Report

QA/QC Data Ratification and Intercalibration Report for the Automatic Urban and Rural Network, January – March 2004

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

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PART A: Data Ratification January - March 2004

1 Introduction

This quarterly report covers the Quality Assurance and Control (QA/QC) activities undertaken by **netcen** to ratify automatic monitoring data from Defra and the Devolved Administrations' urban and rural air quality monitoring network (AURN) for the period January to March 2004. During this period there were 121 monitoring sites in the Network of which 85 are urban sites, 22 rural network sites and 14 sites in the London Air Quality Monitoring Network (LAQN) which are affiliated into the national network.

Included in this report are the results of QA/QC Unit's 6-monthly intercalibration and audit exercise which was carried out during January to March 2004. The report is therefore divided in to two parts as follows:

Part A: Data Ratification

Section 1:	Introduction including recent changes that have taken place in the network and a general overview of network performance.
Section 2:	Generic data quality issues and recommendations for improving or resolving these issues.
Section 3:	Site specific issues.
Section 4:	Reasons for data loss at sites where data capture falls below 90%.
Section 5:	Data capture statistics for January to March 2004 presented in tables.
Appendix A1	Recommendations for replacing or up-grading equipment (compiled in conjunction with CMCUs).
Appendix A2	List of critical sites in the AURN.

Part B: Winter 2004 Intercalibration

Section 6	Introduction
Sections 7–18	Results of the Winter 2004 intercalibration exercise
Appendix B1	Network certificate of calibration

1.1 Recent Changes in the Network

This section gives an overview the main changes that have taken place in the network including site closures, relocations or the addition of any new sites to the network during 2004. A summary is given in Table 1.1.

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

Wigan Leigh

The Wigan Leigh site will be relocated to Wigan College, following the redevelopment of the Police Station. This will be a permanent relocation of the AURN affiliated site to the college, even though the Wigan Leigh site will recommence operation at some point in the future. The problems at this site have meant that the NO_2 diffusion tube intercomparison has been moved to the Liverpool Speke site.

Birmingham East and Centre

The Birmingham East site will be closed down by the end of July, as the school will not renew the lease. QA/QC Unit is working closely with Birmingham County Council to try to identify suitable sites for relocation, especially as the Birmingham Centre site will also need to be relocated by the end of March 2005.

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

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

DD3 Requirements
Additional ozone and rural NO_x analysers have been installed in the network in order to comply with the Third Daughter Directive (DD3) which came into force on 9th September 2003. Installation and commissioning of the analysers has been completed at 12 out of the 13 selected sites. Up-grading of the site power supply to at Glazebury was completed and NOx analyser commissioned on 26/1/04. Arrangements have been made to install the NO_x and PM_{10} analysers at the remaining site (Eskdalemuir) during summer 2004. Plans are also underway to add a further 4 new DD3 sites at Brighton Preston Park, Fort William, Sunderland Silkworth and Leominster. Progress on the affiliation of the remaining DD3 analysers is summarised in Table 1.1 and discussed in more detail in Section 2.1

Table 1.1 Changes to the AURN between January to March 2004

Sites	Date Commenced	Pollutants
New sites		
London Harlington	1/01/04	NO_2 CO O_3 PM_{10}
Site Relocations		
Scunthorpe relocated to Scunthorpe Town	Scunthorpe closed 18/4/04 Scunthorpe Town started 6th June 04	SO_2 PM_{10}
Additional O_3 and/or NO_x (DD3)		
Eskdalemuir	Awaiting installation of a new air conditioning unit prior to installing NOx and PM_{10} analysers	NO_x and PM_{10}
Glazebury	NOx commissioned on 26th January 2004	NOx

1.2 Overview of Network Performance

Ratified hourly average data capture for the network averaged 92% for all pollutants (O_3, NO_2, SO_2, CO, PM_{10} and $PM_{2.5}$) during the 3-month reporting period January to March 2004 (see Table 1.2 below). Overall, this has been a good quarter in terms of data capture especially since this period includes the winter intercalibration and service exercise. On average, data capture for all the pollutants was above the 90% target with the NO_2 data capture being the lowest at 90.3%. This is mainly due to the fact that 3 sites had very low NO_2 data capture for this period (Camden Kerbside (5%), Southwark Roadside (6%) and Wicken Fen (15%)). See Sections 3 and 4 for details.

Table 1.2 AURN Ratified Data Capture (%) January to March 2004
(Using the start date of any new site)

Data Capture (%)	CO	NO_2	O_3	PM_{10}	$PM_{2.5}$	SO_2	Average
Q1 Jan - March 2004	92.0	90.3	93.1	91.1	97.9	91.7	92

Overall, 336 out of the 420 analysers (80%) achieved data capture levels above the required 90% target during this reporting period (See Table 1.3). This is lower than in the previous quarter (Oct-Dec 2003) when 84% of analysers achieved the data capture target. In this period a relatively high proportion (25%) of NO_x and (21%) SO_2 analysers in the network failed to meet the target. The reasons for data loss were varied but these were mainly due analyser malfunction including a few NO_x converter failures. (See Section 2.5 for details).

Table 1.3 Number of Analysers with Data Capture below 90%

	Total Number of Analysers	Analysers with Data Capture <90% Q1 Jan-March 2004
CO	79	16 (20%)
NO_2	106	26 (25%)
O_3	84	14 (16%)
PM_{10}	71	12 (17%)
$PM_{2.5}$	4	0
SO_2	76	16 (21%)
All sites	420	84 (20%)

A more detailed breakdown of the hourly data capture statistics for each site is presented in Section 5, Table 5.1. In total, 32 out of the 121 network sites (26%) had an average data capture rate below the required 90% level for the January – March 2004 period. These sites are listed in Table 1.4. The main site operational and QA/QC issues giving rise to data capture below the required 90% level are summarised in Section 4.

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

Site	Owner	Site Average Data Capture (%) Q1 Jan-March 04
England		
Blackpool	DEFRA	77.6
Bristol Old Market	Affiliate	79.1
Bury Roadside	Affiliate	74.7
Camden Kerbside	Affiliate	51.9
Exeter Roadside	Affiliate	85.4
Hull Freetown	DEFRA	89.5
London Bexley	Affiliate	86.5
London Haringey	Affiliate	84.7
London Lewisham	Affiliate	88.1
London Southwark	Affiliate	82.3
London Westminster	DEFRA	86.1
Newcastle Centre	DEFRA	78.9
Northampton PM10	Affiliate	87.9
Norwich Centre	DEFRA	87.4
Nottingham Centre	DEFRA	89.2
Plymouth Centre	DEFRA	89.7
Reading New Town	DEFRA	80.2
Salford Eccles	Affiliate	89.4

Site	Owner	Site Average Data Capture (%) Q1 Jan-March 04
Southampton Centre	DEFRA	82.2
Southend-on-Sea	DEFRA	86.3
Southwark Roadside	Affiliate	67.3
Stoke-on-Trent Centre	DEFRA	79.3
Sunderland	DEFRA	88.4
Thurrock	Affiliate	87.8
Wicken Fen	DEFRA	70.0
Wigan Leigh	Affiliate	83.0
N. Ireland		
Belfast Clara St	Affiliate	88.8
Lough Navar	DEFRA	49.9
Scotland		
Glasgow Centre	DEFRA	89.2
Grangemouth	Affiliate	82.0
Wales		
Narberth	Affiliate	61.7
Swansea	Affiliate	74.4
Number of sites < 90%		32

Netcen carried out the winter intercalibration and site audits at 120 operational urban and rural sites during January to March 2004. (Market Harborough site had just had a satisfactory commissioning audit in December 2003 so was not revisited). Results from this intercalibration exercise have been used to assess the accuracy and consistency of the data for this reporting period. Details of the Winter 2004 intercalibration are provided in Part B (Sections 6-18) of this report.

1.3 LSO Manual

QA/QC Unit up-dated the AURN Site Operator's manual in November 2003 and an electronic version of the manual has recently been put on disc and will be issued to the LSOs in the near future. The new manual is already available electronically on the following web sites:
AURN Hub http://www.aeat.co.uk/com/AURNHUB/lsoman.html
Air Quality Archive http://www.aeat.co.uk/netcen/airqual/reports/lsoman/lsoman.html

1.4 AURN Hub Updates

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

- Updated edition of the Local Site Operator's Manual including new analyser instruction sets
- Presentations from LAQN Annual Site Operator's meeting, April 2004 (pdf files)
- Monthly PM_{10} (Gravimetric) exceedences for June 2004
- QA/QC Unit's Summer 2004 intercalibration and audit schedule
- ESU's Summer service schedules (where provided)
- QA/QC Unit's ratification report and annual review Oct - Dec 2003
- Recent Management Unit reports (January- March 2004)

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

1.5 AURN Equipment Replacement Programme

A major programme took place during the summer of 2003 to replace aged and/or problematic equipment at 40 sites in the AURN. This first round of equipment up-grading is now completed with the exception of three sites (Leeds + two others to be decided). New Horiba equipment was installed at Leicester Centre and a commissioning audit was carried out on 16th June 2004. The equipment up-grading at Leeds has been delayed until a new floor is put into the hut.

Some Local Authorities have also taken measures to up-grade their own equipment at affiliated sites. For example, new analysers have been installed at London Bexley, London Brent and Birmingham East. Commissioning audits of all new equipment at affiliated sites have also been carried out.

As requested by CMCU, recommendations for further equipment up-grading in the network were provided by QA/QC Unit in January 2004.

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

2 Generic Data Quality Issues

2.1 Progress on Monitoring Requirements of the EU Daughter Directives

In order to comply with the third Daughter Directive (DD3 implementation date 9th September 2003), an additional 6 ozone and 7 rural NO_x monitors were required at a number of existing sites in the network. Further details on the third Daughter Directive can be found at:
http://www.defra.gov.uk/environment/consult/air-23daughter/index.htm

All of these analysers are now fully operational with the exception of the NOx analyser at Eskdalemuir. A new air conditioning unit is required at this site before the NOx and PM_{10} analysers can be installed. This is scheduled to take place during the summer 2004.

In order to satisfy the requirements of DD3 there are also plans to commission 3 new direct-funded NO_x and O_3 sites and affiliate one Local Authority owned site at the following locations:

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

Progress on the establishment/affiliation of the new sites is given in Table 2.1.

Table 2.1 New DD3 Monitoring Stations, July 2004

New Site	Pollutants	Progress to date	Expected integration date
Brighton Preston Park	O_3 and NO_x	All equipment has been installed. Issues with air conditioning unit and logger still to be addressed	August 2004
Fort William	O_3 and NO_x	Planning consent has now been granted but still awaiting the lease.	End of year
Sunderland Silkworth	O_3 and NO_x	Arrangements in hand to affiliate Local Authority NO_x analyser and install a new O_3 analyser.	August 2004
Leominster	O_3 and NO_x	Planning consent and lease have now been granted. Arrangements for site installation going ahead.	End Oct 2004

2.2 PM_{10} Episodes

Overall there have been many fewer exceedences of the daily mean gravimetric PM10 standard recorded this year compared to the same time last year. The sites that have recorded the highest number of days with exceedences of 50µg/m^3 from January to the end of June 2004 (based on provisional data) are as follows:

34 days - London Marylebone Road (Kerbside)
26 days - Port Talbot (Industry)
21 days - Camden Kerbside (Kerbside)
19 days - Glasgow Kerbside (Kerbside)
13 days - Bury Roadside (Roadside)
13 days – Liverpool Speke (Urban background/local source)

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

2.3 Data Capture for Critical Sites in Zones and Agglomerations

In order to meet the requirements of the Daughter Directives, any zone or agglomeration[2] with an exceedence of the limit value must be formally reported to the Commission. The critical sites are those which, if data capture falls below 90%, there will be insufficient data for the whole zone or agglomeration. In most cases the critical sites are those where there is only one site in the zone or agglomeration. However, for some pollutants (especially ozone) monitoring is required at several sites in each zone or agglomeration and hence these may all need to be classified as critical sites for that pollutant. The list of the critical sites in the Network has been revised to reflect the requirements of the First, Second and Third Daughter Directives (see Appendix A2). In total 61 sites have been identified as critical for DD1, DD2 or DD3. (25 sites in agglomerations and 36 in zones).

Critical sites with less than 90% data capture during the 3-month period January to March 2004 are given in Table 5.2. Reasons for data loss at these sites are given in Section 4. In total 39 out of the 189 critical site analysers (21%) did not meet the required 90% data capture during the first 3 months of 2004. Any site with less than 60% data capture during this first 3-month period will not achieve the 90% data capture target for the year. The 8 sites that fall into this category are as follows:

- Southend on Sea CO
- Grangemouth CO
- Wicken Fen NO_2
- Reading New Town O_3
- Lough Navar O_3
- Stoke-on-Trent PM_{10}
- Blackpool SO_2
- Wigan Leigh SO_2

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

2.4 Gravimetric PM_{10} Data Ratification

Gravimetric PM_{10} analysers (Partisols) are located at seven sites in the network (Bournemouth, Northampton, Wrexham, Dumfries, Inverness, London Westminster and Brighton Roadside PM_{10}). The gravimetric PM_{10} analyser at Northampton is also co-located with a TEOM analyser which provides a useful check that both techniques are operating correctly. Gravimetric PM_{10} concentrations and the daily mean TEOM scaled by 1.3 at Northampton are shown in Figure 2.1.

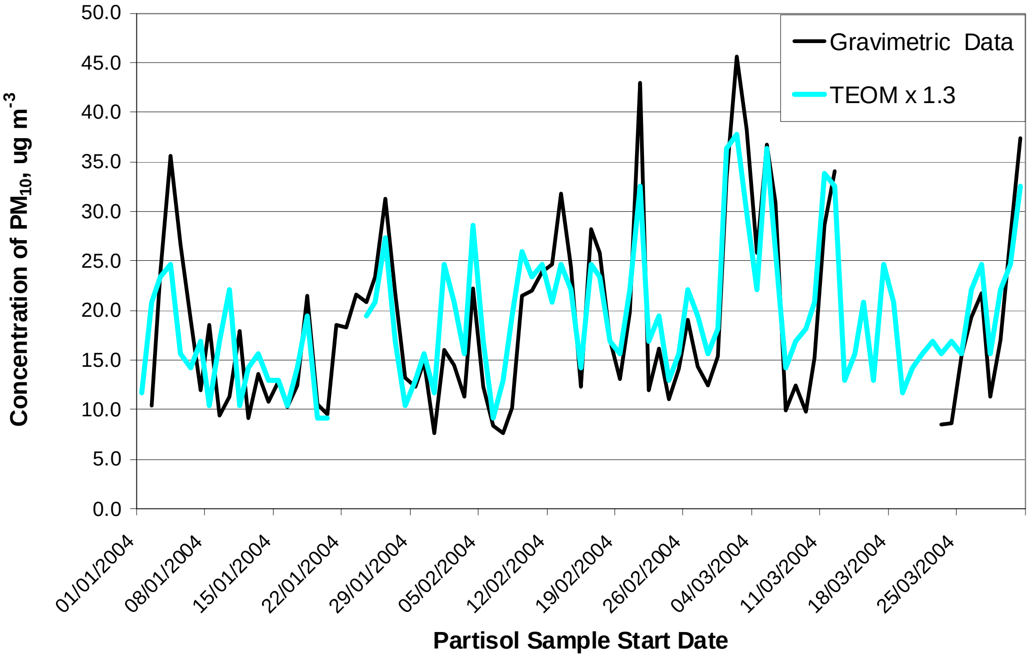

Figure 2.1 Partisol and TEOM (x1.3) Concentrations at Northampton (Jan-March 2004)

Data capture for the gravimetric PM_{10} (Partisol) analysers for January to March 2004 is given in Table 2.2. Only two out of the seven operational gravimetric PM_{10} analysers did not meet the required 90% data capture target for this reporting period. Details of data loss associated with these two sites (Northampton and Dumfries) are given in Section 4.1.

Table 2.2 Gravimetric PM_{10} Data Capture (%) January – March 2004
(Calculated from site start date)

Site	Data Capture (%) January - March 2004
Bournemouth	95.6%
Brighton Roadside PM_{10}	94.5%
London Westminster	90.1%
Northampton	87.9%
Dumfries	81.3%
Inverness	95.6%
Wrexham	98.9%
Average	91.9%

Six out of the seven Partisol sites have now has been connected to telemetry. This allows the exposure data and filter numbers to be downloaded automatically and regular checks on the operational status of the analyser can be carried out remotely. The one remaining Partisol unit at Bournemouth needs to be connected via a separate mobile phone system, as the existing line is not compatible with the Partisol software.

Recommendation

For the data collection system to work remotely, the LSO must ensure that the filter ID numbers are correctly entered into the Partisol unit when the filters are exchanged.

2.5 NO_2 Converter Efficiencies

Fifteen converter failures were identified during QA/QC Unit's Winter 2004 intercalibration exercise. Of these, nine were considered to be borderline cases and there was no resulting effect on data quality or capture. Details of these converter faults and the resulting effect on data quality are given in Table 2.3 below. See also Section 8.3 in the Intercalibration Part B of this report.

Table 2.3 Converter faults identified at the Winter 2004 Intercalibration (January-March 2004)

Site	Converter Efficiency	Resulting Effect on Data Quality
Blackpool	89.6%	1-minute calibration data reviewed and a drop in NO_2 calibration response was seen in late February. 2 weeks data were deleted from the audit on 26/2 to the service on 9/3 when the converter was replaced.
Dumfries	94%	Borderline – no data loss
Edinburgh St Leonards	93.1%	NO_2 span drift seen in January. Data deleted from last good calibration on 22/1 to service on 18 February (1 month)
London Bromley	93.7%	Borderline – no data loss. Repeat offender – failed previous audit in summer 2003.
London Marylebone Road	94.5%	Borderline – no data loss
London Westminster	83.1%	Data deleted from 25th November 2003 until service on 13th February 2004 when the converter was replaced (2.5 months)
Manchester Piccadilly	93.8%	Borderline – no data loss
Manchester South	92.8%	Borderline – no data loss
Nottingham Centre	90%	NO_2 calibration span response falling from end October. Data deleted from 22 October 2003 until the service on 16th January when the converter was replaced. (3 months)
Redcar	94.7%	Borderline - no data loss
Rotherham Centre	93.3%	Borderline - no data loss
Sheffield Centre	93.1%	Borderline - no data loss
Southwark Roadside	89%	Data rejected from January 2004 until the service on 25th March 2004 as there were no NO_2 calibrations (empty cylinder) and the autocalibrations appeared unstable. (3 months) Repeat offender – failed previous audit in summer 2003.

Tower Hamlets	94%	Borderline - no data loss.
Wirral Tranmere	92.1%	Data deleted between audit on 24th February and ESU service on 10th March 2004 (2 weeks).

RECOMMENDATION

The ESUs should ensure the converters are performing satisfactorily at the Summer 2004 service. It is especially important that the "borderline" cases get adequate attention at the service in order to ensure they are set up to operate satisfactorily for the next 6 month period. See also the CEN requirements outlined in Section 15 in Part B of this report.

Extra care should also be taken at the "repeat offender" sites (London Bromley and Southwark Roadside) in order to determine the cause of the repeated converter failures and/or to ensure the converters are replaced.

LSOs should also 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. This early warning indication of a potential converter fault may help to avoid large periods of data being rejected. Full details of this check can be found in the "Trouble-shooting" section of the Site Operator's Manual. (http://www.aeat.co.uk/netcen/airqual/reports/lsoman/lsoman.html

2.6 Ozone Outliers

22 out of 85 ozone analysers (26%) were identified as outliers during QA/QC Unit's Winter 2004 intercalibration exercise. This is a similar number to the previous summer intercalibration where 26% of the analysers tested were identified as outliers. Full details of the ozone outliers are given in Section 11 of the Intercalibration part of this report (Part B). Where appropriate, the data from these sites have been rescaled accordingly during the ratification process.

In order to help ensure that ozone monitors are not serviced during high pollution episodes in the summer, thereby losing the most important peak measurements, Netcen's Air Quality Forecasting Unit are now providing the Equipment Support Units with twice weekly updates on UK air pollution forecasts.

2.7 TEOM k_0

Only 1 of the TEOM instruments tested during the Winter 2004 intercalibration was found to be operating with a calibration constant (k_0) outside the acceptable $\pm$ 2.5% deviation. This was at Sheffield Centre where the k_0 deviation was –3.1%. This result will be checked again at the forthcoming summer 2004 service and if necessary the data from this analyser will be rescaled. In addition 12 TEOMs were found to be operating outside of the expected flow rates (see Section 12.2 in Part B of this report). Major flow leaks were identified during the audits at Swansea and Stoke-on-Trent resulting in significant data loss during this period (see Sections 3.3 and 3.4)

2.8 Auto-Calibration Run-ons

A generic problem affecting many analysers in the network has been identified due to autocalibration gas leaking into the sampling system during the ambient measurement period immediately after the autocalibration cycle. Invalid measurements (usually between 01:30 and 02:00) have been removed during data ratification. This can be a serious source of data loss resulting in one hour out of twenty four being lost, which is 4% of the annual data capture. This problem was identified by examining graphs of the diurnal variation of concentrations for the individual sites. An example of a large NO_2 autocalibration run-on seen at High Muffles during the period April-June 2004 is shown in Figure 2.2. At this site up to 3 hours data have been deleted each day resulting in NO_2 data capture below the 90% data capture target for the period.

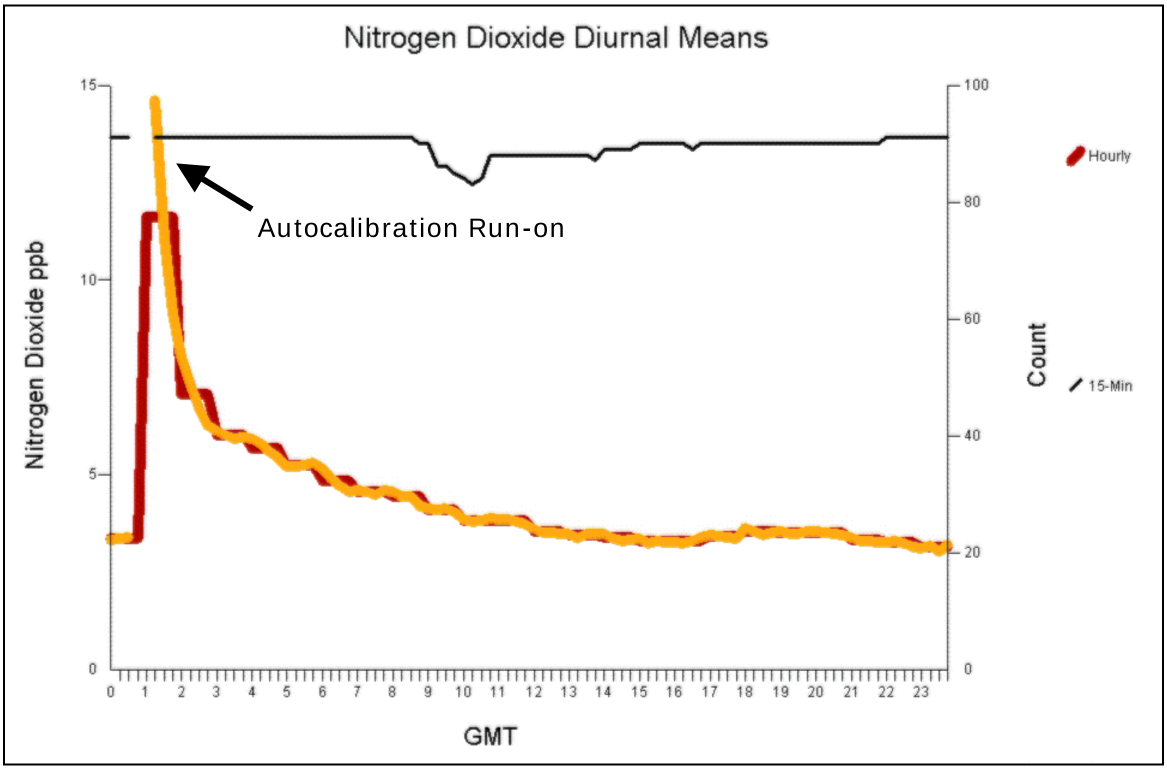

Figure 2.2 Autocal Run-on seen at High Muffles during April-June 2004 (Provisional data)

The ESUs have investigated the autocalibration problem at many of the sites and thorough cleaning of the solenoid valves has, in most cases, resolved the problem. The sites showing a problem with the autocalibration run-on during January to March 2004 are given in Table 2.4. Any autocalibration run-on data that look visibly significant have been deleted from these data sets during ratification, resulting in a loss of an additional hour of data each day (4% data loss).

Table 2.4 Estimate of Spike or Dip due to Auto-calibration Run-on (15-minute average) January-March 04.

Site	Site Type	Pollutant	Run-on (ppb)	Autocal conc (ppb)	Data loss (Hours)	Problem continuing
Aberdeen	Urban	NO_2	5	200	1	No
Aston Hill	Rural	NO_2	4.3	300	2	?
Belfast Centre	Urban	NO_2	8	300	2	Yes
Birmingham Centre	Urban	NO_2	4	750	1	Yes
Bristol Centre	Urban	NO_2	6	500	1	No
Bush Estate	Rural	NO_2	1.6	240	1	Yes
High Muffles	Rural	NO_2	17.9	500	3	Yes - very bad

Site	Site Type	Pollutant	Run-on (ppb)	Autocal conc (ppb)	Data loss (Hours)	Problem continuing
Leamington Spa	Urban	NO_2	6	1700	1	Yes
London Brent	Urban	NO_2	5	1400	1	Yes
London Southwark	Urban/LAQN	NO_2	8	150	1	Yes
Lullington Heath	Rural	NO_2	3	300	1	Yes
Market Harborough	Rural	NO_2	2.1	350	1	Yes
Middlesbrough	Urban	NO_2	7	700	1	Yes
Narberth	Rural	NO_2	1.8	150	1	Yes
Somerton	Rural	NO_2	2	180	1	Yes
St Osyth	Rural	NO_2	4	300	1	Yes
Stoke-on-Trent	Urban	NO_2	4	335	1	No

One recommendation to reduce the magnitude of the autocalibration run-on is to lower the concentration of the NO_2 autocalibration span gas, especially at the rural network sites where small run-ons are very visible in the ambient data. Figure 2.3 shows the range of NO_2 autocalibration span values used throughout the network. As seen, there are several sites where the span concentrations are in excess of 500ppb NO_2.

