Report

QA/QC Data Ratification Report for the Automatic Urban Network, January to June 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 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 January to June 2002. This is the last report in this current series. In future, QA/QC ratification reports will be produced every 3 months and will cover all sites in the automatic urban and rural networks. Sites in the London Air Quality Monitoring Network, which are affiliated into the national network, will also be included.

Significant QA/QC issues related to the urban network are summarised in this report 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 Devolved Administrations 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.

Since July 2001 a number of new sites and instruments were added to the Network in order to comply with the requirements of the First European Air Quality Daughter Directive (DD1) for SO_2, NO_x, PM_{10} 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.

The installation of additional CO analysers was also undertaken to fulfil the requirements of the Second European Daughter Directive (DD2) which will come into force on 13th December 2002.

Gravimetric (Partisol) analysers measuring daily averaged PM_{10} concentrations have also 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 January 2002 and October 2002 are summarised in Table 1.1. Site operations at Wrexham were restored on 6th March 2002, bringing the total number of operational sites to 82.

Additional CO analysers have been installed at a seven more sites (Cwmbran, Northampton, Portsmouth, Stockton-on-Tees Yarm, Wigan Leigh, Bournemouth and Barnsley Gawber). An ozone analyser was also affiliated in conjunction with the CO monitor at Wigan Leigh. Installation of the remaining CO analyser at Grangemouth has been delayed until the site infrastructure has been upgraded.

Monitoring at Hull Centre was suspended on 17th January 2002 because of nearby demolition work associated with the redevelopment of the area. The process of planning application is underway for the relocation of the site. It is anticipated that the Hull site will resume operation in November 2002. The monitoring site at London Bloomsbury was relocated on 4th February 2002 to another part of Russell Square with monitoring recommencing on 5th March 2002. The site at Edinburgh was also closed 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 not initially fitted with a TEOM analyser therefore a short period of PM_{10} data was lost from 24th April until 2nd May. A new location for a permanent site has been agreed and monitoring at the new site (Hull Freetown) is scheduled to start

in November 2002. The Stockport site was relocated on 11th October 2002 to Stockport Shaw Heath.

The Grangemouth site was shut down on 1st August in order to be upgraded to accommodate the addition of CO monitoring for DD2 and additional equipment for the local authority. The upgrade has not yet been completed.

Table 1.1 Changes to the AUN between January to October 2002

Sites	Date Commenced	Pollutants
New sites		
Wrexham	6 March 2002	NO_2 CO SO_2
Additional CO monitoring		
Cwmbran	12 March 2002	CO
Northampton	12 March 2002	CO
Portsmouth	21 March 2002	CO
Wigan Leigh	15th May 2002	CO and O_3
Barnsley Gawber	8th July 2002	CO
Bournemouth	17th July 2002	CO
Stockton-on-Tees Yarm	15th August 2002	CO
Additional Gravimetric PM_{10} (Partisol) monitoring		
Inverness	13th February 2002 (restarted after vandalism)	PM_{10}
Wrexham	6th March 2002	PM_{10}
Monitoring suspended	**Data Loss**	
Hull Centre relocation	17 Jan 2002 - Nov 2002	All
Grangemouth – site up grade	1st August 2002 ongoing	All
Inverness – vandalised	30th September 2001 to 13th February 2002	PM_{10} (Gravimetric)
London Bloomsbury relocation	4 Feb 2002 to 5 March 2002	All
Edinburgh relocation in Princes Street Gardens	24th April – 2nd May 2002	PM_{10}
Stockport relocated to Stockport Shaw Heath	11th October 2002	All

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.

Ratified hourly average data capture for the network averaged 92% for all pollutants (O_3, NO_2, SO_2, CO and PM_{10}) during this 6-month reporting period. This is slightly lower than the data capture from previous years, however it is still well above the 90% target level. (Figure 1.1).

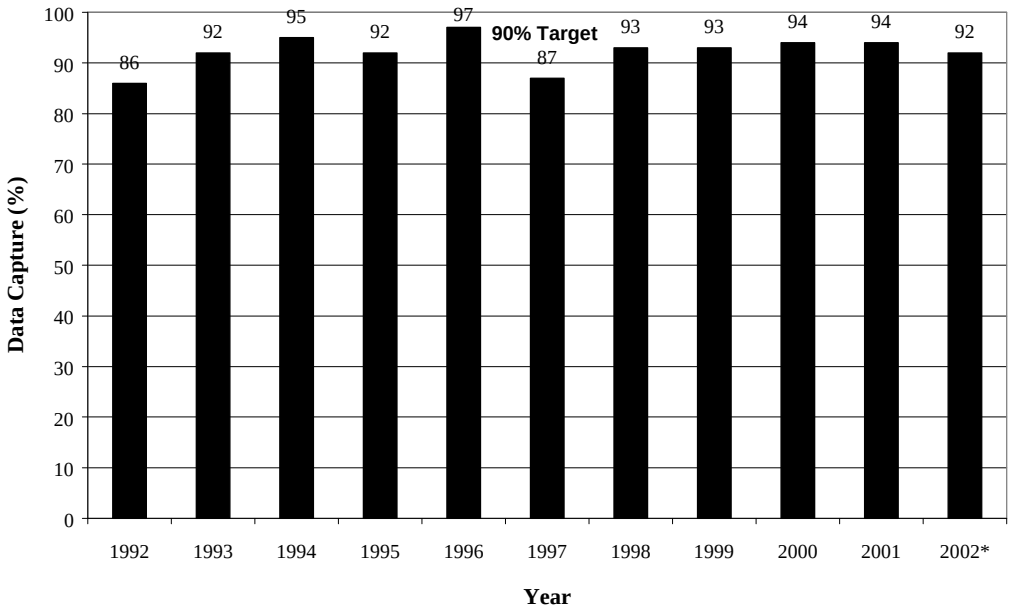


Figure 1.1 AUN Data Capture 1992 to 2002*
(*based on 6 months data only (January-June 2002)

The overall Network data capture has been reduced mainly as a result of lower CO and PM_{10} data capture. (See Table 1.2). The Network average CO data capture fell below the 90% target level to 87.9% with the PM_{10} data capture being on the border line at 90.4%. The data capture for these pollutants is significantly lower than the levels achieved in the previous ratification period (July-December 2001) which were at 95.1% for CO and 94.2% for PM_{10}.

Table 1.2 AUN Ratified Data Capture (%) January to June 2002

(Using the start date of any new site)

Pollutant	O_3	NO_2	CO	PM_{10}	SO_2	Average
Data Capture (%)	93.4	93.2	87.9	90.4	93.4	92.3

A summary showing the number of analysers in the network that did not meet the 90% data capture target is given in Table 1.3. From this is can be seen that a relatively high proportion of CO analysers (39%) 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 24% of the PM_{10} analysers in the network did not achieve 90% data capture and this was mainly due to TEOM response instability and operational problems with the gravimetric PM_{10} analysers. 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%

	Total Number Of Analysers	Analysers with Data Capture < 90%	Analysers with Data Capture<80%
CO	64	16	10
NO_2	77	10	3
O_3	48	5	3
PM_{10}	57	14	9
SO_2	63	10	4

All data capture figures given in this report now include the gravimetric PM_{10} data. Note that there are two PM_{10} 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 PM_{10} 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, 15 out of the 82 sites (18%) had an average data capture rate below the required 90% level for the January to June 2002 period. (See Table 1.4)

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

Site	Status	Average Data Capture (%)
Hull Centre	DEFRA	8.9
London Bloomsbury	DEFRA	80.4
Reading	DEFRA	80.9
Wirral Tranmere	DEFRA	84.6
Liverpool Centre	DEFRA	86.9
Dumfries	DEFRA	89.3
Inverness	DEFRA	74.6
Barnsley Gawber	Affiliate	75.9
Middlesbrough	Affiliate	79.3
Northampton	Affiliate	80.4
Coventry Memorial Park	Affiliate	81.7
Scunthorpe	Affiliate	83.5
Aberdeen	Affiliate	86.9
Cambridge Roadside	Affiliate	88.8
Thurrock	Affiliate	89.6

The QA/QC Unit carried out the winter network intercalibration and site audits during January to March 2002. The summer network intercalibration was carried out during July to September 2002. Results from both intercalibration exercises have been used to assess the accuracy and consistency of the data for this reporting period. Details of the summer 2002 intercalibration and audit exercise are 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 Union Daughter Directive (DD1), a number of new sites were integrated into the network during 2001. Twelve new sites were operational by the time that DD1 came into force in the UK on 19th July 2001 (See Table 2.1). One site (Wrexham) commenced operation on 6th July 2001 but was subsequently vandalised and closed until 6th March 2002 for security reasons. Gravimetric PM_{10} analysers (Partisols) were also installed at Bournemouth, Northampton, Dumfries, Inverness and Wrexham. Installation of the gravimetric PM_{10} analysers at Brighton Roadside and London Westminster has taken place, however these are not fully operational yet.

In addition nine CO analysers were installed at sites in the network in order to comply with the EU DD2 Directive for CO monitoring. Details of the new sites affiliated and analysers installed are provided in Table 2.1

Table 2.1 Status on the Affiliation of New DD1 and DD2 Sites

Site	Status	Pollutants	Data From	Comments
Grangemouth	Affiliate	NO_2, SO_2 ,PM_{10}	1 Jan 2001	Awaiting upgrading to house additional CO monitor (DD2)
Aberdeen *(existing site)*	Affiliate	SO_2	1 Jan 2001	
Stockton-on-Tees Yarm	Affiliate	NO_2, PM_{10} CO	1 Jan 2001 15th August 2002 (CO)	
Wigan Leigh	Affiliate	NO_2, SO_2, PM_{10} CO	1 Jan 2001 16th May 2002 (CO)	
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 *(existing site)*	Affiliate	SO_2,	3 Jan 2001 (SO_2)	
Brighton Roadside (*existing site*)	Affiliate	PM_{10}		Not operational yet
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 1st 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 *(existing site relocated)*	Affiliate	PM_{10}	26 Feb 2001	The site was relocated to Coventry Memorial Park. Monitoring commenced 26th 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} CO	5 Mar 2001 (NO_2, SO_2) 18 July 2001 (Partisol) 19th July 2002 (CO)	
Inverness	DEFRA	NO_2, CO, PM_{10}	17 July 2001 (NO_2, CO) 11 July 2001 (Partisol)	The Partisol was not operational between 30th September 2001 and 13th 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 18th July 2001. Manifold sample pump problem until 20th July 2001.
Wrexham	DEFRA	NO_2 ,SO_2, PM_{10} CO	6 March 2002 (NO_2 ,SO_2 CO,) 6 March 2002 (Partisol)	The site was installed 6th July 2001 but there was serious vandalism. Site re-stared March 2002.
Barnsley Gawber	Affiliate	CO	8th July 2002 (CO)	

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 C. Out of the 41 critical sites there were 27 sites where one or more of the critical pollutants did not meet the 90% data capture target during the 6-month period January to June 2002 (See Tables 2.2 and 2.3). The reasons for data loss at these sites are provided in Section 4.

