Report

QA/QC Data Ratification and Intercalibration Report for the Automatic Urban and Rural Network, January-March 2005

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Executive Summary

Netcen carries out the quality assurance and control (QA/QC) activities for the Automatic Urban and Rural Monitoring Network (AURN) on behalf of the UK Department for Environment, Food and Rural Affairs (Defra) and the Devolved Administrations (DAs). This report provides a review of data ratification issues and QA/QC audit results for the 3-month period January-March 2005.

The network has undergone significant changes since it was first established in 1992. Site numbers have increased to 123 sites to date, of which 63 are Local Authority owned sites which are affiliated to the national network. The further addition of 4 new sites in 2005 will bring the total number of AURN sites to 127.

In general this has been a good 3-month period for the AURN with a network average data capture of 94% being achieved. This is consistent with the overall data capture figure for 2004 (93%).

Although overall network data capture was high at 94%, there were a number of critical site/analysers that missed the 90% threshold for the period, and concern must be expressed for these sites in meeting the 90% annual data capture target. The main reason for data loss at these sites has been provided and these were predominantly due to instrument faults or response instability. A summary of recommendations given in this report to help improve network performance is given in Appendix A4.

Results of the 6-monthly intercalibrations carried out in 2005 showed that the data quality objectives in terms of measurement accuracy, precision and consistency were within acceptable limits. Out of the 413 analysers tested approximately 80% were shown to be performing satisfactorily.

QA/QC Unit continues to maintain a watching brief on new methodologies and technical advances in air quality in order to keep pace with any changes that may be required in the coming years, particularly in view of the recently published European CEN standards. New long-term data checking tools have been incorporated into the routine data ratification process and further measures to assist with the identification of consistent poorly performing sites are being developed.

PART A: DATA RATIFICATION JANUARY-MARCH 2005

Part A: Data Ratification
January-March 2005

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-March 2005. During this period there were 123 monitoring sites in the Network of which there are 87 urban sites, 22 rural sites and a further 14 sites in the London Air Quality Monitoring Network (LAQN) which are affiliated into the national network. There are currently 60 defra-funded sites and 63 affiliate sites. Three sites (Belfast Clara Street, Northampton PM_{10} and Brighton Roadside PM_{10}) measure PM_{10} only and are included as individual sites in the total of 123, although Northampton PM_{10} is co-located with the Northampton AURN site, and Brighton Roadside PM_{10} is close to the Brighton Roadside AURN site. The Blackpool site was closed for the entire period 1 January-31 March.

Included in this report is an intercalibration review of network performance and QA/QC Unit activities during January-March 2005. 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-March 2005 and for the complete year presented in tables.
Section 6 Intercomparisons and Future Issues

Appendix A1 Recommendations for replacing or up-grading equipment (compiled in conjunction with CMCUs).
Appendix A2 List of critical sites in the AURN.
Appendix A3 Inventory of Department-owned equipment used by QA/QC Unit.
Appendix A4 Summary of recommendations

PART B: Winter 2005 Intercalibration Results

Section 7: Introduction
Section 8-14: Results Summary
Section 15: Site Information
Section 16: Implications of the CEN Standard
Section 17: Safety

Appendix B1: Certificate of Calibration

1.1 Recent Changes in the Network

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

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

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

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

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

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

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

Bath Roadside
The Bath Roadside site has been relocated to a commercial property a short distance from the original location. The two locations are to be considered as the same site.

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

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

DD3 Requirements
Installation of additional ozone and rural NO_x analysers at existing sites in the network in order to comply with the Third Daughter Directive (DD3) is now complete.

Two of the four new sites required for compliance with the Third Daughter Directive (DD3) have now been commissioned. Of the two remaining, Leominster is scheduled for commissioning in July, and Fort William for later in 2005.

A site measuring ozone in Lerwick, Shetland, will commence in summer 2005 and PM10 and PM2.5 analysers will be installed at the rural site at Auchencorth Moss (near Edinburgh) during 2005.

Equipment Replacement
The remaining two sets of Horiba equipment were installed at Norwich Centre and Southend-on-Sea in March 2005 and commissioning audits and LSO training has been carried out.

Changes to the network during the period January-March 2005 are summarised in Table 1.1

Table 1.1 Changes to the AURN between January-March 2005

Sites	Date Commenced	Pollutants
Norwich Roadside (now Norwich Forum Roadside)	3 March 2005	NOx

1.2 Overview of Network Performance

Ratified hourly average data capture for the network averaged 94% 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 2005 (see Table 1.2 below). This has again been another very good quarter in terms of network performance with average data capture for all the pollutants being above the 90% target level. The annual average network data capture for the calendar year 2004 was 93%.

Table 1.2 AURN Ratified Data Capture (%) January-March 2005
(Using the start date of any new site)

Data Capture (%)	CO	NO_2	O_3	PM_{10}	$PM_{2.5}$	SO_2	Network Average
Q1 Jan-Mar 2005	92.4	93.0	94.2	95.0	96.8	90.8	94.0

Overall, 368 out of the 413 analysers (87%) achieved data capture levels above the required 90% target during this reporting period (See Table 1.3). The figures shown in Table 1.3 also demonstrate that the high level of network performance has been consistently maintained across all analyser types in the network. Only a relatively small proportion of analysers (7-19%) failed to meet the 90% data capture target, which is reasonable in a network of this size and complexity.

Table 1.3 Number of Analysers with Data Capture below 90%

Total Number of Analysers		Analysers with Data Capture <90% in Q1 2005 (January-March 2005)
CO	78	19
NO_2	108	19
O_3	85	11
PM_{10}	63	7
$PM_{2.5}$	4	0
SO_2	75	10

In total, 21 out of the 122 operational network sites (17%) had an average data capture rate below the required 90% level for the January-March 2005 period. These sites are listed in Table 1.4. The main site operational and QA/QC issues giving rise to data capture below the required 90% level are summarised in Section 4. A summary of the main recommendations made in this report to help improve network performance is given in Appendix A4.

Table 1.4 Sites with Average Data Capture < 90%, January-March 2005
(Data capture calculated from site start date)

	Site	Owner	Site Average Data Capture (%)
	England		
	Barnsley Gawber	Affiliate	88.1
	Bury Roadside	Affiliate	84.2
	High Muffles	defra	80.6
	Leeds Centre	defra	72.4
	London Brent	Affiliate	78.3
	Manchester Piccadilly	defra	81.7
	Manchester South	Affiliate	63.9
	Manchester Town Hall	defra	85.9
	Plymouth Centre	defra	88.5
	Redcar	Affiliate	86.0
	Rotherham Centre	Affiliate	64.7
	Salford Eccles	Affiliate	81.9
	Sandwell West Bromwich	Affiliate	85.5
	Stockport Shaw Heath	Affiliate	87.7
	Stoke-on-Trent Centre	defra	74.8
	Tower Hamlets Roadside	Affiliate	85.8
	Walsall Willenhall	Affiliate	55.0
	N Ireland		
	Belfast Clara Street	Affiliate	85.8
	Derry	Affiliate	84.1
	Scotland		
	Bush Estate	defra	73.2
	Wales		
	Narberth	Affiliate	72.8

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

The summer intercalibration is scheduled to start at the beginning of July 2005. A full schedule of QA/QC Unit audits and ESU service visits has been posted on the AURN Hub. To reduce the risk of sites being audited or serviced during the summer high pollution

episodes, the Air Quality Communications Unit are now issuing twice weekly updates on UK air pollution forecasts to the Equipment Support Units. It may, however, not always be feasible for ESUs to reschedule service visits and any decisions taken based on the forecasts must involve the CMCUs and QA/QC Unit of the network as well as the ESUs.

1.3 LSO Manual

Copies of the Local Site Operator's manual on disc (CD) were distributed to the network participants at the annual LSO meeting in December 2004. If LSOs have not received a copy or further copies are required please contact Andy.Cook@aeat.co.uk. The manual is also available electronically on the following web sites:
AURN Hub http://www.aeat.co.uk/com/AURNHUB/lsoman.html
Air Quality Archive http://www.aeat.co.uk/netcen/airqual/reports/lsoman/lsoman.html

1.4 AURN Hub Updates

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

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

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

The Hub has continued to provide a valuable source of information for interested organisations-see Figure 1.1

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

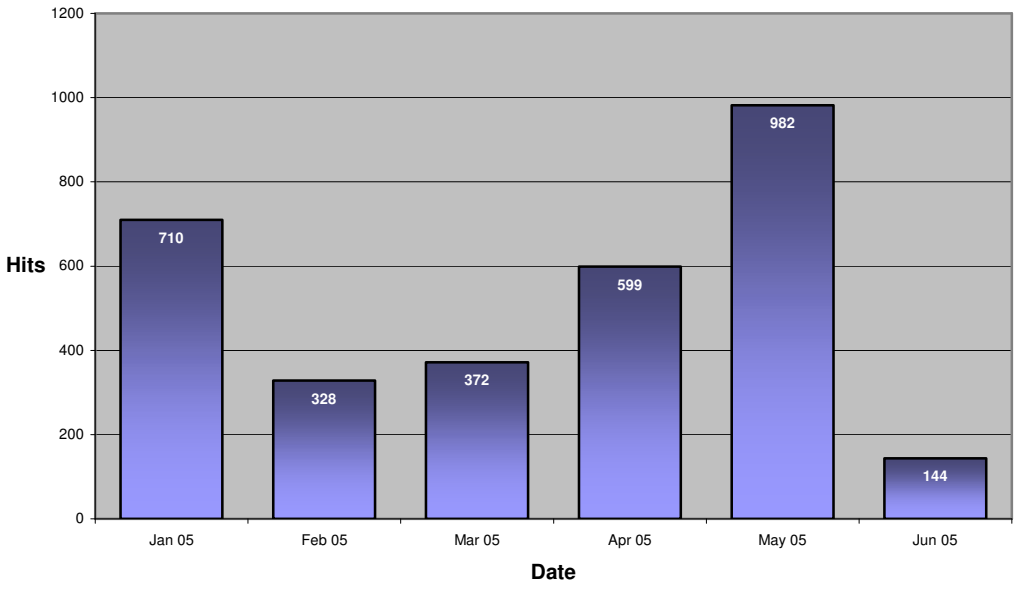


Figure 1.1 AURN Hub Monthly Usage Statistics January-June 2005

2 Generic Data Quality Issues

2.1 Progress on Monitoring Requirements of the EU Daughter Directives

Installation of all of the additional NO_x and O_3 analysers required to comply with the third Daughter Directive has now been completed. Further details on the third Daughter Directive can be found at:
http://www.defra.gov.uk/environment/consult/air-23daughter/index.htm

Two of the four new sites also needed to meet the requirements of DD3 were operational before the end of 2004 (Brighton Preston Park and Sunderland Silkworth). Progress is underway to install the remaining site and details are given in Table 2.1.

Table 2.1 New DD3 Monitoring Stations, July 2005

New Site	Pollutants	Progress to date	Expected integration date
Fort William	O_3 and NO_x	Planning consent and lease agreement completed. Site installation awaited.	Late 2005
Leominster	O_3 and NO_x	Installation of all equipment is complete –site commissioned 14 July 2005	

2.2 Data Capture for Critical Sites in Zones and Agglomerations

In order to meet the requirements of the Daughter Directives, any zone or agglomeration[2] with an exceedence of the limit value must be formally reported to the Commission. The critical sites are those which, if data capture falls below 90%, there will be insufficient data for the whole zone or agglomeration. In most cases the critical sites are those where there is only one site in the zone or agglomeration. However, for some pollutants (especially ozone) monitoring is required at several sites in each zone or agglomeration and hence these may all need to be classified as critical sites for that pollutant. The list of the critical sites in the Network necessary to meet the requirements of the first, second and third Daughter Directives is given in Appendix A2. In total 61 sites (185 analysers) have been identified as critical for DD1, DD2 or DD3 (25 sites in agglomerations and 36 in zones).

Data capture for all 61 of the critical sites during the 3-month period January to March 2005 is given in Section 5, Table 5.2. The critical sites with less than 90% data capture and the main reasons for data loss at these sites are given in Table 2.2 below. In total, 25 out of the 185 critical site analysers (13%) did not meet the required 90% data capture during the period January-March 2005.

Table 2.2 Critical sites with <90% data capture, January – March 2005

Site	Owner	CO	NO_2	O_3	PM_{10}	SO_2	
Agglomerations							
Cardiff Centre	DEFRA	96.6	97.1	96.7	78.4	89.3	PM_{10} logger faulty. SO_2-unstable after service
Glasgow Centre	DEFRA	83.4	96.9	97.0	96.9	96.7	Pump failure
Newcastle Centre	DEFRA	93.5	89.3	93.4	93.6	92.9	Logger fault
Nottingham Centre	DEFRA	87.3	96.0	96.8	96.8	96.6	CO noisy/baseline drift
Preston	DEFRA	75.4	92.1	99.6	98.6	99.8	Pump failure
Reading New Town	DEFRA	88.9	94.5	94.7	98.1	89.7	CO and SO_2 data noisy
Sheffield Centre	DEFRA	94.9	67.6	97.2	97.1	96.0	Air con turned off, NOx chamber pressure fault
Stoke-on-Trent Centre	DEFRA	96.7	92.2	89.1	96.0	0.0	SO_2 very noisy, ozone pump failure
Zones							
Barnsley Gawber	Affiliate	90.8	68.0	96.5	-	97.0	Generally poor quality, noisy data
Bush Estate	DEFRA	-	49.2	97.2	-	-	Repeated NOx analyser failure
Derry	Affilate	95.9	91.8	59.8	96.0	77.2	O_3, SO_2 bad zero drift, O_3 failed leak check
High Muffles	DEFRA	-	79.8	81.3	-	-	Internal sampling
Narberth	Affilate	-	88.4	53.9	53.8	95.1	Various O_3 and PM_{10} faults

[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

Norwich Centre	DEFRA	96.9	87.5	89.6	96.8	96.9	Various faults
Plymouth Centre	DEFRA	96.7	96.7	55.6	96.6	96.8	O_3 30% out at audit
Sunderland Silksworth	Affilate	-	93.7	88.0	-	-	O_3 autocal fault
Wigan Centre	Affilate	98.9	94.0	98.8	87.8	99.3	NOx leak, data lost through use of out-of-service switches
Number of sites		39	51	47	35	39	
Number of sites < 90%		4	7	7	3	4	
Network Mean (%)		95.7	93.1	93.6	95.3	93.8	

Recommendation

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

2.3 Gravimetric PM_{10} Data Ratification

Gravimetric PM_{10} analysers (Partisols) are located at seven sites in the network (Bournemouth, Northampton, Wrexham, Dumfries, Inverness, London Westminster and Brighton Roadside PM_{10}). The gravimetric PM_{10} analyser at Northampton is also co-located with a TEOM analyser, which provides a useful check that both techniques are operating correctly. Gravimetric PM_{10} concentrations and the daily mean TEOM scaled by 1.3 at Northampton for the 3-month period January-March 2005 are shown in Figure 2.1.

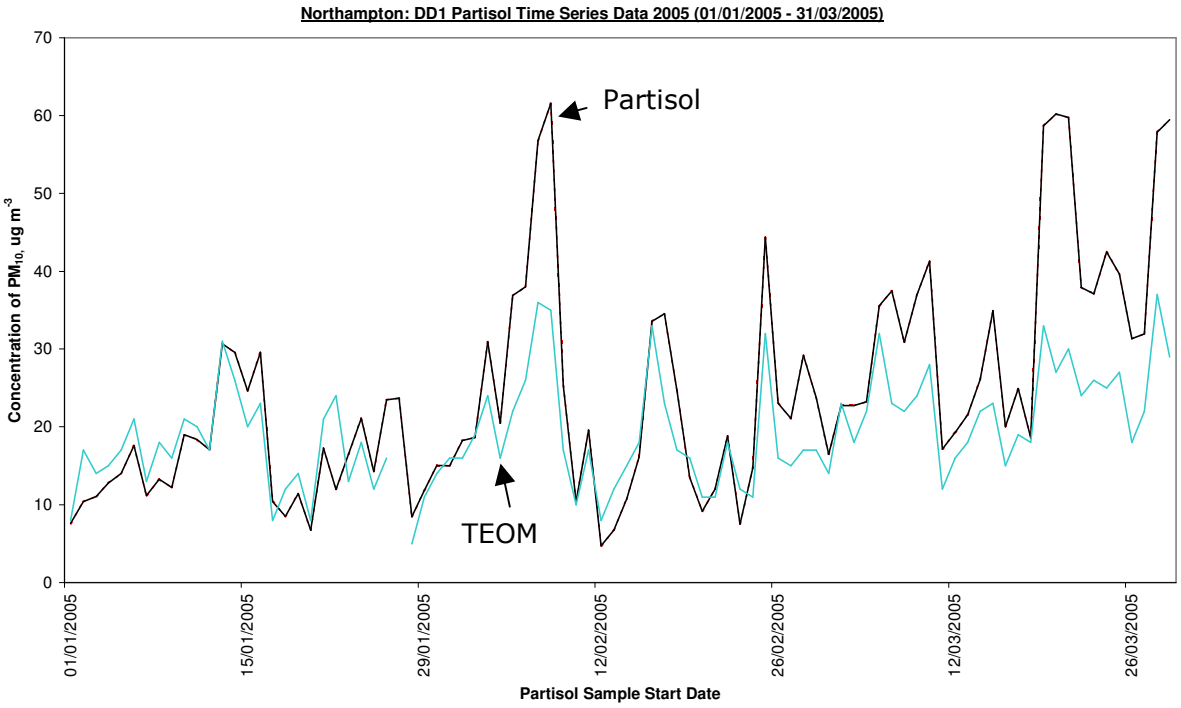


Figure 2.1 Partisol and TEOM (x1.3) Concentrations at Northampton (January – March 2005)

The Northampton site has collocated Partisol and TEOM analysers. The data for 2004 showed generally good agreement between the two measurement methods, however since January 2005, the Partisol has indicated nine exceedences of the daily objective compared to none by the TEOM. In the whole of 2004, there were 8 daily exceedences as measured by the Partisol at this site, compared to one by the TEOM. It is thought that the difference in exceedences measured by the two methods may be due to increasing proportion of secondary, volatile species at higher PM_{10} concentrations; these being lost in the heated TEOM inlet. Further analysis of these data is currently being carried out to confirm this.

