

Report

**QA/QC Data Ratification Report for
the Automatic Urban Network,
July to December 2001**

A report produced for the Department of the
Environment, Food and Rural Affairs, Scottish
Executive, National Assembly for Wales and the DoE
in Northern Ireland

AEAT/ENV/R/1107 Issue 1
May 2002

UNRESTRICTED

QA/QC Data Ratification Report for the Automatic Urban Network, July to December 2001

Geoff Broughton

May 2002

Title	QA/QC Data Ratification Report for the Automatic Urban Network, July to December 2001
Customer	Department of the Environment, Food and Rural Affairs, Scottish Executive, National Assembly for Wales and the DoE in Northern Ireland
Customer reference	
Confidentiality, copyright and reproduction	Unrestricted Copyright AEA Technology plc All rights reserved. Enquiries about copyright and reproduction should be addressed to the Commercial Manager, AEA Technology plc.
File reference	EEQC 20568106
Report number	AEAT/ENV/R/1107

Geoff Broughton
AEA Technology
National Environmental Technology Centre
Culham E4/26
Abingdon
Oxfordshire OX14 3ED
Telephone 01235 463072
Facsimile 01235 463011

AEA Technology is the trading name of AEA Technology plc
AEA Technology is certificated to BS EN ISO9001:(1994)

	Name	Signature	Date
Author	Geoff Broughton		
Reviewed by	Ken Stevenson		
Approved by	Geoff Dollard		

1.	INTRODUCTION	5
2.	GENERIC DATA QUALITY ISSUES	8
2.1	Progress on the Affiliation of New Sites	8
2.2	Data Capture for Critical Sites in Zones and Agglomerations	10
2.3	Partisol Data Ratification	11
2.4	NO ₂ Converter Efficiencies	12
2.5	CO and SO ₂ Zero Truncation	13
2.6	Ozone Outliers	14
2.7	TEOM K ₀	15
2.8	Auto-Calibration Run-ons	16
3.	SITE SPECIFIC ISSUES	18
3.1	Belfast Clara Street BAM	18
3.2	Bristol Old Market NO _x	18
3.3	Plymouth Centre Ozone	19
3.4	Sandwell West Bromwich CO	19
3.5	Thurrock CO	19
4.	SITES WITH DATA CAPTURE BELOW 90%	20
5.	RATIFIED DATA CAPTURE STATISTICS	24
APPENDIX A	Inventory of DEFRA Equipment held by QA/QC Unit	
APPENDIX B	List of recommended equipment for up-grading	

1. Introduction

This report covers the Quality Assurance and Control (QA/QC) activities undertaken by Netcen to ratify automatic urban monitoring network data for the 6-month period July to December 2001. Significant QA/QC issues related to the network are summarised and the major site problems where data capture falls below the required 90% level are identified. Included in this report is an up-to-date inventory of the equipment owned by the Department and used by the QA/QC Unit (Appendix A). A list of equipment that may need replacing or up-grading in the network is also provided in Appendix B.

The Network was expanded significantly in 2001 in order to comply with the requirements of the First European Air Quality Daughter Directive for SO₂, NO_x, PM₁₀ and lead. This Directive came into force in the UK on July 19th 2001 with the adoption of Statutory Instrument 2001 No 2315 "The Air Quality Limit Values Regulations 2001". Further details can be found at www.hmso.gov.uk/si/si2001/20012315.htm.

Work is underway by the CMCU to complete the installation of additional CO analysers to fulfil the requirements of the Second European Daughter Directive which will come into force on 13th December 2002.

During this period, Partisol analysers measuring gravimetric daily averaged PM₁₀ concentrations have been introduced into the network for the first time. Netcen has developed field intercalibration techniques and ratification procedures to extend QA/QC operations to include these analysers. These are described in Section 2.3.

The changes to the AUN between July 2001 and April 2002 are summarised in Table 1.1. Four new sites were integrated during July 2001 to April 2002 bringing the total number of sites to 82. There were 81 monitoring sites at the end of 2001 with Wrexham being established in March 2002. Additional CO and PM₁₀ (Partisol) instruments were also installed at four and three existing sites respectively. Monitoring at the Hull Centre site was temporarily suspended on 17th Jan 2002 because of nearby demolition work. The monitoring site at London Bloomsbury was relocated on 4th Feb 2002 to another part of Russell Square with monitoring recommencing on 5th March 2002.

Table 1.1 Changes to the AUN between July 2001 to April 2002

Sites	Date Commenced	Pollutants
New sites		
London Westminster	17 July 2001	O ₃ NO ₂ CO SO ₂
Inverness	17 July 2001	NO ₂ CO
Cwmbran	20 July 2001	NO ₂ SO ₂ PM ₁₀
Wrexham	6 March 2002	NO ₂ CO SO ₂
Additional CO monitoring		
Dumfries	17 July 2001	CO
Cwmbran	12 March 2002	CO
Northampton	12 March 2002	CO
Portsmouth	21 March 2002	CO
Additional PM₁₀ (Partisol) monitoring		
Inverness	11 July 2001	PM ₁₀
Bournemouth	18 July 2001	PM ₁₀
Dumfries	17 Aug 2001	PM ₁₀
Monitoring suspended		
Hull Centre	17 Jan 2002 ongoing	
London Bloomsbury	4 Feb 2002 to 5 March 2002	

Generic data quality issues affecting the network are discussed in Section 2, while some of the more specific data quality issues affecting individual sites are given in Section 3. The main site operational and QA/QC issues giving rise to data capture below the required 90% level are summarised in Section 4.

In addition, during this period approximately 3.5 years of unratified PM₁₀ data from the BAM analyser at Belfast Clara Street has been checked and reviewed. This work is described in Section 3.1.

Ratified hourly average data capture for the network averaged 94% for all pollutants (O₃, NO₂, SO₂, CO and PM₁₀) during this 6-month reporting period (Table 1.2). The ratified data capture statistics for the complete year (January to December 2001) are given in Table 5.2. The annual average data capture for the year was 93.6% which is consistent with the overall high levels of network performance seen over the last few years (Figure 1.1).

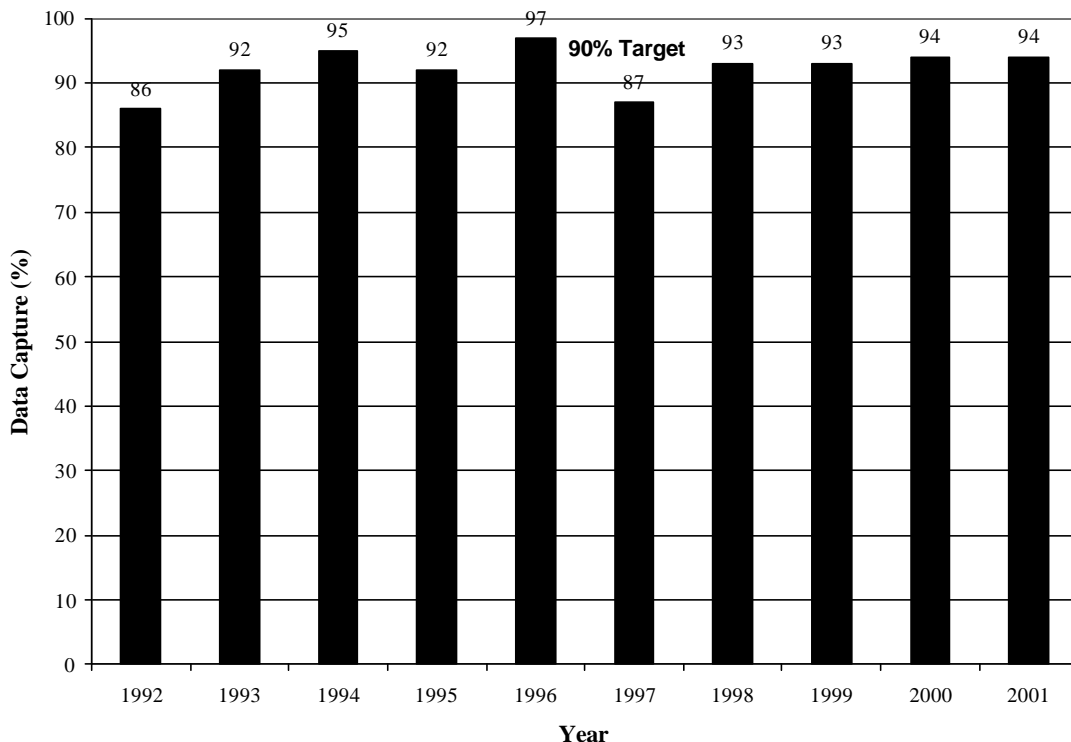


Figure 1.1 AUN Data Capture 1992 to 2001
(Using the start date of any new site)

Table 1.2 AUN Ratified Data Capture (%) July to December 2001
(Using the start date of any new site)

Pollutant	O ₃	NO ₂	CO	PM ₁₀	SO ₂	Average
Data Capture (%)	92.9	94.2	95.1	94.2	94.6	94.1

All data capture figures given in this report now include the Partisol data for the first time. 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.

A more detailed breakdown of the hourly data capture statistics for each site is presented in Section 5, Tables 5.1 and 5.2. In total, 11 out of the 81 sites (13.6%) had an average data capture rate below the required 90% level for the July to December 2001 period (Figure 1.2).