Table 2.2 Critical Sites in Agglomerations* with < 90% data capture

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

Critical Sites in Agglomerations		
Site	**Pollutant**	**Data Capture(%)**
Bournemouth	NO_2	86.1
Coventry Memorial Park	CO NO_2	37 84.2
Brighton Roadside	PM_{10} (Grav)	Not installed
Hull Centre	CO SO_2, NO_2, PM_{10}	9.0
Nottingham Centre	PM_{10}	82.3
Portsmouth[1]	SO_2 CO	89.2 53.6
Southampton	SO_2	81.2
Edinburgh	PM_{10}	89.6
Glasgow Centre	SO_2	82.2
Cardiff Centre	CO SO_2	87.8 78.8
Sheffield Centre	PM_{10}	89.8
Wirral Tranmere	CO	58.6
Leicester	PM_{10}	76.9
Liverpool	CO	47.2
Reading	CO	29.3
Newcastle	CO	85.1

Table 2.3 Critical Sites in Zones* with <90% data capture

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

Critical Sites in Zones		
Site	**Pollutant**	**Data Capture**
Barnsley Gawber	NO_2 CO	74.9 Not installed
Northampton	CO	14.0
Scunthorpe	PM_{10}	69.1
Derry	CO	89.9
Aberdeen	PM_{10}	59.1
Dumfries	CO PM_{10} (Grav)	87.4 87.8
Cwmbran	CO	53.3
Grangemouth	CO	Not installed
Stockton on Tees Yarm	CO	Not installed

Critical Sites in Zones		
Site	**Pollutant**	**Data Capture**
Wrexham	CO NO_2 SO_2 PM_{10} (Grav)	64.1 61.7 64.1 55
Wigan Leigh	CO	25.6

*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

Sites which already have data capture below 80% during this first half of the year will not achieve the 90% data capture target for 2002.

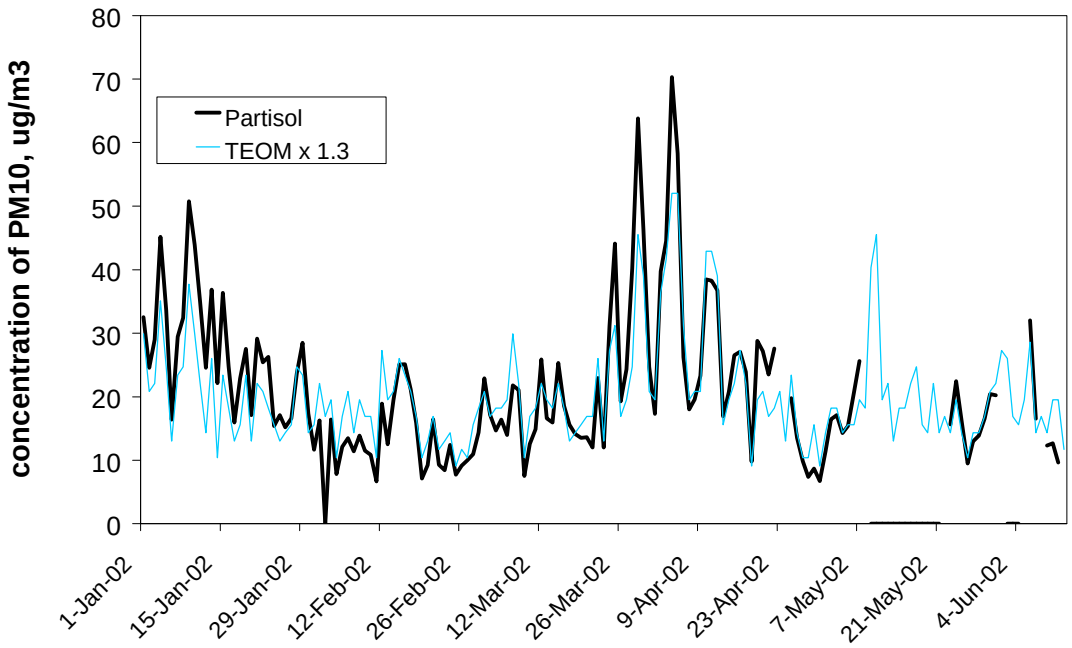
RECOMMENDATION
Every effort should be made to ensure that data capture is maximised for the critical sites identified in Tables 2.2 and 2.3 during the next 6 months. LSOs and ESUs should undertake call-outs and repairs as soon as possible to avoid further data loss.

2.3 Gravimetric PM_{10} Data Ratification

PM_{10} measurements using the gravimetric Partisol instrument were ratified 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 PM_{10} concentrations made using these three techniques. Analysis has shown that measurements made using the gravimetric PM_{10} (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.

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



Partisol instruments are operating at Northampton (5th Apr 2001), Bournemouth (18th July 2001), Inverness (11th July 2001), Dumfries (17th Aug 2001) and Wrexham (1st March 2002). Partisol analysers have also now been installed at Brighton Roadside and London Westminster and it is anticipated that these will become operational in the next period.

The Northampton Partisol is also co-located with a TEOM which provides a useful check that both techniques are operating correctly. Gravimetric PM_{10} 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.

Data capture for the gravimetric PM_{10} (Partisol) analysers during the January-June 2002 was below the required 90% for four out of the five operational sites. The average data capture for the gravimetric PM_{10} analysers (Partisols) over this period was only 85% (excluding the Inverness analyser which was vandalised) reflecting a relatively poor performance compared to other instrument types in the network (See Table 2.4). The majority of the Partisol instruments have been in operation since July 2001 so have had sufficient time to overcome initial teething problems. Most quality control issues with the Partisol instruments were found to be due to the automatic changing of the filters or the sample flow. Data were also lost due to visibly damaged or inverted filters, pump problems and vandalism. Details of data loss associated with each site are given in Section 4.1.

Table 2.4 Gravimetric PM_{10} Data Capture for January to June 2002

Site	Data Capture(%)
Bournemouth	95.6
Dumfries	87.8
Inverness	34.8
Northampton	76.2
Wrexham (Started 1st March 02)	82.6
Average (excluding Inverness)	85.5

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 arranging for the Partisol analysers to be connected to a telemetry system.

RECOMMENDATION

On the basis of the low data capture for the gravimetric PM_{10} analysers during this 6-month period, we strongly recommend that remote collection of instrument diagnostics and alarms is made available.

2.4 NO_2 Converter Efficiencies

Two intercalibration exercises were relevant to the ratification of the January to June 2002 AUN data. The winter 2001/2 intercalibration exercise identified five sites that failed the NO_x converter test. Of these, four were considered to be “borderline” cases where the converters were found to be operating just marginally below the 95% level (Table 2.5). There were no converter failures identified during the summer 2002 intercalibration. 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.

Table 2.5 Sites with low NO_x converter efficiency

Site	C.E (%)	Analyser	Test Date	Comment
Winter 2001/2				
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 18th 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 11th Feb 2002 was 99.2%.
Rotherham	92	Ambirack	13/03/02	Borderline: 97.4% efficient on 17th Sept 2001.
Summer 2002				
None				

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 NO_2 calibrations. In cases where the converter efficiency was low, a noticeable decline in the response of the NO_2 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 2.6.

Table 2.6 Effect of Low Converter Efficiency on Data Quality

Site	C.E (%)	Analyser	Effect on data quality	Data loss
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

RECOMMENDATION

LSOs should continue to pay careful attention to the short-term stability of the NO_2 calibration response and 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 Zero Truncation

A problem with zero truncation (also called baseline clipping) was observed with the CO instrument at Bristol Old Market (Figure 2.2) during January and February 2002. This instrument has been regularly adjusted so that the zero is returned to above +50mV. In June 2002 a large offset of 10ppm (200mV) was applied. Over 3 weeks data have been rejected during the period when the output fell below the baseline cut-off. Although

these adjustments were necessary to prevent data loss, adjusting an instrument on a regular basis is generally not recommended.