Data capture for the gravimetric PM_{10} (Partisol) analysers for the period January-March 2005 is given in Table 2.3 Bournemouth is the one remaining Partisol unit that still needs to be connected to telemetry via a separate mobile phone system, as the existing line is not compatible with the Partisol software.

Table 2.3 Gravimetric PM_{10} Data Capture (%) January – March 2005

Site	3-months Data Capture (%) January – March 2005
Bournemouth	96
Brighton Roadside PM_{10}	83
London Westminster	98
Northampton	93
Dumfries	98
Inverness	92

Site	3-months Data Capture (%) January – March 2005
Wrexham	83
Average	**92**

2.4 NO_2 Converter Efficiencies

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

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

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

Recommendations

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

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

QA/QC Unit has been taking measures to ensure procedures used in the AURN will comply with any CEN requirements before they become mandatory. The finalised CEN standards set a requirement to ensure that the NO_x converter efficiency is better than 98% for type approval and better than 95% in field operation. NO_2 data will have to be rescaled for converter efficiencies between 95-100%, but rejected if below 95%. These are more stringent requirements than currently used where "borderline failures" are accepted. It is, therefore, especially important that the borderline cases also get adequate attention at the service in order to ensure they are set up to operate satisfactorily for the next 6-month period.

Recommendation

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

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

converter efficiency calculator will shortly be issued to Equipment Support Units for use in the field.

2.5 NO_x Switching Valve Leaks

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

2.6 Ozone Outliers

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

Table 2.5 Ozone outliers identified at the winter 2005 intercalibration

1	Barnsley Gawber	-6%
2	Birmingham Tyburn	+27%
3	Coventry Memorial Park	+10%
4	Derry	-45%
5	Glazebury	+8%
6	Leeds Centre	-8%
7	London Hillingdon	+22%
8	London Lewisham	+38%
9	London Southwark	+22%
10	London Teddington	-20%
11	London Wandsworth	-8%
12	Manchester Piccadilly	+13%
13	Manchester South	+8%
14	Narberth	-12%
15	Northampton	+10%
16	Plymouth Centre	+30%
17	Portsmouth	+8%
18	Preston	-6%
19	Salford Eccles	+9%
20	Sibton	-25%
21	Stoke-on-Trent	-17%
22	St Osyth	-9%
23	Strath Vaich	+12%

2.7 TEOM k_0

Three out of the 67 TEOM instruments tested during the Winter 2005 intercalibration were found to be operating with a calibration constant (k_0) outside the acceptable ± 2.5%

deviation. These were at London A3 Roadside, Portsmouth and Glasgow Kerbside. In all cases the value of the calibration constant stamped on the sensor unit was found to be different from the value stored in the control unit. (See Table 2.6). Details of the resulting effect on data quality data is also provided in Table 2.6.

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

- Southend-on-Sea (auxiliary flow –23%)
- London Brent (auxiliary flow –14%)
- Narberth (main/auxiliary flow settings, -43%)

These flow outliers may have a significant effect on the resulting data quality, however this will be examined in detail during the next ratification period. At Narberth there was a discrepancy in the flows stated by the instrument (3 l/min main and 13.6 l/min auxiliary) and the actual flow rates measured at the audit (1.73 l/min main and 14.5 l/min auxiliary). Consequently the mass concentrations recorded during the 3-month period that this instrument was in place (November 8th 2004 until 7rd February 2005) were erroneous and have been deleted.

As part of the winter intercalibration exercise, QA/QC Unit completed the task of gathering additional information on the operational configuration of PM_{10} analysers in the network. Full details of this are given in Part B of this report.

Table 2.6 TEOM k_0 issues identified at the Winter 2005 Intercalibration

Site	Problems identified at audit	Effect on data quality
Portsmouth	k_0 values were found to be different on sensor unit and in the control unit software at the Summer audit and again at the Winter audit on 10/1/05 (k_0 +4.5%)	Data rescaled from 1 January 2004 until service on 18th January 2005. ESU to confirm that the control unit was reset to agree with sensor at the service.
London A3 Roadside	k_0 on sensor and control unit different by 10% at summer audit on 8/7/04. The TEOM was exchanged on 24 July 2004. At the following Winter 2005 audit the k_0 on sensor and control unit was found different again. (k_0 + 3.3%).	Data rescaled from when the replacement TEOM was installed on 21st April until the ESU visit on 23rd July 2004 to exchange the TEOM. Further data rescaling was required to reduce the data by 3.3% from 24th July until the service in January 2005. ESU to confirm that the control unit was reset to agree with sensor at the service.
Glasgow Kerbside	K_0 on sensor and control unit different by –16% at winter audit on 9/3/05. Netcen will revisit to check.	This TEOM has shown a history of response instability problems after filter changes and the large k_0 deviation may be due to this. A new TEOM sensor and controller were fitted on 29/3/04. Any necessary data rescaling from January 2005 until the repair will be carried during the next

		ratification period. The PM_{10} data should be considered provisional for this quarter.

Recommendations

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

2.8 Zero Response Truncation

There were no sites where significant periods of data were lost due to zero truncation (or baseline clipping) during the period January-March 2005. This is a good result and shows that the analysers are being configured correctly and response drifts are being carefully monitored over time. Zero response truncation can occur when the analyser response drifts downwards until it falls below the minimum response threshold resulting in extended period of 0mV response. This problem can arise if the analyser is not configured to output negative voltages or if the logger cannot record a response below a certain voltage threshold.

Recommendation

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

2.9 Auto-Calibration Run-ons

Autocalibration "run-on" is a generic problem affecting many analysers in the network and is due to autocalibration gas leaking into the sampling system during the ambient measurement period immediately after the autocalibration cycle. The problem can be identified by examining the diurnal variation of NO_2 concentrations for the individual sites. Invalid measurements (usually between 01:30 and 02:00) have been removed during data ratification. This can be a serious source of data loss resulting in one hour out of twenty four being deleted, which is 4% of the annual data capture. At some sites significantly more data are being lost resulting in data capture below the 90% data capture target for the period.

The ESUs have investigated the autocalibration run-ons at many of the sites and tried different ways to resolve the problem including thorough cleaning of the solenoid valves and installation of permapure driers. In most cases this has improved the situation but it has not always eliminated the problem completely. The 35 sites showing continuing problems with the autocalibration run-on during January to March 2005 are given in Table 2.7. Any autocalibration run-on data that look visibly significant have been deleted from these data sets during ratification. The Reading SO_2 and Sunderland Silksworth ozone problems appear to be caused by the calibration timings being out of sequence.

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

Site	Pollutant	Run-on (ppb)	Data loss (Hours per day)	Approx. autocal span concentration (ppb)
Aberdeen	NO_2	5	1	200
Birmingham Centre	NO_2	6	1	750
Bournemouth	NO_2	3	1	600
Bradford Centre	NO_2	3	1	650
Bush Estate	NO_2	3.5	1 (Jan-Feb)	240
Derry	NO_2	3	1	300
Dumfries	NO_2	6	1	700
Eskdalemuir	NO_2	6	1	500
Exeter Roadside	NO_2	11	1	500
Glazebury	NO_2	5.2	1	190
Harwell	NO_2	3.8	2	200
Ladybower	NO_2	4	2	300
Leamington Spa	NO_2	6	1	750
Lullington Heath	NO_2	2.2	-	300
Manchester Town Hall	NO_2	6	1	450
Market Harborough	NO_2	3.3	2	350
Middlesbrough	NO_2	3	1	450
Narberth	NO_2	2.3	1	150
Newcastle Centre	NO_2	4	1	300
Preston	NO_2	3	1	500
Reading New Town	NO_2	4	1	250
Redcar	NO_2	3	1 (Feb-Mar)	300
Rochester	NO_2	1.8	1	200
Southampton Centre	NO_2	4	1	850
Southend-on-Sea	NO_2	3	1	350
St Oysth	NO_2	1.6	1	300
Stoke-on-Trent	NO_2	4	1	335
Wrexham	NO_2	3	1	350
Yarner Wood	NO_2	0.8	1	200
London Brent	SO_2	1	1	900
Wirral Tranmere	SO_2	1	1 (Feb-Mar)	650
Reading New Town	SO_2	1	2	600
Leeds centre	CO	0	1	Zero run-on
Reading New Town	O_3	0	1	Zero run-on
Sunderland Silksworth	O_3	0	1	Zero before autocal time

Recommendations

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

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

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

3 Site Specific Issues

3.1 Manchester Piccadilly SO_2

This analyser has historically shown poor performance for some time, both in terms of noise and baseline drift. As a result, the data have been deleted for the period

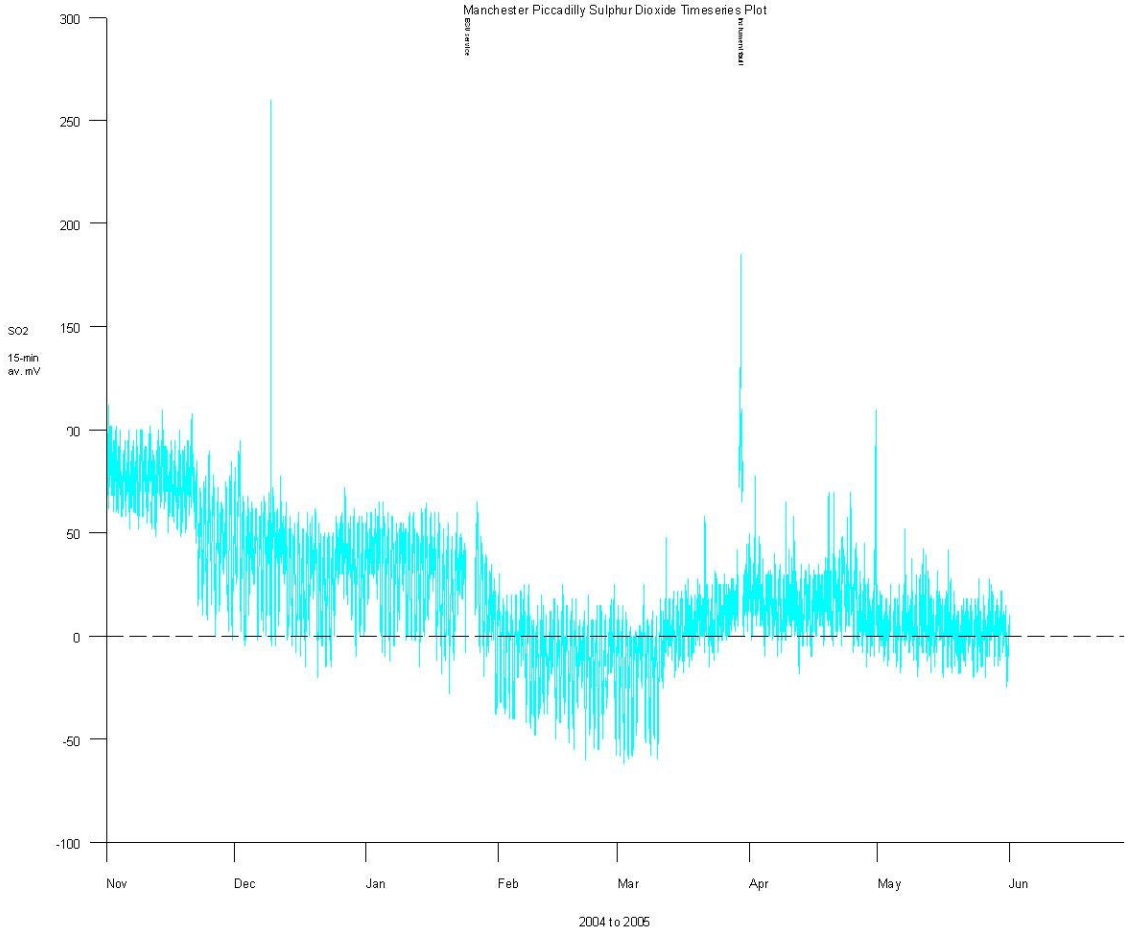


Figure 3.1 Manchester Piccadilly SO_2 analyser unacceptably high response noise

Recommendation

We recommend that the SO_2 analyser at Manchester Piccadilly should be up-graded or repaired.

3.2 Stoke-on-Trent SO_2

The SO_2 analyser at Stoke-on-Trent continued to show erratic baseline response resulting in almost 4 months data rejection, from 4th December 2004 until 31 March 2005 (See Figure 3.2). Despite the analyser's UV lamp being replaced on 10th December and optical filter replaced on 17th January 2005, the baseline response drift continued. The analyser noise has also appeared to increase since the service on 21 February.

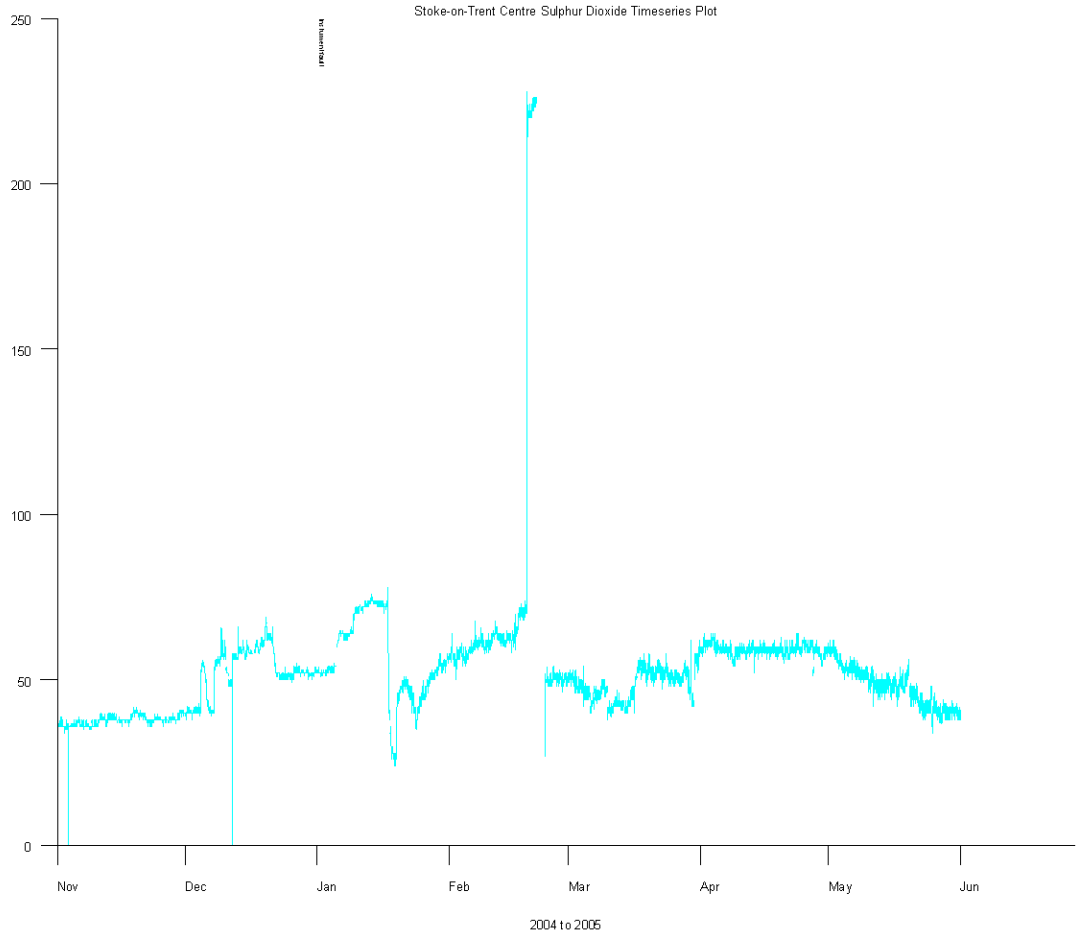


Figure 3.2 Stoke-on-Trent SO_2 unstable baseline response, Dec 2004 – Feb 05

Recommendation

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

3.3 Narberth O_3

The ozone analyser at Narberth showed an unusually low period up to the service on 7 February. At the QA/QC visit, the analyser was shown to be 12.8% low, but even when rescaled, the ambient data appeared to be unreliable; hence all data from 1 January 2005 to the service on 9 February have been deleted at this site; all data have also been deleted last quarter of 2004. The 3-way valve was replaced by the ESU on 26 April, and the subsequent data remains provisional until sufficient evidence is obtained that the fault has been rectified.