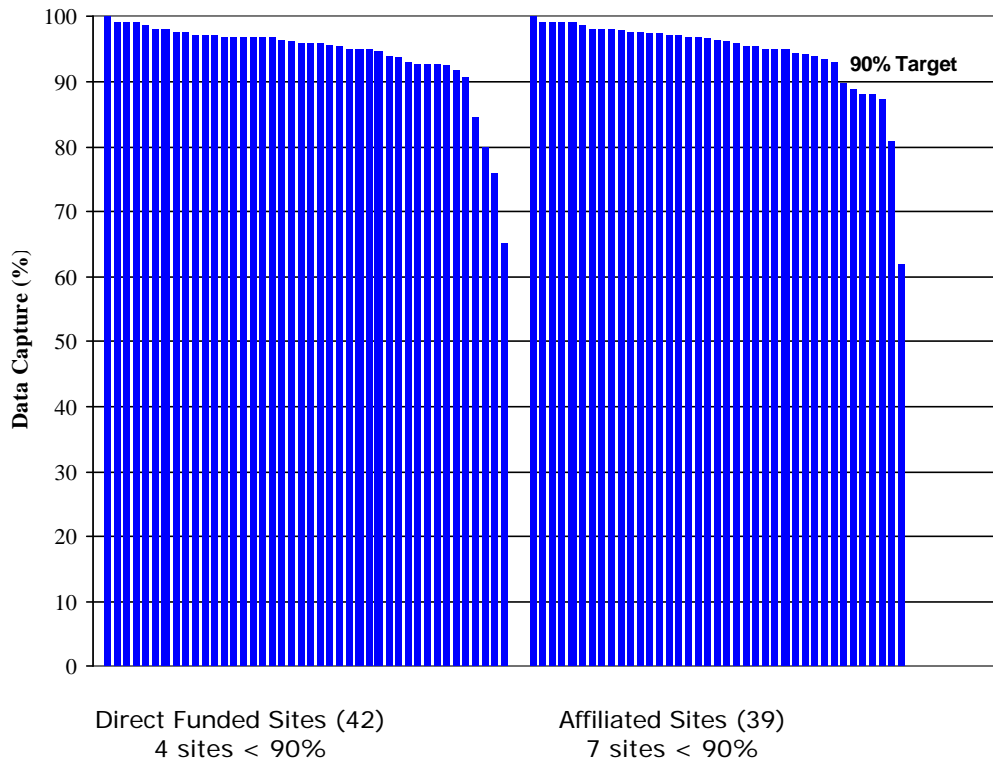


Figure 1.2 AUN Data Capture July to December 2001
(Using the start date of any new site)

The data capture statistics in Table 1.3 show that, over the last few years, the number of sites failing to reach 90% target data capture has fallen significantly. As shown in Figure 1.2, there is now very little difference between the overall performance of the affiliated sites compared to the direct funded sites, with 90% of the direct funded sites and 82% of the affiliated sites achieving the target 90% data capture level during this ratification period.

Table 1.3 Percentage of Sites with Data Capture below 90% Target Level
(Using the start date of any new site and Partisol since 2001)

Ratification Period	Direct Funded Sites	Affiliated Sites
1997	28%	59%
1998	8%	23%
1999	3%	42%
2000	10%	23%
2001	12%	18%
January to June 2001	18%	15%
July to December 2001	10%	18%

The QA/QC Unit carried out the winter network intercalibration and site audits during January to March 2002 and the results have been used to assess the accuracy and consistency of the data for this reporting period. Details of this intercalibration and audit exercise will be reported separately.

The QA/QC Unit's data ratification and intercalibration reports are now available via the Web at the following address: http://www.aeat.co.uk/netcen/airqual/reports/research00_01/304.html

2. Generic Data Quality Issues

2.1 Progress on the Affiliation of New Sites

In order to comply with requirements of the First European Daughter Directive (DD1), new sites were integrated into the network during 2001. The QA/QC Unit and CMCU worked closely to ensure that the 11 new sites were operational and additional monitors installed at a further three existing sites by the time that DD1 came into force in the UK on 19th July 2001. The QA/QC Unit also carried out the pre-affiliation site audits and site operator training in order to ensure the smooth integration of the new sites into the network. Seven of the sites affiliated started on or around 1st January 2001, and five more were operational before the deadline of 19th July 2001. One site (Wrexham) commenced operation on 6th July 2001 but was subsequently vandalised and closed until 6th March 2002 for security reasons. Details of the new sites affiliated are provided in Table 2.1. In addition, gravimetric PM₁₀ analysers (Partisols) were installed at Bournemouth, Dumfries, Inverness and Wrexham. Installation of the gravimetric PM₁₀ analyser at Hove has been delayed due to planning permission issues.

Data capture from the new DD1 sites, calculated from 1st January 2001 for the whole of 2001, is shown in Figure 2.1. Some of the instruments achieved the 90% data capture target for the year 2001.

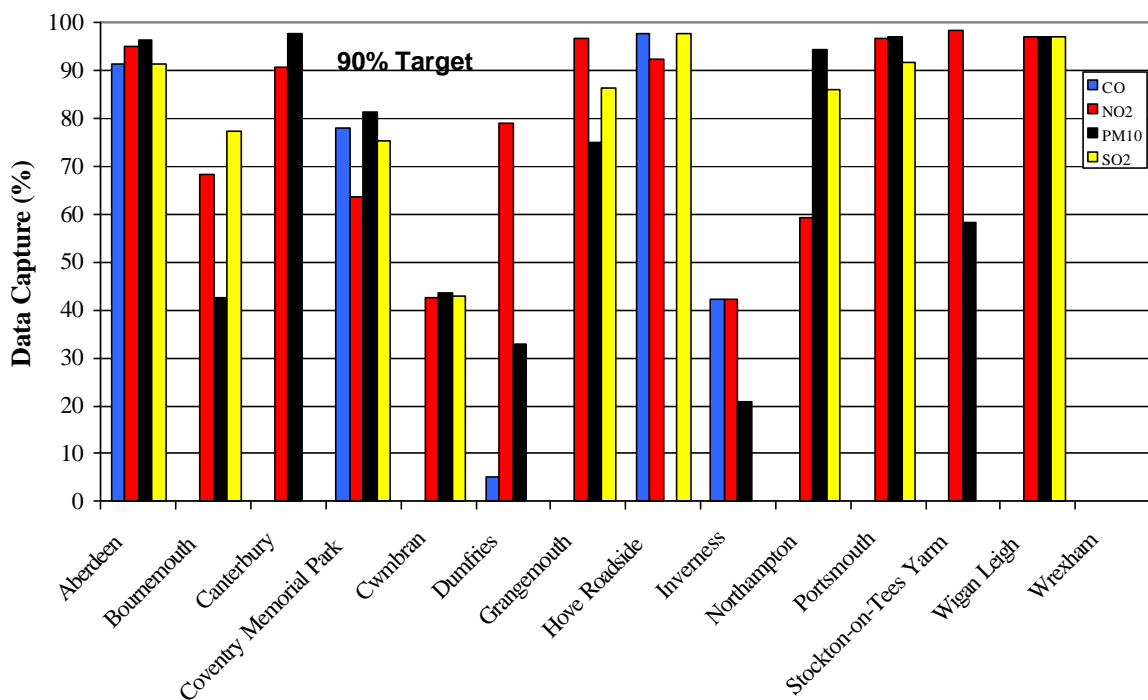


Figure 2.1 Data Capture from New DD1 Sites, January to December 2001

(All data captures are calculated from 1st January to 31st December 2001)

The QA/QC Unit and CMCU have worked closely to establish five additional CO instruments to fulfil the requirements of the Second European Daughter Directive (DD2). Two of these CO instruments were operational during 2001.

Table 2.1 Status on the Affiliation of New DD1 Sites

Site	Status	Pollutants	Data From	Comments
Grangemouth	Affiliate	NO ₂ , SO ₂ , PM ₁₀	1 Jan 2001	
Aberdeen <i>(existing site)</i>	Affiliate	SO ₂	1 Jan 2001	
Stockton-on-Tees Yarm	Affiliate	NO ₂ , PM ₁₀	1 Jan 2001	
Wigan Leigh	Affil	NO ₂ , SO ₂ , PM ₁₀	1 Jan 2001	
Portsmouth	Affiliate	NO ₂ , SO ₂ , PM ₁₀ , CO	1 Jan 2001 (NO ₂ , PM ₁₀) 16 Jan 2001 (SO ₂) 21 Mar 2002 (CO)	
Hove <i>(existing site)</i>	Affiliate	SO ₂ , PM ₁₀	3 Jan 2001 (SO ₂)	The installation of the PM ₁₀ monitor is delayed by planning restrictions.
Canterbury	Affiliate	NO ₂ , PM ₁₀	2 Jan 2001 (PM ₁₀) 1 Feb 2001 (NO ₂)	NO/NO ₂ channel mismatch in January 2001. Data were rejected to 1 st Feb 2001
Northampton	Affiliate	NO ₂ , SO ₂ , PM ₁₀ , CO	12 Jan 2001 (PM ₁₀) 12 Feb 2001 (SO ₂) 5 Apr 2001 (Partisol) 24 May 2001 (NO ₂) 12 Mar 2002 (CO)	
Coventry Memorial Park <i>(existing site relocated)</i>	Affiliate	PM ₁₀	26 Feb 2001	The site was relocated to Coventry Memorial Park. Monitoring commenced 26 th Feb 2001
Dumfries	DEFRA	NO ₂ , CO, PM ₁₀	1 Mar 2001 (NO ₂) 17 July 2001 (CO) 17 Aug 2001 (Partisol)	
Bournemouth	Affiliate	NO ₂ , SO ₂ , PM ₁₀	5 Mar 2001 (NO ₂ , SO ₂) 18 July 2001 (Partisol)	
Inverness	DEFRA	NO ₂ , CO, PM ₁₀	17 July 2001 (NO ₂ , CO) 11 July 2001 (Partisol)	The Partisol was not operational between 30 th September 2001 and 27 th February 2002 due to vandalism.
Cwmbran	DEFRA	NO ₂ , SO ₂ , PM ₁₀ , CO	20 July 2001 (NO ₂ , SO ₂ , PM ₁₀) 12 Mar 2002 (CO)	The site was relocated on 18 th July 2001. Manifold sample pump problem until 20 th July 2001.
Wrexham	DEFRA	NO ₂ , SO ₂ , PM ₁₀	6 March 2002 (NO ₂ , SO ₂) 1 Mar 2002 (Partisol)	The site was installed 6 th July 2001 but there was serious vandalism. Site re-started March 2002.