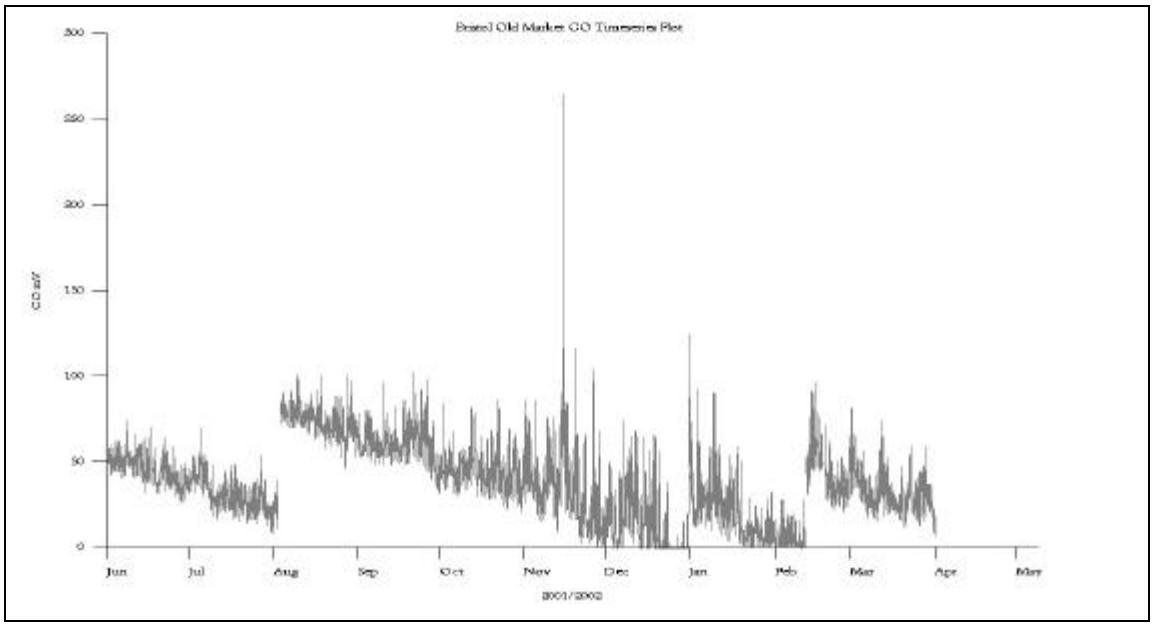


Figure 2.2 CO Instrument Baseline Drift and Zero Truncation at Bristol Old Market (mV)

RECOMMENDATION

Although a high baseline offset of 10ppm has now been applied to the Bristol Old Market CO analyser, the baseline response will continue to drift until the analyser baseline stability is rectified by the ESU. The site operator should carefully monitor the zero calibration response in order to check that the baseline does not fall below 20mV.

2.6 Ozone Outliers

The results from two intercalibration exercises were relevant to the ratification and scaling of the January to June 2002 AUN ozone data. A total of 11 out of the 47 ozone analysers (23%) tested during the winter 2001/2 audit were found to be outliers (Table 2.7). Again, another 11 out of 47 (23%) ozone analysers were outliers during the Summer 2002 exercise. Full details are provided in the relevant intercalibration reports. Data from these sites have been corrected accordingly during the ratification process.

Table 2.7 Ozone Outliers Identified at the Intercalibration Exercises

Winter 2001/2			Summer 2002	
Site	**Outlier (%)**		**Site**	**Outlier (%)**
Belfast Centre	6		Barnsley Gawber	-15
Blackpool	-7		Birmingham East	5.9
Bristol Centre	-10.4		London Brent	-6.5
Cardiff Centre	-10		Bristol Centre	-25
Leicester Centre	7.6		Derry	-12
Manchester South	-6.6		Edinburgh Centre	-30
Norwich Centre	-23		Northampton	7
Rotherham Centre	-8.3		Redcar	8
Sheffield Centre	-16.2		Thurrock	7
Stoke-on-Trent	-29		Wigan Leigh	8
Wirral Tranmere	-29		Wolverhampton Centre	-7

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 ± 2.5% are considered acceptable. Table 2.8 shows the sites where there were large deviations between the measured and stamped K_0 values.

Table 2.8 Large TEOM K_0 Deviations identified at the Intercalibration Exercises

Site	K_0 Deviation (%)	Test Date
Coventry Memorial Park	-4.6	12th July 2001
	-4.6	17th Jan 2002
Preston	6.2	25th July 2001
	-2.9	30th Jan 2002
Belfast Centre	-3.2	17th July 2001
	-3.2	29th Jan 2002
	2.6	19th August 2002
Wigan Leigh	2.8	6th August 2002
Leicester Centre	27.6	21 August 2002

The QA/QC Unit investigated each K_0 deviation and the following corrections were made to the TEOM data (Table 2.9).

Table 2.9 Corrections due to TEOM K_0 Deviations

Site	Comment
Coventry Memorial Park	An incorrect value of K_0 had been used throughout 2001/2 and all data have been rescaled until July 2002 when the audit showed that the problem was resolved.
Preston	The sensor unit was replaced after the summer intercalibration and was re-fitted on 5th Nov 2001. However the K_0 was not updated in the software on this date. All data between 5th Nov 2001 and 24th 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.
Wigan Leigh	The K_0 deviation was borderline and no corrections were undertaken.
Leicester Centre	The large deviation arose because the $K_o$value stamped on the side of the unit did not match the value stored in the software. The 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.

2.8 Auto-Calibration Run-ons

In the previous data ratification report a new data quality problem (auto-calibration run-on) was described. The problem arises 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 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.

Auto-calibration run-on problems were identified at 27 sites in the last report. During this period there has been a significant reduction in the number of sites showing this problem, with only 6 sites requiring data correction. This improvement is likely to be due to the ESUs cleaning the solenoid valves on the IZS systems of the analysers. There are however some sites which still show a problem with auto-calibration run-on resulting in data loss during this ratification period. These sites are given in Table 2.10.

Table 2.10 Estimate of Spike or Dip in 15-Minute Concentrations due to Auto-calibration Run-on

Site	Gas	Conc
Barnsley Gawber	NO_2	2 ppb
Birmingham Centre	CO	0.1 ppm
Bournemouth	SO_2	0.2 ppb
Bradford Centre	SO_2	-1 ppb
Leamington Spa	NO_2	-3 ppb
Plymouth Centre	SO_2	1.5 ppb
Reading	SO_2	- 1 ppb
Wirral Tranmere	O_3 SO_2	7 ppb 0.3 ppb

RECOMMENDATION

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

3. Site Specific Issues

3.1 London Cromwell Road SO_2

An unusual problem was identified with the SO_2 data from London Cromwell Road. Diurnal plots showed that low 15-minute mean concentrations were being recorded every hour since February 2002 (See Figure 3.1). Investigation by the ESU concluded that the low values were being recorded when the site was being polled every hour. Replacement of the modem did not resolve the problem therefore the logger was replaced on 16th July, which cured the fault. Data were corrected by removing one 15-minute mean value every hour.

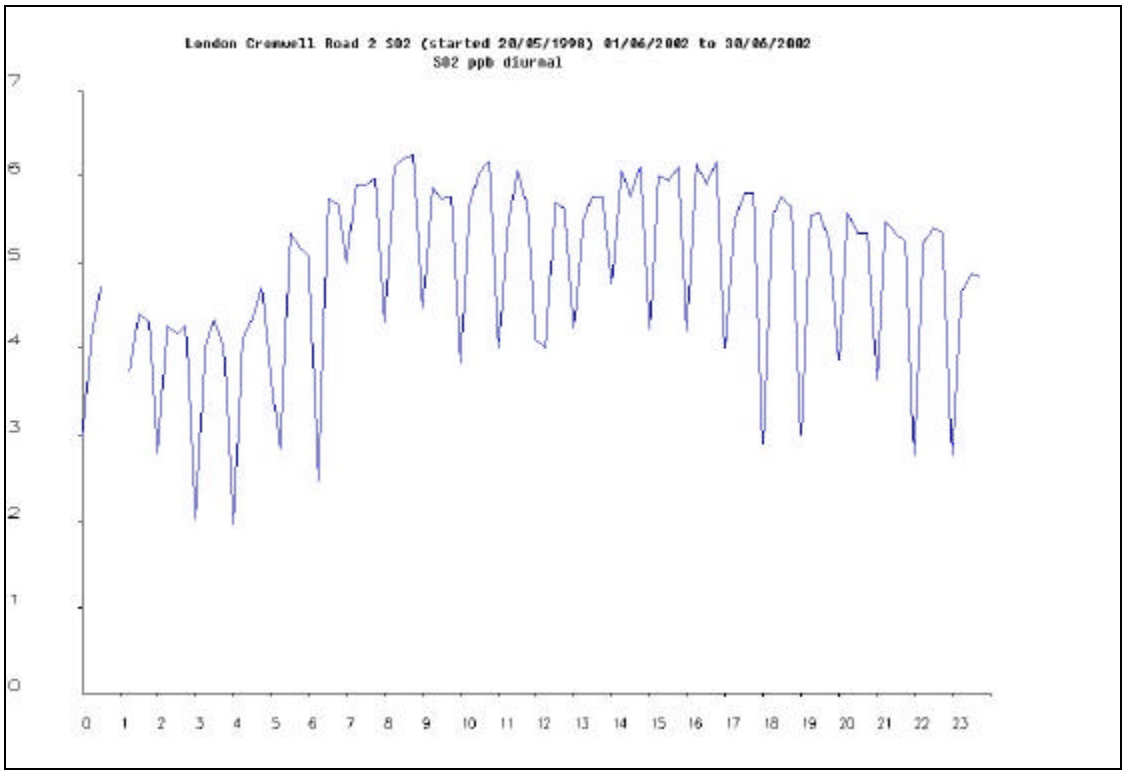


Figure 3.1 London Cromwell Road 2 SO_2 15-Minute Diurnal Variations

3.2 London Cromwell Road Linearity Failure

The QA/QC audit on the 7th March 2002 highlighted linearity failures with the CO and SO_2 instruments. The tests were carried out twice resulting in very low R^2 values (CO: 0.9595 and SO_2: 0.9502). Closer inspection showed that the response was non-linear above the range of the site cylinders. This problem did not, therefore, effect the scaling of ambient data as these lower concentrations were within the linear response range of the analyser.

RECOMMENDATION

ESU to be informed of a problem with these analysers, even though it is not currently affecting data quality. The QA/QC will continue to perform linearity tests and report failures.

3.3 Reading CO

Over 3 months of CO data from Reading have been deleted from1st March to the end of June due to excessive instrument response noise. (Figure 3.2). The ESU visited the site on 12th July and found that the problem was due to the pump vibrating caused by a loose mounting. Once the pump was secured the instrument response improved dramatically.

RECOMMENDATION

During routine calibrations LSOs should try to note any excessive noise or vibration from instruments or pumps, as this may have an adverse effect on data quality.