The poor performance of this analyser is cause for considerable concern, and it is strongly recommended that the ozone analyser is replaced as soon as possible, or as a minimum, a duplicate instrument installed to allow data collection to restart at this critical site. It is noted that the ESU has made a significant effort to identify and rectify problems at this site, and this will be reported in the next quarterly report.

3.4 Salford Eccles

There has been significant data loss of all pollutants (~10% data loss of all pollutants) at this site during this quarter, apparently due to problems associated with the daily autocalibration system affecting the logger. The autocals were disabled by the LSO on 4 March in an attempt to cure the problem, and have not yet been re-enabled. The ESU should restart these at the next visit, but take care to check that the system does not cause a repeat of the analyser problems observed from mid-January onwards.

The NOx converter was identified as only 90% efficient at the service, although it had been acceptable ot the audit. The converter was changed on 1 March. NOx data capture for the period was 49%.

3.5 Other Analysers Highlighted in Recent Reports

Several analysers have been highlighted recently as being of concern to the QA/QC unit. An update is given in Table 3.1

Site	Analyser	Fault	Current status
Exeter Roadside	CO	Erratic output	Shows improvement since service in February 2005
Manchester South	SO2	High instrument noise	No improvement this quarter (Analyser replaced 22 July)

In addition, the QA/QC unit has flagged up the following analysers where performance is not optimal, and these will be examined more closely in the future.

Bradford Centre CO lots of downspikes
Bradford Centre SO2 unstable baseline and downspike
Derry CO downspikes
Glasgow Kerbside CO downspikes
London Hillingdon CO unstable baseline and downspikes

Manchester Piccadilly CO very noisy response
Manchester Piccadilly SO2 very noisy response
Manchester South SO2 very noisy response
Norwich Centre SO2 very noisy response
Reading New Town CO very noisy response with big downspikes
Reading New Town SO2 very unstable
Rotherham Centre SO2 very noisy
Sheffield Centre SO2 very noisy
Stoke-on-Trent SO2 very noisy
Wirral Tranmere CO lots of downspikes

3.6 Ozone Analyser Faults

Several ozone analysers were replaced during 2004, which subsequently proved to give erroneous spikes in the data. At many of these sites the problem API M400 analysers have now been removed and replacement instruments installed in their place. Where replacement analysers have been installed, it has often not been possible to configure the autocalibration systems and therefore analysers have been left operating without daily calibration checks. This is also clearly unsatisfactory in terms of operational performance checking and for data ratification purposes (e.g. checking zero response stability and span drift between photometer calibrations).

Recommendation

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

4 Sites with Data Capture Below 90%

4.1 Sites with Low Data Capture

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-March 2005 (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 2005
(Using the start date of any new site or end date of site closed)

	Data capture	Start date	End date	Reason	Comments	Days lost	Hours lost
England							
Barnsley Gawber							
NO2	68.0%	07-Jan-05	08-Jan-05	Unstable response	spurious data rejected	0.4	9
		09-Jan-05	10-Jan-05	High noise	high readings probably due to O3 scrubber	0.3	8
		02-Feb-05	15-Feb-05	Unstable response	unstable analyser output	13.6	326
		09-Mar-05	23-Mar-05	ESU service	spurious data from audit to service rejected	13.8	331
Birmingham Centre							
NO2	85.2%	12-Jan-05	13-Jan-05	Power cut	power cut	1	24
		22-Feb-05	24-Feb-05	Communication fault	LSO C/O No comms as power tripped	1.9	45
		15-Mar-05	17-Mar-05	Switched out-of-service	Offline since audit visit	2	49
		28-Mar-05	13-Apr-05	ESU service	SERVICE Powercuts during service.	16.5	397
Bradford Centre							
CO	81.7%	22-Dec-04	14-Jan-05	Instrument fault	Internal temp sensor fault unstable output	23.1	555
		14-Feb-05	16-Feb-05	ESU service	SERVICE	2.3	56
NO2	89.2%	14-Feb-05	17-Feb-05	ESU service	SERVICE	3.1	74
		29-Mar-05	02-Apr-05	Instrument fault	unexplained gap and step jump possibly converter problem?	4	95
Brentford Roadside							
CO	87.5%	21-Mar-05	10-May-05	Instrument fault	Unstable baseline	50.5	1211
Brighton Roadside							
CO	85.0%	19-Mar-05	01-Apr-05	Low flow rate	Unstable due to flow problems	13.7	329
Bury Roadside							
CO	54.9%	06-Jan-05	08-Jan-05	Unstable response	Unstable baseline	1.6	38
		19-Jan-05	20-Jan-05	Unstable response	Unstable baseline	1.5	36
		27-Jan-05	31-Jan-05	Communication fault	All channels mising - assume comms problems	5	120
		03-Feb-05	03-Feb-05	Unstable response	Deleted period with unstable baseline	0.5	11
		13-Feb-05	14-Feb-05	Unstable response	Deleted period with unstable baseline	1	25
		15-Feb-05	15-Feb-05	Unstable response	Deleted period with unstable baseline	0.8	19
		28-Feb-05	01-Mar-05	ESU service	SERVICE	1	25
		03-Mar-05	05-Apr-05	Unstable response	Analyser response unstable	33.3	800
NO2	89.5%	27-Jan-05	31-Jan-05	Communication fault	All channels missing - assume comms problems	5	120
		28-Feb-05	03-Mar-05	Unstable response	SERVICE data deleted until 3/3/05	3.5	83
Camden Kerbside							
NO2	89.5%	23-Mar-05	01-Apr-05	Instrument fault	PMT fault repaired.	9.3	224
Exeter Roadside							
CO	89.0%	12-Jan-05	13-Jan-05	Unstable response	Low data	0.3	7
		26-Jan-05	31-Jan-05	Unstable response	Analyser response change after Audit	5.3	127

		09-Feb-05	13-Feb-05	ESU service	SERVICE	3.5	84
Haringey Roadside							
PM10	90.0%	10-Jan-05	10-Jan-05	Power cut	Power Cut.	0.3	6
		26-Jan-05	03-Feb-05	Low flow rate	main flow fault following service	8.2	196
Harwell							
NO2	87.1%	25-Jan-05	26-Jan-05	ESU service	Service	1.1	26
		27-Jan-05	30-Jan-05	Power cut	Possible powercut - info requested	2.3	55
High Muffles							
NO2	79.8%	08-Jan-05	09-Jan-05	Power cut	powercut	1.6	38
		10-Mar-05	25-Mar-05	Sampling fault	Internal Sampling	15	361
O3	81.3%	08-Jan-05	09-Jan-05	Power cut	Powercut	1.6	38
		10-Mar-05	25-Mar-05	Sampling fault	Internal Sampling	14.6	350
Leeds Centre							
CO	71.8%	15-Feb-05	10-Mar-05	Monitoring suspended	ENG C/O Site decommissioned for replacement of analysers	23	553
NO2	73.8%	15-Feb-05	10-Mar-05	Monitoring suspended	ENG C/O Site decommissioned for replacement of analysers	23	553
O3	73.7%	15-Feb-05	10-Mar-05	Switched out-of-service	ENG C/O Site decommissioned for replacement of analysers	23	553
PM10	68.8%	15-Feb-05	14-Mar-05		ENG C/O Site decommissioned for replacement of analysers	27.1	650
SO2	73.8%	15-Feb-05	10-Mar-05	Instrument fault	ENG C/O Site decommissioned for replacement of analysers	23	553
London Brent							
CO	27.2%	01-Jan-05	07-Mar-05	Unstable response	ENG C/O Replaced chopper wheel	65.5	1572
NO2	83.4%	21-Feb-05	22-Feb-05	ESU service	SERVICE	1.2	28
		18-Mar-05	31-Mar-05	Rapid drift	NOx baseline skipped upwards	13	312
London Eltham							
PM10	86.0%	28-Jan-05	09-Feb-05	High noise	Sensor unit replaced.	11.6	278
		23-Feb-05	23-Feb-05	QAQC audit	AUDIT	0.3	6
London Hillingdon							
O3	83.4%	12-Jan-05	26-Jan-05	Unstable response	new analyser installed	14	337
London N. Kensington							
CO	87.5%	20-Mar-05	30-Mar-05	Pump fault	ENG C/O Replaced sample pump	10.5	253
NO2	84.9%	13-Jan-05	26-Jan-05	QAQC audit	rejected due to a pump fault.	13.1	314
Lullington Heath							
NO2	83.8%	09-Feb-05	10-Feb-05	ESU service	SERVICE	1	25
		23-Mar-05	12-Apr-05	Flat response	NO ch. output low after LSO cal	20	480
Manchester Piccadilly							
SO2	21.9%	22-Nov-04	10-Mar-05	High noise	Noisy data until March 2005-see section 3.1	109	2616
		29-Mar-05	30-Mar-05	Instrument fault	ENG C/O new heater installed.	1	25

Manchester South							
NO2	89.3%	01-Jan-05	07-Jan-05	Instrument fault	Broken glass in capiliary	6.5	156
		31-Jan-05	02-Feb-05	ESU service	SERVICE	2	49
		16-Feb-05	17-Feb-05	No mV data collected	Data missing	0.3	7
SO2	8.1%	01-Jan-05	24-Mar-05	Unknown	ENG C/O noisy response lamp reset.	82.6	1982
Manchester Town Hall							
CO	77.8%	27-Jan-05	28-Jan-05	ESU service	SERVICE	1.1	26
		04-Feb-05	04-Feb-05	High noise	Noisy data and baseline shift	0.3	7
		24-Feb-05	14-Mar-05	High noise	Noisy data.	18.1	435
Newcastle Centre							
NO2	89.3%	05-Feb-05	08-Feb-05	Logger fault	ENG C/O Logger lost configuration	3.1	74
		16-Mar-05	18-Mar-05	ESU service	SERVICE	2.1	51
Norwich Centre							
NO2	87.5%	17-Jan-05	20-Jan-05	QAQC audit	AUDIT	3	73
		20-Jan-05	21-Jan-05	ESU service	Serviced NOx pump-	0.7	17
		31-Jan-05	02-Feb-05	ESU service	SERVICE	2.1	51
		05-Feb-05	06-Feb-05	NO2 converter fault	NO2 converter temp failure	0.5	13
		07-Feb-05	08-Feb-05	ESU service	NOx NC card modified	1	23
		15-Feb-05	16-Feb-05	No mV data collected	No mV data	0.8	18
		21-Feb-05	21-Feb-05	No mV data collected	No mV data	0.3	7
		27-Feb-05	28-Feb-05	No mV data collected	No mV data	1.4	33
		15-Mar-05	16-Mar-05	No mV data collected	No mV data	0.5	12
O3	89.6%	31-Jan-05	02-Feb-05	ESU service	SERVICE	2.1	51
		05-Feb-05	08-Feb-05	ESU service	Eng c/o kinked pipe cleared	3.1	74
Norwich Roadside							
NO2	48.0%	24-Jan-05	25-Jan-05	ESU service	6 month service after audit.	1	23
		14-Feb-05	31-May-05	Monitoring suspended	Site closed for relocation	107	2559
Nottingham Centre							
CO	87.3%	14-Feb-05	16-Feb-05	ESU service	SERVICE	2.2	53
		23-Mar-05	04-Apr-05	Instrument fault	Noisy	12.1	291
Plymouth Centre							
O3	55.6%	01-Jan-05	09-Feb-05	Rapid drift	IZS Drift in cal. factor & Audit result 30% out	39.8	955
Preston							
CO	75.4%	10-Mar-05	14-Apr-05	Pump fault	Replaced pump at service.	35.4	850
Reading New Town							
CO	88.9%	23-Mar-05	15-Apr-05	Instrument fault	Replacement three way valve fitted.	24	575
Redcar							
CO	79.0%	14-Jan-05	17-Jan-05	No mV data collected	Assumed logger fault	2.8	66
		24-Feb-05	24-Feb-05	No mV data collected	Assume logger fault	0.3	7
		09-Mar-05	24-Mar-05	High noise	Increased signal noise following service	14.7	353

		30-Mar-05	31-Mar-05	Communication fault	Assume Comms problem as no evidence of fault	0.6	15
O3	67.2%	01-Jan-05	06-Jan-05	Sampling fault	Intermittent flow fault.	5.1	123
		21-Feb-05	22-Feb-05	Switched out-of-service	LSO Cal Status switches left off	1.3	32
		09-Mar-05	22-Apr-05	Instrument fault	Problem with 3-Way zero/span valve	44.5	1067
Rotherham Centre							
SO2	0.0%	01-Jan-05	11-May-05	Unstable response	Cyclic response probably temperature related	131	3132
Salford Eccles							
CO	88.2%	24-Jan-05	25-Jan-05	ESU service	SERVICE	1.1	26
		28-Jan-05	28-Jan-05	No mV data collected	IZS sequence fault causing logger to malfunction-see section 3.4	0.4	9
		29-Jan-05	01-Feb-05	Instrument fault	Baseline shifted after IZS sequence.	3.5	85
		13-Feb-05	14-Feb-05	No mV data collected	IZS sequence fault nulling data.	0.7	16
		17-Feb-05	17-Feb-05	No mV data collected	IZS sequence fault nulling data.	0.7	17
		18-Feb-05	18-Feb-05	No mV data collected	IZS sequence fault nulling data.	0.3	8
		02-Mar-05	02-Mar-05	No mV data collected	IZS sequence fault nulling data.	0.5	12
NO2	49.4%	18-Jan-05	04-Mar-05	Instrument fault	NOx converter failure and IZS sequence fault-see section 3.4	45.1	1083
Sandwell West Bromwich							
CO	88.2%	12-Jan-05	14-Jan-05	Pump fault	ENG C/O Pump was overheating	2	47
		09-Feb-05	14-Feb-05	ESU service	SERVICE Logger fault	5.3	128
		21-Feb-05	24-Feb-05	No mV data collected	Confusion over out of service switch.	2.8	67
O3	89.9%	13-Jan-05	14-Jan-05	Unstable response	recovers after autocal.	0.3	6
		09-Feb-05	14-Feb-05	ESU service	SERVICE Logger fault	5.3	128
		21-Feb-05	24-Feb-05	No mV data collected	Confusion over out of service switch.	2.8	67
SO2	73.8%	09-Feb-05	04-Mar-05	ESU service	HC filter not seated correctly.	23.1	554
Sheffield Centre							
NO2	67.6%	26-Jan-05	21-Feb-05		LSO accidentally turned off air con	26.6	638
		21-Mar-05	23-Mar-05	ESU service	SERVICE	2.1	50
Stockport Shaw Heath							
CO	62.7%	01-Jan-05	01-Jan-05	No mV data collected	No data collected	0.6	14
		20-Jan-05	18-Feb-05	ESU service	SERVICE	29.9	717
		22-Mar-05	23-Mar-05	Unstable response	unstable data due to chopper fault	0.7	16
Stoke-on-Trent Centre							
O3	89.1%	21-Feb-05	23-Feb-05	ESU service	SERVICE	2.2	52
		23-Mar-05	30-Mar-05	Pump fault	ENG C/O replaced sample pump.	7.1	170
SO2	0.0%	01-Jan-05	31-Mar-05	Instrument fault	Unacceptable zero baseline drift. See section 3.2	90	2160
Sunderland Silksworth							
O3	88.0%	08-Mar-05	09-Mar-05	Power cut	suspected power outage	1.2	28
		11-Mar-05	11-Mar-05	Power cut	suspected power outage	0.3	6
		26-Mar-05	18-Apr-05	Instrument fault	IZS causing data loss	22.8	548
Tower Hamlets Roadside							