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 2001 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). The 36 critical sites in the AUN are given in Tables 2.2 and 2.3. An indication of whether or not the 90% data capture target has been achieved is shown together with the actual data capture for all pollutants below 90%. Details of data capture and reasons for data loss are provided in Section 4.

Table 2.2 Critical Sites in Agglomerations*

(All data captures are calculated from 1st January to 31st December 2001)

Critical Sites in Agglomerations	90% Data Capture Achieved (Calendar Year 2001)		
	NO ₂	PM ₁₀	SO ₂
Blackpool	X (89.6%)	✓	X (89.4%)
Bournemouth	X (68.5%)	-	X (77.3%)
Coventry Memorial Park	X (63.6%)	X (81.3%)	X (75.3%)
Hove Roadside	M	X (0%)	✓
Hull Centre	✓	✓	✓
Leicester Centre	✓	✓	✓
Liverpool Centre	✓	✓	✓
Newcastle Centre	X (85.6%)	✓	✓
Nottingham Centre	X (84.6%)	✓	X (89.6%)
Portsmouth	✓	✓	✓
Preston	✓	✓	X (84.9%)
Reading	✓	✓	✓
Southampton	✓	✓	✓
Southend-on-Sea	✓	✓	✓
Stoke-on-Trent Centre	✓	✓	✓
Wirral Tranmere	✓	✓	X (79.8%)
Belfast Centre	X (85.5%)	M	M
Edinburgh	✓	✓	✓
Glasgow Centre	M	✓	M
Cardiff Centre	✓	✓	✓

Table 2.3 Critical Sites in Zones*

(All data captures are calculated from 1st January to 31st December 2001)

Critical Sites in Zones	90% Data Capture Achieved (Calendar Year 2001)		
	NO ₂	PM ₁₀	SO ₂
Barnsley Gawber	X (82.5%)	-	M
Canterbury	M	✓	-
Leamington Spa	✓	✓	✓
Northampton	X (59.3%)	✓	X (86.0%)
Oxford Centre	M	-	✓
Plymouth Centre	M	✓	M
Scunthorpe	-	✓	M
Stockton-on-Tees Yarm	✓	X (58.3%)	-
Wigan Leigh	✓	✓	✓
Derry	✓	✓	✓
Aberdeen	✓	✓	✓
Dumfries	X (79.2%)	X (0%)	-
Grangemouth	✓	X (74.9%)	X (86.5%)
Inverness	X (42.3%)	X (0%)	-
Cwmbran	X (42.7%)	X (43.5%)	X (42.9%)
Wrexham	X (0%)	X (0%)	X (0%)

KEY to Tables 2.2 and 2.3

✓	90% data capture achieved for January to December 2001
X	Less than 90% data capture for January to December 2001
M	Monitored at site but not a critical pollutant
-	Not monitored

*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>

2.3 Partisol Data Ratification

PM₁₀ measurements using the gravimetric Partisol instrument were ratified for the first time during this period using a new data ratification procedure. 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 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.

Partisol instruments are now operating at Northampton (5th Apr 2001), Bournemouth (18th July 2001), Inverness (11th July 2001), Dumfries (17th Aug 2001) and Wrexham (1st March 2002). The Northampton partisol is also co-located with a TEOM which provides a useful check that both techniques are operating correctly. Partisol concentrations and the 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.

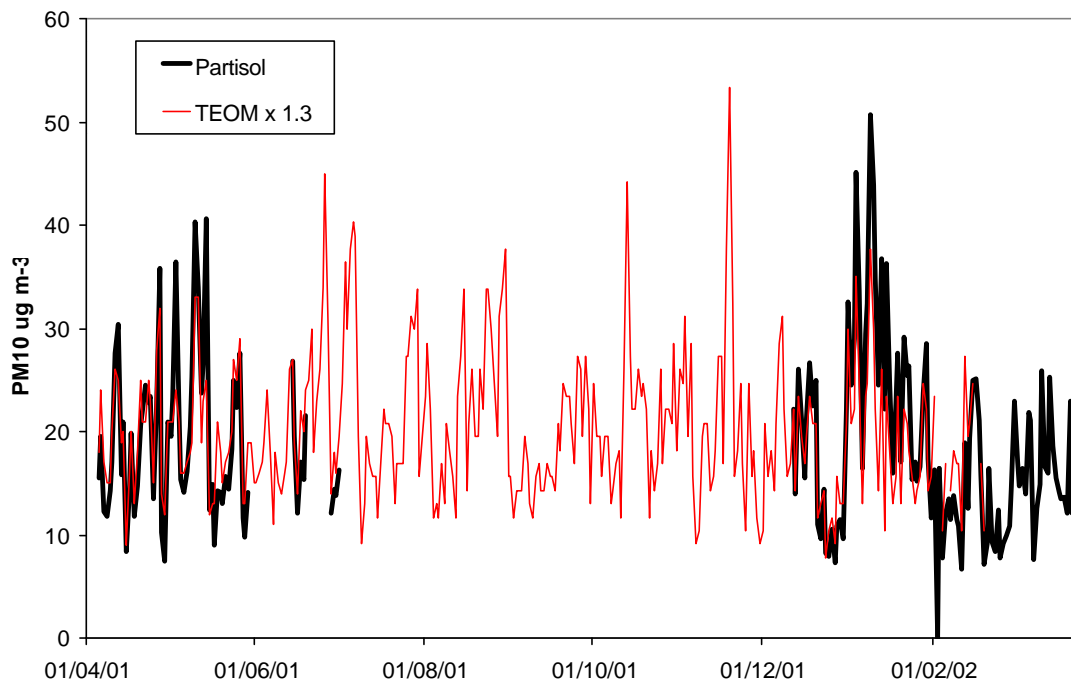


Figure 2.1 Partisol and TEOM (x1.3) Concentrations at Northampton

Most quality control issues with the partisol instruments were found to be either due to the automatic changing of the filter or the sample flow. Data were lost due to visibly damaged or inverted filters, pump problems and vandalism.

2.4 NO₂ Converter Efficiencies

There were two intercalibration exercises that were relevant to the ratification of the July to December 2001 AUN data. The summer 2001 intercalibration exercise identified four sites that failed the NO_x converter test with one "borderline" case where the converter was found to be operating just marginally below the 95% level (Table 2.4). Five instruments failed during the winter 2001 exercise with four assessed as borderline.

Table 2.4 Sites with low NO_x converter efficiency

Site	C.E (%)	Analyser	Date tested	Comment
Summer 2001				
Norwich Roadside	85	API	14/08/01	
Barnsley Gawber	86	Ambirack	04/09/01	Converter had been replaced on 24 th April 2001 following LSO concerns about response stability.
Aberdeen	92	API	12/09/01	Tested and failed twice
Glasgow Centre	90.5	Signal	24/07/01	Passed last audit but failed previous 2 (failed 3 out of last 4 audits.)
Bolton	89 and 97	ML98	11/07/01	Borderline: failed at high concentration but passed at lower concentration (300ppb NO ₂)
Winter 2001				
Blackpool	93	Ambirack	05/02/02	Borderline: converter efficiency of 93% at higher concentration (450ppb NO ₂) and 94.3% at 300ppb NO ₂ .
Coventry Memorial Park	91	Ambirack	17/01/02	
Manchester Piccadilly	94	Rotork	06/02/02	Borderline: subsequent test on 18 th Feb 2002 was 96.7%.
Wolverhampton Centre	92	Rotork	04/02/02	Borderline: 92% at higher concentration (480ppb NO ₂) and 97% at lower concentration. Subsequent test on 11 th Feb 2002 was 99.2%.
Rotherham	92	Ambirack	13/03/02	Borderline: 97.4% efficient on 17 th Sept 2001.

Careful examination of the data was carried out in order to determine the effect of the low NO_x converter results on data quality. Where available, chart records or 1-minute calibration data were used to examine the response stability during the LSO's fortnightly NO₂ calibrations. In cases where the converter efficiency was low, a noticeable decline in the response of the NO₂ span could often be seen during each calibration. The effect of low converter efficiency on data quality and any resulting data loss is shown in Table 2.5.