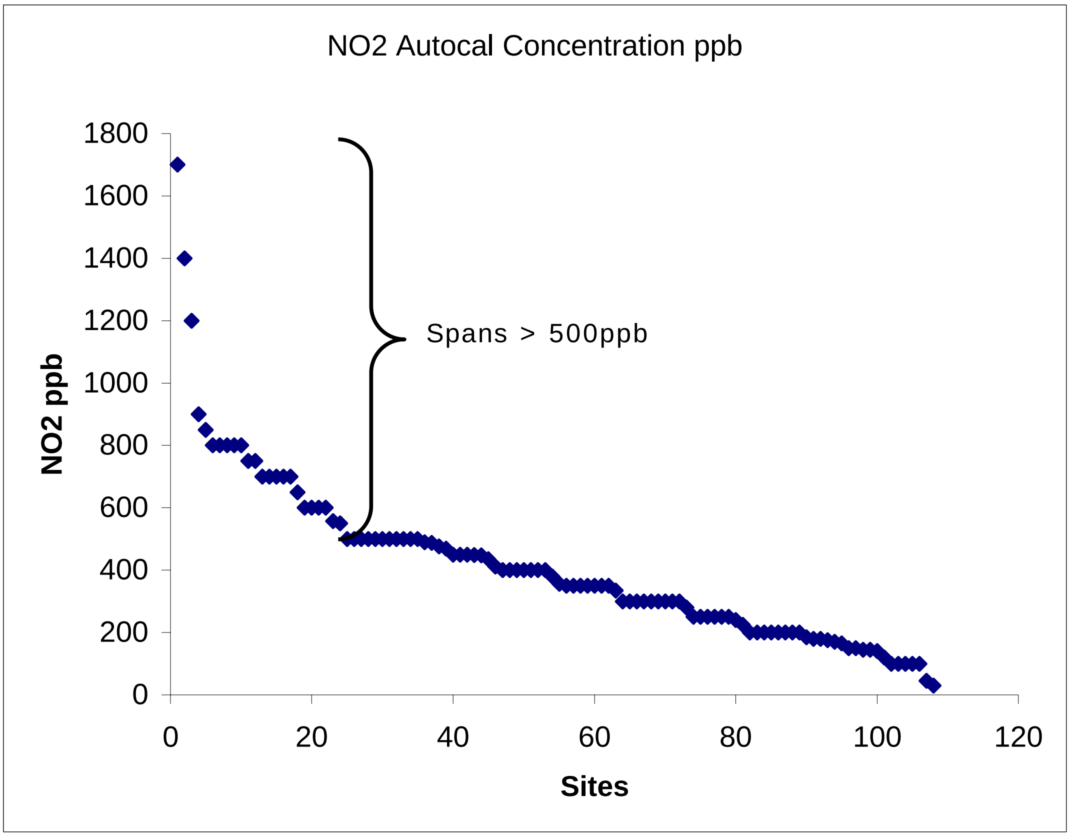

Figure 2.3 NO_2 Autocalibration span concentrations at AURN sites

Table 2.5 below lists all sites with NO_2 autocalibration concentrations greater than 500ppb.

Table 2.5 Sites with NO_2 Autocalibration Spans Above 500ppb

Site name	NO2 ppb
Leamington Spa	1700
London Brent	1400
Exeter Roadside	1200
Salford Eccles	900
Southampton Centre	850
Billingham	800
Oxford Centre	800
Plymouth Centre	800
Southwark Roadside	800
Wicken Fen	800
Birmingham Centre	750
Hove Roadside	750
Bury Roadside	700
Dumfries	700
London Bloomsbury	700
Manchester Town Hall	700
Middlesbrough	700
Glasgow City Chambers	650
Bolton	600
Bournemouth	600
London Cromwell Road 2	600
Sheffield Tinsley	600
Northampton	557
Walsall Willenhall	550

Recommendation

We recommend that, at the sites listed in Table 2.5, the NO2 autocalibration devices be adjusted to reduce the concentration of the span gas to below 500ppb. At rural sites even lower concentrations of approximately 100ppb would be advisable.

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 Noisy CO analysers

There were a number of CO analysers in the network that showed unacceptably high noise or unstable baseline response during this period. Details are as follows:

3.1.1 Sheffield Tinsley CO

CO response instability problems were seen last year at this site with over 5 months data being deleted. The analyser was replaced in May 2003. Problems with temperature stability in the cabin however resulted in further baseline response drift until temperature control within the site was restored again in September 2003. Provisional data from April to June 2004 indicates further problems with drifting and high noise response (See Figure 3.1). This should be investigated by the ESU during the summer 2004 service if not already dealt with.

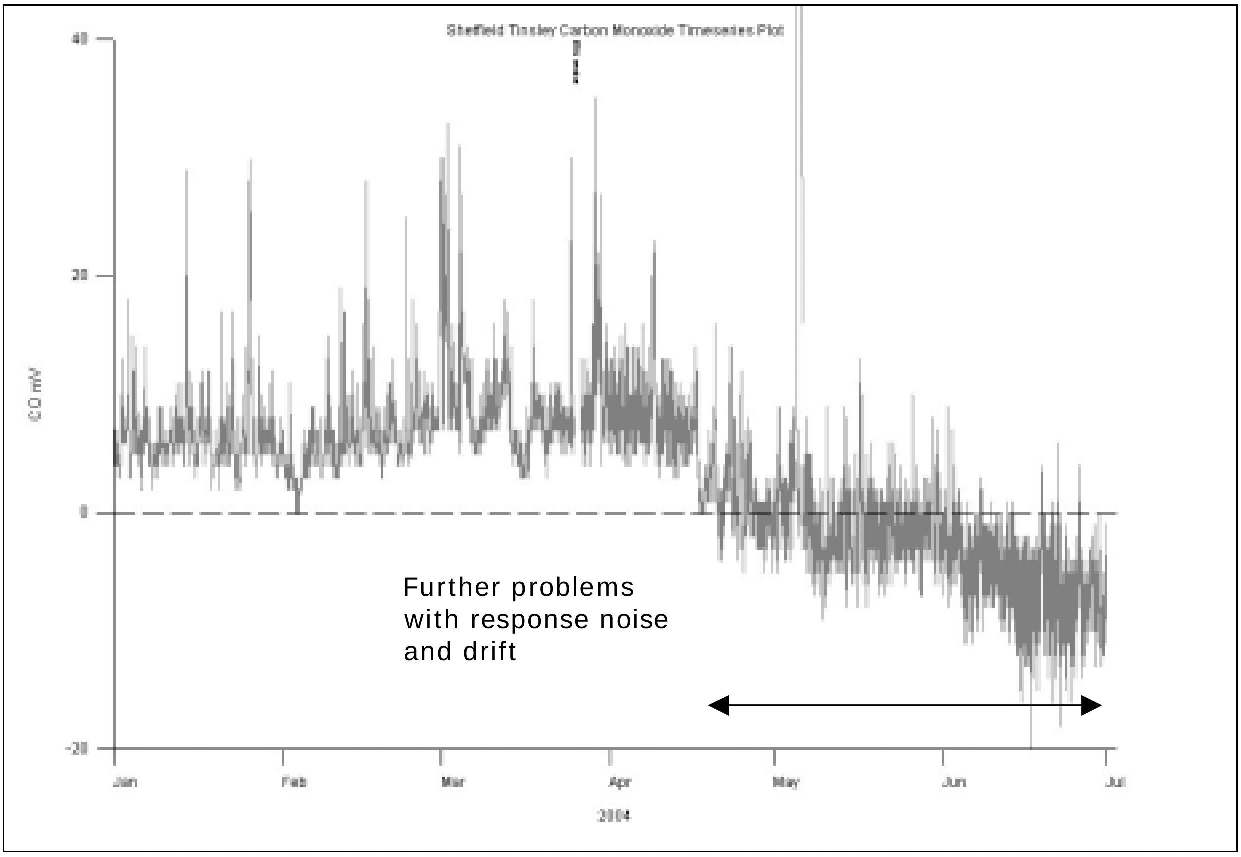

Figure 3.1 Sheffield Tinsley CO high noise and baseline drift, June 2004

3.1.2 Exeter Roadside CO

The CO baseline response at Exeter Roadside has shown a history of instability with frequent step changes and drifts in the zero baseline (See Figure 3.2). There was a chopper motor fault prior to service in February 2004 resulting in 2 weeks data loss (31/1/04 to 17/2/04). However, further response drift was still seen after the after service and in the provisional data for April-June. We therefore recommend that this problem be further investigated by the ESU during the summer 2004 service exercise.

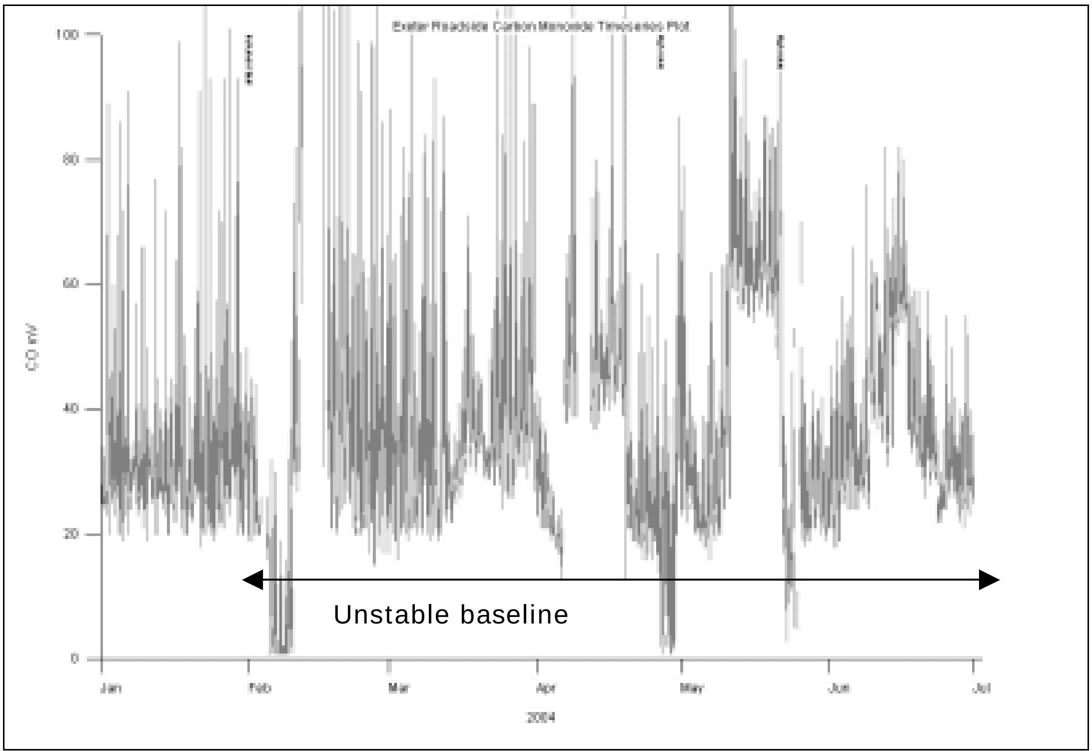

Figure 3.2 Exeter Roadside CO Unstable Baseline Response February - July 2004.

3.1.3 Southend-on-Sea CO

During this period the CO analyser at Southend-on-Sea showed periods of unaceptably high noise and negative response resulting in over three months of data being deleted from 10th February to 19th May 2004 (See Figure 3.3). The infrared lamp and pump were replaced in May and provisional data for April-June indicate that the problem has been resolved.

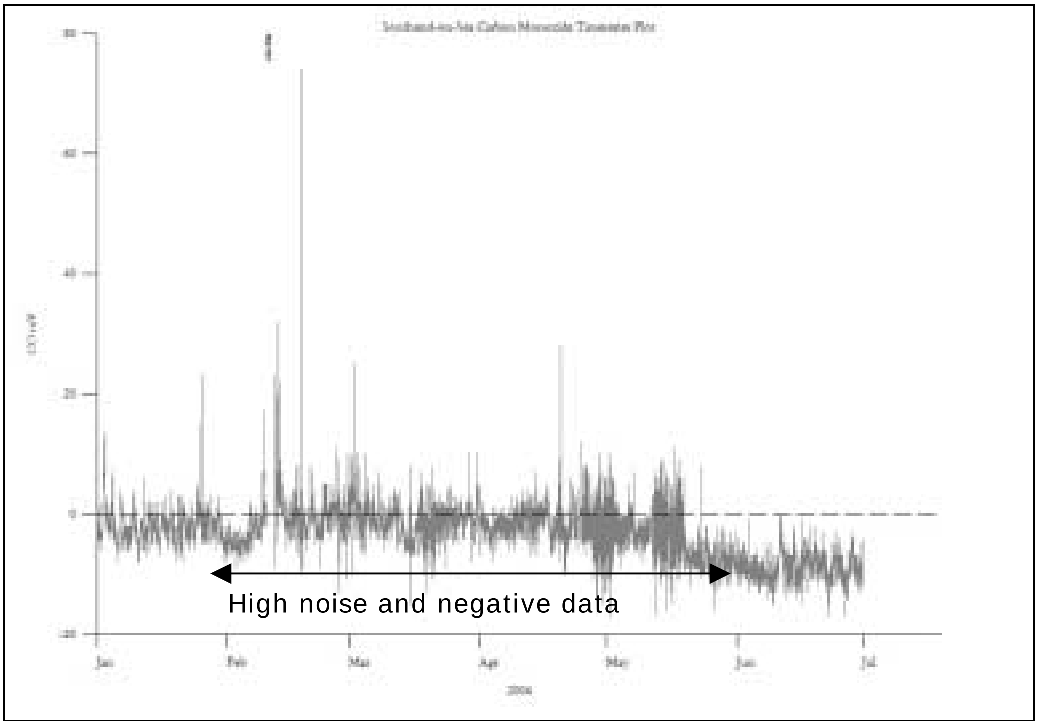

Figure 3.3 Southend-on-Sea CO high noise and negative response, Feb-May O4

3.1.4 Southampton CO

In general the CO analyser has been fairly unstable and suffered from several IR source and chopper motor failures since the new analyser was installed in August 2003 (see Figure 3.4). Over 3 weeks data have been lost during January to March 2004 due to these problems. Provisional data for April-June shows that the analyser performance has improved, however there is an indication of possible zero response truncation in June, though this cannot be confirmed at present. We therefore recommend that this instrument is checked carefully during the summer service to ensure it is operating satisfactorily as this is a critical site.

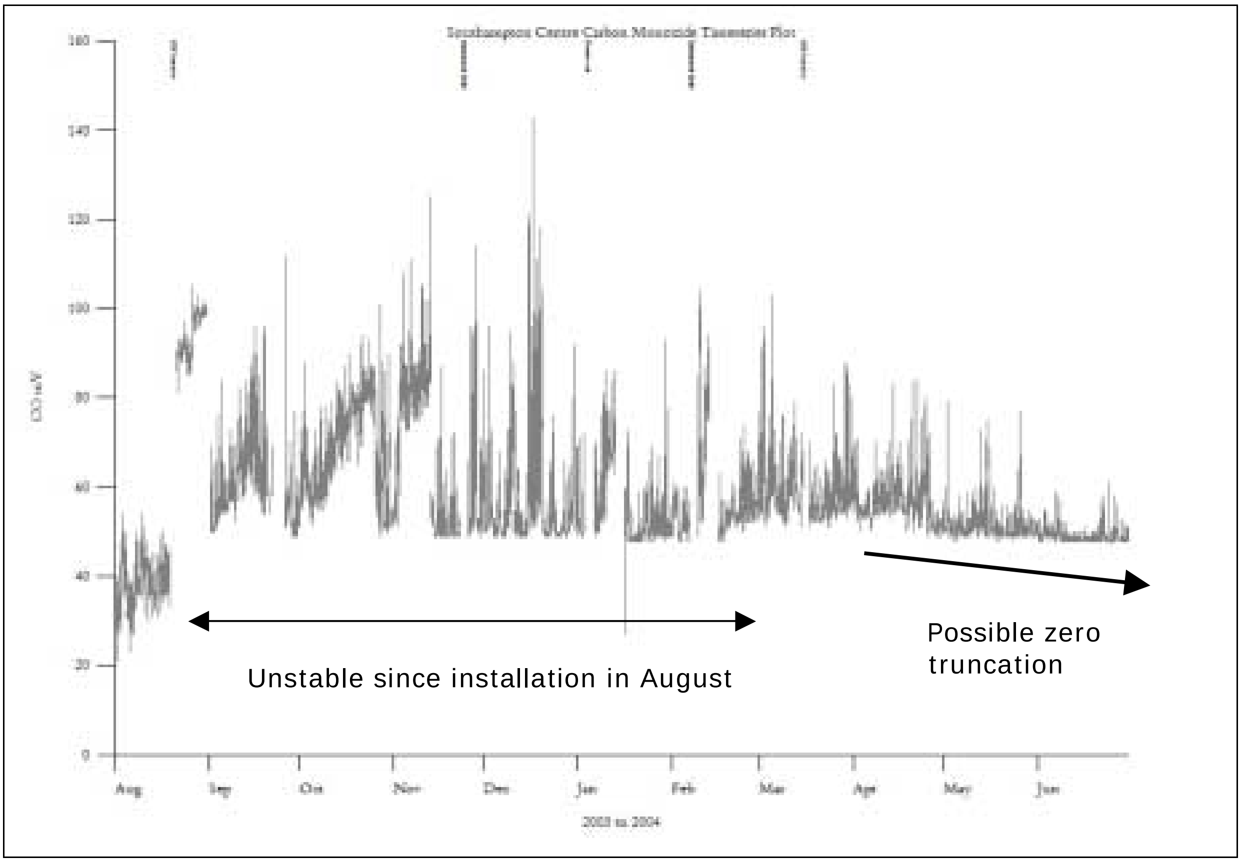

Figure 3.4 Southampton CO Unstable Response August 2003 to February 2004

3.2 Reading New Town SO_2

The SO_2 analyser at Reading New Town has shown a history of response instability mainly due to UV lamp faults in the previous quarter (Oct-Dec 2003). The baseline response has however continued to drift throughout January-March 2004. (See Figure 3.5). There were also problems with the Ambirack PC which was replaced on March 22nd 2004 and as a result data capture for O_3, CO and SO_2 was below 90% for this period.

Recommendation

We recommend that the SO_2 analyser should be upgraded with the modified bench (if not already carried out) as this is a critical site (Defra-funded). If the SO_2 analyser and PC continue to be unreliable, then this site should be a selected as a priority for any future equipment up-grading exercise.

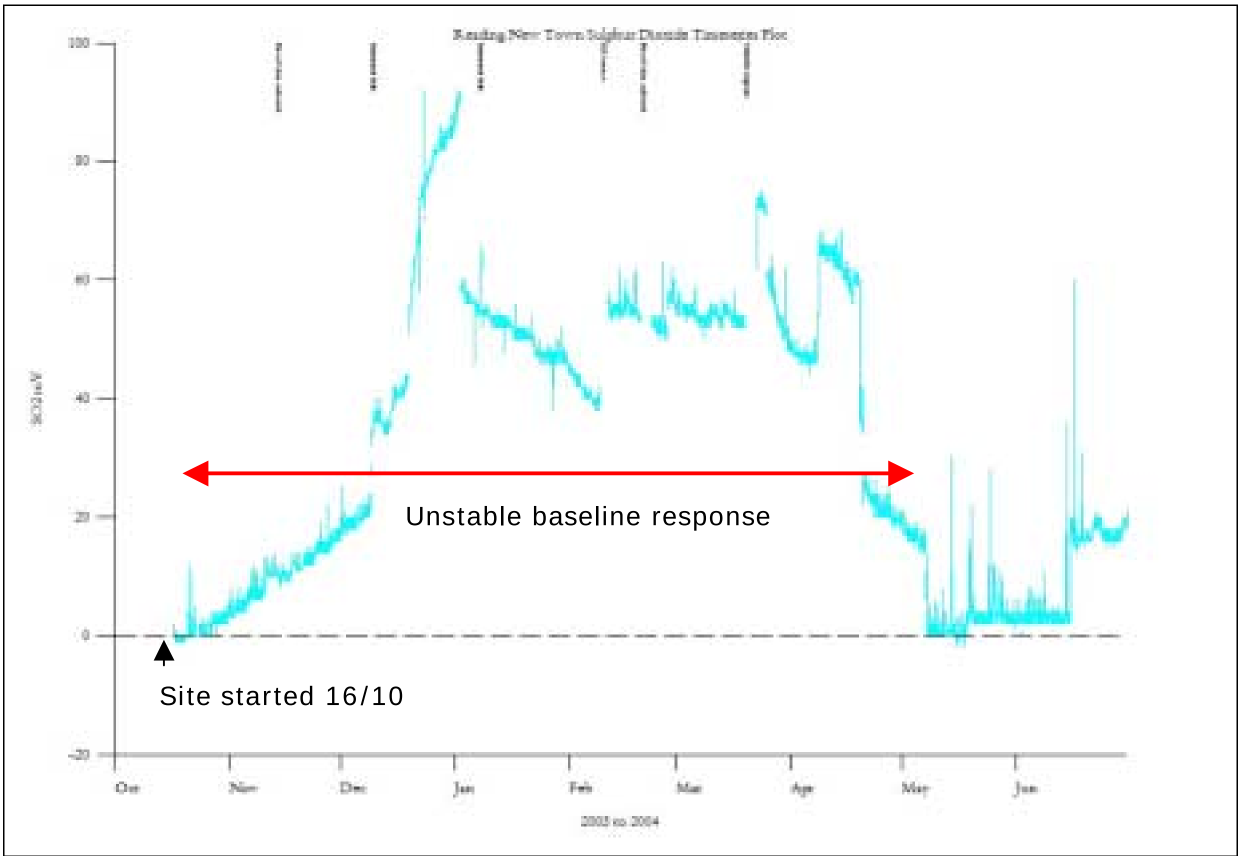

Figure 3.5 Reading New Town Unstable SO2 Response October 2003 – May 2004

3.3 Swansea PM_{10}

A major leak was identified at the QA/QC audit on 16th March 2004 with the TEOM main flow being 60% below its expected value. The leak was traced to a cracked plastic fitting at the mass flow controller. A noticeable increase in PM_{10} response was seen following the repair at the service on 23rd March 2004. Examination of the monthly mean PM_{10} concentrations indicated that the Swansea PM_{10} concentrations from January 2003 were lower than expected compared to other nearby sites (Cardiff and Cwmbran). Consequently 12 weeks data from January 1st to the service and repair on March 23rd have been deleted.

3.4 Stoke on Trent PM_{10}

This problem was reported in detail in the previous October – December 2003 ratification report (Section 3.3). A major leak was identified at the audit in February 2004 with the TEOM main flow being 38% lower than expected. A drop in concentration levels was seen to correspond with a service visit in July 2003 (See Figure 3.6). All data from the service on 29th July 2003 until repair on 12th February 2004 (6.5 months) have been deleted from the data set. The TEOM analyser response also became excessively noisy in March 2004 resulting in further data loss from 2nd-25th March. We recommend that the performance of the TEOM analyser at this site is checked at the Summer 2004 service as this is a critical site and further data loss should be prevented where possible.