CO	72.9%	18-Nov-04	19-Jan-05	Unstable response	ENG C/O IR source cleaned.	62.1	1490
		16-Feb-05	21-Feb-05	Unstable response	Deleted unstable data before service	5.3	128
Walsall Willenhall							
NO2	55.0%	06-Jan-05	15-Feb-05		NOx HV power supply fault	40.1	963
Wigan Centre							
PM10	87.8%	21-Feb-05	21-Feb-05	ESU service	SERVICE	0.3	6
		22-Feb-05	04-Mar-05	Instrument fault	Faulty mass flow controller assembly.	10.2	244
Wolverhampton Centre							
SO2	72.9%	21-Feb-05	22-Feb-05	Communication fault	No data logged following audit	1.1	26
		28-Feb-05	23-Mar-05	ESU service	SERVICE	23	551
N Ireland							
Belfast Clara St							
PM10	85.8%	06-Jan-05	11-Jan-05	Instrument fault	BAM measurement tape broken	5.2	125
		12-Jan-05	13-Jan-05	No mV data collected	Tape / Comms fault.	1	24
		25-Jan-05	26-Jan-05	No mV data collected	Tape / Comms fault.	1	24
		18-Mar-05	21-Mar-05	No mV data collected	Tape / Comms fault.	3.4	81
		27-Mar-05	28-Mar-05	No mV data collected	Tape / Comms fault.	1	25
Derry							
O3	59.8%	19-Jan-05	24-Feb-05	ESU service	Bad zero drift and failed leak check	36	864
SO2	77.2%	21-Feb-05	24-Feb-05	ESU service	SERVICE	3	71
		05-Mar-05	22-Mar-05	Inst. removed for repair	Rapid zero drift	17	409
Scotland							
Bush Estate							
NO2	49.2%	16-Feb-05	12-Apr-05	Instrument fault	Cooler failure	55.1	1322
Glasgow Centre							
CO	83.4%	16-Feb-05	28-Feb-05	Pump fault	ENG C/O pump repair	12.1	291
		08-Mar-05	08-Mar-05	QAQC audit	AUDIT	0.3	6
		09-Mar-05	11-Mar-05	ESU service	SERVICE	1.9	46
Glasgow City Chambers							
CO	82.9%	26-Jan-05	27-Jan-05	No mV data collected	Following on from LSO cal	0.4	10
		17-Mar-05	31-Mar-05	Unstable response	Deleted unstable data	14.6	350
Wales							
Cardiff Centre							
PM10	78.4%	16-Jan-05	31-Jan-05	Logger fault	Logger problem - no data recorded	15.6	374
		02-Feb-05	03-Feb-05	Logger fault	Logger problem - no data recorded	1.3	30
		07-Feb-05	09-Feb-05	ESU service	SERVICE	2.1	50
SO2	89.3%	02-Feb-05	09-Feb-05	ESU service	SERVICE	7	169
		21-Mar-05	23-Mar-05	ESU service	ENG C/O UV lamp and power supply replaced	2.1	50

Narberth							
NO2	88.4%	07-Feb-05	09-Feb-05	ESU service	SERVICE	2.1	50
		29-Mar-05	31-Mar-05	Communication fault	Modem fault	1.9	45
O3	53.9%	01-Jan-04	09-Feb-05	Instrument fault	Data unreliable; suspect baseline. See section 3.3	405	9730
		29-Mar-05	31-Mar-05	Communication fault	Modem Fault	1.8	44
PM10	53.8%	08-Nov-04	09-Feb-05	Low flow rate	TEOM flow rates wrong see sects 2.7 and 13.2	92.7	2224
		29-Mar-05	30-Mar-05	Communication fault	Modem fault	1.8	43

Eng C/O-Engineer call-out
LSO C/O-LSO call-out

4.2 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-March 2005. Casella Stanger has supplied the measured data, undertaken the filter weighing and calculated the particulate concentrations.

In this quarter five of the seven gravimetric Partisol analysers achieved data capture above 90% and there no major problems to report. Brighton and Wrexham both had data capture of 83%.

Site	Data capture %	Comments
Bournemouth	96	
Brighton Roadside	83	One set of filters lost in post (5–18 January)
Dumfries	98	17 and 18 February- damaged filters
Inverness	93	5–11 January-filter mechanism failed
Northampton	100	
Westminster	92	Some days sample period <18hrs, 16–17 January-filter mechanism failure, 3 February-missing filter
Wrexham	83	2-4 January,7–14 January-flow failure, 22–25 January- no filters

5 Ratified Data Capture Statistics

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

Table 5.1 Ratified Network Data Statistics

Site	Owner	CO	NO_2	O_3	PM_{10}	PM_{25}	SO_2	Site Average
England								
Barnsley 12	DEFRA	-	-	-	-	-	97.5	97.5
Barnsley Gawber	Affilate	90.8	68.0	96.5	-	-	97.0	88.1
Bath Roadside	Affilate	98.1	98.0	-	-	-	-	98.0
Billingham	DEFRA	-	96.8	-	-	-	-	96.8
Birmingham Centre	DEFRA	90.7	85.2	91.6	92.1	-	91.7	90.3
Birmingham Tyburn	Affilate	99.4	99.3	99.4	99.5	-	99.4	99.4
Bolton	Affilate	97.3	97.4	97.4	97.2	-	97.4	97.3
Bottesford	Affilate	-	-	99.6	-	-	-	99.6
Bournemouth	Affilate	96.9	92.7	96.8	-	-	96.8	95.8
Bradford Centre	DEFRA	81.7	89.2	92.8	95.0	-	94.3	90.6
Brentford Roadside	Affilate	87.5	99.5	-	-	-	-	93.5
Brighton Preston Park	DEFRA	-	98.9	98.2	-	-	-	98.6
Brighton Roadside	Affilate	85.0	98.7	-	-	-	-	91.8
Bristol Centre	DEFRA	96.7	96.3	96.5	96.1	-	95.9	96.3
Bristol Old Market	Affilate	98.6	98.3	-	-	-	-	98.4
Bury Roadside	Affilate	54.9	89.5	92.3	92.5	-	91.9	84.2
Cambridge Roadside	Affilate	-	91.8	-	-	-	-	91.8
Camden Kerbside	Affilate	-	89.5	-	99.5	-	-	94.5
Canterbury	Affilate	-	98.2	-	98.4	-	-	98.3
Coventry Memorial Park	DEFRA	98.1	98.5	98.1	98.3	-	98.2	98.2
Exeter Roadside	Affilate	89.0	93.6	97.8	-	-	97.8	94.6
Glazebury	DEFRA	-	94.2	98.3	-	-	-	96.3
Great Dun Fell	DEFRA	-	-	98.4	-	-	-	98.4
Haringey Roadside	Affilate	-	93.1	-	90.0	-	-	91.5
Harwell	DEFRA	-	87.1	95.3	96.0	95.7	95.3	93.9
High Muffles	DEFRA	-	79.8	81.3	-	-	-	80.6
Hove Roadside	Affilate	96.4	90.9	-	-	-	96.5	94.6
Hull Freetown	DEFRA	96.9	96.9	97.0	96.1	-	96.4	96.6
Ladybower	DEFRA	-	90.2	97.0	-	-	98.5	95.2
Leamington Spa	Affilate	97.7	93.7	91.5	98.3	-	97.8	95.8
Leeds Centre	DEFRA	71.8	73.8	73.7	68.8	-	73.8	72.4
Leicester Centre	DEFRA	96.3	97.2	96.8	96.6	-	97.1	96.8
Liverpool Speke	Affilate	99.4	99.2	99.4	99.2	-	99.4	99.3
London A3 Roadside	DEFRA	97.0	97.0	-	97.0	-	-	97.0
London Bexley	Affilate	93.8	97.4	94.2	97.2	-	96.2	95.8

Site	Owner	CO	NO_2	O_3	PM_{10}	PM_{25}	SO_2	Site Average
London Bloomsbury	DEFRA	96.9	96.7	96.9	97.0	96.9	96.9	96.9
London Brent	Affilate	27.2	83.4	90.4	97.9	-	92.7	78.3
London Bromley	Affilate	99.3	98.2	-	-	-	-	98.8
London Cromwell Road 2	DEFRA	93.7	97.9	-	-	-	97.9	96.5
London Eltham	Affilate	-	92.5	99.0	86.0	-	99.0	94.1
London Hackney	Affilate	99.3	99.1	98.5	-	-	-	99.0
London Haringey	Affilate	-	-	99.6	-	-	-	99.6
London Harlington	Affilate	99.6	99.6	99.7	99.1	-	-	99.5
London Hillingdon	DEFRA	96.9	96.8	83.4	97.2	-	96.9	94.3
London Lewisham	Affilate	-	99.4	99.5	-	-	99.6	99.5
London Marylebone Road	Affilate	99.4	99.1	99.0	99.0	99.5	99.4	99.2
London N. Kensington	Affilate	87.5	84.9	99.0	98.9	-	99.1	93.9
London Southwark	Affilate	98.2	98.1	97.2	-	-	96.3	97.5
London Teddington	Affilate	-	99.5	99.7	-	-	99.5	99.6
London Wandsworth	Affilate	-	99.4	99.4	-	-	-	99.4
London Westminster	DEFRA	98.0	97.6	94.7	-	-	97.9	97.0
Lullington Heath	DEFRA	-	83.8	97.1	-	-	96.7	92.5
Manchester Piccadilly	DEFRA	96.6	96.5	96.8	96.9	-	21.9	81.7
Manchester South	Affilate	-	89.3	94.3	-	-	8.1	63.9
Manchester Town Hall	DEFRA	77.8	93.9	-	-	-	-	85.9
Market Harborough	DEFRA	98.1	92.6	98.2	-	-	-	96.3
Middlesbrough	Affilate	96.9	93.0	97.2	95.8	-	97.1	96.0
Newcastle Centre	DEFRA	93.5	89.3	93.4	93.6	-	92.9	92.5
Northampton	Affilate	99.3	98.2	90.8	96.5	-	99.2	96.8
Norwich Centre	DEFRA	96.9	87.5	89.6	96.8	-	96.9	93.6
Norwich Roadside	Affilate	-	95.9	-	-	-	-	95.9
Nottingham Centre	DEFRA	87.3	96.0	96.8	96.8	-	96.6	94.7
Oxford Centre Roadside	Affilate	99.2	99.2	-	-	-	99.2	99.2
Plymouth Centre	DEFRA	96.7	96.7	55.6	96.6	-	96.8	88.5

Site	Owner	CO	NO_2	O_3	PM_{10}	PM_{25}	SO_2	Site Average
Portsmouth	Affilate	97.0	97.4	97.7	96.8	-	96.8	97.1
Preston	DEFRA	75.4	92.1	99.6	98.6	-	99.8	93.1
Reading New Town	DEFRA	88.9	94.5	94.7	98.1	-	89.7	93.2
Redcar	Affilate	79.0	93.0	67.2	96.2	-	94.7	86.0
Rochester	Affilate	-	93.7	97.6	97.7	95.2	97.7	96.4
Rotherham Centre	Affilate	-	96.9	97.2	-	-	0.0	64.7
Salford Eccles	Affilate	88.2	49.4	90.5	90.9	-	90.4	81.9
Sandwell West Bromwich	Affilate	88.2	90.1	89.9	-	-	73.8	85.5
Scunthorpe Town	Affilate	-	-	-	96.1	-	98.1	97.1
Sheffield Centre	DEFRA	94.9	67.6	97.2	97.1	-	96.0	90.5
Sheffield Tinsley	DEFRA	98.3	92.1	-	-	-	-	95.2
Sibton	DEFRA	-	-	94.5	-	-	-	94.5
Somerton	Affilate	-	90.2	90.4	-	-	-	90.3
Southampton Centre	DEFRA	96.2	93.1	97.2	97.4	-	95.4	95.9
Southend-on-Sea	DEFRA	96.9	92.5	97.2	95.2	-	96.2	95.6
Southwark Roadside	Affilate	97.9	98.3	-	-	-	98.2	98.1
St Osyth	DEFRA	98.2	94.1	98.2	-	-	-	96.9
Stockport Shaw Heath	Affilate	62.7	92.9	-	97.7	-	97.5	87.7
Stockton-on-Tees Yarm	Affilate	98.5	98.5	-	98.4	-	-	98.5
Stoke-on-Trent Centre	DEFRA	96.7	92.2	89.1	96.0	-	0.0	74.8
Sunderland	DEFRA	-	-	-	-	-	96.8	96.8
Sunderland Silksworth	Affilate	-	93.7	88.0	-	-	-	90.8
Thurrock	Affilate	96.4	97.0	97.2	97.2	-	96.9	96.9
Tower Hamlets Roadside	Affilate	72.9	98.6	-	-	-	-	85.8
Walsall Alumwell	DEFRA	-	98.3	-	-	-	-	98.3
Walsall Willenhall	Affilate	-	55.0	-	-	-	-	55.0
West London	DEFRA	99.3	99.4	-	-	-	-	99.3
Weybourne	Affilate	-	-	96.2	-	-	-	96.2
Wicken Fen	DEFRA	-	98.2	98.2	-	-	98.2	98.2
Wigan Centre	Affilate	98.9	94.0	98.8	87.8	-	99.3	95.8
Wirral Tranmere	DEFRA	99.8	99.5	99.9	99.5	-	95.6	98.9
Wolverhamp. Centre	DEFRA	94.2	96.0	95.9	96.2	-	72.9	91.0
Yarner Wood	DEFRA	-	95.5	98.3	-	-	-	96.9
N Ireland								
Belfast Centre	DEFRA	97.3	97.3	97.4	96.9	-	97.2	97.2
Belfast Clara St	Affilate	-	-	-	85.8	-	-	85.8
Belfast East	DEFRA	-	-	-	-	-	98.5	98.5

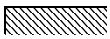
Site	Owner	CO	NO_2	O_3	PM_{10}	PM_{25}	SO_2	Site Average
Derry	Affilate	95.9	91.8	59.8	96.0	-	77.2	84.1
Lough Navar	DEFRA	-	-	99.4	99.2	-	-	99.3
Scotland								
Aberdeen	Affilate	99.9	95.3	99.9	99.8	-	99.5	98.9
Bush Estate	DEFRA	-	49.2	97.2	-	-	-	73.2
Dumfries	DEFRA	92.0	94.3	-	-	-	-	93.1
Edinburgh St Leonards	DEFRA	98.1	95.6	98.0	97.4	-	97.7	97.4
Eskdalemuir	DEFRA	-	95.4	99.5	-	-	-	97.5
Glasgow Centre	DEFRA	83.4	96.9	97.0	96.9	-	96.7	94.2
Glasgow City Chambers	DEFRA	82.9	97.5	-	-	-	-	90.2
Glasgow Kerbside	DEFRA	98.2	98.1	-	97.6	-	-	98.0
Grangemouth	Affilate	99.4	99.4	-	99.4	-	99.4	99.4
Inverness	DEFRA	98.2	98.4	-	-	-	-	98.3
Strath Vaich	DEFRA	-	-	95.5	-	-	-	95.5
Wales								
Aston Hill	DEFRA	-	99.4	99.4	-	-	-	99.4
Cardiff Centre	DEFRA	96.6	97.1	96.7	78.4	-	89.3	91.6
Cwmbran	Affilate	98.3	98.4	98.7	98.6	-	95.7	97.9
Narberth	Affilate	-	88.4	53.9	53.8	-	95.1	72.8
Port Talbot	Affilate	-	96.9	97.0	97.2	-	97.1	97.0
Swansea	Affilate	96.9	96.9	96.9	97.2	-	96.9	97.0
Wrexham	DEFRA	98.0	94.2	-	-	-	98.3	96.8
Number of sites		78	108	85	63	4	75	120
Number of sites < 90%		19	19	11	7	0	10	21
Network Mean (%)		92.4	93.0	94.2	95.0	96.8	90.8	93

Table 5.2 shows the ratified AURN data capture for the 61 **critical sites** in the network for the year January to March 2005. Sites with less than 90% data capture are shaded.