Table 2.5 Effect of Low Converter Efficiency on Data Quality

Site	C.E (%)	Analyser	Effect on data quality	Data loss
Norwich Roadside	85	API	Evidence of response drift and calibration instability seen from 1 st June 2001.	1/6/01 to 31/8/01
Barnsley Gawber	86	Ambirack	1-minute calibration data provided by the ESU showed a fall in the NO ₂ calibration response from 1 st August 2001.	1/8/01 to service on 13/9/01
Aberdeen	92	API	No significant effect seen in response stability.	None
Glasgow Centre	90.5	Signal	Drift in calibration sensitivity seen at end of June.	28/06/01 to 31/07/01

Site	C.E (%)	Analyser	Effect on data quality	Data loss
Bolton	89 and 97	ML98	Converter passed test at lower concentration therefore accepted.	None
Blackpool	93	Ambirack	No effect observed.	None
Coventry Memorial Park	91	Ambirack	Instability found in the 1-minute calibration data downloaded from site.	From ESU test on 07/11/01 to service on 27/01/02
Manchester Piccadilly	94	Rotork	No effect observed.	None
Wolverhampton Centre	92	Rotork	No effect observed.	None
Rotherham	92	Ambirack	No effect observed.	None

RECOMMENDATIONS

i)	The ESUs should carry out 3-monthly converter tests at sites where the analysers have failed the converter test or are considered borderline cases. We therefore recommend 3-month converter tests at Blackpool, Coventry Memorial Park, Manchester Piccadilly, Wolverhampton Centre and Rotherham.
ii)	LSOs should continue to pay careful attention to the short-term stability of the NO ₂ calibration response. Notify the CMCU if a declining NO ₂ 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 CO and SO₂ Zero Truncation

The QA/QC Unit continued to investigate instances of zero truncation (also called baseline clipping) during this data ratification period. An example is observed with the CO instrument at Bristol Old Market (Figure 2.2). This instrument is regularly adjusted so that the zero is returned to above +50mV. However, some data have still been rejected (part of December 2001 and February 2002). Though these adjustments were necessary to prevent data loss, in general adjusting an instrument on a regular basis is not recommended for several reasons. For example: the calibration history of the instrument is interrupted, the CMCU must quickly re-scale the data correctly for hourly dissemination and the QA/QC unit must investigate each adjustment during data ratification.

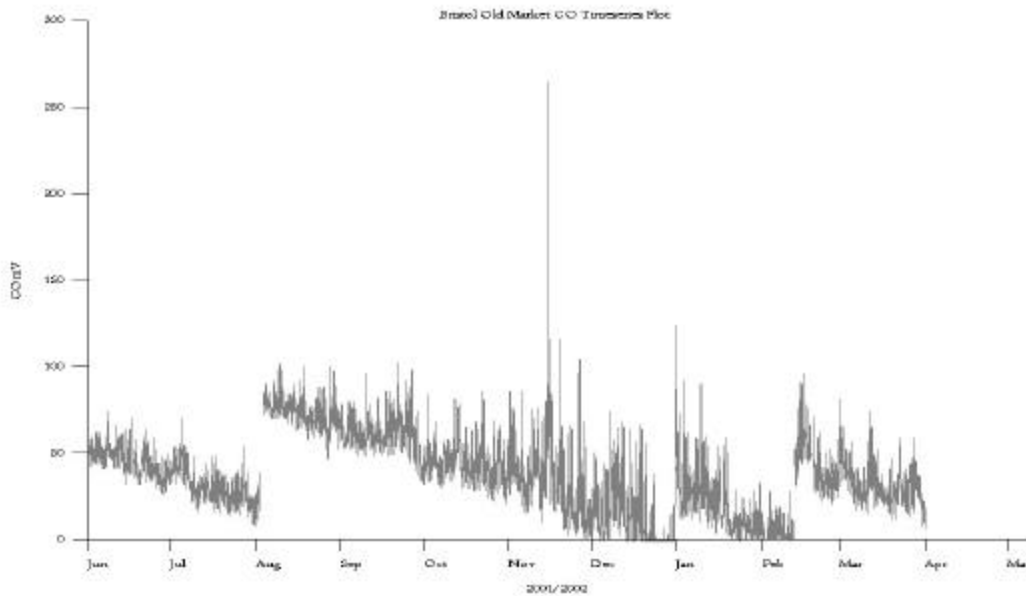


Figure 2.2 CO Instrument Baseline Drift and Zero Truncation at Bristol Old Market (mV)

There were some other CO and SO₂ instruments that showed some signs of baseline truncation during this ratification period. These data, however, were retained since the problems were marginal, stable and unlike the examples described above.

RECOMMENDATION

The ESU should rectify the baseline drifts on the CO instruments at Bristol Old Market.

2.6 Ozone Outliers

There were two intercalibration exercises that were relevant to the ratification of the July to December 2001 AUN data. A total of 15 out of the 47 ozone analysers (32%) tested during the summer 2001 audit were found to be outliers (Table 2.6). While 11 out of 47 (23%) were outliers during the winter 2001 exercise. Full details are provided in the relevant intercalibration report.

Data from these sites have been corrected accordingly during the ratification process.

Table 2.6 Ozone Outliers Identified at the Intercalibration Exercises

Site	Outlier (%)	Site	Outlier (%)
Summer 2001		Winter 2001	
Barnsley Gawber	-9.4	Belfast Centre	6
Belfast Centre	6.6	Blackpool	-7
Bristol Centre	9.1	Bristol Centre	-10.4
Exeter Roadside	-17.8	Cardiff Centre	-10
London Bloomsbury	-18.1	Leicester Centre	7.6
Manchester South	6	Manchester South	-6.6
Nottingham Centre	-9.3	Norwich Centre	-23
Preston	-8.9	Rotherham	-8.3
Reading	-8.7	Sheffield Centre	-16.2
Redcar	6.1	Stoke-on-Trent	-29
Rotherham Centre	-6.9	Wirral Tranmere	-29
Salford Eccles	11.8		
Sheffield Centre	-5.6		
Southampton Centre	10.9		
Wolverhampton Centre	35.1		

2.7 TEOM K_0

The TEOM instruments in the AUN 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 2.7 shows the sites where there were large deviations between the measured and stamped K_0 values.

Table 2.7 Large TEOM K_0 Deviations identified at the Intercalibration Exercises

Site	K_0 Deviation (%)	Test Date
Coventry Memorial Park	-4.6	12 th July 2001
	-4.6	17 th Jan 2002
Portsmouth	-2.9	10 th July 2001
Northampton	-2.7	9 th July 2001
	2.3	26 th Oct 2001
Preston	6.2	25 th July 2001
	-2.9	30 th Jan 2002
Belfast Centre	-3.2	17 th July 2001
	-3.2	29 th Jan 2002

The QA/QC Unit investigated each K_0 deviation and the following corrections were made to the TEOM data (Table 2.8).

Table 2.8 Corrections due to TEOM K_0 Deviations

Site	Comment
Coventry Memorial Park	The monitoring site was established on 26 th February 2001 by the relocation of the equipment from the Coventry Centre site. An incorrect value of K_0 had been used throughout 2001 and all data were rescaled.
Portsmouth	The K_0 deviation was borderline and no corrections were undertaken.
Northampton	The K_0 deviation was borderline and no corrections were undertaken.
Preston	The sensor unit was replaced after the summer intercalibration and was re-fitted on 5 th Nov 2001. However the K_0 was not updated in the software on this date. All data between 5 th Nov 2001 and 24 th Jan 2002 were rescaled.
Belfast Centre	A clear history of changes to the sensor unit could not be determined. However, the K_0 deviation was borderline and no corrections were undertaken.

RECOMMENDATION

ESUs should ensure that the correct K_0 value is entered into the analyser software whenever the sensor unit is repaired or replaced.

2.8 Auto-Calibration Run-ons

The QA/QC Unit and CMCU identified a new data quality problem (auto-calibration run-on) during this ratification period. Most instruments in the AUN perform an automatic calibration cycle every night. Zero gas and then calibration gas are introduced into the instruments between the times of 0045 and 0115. The resultant readings for these gases are used to identify instrument breakdowns or excessive drifts. Data during the calibration cycle are flagged as zero and span measurements and are not used to calculate the reported ambient measurements.

A problem can occur if the solenoid valves in the pneumatic system do not close fully after the cycle. Calibration gas may then leak into the instrument during the ambient measurement period. The fault can be identified by calculating the diurnal variation of concentrations during this period (i.e. calculating the average concentration for each 15-minute period). An example is shown in Figure 2.3 which is the diurnal variation for the Belfast Centre NO_x instrument.

Figure 2.3 shows the average diurnal cycle of 15-minute and hourly average NO₂ concentrations at Belfast Centre. Hourly averages, which are the basic reporting time period for the AUN, are calculated from at least three valid 15-minute concentrations. This example shows that the calibration gas introduced between 0045 and 0115 remained in the instrument until about 0200. The ambient measurements between 0130 and 0200 are therefore invalid and were removed during data ratification. If this correction is required throughout a year, one hour out of twenty-four will be lost which is 4% of the annual data capture. This can be a serious source of data loss when the target data capture is 90%.

