampton Urban Area	URBAN CENTRE	CO NO ₂ PM ₁₀ SO ₂
Southend-on-Sea	Southend Urban Area	URBAN BACKGROUND	CO NO ₂ PM ₁₀ SO ₂
Swansea+	Swansea Urban Area	URBAN CENTRE	CO
Stoke-on-Trent Centre	The Potteries	URBAN CENTRE	CO NO ₂ PM ₁₀ SO ₂
Newcastle Centre	Tyneside	URBAN CENTRE	CO NO ₂ PM ₁₀ SO ₂
	Zone		
Grangemouth+	Central Scotland	URBAN INDUSTRIAL	CO ^a NO ₂ PM ₁₀ SO ₂
Northampton+	East Midlands	URBAN BACKGROUND	CO NO ₂ PM ₁₀ ^b SO ₂
Inverness	Highland	ROADSIDE	NO ₂ PM ₁₀
Stockton-on-Tees Yarm+	North East	ROADSIDE	CO NO ₂ PM ₁₀
Sunderland	North East	URBAN BACKGROUND	SO ₂
Aberdeen+	North East Scotland	URBAN BACKGROUND	CO NO ₂ PM ₁₀ SO ₂
Wrexham	North Wales	ROADSIDE	CO NO ₂ PM ₁₀ SO ₂
Wigan Leigh+	North West & Merseyside	URBAN BACKGROUND	CO NO ₂ PM ₁₀ SO ₂
Derry+	Northern Ireland	URBAN BACKGROUND	CO NO ₂ PM ₁₀ SO ₂
Dumfries	Scottish Borders	ROADSIDE	CO NO ₂ PM ₁₀
Canterbury+	South East	URBAN BACKGROUND	PM ₁₀
Oxford Centre+	South East	ROADSIDE	CO SO ₂
Cwmbran+	South Wales	URBAN BACKGROUND	CO NO ₂ PM ₁₀ SO ₂
Plymouth Centre	South West	URBAN CENTRE	PM ₁₀
Leamington Spa+	West Midlands	URBAN BACKGROUND	CO NO ₂ PM ₁₀ SO ₂
Barnsley Gawber+	Yorkshire & Humberside	URBAN BACKGROUND	CO NO ₂
Scunthorpe+	Yorkshire & Humberside	URBAN INDUSTRIAL	PM ₁₀

Total of 41 Critical Sites (24 in Agglomerations and 17 in Zones)

"+" indicates Affiliate site"

Notes a: not commenced yet b: PM₁₀ monitored by Gravimetric and TEOM