Table 5.2 AURN Ratified Data Capture (%) for CRITICAL SITES January to March 2005

Critical Sites		CO	NO_2	O_3	PM_{10}	SO_2
AGGLOMERATIONS						
Belfast Centre	DEFRA	97.3	97.3	97.4	96.9	97.2
Blackpool[1]	DEFRA	0	0	0	0	0
Bournemouth	Affiliate	96.9	92.7	96.8	-	96.8
Brighton Roadside PM_{10}	Affiliate	-	98.9	98.2	-	-
Bristol Centre	DEFRA	96.7	96.3	96.5	96.1	95.9
Cardiff Centre	DEFRA	96.6	97.1	96.7	78.4	89.3
Coventry Memorial Park	DEFRA	98.1	98.5	98.1	98.3	98.2
Edinburgh St Leonards	DEFRA	98.1	95.6	98.0	97.4	97.7
Glasgow Centre	DEFRA	83.4	96.9	97.0	96.9	96.7
Hove Roadside	Affiliate	96.4	90.9	-	-	96.5

Critical Sites		CO	NO_2	O_3	PM_{10}	SO_2
Hull Freetown	DEFRA	96.9	96.9	97.0	96.1	96.4
Leicester Centre	DEFRA	96.3	97.2	96.8	96.6	97.1
Liverpool Speke	Affiliate	99.4	99.2	99.4	99.2	99.4
Newcastle Centre	DEFRA	93.5	89.3	93.4	93.6	92.9
Nottingham Centre	DEFRA	87.3	96.0	96.8	96.8	96.6
Portsmouth	Affiliate	97.0	97.4	97.7	96.8	96.8
Preston	DEFRA	75.4	92.1	99.6	98.6	99.8
Reading New Town	DEFRA	88.9	94.5	94.7	98.1	89.7
Sheffield Centre	DEFRA	94.9	67.6	97.2	97.1	96.0
Southampton Centre	DEFRA	96.2	93.1	97.2	97.4	95.4
Southend-on-Sea	DEFRA	96.9	92.5	97.2	95.2	96.2
Stoke-on-Trent Centre	DEFRA	96.7	92.2	89.1	96.0	0.0
Swansea	Affiliate	96.9	96.9	96.9	97.2	96.9
Wirral Tranmere	DEFRA	99.8	99.5	99.9	99.5	95.6
ZONES						
Aberdeen	Affiliate	99.9	95.3	99.9	99.8	99.5
Aston Hill	DEFRA	-	99.4	99.4	-	-
Barnsley Gawber	Affiliate	90.8	68	96.5	-	88.1
Bush Estate	DEFRA	-	49.2	97.2	-	-
Canterbury	Affiliate	-	98.2	-	98.4	-
Cwmbran	Affiliate	98.3	98.4	98.7	98.6	95.7
Derry	Affiliate	95.9	91.8	59.8	96.0	77.2
Dumfries	DEFRA	92.0	94.3	-	-	-
Eskdalemuir	DEFRA	-	95.4	99.5	-	-
Glazebury	DEFRA	-	94.2	98.3	-	-
Grangemouth	Affiliate	99.4	99.4	-	99.4	99.4
Great Dun Fell	DEFRA	-	-	98.4	-	-
High Muffles	DEFRA	-	79.8	81.3	-	-
Inverness	DEFRA	98.2	98.4	-	-	-
Leamington Spa	Affiliate	97.7	93.7	91.5	98.3	97.8
Lough Navar	DEFRA	-	-	99.4	99.2	-
Narberth	Affiliate	-	88.4	53.9	53.8	95.1
Northampton	Affiliate	99.3	98.2	90.8	96.5	99.2
Norwich Centre	DEFRA	96.9	87.5	89.6	96.8	96.9
Oxford Centre Roadside	Affiliate	99.2	99.2	-	-	99.2
Plymouth Centre	DEFRA	96.7	96.7	55.6	96.6	96.8
Scunthorpe Town	Affiliate	-	-	-	96.1	98.1
Sibton	DEFRA	-	-	94.5	-	-
Somerton	Affiliate	-	90.2	90.4	-	-
St Osyth	DEFRA	98.2	94.1	98.2	-	-
Stockton-on-Tees Yarm	Affiliate	98.5	98.5	-	98.4	-
Strath Vaich	DEFRA	-	-	95.5	-	-
Sunderland	DEFRA	-	-	-	-	96.8
Sunderland Silksworth	Affiliate	-	93.7	88.0	-	-
Thurrock	Affiliate	96.4	97.0	97.2	97.2	96.9
Wicken Fen	DEFRA	-	98.2	98.2	-	98.2
Wigan Leigh	Affiliate	98.9	94.0	98.8	87.8	99.3
Wrexham	DEFRA	98.0	94.2	-	-	98.3
Yarner Wood	DEFRA	-	95.5	98.3	-	-
Number of critical analysers		39	51	47	35	39
Number of sites < 90%		4	7	7	3	4

Key  Pollutant monitored but not critical at this site
- Not monitored
[1] Blackpool site closed on 10/11/04 to be relocated.

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.

Appendix A1

As requested by the Department, QA/QC Unit has provided a list of suggestions for equipment that may need replacing or upgrading 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 July 2005	Priority	Action
14	Several analysers still exhibit poor performance- see items 12, 11, 10 and 7 below.	High	Repair/replacement to be actioned by ESUs
13	Continuing problems with some autocal run-ons causing loss of up to 3 hours per day	High	Many sites now cured, but some need attention at Summer 2005 service
	Recommendations May 2005	**Priority**	**Action**
12	CO baseline response instability at Exeter Roadside needs to be investigated and the analyser repaired or up-graded.	Medium	Now fixed
11	SO_2 analyser at Stoke-on-Trent shows severe baseline response drift. Recommend immediate repair/up-grading	High Critical Site	Still poor response, all SO_2 data deleted Q1 2005
10	The SO_2 analyser at Manchester South has shown a history of high noise response and should be up-graded or repaired.	Medium	Analyser performance still poor
	Recommendations January 2005		
9	Recommend the High Muffles NO_x autocalibration system is repaired/up-graded or turned off (span off only) until a satisfactory solution to autocalibration run-on problem is found.	High Critical site	Autocal span turned off but accidentally reactivated after service.
8	As the Blackpool site is now closed, we recommend the opportunity be taken to install ladder securing points to allow safer access to the site roof, prior to the site being relocated.	High Critical site	Site relocation underway

	Recommendations October 2004		
7	Recommend repair or up-grading of 11 unstable CO analysers detailed in Section 3.1 of this report. Of these, Barnsley Gawber (Affiliate) and Nottingham Centre (Defra) are critical for CO.	High Critical sites	On-going
6	Further advice for AURN equipment replacement and up-grading was given to CMCU on 8th September 2004.		On-going
	Recommendations July 2004		
5	Exeter Roadside CO unstable baseline. Recommend up-grading or repair.	Medium	On-going
4	Sheffield Tinsley CO noisy and drifting response. Recommend up-grade or repair	Medium	On-going
3	Recommend up-grading or modify SO_2 Ambirack bench at Reading New Town	Critical Site (Defra)	On-going
	Recommendations January 2004	**Priority**	**Action**
2	Recommend up-grade/modifications to SO_2 Ambirack bench at Blackpool and Norwich Centre to improve response noise. (Already done at Wirral Tranmere and Preston)	Blackpool Critical Site	Blackpool - new SO_2 bench fitted 9th March 2004
1	Advice on requirements for further AURN equipment up-grades has been given to CMCU (20/1/04)		On-going

APPENDIX A2

CRITICAL SITES IN THE AURN (May 2005)

Table A1 Critical Sites in Agglomerations

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

"+ indicates Affiliate site"

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

Table A2 Critical Sites in Zones

Site Name	Zone	Critical Pollutant		
		DD1	DD2[7]	DD3
Grangemouth+	Central Scotland	NO_2 PM_{10} SO_2	CO	
Bush Estate	Central Scotland			NO_2 O_3
Northampton+	East Midlands	NO_2 PM_{10}[2] SO_2	CO	NO_2 O_3
Sibton	Eastern			O_3[3]
St Osyth	Eastern			NO_2 O_3
Norwich Centre	Eastern			NO_2 O_3
Wicken Fen	Eastern			NO_2 O_3
Thurrock	Eastern			NO_2 O_3
Fort William	Highland			NO_2[6] O_3[6]
Strath Vaich	Highland			O_3[3]
Inverness	Highland	NO_2 PM_{10}		
Sunderland Silkworth+	North East			NO_2 O_3
Stockton-on-Tees Yarm+	North East	NO_2 PM_{10}	CO	
Sunderland	North East	SO_2		
Aberdeen+	North East Scotland	NO_2 PM_{10} SO_2	CO	NO_2 O_3
Aston Hill	North Wales			NO_2 O_3
Wrexham	North Wales	NO_2 PM_{10} SO_2	CO	
Great Dunn Fell	North West & Merseyside			O_3[3]
Wigan Leigh+/Centre[8]	North West & Merseyside	NO_2 PM_{10} SO_2	CO	NO_2 O_3
Glazebury	North West & Merseyside			NO_2 O_3
Lough Navar	Northern Ireland			O_3[3]
Derry+	Northern Ireland	NO_2 PM_{10} SO_2	CO	NO_2 O_3
Eskdalemuir	Scottish Borders			NO_2 O_3
Dumfries	Scottish Borders	NO_2 PM_{10}	CO	
Canterbury+	South East	PM_{10}		
Oxford Centre Roadside+	South East	SO_2	CO	
Narberth	South Wales			O_3[3]
Cwmbran+	South Wales	NO_2 PM_{10} SO_2	CO	NO_2 O_3
Somerton	South West			NO_2 O_3
Yarner Wood	South West			NO_2 O_3
Plymouth Centre	South West	PM_{10}		
Leominster	West Midlands			NO_2[4] O_3[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 Town+	Yorkshire & Humberside	PM_{10}		

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

Note 2: PM_{10} monitored by Gravimetric and TEOM
Note 3: DD3 Critical as Rural Background station
Note 4: If NO_2 at Leominster is Suburban then NO_2 at Leamington Spa is no longer critical for DD1
Note 6: Not Affiliated/Monitoring yet
Note 7: Addresses CO, Benzene not included here
Note 8: Wigan Leigh relocated to Wigan Centre on 8th October 2004

APPENDIX A3

Inventory of Defra owned Equipment

An up-to-date inventory of Department-owned equipment used by the QA/QC Unit is provided below:

QA/QC Unit's inventory of Department-owned equipment, April 2004

Computer software	The HIS (Heuristic Information System) software suite used for all data management. A few specific capabilities of HIS were developed in order to meet specific Department deliverables or requirements (examples include software for annual report analysis/compilation, for formatting/transmitting network data to archive or DDU and for reporting Directive compliance data to the EC).
Field support equipment	1 intercalibration equipment set (includes mass flow controllers and read-out unit) A second intercalibration kit (commissioned January 2001) UV photometers: API model M401- purchased April 1999 (on temporary loan) API model 401 - purchased October 2000 (on temporary loan) API model 401 – purchased December 2002 (on temporary loan) 4 API model 401 – purchased March 2004 Mass flow controllers - purchased April 2002 3 Drycal flow meters - purchased September 2002 1 Mass flow controller read-out unit to be incorporated in the audit dilution apparatus – purchased September 2002. A third intercalibration kit (commissioned May 2004) Drycal flow meter – purchased March 2004 Sabio 2010 dilution calibrator – purchased February 2005 Sabio 2020 zero air generator – purchased February 2005 Sabio 2030 ozone photometer – purchased February 2005
Zero air pumps	6 spare zero air pumps for routine maintenance/repair of zero air generators in the AURN.
Analysers	AC31 dual chamber NO_x analyser TEI 43C SO_2 analyser TEI 48C CO analyser M265 chemiluminescent ozone analyser (All of the above purchased on behalf of Defra by Casella Stanger in March 2003 and transferred to QA/QC Unit)

APPENDIX A4

Summary of Recommendations

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

	Need	Recommendation	Section	FAO
1	Improve data capture at critical sites	LSOs and ESUs should undertake call-outs as soon as possible at these sites	2.2	LSOs and ESUs
2	Routine converter efficiency checking	Pay careful attention to stability of fortnightly NO_2 calibration span response	2.5	LSOs
3	NO_x converter set-up after service and converter replacement	Converter to operate at >98% after service, or following converter replacement	2.5	ESUs
4	TEOM k_0 outliers	Confirm k_0 at Portsmouth has been correctly re-set after service	2.7	ESUs
5	Zero baseline truncation	Instrument zero baseline offsets of 20-50mV to be applied after service where possible	2.8	ESUs
6	Autocalibration run-on	Investigate problem of autocalibration run on at sites given in Table 2.7. Autocalibration span concentrations to be <200ppb for urban sites and <100ppb for rural sites.	2.9	ESUs
7	Manchester South SO_2 (Affiliate site)	Noisy analyser to be repaired or up-graded (carried out 21 July)	3.1	SU
8	Stoke-on-Trent SO_2 (Critical site analyser)	SO_2 analyser baseline response instability to be investigated/ repaired	3.2	CMCU/ ESU
9	Replacement rural ozone analysers	Status of faulty ozone analysers to be clarified and a plan for re-installation supplied	3.6	ESU
10	NOx calibrations	LSOs to check NO reading with NO2 cylinder against zero reading	8.2	LSO
11	NO_x switching valves	It is strongly recommended that ESU's clean all NOx analyser switching valves during servicing, and ensure the valve is leak checked afterwards.	8.3	ESU
12	TEOM configurations	ESU's to check and reset TEOM wait times and MR/MC averages where necessary	12.2	ESU
13	Blackpool	CMCU to prioritise reinstatement of this site	17	CMCU

PART B: Winter Intercalibration Results January to March 2005

6 Introduction

In Winter 2005, netcen undertook an intercalibration of the 122 operational monitoring stations in operation in the defra and the Devolved Administrations sponsored Urban, Rural and London Monitoring Networks. This 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_o 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 LSO's 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. These are identified and corrected during ratification.
- Pressurisation of the sampling system at the audit. Occasionally, an analyser can be very 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.
- Leaks, sample switching valves, etc. Outliers can be generated if an analyser is not sampling ambient air properly. It is likely that if a leaking analyser is identified, data losses will result.

The procedures used to determine network performance are documented in netcen Work Instructions. These methods are regularly updated and improved and are evaluated annually 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 and PM_{10} 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 122 sites were audited in this exercise. The site at Blackpool has been closed pending site relocation.

The following sections of this report identify analysers that did not meet performance standards, investigates the possible causes of these results and recommends any remedial action required.

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 in network*	% outliers in total
NOx analyser	29	108	28%
CO analyser	6	78	7%
SO_2 analyser	11	75	14%
Ozone analyser	23	85	27%
TEOM and BAM analysers	3 k_0, 3 flow	67 TEOM 1 BAM	8%
Gravimetric PM_{10} analysers	-	7	n/a
Total	76	421	18%

* Excludes Blackpool

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% from the standard photometer for O_3. For PM_{10} 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, 10 of the 385 site cylinders (~2.5%) used to scale instrument data into concentrations appeared to have drifted by more than 10% from their certificated values. Only two NO_x converters were found to be lower than the 95% acceptance limit, while a further converter failed in test.

The number of analyser outliers identified is similar to the previous exercise. At the summer 2004 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. The results for $PM_{2.5}$ analysers are presented in Table 7.3:

Table 7.2 – Performance Breakdown

SITE	Date visited	NO_x	CO	SO_2	O_3	PM_{10}
ENGLAND						
Barnsley 12	28/02			OK		
Barnsley Gawber	09/03	Outlier -40%	OK	OK	Outlier -6%	
Bath Roadside	02/03	OK	OK			
Billingham	23/02	OK				
Birmingham Centre	15/03	OK	OK	OK	OK	OK
Birmingham Tyburn	24/02	OK	OK	OK	Outlier +27%	OK
Bolton	17/02	OK	OK	OK	OK	OK
Bottesford	31/01				OK	
Bournemouth	14/03	OK	OK	OK	OK	OK

SITE	Date visited	NO_x	CO	SO_2	O_3	PM_{10}
Bradford Centre	09/02	Outlier -11%	OK	OK	OK	OK
Brentford Roadside	28/01	OK	OK			
Brighton Preston Park	16/03	OK			OK	
Brighton Roadside	17/03	OK	OK			
Brighton Roadside PM_{10}	17/03					OK
Bristol Centre	24/01	OK	Outlier -21%	Outlier -28%	OK	OK
Bristol Old Market	24/01	OK	OK			
Bury Roadside	16/02	OK	OK	Outlier +19%	OK	OK
Cambridge Roadside	19/01	OK				
Camden Kerbside	12/01	OK				OK
Canterbury	25/01	OK				OK
Coventry Memorial Park	03/02	OK	OK	OK	Outlier +10%	OK
Exeter Roadside	26/01	OK	OK	OK	OK	
Glazebury	17/01	Outlier -14%			Outlier +8%	
Great Dun Fell	23/03				OK	
Haringey Roadside	13/01	Outlier -24%				OK
Harwell	10/01	Outlier -26%		OK	OK	OK
High Muffles	21/02	OK			OK	
Hove Roadside	16/03	OK	OK	OK		
Hull Freetown	07/02	Outlier +45%	OK	OK	OK	OK
Ladybower	20/01	Outlier -17%		OK	OK	
Leamington Spa	02/03	OK	OK	OK	OK	OK
Leeds Centre	09/02	OK	OK	OK	Outlier -8%	OK
Leicester Centre	02/02	OK	OK	OK	OK	OK
Liverpool Speke	07/04	OK	OK	OK	OK	OK
London A3 Roadside	13/01	Outlier +24%	Outlier +11%			k_0 +3.3%
London Bexley	24/01	OK	OK	OK	OK	OK
London Bloomsbury	11/01	OK	Outlier +16%	OK	OK	OK
London Brent	14/02	OK	OK	OK	OK	A flow -14%
London Bromley	02/02	OK	OK			
London Cromwell Road 2	23/03	OK	OK	OK	OK	
London Eltham	23/02	OK		Outlier -15%	OK	OK
London Hackney	18/01	OK	OK		OK	
London Haringey	13/01				OK	
London Harlington	24/03	OK	OK		OK	OK
London Hillingdon	10/01	Outlier -14%	OK	OK	Outlier +23%	OK
London Lewisham	11/02	OK		OK	Outlier +38%	
London Marylebone Road	27/01	OK	OK	OK	OK	OK
London N. Kensington	13/01	OK	OK	OK	OK	OK
London Southwark	10/02	Converter 94.9%	OK	OK	Outlier +22%	
London Teddington	16/03	Outlier -15%		Outlier +53%	Outlier -20%	
London Wandsworth	03/02	Outlier -12%			Outlier -8%	
London Westminster	17/03	Outlier -20%	OK	OK	OK	OK
Lullington Heath	26/01	Converter 94.2%		OK	OK	
Manchester Piccadilly	18/01	Outlier -13%	OK	OK	Outlier +13%	OK
Manchester South	19/01	OK		OK	Outlier +8%	
Manchester Town Hall	18/01	OK	OK			
Market Harborough	31/01	Outlier +24%	OK		OK	