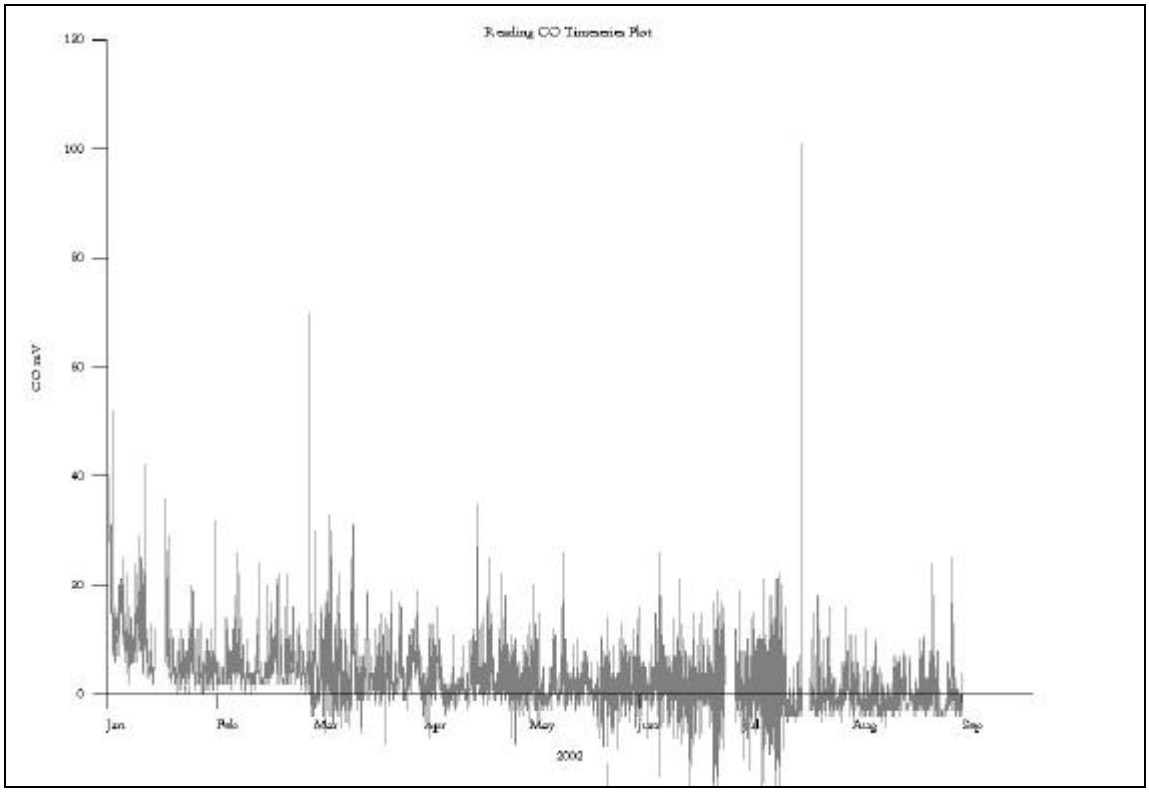


Figure 3.2 Reading CO Excessive Response Noise

3.4 Belfast Clara Street BAM

The PM_{10} 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. A new procedure has been developed by the QA/QC Unit to check and review the data from the BAM. During the ratification process an unusually high number of 0 or 1µg/m^3 concentrations were observed and the LSO was asked to check the operation of the analyser. No obvious problems were found, however the ESU indicated that the fault might be due to a calibration drift.

RECOMMENDATION

ESU to confirm the reason for the unusually high number of low readings recorded and rectify the fault.

3.5 Bristol Old Market NO_x

The unusually high NO_2 concentrations reported previously at Bristol Old Market site are still under investigation. High levels were recorded in November and December 2001 and at the time no reason could be found to reject the data. However, these high concentrations reoccurred in April 2002 (see Figure 3.3) and QA/QC Unit therefore installed a second NO_x analyser at the site on 26th April to verify the data from the AUN instrument. Results from the duplicate analyser showed concentrations that broadly agreed with the high levels being recorded by the AUN analyser. Further site investigations by QA/QC Unit showed that the flow through the manifold was very low, suggesting a possible obstruction or damage to the manifold. The ESU visited the site on 18th July and repaired a kink in the teflon sample line which was restricting the flow through the analyser. The site has since been relocated to the ground floor with the sample inlet very close to its original location so as not to change the site classification. Although it is likely that the periods of high data were an artefact of the sampling fault, no action has yet been taken to delete the data until a sufficient period of data has been collected from the instrument in its new location.

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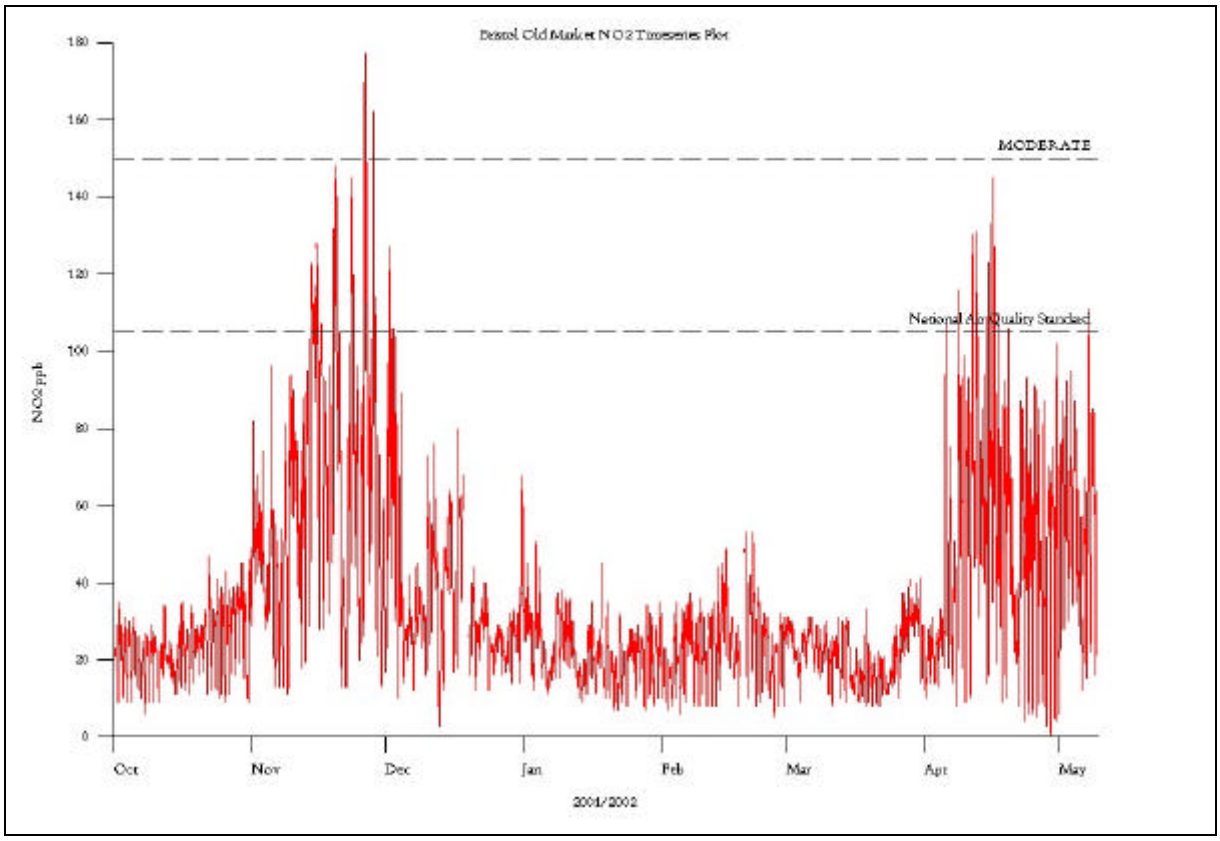

Figure 3.3 High NO_2 Concentrations at Bristol Old Market

3.6 Grangemouth Duplicate Data

Close inspection of the Grangemouth data during ratification showed that occasional days of raw mV data were being duplicated for all channels. For example, the raw mV data on 22nd June 2002 were repeated on 23rd June for all channels. Table 3.1 shows the days on which duplicate data were identified. Investigation by the ESU reported a software bug which was subsequently rectified. Fortunately it was possible to retrieve the correct data for the duplicate days from the logger and therefore no data were lost due to this problem.

Table 3.1 Duplicate Data at Grangemouth

Days with Duplicate Data	Pollutant
27th / 28th February 2001	PM_{10}
10th / 11th April 2001	NO_x PM_{10} SO_2
15th / 16th May 2001	NO_x PM_{10} SO_2
22nd / 23rd May 2001	NO_x PM_{10} SO_2
5th / 6th July 2001	NO_x PM_{10} SO_2
17th /18th January 2002	NO_x PM_{10} SO_2
8th / 9th February 2002	NO_x PM_{10} SO_2
10th / 11th May 2002	NO_x PM_{10} SO_2
16th / 17th June 2002	NO_x PM_{10} SO_2
22nd / 23rd June 2002	NO_x PM_{10} SO_2
24th /25th June 2002	SO_2

3.7 Coventry Memorial Park CO

The CO analyser at Coventry Memorial Park showed unacceptably high levels of response noise from March 2002 onwards (Figure 3.4). Data between 12th March to 31st July 2002 (20 weeks) was rejected during ratification. Data during August to October 2002 may also require rejection for similar reasons.

RECOMMENDATION

ESU to investigate CO response noise and instability at Coventry. This should be given high priority as it is a critical site.