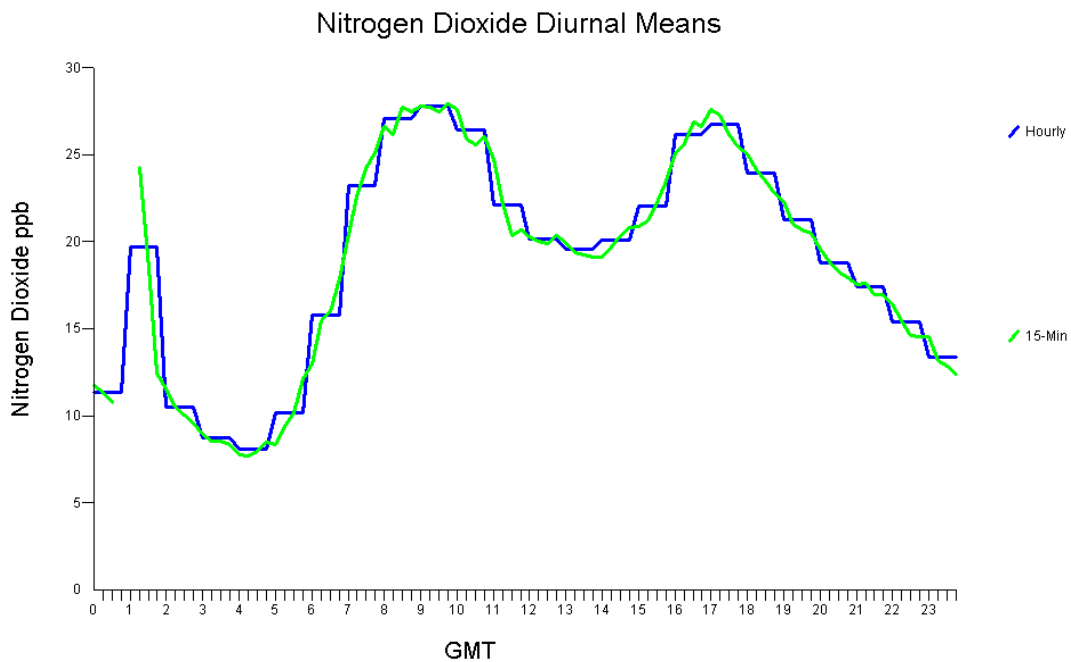


Figure 2.3 Auto-Calibration Run-on for the Belfast Centre NO_x Instrument

Similar run-on problems were identified at many other sites (Table 2.9). However, the peak due to leakage of calibration gas, or dip due to zero gas, was often of smaller magnitude. All the instruments listed in Table 2.9 were corrected using a new data processing procedure introduced by the QA/QC Unit.

Table 2.9 Estimate of Spike or Dip in 15-Minute Concentrations

Site	NO ₂ (ppb)	O ₃ (ppb)	SO ₂ (ppb)
Barnsley Gawber	5	8	
Belfast Centre	15		
Billingham	5		
Birmingham Centre	5		
Birmingham East	8		
Blackpool	5		
Bournemouth	3		5
Bradford Centre			1
Brighton Roadside	2		
Bristol Centre	4		
Cardiff Centre	9		-5
Coventry Memorial Park	3		-2
Derry	5		
Edinburgh Centre			0.5
Exeter	5		
Hove Roadside	6		
Leamington Spa	3		
Leeds Centre	5		
London Bloomsbury	3		0.5
London Brent	5		1.2
London Westminster	5		
Manchester South	3		
Newcastle Centre			5
Rotherham	3		
Walsall Willenhall	7		
Wirral Tranmere			-1
Wolverhampton Centre	4		1

The relevant ESUs were advised of these new problems and have successfully remedied most the pneumatic faults. However, this type of problems has been identified at some recently established sites and these will be assessed during the next ratification period.

RECOMMENDATION

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

3. Site Specific Issues

3.1 Belfast Clara Street BAM

The PM₁₀ instrument at the Belfast Clara Street site is a Beta-Ray Attenuation Monitor (BAM). This is the only instrument using this technique in the AUN. The other PM₁₀ instruments in the AUN are either the TEOM (Tapered Element Oscillating Micro-Balance) or Partisols. A new procedure was developed by the QA/QC Unit during this period to check and review the data from the BAM. All the BAM data from June 1998 to December 2001 have now been checked and reviewed and are available on the National Air Quality Archive.

3.2 Bristol Old Market NO_x

The NO₂ measurements at Bristol Old Market have been ratified for this period. However, the concentrations were unusually high during November and early December 2001 (Figure 3.1) and higher than nearby monitoring sites. The QA/QC Unit investigated possible causes for these anomalous concentrations and had discussions with the CMCU, ESU and LSO. No reason could be found to reject the data, so the data were retained.

However, these high concentrations have now reoccurred during April 2002. The QA/QC Unit has, therefore, installed a second NO_x analyser at the site to verify the data from the AUN instrument. The ratified data during 2001 may require further correction based on the outcome of the parallel monitoring. This will be completed before the routine submission of the UK dataset and statistics to the European Commission.

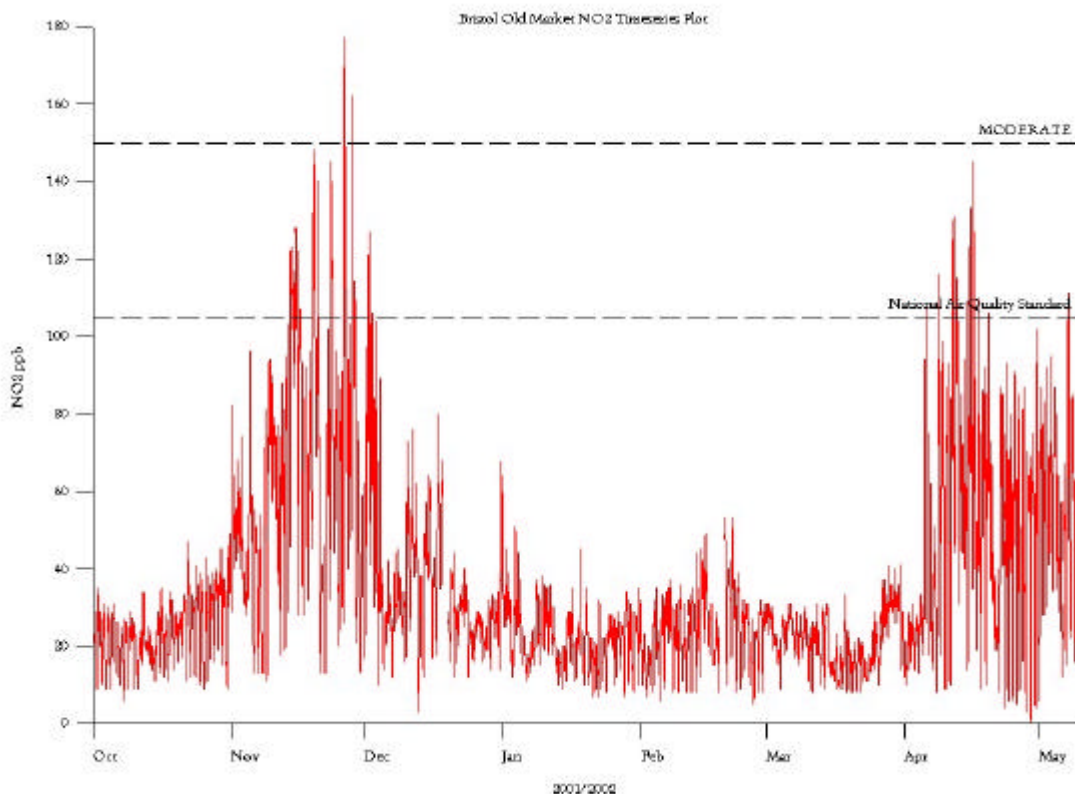


Figure 3.1 High NO₂ Concentrations at Bristol Old Market

3.3 Plymouth Centre Ozone

A problem was suspected with the Plymouth Centre ozone instrument during 2001. This was discussed in the January to June 2001 ratification report. High ozone concentrations were being measured which did not agree with nearby monitoring stations. The QA/QC Unit installed a second instrument during September 2001 to confirm the readings from the AUN instrument. The conclusion of this exercise was that the AUN instrument was reading too high and a pneumatic leak was discovered. Data between 1st March to 12th November 2001 were, therefore, rejected during ratification. The monitor is now operating satisfactorily after this date.

3.4 Sandwell West Bromwich CO

The CO analyser at Sandwell West Bromwich showed unacceptably high levels of noise and baseline response instability during 2001 (Figure 3.3). The baseline was difficult to determine and the data between 20th March to 31st August 2001 was rejected during ratification. Data during 2002 may also require rejection for similar reasons.

RECOMMENDATION

ESU to investigate CO response noise and instability at Sandwell West Bromwich.