SITE	Date visited	NO_x	CO	SO_2	O_3	PM_{10}
Middlesbrough	22/02	Outlier +13%	OK	OK	OK	OK
Newcastle Centre	24/02	OK	OK	Outlier +13%	OK	OK
Northampton	12/01	OK	OK	OK	Outlier +10%	OK
Northampton PM_{10} (Grav)	12/01					OK
Norwich Centre	17/01	OK	OK	OK	OK	OK
Norwich Roadside	17/01	OK				
Nottingham Centre	31/01	OK	OK	OK	OK	OK
Oxford Centre Roadside	11/01	OK	OK	OK		
Plymouth Centre	25/01	Outlier -16%	OK	OK	Outlier +30%	OK
Portsmouth	10/01	Outlier -24%	OK	OK	Outlier +8%	k_0 +4.5%
Preston	05/04	OK	Outlier +31%	OK	Outlier -6%	OK
Reading New Town	21/03	OK	OK	OK	OK	OK
Redcar	22/02	Outlier -15%	OK	OK	OK	OK
Rochester	27/01	OK		OK	OK	OK
Rotherham Centre	09/03	OK		Outlier -18%	OK	
Salford Eccles	17/01	OK	OK	OK	Outlier +9%	OK
Sandwell West Bromwich	04/02	Outlier +24%	OK	OK	OK	
Scunthorpe	07/02			Outlier +15%		OK
Sheffield Centre	28/02	OK	OK	OK	OK	OK
Sheffield Tinsley	28/02	OK	OK			
Sibton	18/01				Outlier -25%	
Somerton	27/01	OK			OK	
Southampton Centre	25/01	OK	OK	OK	OK	OK
Southend-on-Sea	14/03	Outlier +26%	OK	OK	OK	A flow -23%
Southwark Roadside	28/01	OK	OK	OK		
St Osyth	15/03	Outlier +15%	OK		Outlier –9%	
Stockport Shaw Heath	19/01	Outlier +16%	OK	OK		OK
Stockton-on-Tees Yarm	23/02	OK	OK			OK
Stoke-on-Trent Centre	15/02	Outlier +30%	OK	OK	Outlier -17%	OK
Sunderland	25/02			OK		
Sunderland Silksworth	24/02	OK			OK	
Thurrock	22/03	OK	OK	OK	OK	OK
Tower Hamlets Roadside	03/02	OK	OK			
Walsall Alumwell	22/02	OK				
Walsall Willenhall	03/03	OK				
West London	29/03	OK	OK			
Weybourne	18/01				OK	
Wicken Fen	20/01	OK		Outlier +15%	OK	
Wigan Centre		OK	OK	OK	OK	OK
Wirral Tranmere	06/04	Outlier +21%	Outlier +13%	Outlier -11%	OK	OK
Wolverhampton Centre	21/02	OK	OK	OK	OK	OK
Yarner Wood	26/01	OK			OK	
NORTHERN IRELAND						
Belfast Centre	08/02	OK	OK	OK	OK	OK
Belfast Clara St	08/02					OK
Belfast East	08/02			OK		
Derry	09/02	OK	OK	Outlier +12%	Outlier -45%	OK
Lough Navar	22/02				OK	OK

SITE	Date visited	NO_x	CO	SO_2	O_3	PM_{10}
SCOTLAND						
Aberdeen	21/03	OK	OK	OK	OK	OK
Bush Estate	15/03	Outlier +14% Converter fail			OK	
Dumfries	23/03	OK	OK			OK
Edinburgh St Leonards	15/03	OK	OK	OK	OK	OK
Eskdalemuir	07/03	Outlier +24%			OK	
Glasgow Centre	08/03	OK	OK	OK	OK	OK
Glasgow City Chambers	08/03	Outlier -15%	OK			
Glasgow Kerbside	09/03	Outlier -32%	OK			k_0 -15.5%
Grangemouth	14/03	OK	OK	OK	OK	OK
Inverness	22/03	OK	OK			OK
Strath Vaich	22/03				Outlier +13%	
WALES						
Aston Hill	04/04	Outlier +11%			OK	
Cardiff Centre	04/02	OK	OK	OK	OK	OK
Cwmbran	03/02	OK	Outlier +14%	OK	OK	OK
Narberth	01/02	OK		OK	Outlier -12%	M flow -42%
Port Talbot	31/01	OK		OK	OK	OK
Swansea	31/01	OK	OK	Outlier +19%	OK	OK
Wrexham	07/02	Outlier -20%	OK	OK		OK

Table 7.3 – Performance summary, $PM_{2.5}$

Site	Date Visited	$PM_{2.5}$
Harwell	10 Jan	OK
London Bloomsbury	11 Jan	OK
London Marylebone Road	27 Jan	OK
Rochester	27 Jan	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 29 sites were outside the ±10% acceptance limit from the network mean. These outliers can be broken down into various types, as presented below:

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

1. Glazebury
2. Hull Freetown 2x® - Cylinder now replaced.
3. London A3
4. Middlesbrough

5. Portsmouth
6. Stockport Shaw Heath
7. Stoke-on-Trent 2x® - Cylinder now replaced.

® denotes a repeat offender, 2x® Twice repeat offender, etc.

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. 21 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 analyser at Bush failed during the test. Some data from this site has been rejected as a result.

In addition, the analyser at Wigan Centre failed the leak test.

Using the methodology detailed in Section 6, comparison of the network averages to audit cylinder concentrations showed that the network measures concentrations of NO and NO_2 to within 2% of the network standards. The percentage standard deviations of these results, which is an indication of how close the results are grouped together, were less than 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 four analysers:

1. Ladybower - measured 20 ppb NO in an NO_2 cylinder
2. Stoke-on-Trent - measured 14 ppb NO in an NO_2 cylinder
3. Glasgow Kerbside - measured 11 ppb NO in an NO_2 cylinder
4. Wrexham – measured 12 ppb NO in an NO_2 cylinder ®

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

1. London Brent - measured 12 ppb NO in an NO_2 cylinder
2. Reading New Town– measured 20 ppb NO in an NO_2 cylinder
3. Wicken Fen - measured 12 ppb NO in an NO_2 cylinder
4. Wolverhampton Centre - measured 14 ppb NO in an NO_2 cylinder
5. Dumfries - measured 13 ppb NO in an NO_2 cylinder

® denotes a repeat offender

These results are significantly better than those found at the summer 04 exercise, where 18 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 zero 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 LSO's or QA/QC to leak check these valves.

Recommendation

It is recommended that LSO's continue to pay particular attention to the NO_2 calibration results, to see whether the NO response is significantly higher (>10ppb) 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 emails 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.

Recommendation

It is strongly recommended that ESU's clean all NOx analyser switching valves during servicing, and ensure the valve is leak checked afterwards.

netcen will continue to monitor these results at audit visits.

8.3 Converter Tests

Just two converters were found to be less than 95% efficient:

- London Southwark – 94.9% (borderline - no data rejected)
- Lullington Heath – 94.2% (borderline - no data rejected)

The converter in the analyser at Bush failed during testing, making the result invalid. As a result of this fault, six weeks data were rejected from this site.

The converter at Wigan Centre was found to be 108% efficient. This is most likely to be due to a "phase tuning" error within the Horiba analyser – the ESU will need to correct this at the earliest opportunity.

It is worth noting at this point that the future requirement for the performance of NOx analysers will become much tighter. Converters will still need to be at least 95% efficient, but all NO_2 data will need to be rescaled to reflect the inefficiencies of the individual converters. In addition to this rescaling, data from any analysers with converters found to be lower than 95% efficient will be rejected. Clearly, significant future effort will be required to rescale this amount of data.

Recommendation

ESU's must set up converters to be greater than 98% efficient, and provide records that this has been done

9 Carbon Monoxide

The intercalibration showed that the results from 6 analysers were outside the ±10% acceptance criterion. Of these, 2 can be attributed to drifts in calibration factors between LSO calibrations, and no data were lost as a result of this.

The remaining 4 analysers all exhibited faults at the time of the audit, and it is likely that this has compromised the audit results. The data from the sites have been examined during ratification; some data from these sites have been rejected as a result of these investigations.

Comparison of the network average to the audit cylinder concentration showed that the network measures CO concentrations to within 2% of the reference standard. The percentage standard deviation was 3%. These are excellent 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 11 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.

The calibration factors from the Teddington site, in use on the day of the QA/QC audit, were 19 weeks old. The LSO and CMCU are reminded of the importance of keeping these records up to date; the raw data are used to predict possible pollution episodes. A significant amount of poorly scaled provisional data could be generated if the calibration records are not kept up to date.

The outliers at Bury and Rotherham were due to changes in the concentration of the site calibration cylinders. Data from these two sites have been carefully examined and rescaled as necessary. No data have been lost as a result of these investigations.

Comparison of the network average to the audit cylinder concentration showed that the network measures SO_2 concentrations to within 2.5% of the reference standard. The percentage standard deviation was less than 5%. These are 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 current 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 46 analysers were outside the required standard:

1.	Birmingham Centre	(19ppb) ®
2.	Bolton	(17ppb) 2x®
3.	Bristol Centre	(12ppb) ®
4.	Bury	(20ppb) 2x®
5.	Exeter	(17ppb) ®
6.	Harwell	(16ppb) ®
7.	Hove	(16ppb) 2x®
8.	Hull Freetown	(17ppb) 2x®
9.	Liverpool Speke	(19ppb) ®
10.	Bexley	(14ppb) ®
11.	Brent	(13ppb) 2x®
12.	Cromwell Road 2	(15ppb)
13.	Eltham	(24ppb) ®
14.	Lewisham	(21ppb) ®
15.	Marylebone Road	(15ppb) ®
16.	London Southwark	(11ppb)
17.	Westminster	(18ppb) ®
18.	Manchester Piccadilly	(23ppb) 3x®
19.	Manchester South	(23ppb) 3x®
20.	Middlesbrough	(14ppb) ®
21.	Newcastle	(11ppb) 3x®
22.	Nottingham	(32ppb)
23.	Oxford	(14ppb) ®
24.	Reading	(14ppb)
25.	Redcar	(14ppb)
26.	Rotherham	(23ppb) 2x®
27.	Salford Eccles	(16ppb) ®
28.	Sandwell West Bromwich	(16ppb)
29.	Scunthorpe Town	(11ppb)
30.	Sheffield Centre	(27ppb) 2x®
31.	Southampton	(22ppb) 3x®
32.	Southend-on-Sea	(12ppb)
33.	Stockport Shaw Heath	(13ppb) 2x®
34.	Stoke-on-Trent	(16ppb) 2x®
35.	Sunderland	(15ppb) 2x®
36.	Thurrock	(23ppb) ®
37.	Wicken Fen	(14ppb) ®
38.	Belfast Centre	(22ppb) ®
39.	Belfast East	(13ppb)
40.	Derry	(12ppb)
41.	Edinburgh St Leonards	(20ppb) ®
42.	Grangemouth	(13ppb) 3x®
43.	Cardiff	(13ppb) ®
44.	Narberth	(24ppb) 3x®
45.	Port Talbot	(12ppb) 2x®
46.	Wrexham	(15ppb)

® denotes a repeat offender, 2x® twice repeat offender, etc

These results are similar to the previous intercalibration, when 45 analyser kickers were identified as outliers. However, at present, none of these results give immediate cause for concern. No data have been rejected, and no specific actions are required at present. To put these results into perspective, at the expected maximum ambient concentrations of m-xylene (50ppb has been recorded as an hourly maximum, close to a shipyard), the worst kicker would show an interference response of around 1.5 ppb. At typical ambient concentrations, therefore, even the worst kicker in use at present would show a response of less than 1 ppb as a result of hydrocarbon interference.

The CEN requirement is that kicker response is only evaluated during type approval tests. The response of the analyser to 1ppm m-xylene must be lower than 1% (i.e. 10ppb SO_2), or the analyser fails the approval tests. There is no CEN requirement to evaluate the ongoing performance of the kicker, once an analyser is deployed in the field.

Netcen will continue to evaluate the performance of the hydrocarbon kickers, but in light of the CEN requirements, will place a more relaxed limit on acceptable performance. Based on ambient UK concentrations of likely hydrocarbon interferents, a kicker will be allowed to give a response of up to 50ppb to a 1ppm m-xylene cylinder. If an analyser gives a result worse than this, the kicker must be replaced.

11 Ozone

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

Of the 23 analysers, 11 had drifted by less than 10%; ratification of these datasets was straightforward, with no loss of data.

5 of the remaining analysers had drifted by less than 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 other 7 analysers had drifted by more than 20%. Ratification of the data from these analysers has been carefully undertaken, to ensure that suitable scaling of the data could be applied. The data for the Narberth analyser have been rejected.

These results are worse than the summer 2004 intercalibration; then, no analysers were found to be more than 20% from the reference photometer. This trend will be closely examined at the next intercalibration.

12 Particulate analysers

12.1 TEOM k_0

There were three outliers for TEOM k_0 during this intercalibration.

The analyser at London A3 was identified as an outlier at 3.3% from its stated values. The history of the analyser has been examined, and the dataset has been rescaled as appropriate with no loss of data. It is recommended that the k_0 values on the control and sensor units of this analyser are now adjusted accordingly.

The analyser at Portsmouth was found to have different values programmed into the sensor unit and control unit. The calculated k_0 value agreed with the value in the sensor unit, but was 4.5% out from the control unit value. Therefore the results from the instrument are not currently being scaled correctly, so the data have been corrected during ratification. We recommend that the value on the control unit is adjusted to agree with the value stored on the sensor unit.

The analyser at Glasgow Kerbside was identified as an outlier at -15.5% from its stated values. This instrument had been unstable for some time leading up to the audit visit. The ESU repeated the k_0 determination at the service, but found acceptable results. Netcen will revisit the site to re-evaluate the k_0 value.

At Narberth there was a discrepancy in the flows stated by the instrument (3 l/min main and 13.6 l/min auxiliary) and the actual flow rates measured at the audit (1.73 l/min main and 14.5 l/min auxiliary). Consequently the mass concentrations recorded during the 3-month period that this instrument was in place (November 8th 2004 until 7th February 2005) were erroneous and have been deleted.

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 three sites were found to be outside the ±10% acceptance limit:

1. London Brent (Aux Flow -14%)
2. Southend-on-Sea (Aux Flow -23%)
3. Narberth (Main Flow -43%)

These analysers also failed the leak tests. Close examination of the datasets from Brent and Southend suggests that ambient data at have not been affected by the leaks. The Narberth analyser leak was more significant and the data have been deleted up to the service on 7 February.