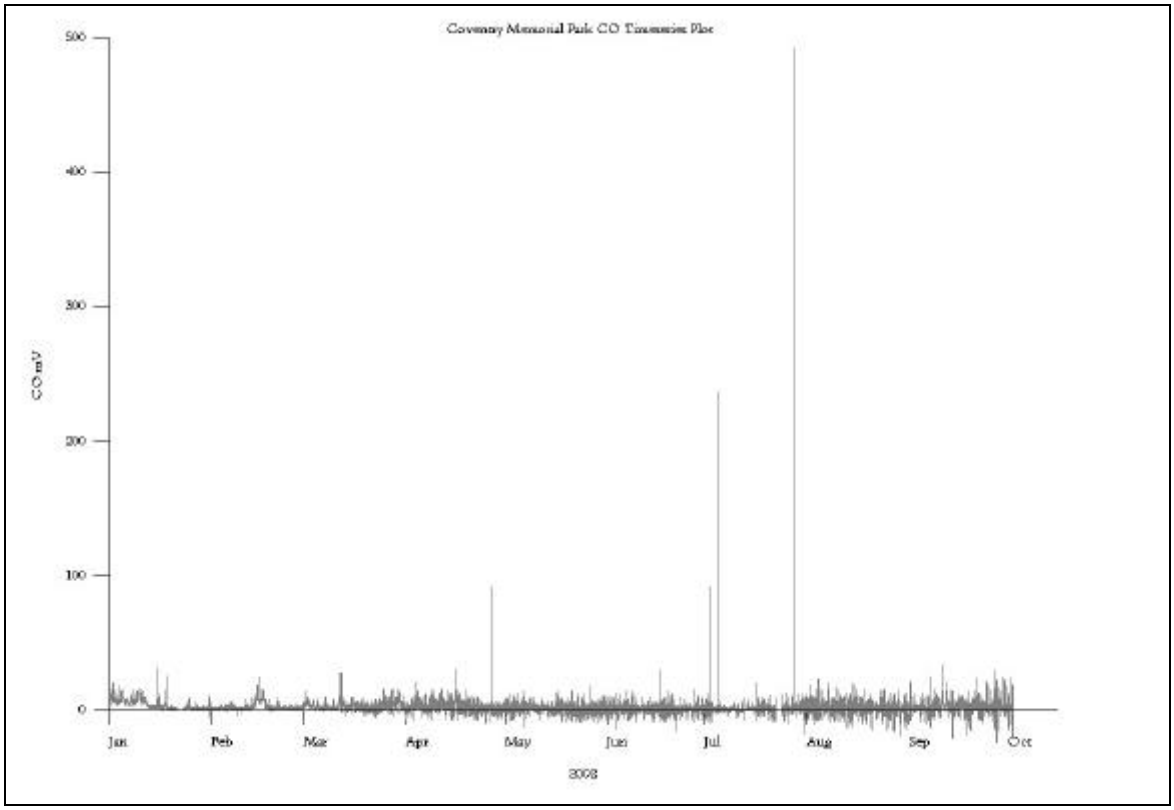

Figure 3.4 Coventry Memorial Park CO high noise response

3.8 Wolverhampton CO

The CO analyser at Wolverhampton showed unacceptably high levels of noise and baseline response instability in June 2002 (Figure 3.5). Data between 1st to 30th June were rejected during ratification. Data during August to October 2002 may also require rejection for similar reasons.

RECOMMENDATION

ESU to investigate CO response noise and instability at Wolverhampton.

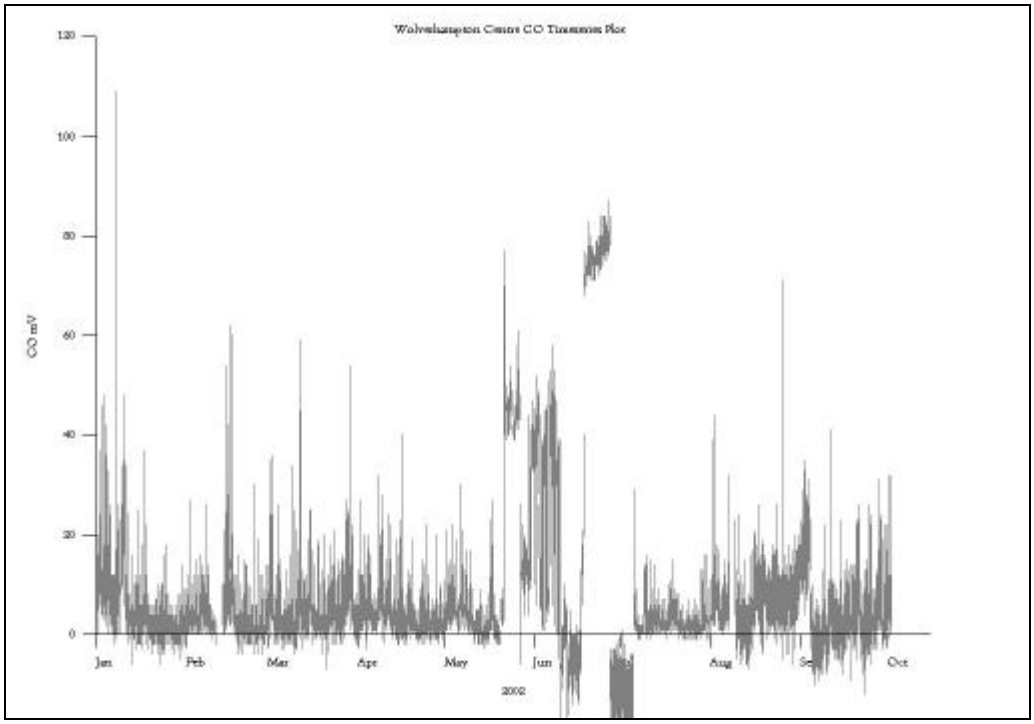

Figure 3.5 Wolverhampton CO high noise and response instability

3.9 Leicester Centre PM_{10}

The TEOM analyser at Leicester Centre showed intermittent response instability throughout January to July resulting in a total data loss of over 5 weeks (See Figure 3.6). There were many attempts to repair the fault which was thought to be due to temperature instability. Satisfactory response performance was eventually achieved on 23rd July following the removal of a transit screw located in the sensor unit.

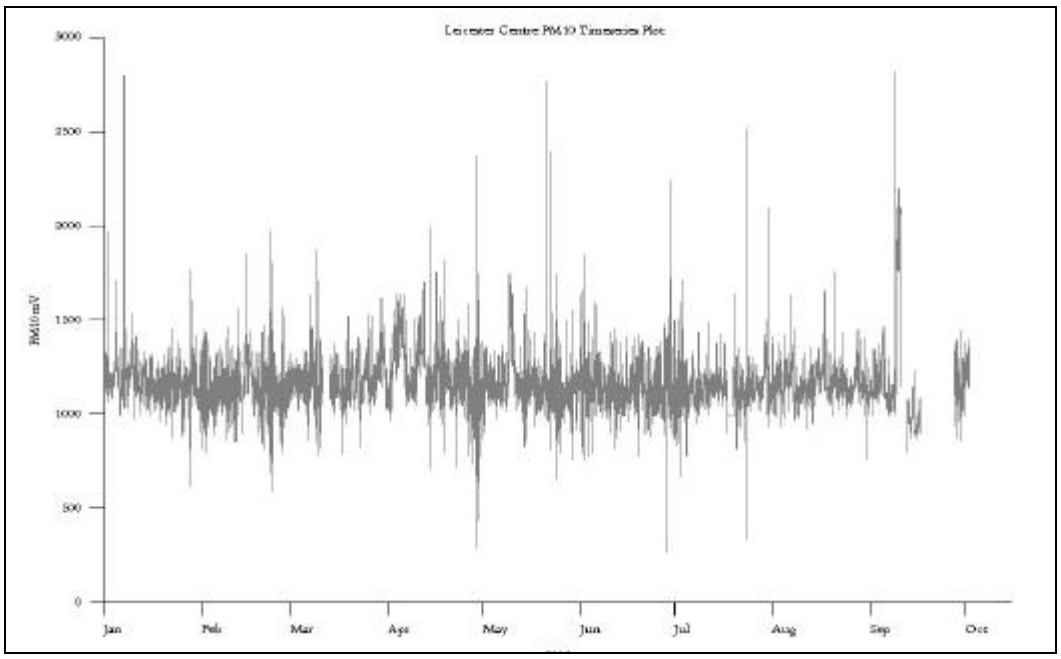

Figure 3.6 Leicester Centre TEOM Response Instability, Jan-Oct 2002

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 January to June 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 six-month reporting period.

Table 4.1 Sites with data capture below 90% January to June 2002
(Using the start date of any new site)

Data Capture (%)		Start	End	Reasons for Data Loss	Days	Hours
Aberdeen						
PM_{10}	59.1%	29-Jan-02	30-Jan-02	Service	1.4	34
		17-Feb-02	30-Apr-02	TEOM response instability and high noise. Analyser removed from site for repair.	71.9	1726
Barnsley Gawber						
NO_2	74.9%	07-Feb-02	07-Feb-02	Details not provided	0.5	12
		12-Mar-02	12-Mar-02	QA/QC Unit audit	0.3	8
		14-Mar-02	16-Mar-02	Unstable response. Photomultiplier tube replaced	1.6	39
		25-Mar-02	30-Apr-02	Monitoring suspended for Ambirak upgrade and installation of CO analyser	36.6	878
O_3	78.2%	12-Mar-02	12-Mar-02	QA/QC Unit audit	0.3	6
		25-Mar-02	30-Apr-02	Monitoring suspended for Ambirak upgrade and installation of CO analyser	36.1	866
SO_2	74.6%	12-Mar-02	18-Mar-02	Analyser fault at audit. Chopper motor replaced	6.2	148
		25-Mar-02	30-Apr-02	Monitoring suspended for Ambirak upgrade and installation of CO analyser	36.6	878
Bournemouth						
NO_2	86.1%	08-Jan-02	16-Jan-02	Data rejected due to large change in response sensitivity	8.4	201
		06-Feb-02	07-Feb-02	No mV data	1.2	29
		21-Feb-02	22-Feb-02	No mV data	0.8	19
		06-Mar-02	12-Mar-02	QA/QC audit, analyser fault and service	6.3	151
Bristol Old Market						
CO	82.8%	20-Jan-02	14-Feb-02	Data rejected due to truncated zero baseline	24.4	586
		18-Feb-02	19-Feb-02	Service	1	25
		16-Jun-02	17-Jun-02	Constant 1mV output. Main fuse blown	0.8	20
		17-Jun-02	20-Jun-02	Faulty cooling fan	3.5	85
Cambridge Roadside						
NO_2	88.8%	10-Jan-02	11-Jan-02	Missing data – no details provided '	0.8	18
		06-Apr-02	07-Apr-02	Undocumented fault.	0.5	13
		24-Apr-02	28-Apr-02	Malfunction of ozone generator and comms fault	3.5	85
		06-May-02	06-May-02	Converter temperature fault	0.5	12
		07-Jun-02	12-Jun-02	Converter thermocouple replaced and incorrect sample line reconnection after repair.	5.2	124
Cardiff Centre						
CO	87.8%		General	From Jan-March the analyser zero baseline was		