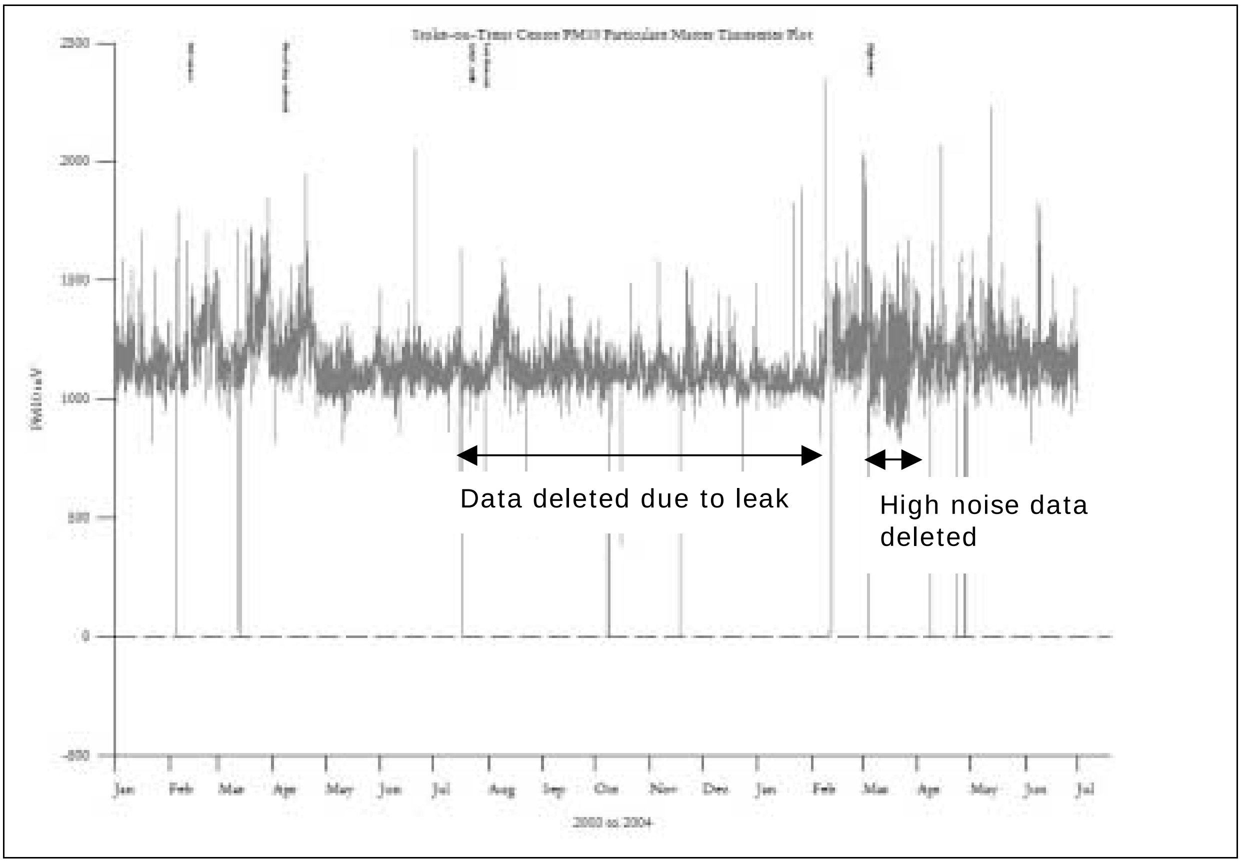

Figure 3.6 Stoke-on-Trent low PM10 data due to leak, July 03 to Feb 04.

3.5 Zero Response Truncation

There were a few sites where significant periods of data were lost due to zero truncation (or baseline clipping). This occurs when the analyser response drifts downwards until it falls below the minimum response threshold resulting in extended period of 0mV response. This problem can occur if the analyser is not configured to output negative voltages or if the logger cannot record a response below a certain voltage threshold. Cases of zero response truncation resulting in data loss were seen at the following sites during this period:

- Grangemouth CO October 2003 – March 2004 (3.5 months)
- Bristol Old Market CO February – March 2004 (1 month)
- Wicken Fen NOx December 2003 – March 2004 (3 months). See Fig 3.7

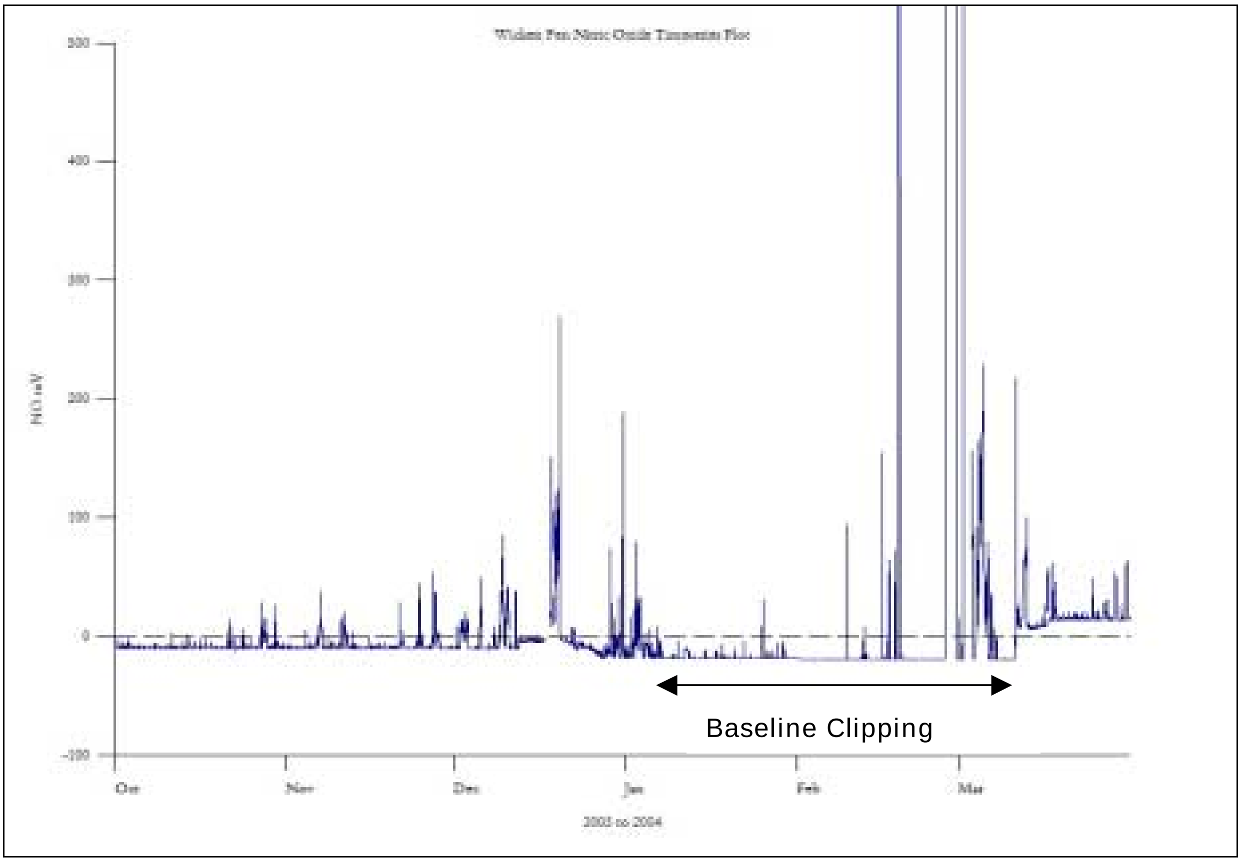

Figure 3.7 Wicken Fen NOx response truncation, January-March 2004

Recommendation

We recommend that, wherever possible, all analysers are routinely set up after the service with zero baseline offsets of 20-50mV. Special attention should be given to the sites mentioned above in order to ensure the baseline response does not drift downwards over time, resulting in further periods of truncation and data loss.

3.6 Camden Kerbside NOx Response Instability

Four months of NOx data from Camden Kerbside site have been deleted from the service on 5th January to the repair of the analyser on 5th May 2004 because of the rapid NO sensitivity drift seen over this period. During ratification of the January to March 2004 data set, the data ratifier identified an indication of potential oxidation of the NO cylinder (i.e. high NO_2 response to NO cylinder calibration). The calibration control charts showed that the NO channel sensitivity was drifting significantly (see Figure 3.8) whilst the NOx channel sensitivity was stable (See Figure 3.9). The cylinder was therefore removed from the site for recalibration at Netcen on 17/5/04. Results of the cylinder recalibration showed that the NO concentration in the cylinder was stable and agreed well with the original calibration certificate.

The response problem was therefore due to an instrument fault and this was subsequently confirmed following an ESU report in May which identified a blocked ozone orifice. Provisional data for June 2004 indicate that response stability has improved following the repair but CMCU will need to confirm this with the up-to-date calibration data.

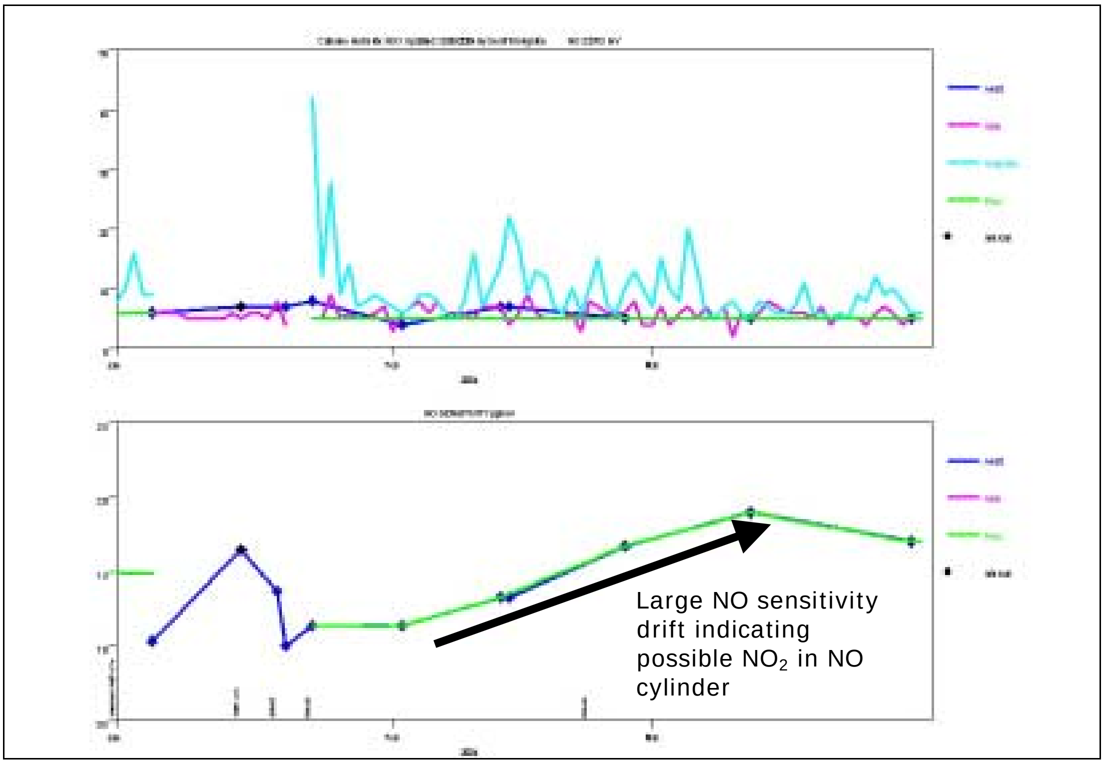

Figure 3.8 Camden Kerbside NO calibration sensitivity Jan-March 04

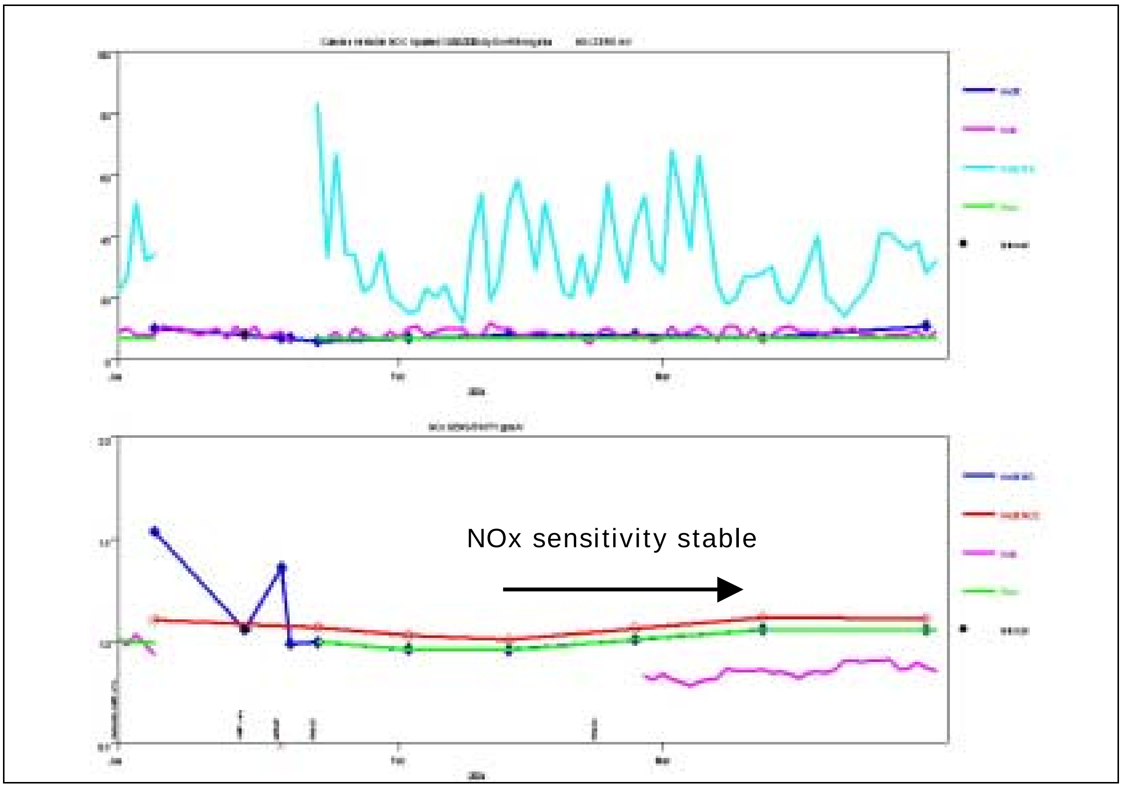

Figure 3.9 Camden Kerbside NOx calibration sensitivity Jan-March 04

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

Table 4.1 Sites with data capture below 90% January to March 2004
(Using the start date of any new site or end date of site closed)

Data Capture (%)		Start date	End date	Reason	Comments	Days	Hours
ENGLAND							
Birmingham Centre							
NO_2	87.5%	03-Feb-04	04-Feb-04	Telemetry	Problems with data logger and communications	0.9	22
		19-Feb-04	21-Feb-04	Telemetry	As above	1.7	41
		06-Mar-04	07-Mar-04	Analyser fault	Instrument fault	0.3	7
		09-Mar-04	11-Mar-04	ESU service	Service	2.3	54
		24-Mar-04	25-Mar-04	Power cut	Power cut	1	25
Birmingham East							
NO_2	82.6%	22-Feb-04	23-Feb-04	Power cut	Power cut	1.3	32
		11-Mar-04	25-Mar-04	Response drift	Step change in baseline and spurious low NOx response between routine calibrations	13.9	334
Blackpool							
NO_2	84.2%	26-Feb-04	11-Mar-04	NO_2 converter fault	Converter fault (89%) identified at audit. Data deleted to repair at service. See Section 2.5	13.9	333
SO_2	18.6%	11-Aug-03	14-Mar-04	High noise	History of high noise response All data deleted until new optical bench fitted at service	217	5198
Bristol Centre							
O_3	88.4%	21-Jan-04	26-Jan-04	Instrument fault	Ozone generator fault	4.7	113
		02-Feb-04	04-Feb-04	ESU service	Service	2.2	52
		02-Mar-04	04-Mar-04	Monitoring suspended	Odessa logger removed. Code activated switches installed	2.4	57
		31-Mar-04	31-Mar-04	No mV data	Data missing – no information provided	0.5	11
Bristol Old Market							
CO	60.0%	05-Feb-04	06-Feb-04	ESU service	ESU service	1	25
		25-Feb-04	31-Mar-04	Response truncation and analyser fault	CO zero baseline drifting downward in early February resulting in response truncation from 25/2/04. Analyser removed for repair of pump and cooling fan and reinstalled on 31/3/04	35	841

Bury Roadside							
General					Continuation of PC problems from previous period causing intermittent data loss especially in March. Fault due to corruption of PC configuration and resolved on 23 March.		
CO	81.5%	14-Jan-04	14-Jan-04	Logger fault	Intermittent PC fault	0.3	6
		22-Jan-04	23-Jan-04	Logger fault	As above	1	25
		03-Feb-04	03-Feb-04	Logger fault	As above	0.3	6
		10-Feb-04	11-Feb-04	ESU service	Service	1.1	27
		21-Feb-04	23-Feb-04	Logger fault	Intermittent PC fault	2.6	63
		06-Mar-04	06-Mar-04	Logger fault	As above	0.5	11
		14-Mar-04	23-Mar-04	Logger fault	As above	9.6	230
NO_2	84.6%	22-Jan-04	23-Jan-04	Logger fault	As above	0.7	16
		03-Feb-04	03-Feb-04	Logger fault	As above	0.3	6
		10-Feb-04	11-Feb-04	ESU service	Service	1.1	26
		06-Mar-04	06-Mar-04	Logger fault	Intermittent PC fault	0.5	11
		14-Mar-04	23-Mar-04	Logger fault	As above	9.6	230
O_3	73.5%	22-Jan-04	23-Jan-04	Logger fault	As above	0.7	16
		03-Feb-04	03-Feb-04	Logger fault	As above	0.3	6
		10-Feb-04	11-Feb-04	ESU service	Service	1.1	26
		04-Mar-04	25-Mar-04	Instrument fault	UV lamp fault	21.4	513
PM_{10}	79.7%	08-Jan-04	12-Jan-04	Operator error	Unstable response data deleted after routine filter change	4.3	102
		22-Jan-04	23-Jan-04	Logger fault	Intermittent PC fault	0.7	16
		03-Feb-04	03-Feb-04	Logger fault	As above	0.3	6
		10-Feb-04	11-Feb-04	ESU service	Service	1.1	26
		04-Mar-04	05-Mar-04	Logger fault	Intermittent PC fault	0.9	21
		06-Mar-04	06-Mar-04	Logger fault	As above	0.4	9
		14-Mar-04	23-Mar-04	Logger fault	As above	9.6	230
SO_2	54.3%	12-Jan-04	11-Feb-04	Instrument fault	Unstable data rejected due to series of UV lamp faults. UV lamp replaced	29.8	716
		06-Mar-04	06-Mar-04	Logger fault	Intermittent PC fault	0.5	11
		14-Mar-04	23-Mar-04	Logger fault	As above	9.6	230
Camden Kerbside							
NO_2	5.1%	05-Jan-04	05-May-04	Instrument fault	Blocked ozone orifice resulting in rapid NO sensitivity drift. See Section 3.6	122	2927
Coventry Memorial Park							
PM_{10}	89.3%	08-Dec-03	09-Jan-04	High noise	Site decommissioned on 8th January in order to install new equipment. TEOM response stability problems when site restarted. Improved after commissioning audit on 9/1/04.	32.3	776
Exeter Roadside							
CO	79.9%	31-Jan-04	17-Feb-04	Instrument fault	Chopper motor fault prior to service and excessive	17.5	419

					response drift after service. Analyser's processor board repaired. See Section 3.1.2		
SO_2	66.1%	03-Feb-04	04-Feb-04	ESU service	Service	1.3	30
		05-Mar-04	19-Apr-04	Sampling fault	Intermittent flow fault throughout period. Repair delayed due to Local Authority cost considerations. Flow control circuit board eventually replaced on 19/4/04.	45	1079
Harwell							
NO_2	89.3%	08-Jan-04	15-Jan-04	Instrument fault ESU service	Erratic data and response drift. Analyser replaced at service	7.3	174
		18-Feb-04	19-Feb-04	Power cut	Air conditioning problems causing site power to trip out	1	24
		23-Mar-04	24-Mar-04	Power cut	As above	0.9	21
High Muffles							
NO_2		Throughout	period	Autocal run on	Extreme autocalibration run on problem (18 ppb). 3 hours data deleted per day. Permeation bench and IZS valves cleaned on 8 January. ESU noted problem continuing in March (See Section 2.8)		
Hull Freetown							
NO_2	89.3%	01-Jan-04	07-Jan-04	Logger fault	Logger corrupted	6.6	159
		15-Jan-04	15-Jan-04	QAQC audit	QA/QC audit.	0.3	6
		20-Jan-04	22-Jan-04	ESU service	Service	2.1	50
O_3	83.9%	03-Jan-04	07-Jan-04	Logger fault	Logger corrupted	4.5	108
		15-Jan-04	15-Jan-04	QAQC audit	QA/QC audit.	0.3	6
		20-Jan-04	29-Jan-04	Unstable response	Unstable high concentration data deleted. Reconfigured correctly with photometer.	9.3	222
Ladybower							
NO_2	84.3%	09-Jan-04	21-Jan-04	Sampling fault	Sample line not connected to manifold.	12.4	297
		24-Feb-04	25-Feb-04	ESU service	Service	1.2	28
Leeds Centre							
O_3	88.9%	22-Mar-04	07-Apr-04	Instrument fault	Low data deleted due to lamp fault	16	383
Leicester Centre							
CO	81.0%	06-Jan-04	12-Jan-04	Unstable response	Unstable baseline response throughout period. New CO analyser installed as part of equipment up-grading exercise in June 2004.	6.6	159
		27-Jan-04	29-Jan-04	ESU service	Service	2.2	53
		16-Mar-04	18-Mar-04	Unstable response	Unstable baseline	2	49
		26-Mar-04	03-Apr-04	Unstable	Unstable baseline	8.5	205

				response			
London Bexley							
General					All analysers noisy during this period. New set of instruments installed 25th March and commissioned on 1/4/04.		
CO	82.5%	14-Jan-04	20-Jan-04	Instrument fault	IR source fault and faulty power supply.	5.5	133
		26-Jan-04	27-Jan-04	ESU service	Service	1.3	31
		23-Mar-04	31-Mar-04	Monitoring suspended	Monitoring suspended until new equipment installed.	8.5	205
NO_2	88.6%	26-Jan-04	27-Jan-04	ESU service	Service	1.3	30
		23-Mar-04	31-Mar-04	Monitoring suspended	As above	8.5	205
O_3	86.5%	26-Jan-04	29-Jan-04	ESU service	Service.	3.2	76
		23-Mar-04	31-Mar-04	Monitoring suspended	As above	8.5	205
PM_{10}	88.7%	26-Jan-04	27-Jan-04	ESU service	Service.	1.3	31
		23-Mar-04	31-Mar-04	Monitoring suspended	As above.	8.5	205
SO_2	86.2%	26-Jan-04	29-Jan-04	ESU service	Service and stabilisation time	3.6	86
		23-Mar-04	31-Mar-04	Monitoring suspended	As above.	8.5	205
London Eltham							
O_3	88.3%	05-Feb-04	13-Feb-04	Instrument fault	Cooling fan fault causing intermittent data loss	7.4	177
		26-Mar-04	29-Mar-04	Flat response	Flat response data nulled after LSO calibration	2.9	70
London Haringey							
O_3	84.7%	04-Feb-04	17-Feb-04	Sampling fault	Low response data deleted due to sample line/manifold fault. Sample inlet repositioned by LSO.	13.2	317
		12-Mar-04	13-Mar-04	Flat response	No mV data recorded	0.5	13
London Lewisham							
O_3	67.1%	09-Feb-04	09-Mar-04	Instrument fault	Spurious low response data investigated by ESU but no obvious fault. Replacement analyser installed.	29.6	710
London Marylebone Road							
SO_2	89.0%	12-Jan-04	19-Jan-04	Instrument fault	UV lamp fault caused by loose wires	7.5	181
		25-Jan-04	26-Jan-04	Power cut	Power failure	1.2	28
		27-Mar-04	27-Mar-04	Instrument fault	UV lamp and photomultiplier tube replaced.	0.4	9
London N. Kensington							
PM_{10}	85.5%	19-Jan-04	20-Jan-04	Unstable response	TEOM response unstable after QA/QC audit.	0.8	20
		18-Feb-04	01-Mar-04	High noise	High noise data deleted after LSO visit. Sensor unit replaced	12.1	291

					and insulator fitted on exposed sample tube.		
London Southwark							
CO	83.7%	10-Mar-04	24-Mar-04	Sampling fault	Glass manifold port broken whilst tightening a loose connection. Manifold repaired by ESU on 24/3/04	14.1	339
NO_2	78.8%	09-Mar-04	24-Mar-04	Sampling fault	As above	15.3	366
O_3	83.3%	10-Mar-04	24-Mar-04	Sampling fault	As above	14.1	339
SO_2	83.6%	10-Mar-04	24-Mar-04	Sampling fault	As above	14.1	338
London Westminster							
NO_2	50.4%	25-Nov-03	13-Feb-04	Converter fault	NOx converter fault (83%) found at audit. (See Section 2.5)	80.3	1928
		19-Feb-04	20-Feb-04	ESU service	Service	1.2	28
Newcastle Centre							
CO	68.2%	03-Mar-04	31-Mar-04	Power cut	Air conditioning problem causing site power to trip off	28.6	686
NO_2	68.1%	03-Mar-04	31-Mar-04	Power cut	Power cut	28.6	686
SO_2	68.2%	03-Mar-04	27-Apr-04	No calibrations	Power cut and no calibrations until end April 04.	55.6	1334
Norwich Centre							
CO	80.4%	29-Jan-04	13-Feb-04	Air conditioning	Air conditioning unit overheating causing site power cut followed by a chopper motor fault	15.1	363
		23-Feb-04	25-Feb-04	ESU service	Service	2.2	52
NO_2	82.1%	25-Jan-04	06-Feb-04	Air conditioning	Photomultiplier tube fault followed by site power cut	13	312
		17-Feb-04	18-Feb-04	Unstable response	Response stabilisation after site visit	0.5	11
		23-Feb-04	25-Feb-04	ESU service	Service	2.1	50
SO_2	89.7%	29-Jan-04	04-Feb-04	Air conditioning	Air conditioning fault causing power cut.	6.7	160
		23-Feb-04	25-Feb-04	ESU service	Service	2.1	51
Nottingham Centre							
CO	73.9%	14-Jan-04	16-Jan-04	Service	Service	2.3	54
		11-Mar-04	31-Mar-04	Instrument fault	Noisy data. Optical balance reset	20.4	489
NO_2	82.1%	22-Oct-03	16-Jan-04	Converter fault	NOx converter fault (90%) found at audit (See section 2.5)	86	2063
Plymouth Centre							
NO_2	67.8%	09-Jan-04	05-Feb-04	NO mV data	Intermittent NO_2 data loss due to site temperature problems. Instrument cooling fans, rack thermostat control and air conditioning adjusted.	27.5	659
		19-Feb-04	19-Feb-04	QAQC audit	QA/QC audit	0.3	6
		24-Feb-04	26-Feb-04	No mV data	Missing data due to	1.3	30