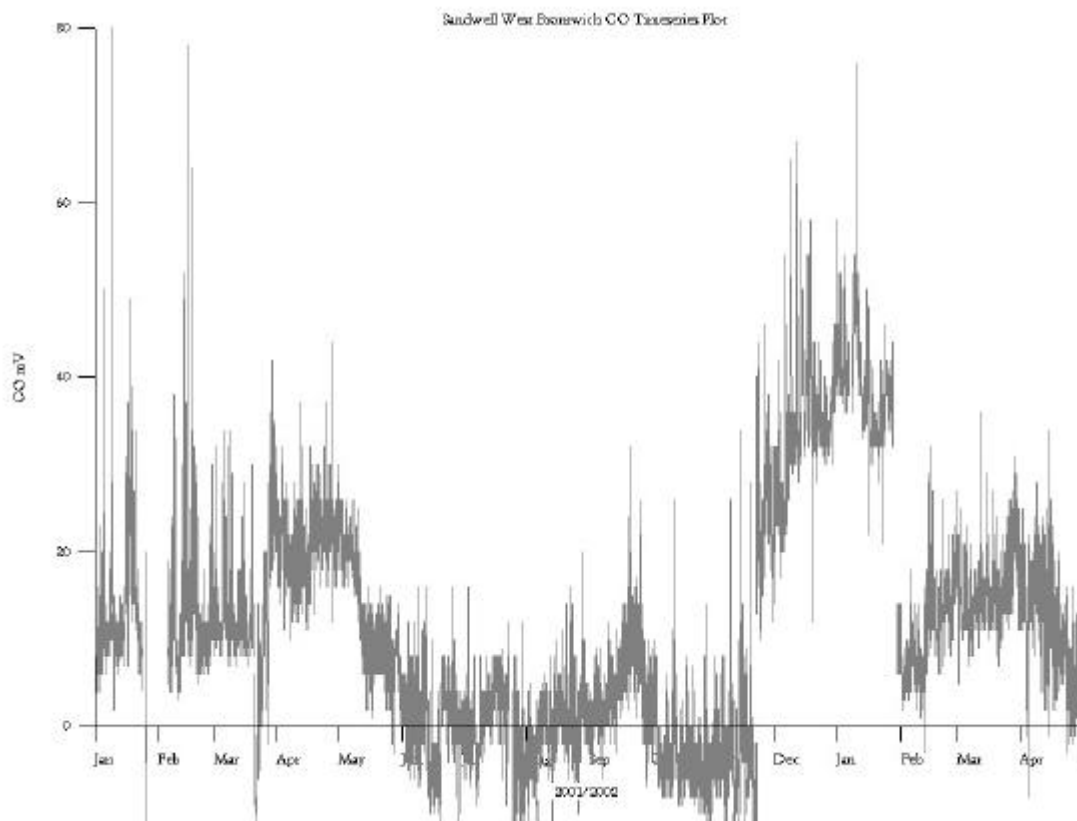


Figure 3.3 Sandwell West Bromwich CO response instability and high noise

3.5 Thurrock CO

CO measurements at the Thurrock monitoring site were found to be unusually low during data ratification. This was discussed in the January to June 2001 ratification report. Also, the data in the QA/QC Unit database did not agree with the data disseminated by the CMCU. Subsequent analysis revealed that the mV measurements were divided by 5 during the monthly data transfer between the CMCU and the QA/QC Unit. This error was corrected and all CO data between July 2000 to December 2001 were rescaled.

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 December 2001 (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 six-month reporting period.

Table 4.1 Sites with data capture below 90% July to December 2001
(Using the start date of any new site)

Data Capture (%)	Start	End	Reason for data Loss	Days	Hours
Barnsley Gawber					
NO ₂	72.4%	01-Aug-01	13-Sep-01 Converter fault	43.4	1042
Belfast Centre					
CO	71.2%	31-Jul-01	02-Aug-01 Service	2.1	51
		21-Aug-01	09-Oct-01 Noisy and negative readings after instrument reinstallation	48.7	1169
Blackpool					
SO ₂	84.0%	17-Sep-01	15-Oct-01 Drift after service	28.2	676
		13-Nov-01	13-Nov-01 Missing data when the electronics tripped out in cabin	0.3	6
Bournemouth					
NO ₂	89.7%	13-Aug-01	14-Aug-01 No data received by the QA/QC Unit	0.5	13
		04-Sep-01	06-Sep-01 Service	2.1	50
		01-Nov-01	09-Nov-01 Instrument off-site. The auto-calibration sequence was operating at uncontrolled intervals.	8.2	197
Bradford Centre					
SO ₂	89.7%	25-Aug-01	28-Aug-01 Air conditioning failure affected data.	3.5	83
		02-Sep-01	05-Sep-01 Air conditioning failure affected data.	3	72
		17-Sep-01	19-Sep-01 Service	2.1	51
		28-Oct-01	29-Oct-01 Invalid data before system rebooted.	1.5	36
		28-Dec-01	28-Dec-01 Fault with the site power supply	0.5	12
Coventry Memorial Park					
NO ₂	63.8%	14-Jul-01	15-Jul-01 Power cut	1.1	27
		23-Jul-01	26-Jul-01 Service	3.1	74
		14-Aug-01	15-Aug-01 Water was discovered in the manifold	1.2	28
		11-Sep-01	12-Sep-01 System stopped logging after LSO calibration	0.3	8
		07-Nov-01	23-Jan-02 Converter fault	77	1848
SO ₂	89.9%	14-Jul-01	15-Jul-01 Power cut	1.1	27
		23-Jul-01	26-Jul-01 Service	3.1	74
		14-Aug-01	15-Aug-01 Water was discovered in the manifold	1.5	36
		11-Sep-01	12-Sep-01 System stopped logging after LSO calibration	0.3	8
		02-Dec-01	03-Dec-01 System stopped logging	0.5	13
		23-Dec-01	26-Dec-01 System stopped logging	3.5	84

Data Capture (%)	Start	End	Reason for data Loss	Days	Hours			
Dumfries								
CO	10.9%	01-Jul-01	17-Jul-01	Zero drift and baseline truncation	16.6	399		
		05-Aug-01	12-Jan-02	Zero drift and baseline truncation	160	3840		
PM ₁₀ (Partisol)	87.6%	04-Sep-01	14-Sep-01	Filter exchange mechanism jammed	10	240		
		24-Sep-01	26-Sep-01	Filter damaged	2	48		
		13-Nov-01	15-Nov-01	Filter inverted	2	48		
		2-Dec-01	3-Dec-01	Filter inverted	1	24		
		5-Dec-01	6-Dec-01	Filter inverted	1	24		
		15-Dec-01	16-Dec-01	Low flow rate	1	24		
Exeter Roadside								
CO	62.9%	04-Jul-01	04-Aug-01	Instrument producing spurious data	31.1	746		
		13-Aug-01	14-Aug-01	Instrument overheating followed by service	1.1	26		
		24-Aug-01	08-Sep-01	Site out of service with data logger corruption	15.3	367		
		12-Sep-01	25-Sep-01	Instrument removed for repair	13	313		
		31-Oct-01	31-Oct-01	Baseline automatically changed in uncontrolled manner	0.3	6		
		01-Nov-01	01-Nov-01	Baseline automatically changed in uncontrolled manner	0.3	7		
		27-Nov-01	28-Nov-01	Logging stopped with air conditioning fault	0.8	20		
		12-Dec-01	17-Dec-01	Low and erratic data after LSO calibration	5.1	122		
		NO ₂	86.2%	13-Aug-01	14-Aug-01	Service	1.1	26
				24-Aug-01	08-Sep-01	Site out of service with data logger corruption	15.3	367
27-Nov-01	28-Nov-01			Logging stopped due to air conditioning fault	0.8	20		
O ₃	89.9%	13-Aug-01	14-Aug-01	Service	1.1	26		
		24-Aug-01	08-Sep-01	Site out of service with data logger corruption	15.3	367		
		27-Nov-01	28-Nov-01	Logging stopped due to air conditioning fault	0.8	20		
SO ₂	84.7%	12-Aug-01	14-Aug-01	Unknown analyser fault followed by service	2.1	50		
		17-Aug-01	08-Sep-01	Unknown analyser fault and site out of service with data logger corruption	21.9	526		
		27-Nov-01	29-Nov-01	Instrument overheating with cooler failure	2	49		
Glasgow Centre								
NO ₂	74.5%	28-Jun-01	15-Aug-01	Low converter efficiency and sensitivity drift	47.9	1150		
		07-Dec-01	07-Dec-01	Unstable data	0.4	9		
SO ₂	53.4%	08-Aug-01	09-Aug-01	No data received by the QC/QC unit	0.9	21		
		13-Aug-01	01-Oct-01	UV lamp problems	49.1	1178		
		14-Nov-01	19-Dec-01	UV lamp problems	35.1	842		
Inverness								
PM ₁₀ (Partisol)	43.7%	21-Jul-01	22-Jul-01	Filter damaged	1	24		
		9-Sep-01	12-Sep-01	Low flow rate	3	72		
		30-Sep-01	ongoing	Site vandalised	92	2208		
Leeds Centre								