				erratic with intermittent periods of high noise		
		21-Jan-02	21-Jan-02	Data rejected - erratic output	0.3	6
		22-Jan-02	22-Jan-02	Data rejected - erratic output	0.3	6
		26-Jan-02	28-Jan-02	Data rejected - erratic output	1.8	42
		05-Mar-02	08-Mar-02	Data rejected - erratic output	2.8	66
		13-Mar-02	17-Mar-02	Data rejected - erratic output	3.9	93
		20-Mar-02	22-Mar-02	Service	2	48
		10-May-02	18-May-02	Analyser out of service due to air con problems	7.7	184
SO_2	78.8%	06-Mar-02	15-Mar-02	Response drift following UV lamp replacement	8.6	207
		20-Mar-02	22-Mar-02	Service	2	48
		16-Apr-02	17-Apr-02	Response instability. Replacement analyser installed	1.1	27
		10-May-02	20-May-02	Air con fault effecting response. Analyser switched out of service.	10	239
		12-Jun-02	27-Jun-02	Baseline truncated and intermittent spurious response spikes	15	360
Coventry Memorial Park						
CO	37.0%	21-Jan-02	23-Jan-02	Service	2	49
		12-Mar-02	31-Jul-02	Noisy data rejected (see Section 3.7)	142	3408
NO_2	84.2%	07-Nov-01	23-Jan-02	NO_x converter fault (91% efficiency) data rejected	77	1848
		26-Mar-02	26-Mar-02	Out of service switch left on after calibration	0.3	7
Cwmbran						
CO	86.9%	01-Jan-02	25-Mar-02	CO analyser installed 12 March. Logger problem until 25th March	83.6	2006
		09-Apr-02	10-Apr-02	No data for all pollutants. No details provided	0.9	22
Derry						
CO	89.9%	27-Dec-01	07-Jan-02	Faulty sample pump	11.5	277
		16-Jan-02	22-Jan-02	Chopper motor and infrared light source replaced.	6.2	149
		23-Jan-02	24-Jan-02	Data missing - no details provided	0.4	10
		30-Jan-02	30-Jan-02	QA/QC Unit audit	0.3	6
		04-Feb-02	07-Feb-02	Service	3	72
		26-Mar-02	26-Mar-02	Data missing – no details provided	0.3	7
		15-May-02	15-May-02	Data missing – telemetry fault	0.3	6
Dumfries						
CO	87.4%	05-Aug-01	12-Jan-02	Zero drift and baseline truncation	160	3840
		14-Feb-02	24-Feb-02	Site decommissioned for repairs plus service.	9.6	230
		20-May-02	21-May-02	Engineer call-out. Infra red source replaced	0.9	21
PM_{10} (Grav)	87.8%			See Section 4.1		
Edinburgh Centre						
PM_{10}	89.6%	16-Mar-02	18-Mar-02	Power supply fault	2.5	60
		11-Apr-02	16-Apr-02	TEOM flow fault. Blockage in flow splitter cleared	5	119
		24-Apr-02	02-May-02	TEOM removed and installed in mobile unit	8	193
		15-May-02	16-May-02	Cable to logger accidentally disconnected during routine calibration	1	25
Glasgow Centre						
SO_2	82.2%	01-Jan-02	01-Jan-02	Logger/telemetry fault	1	24
		11-Feb-02	13-Feb-02	Service NO_x analyser not responding to span gas. No calibration data	2	47

		20-Feb-02	06-Mar-02	No details provided	14.2	341
		15-May-02	29-May-02	Spurious change in baseline response	14.2	341
Hull Centre						
CO	8.5%	01-Jan-02	01-Jan-02	Logger/telemetry fault	0.6	14
CO, NO_x, O_3 PM_{10} SO_2	8.9%	17-Jan-02	15-Aug-02	Routine monitoring suspended due to local demolition work	211	5052
Inverness						
PM_{10} (Grav)	34.8%			See Section 4.1		
Leeds Centre						
CO	88.7%	12-Jan-02	13-Jan-02	Data rejected - air conditioning problems	0.5	11
		01-Feb-02	15-Feb-02	Air Con unit malfunction. High cabin temperatures effecting analyser performance. Analyser switched out of service.	14	335
		23-Apr-02	25-Apr-02	Service	2	48
		26-May-02	27-May-02	Analyser response effected by decrease in rack temperature	0.8	19
		17-Jun-02	17-Jun-02	Data rejected – decrease in rack temps	0.8	20
NO_2	89.1%	02-Feb-02	04-Feb-02	Air con fault. High cabin temperatures effecting analyser response.	2	48
		08-Feb-02	15-Feb-02	Chopper motor fault	6.5	157
		23-Apr-02	25-Apr-02	Service	2	48
SO_2	84.0%	01-Feb-02	15-Feb-02	Air Con unit malfunction. Analyser switched out of service as a measure to reduce cabin temperature.	14.1	339
		23-Apr-02	25-Apr-02	Service	2	48
		30-May-02	06-Jun-02	UV lamp fault	6.6	159
		13-Jun-02	14-Jun-02	Data rejected – analyser fault	1.4	34
		17-Jun-02	17-Jun-02	Analyser response effected by decrease in rack temperature	0.3	6
Leicester Centre						
PM_{10}	76.9%	27-Jan-02	29-Jan-02	Data rejected – high noise and response instability	1.3	30
		31-Jan-02	31-Jan-02	Data rejected – as above	0.3	6
		04-Feb-02	04-Feb-02	Data rejected – as above	0.5	13
		06-Feb-02	06-Feb-02	Data rejected – as above	0.4	10
		07-Feb-02	07-Feb-02	Data rejected – as above	0.3	8
		08-Feb-02	09-Feb-02	Data rejected – as above	0.5	13
		10-Feb-02	12-Feb-02	Data rejected – as above	1.2	29
		19-Feb-02	20-Feb-02	Data rejected - as above	0.8	19
		22-Feb-02	23-Feb-02	Data rejected - as above	1.7	41
		26-Feb-02	26-Feb-02	Data rejected - as above	0.8	19
		27-Feb-02	27-Feb-02	Data rejected - as above	0.3	8
		06-Mar-02	07-Mar-02	Data rejected - as above	1.3	30
		09-Mar-02	09-Mar-02	Data rejected - as above	0.3	8
		10-Mar-02	10-Mar-02	Data rejected - as above	0.5	11
		11-Mar-02	13-Mar-02	Service	2.1	50
		26-Apr-02	01-May-02	Data rejected – response instability. ESU visit to recalibrate amplifier board and insulate sample tube to minimise possible sample temperature fluctuations	5.3	127
		14-May-02	17-May-02	Data rejected – response instability. TEOM	3.2	76

				replaced. Replacement analyser showed similar response instability problems		
		21-May-02	25-May-02	Rejected data – response instability	4.4	105
		28-May-02	29-May-02	Rejected data – response instability	1.3	31
		03-Jun-02	03-Jun-02	Rejected data – response instability	0.3	7
		04-Jun-02	04-Jun-02	Rejected data – response instability	0.3	6
		09-Jun-02	13-Jun-02	Rejected data – response instability	3.7	89
		16-Jun-02	19-Jun-02	Rejected data – response instability	2.9	70
		24-Jun-02	25-Jun-02	Rejected data – response instability	0.5	12
		27-Jun-02	01-Jul-02	Rejected data – response instability. Original analyser reinstated. Response instability continued. TEOM replaced on 4th July. Control unit of replacement unit locked up on 17th July. Original analyser reinstated again on 19th July. Response instability resolved on 23rd July by removal of transit screw located in the sensor unit.	3.5	84
Liverpool Centre						
CO	47.2%	16-Jan-02	19-Jan-02	Data rejected – noisy and erratic data due to temperature fault	2.7	64
		22-Jan-02	23-Jan-02	Data rejected – as above	0.8	20
		24-Jan-02	25-Jan-02	Data rejected – as above	0.6	15
		26-Jan-02	27-Jan-02	Data rejected – as above	0.8	20
		19-Feb-02	06-Mar-02	Instrument temperature fault. Loose temperature sensor connection rectified. Air conditioning vents redirected.	14.5	348
		12-Mar-02	18-Mar-02	Service and analyser fault. Chopper motor and cooling fan replaced.	6.3	151
		23-Apr-02	22-Jul-02	Spurious data quality. Reason unknown. No fault identified at ESU call-out.	89.9	2158
London Bexley						
SO_2	77.0%	09-Jan-02	10-Jan-02	No details provided	0.4	10
		28-Jan-02	08-Mar-02	Analyser fault. Replacement analyser installed but giving negative output and UV lamp set too high.	39.2	941
London Bloomsbury						
CO	80.60%	04-Feb-02	05-Mar-02	Site closed due to redevelopment of local area. Site relocated 40m north and recommissioned.	29	696
		11-Apr-02	12-Apr-02	Baseline response instability	0.3	6
		12-Apr-02	13-Apr-02	Baseline instability	0.3	8
		13-Apr-02	14-Apr-02	Baseline instability	0.3	7
		17-Apr-02	17-Apr-02	Baseline instability	0.3	6
		28-Apr-02	29-Apr-02	Baseline instability	0.3	6
		03-May-02	03-May-02	Baseline instability	0.3	7
		04-May-02	04-May-02	Baseline instability	0.3	6
		05-May-02	05-May-02	Baseline instability	0.3	8
		05-May-02	06-May-02	Baseline instability	0.3	7
		15-May-02	15-May-02	Baseline instability	0.3	7
		26-May-02	27-May-02	Baseline instability – possibly linked to cooling fan fault. Fixed in July.	0.3	7
NO_2	83.0%	04-Feb-02	05-Mar-02	Site closed for nearby relocation	29	696
O_3	81.7%	04-Feb-02	05-Mar-02	Site closed for nearby relocation	29	697
		27-Apr-02	29-Apr-02	Pump problem	1.9	45
PM_{10}	74.2%	04-Jan-02	06-Jan-02	Erroneous data after routine filter change.	1.7	40
		04-Feb-02	05-Mar-02	Site closed for nearby relocation	29	696
		17-Apr-02	19-Apr-02	ESU call-out. TEOM and O_3 pump problems fixed	2	47
		24-May-02	29-May-02	TEOM response instability	4.7	112