					temperature control problems		
Portsmouth							
PM_{10}	76.7%	21-Jan-04	10-Feb-04	Instrument fault	TEOM auxiliary flow fault after service. Mass flow controller replaced.	20	480
Reading New Town							
CO	88.6%	25-Jan-04	27-Jan-04	Sampling fault	Pump failure	1.7	40
		09-Feb-04	11-Feb-04	ESU service	Service	2.1	50
		20-Feb-04	23-Feb-04	PC/logger fault	PC crashed and rebooted	2.8	67
		19-Mar-04	22-Mar-04	PC/logger fault	PC crashed again and replaced	3.3	79
O_3	47.4%	06-Jan-04	08-Jan-04	Sampling fault	Faulty sample flow pump replaced	2.5	59
		09-Feb-04	25-Mar-04	Service and sampling fault	Low data deleted due to sampling leak after service	45.2	1084
SO_2	84.3%	09-Dec-03	02-Jan-04	Unstable response	Drifting response data deleted. Pre amp board and PMT high voltage reset. (See Section 3.2)	24.5	589
		07-Jan-04	08-Jan-04	No mV data	ESU on site to repair ozone analyser	0.8	18
		09-Feb-04	11-Feb-04	ESU service	Service	2.1	50
		20-Feb-04	23-Feb-04	PC/logger fault	PC crashed	2.8	67
		19-Mar-04	25-Mar-04	Unstable response	PC changed and UV lamp replaced	6.2	148
Rotherham Centre							
SO_2	85.6%	23-Jan-04	04-Feb-04	Unstable response	Unstable response caused by pump fault. Pump diaphragm replaced	12.6	302
Salford Eccles							
SO_2	83.1%	15-Jan-04	20-Jan-04	PC/logger fault	PC hard drive failure resulting in deletion of fragmented data set.	5.6	135
		01-Feb-04	08-Feb-04	ESU Service	Unstable data removed after service	8	192
Scunthorpe							
PM_{10}	82.6%	27-Feb-04	28-Feb-04	No mV data collected	No details provided.	0.9	21
		18-Mar-04	31-Mar-04	Monitoring suspended	Site closed for relocation	13.5	325
SO_2	83.5%	27-Feb-04	28-Feb-04	No mV data collected	No details provided	0.9	21
		18-Mar-04	31-Mar-04	Monitoring suspended	Site closed for relocation	13.5	325
Southampton Centre							
General					In general the CO and Ozone analysers have been unstable and unreliable since it was replaced in August 2003 (See section 3.1.4)		
CO	69.7%	03-Jan-04	16-Jan-04	Power cut	Power tripping out due to defective pump associated with	13.8	331

					benzene monitoring at site (3 days). Short circuit fixed. Also CO range fault. Detector signal adjusted.		
		06-Feb-04	16-Feb-04	Instrument fault	Reoccurrence of range fault. IR source and chopper wheel replaced	9.8	235
		14-Mar-04	17-Mar-04	ESU service	Service	3.3	80
O_3	67.2%	03-Jan-04	06-Jan-04	Power cut	Power cut as above	3.4	82
		21-Jan-04	21-Jan-04	Instrument fault	Spurious data deleted. Instrument reaction cell cleaned and sintered filter replaced	0.3	8
		01-Feb-04	24-Feb-04	Instrument fault	Data deleted due to main switching valve leak. Valve replaced	23.5	563
		15-Mar-04	17-Mar-04	ESU service	Service	2	48
SO_2	89.8%	03-Jan-04	09-Jan-04	Instrument fault	Permeation tube contamination. Analyser removed from site for thorough cleaning in workshop	5.8	140
		15-Mar-04	17-Mar-04	ESU service	Service	2	48
Southend-on-Sea							
CO	44.0%	10-Feb-04	19-May-04	High noise	High noise and negative data deleted. IR source and pump replaced in May. (See section 3.1.3)	99.3	2383
Southwark Roadside							
NO_2	6.0%	01-Jan-04	26-Mar-04	Converter fault	NOx converter failed at audit a (89%). See Section 2.5	85.6	2054
Stoke-on-Trent Centre							
CO	89.0%	02-Feb-04	11-Feb-04	Sampling fault and service	Leak found at audit. Analyser replaced at service	9	217
		06-Mar-04	06-Mar-04	No mV data collected	No details provided	0.4	9
		08-Mar-04	08-Mar-04	No mV data collected	No details provided	0.3	6
PM_{10}	27.3%	29-Jul-03	12-Feb-04	Low flow rate	Main flow leak (-38%) detected at audit. Low data rejected from summer service in July 03 until repair at service in Feb (See section 3.4.)	198	4757
		03-Mar-04	26-Mar-04	High noise	High noise data deleted	23.5	564
Sunderland							
SO_2	88.4%	17-Feb-04	27-Feb-04	Sampling fault	Sample inlet filter leak after LSO calibration	10.3	246
Thurrock							
NO_2	67.0%	01-Jan-04	30-Jan-04	Instrument removed for repair	Excessive instrument response drift. Analyser removed for repair.	29.5	708
PM_{10}	88.0%	15-Jan-04	24-Jan-04	High noise	High noise response. Filter reseated	8.4	201

		28-Jan-04	30-Jan-04	ESU service	Service	2.1	51
Wicken Fen							
NO_2	15.2%	12-Dec-03	17-Mar-04	Instrument fault	Baseline truncation after repair in mid-December until replacement analyser installed in March. (See Section 3.5)	95.7	2296
Wigan Leigh							
SO_2	33.6%	03-Jan-04	05-Jan-04	Power cut	Power cut	2	49
		03-Feb-04	15-Apr-04	No calibrations	No calibrations and step change in baseline. Audit showed 22% outlier. Data deleted until new cylinder installed in April.	73	1752
Wirral Tranmere							
NO_2	83.0%	24-Feb-04	10-Mar-04	Converter fault	Converter fault identified at audit (92.1%). See section 2.5	15.2	364
Wolverhampton Centre							
CO	84.8%	01-Feb-04	04-Feb-04	Instrument fault	Chopper motor failure	3.3	80
		22-Mar-04	31-Mar-04	Instrument fault	Further chopper motor failure. Motor replaced.	8.9	214

N IRELAND

Belfast Centre							
NO_2	88.0%	18-Mar-04	23-Mar-04	Monitoring suspended	Monitoring suspended over the weekend in order to renovate the exterior of the hut. Worked delayed by rain.	5.4	130
		29-Mar-04	30-Mar-04	ESU service	Service	1.3	30
Belfast Clara St							
PM_{10}	88.8%	10-Jan-04	13-Jan-04	No mV data	Communications problems resulting in data loss	3.9	93
		25-Jan-04	26-Jan-04	No mV data	As above	1	24
		29-Feb-04	29-Feb-04	No mV data	As above	1	24
		09-Mar-04	10-Mar-04	ESU service	Service	0.9	22
		27-Mar-04	28-Mar-04	No mV data	As above	1	24
		31-Mar-04	31-Mar-04	No mV data	As above	1	24
Derry							
NO_2	88.6%	14-Jan-04	14-Jan-04	No mV data	No details provided	0.3	7
		21-Feb-04	21-Feb-04	No mV data	No details provided	0.4	10
		10-Mar-04	10-Mar-04	QA/QC audit	Audit	0.3	6
		22-Mar-04	31-Mar-04	ESU service	Fault after service. Problem with span calibration	8.8	211
SO_2	89.6%	05-Feb-04	11-Feb-04	Sampling fault	Pump fault and hydrocarbon kicker replaced	5.7	136
		21-Feb-04	21-Feb-04	No mV data	No details provided	0.4	10
		22-Mar-04	25-Mar-04	ESU service	Service	2.8	68

Lough Navar							
O_3	0.4%	01-Jan-04	31-Mar-04	Sampling fault	Analyser power supply fault from 29th Nov. New box installed 3rd December however the sample manifold fan stopped resulting in spurious low data until the service on 31st March 2004	90.6	2175
SCOTLAND							
Edinburgh St Leonards							
NO_2	67.8%	22-Jan-04	20-Feb-04	NO2 converter fault	Converter fault (93%) identified at audit. See Section 2.5	29.1	698
Glasgow Centre							
CO	81.2%	01-Jan-04	10-Jan-04	Instrument fault	Chopper motor failure. Motor and IR lamp replaced.	9.5	227
		16-Feb-04	18-Feb-04	ESU service	Service	1.9	45
		12-Mar-04	17-Mar-04	Removed from site	Further chopper motor failure. Analyser returned to workshop for repair. Replacement analyser installed on 17/3/04	5.1	123
NO_2	81.4%	03-Feb-04	05-Feb-04	Instrument fault	Analyser not responding to span gas. Ozone generator fault.	1.6	39
		16-Feb-04	18-Feb-04	ESU service	Service	1.9	45
		18-Mar-04	31-Mar-04	Unstable response	Data deleted between routine calibrations due to spurious step change in baseline.	13	311
Grangemouth							
CO	31.0%	01-Oct-03	03-Mar-04	Baseline truncated	Baseline truncation. Data deleted until offset applied on 3/3/04. Analyser reconfigured to allow negative mV output in mid April.	155	3711
WALES							
Cardiff Centre							
O_3	89.1%	22-Jan-04	28-Jan-04	Unstable response	Unstable negative response after calibration	6.1	146
		28-Mar-04	02-Apr-04	Service	Service. Switched from Odessa logger to code activated switches.	4.8	116
Narberth							
General					As reported previously, continuing power supply problems until repair on 27 Feb 2004. Fault traced to loose connections on Ambirack power supply unit.		
NO_2	82.2%	01-Jan-04	05-Jan-04	Power cut	Power failure	4.5	108
		07-Jan-04	09-Jan-04	Power cut	As above	2	48
		20-Jan-04	21-Jan-04	Power cut	As above	0.6	14
		03-Feb-04	04-Feb-04	Power cut	As above	0.9	22

		21-Feb-04	21-Feb-04	Power cut	As above	0.5	11
		26-Feb-04	27-Feb-04	Power cut	As above. Ambirack main power feed and power supply connection repaired.	1.5	36
		22-Mar-04	24-Mar-04	ESU service	ESU service	2	48
O_3	85.7%	01-Jan-04	05-Jan-04	Power cut	Power failure	4.5	109
		07-Jan-04	09-Jan-04	Power cut	As above	2	47
		20-Jan-04	21-Jan-04	Power cut	As above	0.6	14
		03-Feb-04	04-Feb-04	Power cut	As above	0.9	22
		21-Feb-04	21-Feb-04	Power cut	As above	0.5	11
		26-Feb-04	27-Feb-04	Power cut	As above	1.5	36
		22-Mar-04	24-Mar-04	ESU service	Service	2	48
PM_{10}	8.2%	03-Sep-03	24-Mar-04	Unstable response	Data rejected as interface between temporary Ambirack and TEOM not configured correctly resulting in spurious low data. (Details in Oct-Dec 2003 ratification report)	204	4884
SO_2	70.7%	01-Jan-04	21-Jan-04	Power cut	Power failure	20.5	492
		03-Feb-04	04-Feb-04	Power cut	As above	0.9	22
		21-Feb-04	21-Feb-04	Power cut	As above	0.5	11
		24-Feb-04	24-Feb-04	Unstable response	Unstable response data deleted	0.5	12
		26-Feb-04	27-Feb-04	Power cut	Power failure	1.5	36
		22-Mar-04	24-Mar-04	ESU service	Service	2	48
Swansea							
NO_2	73.7%	20-Jan-04	10-Feb-04	Removed for repair	Molybdenum converter temperature fault. Analyser removed for repair.	21.1	507
		22-Mar-04	24-Mar-04	ESU service	Service	2.1	50
PM_{10}	8.0%	01-Jan-04	24-Mar-04	Low flow rate	TEOM major leak found at audit and confirmed at service. Low data deleted. Leak due to cracked plastic fitting at the mass flow controller. (See Section 3.3)	83.6	2007

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

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

Dumfries (Data capture 81.3%)

Filter exchange failures occurred on two occasions during this period resulting in data loss. Error codes R (filter temperature range) and P (elapsed sample time) were frequently recorded although none required rejection of data. The cause should be investigated by the ESU as data loss could occur if the problem persists. Since 27th April 2004 the Partisol unit has been connected to telemetry which should enable CMCU to identify any future operational problems more quickly.

Month	Comment	Data Loss
February	27th Feb – 4th March: filter exchange failure	7 days
March	22nd March – 1st April: filter exchange failure	11 days

Northampton (Data capture 87.9%)

Month	Comment	Data Loss
January	1st Jan: unexposed filter	1 day
March	13th – 22nd March: filter exchange failure	10 days

Progress towards the installation of telemetry at the Partisol sites has been carried forward at three more sites:

- London Westminster connected 9th March 2004
- Dumfries connected 27th April 2004
- Inverness connected 5th May 2004

Wrexham, Northampton and Brighton Roadside were already connected in 2003. The Partisol at Bournemouth needs to be connected via a mobile phone unit and this is still under investigation.

5 Ratified Data Capture Statistics

Table 5.1 provides the ratified data capture figures for each site for the 3-month period January to March 2004. Data capture values below 90% are shown in the shaded boxes.

Table 5.2 show the ratified AURN data capture for the 61 **critical sites** in the network.

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

Site	CO	NO_2	O_3	PM_{10}	$PM_{2.5}$	SO_2	Site Average
England							
Barnsley 12	-	-	-	-	-	98.4	98.4
Barnsley Gawber	97.5	97.1	97.7	-	-	97.6	97.5
Bath Roadside	98.2	95.8	-	-	-	-	97.0
Billingham	-	98.4	-	-	-	-	98.4
Birmingham Centre	90.3	87.5	93.8	94.0	-	94.0	91.9
Birmingham East	97.9	82.6	96.5	98.0	-	97.9	94.6
Blackpool	97.0	84.2	92.1	96.0	-	18.6	77.6
Bolton	96.8	96.8	96.8	94.8	-	96.8	96.4
Bottesford	-	-	99.6	-	-	-	99.6
Bournemouth	97.8	98.2	98.4	95.6	-	98.3	97.7
Bradford Centre	97.1	96.8	96.8	95.7	-	96.8	96.6
Brentford Roadside	92.8	99.4	-	-	-	-	96.1
Brighton Roadside	98.4	98.6	-	-	-	-	98.5
Brighton Roadside PM10	-	-	-	94.5	-	-	94.5
Bristol Centre	94.3	90.8	88.4	94.1	-	90.4	91.6
Bristol Old Market	60.0	98.2	-	-	-	-	79.1
Bury Roadside	81.5	84.6	73.5	79.7	-	54.3	74.7
Cambridge Roadside	-	97.8	-	-	-	-	97.8
Camden Kerbside	-	5.1	-	98.8	-	-	51.9
Canterbury	-	98.9	-	99.7	-	-	99.3
Coventry Memorial Park	99.3	99.2	99.2	89.3	-	99.5	97.3
Exeter Roadside	79.9	97.7	97.9	-	-	66.1	85.4
Glazebury	-	96.8	96.7	-	-	-	96.8
Great Dun Fell	-	-	99.3	-	-	-	99.3
Haringey Roadside	-	99.2	-	98.9	-	-	99.0
Harwell	-	89.3	95.7	97.3	97.3	95.7	95.1
High Muffles	-	86.7	99.3	-	-	-	93.0
Hove Roadside	98.3	97.0	-	-	-	98.3	97.8
Hull Freetown	91.8	89.3	83.9	91.0	-	91.4	89.5
Ladybower	-	84.3	97.8	-	-	97.8	93.3
Leamington Spa	99.2	92.8	99.5	99.5	-	99.3	98.0
Leeds Centre	95.1	92.1	88.9	97.4	-	96.9	94.1
Leicester Centre	81.0	96.3	96.6	96.5	-	94.2	92.9
Liverpool Speke	97.2	97.1	96.6	94.8	-	96.2	96.4
London A3 Roadside	98.4	98.2	-	98.3	-	-	98.3
London Bexley	82.5	88.6	86.5	88.7	-	86.2	86.5
London Bloomsbury	97.8	97.6	96.8	98.0	98.0	97.7	97.6
London Brent	98.2	92.8	98.2	98.1	-	98.2	97.1
London Bromley	99.6	97.9	-	-	-	-	98.8
London Cromwell Road 2	98.0	98.0	-	-	-	97.9	98.0
London Eltham	-	99.4	88.3	99.4	-	99.1	96.5
London Hackney	99.1	99.2	98.4	-	-	-	98.9
London Haringey	-	-	84.7	-	-	-	84.7

Site	CO	NO_2	O_3	PM_{10}	$PM_{2.5}$	SO_2	Site Average
London Harlington	93.5	99.7	99.8	99.9	-	-	98.2
London Hillingdon	96.7	96.7	96.8	96.4	-	96.8	96.7
London Lewisham	-	99.5	67.1	-	-	97.8	88.1
London Marylebone Road	97.8	97.8	96.7	96.9	98.0	89.0	96.0
London N. Kensington	98.8	99.0	99.0	85.5	-	91.6	94.8
London Southwark	83.7	78.8	83.3	-	-	83.6	82.3
London Teddington	-	98.2	98.3	-	-	98.3	98.2
London Wandsworth	-	99.1	99.0	-	-	-	99.1
London Westminster	97.9	50.4	94.2	90.1	-	97.7	86.1
Lullington Heath	-	92.9	92.7	-	-	95.3	93.7
Manchester Piccadilly	94.4	94.6	94.7	94.9	-	94.7	94.7
Manchester South	-	96.3	96.2	-	-	96.3	96.3
Manchester Town Hall	91.6	98.1	-	-	-	-	94.8
Market Harborough	97.8	93.4	98.0	-	-	-	96.4
Middlesbrough	98.6	92.9	98.6	94.3	-	98.8	96.6
Newcastle Centre	68.2	68.1	95.0	95.1	-	68.2	78.9
Northampton	99.3	97.0	98.5	97.0	-	99.2	98.2
Northampton PM10	-	-	-	87.9	-	-	87.9
Norwich Centre	80.4	82.1	92.4	92.3	-	89.7	87.4
Norwich Roadside	-	98.2	-	-	-	-	98.2
Nottingham Centre	73.9	82.1	96.5	96.8	-	96.7	89.2
Oxford Centre	97.9	96.0	-	-	-	97.9	97.3
Plymouth Centre	95.9	67.8	95.7	93.2	-	96.0	89.7
Portsmouth	97.5	96.3	96.8	76.7	-	94.8	92.4
Preston	95.9	92.6	97.2	96.1	-	97.1	95.8
Reading New Town	88.6	90.3	47.4	90.3	-	84.3	80.2
Redcar	96.9	97.0	97.1	97.2	-	97.1	97.1
Rochester	-	97.7	98.2	97.3	98.3	97.9	97.9
Rotherham Centre	-	98.9	99.4	-	-	85.6	94.6
Salford Eccles	91.6	91.5	90.5	90.3	-	83.1	89.4
Sandwell West Bromwich	97.2	98.1	97.7	-	-	98.1	97.8
Scunthorpe	-	-	-	96.3	-	97.4	96.9
Sheffield Centre	97.0	97.1	97.1	96.8	-	96.4	96.9
Sheffield Tinsley	98.0	98.0	-	-	-	-	98.0
Sibton	-	-	99.6	-	-	-	99.6
Somerton	-	91.9	97.5	-	-	-	94.7
Southampton Centre	69.7	93.1	67.2	91.2	-	89.8	82.2
Southend-on-Sea	44.0	96.7	97.1	96.9	-	96.9	86.3
Southwark Roadside	98.0	6.0	-	-	-	97.9	67.3
St Osyth	98.4	90.4	98.5	-	-	-	95.8
Stockport Shaw Heath	98.2	98.0	-	92.3	-	98.2	96.7
Stockton-on-Tees Yarm	92.9	97.8	-	97.2	-	-	95.9
Stoke-on-Trent Centre	89.0	91.6	96.3	27.3	-	92.5	79.3
Sunderland	-	-	-	-	-	88.4	88.4
Thurrock	90.4	67.0	96.9	88.0	-	96.7	87.8
Tower Hamlets Roadside	99.2	99.6	-	-	-	-	99.4
Walsall Alumwell	-	90.7	-	-	-	-	90.7
Walsall Willenhall	-	92.8	-	-	-	-	92.8
West London	98.2	98.2	-	-	-	-	98.2

Site	CO	NO_2	O_3	PM_{10}	$PM_{2.5}$	SO_2	Site Average
Weybourne	-	-	92.9	-	-	-	92.9
Wicken Fen	-	15.2	97.3	-	-	97.5	70.0
Wigan Leigh	95.7	95.5	94.9	95.5	-	33.6	83.0
Wirral Tranmere	97.1	83.0	97.3	96.9	-	92.2	93.3
Wolverhampton Centre	84.8	95.1	96.0	96.7	-	96.2	93.8
Yarner Wood	-	98.2	98.3	-	-	-	98.2
N Ireland							
Belfast Centre	92.0	88.0	92.0	90.8	-	90.2	90.6
Belfast Clara St	-	-	-	88.8	-	-	88.8
Belfast East	-	-	-	-	-	91.7	91.7
Derry	95.7	88.6	95.8	94.8	-	89.6	92.9
Lough Navar	-	-	0.4	99.4	-	-	49.9
Scotland							
Aberdeen	94.4	97.2	98.8	98.6	-	98.5	97.5
Bush Estate	-	93.7	97.8	-	-	-	95.8
Dumfries	98.4	98.4	-	81.3	-	-	92.7
Edinburgh St Leonards	97.0	67.8	97.2	96.7	-	97.0	91.1
Eskdalemuir	-	-	99.5	-	-	-	99.5
Glasgow Centre	81.2	81.4	96.3	96.7	-	90.1	89.2
Glasgow City Chambers	97.9	96.6	-	-	-	-	97.3
Glasgow Kerbside	97.2	97.0	-	91.2	-	-	95.1
Grangemouth	31.0	99.0	-	99.1	-	99.0	82.0
Inverness	96.5	98.4	-	95.6	-	-	96.8
Strath Vaich	-	-	96.2	-	-	-	96.2
Wales							
Aston Hill	-	91.4	98.3	-	-	-	94.8
Cardiff Centre	95.7	95.6	89.1	95.7	-	95.2	94.2
Cwmbran	98.5	98.4	98.6	99.1	-	98.5	98.6
Narberth	-	82.2	85.7	8.2	-	70.7	61.7
Port Talbot	-	92.4	93.2	92.6	-	93.2	92.9
Swansea	96.8	73.7	96.8	8.0	-	96.7	74.4
Wrexham	98.2	97.3	-	98.9	-	98.1	98.1
Number of sites	79	106	84	71	4	76	121
Number of sites < 90%	16	26	14	12	0	16	32
Network Mean (%)	**92.0**	**90.3**	**93.1**	**91.1**	**97.9**	**91.7**	**92**

Sites and instruments established between 01/1/2004 and 31/3/2004

Site	Instruments	Start Date
London Harlington	NO_2 CO O_3 PM_{10}	1/01/2004
Glazebury	NO_2	26/01/2004

Table 5.2 AURN Ratified Data Capture (%) for CRITICAL SITES January to March 2004

Critical Sites		CO	NO_2	O_3	PM_{10}	SO_2
AGGLOMERATIONS						
Belfast Centre	DEFRA	92.0	88.0	92.0		
Blackpool	DEFRA	97.0	84.2	92.1	96.0	18.6
Bournemouth	Affiliate	97.8	98.2	98.4	95.6	98.3
Brighton Roadside PM10	Affiliate	-	-	-	94.5	-
Bristol Centre	DEFRA		90.8	88.4	94.1	90.4
Cardiff Centre	DEFRA	95.7	95.6	89.1	95.7	95.2
Coventry Memorial Park	DEFRA	99.3	99.2	99.2	89.3	99.5
Edinburgh St Leonards	DEFRA	97.0	67.8	97.2	96.7	97.0
Glasgow Centre	DEFRA		81.4	96.3	96.7	90.1
Hove Roadside	Affiliate			-	-	98.3
Hull Freetown	DEFRA	91.8	89.3	83.9	91.0	91.4
Leicester Centre	DEFRA	81.0	96.3	96.6	96.5	94.2
Liverpool Speke	Affiliate	97.2	97.1	96.6	94.8	96.2
Newcastle Centre	DEFRA	68.2	68.1	95.0	95.1	68.2
Nottingham Centre	DEFRA	73.9	82.1	96.5	96.8	96.7
Portsmouth	Affiliate	97.5	96.3	96.8	76.7	94.8
Preston	DEFRA	95.9	92.6	97.2	96.1	97.1
Reading New Town	DEFRA	88.6	90.3	47.4	90.3	84.3
Sheffield Centre	DEFRA				96.8	
Southampton Centre	DEFRA	69.7	93.1	67.2	91.2	89.8
Southend-on-Sea	DEFRA	44.0	96.7	97.1	96.9	96.9
Stoke-on-Trent Centre	DEFRA	89.0	91.6	96.3	27.3	92.5
Swansea	Affiliate	96.8				
Wirral Tranmere	DEFRA	97.1	83.0	97.3	96.9	92.2
ZONES						
Aberdeen	Affiliate	94.4	97.2	98.8	98.6	98.5
Aston Hill	DEFRA	-	91.4	98.3	-	-
Barnsley Gawber	Affiliate	97.5	97.1	97.7	-	
Bush Estate	DEFRA	-	93.7	97.8	-	-
Canterbury	Affiliate	-		-	99.7	-
Cwmbran	Affiliate	98.5	98.4	98.6	99.1	98.5
Derry	Affiliate	95.7	88.6	95.8	94.8	89.6
Dumfries	DEFRA	98.4	98.4	-	81.3	-
Eskdalemuir	DEFRA	-	-	99.5	-	-
Glazebury	DEFRA	-	96.8	96.7	-	-
Grangemouth	Affiliate	31.0	99.0	-	99.1	99.0
Great Dun Fell	DEFRA	-	-	99.3	-	-
High Muffles	DEFRA	-	86.7	99.3	-	-
Inverness	DEFRA		98.4	-	95.6	-
Leamington Spa	Affiliate	99.2	92.8	99.5	99.5	99.3
Lough Navar	DEFRA	-	-	0.4		-
Narberth	Affiliate	-		85.7		
Northampton	Affiliate	99.3	97.0	98.5	97.0	99.2
Norwich Centre	DEFRA		82.1	92.4		
Oxford Centre	Affiliate	97.9		-	-	97.9
Plymouth Centre	DEFRA				93.2	
Scunthorpe	Affiliate	-	-	-	96.3	97.4
Sibton	DEFRA	-	-	99.6	-	-
Somerton	Affiliate	-	91.9	97.5	-	-

Critical Sites		CO	NO_2	O_3	PM_{10}	SO_2
St Osyth	DEFRA	98.4	90.4	98.5	-	-
Stockton-on-Tees Yarm	Affiliate	92.9	97.8	-	97.2	-
Strath Vaich	DEFRA	-	-	96.2	-	-
Sunderland	DEFRA	-	-	-	-	88.4
Thurrock	Affiliate		67.0	96.9		
Wicken Fen	DEFRA	-	15.2	97.3	-	
Wigan Leigh	Affiliate	95.7	95.5	94.9	95.5	33.6
Wrexham	DEFRA	98.2	97.3	-	98.9	98.1
Yarner Wood	DEFRA	-	98.2	98.3	-	-
Number of sites < 90%		8	13	7	4	7

Key [hatched] Pollutant monitored but not critical at this site
- Not monitored

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

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

PART B: Summer Intercalibration Results January to March 2004

PART B - Intercalibration Report for the Automatic Urban, Rural and London Networks, January to March 2004

6 Introduction

In Winter 2004, **netcen** undertook an intercalibration of 120 monitoring stations in operation in the defra and the Devolved Administrations sponsored Urban, Rural and London Monitoring Networks. (Although there were 121 operational sites in the network, Market Harborough site had just had a full site commissioning audit in December 2003 so this site was not revisited). This intercalibration has allowed data from all of the analysers in the networks to be harmonised to a single set of audit standards, thereby improving confidence in the accuracy, consistency and traceability of air pollution measurements made in the UK.