12.3 Analyser Configuration Information

The PM_{10} analysers used in the network, especially the TEOMs, are a wide range of ages and permutations. We have compiled a database of how all the analysers are configured. Tables 12.1 and 12.2 below summarise the major settings:

Table 12.1. – TEOM Configurations:

Site	Type	Serial Number	Software	Flow corrected to 25°C, 1atm?	Wait time = 1800s	MR/MC ave = 300	Main Flow	Const A = 3	Const B = 1.03
Birmingham Centre	A	2297	**2.106**	**No**	Yes	Yes	3	Yes	Yes
Birmingham East	AB	24637	3.017	Yes	Yes	Yes	3	Yes	Yes
Blackpool									
Bolton	AB	21197	3.003	Yes	Yes	Yes	3	Yes	Yes
Bradford Centre	AB	21494	3.008	Yes	**No - set to 180**	Yes	**2**	Yes	Yes
Bristol Centre	A	24426	3.017	Yes	Yes	Yes	**2**	Yes	Yes
Bury Roadside	AA	658	3.014	No	Yes	Yes	**2**	Yes	Yes
Camden Kerbside									
Canterbury	A	20931	**2.115**	**No**	Yes	Yes	3	Yes	Yes
Coventry Memorial Park	AB	25026	3.018	Yes	Yes	Yes	3	Yes	Yes
Haringey Roadside	A	20695	**2.115**	**No**	Yes	**No - set 900**	3	Yes	Yes
Harwell	AB	21489	3.013	Yes	Yes	Yes	3	Yes	Yes
Harwell PM2.5	AB	21490	3.005	Yes	Yes	Yes	3	Yes	Yes
Hull Freetown	A	24445	3.017	**No**	**No - set 10**	Yes	**2**	Yes	Yes
Leamington Spa	A	2075	**2.113**	**No**	Yes	Yes	3	Yes	Yes
Leeds Centre	A	2032	3.009	Yes	Yes	Yes	2	Yes	Yes
Leicester Centre									
Liverpool Speke	AB	24450	3.014	No	Yes	Yes	2	Yes	Yes
London A3 Roadside									
London Bexley	AB	2000	3.005	**No**	Yes	Yes	**2**	Yes	Yes
London Bloomsbury	AB	24446	3.017	**No**	Yes	Yes	3	Yes	Yes
London Bloomsbury PM2.5	AB	21492	3.005	Yes	Yes	Yes	3	Yes	Yes
London Brent	AB	21145	3.003	**No**	Yes	Yes	3	Yes	Yes
London Eltham	AA	2096	3.013	**No**	Yes	**No – set 900**	3	Yes	Yes
London Harlington									
London Hillingdon									
London Marylebone Road	AB	21306	3.005	Yes	Yes	**No – set 900**	3	Yes	Yes
London N. Kensington									
Manchester Piccadilly	AA	2000	3.015	**No**	Yes	Yes	**2**	Yes	Yes
Middlesbrough									
Newcastle Centre	AB	24448	3.017	Yes	Yes	Yes	3	Yes	Yes
Northampton	AB	21621	3.009	Yes	Yes	Yes	3	Yes	Yes
Norwich Centre	AB	21495	3.012	Yes	**No -**	Yes	**2**	Yes	Yes

Site	Type	Serial Number	Software	Flow corrected to 25°C, 1atm?	Wait time = 1800s	MR/MC ave = 300	Main Flow	Const A = 3	Const B = 1.03
					set180				
Nottingham Centre	A	20904	3.016	**No**	Yes	Yes	**2**	Yes	Yes
Plymouth Centre	AB	24428	3.017	Yes	**No - set180**	Yes	**2**	Yes	Yes
Portsmouth	AB	21578	3.009	Yes	Yes	Yes	3	Yes	Yes
Preston	AB	22881	3.013	No	Yes	Yes	2	Yes	Yes
Reading New Town	AB	2000	3.016	Yes	**No - set180**	Yes	**2**	Yes	Yes
Redcar	AB	21344	3.005	**No**	**No – set450**	Yes	3	Yes	Yes
Rochester	AB	24381	3.017	Yes	Yes	Yes	3	Yes	Yes
Rochester PM2.5	AB	21491	3.012	Yes	Yes	Yes	3	Yes	Yes
Salford Eccles	AB	21168	3.003	Yes	Yes	Yes	**2**	Yes	Yes
Scunthorpe Town	A	2000	3.018	**No**	Yes	Yes	3	Yes	Yes
Sheffield Centre	AA	20915	3.016	**No**	**No - set180**	Yes	**2**	Yes	Yes
Southampton Centre	AB	4484	3.017	Yes	**No – set300**	Yes	**2**	Yes	Yes
Southend-on-Sea									
Stockport Shaw Heath	AA	2000	3.015	**No**	Yes	Yes	3	Yes	Yes
Stockton-on-Tees Yarm	AB	22885	3.013	Yes	Yes	Yes	3	Yes	Yes
Stoke-on-Trent Centre	AB	21317	3.005	Yes	Yes	Yes	**2**	Yes	Yes
Thurrock	AB	25039	3.018	**Corrects to ambient**	Yes	Yes	3	Yes	Yes
Wigan Leigh	AB	22188	3.016	Yes	Yes	Yes	3	Yes	Yes
Wirral Tranmere	AB	22883	3.013	No	Yes	Yes	2	Yes	Yes
Wolverhampton Centre									
Belfast Centre	AB	24423	3.017	Yes	Yes	Yes	3	Yes	Yes
Derry	AB	49608	3.005	Yes	Yes	Yes	**2**	Yes	Yes
Lough Navar	AB	21196	3.012	Yes	**No - set900**	Yes	3	Yes	Yes
Aberdeen	AB	24427	3.017	**No**	Yes	Yes	3	Yes	Yes
Edinburgh St Leonards	AB	21308	3.005	Yes	Yes	Yes	**2**	Yes	**No - set to 1.0**
Glasgow Centre	A	20913	**2.115**	**No**	Yes	Yes	**2**	Yes	Yes
Glasgow Kerbside	AB	24444	3.017	**No**	Yes	Yes	**2**	Yes	Yes
Grangemouth	AB	22763	3.012	Yes	Yes	Yes	3	Yes	Yes
Cardiff Centre	AB	2449	3.017	Yes	Yes	Yes	**2**	Yes	Yes
Cwmbran	AB	21557	3.009	Yes	Yes	Yes	3	Yes	Yes
Narberth	AB	21143	3.017	Yes	**No - set180**	Yes	3	Yes	Yes
Port Talbot	AA	9402	3.011	**No - corrects to 0°**	Yes	Yes	3	Yes	Yes
Swansea	A	2130	**2.103**	**No**	Yes	Yes	**2**	Yes	Yes

Table 12.2 – Partisol Configurations:

Site	Serial number	Software	Flow corrected to 25°C, 1atm?	Start time	Duration	Mode
Bournemouth	21257	1.4	No – ambient	0:00	24h	Basic
Brighton Roadside						
Harwell PM2.5	21020	1.202	No – ambient	0:00	24h	Basic
London Westminster	20939	1.202	No – ambient	0:00	24h	Basic
Northampton						
Dumfries	21221	1.4	No – ambient	0:00	24h	Basic
Inverness	21255	1.4	No – ambient	0:00	24h	Basic
Wrexham						

Note - sites with blank entries will be completed during the Summer 2005 roadshow.

Values highlighted in bold are at settings that are different from the configurations being used for the PM_{10} intercomparison studies. Once the results of these studies are known, QA/QC Unit will provide recommendations for any required flow adjustments. No flow adjustments should, therefore be made at this time. However, the Wait Time settings must be 1800 and the MR/MC average and TM average settings must be 300. ESU's should therefore adjust these settings, if needed, at the next service visit

Recommendations

Specific actions required are:

- Wait time must be set to 1800 seconds
- MR/MC average must be set to 300 seconds

Netcen will continue to update these tables and present them in future reports.

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 10 of the 385 cylinders (~2.5%) used to scale analyser data into concentrations (NO, CO and SO_2) appear to be outside the ±10% acceptance criterion. This is better than the Winter 2004 roadshow, where 4% (15 cylinders) were outside the acceptance limits.

In addition, the concentrations of 23 NO_2 cylinders appear to have drifted by more than 10%.

In total, 33 of the 385 cylinders (9%) were outside the acceptance limits. This is better than the Summer 2004 intercalibration, where 12% 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.

As a result of this exercise, the following cylinders were identified for replacement:

London A3 NO
Middlesbrough NO
Portsmouth NO
Bush NO

14 Site Information

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

The Table below presents information about the sampling systems deployed on site, together with accurate, validated grid references. Considerable effort has been made in compiling these grid references. It should be noted that while the measurements are accurate to within 1 metre, 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 14.1 – Site Information

Site Name	Manifold type	Grid Reference	6 figure easting	6 figure northing	Altitude (m)
Aberdeen	Glass	NJ944074	394416	807408	10
Aston Hill	Glass	SO299901	329902	290062	370
Barnsley 12	Narrow-bore Teflon	SE343065	434276	406542	120
Barnsley Gawber	Wide-bore Teflon	SE325075	432529	407472	105
Bath Roadside (new)	Narrow-bore Teflon	ST755658	375473	165845	35
Belfast Centre	Glass	Lat / Long	54° 35' 58.8" N	5° 55′ 39.3″W	10
Belfast Clara St	N/A	Lat / Long	54° 35' 27.3" N	5° 53' 39.4" W	10
Belfast East	Narrow-bore Teflon	Lat / Long	54° 35′ 47.5″N	5° 54′ 2.1″W	10
Billingham	Glass	NZ470237	446962	523650	15
Birmingham Centre	Glass	SP063869	406342	286862	140
Birmingham East	Glass	SP115889	411520	288882	100
Birmingham Tyburn	Glass	SP116905	411625	290457	95

Site Name	Manifold type	Grid Reference	6 figure easting	6 figure northing	Altitude (m)
Blackpool	Wide-bore Teflon	SD323332	332320	433215	0
Bolton	Wide-bore Teflon	SD710086	371000	408562	105
Bottesford	Narrow-bore Teflon	SK798377	479768	337654	30
Bournemouth	Narrow-bore Teflon	SZ123933	412320	93344	10
Bradford Centre	Wide-bore Teflon	SE166331	416615	433098	102
Brentford Roadside	Narrow-bore Teflon	TQ174780	517425	178074	10
Brighton Preston Park	Wide-bore Teflon	TQ305062	530508	106222	30
Brighton Roadside	Glass	TQ313043	531307	104305	10
Brighton Roadside PM10		TQ313043	531322	104302	10
Bristol Centre	Glass	ST594733	359427	173285	15
Bristol Old Market	Glass	ST596732	359570	173173	20
Bury Roadside	Glass	SD809048	380922	404772	100
Bush Estate	High Flow wide tube	NT246639	324626	663880	185
Cambridge Roadside	Narrow-bore Teflon	TL452582	545248	258155	10
Camden Kerbside	Narrow-bore Teflon	TQ266844	526640	184433	50
Canterbury	Narrow-bore Teflon	TR162573	616198	157330	30
Cardiff Centre	Glass	ST184765	318417	176505	12
Coventry Memorial Park	Wide-bore Teflon	SP328773	432801	277340	95
Cwmbran	Wide-bore Teflon	ST305954	330510	195436	65
Derry	Wide-bore Teflon	Lat / Long	55° 0' 1.5" N	7° 19' 42.1" W	25
Dumfries	Narrow-bore Teflon	NX970763	297012	576278	20
Edinburgh Centre	Glass	NT255738	325523	673850	40
Edinburgh St Leonards	Glass	NT263731	326250	673132	30
Eskdalemuir	Narrow-bore Teflon	NT235030	323528	603030	260
Exeter Roadside	Stainless Steel	SX919928	291940	92840	35
Glasgow Centre	Wide-bore Teflon	NS589650	258902	665028	5
Glasgow City Chambers	Narrow-bore Teflon	NS595653	259528	665308	15

Site Name	Manifold type	Grid Reference	6 figure easting	6 figure northing	Altitude (m)
Glasgow Kerbside	Wide-bore Teflon	NS587652	258708	665200	10
Glazebury	Narrow-bore Teflon	SJ687960	368733	396034	20
Grangemouth	Wide-bore Teflon	NS938810	293840	681032	5
Great Dun Fell	Narrow-bore Teflon	NY710322	371020	532190	850
Haringey Roadside	Narrow-bore Teflon	TQ339907	533885	190669	15
Harwell	Wide-bore Teflon	SU468860	446772	186020	125
High Muffles	Wide-bore Teflon	SE775939	477535	493865	260
Hove Roadside	Glass	TQ301045	530088	104484	30
Hull Centre	Glass	TA097289	509700	428885	5
Hull Freetown	Glass	TA095293	509478	429329	0
Inverness	Glass	NH657457	265720	845680	10
Ladybower	Wide-bore Teflon	SK166896	416575	389565	360
Leamington Spa	Glass	SP319657	431932	265743	55
Leeds Centre	Glass	SE300343	429976	434268	60
Leicester Centre	Glass	SK588041	458767	304083	65
Leominster	Glass	SO498584	349773	258387	75
Lerwick	Narrow-bore Teflon	HU453397	445345	1139685	85
Liverpool Centre	Glass	SJ349906	334887	390638	20
Liverpool Speke	Glass	SJ439836	343860	383598	35
London A3 Roadside	Wide-bore Teflon	TQ190652	518983	165220	30
London Bexley	Glass	TQ519764	551852	176396	10
London Bloomsbury	Glass	TQ301820	530107	182041	20
London Brent	Glass	TQ196893	519570	189275	50
London Bromley	Narrow-bore Teflon	TQ405693	540533	169334	65
London Cromwell Road 2	Wide-bore Teflon	TQ265790	526530	178975	5
London Eltham	Narrow-bore Teflon	TQ440747	543978	174668	65
London Hackney	Wide-bore Teflon	TQ348862	534812	186230	20
London Haringey	Narrow-bore Teflon	TQ299891	529914	189132	40
London Harlington	Narrow-bore Teflon	TQ083778	508299	177809	25
London Hillingdon	Glass	TQ069786	506933	178607	25
London Lewisham	Narrow-bore Teflon	TQ377737	537680	173685	20
London Marylebone Road	Glass	TQ281820	528120	182000	30
London N. Kensington	Narrow-bore Teflon	TQ240817	524040	181740	20
London Southwark	Glass	TQ322786	532245	178565	20

Site Name	Manifold type	Grid Reference	6 figure easting	6 figure northing	Altitude (m)
London Teddington	Glass	TQ155704	515538	170427	20
London Wandsworth	Narrow-bore Teflon	TQ258747	525778	174677	10
London Westminster	Glass	TQ298789	529796	178949	0
Lough Navar	Glass	Lat / Long	54° 26′ 21.5" N	7° 53′ 55.9" W	
Lullington Heath	Wide-bore Teflon	TQ539018	553855	101740	115
Mace Head	Narrow-bore Teflon	Lat / Long	53° 19′ 35.2′′N	9° 54′ 14.1′′W	5
Market Harborough	Glass	SP833959	483337	295905	145
Manchester Piccadilly	Glass	SJ843983	384310	398325	60
Manchester South	Glass	SJ839858	383912	385828	65
Manchester Town Hall	Wide-bore Teflon	SJ839980	383874	397976	60
Middlesbrough	Glass	NZ505196	450480	519632	5
Narberth	Wide-bore Teflon	SN146127	214640	212700	160
Newcastle Centre	Glass	NZ250649	425016	564940	45
Northampton	Glass	SP761645	476111	264524	125
Norwich Centre	Wide-bore Teflon	TG231089	623078	308910	20
Norwich Roadside (new)	Narrow-bore Teflon	TG230085	622998	308521	35
Nottingham Centre	Glass	SK574401	457420	340050	40
Oxford Centre	Wide-bore Teflon	SP514062	451366	206152	60
Plymouth Centre	Glass		247742	54610	10
Port Talbot	Glass	SS780882	278036	188249	30
Portsmouth	Glass	SU657036	465686	103607	5
Preston	Wide-bore Teflon	SD552301	355248	430143	45
Reading New Town	Wide-bore Teflon	SU734732	473441	173198	45
Redcar	Glass	NZ600246	459975	524563	5
Rochester	Narrow-bore Teflon	TQ831762	583133	176220	14
Rotherham Centre	Teflon coated metal	SK431930	443088	393028	40
Salford Eccles	Glass	SJ779987	377932	398713	30
Sandwell West Bromwich	Glass	SP003915	400395	291503	165
Scunthorpe	Narrow-bore Teflon	SE906107	490592	410689	35
Scunthorpe Town	TBA	SE904108	490421	410812	35
Sheffield Centre	Glass	SK351868	435134	386885	75
Sheffield Tinsley	Glass	SK402906	440240	390585	45
Sibton	Wide-bore Teflon	TM363719	636295	271870	45
Somerton	Wide-bore Teflon	ST485265	348544	126525	45
Southampton Centre	Glass	SU426123	442565	112255	5
Southend-on-Sea	Wide-bore	TQ856861	585566	186130	35

Site Name	Manifold type	Grid Reference	6 figure easting	6 figure northing	Altitude (m)
	Teflon				
Southwark Roadside	Wide-bore Teflon	TQ346777	534621	177680	5
St Osyth	Glass	TM104132	610426	213205	5
Stockport Shaw Heath	Glass	SJ894896	389386	389604	75
Stockton-on-Tees Yarm	Wide-bore Teflon	NZ419129	441908	512886	10
Stoke-on-Trent Centre	Wide-bore Teflon	SJ883479	388348	347894	180
Strath Vaich	Wide-bore Teflon	NH348748	234829	874785	270
Sunderland	Narrow-bore Teflon	NZ399570	439855	556990	20
Sunderland Silksworth	Wide-bore Teflon	NZ381545	438142	554478	110
Swansea	Glass	SS656932	265566	193158	20
Thurrock	Glass	TQ610779	561018	177894	5
Tower Hamlets Roadside	Narrow-bore Teflon	TQ359822	535914	182230	10
Walsall Alumwell	Narrow-bore Teflon	SJ994983	399374	298264	130
Walsall Willenhall	Glass	SJ979012	397860	201173	150
West London	Wide-bore Teflon	TQ250788	525041	178751	5
Weybourne	Narrow-bore Teflon	TG098438	609832	343775	20
Wicken Fen	Wide-bore Teflon	TL563692	556310	269210	10
Wigan Centre	TBA	SD578060	357825	406025	45
Wirral Tranmere	Wide-bore Teflon	SJ321866	332096	386644	30
Wolverhampton Centre	Glass	SO914989	391368	298942	150
Wrexham	Glass	SJ329499	332862	349904	80
Yarner Wood	Wide-bore Teflon	SX786789	278605	78948	120

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.

For sites in Northern Ireland, Latitude and Longitude references are used to ensure accurate positioning. The GB and Irish grid reference systems are slightly different, which can lead to positioning errors. Latitude / Longitude data are also held for all existing sites.

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

15 CEN Standards

The European Committee for Standardisation (CEN) have now finalised and published 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 have been published by BSi for the operation of air pollution analysers; BS EN 14211 (NOx), BS EN 14212 (SO_2) 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.