		05-Jun-02	12-Jun-02	TEOM response instability. Replacement TEOM installed on 12 June.	6.9	165
		25-Jun-02	26-Jun-02	TEOM response instability	0.8	20
SO_2	82.6%	04-Feb-02	05-Mar-02	Site closed for nearby relocation	29.1	698
		13-Jun-02	13-Jun-02	Unstable response after calibration.	0.6	14
London Cromwell Road 2						
SO_2	83.6%	24-Jan-02	25-Jan-02	Power cut and analyser response instability	1.1	26
		13-Mar-02	01-Apr-02	Service and erratic response problems	18.9	453
London Hillingdon						
CO	75.8%	08-Jan-02	10-Jan-02	Service	2.1	50
		21-May-02	02-Jul-02	6 engineer call-out visits to rectify recurring pump failures.	42	1007
Manchester Piccadilly						
NO_2	83.2%	18-Feb-02	20-Feb-02	Service	2	47
		07-Mar-02	21-Mar-02	Faulty solenoid switching valve.	14.5	348
		30-Apr-02	01-May-02	Analyser replaced. No calibration until 1 May.	0.9	22
		07-May-02	13-May-02	Analyser cable fault.	6	145
		20-Jun-02	24-Jun-02	Replacement of analyser's front panel switch card. Filter separation paper found in sample inlet filter.	4.3	103
Manchester South						
NO_2	88.1%	18-Feb-02	19-Feb-02	Service	1.1	27
		07-Jun-02	19-Jun-02	Faulty converter solenoid replaced. Spurious data continued so replacement analyser installed.	12.2	292
Middlesbrough						
CO	73.4%	25-Feb-02	27-Feb-02	Service	2	49
		17-Mar-02	31-Mar-02	Data rejected due to temperature instability	15	360
NO_2	67.2%	21-Jan-02	31-Jan-02	Leaking instrument. Replacement analyser installed	10.4	250
		04-Feb-02	04-Feb-02	Scrubber problem repaired	0.3	8
		25-Feb-02	27-Feb-02	Service	2	49
		17-Mar-02	31-Mar-02	Data rejected due to temperature instability	15	360
PM_{10}	59.6%	19-Feb-02	19-Feb-02	QA/QC audit	0.3	8
		25-Feb-02	27-Feb-02	Service	2	48
		26-Mar-02	26-Mar-02	Power cut	0.3	7
		17-Apr-02	25-Jun-02	Intermittent response problems. TEOM removed for repair. Investigation showed TEOM was beyond economic repair. Temporary loan analyser installed on 25th June.	68.9	1654
Newcastle Centre						
CO	85.1%	02-Feb-02	02-Feb-02	Data rejected – erratic output and changes in baseline response	0.3	7
		20-Feb-02	23-Feb-02	Data rejected – change in analyser baseline	2.5	60
		26-Feb-02	27-Feb-02	Data rejected – change in analyser baseline	0.3	7
		19-Mar-02	19-Mar-02	Data rejected – change in analyser baseline	0.5	12
		02-Apr-02	05-Apr-02	Service	3.4	81
		09-Apr-02	12-Apr-02	Data rejected – change in baseline after autocal	3	72
		18-Apr-02	20-Apr-02	Data rejected – change in baseline after autocal	2	48
		09-May-02	12-May-02	Data rejected – change in baseline after autocal	3	72
		24-May-02	25-May-02	Data rejected – change in baseline after autocal	1	24

		29-May-02	30-May-02	Data rejected – change in baseline after autocal	1	24
		02-Jun-02	03-Jun-02	Data rejected – change in baseline after autocal	1	24
		10-Jun-02	11-Jun-02	Data rejected – change in baseline after autocal	1	24
		28-Jun-02	29-Jun-02	Data rejected – intermittent changes in baseline	1.3	30
Northampton						
CO	22.9%	01-Jan-02	05-Jun-02	CO analyser affiliated on 12th March but no calibrations for data scaling until 5th June.	156	3734
PM_{10} (Grav)	76.2%			See Section 4.1		
Nottingham Centre						
PM10	82.3%	11-Mar-02	11-Apr-02	High noise and negative data due to faulty mass transducer and AMP board	31.2	749
Portsmouth						
SO_2	89.2%	18-Jan-02	23-Jan-02	Missing data. No details provided	5.1	122
		07-Feb-02	19-Feb-02	Service. Spurious data after service rejected.	12.1	290
		19-Mar-02	20-Mar-02	Telemetry fault	1	24
Reading						
CO	29.3%	01-Jan-02	01-Jan-02	Missing Data. Logger/telemetry fault	0.8	18
		14-Jan-02	17-Jan-02	Service	3	73
		01-Mar-02	19-Jul-02	High noise data rejected. Pump vibrating due to a loose mounting.	141	3373
Salford Eccles						
O_3	86.5%	29-Jan-02	29-Jan-02	Sample pump fault	0.3	6
		31-Jan-02	07-Feb-02	Internal sampling due to a major leak in the sample inlet filter assembly	6.8	163
		14-Feb-02	25-Feb-02	Analyser fault. Removed from site for repair	11.5	275
		28-Feb-02	01-Mar-02	No details provided	1.1	26
		23-Mar-02	23-Mar-02	No details provided	0.6	14
		09-May-02	11-May-02	Suspected leak following routine LSO calibration	1.9	46
		11-May-02	12-May-02	Power cut/telemetry	0.6	14
		30-Jun-02	30-Jun-02	No details provided	0.4	10
Scunthorpe						
PM_{10}	69.10%	04-Jan-02	06-Jan-02	Response instability after routine LSO visit.	2.1	50
		14-Feb-02	15-Feb-02	TEOM response instability	0.8	20
		28-Feb-02	13-Apr-02	TEOM switched out of service due to pump problem. Sensor unit replaced on 12th April.	44.5	1066
		21-May-02	22-May-02	Response instability following routine LSO visit	0.8	18
		28-May-02	29-May-02	Response instability following LSO visit	1	25
		05-Jun-02	08-Jun-02	Response instability following ESU visit	3.5	85
		24-Jun-02	25-Jun-02	Response instability following LSO visit. ESU suggested that the filter was not being properly temperature conditioned by the LSO.	0.9	21
Sheffield Centre						
CO	84.6%	18-Mar-02	20-Mar-02	Service	2.1	51
		05-May-02	07-May-02	Missing data – analyser stuck in autocal mode	1.5	37
		07-Jun-02	31-Jul-02	Data rejected due to analyser response drift and changes in baseline caused by a flow blockage	53.9	1293
PM_{10}	89.8%	01-Jan-02	03-Jan-02	Main flow fault	2.5	61

		11-Jan-02	11-Jan-02	Erroneous data after ESU attention.	0.3	6
		09-Feb-02	21-Feb-02	Noisy data due to a flow leak caused by split o-ring	12.4	297
		18-Mar-02	20-Mar-02	Service	2.1	51
		08-May-02	08-May-02	Spurious data following filter change	0.3	8
		05-Jun-02	05-Jun-02	Spurious data following filter change	0.3	6
Southampton Centre						
SO_2	81.2%	11-Feb-02	13-Feb-02	Service	2.2	53
		01-Jun-02	30-Jul-02	Data rejected – excessive noise and negative spikes	59.6	1431
Thurrock						
PM_{10}	67.6%	03-Jan-02	26-Feb-02	TEOM removed from site for repair. Mass flow controllers cleaned.	54.1	1298
		27-Mar-02	28-Mar-02	Power failure.	0.7	16
		06-Apr-02	08-Apr-02	Logger fault after power failure	1.8	42
		28-Apr-02	29-Apr-02	Power failure	1.4	33
Wirral Tranmere						
CO	58.6%	04-Feb-02	06-Feb-02	Service	2.1	50
		27-Feb-02	09-May-02	Solenoid valves leaking and zero reference not working correctly. Replacement analyser installed	71	1705
O_3	75.5%	21-Dec-01	06-Feb-02	Data rejected – low detector frequency fault. UV lamp and ozonator replaced.	47.5	1140
		17-Jun-02	19-Jun-02	Faulty circuit board	2.3	55
		21-Jun-02	21-Jun-02	UV lamp problem	0.5	11
Wolverhampton Centre						
CO	74.9%	11-Feb-02	13-Feb-02	Service	2.2	52
		01-Jun-02	30-Jun-02	Intermittent fault and unstable response to calibration gas. Replacement analysers installed on 10th and 27th June.	30	720
Wrexham						
PM_{10} (Grav)	82.6%			See Section 4.1		

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

This section gives details of the main site operational problems which have resulted in gravimetric PM_{10} data capture below the required 90% level during the reporting period January to June 2002. In general, the performance of the gravimetric PM_{10} (Partisol) analysers during this 6-month period has been insufficient to achieve the 90% data capture target for four out of the five operational analysers. Details of the reasons for the data loss are given for each site below.

Northampton (72.6 % data capture)
During this period, there were several occasions when the Partisol stopped functioning and data were lost. An investigation showed that the temperature probe had been disconnected and a standard temperature of 25^{o}C and pressure of 760 mmHg had been entered. There are no ambient temperature and pressure measurements available to retrospectively correct the data. In any case, the correction would be small compared to the overall accuracy of the instrument and therefore no correction has been made. The Partisol is co-located with a TEOM analyser and the data agree well with the TEOM scaled by 1.3 (See Figure 2.1).

Feb	2nd: I day lost due to damaged filter.
April	Unit stopped for 2 days. Flow fault
May	17th – 25th Unit out of action – cause not known.
June	1st – 5th – unit stopped with flow fault
June	8th Unit stopped for 1 day with flow fault.
June	12th Unit breakdown.

Bournemouth (95.6 % data capture)

There were very few problems with this site during January to June 2002.

Jan	No data 4th- 8th January 2002 the Partisol had run out of filters.
March	Filter jam 6th March.
March	Short exposure 19th March.
April	2nd April no access for filter change. 1 day lost.
June	Short power failures on June 5th and 6th

Inverness (34.8 % data capture)

This site returned to operation on 13th February having been vandalised last year. One month's data was lost when the sampler developed a fault, possibly in the filter exchange mechanism, and it was therefore shut down pending repair. The analyser was re-started on 19th June.