The tests were undertaken to cross-reference the individual data sets to common traceable calibration standards. This enabled the consistency of measurements throughout the network to be determined. The following major checks are made:

1. **Analyser accuracy and precision**, as a basic check to ensure reliable datasets from the analysers.
2. **Instrument linearity**, to check that doubling a concentration of gas to the analyser results in a doubling of the analyser signal response. If an analyser is not linear, data cannot be reliably scaled into concentrations.
3. **Instrument signal noise**, to check for a stable analyser response to calibration gases.
4. **Analyser response time**, to check that the analyser responds quickly to a change in gas concentrations.
5. **Leak and flow checks**, to ensure that ambient air reaches the analysers, without being compromised in any way.
6. **NOx analyser converter efficiency**, to ensure reliable operation. This is the device that allows the measurement of NO_2 to be undertaken, so it must work acceptably.
7. **TEOM k_0 evaluation**. The analyser uses this factor to calculate mass concentrations, so the value is calculated to determine its accuracy.
8. **Particulate analyser flow rate checks**, to ensure that the flow rates through critical parts of the analyser are within specified limits.
9. **SO_2 analyser hydrocarbon interference**, as certain hydrocarbons are known to interfere with the SO_2 detector.
10. **Evaluation of site cylinder concentrations**, using a set of **netcen** certified cylinders that are taken to all the sites. The concentrations of the site cylinders are used to scale pollution datasets, so it is important to ensure that the concentration of gas in the cylinder does not change.
11. **Competence of Local Site Operators** (LSO) in undertaking calibrations. As it is the calibrations by the LSOs that are used to scale pollution datasets, it is important to check that these are undertaken competently.

In addition to the above tests, a “Network Intercomparison” is conducted. This exercise utilises audit gas cylinders transported to each site in the Network. These cylinders have been recently calibrated by the Calibration Laboratory at **netcen**, and allow us to examine how different site analysers respond when they are supplied with the same gas used at other sites. For ozone analysers, the calibration is undertaken with recently calibrated ozone photometers.

The technique used to process the intercomparison results is broadly as follows:

- The analyser responses to audit gas are converted into concentrations, using provisional calibration factors obtained on the day of the intercalibration. This factor is also used for the provisional data supplied to the web/teletext.
- These individual results are tabulated, and statistical analyses undertaken (e.g. network average result, network standard deviation, deviation of individual sites from the network mean etc.)

These results are then used to pick out problem sites, or “outliers”, which are investigated further to determine reasons and investigate possible remedies for the outliers. The definition of an outlier is a site result that falls outside the following limits:

- ±10% of the network average for NOx, CO and SO_2 analysers,
- ±5% of the reference standard photometer for ozone analysers,
- ±2.5 % of the stated k_0 value for TEOM analysers,
- ±10% for particulate analyser flow rates,
- ±10% for the recalculation of site cylinder concentrations.

Thus, the intercalibration investigates the quality of provisional data output by the Management Units for use in forecasting, teletext and the web. It also provides input into the ratification process by highlighting sites where close scrutiny of datasets is likely to be required.

As stated earlier, any outliers that are identified are rigorously checked to determine the cause, and corrective action taken, if necessary. There are a number of likely main causes for outlier results, as discussed below:

- Drift of an analyser between scheduled LSO calibrations. This is by far the most common cause of an outlier result, and one that is simply corrected for during ratification of data.
- Drift of site cylinder concentrations between intercalibrations. Site cylinders can sometimes become unstable, especially at low pressures. All site cylinder concentrations are checked every six months, and are replaced as necessary.
- Erroneous calibration factors. It can occasionally happen that an analyser calibration is unsuccessful, and results in unsuitable scaling factors being used to produce pollution datasets. Again, these are readily identified and corrected for during ratification.
- Pressurisation of the sampling system at the audit. Occasionally, an analyser can be extremely sensitive to small changes in applied flow rates of calibration gas. This is more difficult to identify and correct, and may have consequences for data quality.

The procedures used to determine network performance are documented in **netcen** Work Instructions. These methods are regularly updated and improved and have been evaluated by the United Kingdom Accreditation Service (UKAS). **netcen** holds UKAS accreditation for the on-site calibration of all the analyser types (NOx, CO, SO_2, O_3) and for the determination of the TEOM k_0 factor, PM_{10} and $PM_{2.5}$ analyser flow rates used in the network. A UKAS Certificate of Calibration (Calibration Laboratory number 0401) for the Automatic Urban, Rural and London Networks is appended to this report.

A total of 120 sites were audited in this exercise. A new affiliate site, London Harlington was included in the intercalibration for the first time.

This section of the report identifies analysers that did not meet performance standards, investigates the possible causes of these results and recommends any remedial action required. A further section, outlining future performance requirements specified by the proposed CEN standards, is also included.

7 Results Summary

The results of the intercalibration are summarised in Table 7.1 below:

Table 7.1 – Summary of network performance

Parameter	Number of outliers	Number audited	% outliers in total
NOx analyser	34	105	32%
CO analyser	7	77	9%
SO_2 analyser	14	76	18%
Ozone analyser	22	85	26%
TEOM and BAM analysers	1 k_0, 10 flow	68 TEOM 1 BAM	16%
Gravimetric PM_{10} analysers	-	7	n/a
Total	88	419	21%

An outlier is defined as an analyser that shows a deviation from the network mean of greater than 10% for NOx, CO and SO_2 and 5% for O_3. For PM_{10} and $PM_{2.5}$ analysers, the flow rates must be within 10% of the specified limits and the TEOM k_0 factor must be within 2.5% of the stated value.

In addition to these results, 18 of the 364 site cylinders (~5%) used to scale instrument data into concentrations appeared to have drifted by more than 10% from their certificated values. Fifteen NOx converters were found to be outside the 95% acceptance limit.

The number of analyser outliers identified is slightly worse than the previous exercise. At the winter 2003 intercalibration 18% of the analysers in use were identified as outliers. Table 7.2 below presents a breakdown of the outliers identified, on a site-by-site basis:

Table 7.2 – Performance Breakdown

SITE	Date visited	NO_x	CO	SO_2	O_3	PM_{10}	$PM_{2.5}$
ENGLAND							
Barnsley 12	12/03			OK			
Barnsley Gawber	18/03	OK	OK	OK	Outlier -25%		
Bath Roadside	11/02	OK	OK				
Billingham	17/02	OK					
Birmingham Centre	26/02	Outlier –30%	OK	OK	OK	OK	
Birmingham East	30/03	OK	OK	OK	Outlier +8%	OK	
Blackpool	26/02	OK (CE 90%)	OK	OK	OK	OK	
Bolton	06/02	OK	OK	OK	Outlier -32%	OK	
Bottesford	13/01				OK		
Bournemouth	06/02	OK	Outlier –13%	OK	OK	OK	
Bradford Centre	30/03	OK	OK	Outlier +16%	OK	Outlier (flow)	
Brentford Roadside	23/01	Outlier +12%	OK				
Brighton Roadside	04/03	OK	OK				
Brighton Roadside PM_{10}	30/01					OK	
Bristol Centre	26/01	Outlier +11%	OK	OK	OK	Outlier (flow)	
Bristol Old Market	03/02	OK	OK				
Bury Roadside	12/03	OK	OK	Outlier –16%	OK	Outlier	

SITE	Date visited	NO_x	CO	SO_2	O_3	PM_{10}	$PM_{2.5}$
						(flow)	
Cambridge Roadside	16/02	OK					
Camden Kerbside	15/01	OK				OK	
Canterbury	21/01	OK				OK	
Coventry Memorial Park	09/01	OK	OK	Outlier +11%	Outlier -21%	OK	
Exeter Roadside	28/01	OK	OK	OK	OK		
Glazebury	26/01	Outlier –21%			Outlier -8%		
Great Dun Fell	23/03				OK		
Haringey Roadside	30/01	OK				OK	
Harwell	08/01	OK		Outlier +25%	Outlier -14%	OK	Outlier (flow)
High Muffles	18/02				OK		
Hove Roadside	04/03	OK	OK	OK			
Hull Freetown	15/01	Outlier +17%	OK	OK	OK	OK	
Ladybower	13/02	Outlier +51%		OK	OK		
Leamington Spa	30/03	Outlier –13%	OK	OK	Outlier+7%	OK	
Leeds Centre	10/03	OK	OK	Outlier –34%	Outlier –7%	OK	
Leicester Centre	12/01	Outlier –13%	Outlier –17%	Outlier –14%	OK	OK	
Liverpool Speke	01/03	OK	OK	OK	OK	OK	
London A3 Roadside	19/01	Outlier +31%	OK			OK	
London Bexley	22/01	OK	OK	OK	OK	OK	
London Bloomsbury	08/01	OK	OK	OK	OK	OK	OK
London Brent	20/01	OK	Outlier –18%	OK	OK	OK	
London Bromley	25/02	OK (CE 94%)	OK				
London Cromwell Road 2	16/03	Outlier –12%	OK	OK	OK		
London Eltham	25/03	Outlier +11%		Outlier –12%	OK	OK	
London Hackney	16/02	OK	OK		OK		
London Haringey	28/01				OK		
London Harlington	14/04	OK	OK		OK	OK	
London Hillingdon	07/01	OK	OK	OK	OK	OK	
London Lewisham	24/02	Outlier –16%		OK	OK		
London Marylebone Road	13/02	OK (CE 94.5%)	OK	OK	OK	OK	OK
London N. Kensington	19/01	OK	OK	OK	Outlier +6%	OK	
London Southwark	06/04	OK	OK	OK	OK		
London Teddington	01/03	Outlier –32%		Outlier +30%	Outlier –8%		
London Wandsworth	20/01	Outlier –13%			OK		
London Westminster	10/02	OK (CE 94%)	OK	OK	OK	OK	
Lullington Heath	05/03	OK		OK	Outlier +6%		
Manchester Piccadilly	27/01	OK (CE 94%)	OK	OK	Outlier +7%	OK	
Manchester South	12/02	OK (CE 93%)		OK	OK		
Manchester Town Hall	12/02	OK	OK				
Middlesbrough	16/01	Outlier –83%	OK	OK	OK	OK	
Newcastle Centre	18/02	OK	OK	OK	OK	OK	
Northampton	16/02	OK	OK	OK	OK	OK	
Northampton PM_{10} (Grav)	21/01					OK	

SITE	Date visited	NO_x	CO	SO_2	O_3	PM_{10}	$PM_{2.5}$
Norwich Centre	17/02	Outlier +39%	OK	Outlier +13%	OK	OK	
Norwich Roadside	19/02	OK					
Nottingham Centre	13/01	OK (CE 90%)	OK	OK	OK	OK	
Oxford Centre	07/01	OK	OK	Outlier +12%			
Plymouth Centre	27/01	Outlier –18%	Outlier +11%	OK	OK	OK	
Portsmouth	16/01	OK	OK	OK	OK	OK	
Preston	27/02	OK	Outlier –20%	OK	OK	OK	
Reading	04/02	OK	OK	Outlier -21%	Outlier –32%	Outlier (flow)	
Redcar	17/02	Outlier +16% (CE 94.5%)	OK	OK	Outlier +11%	OK	
Rochester	08/03	OK		OK	Outlier –19%	Outlier (flow)	OK
Rotherham Centre	01/04	Outlier –25% (CE 93%)		Outlier –16%	OK		
Salford Eccles	26/01	OK	OK	OK	OK	OK	
Sandwell West Bromwich	03/02	Outlier +29%	OK	OK	OK		
Scunthorpe	14/01			OK		OK	
Sheffield Centre	11/03	OK (CE 93%)	OK	OK	OK	Outlier (flow + k_0)	
Sheffield Tinsley	17/03	Outlier –11%	OK				
Sibton	22/01				OK		
Somerton	29/01	OK			OK		
Southampton Centre	17/02	OK	OK	OK	OK	OK	
Southend-on-Sea	25/03	OK	OK	OK	Outlier -10%	OK	
Southwark Roadside	17/03	OK (CE 89%)	OK	OK			
St Osyth	22/01	Outlier +24%	OK		Outlier –8%		
Stockport Shaw Heath	05/02	OK	OK	OK		Not tested	
Stockton-on-Tees Yarm	18/02	OK	OK			OK	
Stoke-on-Trent Centre	01/02	Outlier +12%	Outlier –29%	Outlier +12%	Outlier -21%	Outlier (flow)	
Sunderland	17/02			OK			
Thurrock	23/01	Not tested	OK	OK	OK	OK	
Tower Hamlets Roadside	02/04	OK (CE 94%)	OK				
Walsall Alumwell	22/03	OK					
Walsall Willenhall	15/03	OK					
West London	16/03	OK	OK				
Weybourne	18/02				OK		
Wicken Fen	16/02	Outlier –13%		OK	OK		
Wigan Leigh	01/04	OK	OK	OK	OK	OK	
Wirral Tranmere	24/02	OK (CE 92%)	OK	OK	OK	OK	
Wolverhampton Centre	22/03	OK	Outlier +20%	OK	OK	OK	
Yarner Wood	28/01	Outlier +20%			OK		
NORTHERN IRELAND							
Belfast Centre	08/03	OK	OK	OK	OK	Outlier (flow)	
Belfast Clara St	08/03					OK	
Belfast East	09/03			Outlier +14%			

SITE	Date visited	NO_x	CO	SO_2	O_3	PM_{10}	$PM_{2.5}$
Derry	10/03	OK	OK	OK	Outlier -20%	OK	
Lough Navar	11/03				Outlier +9%	OK	
SCOTLAND							
Aberdeen	14/01	Outlier +27%	OK	OK	OK	OK	
Bush Estate	09/02	Outlier –11%			OK		
Dumfries	03/02	OK (CE 94%)	OK			OK	
Edinburgh St Leonards	09/02	Outlier –22% (CE 93%)	OK	OK	Outlier –8%	OK	
Eskdalemuir	03/02				OK		
Glasgow Centre	07/02	Outlier –30%	OK	OK	OK	OK	
Glasgow City Chambers	04/02	Outlier +41%	OK				
Glasgow Kerbside	08/02	OK	OK			OK	
Grangemouth	06/02	Outlier –11%	OK	OK	OK	OK	
Inverness	11/01	Outlier –19%	OK			OK	
Strath Vaich	11/01				OK		
WALES							
Aston Hill	13/02	OK			OK		
Cardiff Centre	18/03	OK	OK	OK	OK	OK	
Cwmbran	19/03	Outlier +18%	OK	OK	Outlier +6%	Outlier (flow)	
Narberth	15/03	OK		OK	OK	Outlier (flow)	
Port Talbot	18/03	OK		OK	OK	OK	
Swansea	16/03	OK	OK	OK	OK	Outlier (flow)	
Wrexham	23/02	Outlier –28%	OK	OK		OK	

The following sections look at each pollutant in turn, and investigate causes for outliers.

8 Oxides of Nitrogen

8.1 Intercalibration Outliers

The intercalibration highlighted that the results from 34 sites were outside the ±10% acceptance limit from the network mean. These outliers can be broken down into various types, as presented below:

Ten outliers can be attributed to changes in the site cylinder concentrations, as listed below:

1. Brentford Roadside
2. Bristol Centre
3. Hull Freetown
4. Ladybower
5. London Eltham
6. Reading New Town
7. Redcar
8. Yarner Wood
9. Glasgow Centre
10. Glasgow City Chambers

This has been a significant cause of outliers at this exercise, and will be discussed in detail in the cylinder section. Data from all the affected sites has been carefully examined and rescaled as needed. No data have been lost as a result of the rescaling. A further 16 outliers can be attributed to drifts in calibration factors between LSO calibrations, and no data will be lost as a result of these findings.

The analysers at Sandwell West Bromwich, Wicken Fen, Leamington Spa and Somerton were all outliers as a result of instrument malfunctions at the time. Some data from all of these sites have been rejected as a result but only for Wicken Fen did the data capture fall below 90%.

The outliers at Bradford, London A3 and Preston appear to be due to the analysers exhibiting some differences in response when gas was introduced through the sample inlet, as opposed to the dedicated cylinder inlet. The data from the sites have been examined during ratification; it appears that the above responses do not affect measured concentrations unduly, and the data will be retained.

The analyser at Thurrock was unavailable at the time of the audit visit.

As detailed in the introduction of this section of the report, comparison of the network averages to audit cylinder concentrations showed that the network measures concentrations of NO to within 1% of the network standard and NO_2 concentrations to within 3.5%. The percentage standard deviations of these results, which is an indication of how close the results are grouped together, was less than 4.5% in both cases. These are very good results, and demonstrate that data from the vast majority of NOx analysers are accurate, harmonised and traceable to national metrology standards.

8.2 Leaking switching valves

This phenomenon has been observed as a significant cause of outliers in NOx analysers. When NO_2 gas is used for calibration, some analysers have been seen to produce a significant NO signal. This gives cause for concern, because a cylinder of NO_2 will be virtually 100% NO_2, very little NO will be present in the mixture.

Analysers that exhibit this behaviour could be underestimating concentrations of NO_2, as highlighted by the following five outliers:

1. Yarner Wood – measured 15 ppb NO in an NO_2 cylinder
2. Stockport – measured 42 ppb NO in an NO_2 cylinder
3. Wrexham – measured 11 ppb NO in an NO_2 cylinder
4. Birmingham Centre – measured 11 ppb NO in an NO_2 cylinder
5. Wigan Leigh – measured 14 ppb NO in an NO_2 cylinder

In addition, whilst not identified as outliers, the following sites also measured significant concentrations of NO:

1. Brent – measured 15 ppb NO in an NO_2 cylinder
2. Canterbury – measured 11 ppb NO in an NO_2 cylinder
3. Northampton – measured 14 ppb NO in an NO_2 cylinder
4. Bristol OM – measured 14 ppb NO in an NO_2 cylinder
5. Bournemouth – measured 20 ppb NO in an NO_2 cylinder
6. Glasgow Kerbside – measured 18 ppb NO in an NO_2 cylinder
7. Ladybower – measured 13 ppb NO in an NO_2 cylinder
8. Dumfries – measured 20 ppb NO in an NO_2 cylinder

9. London Bromley – measured 12 ppb NO in an NO_2 cylinder
10. Preston – measured 30 ppb NO in an NO_2 cylinder
11. Hove – measured 11 ppb NO in an NO_2 cylinder

These results are significantly worse than those found at the summer 03 exercise – only 8 analysers were seen to have this response.

The most likely cause for this observation is a leaking switching valve inside the analyser. The valves cycle the analysers between sampling NOx, NO and, on some models, reference gases, and any leaks within these systems appear to manifest themselves when calibrating the analysers with NO_2 gas. In many ways, this phenomenon is similar to the leaking main valve faults common to ozone analysers. Unfortunately, as the valves are inside the analysers, it is not possible for LSOs or QA/QC to leak check these valves.

Recommendation

It is therefore recommended that LSOs pay particular attention to the NO_2 calibration results, to see whether the NO response is significantly higher than that obtained for the zero calibration. These observations should be reported to CMCU as soon as possible.

These faults were highlighted to the ESU's in the weekly report e-mails during the intercalibration, to ensure that particular attention was paid to servicing and cleaning these switching valves during services, to try to minimise the occurrence of these outliers.

netcen will continue to monitor these results at audit visits.

8.3 Converter Tests

Fifteen converters were found to be less than 95% efficient:

- Blackpool - 90% (2 weeks data rejected)
- Dumfries – 94% (no data rejected)
- Edinburgh St Leonards – 93% (1 month data rejected)
- London Bromley – 94% (repeat offender - no data rejected)
- London Westminster – 83% (2.5 months data rejected)
- Manchester Piccadilly – 94% (no data rejected)
- Manchester South – 93% (no data rejected)
- Marylebone Road – 94% (no data rejected)
- Nottingham Centre – 90% (3 months data rejected)
- Redcar – 94% (no data rejected)
- Rotherham Centre – 93% (no data rejected)
- Sheffield Centre – 93% (no data rejected)
- Southwark Roadside - 89% (repeat offender – 3 months data rejected)
- Tower Hamlets Roadside – 94% (no data rejected)
- Wirral Tranmere – 92% (2 weeks data rejected)

The results at Dumfries, London Bromley, Manchester Piccadilly, Manchester South, Marylebone Road, Redcar, Rotherham and Tower Hamlets Roadside are borderline failures, and unlikely to affect data quality unduly. However, the data from the remaining sites were closely examined, and some data were rejected as a result, as noted above.

It is worth noting at this point that the future requirement for the performance of NOx analysers is likely to become much tighter. Converters will need to be at least 98% efficient to avoid data rescaling, and at least 95% efficient to avoid data rejection. These requirements are described in more detail in the CEN section of this report.

9 Carbon Monoxide

The intercalibration showed that the results from 7 analysers were outside the ±10% acceptance criterion. Of these, 4 can be attributed to drifts in calibration factors between LSO calibrations, and no data were lost as a result of this.

The analysers at Preston and Stoke on Trent Centre both failed leak tests, and it is likely that this has compromised the audit results. The data from the site have been examined during ratification. It appears that the above responses did affect measured concentrations at Preston unduly, but 9 days data were deleted due to the leak at Stoke-on-Trent.

The outlier at Wolverhampton is due to a change in the site cylinder concentration. Data from the site has been carefully examined and rescaled as needed.

Comparison of the network average to the audit cylinder concentration showed that the network underestimates CO concentrations by an average of 1%. The percentage standard deviation was 3.4%. These are very good results, and demonstrate that data from the CO analysers are accurate, harmonised and traceable to national metrology standards.

10 Sulphur Dioxide

10.1 Intercalibration Outliers

The intercalibration showed that the results from 14 analysers were outside the ±10% acceptance criterion. Of these, 8 can be attributed to drifts in calibration factors between LSO calibrations, and no data were lost as a result of this. A further 5 outliers arose as a result of a change in the concentrations of the site cylinders. Data from the affected sites have been carefully examined and rescaled as needed.

The analyser at Leeds Centre appears to be exhibiting some differences in response when gas was introduced through the sample inlet, as opposed to the dedicated cylinder inlet. The data from the site have been examined during ratification; it appears that the above responses do not affect measured concentrations unduly, and the data were retained.

Comparison of the network average to the audit cylinder concentration showed that the network measures SO_2 concentrations to within 1.6% of the network standard. The percentage standard deviation was 4.6%. These are very good results, and demonstrate that data from the SO_2 analysers are accurate, harmonised and traceable to national metrology standards.

10.2 m-xylene tests

The efficiency of the hydrocarbon “kicker” was evaluated with a 1 ppm m-xylene cylinder. The kicker selectively removes hydrocarbons from the sample inlet prior to analysis. This is an important test, because m-xylene behaves in a similar manner to SO_2 when exposed to UV light within the analyser, and could therefore interfere with the analyser response, if the kicker does not function properly.

To pass the test, the analyser must not respond by more than 1% (10 ppb) of the m-xylene cylinder concentration. However, it should be noted that this particular test is very demanding; typical ambient hourly maximum concentrations of this pollutant rarely exceed 50 ppb, and annual concentrations rarely exceed 5 ppb.