Data Capture (%)	Start	End	Reason for data Loss	Days	Hours	
CO	89.0%	14-Jul-01	18-Jul-01	Instrument generating unstable data	4.5	107
		23-Jul-01	24-Jul-01	Power cut	0.7	16
		28-Jul-01	28-Jul-01	No data received by the QA/QC Unit	0.7	17
		02-Oct-01	04-Oct-01	Service	2	49
		21-Oct-01	21-Oct-01	Air conditioning problems	0.3	6
		28-Oct-01	08-Nov-01	Air conditioning problems	10.6	255
NO ₂	88.2%	15-Jul-01	16-Jul-01	No data received by the QA/QC Unit	1.3	30
		23-Jul-01	24-Jul-01	Powercut	0.7	16
		28-Jul-01	28-Jul-01	No data received by the QA/QC Unit	0.6	15
		02-Oct-01	04-Oct-01	Service	2	49
		06-Nov-01	13-Nov-01	Instrument showing temperature warning	6.9	165
		03-Dec-01	04-Dec-01	No data received by the QA/QC Unit	0.5	13
Liverpool Centre						
CO	84.2%	03-Jul-01	03-Jul-01	Low and erratic data due to unknown reason	0.4	9
		07-Jul-01	07-Jul-01	Low and erratic data due to unknown reason	0.4	9
		06-Aug-01	23-Aug-01	Low and erratic data due to unknown reason	17.6	423
		23-Sep-01	24-Sep-01	Low and erratic data due to unknown reason	1.1	26
		08-Oct-01	16-Oct-01	Manifold leak at the ozone analyser affecting all instruments	7.8	186
London Bloomsbury						
NO ₂	84.1%	04-Jul-01	05-Jul-01	No data received by the QA/QC Unit	1.2	28
		07-Jul-01	27-Jul-01	Sampling fault	20.3	488
London Westminster						
NO ₂	76.6%	08-Aug-01	08-Aug-01	Negative data followed by network intercalibration	0.5	13
		11-Aug-01	15-Aug-01	Service	4	97
		21-Nov-01	19-Dec-01	Uncertain scaling	28.4	681
Northampton						
PM ₁₀ (Partisol)	11.4%	31-May-01	14-Jun-01	Flow fault	15	360
		21-Jun-01	28-Jun-01	Flow fault	8	120
		3-Jul-01	5-Jul-01	Flow fault	2	48
		6-Jul-01	18-Jul-01	Flow fault	13	104
		25-Jul-01	12-Dec-01	Flow fault	141	1833
Norwich Roadside						
NO ₂	88.5%	17-Sep-01	18-Sep-01	Service	1	25
		18-Oct-01	02-Nov-01	Sample inlet disconnected from manifold	15.3	368
		30-Nov-01	03-Dec-01	Chopper motor fault	3.5	83
Nottingham Centre						
SO ₂	80.7%	02-Aug-01	06-Sep-01	Flow problems suspected	35	839
Plymouth Centre						
O ₃	26.8%	01-Mar-01	12-Nov-01	Instrument leaking. See Section 3.3 for more details.	257	6156
Preston						
SO ₂	73.1%	07-Aug-01	10-Aug-01	Service	3	71

Data Capture (%)	Start	End	Reason for data Loss	Days	Hours	
	18-Aug-01	20-Sep-01	Baseline drifting rapidly	32.6	783	
	28-Sep-01	10-Oct-01	Unstable baseline	12.1	290	
	13-Dec-01	13-Dec-01	Unstable baseline	0.3	7	
	19-Dec-01	19-Dec-01	Unstable baseline	0.3	7	
Salford Eccles						
CO	88.7%	04-Jul-01	04-Jul-01	Powercut	0.4	9
		20-Aug-01	20-Aug-01	No data received by the QA/QC Unit	0.7	17
		23-Aug-01	23-Aug-01	No data received by the QA/QC Unit	0.3	8
		04-Sep-01	05-Sep-01	Service	1	25
		10-Oct-01	26-Oct-01	Instrument had a faulty detector	15.9	382
		01-Dec-01	01-Dec-01	No data received by the QA/QC Unit	0.7	17
Sandwell West Bromwich						
CO	64.2%	20-Mar-01	31-Aug-01	Noisy baseline	165	3950
		20-Nov-01	22-Nov-01	Unstable baseline See Section 3.4 for more details.	2.7	64
Stockton-on-Tees Yarm						
PM ₁₀	23.6%	13-Aug-01	09-Jan-02	Obstructed tapered element	79.5	1909
Thurrock						
PM ₁₀	64.2%	05-Jul-01	05-Jul-01	Low flow rate	0.5	11
		06-Jul-01	06-Jul-01	Low flow rate	0.3	7
		10-Jul-01	11-Sep-01	Instrument removed for repair with a low flow rate problem	63.3	1520
Wolverhampton Centre						
NO ₂	88.3%	01-Aug-01	03-Aug-01	Service	2.1	50
		23-Nov-01	23-Nov-01	No data	0.3	7
		21-Dec-01	02-Jan-02	NO _x converter cracked and leaking	12.3	295

5. Ratified Data Capture Statistics

Table 5.1 provides the ratified data capture figures for each site for the 6-month period July to December 2001. Data capture values below 90% are shown in the shaded boxes. Ratified data capture figures for the calendar year 2001 are shown in Table 5.2.

Table 5.1 AUN Ratified Data Capture (%) for July to December 2001
(Using the start date of any new site)

Site	CO	NO ₂	O ₃	PM ₁₀	SO ₂	Site Average
ENGLAND						
Barnsley 12	-	-	-	-	99.5	99.5
Barnsley Gawber	-	72.4	92.8	-	98.1	87.8
Bath Roadside	98.9	98.8	-	-	-	98.9
Billingham	-	94.8	-	-	-	94.8
Birmingham Centre	93.4	91.2	98.3	98.4	98.2	95.9
Birmingham East	98.0	93.8	98.3	98.2	98.2	97.3
Blackpool	97.4	94.0	97.3	97.0	84.0	93.9
Bolton	95.3	97.8	98.0	98.4	98.1	97.5
Bournemouth	-	89.7	-	92.8	98.5	93.7
Bradford Centre	94.0	91.4	94.0	94.4	89.7	92.7
Brighton Roadside	95.2	91.6	-	-	-	93.4
Bristol Centre	94.4	96.5	98.4	94.3	98.4	96.4
Bristol Old Market	92.8	98.1	-	-	-	95.5
Bury Roadside	98.1	97.9	98.1	91.6	97.8	96.7
Cambridge Roadside	-	96.2	-	-	-	96.2
Canterbury	-	99.5	-	99.8	-	99.7
Coventry Memorial Park	94.1	63.8	93.9	94.3	89.9	87.2
Exeter Roadside	62.9	86.2	89.9	-	84.7	80.9
Hove Roadside	98.2	93.7	-	-	98.2	96.7
Hull Centre	94.4	98.0	98.2	97.9	98.2	97.3
Leamington Spa	98.7	94.4	99.0	98.4	98.8	97.9
Leeds Centre	89.0	88.2	93.4	97.6	96.3	92.9
Leicester Centre	96.5	97.7	98.5	96.1	98.5	97.5
Liverpool Centre	84.2	94.0	93.6	98.1	94.1	92.8
London A3 Roadside	98.3	97.8	-	96.8	-	97.6
London Bexley	95.6	90.5	93.9	95.9	93.9	94.0
London Bloomsbury	97.1	84.1	97.8	97.8	93.4	94.0
London Brent	98.9	94.7	99.0	98.6	95.5	97.3
London Cromwell Road 2	98.7	98.6	-	-	95.5	97.6
London Hillingdon	92.3	97.9	95.9	97.7	97.5	96.3
London Westminster	97.8	76.6	97.4	-	97.6	92.4
Manchester Piccadilly	98.2	93.2	98.4	98.4	98.3	97.3
Manchester South	-	94.2	93.1	-	98.3	95.2
Manchester Town Hall	99.0	98.6	-	-	-	98.8
Middlesbrough	98.1	96.1	96.8	98.1	98.2	97.5
Newcastle Centre	93.5	97.7	97.5	98.0	97.2	96.8
Northampton	-	97.2	-	99.5	96.5	97.7
(Northampton Partisol)				(11.4)		
Norwich Centre	97.9	95.0	96.0	97.3	91.4	95.5

Site	CO	NO ₂	O ₃	PM ₁₀	SO ₂	Site Average
Norwich Roadside	-	88.5	-	-	-	88.5
Nottingham Centre	98.3	98.3	98.5	98.5	80.7	94.9
Oxford Centre	96.7	99.6	-	-	99.3	98.5
Plymouth Centre	91.4	94.4	26.8	96.0	90.9	79.9
Portsmouth	-	95.0	-	97.5	95.8	96.1
Preston	97.6	97.2	97.4	93.0	73.1	91.7
Reading	95.7	97.8	98.2	97.5	97.4	97.3
Redcar	95.4	97.9	98.1	98.1	97.3	97.4
Rotherham Centre	-	97.2	98.3	-	98.3	97.9
Salford Eccles	88.7	97.1	97.1	97.6	96.2	95.3
Sandwell West Bromwich	64.2	92.5	97.5	-	97.4	87.9
Scunthorpe	-	-	-	99.1	98.7	98.9
Sheffield Centre	98.0	96.2	98.4	97.9	94.2	96.9
Sheffield Tinsley	98.7	98.9	-	-	-	98.8
Southampton Centre	98.3	96.6	98.4	98.3	93.3	97.0
Southend-on-Sea	93.5	93.9	94.7	96.5	95.7	94.9
Stockport	99.2	98.9	-	98.7	99.2	99.0
Stockton-on-Tees Yarm	-	99.6	-	23.6	-	61.6
Stoke-on-Trent Centre	94.5	96.0	91.5	97.0	94.9	94.8
Sunderland	-	-	-	-	96.1	96.1
Thurrock	95.5	95.3	95.5	64.2	95.4	89.2
Walsall Alumwell	-	97.7	-	-	-	97.7
Walsall Willenhall	-	94.5	-	-	-	94.5
West London	97.7	95.5	-	-	-	96.6
Wigan Leigh	-	98.5	-	98.8	96.0	97.8
Wirral Tranmere	96.8	98.2	91.6	98.1	93.8	95.7
Wolverhampton Centre	90.3	88.3	98.1	97.2	91.6	93.1
Northern Ireland						
Belfast Centre	71.2	92.3	97.5	96.7	97.5	91.0
Belfast Clara St	-	-	-	93.2	-	93.2
Belfast East	-	-	-	-	96.7	96.7
Derry	93.9	92.4	94.5	96.3	95.7	94.6
Scotland						
Aberdeen	95.3	97.6	-	97.0	95.4	96.3
Dumfries	10.9	96.5	-	87.6	-	65.0
Edinburgh Centre	95.9	97.4	97.7	98.2	96.5	97.1
Glasgow Centre	97.8	74.5	97.8	98.5	53.4	84.4
Glasgow City Chambers	98.8	98.6	-	-	-	98.7
Glasgow Kerbside	98.6	98.8	-	97.7	-	98.4
Grangemouth	-	99.5	-	99.3	99.0	99.3
Inverness	92.1	91.8	-	43.7	-	75.9
Wales						
Cardiff Centre	98.0	94.2	98.4	98.4	92.6	96.3
Cwmbran	-	94.5	-	96.2	94.8	95.2
Port Talbot	-	98.0	98.2	98.2	98.1	98.1
Swansea	97.6	97.5	96.8	96.6	95.9	96.9
Number of sites	59	76	47	57	62	
Network Mean (%)	92.9	94.2	95.1	94.2	94.6	94.1