Jan-Feb	Site vandalised – no data until 13th February 2002.
Mar	15th : Filter damage.
Apr – May	23rd April to 8th May filter transfer fault. Filters returned unused.
May	9th : missed 1 day.
May-Jun	20th May – 19th June: Partisol out of operation for repair.

Dumfries (87.8 % data capture)

The previous ratification summary covering the period July-December 2001 highlighted a problem at this site. Canisters were frequently returned after exposure with one or more filter holders "upside down" inside the canister. The LSO confirmed that the filters were

all the right way up in the canister when received from netcen and when put into the Partisol. However, when the canister was removed from the Partisol after exposure, the LSO noticed that occasionally one or more filter holders were upside down. Despite this, the filters were always exposed on the correct side. As these filters were all correctly exposed, there was no reason to reject them. However, sometimes filters were appearing vertically in the canister and their edges could damage the filters above and below resulting in data loss.

The CMCU suggested that the problem of exposed filters being inverted as they are transferred to the storage canister was due to a 'lip' being created by the base-plate of the storage magazine when it is transferred from the supply position. The LSO was asked to depress the base-plate by approximately 0.5cm. This appears to have rectified the fault.

Jan	7th, 9th, 10th, 26th; filter inverted in canister after exposure but data not rejected.
Jan	13th : Filter damage - rejected. 17th : Filter cut inside edge - rejected.
Feb	3rd, , 8th, 17, 15th, 17th, 21st ; filter inverted in canister after exposure. Not rejected.
Feb	1st, 4th, 5th, 7th: filter damage - rejected. 10th, 22nd : filter cut inside edge - rejected.
Mar	17th – 28th: Filter jam – no data.
Apr – May	Frequent filter temperature range errors. No data lost but this may indicate the Partisol needing attention.
May	11th : power failure resulting in loss of 1 day's data.
June	19th June: power failure.

Wrexham (82.6% data capture)

This site started again on 1st March 2002 after being vandalised.

March	12th: filter not exposed
March	26th: Partisol power failure
April	9th: missing filter weight
April-May	24th April – 7th May: Partisol did not run - filters not exposed.
June	15th – 18th June: Partisol ran out of filters

5. Ratified Data Capture Statistics

Table 5.1 provides the ratified data capture figures for each site for the 6-month period January to June 2002. Data capture values below 90% are shown in the shaded boxes.

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

Site	CO	NO_2	O_3	PM_{10}	SO_2	Site Average
ENGLAND						
Barnsley 12	-	-	-	-	98.8	98.8
Barnsley Gawber	-	74.9	78.2	-	74.6	75.9
Bath Roadside	95.4	98.8	-	-	-	97.1
Billingham	-	99.1	-	-	-	99.1
Birmingham Centre	94.1	94.1	98.3	98.4	97	96.4
Birmingham East	95.9	92	96.9	97.4	97.4	95.9
Blackpool	93.3	96.4	96.4	98.4	98.4	96.6
Bolton	98.3	98.3	98.3	98.7	95.3	97.8
Bournemouth	-	86.1	-	95.6	96.1	92.6
Bradford Centre	98.2	97.7	98.3	98.2	97.3	97.9
Brighton Roadside	96.5	94.8	-	-	-	95.7
Bristol Centre	98.3	96.2	98.4	94	98.2	97.0
Bristol Old Market	82.8	97.6	-	-	-	90.2
Bury Roadside	96.5	96.8	96.5	96.2	96.9	96.6
Cambridge Roadside	-	88.8	-	-	-	88.8
Canterbury	-	97.4	-	99.2	-	98.3
Coventry Memorial Park	37.0	84.2	97.3	97.9	92.3	81.7
Exeter Roadside	90.0	90.9	98.0	-	95.9	93.7
Hove Roadside	98.7	90.3	-	-	98.7	95.9
Hull Centre	8.5	8.9	9.0	9.0	9.0	8.9
Leamington Spa	98.4	96.2	98.8	98.0	98.6	98.0
Leeds Centre	88.7	89.1	98.0	98.3	84.0	91.6
Leicester Centre	96.9	95.3	91.1	76.9	96.3	91.3
Liverpool Centre	47.2	95.4	98.1	97.6	96.0	86.9
London A3 Roadside	98.3	92.8	-	94.4	-	95.2
London Bexley	97.7	97.1	94.9	97.8	77.0	92.9
London Bloomsbury	80.6	83.0	81.7	74.2	82.6	80.4
London Brent	99.0	98.0	99.0	98.1	98.9	98.6
London Cromwell Road 2	92.6	96.1	-	-	83.6	90.8
London Hillingdon	75.8	95.8	97.7	98.0	97.4	92.9
London Westminster	98.8	97.1	95.1	-	95.1	96.5
Manchester Piccadilly	95.8	83.2	90.6	94.5	98.2	92.5
Manchester South	-	88.1	98.7	-	96.7	94.5
Manchester Town Hall	99.0	98.7	-	-	-	98.8
Middlesbrough	73.4	67.2	98.2	59.6	98.0	79.3
Newcastle Centre	85.1	95.5	97.7	97.9	97.8	94.8
Northampton	22.9	99.4	-	99.8	99.5	80.4
(Northampton Partisol)				76.2		

Site	CO	NO_2	O_3	PM_{10}	SO_2	Site Average
Norwich Centre	98.0	94.0	91.2	95.1	98.0	95.2
Norwich Roadside	-	96.5	-	-	-	96.5
Nottingham Centre	98.1	97.8	95.3	82.3	98.0	94.3
Oxford Centre	90.6	99.2	-	-	99.0	96.3
Plymouth Centre	95.1	95.2	96.8	98.4	98.3	96.7
Portsmouth	95.1	98.3	-	98.2	89.2	95.2
Preston	94.2	97.9	95.6	98.0	96.8	96.5
Reading	29.3	92.7	91.7	98.6	92.4	80.9
Redcar	95.5	93.1	98.3	98.4	98.4	96.7
Rotherham Centre	-	93.7	98.3	-	97.7	96.5
Salford Eccles	95.8	96.3	86.5	96.1	93.6	93.7
Sandwell West Bromwich	94.8	90.2	96.5	-	98.3	95.0
Scunthorpe	-	-	-	69.1	97.9	83.5
Sheffield Centre	84.6	98.2	98.3	89.8	96.4	93.4
Sheffield Tinsley	99.1	95.4	-	-	-	97.2
Southampton Centre	90.3	98.1	98.2	97.3	81.2	93.0
Southend-on-Sea	96.5	94.1	95.0	97.1	93.4	95.2
Stockport	99.0	96.6	-	92.7	98.8	96.8
Stockton-on-Tees Yarm	-	96.4	-	94.0	-	95.2
Stoke-on-Trent Centre	98.3	97.2	94.1	98.0	98.3	97.2
Sunderland	-	-	-	-	99.2	99.2
Thurrock	96.2	91.4	96.3	67.6	96.3	89.6
Walsall Alumwell	-	97.7	-	-	-	97.7
Walsall Willenhall	-	94.5	-	-	-	94.5
West London	98.8	95.9	-	-	-	97.4
Wigan Leigh	98.5	97.6	99.1	98.4	96.8	98.1
Wirral Tranmere	58.6	93.1	75.5	98.1	97.8	84.6
Wolverhampton Centre	74.9	95.6	95.4	98.1	95.0	91.8
Northern Ireland						
Belfast Centre	96.4	91.1	94.6	96.7	96.1	95.0
Belfast Clara St	-	-	-	92.0	-	92.0
Belfast East	-	-	-	-	94.7	94.7
Derry	89.9	95.0	95.1	97.2	96.9	94.8
Scotland						
Aberdeen	96.5	96.0	-	59.1	96.0	86.9
Dumfries	87.4	92.8	-	87.8		89.3
Edinburgh Centre	93.3	97.2	96.0	89.6	97.4	94.7
Glasgow Centre	91.8	93.5	98.3	98.2	82.2	92.8
Glasgow City Chambers	96.0	96.6	-	-	-	96.3
Glasgow Kerbside	96.1	95.8	-	96.1	-	96.0
Grangemouth	-	98.3	-	99.3	98.3	98.6
Inverness	90.9	98.1	-	34.8		74.6
Wales						
Cardiff Centre	87.8	95.3	98.4	96.2	78.8	91.3
Cwmbran	86.9	98.0	-	97.4	94.3	94.1
Port Talbot	-	95.8	95.8	96.9	95.7	96.1
Swansea	97.4	97.7	98.3	98.3	98.0	97.9
Wrexham	99.2	95.4	-	82.6	99.1	94.1
Number of sites	64	77	48	57	63	
Network Mean (%)	**87.9**	**93.2**	**93.4**	**90.4**	**93.4**	**92.3**

Sites and instruments established between 01/01/2002 and 30/06/2002

Site	Instrument	Start date
Northampton	CO	12/03/2002
Portsmouth	CO	21/03/2002
Wigan Leigh	CO	15/05/2002
Wigan Leigh	O_3	15/05/2002
Cwmbran	CO	12/03/2002
Wrexham	CO	06/03/2002
Wrexham	NO_2	06/03/2002
Wrexham	SO_2	06/03/2002

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, November 2002

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 3 Drycal flow meters - purchased September 2002 1 Mass flow controller read-out unit to be incorporated in the audit dilution apparatus – purchased September 2002.
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 (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 ±0.5ppm 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	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	
16	Up-grade or repair CO analyser (Environnement SA) at Liverpool (response noise and drift).	Critical Site	
17	Up–grade or repair noisy analyser at Coventry Memorial Park (SO_2, and CO – Ambirak)	Critical Site	
18	Up-grade or repair noisy PM_{10} analyser (TEOM) at Leicester Centre	Critical Site	
19	Add remote dial up facility to collect instrument diagnostics for all Partisol analysers in the Network	Critical Sites	

APPENDIX C

Table C1 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 PM10[b] SO2
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: PM_{10} monitored by Gravimetric and TEOM