The following 27 analysers were outside the required standard:

1. Barnsley Gawber (15 ppb)
2. Blackpool (19 ppb – repeat offender)
3. Bolton (17 ppb)
4. Bury Roadside (22 ppb)
5. Hove Roadside (16 ppb)
6. Hull Freetown (22 ppb)
7. Ladybower (15 ppb)
8. London Bloomsbury (20 ppb)
9. London Brent (14 ppb)
10. London North Kensington (28 ppb – repeat offender)
11. Lullington Heath (21 ppb)
12. Manchester Piccadilly (18 ppb – repeat offender)
13. Manchester South (22 ppb – repeat offender)
14. Newcastle Centre (22 ppb – repeat offender)
15. Norwich Centre (18 ppb)
16. Nottingham Centre (27 ppb – repeat offender)
17. Rotherham Centre (36 ppb)
18. Sheffield Centre (19 ppb)
19. Southampton Centre (25 ppb – repeat offender)
20. Stockport Shaw Heath (20 ppb)
21. Stoke-on-Trent Centre (21 ppb)
22. Sunderland (14 ppb)
23. Derry (25 ppb – six time repeat offender)
24. Grangemouth (18 ppb – repeat offender)
25. Narberth (32 ppb – repeat offender)
26. Port Talbot (20 ppb)
27. Swansea (12 ppb)

The kicker at Derry has now been identified as outliers at five consecutive exercises, and it is again recommended that a replacement kicker is installed at these sites. Replacement of the other kickers that are repeat offenders should be considered.

These results are identical to the previous intercalibration, when 27 analyser kickers were also identified as outliers. However none of these results give immediate cause for concern. No data have been rejected, and no specific actions are required at present, other than the replacement recommendations at Derry and the other repeat offender sites.

To put these results into perspective, at the expected maximum ambient concentrations of m-xylene (50ppb), the worst kicker would show an interference response of around 1.5 ppb. There will be a future requirement that kicker response to 1ppm m-xylene <u>must</u> be lower than 1% (i.e. 10ppb SO_2), or data will need to be rejected. This is discussed further in the CEN section of this report.

11 Ozone

Calibration of the network analysers against the **netcen** reference photometers showed that 22 analysers were outside the ±5% acceptance criterion. This is similar to the previous exercise, where 23 of the analysers tested were identified as outliers.

The following 22 ozone analysers were outside the required ±5% acceptance criterion:

1	Barnsley Gawber	(-25%)
2	Birmingham East	(+7.7%)
3	Bolton	(+30%)
4	Coventry MP	(-20%)
5	Derry	(-20%)
6	Edinburgh St Leonards	(-7.4%)
7	Glazebury	(-7.7%)
8	Harwell	(-14%)
9	Leamington Spa	(+6.8%)
10	Leeds Centre	(-7%)
11	London N Kensington	(+6%)
12	London Teddington	(-8%)
13	Lullington Heath	(+6%)
14	Manchester Piccadilly	(+6%)
15	Reading New Town	(-31%)
16	Redcar	(+10%)
17	Rochester	(-18%)
18	Southend on Sea	(-10.2%)
19	St Osyth	(-8.4%)
20	Stoke-on-Trent	(-20%)
21	Cwmbran	(+6%)
22	Lough Navar	(+9%)

Of the 22 analysers, 12 had drifted by less than 10%; ratification of these datasets was straightforward, with no loss of data.

5 analysers had drifted between 10 and 20%. Ratification of the data from these analysers has been more complex, to ensure that suitable scaling of the data could be applied, but no losses of data were necessary.

The ozone analysers at Barnsley Gawber, Bolton, Coventry, Reading New Town and Stoke-on-Trent Centre all gave results greater than 20% from the reference photometers. These severe outliers can be indicative of potential problems or faults. The datasets have been carefully checked during ratification, to ensure the data can be scaled reliably. Fortunately, no data needed to be rejected as a result of these investigations.

12 Particulate analysers

12.1 TEOM k_0

There was one outlier for TEOM k_0 during this intercalibration. The analyser at Sheffield Centre was found to be 3.1% from its stated value. The history of the analyser will be examined, and the dataset will be rescaled as appropriate if a similar result is found at the summer 2004 audit. All other TEOM calibration factors were calculated to be within 2.5% of their stated values.

12.2 Analyser Flow Rates

The flow rates of the analysers at twelve sites were found to be outside the ±10% acceptance limit:

1.	Bradford Centre	(Total Flow –12.5%)
2.	Bristol Centre	(Main Flow –13%)
3.	Bury Roadside	(Main Flow –14.5%)
4.	Harwell ($PM_{2.5}$)	(Total Flow –13%)
5.	Reading New Town	(Main Flow –13%)
6.	Rochester	(Main Flow –10.8%)
7.	Sheffield Centre	(Main Flow –11.5%)
8.	Stoke-on-Trent Centre	(Main Flow –38%)
9.	Wolverhampton Centre	(Main Flow –25%)
10.	Belfast Centre	(Main Flow +13%)
11.	Cwmbran	(Main Flow +16%, Total Flow –14.5%)
12.	Swansea	(Main Flow –60%)

The analysers at Stoke on Trent Centre and Swansea also failed the leak tests. Close examination of the datasets showed these leaks had a significant effect on the data quality resulting in data loss at these sites. (See Section 3.3 and 3.4 in Part A).

The analyser at Stockport Shaw Heath malfunctioned during the audit.

$PM_{2.5}$ analysers at London Bloomsbury, London Marylebone Road, Harwell and Rochester were also audited during this intercalibration exercise. These analysers were found to be operating satisfactorily at all sites except for Harwell where the total flow was under-reading by 13%.

13 Site Cylinder Concentrations

During the intercalibration, the concentrations of the on-site cylinders were evaluated using the audit cylinder standards. The calculated results showed that 18 of the 364 cylinders (~5%) used to scale analyser data into concentrations (NO, CO and SO_2) appear to be outside the ±10% acceptance criterion. This is much worse than the summer 2003 roadshow, where less than 1% (3 cylinders) were outside the acceptance limits.

A significant number of outlying NO cylinders were identified (14 of the 18 cylinders) during this exercise. This is a cause for some concern: NO cylinders are usually very stable. There are a number of possible causes, as described below:

1. Contamination of the cylinder occurring during replacement. It is possible that, when the regulator is attached to a new cylinder, some contaminants can get into the system. This should be extremely unlikely, provided LSOs, ESUs and the netcen auditors follow the procedures for changing cylinders described in section 9.6 of the LSO manual.
2. The cylinder contents were unstable at delivery. This should also be very unlikely, as the cylinders are carefully checked before they are approved for despatch.

As part of a QC check, we recalled the three worst outlier NO cylinders (at Ladybower, Brentford Roadside and Glasgow City Chambers). Evaluation of the cylinder concentrations confirmed the results of the audits for all except the Glasgow cylinder, and data from these two sites have been rescaled accordingly. No data have been rejected as a result of these findings. The result from Glasgow City Chambers appears to be due to a fault during the audit, rather than a change in the site cylinder concentration. Data from this site were therefore not adjusted.

The results for the remaining cylinders will be carefully checked at the next intercalibration, and replacements issued if necessary.

In addition, the concentrations of 33 NO_2 cylinders appear to have drifted by more than 10%. These NO_2 cylinder concentrations are not, however, used for data scaling so there is no significant impact on data quality.

In total, 51 of the 364 cylinders (~14%) were outside the acceptance limits. This is worse than the previous intercalibration, where 8% of the cylinders were found to be out of specification.

The site cylinder evaluations are performed by calibrating the analysers with audit and site cylinder gas through the same inlet system, and using the conditioned site cylinder regulators, thus minimising any possible errors due to contaminated tubing or regulators.

Future requirements for the performance of site cylinders are likely to be much tighter than currently permitted. We plan that, with effect from the summer 2004 roadshow, the way the cylinder concentration database is managed will be changed to reflect these proposed requirements, as described below:

1. The current cylinder database, containing the original certified values, will be maintained as at present. Any subsequent changes would be referred back to this original data file.
2. The audits are currently used to evaluate whether the cylinders have drifted by more than 10% from the certified values. As we already have the capability to calibrate the cylinders on-site, we will use this to provide an updated cylinder concentration every six months. A detailed history of all the cylinders performance with time will be maintained, and criteria set for when a cylinder is removed from site. For example, a cylinder that is drifting by 2% every six months would still be acceptable, whereas a cylinder that has drifted by 20% in the same period may not be.

Based on an evaluation of the cylinder calibration history, decisions will be made on possible data rescaling and/or cylinder replacement, as necessary.

14 Site Information

We have compiled additional information about the monitoring stations in the network, including the types of sampling systems deployed on site.

Table 15.1 below presents information about the sampling systems deployed on site, together with accurate, validated grid references. Considerable effort has been made, both in compiling these grid references, and in ensuring the measurements are accurate to within 1 metre (it should be noted that the uncertainty of the GPS system used is typically the order of ±10 metres).

The following Table 15.1 presents the information collated to date:

Table 15.1 – Site Information

Site Name	Manifold type	Grid Reference	6 figure easting	6 figure northing
Aberdeen	Glass	NJ944074	394416	807408
Aston Hill	Glass			
Barnsley 12	Narrow-bore Teflon	SE343065	434276	406542
Barnsley Gawber	Wide-bore Teflon	SE325075	432529	407472
Bath Roadside	Narrow-bore Teflon	ST759661	375882	166069
Belfast Centre	Glass	TBA		
Belfast Clara St	N/A	TBA		
Belfast East	Narrow-bore Teflon	TBA		
Billingham	Glass	NZ470237	446962	523650
Birmingham Centre	Glass	SP063869	406342	286862
Birmingham East	Glass	SP115889	411536	288870
Blackpool	Wide-bore Teflon	SD323332	332320	433215
Bolton	TBA	SD710086	371000	408562
Bottesford	TBA	SK798377	479768	337654
Bournemouth	Narrow-bore Teflon	SZ123933	412320	93344
Bradford Centre	Wide-bore Teflon	SE166331	416615	433098
Brentford Roadside	Narrow-bore Teflon	TQ174780	517425	178074
Brighton Roadside	Glass	TQ313043	531307	104305
Brighton Roadside PM_{10}	N/A	TQ313043	531322	104302
Bristol Centre	Glass	ST594733	359427	173285
Bristol Old Market	Glass	ST596732	359570	173173
Bury Roadside	Glass	SD809048	380922	404772
Bush Estate	High Flow wide tube	NT246639	324626	663880
Cambridge Roadside	Narrow-bore Teflon	SL452582	545248	258155
Camden Kerbside	Narrow-bore Teflon	TQ268841	526786	184075
Canterbury	Narrow-bore Teflon	TR162573	616198	157330
Cardiff Centre	Glass	ST184765	318417	176505
Coventry Memorial Park	Wide-bore Teflon	SP328773	432801	277340
Cwmbran	TBA	ST305954	330510	195436
Derry	Wide-bore Teflon	TBA		
Dumfries	Narrow-bore Teflon	NX970763	297012	576278
Edinburgh St Leonards	Glass	NT263731	326250	673132
Eskdalemuir	Narrow-bore	NT235030	323528	603030

Site Name	Manifold type	Grid Reference	6 figure easting	6 figure northing
	Teflon			
Exeter Roadside	Stainless Steel	SX919928	291940	92840
Glasgow Centre	Wide-bore Teflon	NS589650	258902	665028
Glasgow City Chambers	Narrow-bore Teflon	NS595653	259528	665308
Glasgow Kerbside	Wide-bore Teflon	NS587652	258708	665200
Glazebury	Narrow-bore Teflon	TBA		
Grangemouth	Wide-bore Teflon	NS538810	293840	681032
Great Dun Fell	Narrow-bore Teflon	NY710322	371020	532190
Haringey Roadside	Narrow-bore Teflon	TQ339907	533885	190669
Harwell	Wide-bore Teflon	SU468860	446772	186020
High Muffles	Wide-bore Teflon	SE774939	477535	493865
Hove Roadside	Glass	TQ301045	530088	104484
Hull Freetown	Glass	TA095293	509478	429329
Inverness	Glass	NH657457	265720	845680
Ladybower	Wide-bore Teflon	SK166896	416575	389565
Leamington Spa	Glass	SP321659	465906	265906
Leeds Centre	Glass	SE300343	429976	434268
Leicester Centre	Glass	SK588041	458767	304075
Liverpool Speke	Glass	SJ439836	343860	383598
London A3 Roadside	Wide-bore Teflon	TQ190652	518983	165220
London Bexley	Glass	TQ519764	551852	176396
London Bloomsbury	Glass	TQ301820	530107	182041
London Brent	Glass	TQ196893	519570	189275
London Bromley	Narrow-bore Teflon	TQ405693	540533	169334
London Cromwell Road 2	Wide-bore Teflon	TQ265790	526530	178975
London Eltham	TBA	TQ440747	543978	174668
London Hackney	Wide-bore Teflon	TQ348862	534812	186230
London Haringey	Narrow-bore Teflon	TQ299891	529914	189132
London Harlington	TBA			
London Hillingdon	Glass	TQ082778	508294	177791
London Lewisham	TBA	TQ069786	506933	178607
London Marylebone Road	Glass	TQ376737	537637	173669
London N. Kensington	TBA	TQ280820	528049	181989
London Southwark	Glass	TQ240817	524049	178494
London Teddington	Glass	TQ323785	532299	178494
London Wandsworth	Narrow-bore Teflon	TQ155704	515538	170427

Site Name	Manifold type	Grid Reference	6 figure easting	6 figure northing
London Westminster	Glass	TQ258747	525778	174677
Lough Navar	Glass	TBA		
Lullington Heath	Wide-bore Teflon	TQ538016	553800	101600
Mace Head	Narrow-bore Teflon	TBA		
Market Harborough	Glass	TBA		
Manchester Piccadilly	Glass	SJ843983	384310	398325
Manchester South	Glass	SJ839858	383912	385828
Manchester Town Hall	Wide-bore Teflon	SJ839980	383874	397976
Middlesbrough	Glass	NZ505196	450480	519632
Narberth	Wide-bore Teflon	SN146127	214640	212700
Newcastle Centre	Glass	NZ250649	425016	564940
Northampton	Glass	SP761645	476111	264524
Norwich Centre	Wide-bore Teflon	TG231089	623078	308910
Norwich Roadside	Narrow-bore Teflon	TG235078	623460	307817
Nottingham Centre	Glass	SK574401	457420	340050
Oxford Centre	Wide-bore Teflon	SP514062	451366	206152
Plymouth Centre	Glass	SX477546	247742	54610
Port Talbot	Glass	SS780882	278036	188249
Portsmouth	Glass	SU657036	465686	103607
Preston	Wide-bore Teflon	SD552301	355248	430143
Reading	Wide-bore Teflon	SU734732	473441	173198
Redcar	Glass	NZ600246	459975	524563
Rochester	TBA	TQ831762	583133	176220
Rotherham Centre	Teflon coated metal	SK431930	443088	393028
Salford Eccles	Glass	SJ779987	377932	398713
Sandwell West Bromwich	Glass	SO597467	459720	246684
Scunthorpe	Narrow-bore Teflon	SE906107	490592	410689
Sheffield Centre	Glass	SE903108	490316	410837
Sheffield Tinsley	Glass	SK351869	435134	386885
Sibton	TBA	TBA		
Somerton	TBA	ST485265	348544	126525
Southampton Centre	Glass	SU426123	442565	112255
Southend-on-Sea	Wide-bore Teflon	TQ856861	585566	186130
Southwark Roadside	TBA	TQ346777	534621	177680
St Osyth	Glass	TM104132	610426	213205
Stockport Shaw Heath	Glass	SJ894896	389386	389604
Stockton-on-Tees Yarm	Wide-bore Teflon	NZ419129	441908	512886
Stoke-on-Trent Centre	Wide-bore Teflon	SJ883479	388348	347894

Site Name	Manifold type	Grid Reference	6 figure easting	6 figure northing
Strath Vaich	Wide-bore Teflon	NH348748	234829	874785
Sunderland	Narrow-bore Teflon	NZ399570	439895	556970
Swansea	Glass	SS656932	265566	193158
Thurrock	Glass	TQ610779	561018	177894
Tower Hamlets Roadside	Narrow-bore Teflon	TQ359822	535914	182230
Walsall Alumwell	Narrow-bore Teflon	SO994983	399374	298264
Walsall Willenhall	Glass	SO979012	397860	201173
West London	Wide-bore Teflon	TQ250788	525041	178751
Weybourne	Narrow-bore Teflon	TBA		
Wicken Fen	Wide-bore Teflon	TL563692	556310	269210
Wigan Leigh	Narrow-bore Teflon	SD578060	357825	406025
Wirral Tranmere	Wide-bore Teflon	SJ665998	366468	399842
Wolverhampton Centre	Glass	SJ321866	332096	386644
Wrexham	Glass	SO914989	391368	298942
Yarner Wood	Wide-bore Teflon	SJ329499	332862	349904

TBA – to be advised in a future report

The grid references quoted in the above table are obtained from GPS measurements, confirmed by reference to Ordnance Survey 1:25000 maps and internet street mapping services. The 6 figure easting and northing references are obtained from GPS measurements, quoted to 1 metre accuracy, and also referenced to internet street mapping services. It should be noted that these figures are likely to carry an uncertainty of ±10 metres.

It is suggested that Management Units check the accuracy of their databases and websites against these data, and provide feedback or update accordingly.

In subsequent reports, this table will be expanded to include: height of sampling inlet above the ground and altitude of the station above sea level.

15 CEN

The European Committee for Normalisation (CEN) have prepared a series of documents prescribing how analysers must be operated, to produce datasets that conform to the Data Quality Objectives of the EC Directives. The CEN documents for operation of air pollution analysers; ISO14211 (NOx), ISO14212 (SO_2), ISO14626 (CO) and ISO14625 (O_3) set out a series of performance criteria for analysers which must be achieved, both in the field and under laboratory conditions.

By way of example, the performance of an analyser in the field must pass a number of tests, including:

- Linearity – the analyser must have a maximum error at any point of less than 5% of the predicted value. This is much tougher to achieve than the current criteria (r^2 of 0.99 or better). Netcen has begun to record maximum residuals from linearity tests, to evaluate the performance of current analysers against these tougher requirements. These results will be reported in detail in the next intercalibration report.
- NOx converter efficiency must be better than 98%. Data may be rescaled for efficiencies between 95 and 98%, but rejected if below 95%. Again, this is tighter than currently, where we accept “borderline” failures. Netcen already use the CEN method for undertaking converter tests
- The sampling system that delivers air to the analyser must remove no more than 2% of the gas to be analysed. Netcen are currently trialling systems to calibrate sampling systems, but this is not currently undertaken on a routine basis in the UK
- The concentration of the site cylinders will need to be determined every six months, and the revised values used to scale ambient data. This is a change to our current procedures, where no action is taken until a cylinder deviates from its stated value by more than 10%. Netcen are currently in the process of introducing this new procedure. The uncertainty of this calculation will need to be substantially lower than the current 10% limit (in the order of 4-5% maximum).
- SO_2 response to a 1ppm meta xylene cylinder will need to be less than 1% (10ppb). This is the current requirement, but action is not taken unless the result is very high (>50ppb), or until an analyser repeats a failure six months later.

As yet, dates for the CEN requirements to become mandatory has not been agreed, but Netcen are taking steps to ensure the procedures used in the UK comply with the requirements ahead of any imposed deadlines.

16 Safety

netcen undertakes regular extensive risk assessments of all its activities on-site, to ensure that its staff are not exposed to unsafe practices while working.

There are no significant issues identified that presented significant risk during this intercalibration exercise. The issue of safe roof access, to audit PM_{10} analyser flow rates has largely been worked around. This has been achieved either by installing ladder securing points on the outside of the huts, or by auditing flow rates inside the monitoring station. However, performing flow measurements inside means that we are unable to perform leak tests on these analysers. For this reason, it would be useful if safer roof access (ladder securing points) could be considered for the following sites:

1. Blackpool
2. London Brent

3. Southend-on-Sea
4. Narberth

In addition, safe roof access is not possible at the following sites:

1. Bolton
2. Coventry Memorial Park

We will continue to monitor and report on safety at sites in subsequent audit reports.

17 Certification

The Network Certificate of Calibration is presented in Appendix B1. This certificate presents the results of the individual analyser scaling factors on the day of the audit, as calculated by **netcen** using the audit cylinder standards, in accordance with our UKAS accreditation.

18 Summary

The intercalibration exercise has demonstrated its value as an effective tool in determining overall site performance and assessing the reliability and traceability of air quality measurements from a large scale network. The results from this intercalibration have been used to assess data quality during the ratification of the network datasets for the 6-month period July to December 2003.

Appendix A1

As requested by the Department, QA/QC Unit has provided a list of suggestions for equipment that may need replacing or up grading in the network. The following provides a summary of the list and the actions taken to date since January 2004. Recommendations have been prioritised as follows:

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

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

	Recommendations January 2004	Priority	Action
1	Advice on requirements for further AURN equipment up-grades has been given to CMCU (20/1/04)		On-going
2	Recommend up-grade/modifications to SO_2 Ambirack bench at Blackpool and Norwich Centre to improve response noise. (Already done at Wirral Tranmere and Preston)	Blackpool Critical Site	Blackpool - new SO_2 bench fitted 9th March 2004
	Recommendations July 2004		
3	Recommend up-grading or modify SO_2 Ambirack bench at Reading New Town	Critical Site (Defra)	
4	Sheffield Tinsley CO noisy and drifting response. Recommend up-grade or repair	Medium	
5	Exeter Roadside CO unstable baseline. Recommend up-grading or repair.	Medium	

APPENDIX A2

CRITICAL SITES IN THE AURN (May 2004)

Table A1 Critical Sites in Agglomerations

Site Name	Agglomeration	Critical Pollutants		
		DD1	DD2[7]	DD3
Belfast Centre	Belfast Urban Area	NO_2	CO	NO_2 O_3
Wirral Tranmere	Birkenhead Urban Area	NO_2 PM_{10} SO_2	CO	NO_2 O_3
Blackpool	Blackpool Urban Area	NO_2 PM_{10} SO_2	CO	NO_2 O_3
Bournemouth+	Bournemouth Urban Area	NO_2 PM_{10} SO_2	CO	NO_2 O_3
Brighton Preston Park	Brighton/Worthing/Littlehampton			NO_2[6] O_3[6]
Brighton Roadside PM_{10} +	Brighton/Worthing/Littlehampton	PM_{10}		
Hove Roadside+	Brighton/Worthing/Littlehampton	SO_2		
Bristol Centre	Bristol Urban Area	PM_{10} SO_2		NO_2 O_3
Cardiff Centre	Cardiff Urban Area	NO_2 PM_{10} SO_2	CO	NO_2 O_3
Coventry Memorial Park+	Coventry/Bedworth	NO_2 PM_{10} SO_2	CO	NO_2 O_3
Edinburgh St Leonards	Edinburgh Urban Area	NO_2 PM_{10} SO_2	CO	NO_2 O_3
Glasgow Centre	Glasgow Urban Area	SO_2		NO_2 O_3
Hull Freetown	Kingston upon Hull	NO_2 PM_{10} SO_2	CO	NO_2 O_3
Leicester Centre	Leicester Urban Area	NO_2 PM_{10} SO_2	CO	NO_2 O_3
Liverpool Speke	Liverpool Urban Area	NO_2 PM_{10} SO_2	CO	NO_2 O_3
Nottingham Centre	Nottingham Urban Area	NO_2 PM_{10} SO_2	CO	NO_2 O_3
Portsmouth+	Portsmouth Urban Area	NO_2 PM_{10} SO_2	CO	NO_2 O_3
Preston	Preston Urban Area	NO_2 PM_{10} SO_2	CO	NO_2 O_3
Reading New Town	Reading/Wokingham Urban Area	NO_2 PM_{10} SO_2	CO	NO_2 O_3
Sheffield Centre	Sheffield Urban Area	PM_{10}		
Southampton Centre	Southampton Urban Area	NO_2 PM_{10} SO_2	CO	NO_2 O_3
Southend-on-Sea	Southend Urban Area	NO_2 PM_{10} SO_2	CO	NO_2 O_3
Swansea+	Swansea Urban Area		CO	
Stoke-on-Trent Centre	The Potteries	NO_2 PM_{10} SO_2	CO	NO_2 O_3
Newcastle Centre	Tyneside	NO_2 PM_{10} SO_2	CO	NO_2 O_3

"+ indicates Affiliate site"

Note 2: PM_{10} monitored by Gravimetric and TEOM
Note 3: DD3 Critical as Rural Background station
Note 4: If NO_2 at West Midlands is Suburban then NO_2 at Leamington Spa is no longer critical for DD1
Note 6: Not Affiliated/Monitoring yet.
Note 7: Addresses CO, Benzene not included here