Sites and instruments established between 01/07/2001 and 31/12/2001

Site	Instrument	Start date
Bournemouth	PM ₁₀ (Partisol)	18/07/2001
Cwmbran	NO ₂	20/07/2001
Cwmbran	PM ₁₀	20/07/2001
Cwmbran	SO ₂	20/07/2001
Dumfries	CO	17/07/2001
Dumfries	PM ₁₀ (Partisol)	17/08/2001
Inverness	CO	17/07/2001
Inverness	NO ₂	17/07/2001
Inverness	PM ₁₀ (Partisol)	11/07/2001
London Westminster	CO	17/07/2001
London Westminster	NO ₂	17/07/2001
London Westminster	O ₃	17/07/2001
London Westminster	SO ₂	17/07/2001

Table 5.2 AUN Ratified Data Capture (%) for Calendar Year 2001
(Using the start date of any new site)

Site	CO	NO ₂	O ₃	PM ₁₀	SO ₂	Site Average
ENGLAND						
Barnsley 12	-	-	-	-	99.2	99.2
Barnsley Gawber	-	82.5	93.0	-	97.8	91.1
Bath Roadside	99.1	84.1	-	-	-	91.6
Billingham	-	94.8	-	-	-	94.8
Birmingham Centre	95.5	92.4	98.0	97.7	98.2	96.4
Birmingham East	97.6	93.7	97.9	98.0	98.0	97.0
Blackpool	91.7	89.6	97.2	97.1	89.4	93.0
Bolton	93.9	97.6	97.6	97.6	94.6	96.3
Bournemouth	-	82.8	-	92.8	93.7	89.8
Bradford Centre	91.4	90.4	92.0	93.5	88.7	91.2
Brighton Roadside	95.3	92.7	-	-	-	94.0
Bristol Centre	92.3	96.4	96.3	95.4	97.1	95.5
Bristol Old Market	77.7	97.8	-	-	-	87.8
Bury Roadside	97.8	97.7	97.8	94.4	90.9	95.7
Cambridge Roadside	-	97.3	-	-	-	97.3
Canterbury	-	99.2	-	98.1	-	98.7
Coventry Memorial Park	92.2	75.1	93.7	96.0	89	89.2
Exeter Roadside	78.0	90.3	94.3	-	91.6	88.6
Hove Roadside	97.9	92.6	-	-	98.4	96.3
Hull Centre	88.9	98.0	98.2	98.1	98.2	96.3
Leamington Spa	98.7	91.3	96.7	98.5	98.8	96.8
Leeds Centre	89.1	90.8	95.7	94.7	94.5	93.0
Leicester Centre	93.8	97.6	98.0	96.6	98.0	96.8
Liverpool Centre	90.6	92.6	95.9	98.0	96.2	94.7
London A3 Roadside	98.4	97.3	-	97.6	-	97.8
London Bexley	96.6	93.8	95.7	96.0	94.2	95.3
London Bloomsbury	93.5	86.9	97.3	97.7	92.5	93.6
London Brent	98.9	88.9	98.9	98.7	97.2	96.5
London Cromwell Road 2	97.6	96.7	-	-	94.6	96.3
London Hillingdon	93.8	96.2	79.2	96.8	80.0	89.2
London Westminster	97.8	76.6	97.4	-	97.6	92.4
Manchester Piccadilly	96.7	72.8	96.9	97.0	96.6	92.0
Manchester South	-	95.9	95.9	-	98.6	96.8
Manchester Town Hall	98.8	98.5	-	-	-	98.7
Middlesbrough	98.2	95.8	97.6	97.9	96.9	97.3
Newcastle Centre	92.7	85.6	97.8	98.1	97.6	94.4
Northampton	-	97.1	-	97.5	97.2	97.3
(Northampton Partisol)				(31.4)		
Norwich Centre	95.8	94.3	94.9	95.7	75.9	91.3
Norwich Roadside	-	93.6	-	-	-	93.6
Nottingham Centre	96.1	84.6	98.6	97.6	89.6	93.3
Oxford Centre	98.1	99.5	-	-	99.4	99.0
Plymouth Centre	94.6	96.3	29.0	97.0	90.3	81.4
Portsmouth	-	96.7	-	97.0	95.8	96.5
Preston	93.1	97.8	97.9	95.7	84.9	93.9
Reading	94.1	97.4	97.8	95.8	97.3	96.5
Redcar	95.3	82.6	97.9	98.0	97.4	94.2
Rotherham Centre	-	95.1	98.1	-	95.8	96.3
Salford Eccles	92.6	96.9	96.9	97.3	96.4	96.0

Site	CO	NO ₂	O ₃	PM ₁₀	SO ₂	Site Average
Sandwell West Bromwich	50.3	95.2	97.7	-	97.8	85.3
Scunthorpe	-	-	-	93	97.9	95.5
Sheffield Centre	98.2	97.3	98.4	95.7	96.3	97.2
Sheffield Tinsley	96.6	98.8	-	-	-	97.7
Southampton Centre	98.3	97.4	98.4	98.3	95.6	97.6
Southend-on-Sea	95.8	95.6	96.3	97.6	97.0	96.5
Stockport	99.0	98.7	-	99.1	99.0	99.0
Stockton-on-Tees Yarm	-	98.5	-	58.3	-	78.4
Stoke-on-Trent Centre	95.9	96.7	94.5	97.7	96.3	96.2
Sunderland	-	-	-	-	97.6	97.6
Thurrock	95.8	95.9	96.3	75.9	96.1	92.0
Walsall Alumwell	-	96.3	-	-	-	96.3
Walsall Willenhall	-	92.4	-	-	-	92.4
West London	98.2	95.4	-	-	-	96.8
Wigan Leigh	-	97.2	-	97.2	97.2	97.2
Wirral Tranmere	92.2	98.1	94.3	97.8	79.8	92.4
Wolverhampton Centre	94.2	91.0	98.1	95.8	92.8	94.4
NORTHERN IRELAND						
Belfast Centre	60.8	85.5	90.4	80.8	89.9	81.5
Belfast Clara St	-	-	-	92.1	-	92.1
Belfast East	-	-	-	-	94.2	94.2
Derry	95.5	92.7	94.4	96.6	96.3	95.1
SCOTLAND						
Aberdeen	91.5	95.2	-	96.6	91.5	93.7
Dumfries	10.9	94.4	-	87.6	-	64.3
Edinburgh Centre	96.7	97.5	97.6	97.3	96.1	97.0
Glasgow Centre	96.6	85.6	98.1	98.5	75.7	90.9
Glasgow City Chambers	97.7	98.7	-	-	-	98.2
Glasgow Kerbside	98.8	98.8	-	98.1	-	98.6
Grangemouth	-	96.9	-	74.9	86.5	86.1
Inverness	92.1	91.8	-	43.7	-	75.9
WALES						
Cardiff Centre	98.0	93.2	98.3	98.3	93.3	96.2
Cwmbran	-	94.5	-	96.2	94.8	95.2
Port Talbot	-	95.5	97.3	97.0	96.9	96.7
Swansea	95.0	95.1	94.8	94.6	93.2	94.5
Number of sites	59	76	47	57	62	
Network Mean (%)	92.1	93.3	94.8	94.0	94.0	93.6

Appendix A

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, October 2001

Computer software	The HIS (Heuristic Information System) software suite used for all data management. A few specific capabilities of HIS were developed in order to meet specific Department deliverables or requirements (examples include software for annual report analysis/compilation, for formatting/transmitting network data to archive or DDU and for reporting Directive compliance data to the EC).
Field support equipment	1 intercalibration equipment set (includes mass flow controllers and read-out unit) A second intercalibration kit (commissioned January 2001) 3 UV photometers: API model M401- purchased April 1999 ML model 9812 – purchased April 1999 API model 401 - purchased October 2000 Mass flow controllers purchased April 2002
Zero air pumps	6 spare zero air pumps for routine maintenance/repair of zero air generators in the AUN.

Appendix B

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		No action (affiliated site)
6	Safer access to Walsall Alumwell		No action
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	Outstanding
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 ±0.5ppm 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	A new instrument was installed in March 2001
	Recommendations October 2001	Priority	Action
14	Up-grade or repair noisy CO analyser at Hull Centre	Medium	
	Recommendations May 2002	Priority	Action
None			