Table A2 Critical Sites in Zones

Site Name	Zone	Critical Pollutant		
		DD1	DD2[7]	DD3
Grangemouth+	Central Scotland	NO_2 PM_{10} SO_2	CO	
Bush Estate	Central Scotland			NO_2 O_3
Northampton+	East Midlands	NO_2 PM_{10}[2] SO_2	CO	NO_2 O_3
Sibton	Eastern			O_3[3]
St Osyth	Eastern			NO_2 O_3
Norwich Centre	Eastern			NO_2 O_3
Wicken Fen	Eastern			NO_2 O_3
Thurrock	Eastern			NO_2 O_3
Fort William	Highland			NO_2[6] O_3[6]
Strath Vaich	Highland			O_3[3]
Inverness	Highland	NO_2 PM_{10}		
Sunderland Silkworth+	North East			NO_2[6] O_3[6]
Stockton-on-Tees Yarm+	North East	NO_2 PM_{10}	CO	
Sunderland	North East	SO_2		
Aberdeen+	North East Scotland	NO_2 PM_{10} SO_2	CO	NO_2 O_3
Aston Hill	North Wales			NO_2 O_3
Wrexham	North Wales	NO_2 PM_{10} SO_2	CO	
Great Dunn Fell	North West & Merseyside			O_3[3]
Wigan Leigh+	North West & Merseyside	NO_2 PM_{10} SO_2	CO	NO_2 O_3
Glazebury	North West & Merseyside			NO_2 O_3
Lough Navar	Northern Ireland			O_3[3]
Derry+	Northern Ireland	NO_2 PM_{10} SO_2	CO	NO_2 O_3
Eskdalemuir	Scottish Borders			NO_2[6] O_3
Dumfries	Scottish Borders	NO_2 PM_{10}	CO	
Canterbury+	South East	PM_{10}		
Oxford Centre+	South East	SO_2	CO	
Narberth	South Wales			O_3[3]
Cwmbran+	South Wales	NO_2 PM_{10} SO_2	CO	NO_2 O_3
Somerton	South West			NO_2 O_3
Yarner Wood	South West			NO_2 O_3
Plymouth Centre	South West	PM_{10}		
Leominster	West Midlands			NO_2[4 & 6] O_3[6]
Leamington Spa+	West Midlands	NO_2 PM_{10} SO_2	CO	NO_2 O_3
Barnsley Gawber+	Yorkshire & Humberside	NO_2	CO	NO_2 O_3
High Muffles	Yorkshire & Humberside			NO_2 O_3
Scunthorpe+	Yorkshire & Humberside	PM_{10}		

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

Note 2: PM_{10} monitored by Gravimetric and TEOM
Note 3: DD3 Critical as Rural Background station
Note 4: If NO_2 at Leominster is Suburban then NO_2 at Leamington Spa is no longer critical for DD1
Note 6: Not Affiliated/Monitoring yet
Note 7: Addresses CO, Benzene not included here

Appendix B1

Network Certificate of Calibration

netcen

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CERTIFICATE OF CALIBRATION

Culham, Abingdon, Oxfordshire OX14 3ED. Telephone 0870 1906465 Facsimile 0870 1906377

UKAS CALIBRATION 0401

0401 51

Certificate No: 01090

AEA Identification Number: 45077030

Approved Signatories: ✓ K. Stevenson
S. Eaton

Signed: Date:

Date of issue: 26 July 2004

Customer Name and Address: Dr Janet Dixon
AEQ Division
Department for Environment, Food and Rural Affairs
Ashdown House (Zone E14)
123 Victoria Street
London SW1E 6DE

Description: Calibration factors for monitoring stations in the Automatic Urban and Rural Monitoring Network

1. Carbon Monoxide

Date Year =2004	Site	Analyser number	[1]Zero output	Uncertainty (ppm)	[2]Calibration Factor	Uncertainty (%)	*R^2
	Scottish Sites						
14/01	Aberdeen	10269	0	0.3	1.025	3	0.9996
03/02	Dumfries	m300-1498	-8	0.3	0.010	3	0.9998
09/02	Edinburgh St Leonards	m300e-240	-1	0.3	1.083	3	0.9979
07/02	Glasgow Centre	gra410-009	-3	0.3	0.053	3	0.9999
04/02	Glasgow City Chambers	m300-721	-27	0.3	0.050	3	0.9994
08/02	Glasgow Kerbside	HAR 002	5	0.4	0.174	3	0.9996
06/02	Grangemouth	12894	0	0.3	1.047	3	0.9996
11/01	Inverness	12577	46	0.3	0.011	3	0.9997
	Welsh Sites						
18/03	Cardiff Centre	14333	-38	0.3	0.053	3	0.9995
19/03	Cwmbran	103006	0	0.3	1.271	3	1.0000
16/03	Swansea	93068	22	0.3	0.050	3	0.9992
23/02	Wrexham	1499	31	0.3	0.010	3	1.0000
	N.Irish Sites						
08/03	Belfast Centre	m491	50	0.3	0.051	3	0.9999
10/03	Derry	J-AR-009	18	0.3	0.055	3	0.9999

Date Year =2004	Site	Analyser number	[1]Zero output	Uncertainty (ppm)	[2]Calibration Factor	Uncertainty (%)	*R^2
	English Sites						
18/03	Barnsley Gawber		26	0.3	0.053	3	0.9998
11/02	Bath Roadside	11388	8	0.3	0.053	3	0.9998
26/02	Birmingham Centre	14418	-40	0.3	0.052	3	0.9996
30/03	Birmingham East	106006	0	0.3	1.047	3	0.9999
26/02	Blackpool	l-ar-010	1	0.3	0.044	3	0.9999
06/02	Bolton	2392	0	0.3	1.018	3	0.9998

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CERTIFICATE OF CALIBRATION

Culham, Abingdon, Oxfordshire OX14 3ED. Telephone 0870 1906465 Facsimile 0870 1906377

UKAS CALIBRATION
0401
0401 51

Certificate No: 01090

AEA Identification Number: 45077030

Date Year =2004	Site	Analyser number	[1]Zero output	Uncertainty (ppm)	[2]Calibration Factor	Uncertainty (%)	*R^2
06/02	Bournemouth	12558	0	0.3	1.231	3	0.9991
30/03	Bradford Centre		11	0.3	0.054	3	0.9998
23/01	Brentford Roadside	159	6	0.3	1.197	3	0.9981
04/03	Brighton Roadside	1434	0	0.3	1.089	3	0.9998
30/01	Bristol Centre	257	-20	0.3	0.053	3	0.9998
26/01	Bristol Old Market	co11m-121	93	0.3	0.07	3	0.9970
03/02	Bury Roadside	1357	0	0.3	0.949	3	0.9995
09/01	Coventry Memorial Park		0	0.3	1.036	3	0.9995
28/01	Exeter Roadside	2830-244	24	0.3	0.055	3	0.9992
04/03	Hove Roadside	1433	0	0.3	1.051	3	0.9996
15/01	Hull Freetown	m1809m489	47	0.3	0.049	3	0.9995
30/03	Leamington Spa	219B	25	0.3	0.049	3	0.9997
10/03	Leeds Centre	92543	37	0.3	0.047	3	0.9973
12/01	Leicester Centre	co11m150	11	0.3	0.057	4.6	0.9982
01/03	Liverpool Speke	m487	1076	0.3	0.0049	3	0.9997
19/01	London A3 Roadside	Ambirak H	-1	0.3	0.058	3	0.9974
22/01	London Bexley	828	9	0.3	0.052	3	0.9999
08/01	London Bloomsbury	14330	-1	0.3	0.051	3	0.9995
20/01	London Brent	1694	24	0.3	0.061	3	0.9998
25/02	London Bromley	37853-256	1	0.3	1.107	3	0.9995
16/03	London Cromwell Road 2	m300-868	10	0.3	0.051	3	0.9984
16/02	London Hackney	36674-254	69	0.3	0.048	3	0.9976
07/01	London Hillingdon	0410-005	-5	0.3	0.050	3	0.9999
13/02	London Marylebone Rd	651	0	0.3	1.027	3	0.9998
19/01	London N. Kensington	360	2	0.3	0.99	3	0.9998
06/04	London Southwark	3008-843	1	0.3	1.013	3	0.9999
10/02	London Westminster	867	10	0.3	0.051	3	0.9984
27/01	Manchester Piccadilly	0410-008	6	0.3	0.045	3	0.9994
12/02	Manchester Town Hall	720	6	0.3	0.050	3	0.9997
18/02	Middlesbrough	14202	1	0.3	0.986	3	0.9976
16/02	Newcastle Centre	m488	46	0.3	0.049	3	0.9996
21/01	Northampton	8905410102	0	0.3	1.091	3	0.9999
17/02	Norwich Centre		10	0.3	0.052	3	0.9999
13/01	Nottingham Centre		-2	0.5	0.046	3.5	0.9984
07/01	Oxford Centre	214b-127	104	0.3	0.044	3	0.9998
27/01	Plymouth Centre	h-rao-410	2	0.3	0.042	3	0.9999
16/01	Portsmouth	902015	0	0.3	1.091	3	0.9994
27/02	Preston	Ambirak N	6	0.3	0.067	3	0.9977
04/02	Reading New Town		4	0.3	0.052	3	0.9997
17/02	Redcar	10620	0	0.3	0.051	3	0.9997
26/01	Salford Eccles	2386	0	0.3	0.994	3	0.9997
03/02	Sandwell West Bromwich	94603	-8	0.3	0.051	3	0.9986
11/03	Sheffield Centre	410-006	8	0.3	0.084	3	0.9997
17/03	Sheffield Tinsley	m300-517	8	0.3	0.051	3	0.9999
17/02	Southampton Centre	m490	49	0.3	0.055	3	0.9979
25/03	Southend-on-Sea	0	12	0.3	0.06	3	0.9986
17/03	Southwark Roadside	14728	0	0.3	1.264	3	0.9957
05/02	Stockport Shaw Heath	1701	20	0.3	0.05	3	0.9998

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UKAS CALIBRATION

0401

0401 S1

Certificate No: 01090

AEA Identification Number: 45077030

Date Year =2004	Site	Analyser number	1Zero output	Uncertainty (ppm)	2Calibration Factor	Uncertainty (%)	*R^2
18/02	Stockton-on-Tees Yarm	m399	0	0.3	0.932	3	0.9988
01/02	Stoke-on-Trent Centre	11-AR-003	7	0.3	0.076	3	0.9974
23/01	Thurrock	262	14	0.3	0.05	3	0.9978
02/04	Tower Hamlets Roadside	272	4	0.3	1.088	3	0.9999
16/03	West London	m300-081	-11	0.3	0.056	3	0.9993
01/04	Wigan Leigh	6011	1	0.3	1.075	3	0.9998
24/02	Wirral Tranmere	0	0	0.3	0.049	3	0.9999
22/03	Wolverhampton Centre	mra0410-002	3	0.3	0.067	3	0.9988

2. Sulphur Dioxide

Date Year =2004	Site	Analyser number	1Zero output	Uncertainty (ppb)	2Calibration Factor	Uncertainty (%)	*R^2	*m-xylene interference (ppb)
	Scottish Sites							
14/01	Aberdeen	12182	0	4.2	1.116	6.9	0.9998	3.4
09/02	Edinburgh St Leonards	m100e-071	0	4.1	0.929	7.3	0.9982	8.4
07/02	Glasgow Centre	gra477018	-10	4.0	0.209	7.2	0.9994	
06/02	Grangemouth	702b-214	0	4.2	0.980	6.9	0.9996	17.6
	Welsh Sites							
18/03	Cardiff Centre	14319	-25	4.0	0.257	6.8	0.9994	9.8
19/03	Cwmbran	408001	5	4.2	1.128	6.9	0.9998	5.6
15/03	Narberth	H-RS458	35	4.3	0.970	6.9	0.9920	31.5
18/03	Port Talbot	943	1	4.2	1.133	6.9	1.0000	20.4
16/03	Swansea	93250	-5	4.0	0.220	6.8	0.9999	11.7
23/02	Wrexham	1181	16	4.0	0.200	6.6	1.0000	1.2
	N.Irish Sites							
08/03	Belfast Centre	ml-m637	220	4.1	0.178	5	0.9987	6.0
09/03	Belfast East	api-703	2	4.2	0.950	6.5	0.9990	2.4
10/03	Derry	J-AR-009	137	4.4	1.202	6.6	0.9979	24.6
	English Sites							
12/03	Barnsley 12	706	-2	4.2	1.218	6.9	0.9998	7.3
18/03	Barnsley Gawber	0	66	9.2	1.202	8.8	0.9984	15.0
26/02	Birmingham Centre	14352	-30	4.1	0.208	6.8	0.9999	
30/03	Birmingham East	301002	2	4.1	0.895	6.5	0.9999	4.3
26/02	Blackpool	L-AR-010	8	4.7	1.543	7.3	0.9996	19.3
06/02	Bolton	2344	11	4.3	1.046	7.0	0.9999	17.0
06/02	Bournemouth	12181	1	4.2	1.032	6.0	0.9995	7.3
30/03	Bradford Centre		90	4.2	1.261	6.9	0.9973	8.8
30/01	Bristol Centre	73	0	4.0	0.234	6.5	0.9955	9.4
03/02	Bury Roadside	1581	-3	4.2	1.216	6.6	0.9999	21.9
09/01	Coventry Memorial Park		0	4.2	1.005	6.5	0.9997	2.9
28/01	Exeter Roadside	9850-634	18	4.2	1.051	6.9	0.9991	10.5
08/01	Harwell	83	-7	4.1	0.549	6.9	0.9981	7.3
04/03	Hove Roadside	1178	0	4.2	1.111	6.9	0.9993	15.8
15/01	Hull Freetown	m1795m68	222	4.1	0.183	6.8	0.9946	22.3

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0401
0401 51

Certificate No: 01090

AEA Identification Number: 45077030

Date Year =2004	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*R^2	*m-xylene interference (ppb)
13/02	Ladybower	84	-5	4.1	0.592	6.9	0.9996	14.8
30/03	Leamington Spa	1793	18	4.2	1.000	6.0	0.9997	7.0
10/03	Leeds Centre	92385	11	4.2	0.340	6.9	0.9997	1.4
12/01	Leicester Centre	m100-204	16	4.2	0.214	6.7	0.9957	3.6
01/03	Liverpool Speke	9850b-m626	244	4.1	0.135	6.5	0.9973	9.6
22/01	London Bexley	ET#93031	-45	4.1	0.208	6.5	0.9999	2.4
08/01	London Bloomsbury	14323	-8	4.0	0.253	6.5	0.9991	19.7
20/01	London Brent	1828	21	4.2	0.986	6.9	0.9989	13.8
16/03	London Cromwell Road 2	m100a-704	5	4.2	1.078	6.6	0.9998	3.2
25/03	London Eltham	822	23	5.3	1.080	7.3	0.9995	10.0
07/01	London Hillingdon	77560-386	-5	4.0	0.168	7.0	0.9974	5.5
24/02	London Lewisham	m1220m498	1	4.3	0.939	6.9	0.9985	1.4
13/02	London Marylebone Rd	411	10	4.1	0.793	6.9	0.9982	5.4
19/01	London N. Kensington	1020	6	4.1	0.860	6.5	0.9991	28.4
06/04	London Southwark	4108-535	4	4.5	1.031	5.1	0.9998	
01/03	London Teddington	94739	2	4.2	0.837	6.9	0.9997	5.2
10/02	London Westminster	705	-7	4.2	1.020	5	0.9979	4.1
05/03	Lullington Heath	m1815m690	101	4.1	0.418	6.8	0.9996	20.9
27/01	Manchester Piccadilly	g-ea0477-013	-33	4.0	0.231	6.6	0.9997	18.0
12/02	Manchester South	E4770104	-10	4.0	0.240	6.8	0.9960	21.6
18/02	Middlesbrough	14166	-1	4.2	1.272	6.9	0.9998	7.2
16/02	Newcastle Centre	m689	270	4.1	0.312	6.8	0.9994	21.8
21/01	Northampton	890563033	-1	4.1	0.731	6.5	0.9984	1.0
17/02	Norwich Centre	Ambirak	68	16.4	3.269	13.0	0.9951	18.0
13/01	Nottingham Centre	0477-016	350	7.0	0.226	9.2	0.9946	27.1
07/01	Oxford Centre	376b-191	116	4.3	0.907	6.9	0.9988	7.7
27/01	Plymouth Centre	77561-386	-6	4.2	0.854	7.0	0.9992	3.2
16/01	Portsmouth	578323093	2	4.1	0.809	6.5	0.9994	1.2
27/02	Preston	Ambirak N	26	4.4	1.145	6.7	0.9992	3.1
04/02	Reading New Town		43	4.8	1.804	7.1	0.9977	7.7
17/02	Redcar	10355	7	4.3	0.970	6.9	0.9998	9.2
08/03	Rochester	m100-414	7	4.3	0.970	6.9	0.9999	4.4
01/04	Rotherham Centre	447-0109	-21	4.7	1.149	7.0	0.9978	35.9
26/01	Salford Eccles	2346	-3	4.2	0.974	6.6	0.9997	4.9
03/02	Sandwell West Bromwich	93082	0	4.1	0.888	6.0	0.9996	2.7
14/01	Scunthorpe	m100-468	2	4.1	0.933	6.6	0.9991	8.4
11/03	Sheffield Centre	477-015	-40	4.0	0.227	7.5	0.9998	18.9
17/02	Southampton Centre	m1676	233	4.0	0.209	5.1	0.9969	25.1
25/03	Southend-on-Sea	0	69	4.3	1.413	5	0.9945	7.1
17/03	Southwark Roadside	3008-659	-2	4.2	1.018	6.9	0.9969	0.4
05/02	Stockport Shaw Heath	659	22	4.3	0.989	6.6	0.9990	19.5
01/02	Stoke-on-Trent Centre	h-ar-003	53	6.2	1.294	7.9	0.9987	21.3
17/02	Sunderland	14321	-4	4.2	1.189	6.9	0.9986	14.3
23/01	Thurrock	m100a-555	-3	4.2	0.987	6.6	0.9999	5.9
16/02	Wicken Fen	14349	-26	4.3	0.662	6.6	0.9876	3.0
01/04	Wigan Leigh	2	-4	4.0	0.193	6.8	0.9938	0.3
24/02	Wirral Tranmere		21	4.4	1.854	6.7	0.9993	3.7

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AEA Identification Number: 45077030

Date Year =2004	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*R^2	*m-xylene interference (ppb)
22/03	Wolverhampton Centre	43c77563-386	-10	4.0	0.174	6.5	0.9997	

3. Ozone

Date Year =2004	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*R^2
	Scottish Sites						
14/01	Aberdeen	13073	0	3	0.987	3.1	0.9999
09/02	Bush Estate	77087-385	2	3	0.539	3.2	0.9998
09/02	Edinburgh St Leonards	m400e-136	0	3	1.099	3.1	0.9985
03/02	Eskdalemuir	m400e-148	0	3	0.506	3.1	0.9998
07/02	Glasgow Centre	0427-013	-14	3	0.195	3.2	0.9969
11/01	Strath Vaich	14339	17	3	0.489	3.1	1.0000
	Welsh Sites						
13/02	Aston Hill	14337	-6	3	0.507	3.1	1.0000
18/03	Cardiff Centre	14348	40	3	0.100	3.1	1.0000
19/03	Cwmbran	402009	4	3	0.941	3.2	1.0000
15/03	Narberth	H-RS458	-1	3	1.035	3.2	0.9997
18/03	Port Talbot	339	3	3	0.503	3.1	1.0000
16/03	Swansea	93221	13	3	0.102	3.1	1.0000
	N.Irish Sites						
08/03	Belfast Centre	m335	241	3	0.096	3.1	0.9994
10/03	Derry	J-AR-009	4	3	1.248	3.1	0.9991
11/03	Lough Navar	api-166	-13	3	0.457	3.1	1.0000
	English Sites						
18/03	Barnsley Gawber		3	3	1.330	3.5	1.0000
26/02	Birmingham Centre	14357	-5	3	0.102	3.1	0.9999
30/03	Birmingham East	301002	3	3	0.927	3.3	0.9999
26/02	Blackpool	L-AR-010	0	3	0.973	3.1	0.9996
06/02	Bolton	2371	0	3	0.757	3.2	0.9997
13/01	Bottesford	EA 357	5	3	1.001	3.3	0.9999
06/02	Bournemouth	10280	-1	3	0.987	3.1	1.0000
30/03	Bradford Centre		2	3	0.983	3.1	0.9999
30/01	Bristol Centre	155	7	3	0.102	3.1	1.0000
03/02	Bury Roadside	1453	1	3	1.028	3.2	0.9997
09/01	Coventry Memorial Park		0	3	1.266	3.3	0.9998
28/01	Exeter Roadside	9812-94	19	3	1.028	3.1	0.9999
26/01	Glazebury	367	86	13	0.487	5.8	0.9961
23/03	Great Dun Fell	API-400E-176	5	3	0.493	3.2	0.9999
08/01	Harwell	167	-5	3	0.564	3.1	0.9999
18/02	High Muffles	14343	-7	3	0.493	3.1	0.9999
15/01	Hull Freetown	m1819-m35	238	3	0.102	3.1	1.0000
13/02	Ladybower	147	3	3	0.485	3.2	1.0000
30/03	Leamington Spa	1469	20	3	0.939	3.1	0.9999
10/03	Leeds Centre	92386	-8	3	0.108	3.1	1.0000
12/01	Leicester Centre	m400-218	-13	3	0.101	3.5	0.9991
01/03	Liverpool Speke	9810b-m331	230	3	0.095	3.3	0.9999
22/01	London Bexley	ET#93033	8	3	0.105	3.1	1.0000
08/01	London Bloomsbury	14335	8	3	0.100	3.1	1.0000
20/01	London Brent	1608	21	3	0.967	3.3	0.9996

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Date Year =2004	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*R^2
25/03	London Eltham	375	8	3	0.989	3.1	0.9997
16/02	London Hackney	36870-254	20	3	0.207	3.1	0.9999
28/01	London Haringey	o341m-538	10	3	1.050	3.1	0.9999
07/01	London Hillingdon	0427-012	-8	3	0.098	5.8	0.9988
24/02	London Lewisham	939b-187	1	3	0.987	3.1	0.9998
13/02	London Marylebone Rd	769	1	3	1.036	3.1	1.0000
19/01	London N. Kensington	497	10	3	0.944	3.2	1.0000
06/04	London Southwark	5776	5	3	1.012	3.7	0.9999
01/03	London Teddington	58811-320	-23	3	0.236	3.2	1.0000
20/01	London Wandsworth	o341m-491	10	3	1.040	3.1	0.9999
10/02	London Westminster	879	10	3	0.524	3.1	1.0000
05/03	Lullington Heath	m1655-m337	100	3	0.464	3.2	0.9997
27/01	Manchester Piccadilly	427-017	15	3	0.186	3.1	0.9992
12/02	Manchester South	E4270102	-3	3	0.097	3.3	0.9997
16/01	Market Harborough		1	3	0.565	3.3	0.9997
18/02	Middlesbrough	14203	1	3	0.979	3.1	1.0000
16/02	Newcastle Centre	m357	238	3	0.098	3.2	0.9999
21/01	Northampton	8905240110	0	3	0.963	3.3	0.9998
17/02	Norwich Centre		0	3	1.036	3.1	0.9997
13/01	Nottingham Centre	0427-016	3	3	0.097	3.2	0.9999
27/01	Plymouth Centre	39525-251	-2	5.5	0.511	3.9	0.9996
16/01	Portsmouth	205002	2	3	0.977	3.2	1.0000
27/02	Preston	Ambirak N	0	3	1.039	3.1	0.9993
04/02	Reading		0	3	1.455	3.2	0.9966
17/02	Redcar	10195	-2	3	0.452	3.1	1.0000
08/03	Rochester	m400-378	8	3	1.230	3.2	0.9999
01/04	Rotherham Centre	d4270106	1	3	0.957	3.1	0.9996
26/01	Salford Eccles	2363	3	3	1.039	3.3	1.0000
03/02	Sandwell West Bromwich	m400121	1	3	0.516	3.1	1.0000
11/03	Sheffield Centre	427-010	33	3	0.100	3.2	0.9996
22/01	Sibton	169	2	3	0.979	3.2	0.9998
29/01	Somerton	m400-427	4	3	0.509	3.1	0.9999
17/02	Southampton Centre	m354	280	3	0.105	3.1	0.9999
25/03	Southend-on-Sea		0	3	1.118	3.1	0.9991
22/01	St Osyth	60869	0	3	0.545	3.1	1.0000
01/02	Stoke-on-Trent Centre	h-ar-003	1	3	1.265	3.5	0.9974
23/01	Thurrock	m400-1040	1	3	0.479	3.1	0.9999
18/02	Weybourne	195	0	3	1.009	3.2	0.9999
16/02	Wicken Fen	14345	-8	3	0.475	3.1	0.9998
01/04	Wigan Leigh	4009	2	3	1.005	3.2	0.9999
24/02	Wirral Tranmere		0	3	1.041	3.1	0.9988
22/03	Wolverhampton Centre	427-009	-18	3	0.097	3.1	1.0000
28/01	Yarner Wood	m400e-158	-15	3	0.517	3.5	1.0000

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0401
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Certificate No: 01090
AEA Identification Number: 45077030

4. Oxides of Nitrogen

Date Year =2004	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	[*]R^2	[*]Converter efficiency (%)
	Scottish Sites								
14/01	Aberdeen	NO	10268	0	5	0.817	5	1.0000	
		NOx		0	5.3	0.839	5	1.0000	97.5
09/02	Bush Estate	NO	42c-	-2	5	1.061	5	0.9999	
		NOx	77564-386	-3	5.4	1.048	5	0.9999	97.6
03/02	Dumfries	NO	m200a-	12	5	0.565	5	0.9997	
		NOx	1494	9	5.6	0.572	6.7	0.9998	94.6
09/02	Edinburgh St	NO	m200e-	1	5	1.786	5	0.9996	
	Leonards	NOx	073	1	5.5	1.847	5.3	0.9992	93.1
07/02	Glasgow Centre	NO	gra447-	5	5	0.652	5.2	0.9915	
		NOx	011	9	5.4	0.649	5.2	0.9920	96.6
04/02	Glasgow City	NO	m200a-	1	5	0.671	5	0.9972	
	Chambers	NOx	575	1	5.4	0.655	5	0.9955	97.2
08/02	Glasgow	NO	HAR 002	6	5	1.768	5	0.9979	
	Kerbside	NOx		6	6.2	1.792	5.3	0.9981	95.3
06/02	Grangemouth	NO		0	5	1.151	5.3	1.0000	
		NOx		2	5.8	1.142	5.1	1.0000	96.7
11/01	Inverness	NO	12184	6	5	0.508	5	1.0000	
		NOx		7	5.5	0.511	5	1.0000	95.6
	Welsh Sites								
13/02	Aston Hill	NO	13067	17	5	0.929	5	0.9975	
		NOx		11	5.3	0.929	5	0.9975	99.2
18/03	Cardiff Centre	NO	14325	18	5	0.660	5	0.9999	
		NOx		18	5.2	0.653	5	1.0000	98.6
19/03	Cwmbran	NO	406003	-3	5	0.998	5	0.9999	
		NOx		0	5.3	0.969	5	0.9998	98.3
15/03	Narberth	NO	H-RS458	39	5	0.750	5	0.9992	
		NOx		39	5.3	0.762	5.5	0.9990	96.0
18/03	Port Talbot	NO	320	1	5	1.215	5	1.0000	
		NOx		-1	5.3	1.223	5	1.0000	98.4
16/03	Swansea	NO	93249	-5	5	0.455	5	0.9999	
		NOx		-7	5.4	0.453	5	0.9999	98.1
23/02	Wrexham	NO	1490	5	5	0.527	5	1.0000	
		NOx		6	5.2	0.529	5	0.9998	95.4
	N.Irish Sites								
08/03	Belfast Centre	NO	ml-m733	244	5	0.492	5	1.0000	
		NOx		249	5.4	0.521	5	0.9999	95.2
10/03	Derry	NO	J-AR-009	50	5	1.944	5	0.9974	
		NOx		51	5.9	1.985	5	0.9981	96.1
	English Sites								
18/03	Barnsley	NO	Ambirak	68	5	3.991	8.1	0.9934	
	Gawber	NOx		68	7.7	4.036	7.7	0.9922	96.8
11/02	Bath Roadside	NO	12758	2	5	1.209	5	1.0000	
		NOx		2	5.3	1.198	5	0.9998	98.6
17/02	Billingham	NO	10440	0	5	1.110	5	0.9998	
		NOx		-1	5.3	1.125	5	0.9998	97.9
26/02	Birmingham	NO	14324	-73	5	0.451	5	0.9998	
	Centre	NOx		-89	5.3	0.448	5	0.9999	97.4
30/03	Birmingham	NO	209006	0	5	0.98	5	0.9999	
	East	NOx		2	5.3	0.979	5	0.9999	99.1
26/02	Blackpool	NO	L-AR-010	40	5	1.987	5	0.9992	
		NOx		41	5.6	1.953	5	0.9998	89.6
06/02	Bolton	NO	2359	0	5	1.130	5	0.9999	

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CERTIFICATE OF CALIBRATION

Culham, Abingdon, Oxfordshire OX14 3ED. Telephone 0870 1906465 Facsimile 0870 1906377

UKAS CALIBRATION 0401 0401 S1

Certificate No: 01090

AEA Identification Number: 45077030

Date Year =2004	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*R^2	*Converter efficiency (%)
		NOx		-1	5.4	1.122	5	0.9999	102.6
06/02	Bournemouth	NO	10279	2	5	1.205	5	0.9996	
		NOx		3	5.3	1.211	5	0.9996	98.2
30/03	Bradford Centre	NO		22	5	2.035	5	0.9989	
		NOx		23	6.2	2.168	5.5	0.9987	97.4
23/01	Brentford Roadside	NO	m1759-m712	-11	5	1.209	5	0.9981	
		NOx		-9	5.5	1.217	5	0.9996	96.7
04/03	Brighton Roadside	NO	1225	2	5	1.229	5	0.9999	
		NOx		2	5.3	1.186	5	0.9999	95.7
30/01	Bristol Centre	NO	77	45	5	0.494	5	0.9999	
		NOx		48	5.2	0.484	5	0.9999	99.4
26/01	Bristol Old Market	NO	m200a-653	-2	5	2.333	5	0.9999	
		NOx		-2	6.2	2.358	6.1	0.9999	95.2
03/02	Bury Roadside	NO	1210	8	5	1.162	5	0.9995	
		NOx		15	5.5	1.168	5	0.9991	102.7
16/02	Cambridge Roadside	NO	42C-55355-303	-1	5	0.109	5	0.9997	
		NOx		-11	5.2	0.108	5	0.9996	97.6
15/01	Camden Kerbside	NO	840	7	5	1.616	5	0.9975	
		NOx		8	5.3	1.037	5	0.9975	100.2
21/01	Canterbury	NO	11666	0	5	1.313	5	0.9998	
		NOx		2	5.4	1.330	5	0.9998	97.2
09/01	Coventry Memorial Park	NO		-3	5	0.923	5	0.9998	
		NOx		1	5.3	0.986	5	0.9999	98.4
28/01	Exeter Roadside	NO	9841a-85	21	5	2.134	5	0.9999	
		NOx		25	5.7	2.291	5.8	1.0000	99.0
26/01	Glazebury	NO	581b-256	55	5	0.531	5	0.9998	
		NOx		53	5.2	0.532	5	1.0000	95.9
30/01	Haringey Roadside	NO	397	2	5	1.599	5	0.9997	
		NOx		2	5.4	1.510	5	0.9997	95.5
08/01	Harwell	NO	78	31	7.3	1.553	5.9	0.9997	
		NOx		32	8.4	1.554	6.1	0.9997	100.0
18/02	High Muffles	NO	12553	20	5	0.513	5	0.9997	
		NOx		21	5.2	0.521	5	0.9998	97.5
04/03	Hove Roadside	NO	199	2	5	1.031	5	0.9997	
		NOx		2	5.3	1.005	5	0.9998	98.7
15/01	Hull Freetown	NO	m8103-m73	234	5	0.686	5.3	0.9995	
		NOx		236	5.6	0.695	5	0.9996	95.8
13/02	Ladybower	NO	72	3	5	0.307	5	0.9994	
		NOx		-1	5.2	0.469	5	0.9998	100.8
30/03	Leamington Spa	NO	1705	23	5	2.723	5	0.9999	
		NOx		21	5.9	2.773	5	1.0000	104.3
10/03	Leeds Centre	NO	93098	3	5	0.648	6.1	0.9998	
		NOx		0	5.2	0.640	5.1	0.9998	97.3
12/01	Leicester Centre	NO	m200-106	0	5	0.445	5	0.9992	
		NOx		2	7	0.439	5.5	0.9995	97.4
01/03	Liverpool Speke	NO	9841b-m734	259	5	0.442	5	0.9974	
		NOx		268	7	0.445	5	0.9974	97.0
19/01	London A3 Roadside	NO		65	5	2.100	5	0.9954	
		NOx		65	7.8	2.144	5.5	0.9962	97.6
22/01	London Bexley	NO	ET#93032	-5	5	0.388	5	0.9998	
		NOx		-5	5.2	0.377	5	0.9998	100.3
08/01	London Bloomsbury	NO	14328	-22	5	0.390	5	0.9996	
		NOx		-16	5.3	0.384	5	0.9998	96.9
20/01	London Brent	NO	1852	23	5	2.425	5.2	0.9993	

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0401
0401 S1

Certificate No: 01090

AEA Identification Number: 45077030

Date Year =2004	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*R²	*Converter efficiency (%)
		NOx		27	6.2	2.448	5.3	0.9999	100.0
25/02	London Bromley	NO	10669	1	5	1.346	5	0.9997	
		NOx		1	5.4	1.361	5.3	0.9998	93.7
16/03	London Cromwell Rd 2	NO	m200a-844	-2	5	2.577	5	0.9998	
		NOx		5	7.8	2.684	5	0.9998	96.5
25/03	London Eltham	NO	307	2	5	1.207	5	0.9991	
		NOx		8	5.7	1.119	5.1	0.9990	97.5
16/02	London Hackney	NO	532b-2343	138	5	1.299	5	0.9983	
		NOx		158	5.9	1.419	5	0.9984	96.2
07/01	London Hillingdon	NO	gra0447-010	-26	5	0.417	5	0.9988	
		NOx		-21	5.4	0.430	5	0.9986	102.6
24/02	London Lewisham	NO	m1231-m530	0	5	1.294	5.2	1.0000	
		NOx		3	5.6	1.376	6.3	0.9999	96.2
13/02	London Marylebone Rd	NO	439	3	5	1.939	5	0.9992	
		NOx		0	5.5	1.907	5	0.9998	94.5
19/01	London N. Kensington	NO	459	2	5	1.097	5	0.9999	
		NOx		3	5.3	1.037	5	0.9997	95.6
06/04	London Southwark	NO	m200e-197	-7	5	1.018	5	0.9999	
		NOx		-4	5.6	1.027	5	1.0000	98.3
01/03	London Teddington	NO	94550	2	5	0.967	5	0.9985	
		NOx		-1	5.3	0.963	5	0.9985	97.1
20/01	London Wandsworth	NO	378	2	5	1.198	5	0.9999	
		NOx		3	5.3	1.005	5	0.9998	96.8
10/02	London Westminster	NO	573	2	5	2.133	5	0.9968	
		NOx		1	5.6	2.128	5	0.9974	83.1
05/03	Lullington Heath	NO	m1657-m675	101	5	1.069	5.5	0.9998	
		NOx		100	5.4	1.079	6.1	0.9996	99.6
27/01	Manchester Piccadilly	NO	g-ra04-47-006	-11	5	0.416	5	0.9991	
		NOx		-13	5.7	0.398	5	0.9996	93.8
12/02	Manchester South	NO	J-RA0447-008	-10	5	0.510	5	0.9999	
		NOx		4	5.4	0.516	5	1.0000	92.8
12/02	Manchester Town Hall	NO	846	0	5	2.500	5	0.9970	
		NOx		3	5.8	2.549	5.7	0.9970	95.4
16/01	Market Harborough	NO	42c-61963-333	-4	5	0.418	5	0.9998	
		NOx		-5	5.2	0.427	5	0.9997	99.5
18/02	Middlesbrough	NO	13160	0	5	1.189	5	0.9998	
		NOx		0	5.3	1.192	5	0.9998	99.8
16/02	Newcastle Centre	NO	m730	247	5	0.450	5	1.0000	
		NOx		238	5.5	0.456	5.1	1.0000	98.6
21/01	Northampton	NO	8513180611	1	5	0.986	5	0.9999	
		NOx		3	5.3	0.920	5	0.9999	101.5
17/02	Norwich Centre	NO	Ambirak	77	5	1.334	5	0.9965	
		NOx		78	5.6	1.384	5	0.9955	98.1
19/02	Norwich Roadside	NO	206	1	5	1.487	5	0.9984	
		NOx		0	5.8	1.482	5	0.9988	98.2
13/01	Nottingham Centre	NO	gra0447-009	-4	5	0.446	5	0.9989	
		NOx		-5	5.2	0.437	5	0.9990	90.8
07/01	Oxford Centre	NO	411b-179	99	5	1.128	5	0.9996	
		NOx		103	5.8	1.179	5	0.9993	96.2
27/01	Plymouth Centre	NO	42c-66639-353	-1	5	1.913	5	0.9999	
		NOx		0	5.9	2.028	5.2	1.0000	98.4
16/01	Portsmouth	NO	903005	0	5	0.982	5	0.9995	
		NOx		-1	5.3	0.972	5	0.9995	98.9
27/02	Preston	NO	SP00656 D	15	5	1.845	5	0.9995	

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0401
0401 S1

Certificate No: 01090
AEA Identification Number: 45077030

Date Year =2004	Site		Analyser number	1 Zero output	Uncertainty (ppb)	2 Calibration Factor	Uncertainty (%)	* R^2	* Converter efficiency (%)
		NOx		16	5.5	1.864	5	0.9991	96.7
04/02	Reading New	NO		11	5	1.195	5	0.9986	
	Town	NOx		12	5.5	1.207	5	0.9984	98.5
17/02	Redcar	NO	10196	1	5	1.094	5	0.9999	
		NOx		1	5.3	1.110	5	0.9999	94.7
08/03	Rochester	NO	473	0	5	1.306	5	1.0000	
		NOx		0	5.4	1.312	5	1.0000	95.4
01/04	Rotherham	NO	q-ra0447-	0	3	1.299	5	0.9993	
	Centre	NOx	001	1	5.5	1.270	5	0.9997	93.3
26/01	Salford Eccles	NO	2381	-1	5	0.979	5	1.0000	
		NOx		3	5.4	1.147	5	0.9994	100.5
03/02	Sandwell West	NO	93081	-1	5	1.084	5	0.9999	
	Bromwich	NOx		1	5.5	1.084	5	0.9997	98.4
11/03	Sheffield Centre	NO	GRA04747	-12	5	0.367	5	0.9999	
		NOx	008	-13	5.2	0.371	5	0.9999	93.1
17/03	Sheffield	NO	m200a-	-6	5	2.464	5	0.9999	
	Tinsley	NOx	847	-7	5.8	2.462	5	0.9999	95.6
29/01	Somerton	NO	m200a-	6	5	0.473	5	0.9998	
		NOx	2120	6	5.2	0.486	5	0.9995	97
17/02	Southampton	NO	m723	248	5	0.419	5	0.9971	
	Centre	NOx		267	5.4	0.422	5	0.9973	96.5
25/03	Southend-on-	NO		46	5.2	2.160	6.5	0.9974	
	Sea	NOx		49	6.1	2.254	5	0.9966	103.1
17/03	Southwark	NO	12132	2	5	1.053	5	0.9970	
	Roadside	NOx		1	5.3	1.065	5	0.9975	89
22/01	St Osyth	NO	60988	-1	5	0.381	5	0.9998	
		NOx		-3	5.2	0.427	5	0.9998	99.1
05/02	Stockport Shaw	NO	1853	19	5	2.607	5	0.9993	
	Heath	NOx		21	6.7	2.721	5	0.9991	96.7
18/02	Stockton-on-	NO	118	-5	5	1.032	5	0.9999	
	Tees Yarm	NOx		-4	5.4	1.030	5	0.9998	96.1
01/02	Stoke-on-Trent	NO	H-AR-003	17	5	2.767	5	0.9990	
	Centre	NOx		17	5.9	2.779	5	0.9995	95.8
23/01	Thurrock	NO	m200a-		Analyser	unavailable	for	testing	
		NOx	920						
02/04	Tower Hamlets	NO	306	2	5	1.365	5	0.9998	
	Roadside	NOx		3	5.4	1.054	5	0.9997	93.9
22/03	Walsall	NO	10771	-2	5	0.980	5	1.0000	
	Alumwell	NOx		-8	5.3	0.989	5	0.9999	96.4
15/03	Walsall	NO	1337	4	5	1.027	5	0.9998	
	Willenhall	NOx		6	5.7	1.035	5	0.9998	98.3
16/03	West London	NO	m200a-	-3	5	1.230	5	1.0000	
		NOx	845	-4	5.7	1.245	5	1.0000	96.3
16/02	Wicken Fen	NO	hs5-zs	-19	5	0.434	5	0.9978	100
		NOx		-19	5.2	0.437	5	0.9970	
01/04	Wigan Leigh	NO		0	5	0.987	5	0.9999	
		NOx		-2	5.3	0.954	5	0.9999	95.5
24/02	Wirral Tranmere	NO		18	5	2.492	4	0.9985	
		NOx		21	5.8	2.531	5	0.9999	92.1
22/03	Wolverhampton	NO	gra0447-	-38	5	0.492	5	1.0000	
	Centre	NOx	007	-46	5.4	0.503	5	1.0000	97.1
28/01	Yarner Wood	NO	m200a-	7	5	0.931	5	0.9999	
		NOx	1784	5	5.4	0.934	5.1	0.9999	97.8

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CERTIFICATE OF CALIBRATION

Culham, Abingdon, Oxfordshire OX14 3ED. Telephone 0870 1906465 Facsimile 0870 1906377

UKAS CALIBRATION
0401
0401 51

Certificate No: 01090
AEA Identification Number: 45077030

5. Particulate Analysers

Date Year =2004	Site	Analyser number	Calculated Spring Constant k_0	Uncertainty (%)	[*4] k_0 accuracy (%)	[3]Measured Main Flow (l/min)	Uncertainty (%)	[3]Measured Total Flow / **Aux Flow** (l/min)	Uncertainty (%)
	Scottish Sites								
14/01	Aberdeen	24427	11476	1	-0.8	3.06	2.2	16.04	2.2
03/02	Dumfries	2025a2122						17.22	2.2
09/02	Edinburgh St Leonards	21308	12727		-0.7	1.88	2.2	16.99	2.2
07/02	Glasgow Centre	20913	13515	1	1.3	1.89	2.2	16.74	2.2
08/02	Glasgow Kerbside	22980	12958	1	-1.4	1.85	2.2	16.81	2.2
06/02	Grangemouth	22763	12660	1	0.1	2.93	2.2	17.14	2.2
11/01	Inverness	2025a2125						16.93	2.2
	Welsh Sites								
18/03	Cardiff Centre	24449	14094	1	-1.5	1.80	2.2	15.13	2.2
19/03	Cwmbran	21557	12425	1	-0.9	2.32	2.2	14.42	2.2
15/03	Narberth	21143	12397	1	-0.7	3.27	2.2	**13.69**	2.2
18/03	Port Talbot	9402	10614	1	0.1	3.18	2.2	17.01	2.2
16/03	Swansea	2130	14206	1	-2.5	0.81	2.2	15.48	2.2
23/02	Wrexham								
	N.Irish Sites								
08/03	Belfast Centre	24423	14068	1	-0.9	2.26	2.2	17.74	2.2
08/03	Belfast Clara St	95366						16.99	2.2
10/03	Derry	49608	11042	1	1.4	2.13	2.2	**15.94**	2.2
11/03	Lough Navar	21196	12819	1	0.0	3.12	2.2	Not tested	
	English Sites								
26/02	Birmingham Centre	2297	12140	1	0.5	2.11	2.2	17.01	2.2
30/03	Birmingham East	24637	13533	1	-0.6	3.15	2.2	16.27	2.2
26/02	Blackpool	24424	12882	1	-0.1	2.00	2.2	**14.67**	2.2
06/02	Bolton	21197	15007	1	-1.1	3.02	2.2	**13.96**	2.2
06/02	Bournemouth							17.07	2.2
30/03	Bradford Centre	21494	11428	1	0.7	2.22	2.2	14.59	2.2
	Brighton Roadside PM_{10}							16.56	2.2
30/01	Bristol Centre	24426	13073	1	-0.8	1.74	2.2	15.40	2.2
03/02	Bury Roadside	658	11481	1	-1	1.71	2.2	14.98	2.2
15/01	Camden Kerbside	21152	16397	1	-0.1	3.21	2.2	17.18	2.2
21/01	Canterbury	95295	13859	1	-1.2	3.09	2.2	16.67	2.2
09/01	Coventry Memorial Park	21316	13582	1	-0.8	Not tested		**12.21**	2.2
30/01	Haringey Roadside	20695	11291	1	-1.4	2.72	2.2	16.42	2.2
08/01	Harwell PM_{10}	21489	14932	1	0.1	3.07	2.2	17.14	2.2
08/01	Harwell $PM_{2.5}$	21490	10900	1	0.2	3.20	2.2	14.50	2.2
15/01	Hull Freetown	24445	14133	1	0.2	1.89	2.2	16.67	2.2
30/03	Leamington Spa	2075	10926	1	-0.1	3.00	2.2	15.94	2.2
10/03	Leeds Centre	2032	13083	1	1.8	2.07	2.2	16.84	2.2
12/01	Leicester Centre	24442	13945	1	-0.6	1.99	2.2	15.44	2.2
01/03	Liverpool Speke	24450	15795	1	-0.1	Not tested		16.00	2.2
19/01	London A3	21314	10426	1	-0.3	2.10	2.2	17.00	2.2

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CERTIFICATE OF CALIBRATION

Culham, Abingdon, Oxfordshire OX14 3ED. Telephone 0870 1906465 Facsimile 0870 1906377

UKAS CALIBRATION
0401
0401 S1

Certificate No: 01090

AEA Identification Number: 45077030

Date Year =2004	Site	Analyser number	Calculated Spring Constant k_0	Uncertainty (%)	[*4] k_0 accuracy (%)	[3]Measured Main Flow (l/min)	Uncertainty (%)	[3]Measured Total Flow / **Aux Flow** (l/min)	Uncertainty (%)
	Roadside								
22/01	London Bexley	2000	10373	1	-0.9	Not tested		16.29	2.2
08/01	London Bloomsbury	24446	13577	1	-1.2	Not tested		**13.20**	2.2
08/01	London Bloomsbury $PM_{2.5}$	21492	14783	1	-1.1	2.95	2.2	15.80	2.2
20/01	London Brent	21145	17425	1	-0.5	3.00	2.2	**13.80**	2.2
25/03	London Eltham	2096	13004	1	0.2	2.74	2.2	15.65	2.2
07/01	London Hillingdon	24422	14187	1	-0.4	2.15	2.2	17.24	2.2
13/02	London Marylebone Road	21306	13354	1	0.1	3.07	2.2	15.41	2.2
13/02	London Marylebone Road $PM_{2.5}$	21493	14526	1	-0.3	3.16	2.2	15.85	2.2
19/01	London N. Kensington	20715	10644	1	-1.6	2.90	2.2	14.68	2.2
10/02	London Westminster							Not tested	
27/01	Manchester Piccadilly	2000	11921	1	-1.1	1.95	2.2	15.67	2.2
18/02	Middlesbrough	24325	13939	1	-1.4	2.06	2.2	16.07	2.2
16/02	Newcastle Centre	24488	13745	1	-0.6	3.07	2.2	17.02	2.2
21/01	Northampton	21621	10990	1	-1.4	3.03	2.2	17.28	2.2
	Northampton Partisol							Not tested	
17/02	Norwich Centre	21495	12128	1	-0.7	2.20	2.2	17.36	2.2
13/01	Nottingham Centre	20904	8725	1	0.6	1.97	2.2	16.22	2.2
27/01	Plymouth Centre	24428	12946	1	0.0	2.00	2.2	17.52	2.2
16/01	Portsmouth	21578	10401	1	-1.6	2.90	2.2	15.78	2.2
27/02	Preston	22881	12678	1	-2.1	1.80	2.2	16.13	2.2
04/02	Reading New Town	2000	13081	1	-0.9	1.74	2.2	14.98	2.2
17/02	Redcar	21344	11793	1	0.1	3.06	2.2	17.19	2.2
08/03	Rochester PM_{10}	24381	11925	1	-1.1	2.68	2.2	15.98	2.2
08/03	Rochester $PM_{2.5}$	21491	13648	1	-2.1	2.98	2.2	15.98	2.2
26/01	Salford Eccles	21168	14442	1	0.2	2.14	2.2	16.75	2.2
14/01	Scunthorpe	2033	4989	1	0.0	2.92	2.2	Not tested	
11/03	Sheffield Centre	20915	10968	1	-3.1	1.77	2.2	15.73	2.2
17/02	Southampton Centre	4484	13811	1	-0.5	2.15	2.2	**14.99**	2.2
25/03	Southend-on-Sea	22927	13512	1	0.9	1.88	2.2	**14.58**	2.2
05/02	Stockport Shaw Heath	2000	Analyser failed during audit tests						
18/02	Stockton-on-Tees Yarm	22885	14184	1	-0.8	3.10	2.2	17.16	2.2
01/02	Stoke-on-Trent Centre	21317	18259	1	-0.6	1.24	2.2	15.36	2.2
23/01	Thurrock	2077	6293	1	-1.1	Not tested		16.28	2.2
01/04	Wigan Leigh		13334	1	0.9	3.1	2.2	16.39	2.2

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Date Year =2004	Site	Analyser number	Calculated Spring Constant k_0	Uncertainty (%)	*[4] k_0 accuracy (%)	[3]Measured Main Flow (l/min)	Uncertainty (%)	[3]Measured Total Flow / **Aux Flow** (l/min)	Uncertainty (%)
24/02	Wirral Tranmere	22883	13204	1	-0.7	2.01	2.2	**15.08**	2.2
22/03	Wolverhampton Centre	20917	13764	1	0.1	1.5	2.2	15.36	2.2

The above factors have been calculated using certified standards. The analysers listed above have been tested for zero response, calibration factor, linearity, converter efficiency (NOx analysers), m-xylene interference (SO_2 analysers), k_0 / main flow rate (for TEOM analysers) and total flow rate (for particulate analysers), by documented methods. Note that the test results are valid on the day of test only, as analyser drift over time cannot be quantified.

The calibration results for NOx, NO, CO, SO_2, O_3 and Particulates are those that fall within our scope of accreditation. Results marked with an asterisk (*) on this certificate are not UKAS accredited, but have been included for completeness.

[1]The zero response is the zero reading on the logging system of the analyser when audit zero gas was introduced to the analysers under test.

[2]The calibration factor is the multiplying factor required to scale the reading on the logging system of the analyser into concentration units (ppb for NO, NOx and SO_2, ppm for CO – 1ppm = 1000 ppb). It should be used in conjunction with the analyser output and the zero response, according to the following equation:

Concentration = (output – zero response) x Calibration factor

[3]The calculated main flow rate (where this is applicable) is the flow rate through the sensor unit of a TEOM analyser. The calculated total flow rate is the flow rate through a particulate analyser sample inlet. The calculated aux flow rate is the flow rate through the auxiliary (bypass) tubing of a TEOM analyser.

[4]The k_0 accuracy value (specifically for TEOM analysers) indicates the closeness of the calculated result to the manufacturer's specified value of k_0.

*R^2 is the correlation coefficient of linearity

*Converter is the measured efficiency of the NO_2 to NO converter in the Oxides of Nitrogen analyser

*meta-xylene interference is the response of the SO_2 analyser when supplied with approx 1ppm meta-xylene