The procedures for carbon monoxide, ISO14626 (CO), will be published in the near future

The final BS EN documents have incorporated a number of significant changes since the final drafts of the CEN procedures. The most important of these are presented below:

- Linearity – the analyser must have a maximum error at any point of less than 6% of the predicted value. This is much tougher to achieve than the current criteria (r^2 of 0.99 or better). Netcen have modified the procedures used for calculating linearity results to record maximum residuals, to evaluate the performance of current analysers against these tougher requirements. These results are reported in this Certificate of Calibration.

- NOx Converter efficiency must be better than 95%. Data must be rescaled for efficiencies between 95 and 100%, 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 continue to evaluate systems to calibrate sampling systems, but this is not currently undertaken on a routine basis in the UK.

  The QA/QC Unit has completed an initial report on the evaluation of methodologies to test losses of gases to sampling manifolds and this is available on the AURN Hub and Air Quality Archive. A follow up report will be added later in 2005.

- 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 have introduced a new procedure for handling drifting cylinder concentrations. In future, the uncertainty of this calculation will need to be substantially lower than the current 10% limit (in the order of 5% maximum).

It is understood that the final operating methodologies will be adopted into the requirements of the Framework Directive. Member States will then have up to two years to ensure their monitoring networks are compliant. 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 satisfactory leak tests on the entire sampling systems of 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 (site closed on 10th November 2004 for relocation)
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

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 period October 2004 to March 2005.

APPENDIX B1

Network Certificate of Calibration

netcen
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CERTIFICATE OF CALIBRATION

551 Harwell, Didcot, Oxfordshire OX11 0QJ. Telephone 0870 1906465 Facsimile 0870 1906377

UKAS CALIBRATION
0401

Certificate No: 01323
AEA Identification Number: 45077030

Approved Signatories: K. Stevenson
S. Eaton ✓

Signed: Date: 28 July 2005

Date of issue: 14 July 2005

Customer Name and Address: Dr Ana Grosinho
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 Monitoring Network

1. Carbon Monoxide

Date Year =2005	Site	Analyser number	[1]Zero output	Uncertainty (ppm)	[2]Calibration Factor	Uncertainty (%)	*Maximum Residual (%)
	Scottish Sites						
21-Mar	Aberdeen	10269	0	0.3	1.012	3	4.8
23-Mar	Dumfries	12555	-38	0.3	0.020	3	3.1
15-Mar	Edinburgh St Leonards	14331	-1	0.3	0.878	3	7.7
08-Mar	Glasgow Centre	0410-009	-14	0.3	0.057	3	3.3
08-Mar	Glasgow City Chambers	721	0	0.3	1.025	3	1.3
09-Mar	Glasgow Kerbside	HAR-002	-3	0.3	0.044	3	3.7
14-Mar	Grangemouth	12894	1	0.3	1.030	3	2.0
22-Mar	Inverness	12557	0	0.3	1.030	3	1.7
	Welsh Sites						
04-Feb	Cardiff Centre	242	0	0.3	0.962	3	3.3
03-Feb	Cwmbran	103006	0	0.3	1.079	3	0.9
31-Jan	Swansea	70	13	0.3	0.050	3	2.5
07-Feb	Wrexham	12556	0	0.3	0.009	3	4.9
	N.Irish Sites						
08-Feb	Belfast Centre	1811-m491	48	0.3	0.048	3	2.8
09-Feb	Derry	j-ar-010	-1	0.3	0.056	3	0.3

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

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Certificate No: 01323

AEA Identification Number: 45077030

Date Year =2005	Site	Analyser number	[1]Zero output	Uncertainty (ppm)	[2]Calibration Factor	Uncertainty (%)	*Maximum Residual (%)
	English Sites						
09-Mar	Barnsley Gawber		-3	0.3	0.052	3	2.4
02-Mar	Bath Roadside	11388	-17	0.3	0.051	3	3
15-Mar	Birmingham Centre	258	-41	0.3	0.054	3	2.9
24-Feb	Birmingham Tyburn		0	0.3	1.019	3	1.3
17-Feb	Bolton	2392	1	0.3	0.982	3	2.4
14-Mar	Bournemouth	1501	1	0.3	0.990	3	1.7
09-Feb	Bradford Centre		-3	0.3	0.049	3	2.0
28-Jan	Brentford Roadside	93034	6	0.3	1.071	3	1.7
17-Mar	Brighton Roadside	1434	1	0.3	1.047	3	1.6
24-Jan	Bristol Centre	257	0	0.3	1.250	3	2.9
24-Jan	Bristol Old Market	717	0	0.3	1.025	3	2.0
16-Feb	Bury Roadside	1357	0	0.3	1.045	3	0.9
03-Feb	Coventry Memorial Park		0	0.3	0.988	3	0.4
26-Jan	Exeter Roadside	244	0	0.3	0.049	3	1.1
16-Mar	Hove Roadside	1433	0	0.3	1.041	3	1.8
07-Feb	Hull Freetown	asee	45	0.3	0.049	3	1.8
02-Mar	Leamington Spa	399	27	0.3	0.049	3	2.2
09-Feb	Leeds Centre	148	94	0.3	0.052	3	0.7
02-Feb	Leicester Centre	207004	-1	0.3	1.041	3	1.0
07-Apr	Liverpool Speke	1807-m487	1041	0.3	0.005	3	1.6
13-Jan	London A3 Roadside	Ambirak H	-17	0.3	0.047	3	1.7
24-Jan	London Bexley	443	-1	0.3	1.030	3	2.6
11-Jan	London Bloomsbury	014330et	0	0.3	0.060	3	1.7
14-Feb	London Brent	1694	29	0.3	0.050	6.7	1.0
02-Feb	London Bromley	48-37853-256	2	0.3	0.988	3	3.1
23-Mar	London Cromwell Rd 2	10-776	11	0.3	0.050	3	0.9
18-Jan	London Hackney	36674-254	11	0.3	0.053	3	1.6
24-Mar	London Harlington	1045	0	0.3	0.995	3	1.2
10-Jan	London Hillingdon	0410-005	18	0.3	0.058	3	3.2
27-Jan	London Marylebone Rd	651	-1	0.3	1.015	3	2.4
13-Jan	London N. Kensington	360	2	0.3	0.981	3	1.7
10-Feb	London Southwark	843	1	0.3	0.929	3	1.3
17-Mar	London Westminster	867	8	0.3	0.051	3	1.8
18-Jan	Manchester Piccadilly	0410-008	0	0.3	0.048	3	0.9
18-Jan	Manchester Town Hall	m300-486	-5	0.3	0.049	3	1.4
31-Jan	Market Harborough	60983	4405	0.3	0.001	14.5*	0.2
22-Feb	Middlesbrough	204	0	0.3	0.995	3	2.3
24-Feb	Newcastle Centre	m488	49	0.3	0.05	3	2.3
12-Jan	Northampton	8905410	0	0.3	1.026	3	0.3
17-Jan	Norwich Centre	ws123	-1	0.3	0.05	3	0.3
31-Jan	Nottingham Centre		-1	0.3	0.044	3	4.1
11-Jan	Oxford Centre Roadside	214b-127	101	0.3	0.046	3	1.5

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2 , providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

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UKAS CALIBRATION
0401

Certificate No: 01323

AEA Identification Number: 45077030

Date Year =2005	Site	Analyser number	[1]Zero output	Uncertainty (ppm)	[2]Calibration Factor	Uncertainty (%)	*Maximum Residual (%)
25-Jan	Plymouth Centre	h-rao-410	-32	0.3	0.005	3	2.7
10-Jan	Portsmouth	902015	0	0.3	1.108	3	0.4
05-Apr	Preston	Ambirak N	-6	0.7	0.410	28	2.7
21-Mar	Reading New Town	H-AR-004	-5	0.3	0.046	3	1.5
22-Feb	Redcar	300	-7	0.3	0.051	3	1.8
17-Jan	Salford Eccles	2386	0	0.3	0.984	3	4.8
04-Feb	Sandwell West Bromwich	151	1	0.3	0.053	3	4.9
28-Feb	Sheffield Centre	410-006	-2	0.3	0.049	3	3.3
28-Feb	Sheffield Tinsley	517	3	0.3	0.051	3	4.8
25-Jan	Southampton Centre	1810-m490	47	0.3	0.05	3	2.6
14-Mar	Southend-on-Sea	l-ar-01	-12	0.3	0.05	3	3.8
28-Jan	Southwark Roadside	358	-2	0.3	0.926	3	1.8
15-Mar	St Osyth	60872	340	0.3	0.005	14.4*	0.5
19-Jan	Stockport Shaw Heath	9830-340	18	0.3	0.051	3	2.5
23-Feb	Stockton-on-Tees Yarm	m1368-m399	0.5	0.3	1.126	3	2.7
15-Feb	Stoke-on-Trent Centre	h-ar-003	-29	0.3	0.052	3	1.2
22-Mar	Thurrock	262	19	0.3	0.045	3	2.4
03-Feb	Tower Hamlets Roadside	272	9	0.3	1.453	3	4.9
29-Mar	West London	94683	-10	0.3	0.055	3	10.9
16-Feb	Wigan Centre		0.1	0.3	1.002	3	1.1
06-Apr	Wirral Tranmere		-1	0.3	0.051	3	0.3
21-Feb	Wolverhampton Centre		-7	0.3	0.051	3	2

2. Sulphur Dioxide

Date Year =2005	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)	*m-xylene interference (ppb)
	Scottish Sites							
21-Mar	Aberdeen	12182	-1	4.3	0.933	5	2.1	8.9
15-Mar	Edinburgh St Leonards	14320	0	4.2	1.127	5	6.4	20
08-Mar	Glasgow Centre	1400-RS	3	4.2	0.958	6.7	1.4	1
14-Mar	Grangemouth	703B-274	1	4.1	0.834	5		12.5
	Welsh Sites							
04-Feb	Cardiff Centre	70	3	4.2	1.131	5	0.2	12.8
03-Feb	Cwmbran	408001	10	4.1	0.941	5	1.7	3.8
01-Feb	Narberth	h-rs-458	68	4.2	0.656	5	2.9	23.9
31-Jan	Port Talbot	943	3	4.2	1.059	5	1.3	11.6
31-Jan	Swansea	168	0	4.0	0.167	5	1.1	6.4
07-Feb	Wrexham	12183	13	4.0	0.192	5	0.6	14.7
	N.Irish Sites							

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2 , providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

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Date Year =2005	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)	*m-xylene interference (ppb)
08-Feb	Belfast Centre	1637-m637	204	4.1	0.185	5	2.4	22
08-Feb	Belfast East	10778	3	4.2	0.969	5	2.8	12.6
09-Feb	Derry	j-ar-011	163	4.2	1.046	5	1.7	11.5
	English Sites							
28-Feb	Barnsley 12	706	2	4.2	0.944	5	2.5	7.6
09-Mar	Barnsley Gawber		91	4.7	1.143	5	0.8	6
15-Mar	Birmingham Centre	85	-10	4.0	0.210	5	1.9	19.5
24-Feb	Birmingham Tyburn	n/a	0	4.2	1.040	5	6.8	7.4
17-Feb	Bolton	2344	1	4.2	0.973	5	2.3	16.5
14-Mar	Bournemouth	1179	0	4.2	1.014	5	3.9	9.8
09-Feb	Bradford Centre		68	4.3	1.333	5	1.9	8
24-Jan	Bristol Centre	73	3	4.3	1.511	5	35.0	11.6
16-Feb	Bury Roadside	1581	-1	4.3	1.049	5	3.5	20.2
03-Feb	Coventry Memorial Park		2	4.4	1.328	5	0.6	0.5
26-Jan	Exeter Roadside	634	19	4.2	1.075	5	0.9	17.2
10-Jan	Harwell	83	-2	4.1	0.515	5	4.4	16.2
16-Mar	Hove Roadside	1178	0	4.2	0.951	5	0.6	16
07-Feb	Hull Freetown		242	4.1	0.177	5	1.1	16.9
20-Jan	Ladybower	100e-084	5	4.2	0.513	5	1.1	4.4
02-Mar	Leamington Spa	584	21	4.1	0.923	5	1.0	8.3
09-Feb	Leeds Centre	m100-053	2	4.1	0.208	5	0.5	5.5
02-Feb	Leicester Centre	215001	10	4.0	0.087	5	0.6	0.1
07-Apr	Liverpool Speke	9850b-m626	248	4.1	0.346	5	1.7	19
24-Jan	London Bexley	318	1	4.2	1.162	5	0.4	14.1
11-Jan	London Bloomsbury	014323et	13	4.0	0.201	5	10.8	0.6
14-Feb	London Brent	1828	20	4.3	0.982	5	5.1	13.3
23-Mar	London Cromwell Rd 2	10-779	-1	4.2	1.034	5	1.5	15.5
23-Feb	London Eltham	822	27	4.2	1.117	5	0.8	23.5
10-Jan	London Hillingdon	77580-386	8	4.0	0.186	5.3	4.3	5.6
11-Feb	London Lewisham	1220-M498	2	4.1	0.881	5	2.5	21.1
27-Jan	London Marylebone Rd	411	-4	4.2	1.083	5	3.0	15.3
13-Jan	London N. Kensington	1020	50	4.2	1.082	5	11.6	-3.2
10-Feb	London Southwark	535	-1	4.3	1.043	5	5.1	10.7
16-Mar	London Teddington	94739	-2	4.3	0.630	5	4.7	6.8
17-Mar	London Westminster	705	-3	4.3	0.938	5	2.8	18.3
26-Jan	Lullington Heath	m690	99	4.1	0.551	5	1.5	6.3
18-Jan	Manchester Piccadilly	0477-013	-44	6.4	0.207	6.4	1.1	22.7
19-Jan	Manchester South	477-0104	-63	7.5	0.191	7.4	5.0	23.3
22-Feb	Middlesbrough	1660	1	4.2	1.101	5	0.9	14.1
24-Feb	Newcastle Centre	m689	50	4.6	2.250	5	3.6	11.3
12-Jan	Northampton	8905630	-4	4.1	0.919	5.1	13.0	8.3
17-Jan	Norwich Centre	ws123	104	5.3	2.385	5	1.7	7.8
31-Jan	Nottingham Centre	0477-0176	348	10.5	0.203	8.7	4.0	31.9
11-Jan	Oxford Centre Roadside	376b-161	101	4.1	0.758	5	0.7	14.4
25-Jan	Plymouth Centre		0	4.0	0.084	5	4.7	1.8

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UKAS CALIBRATION
0401

Certificate No: 01323

AEA Identification Number: 45077030

Date Year =2005	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max Residual (%)	*m-xylene interference (ppb)
10-Jan	Portsmouth	578323093	2	4.2	1.234	5	15.3	2.5
05-Apr	Preston		40	4.2	1.110	5.4	6.9	6.7
21-Mar	Reading New Town	H-AR-004	3	4.6	1.542	5	3.5	14.3
22-Feb	Redcar	482	4	4.2	1.075	5	1.9	14
27-Jan	Rochester	95058	-1	4.4	1.073	5	2.8	9.1
09-Mar	Rotherham Centre	14770109	10	4.1	0.888	5	4.7	23.1
17-Jan	Salford Eccles	9800-2346	-2	4.7	1.136	6.6	3.1	15.6
04-Feb	Sandwell West Bromwich	137	-7	4.1	0.908	5	2.4	13.6
07-Feb	Scunthorpe Town	468	-1	4.5	0.809	6.1	8.0	11.3
28-Feb	Sheffield Centre	0477-015	4	4.1	0.199	5	2.8	27.1
25-Jan	Southampton Centre	m1768-m1676	229	4.2	0.191	5	0.9	21.8
14-Mar	Southend-on-Sea	l-ar-01	77	4.5	1.927	5	1.7	11.6
28-Jan	Southwark Roadside	659	3	4.4	1.078	5	2.1	7
19-Jan	Stockport Shaw Heath	0	15	4.1	0.941	5	1.0	13.2
15-Feb	Stoke-on-Trent Centre	h-ar-003	52	4.6	1.477	5.1	2.1	15.5
25-Feb	Sunderland	72	0	4.2	1.091	5	0.6	15.3
22-Mar	Thurrock	555	7	4.2	1.150	7.2	2.3	23
20-Jan	Wicken Fen	14349	-14	4.1	0.658	5	1.4	13.8
16-Feb	Wigan Centre		1	4.2	0.998	5	0.7	26.2
06-Apr	Wirral Tranmere		-10	11.8	5.152	9.1	15.7	1.3
21-Feb	Wolverhampton Centre		8	4.0	0.189	5	4.9	0.9

3. Ozone

Date Year =2005	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*R^2
	Scottish Sites						
21-Mar	Aberdeen	13073	1	3	0.955	3.1	1.0000
15-Mar	Bush Estate	77087-385	1	3	0.502	3.1	1.0000
15-Mar	Edinburgh St Leonards	14334	4	3	1.009	3.1	1.0000
07-Mar	Eskdalemuir	158	8	3	0.457	3.1	0.9998
08-Mar	Glasgow Centre	427-013	1	3	0.963	3.1	0.9997
22-Mar	Strath Vaich	324	-1	3	0.432	3.1	0.9998
	Welsh Sites						
04-Apr	Aston Hill	m400e-144	-11	3	0.477	3.1	1.0000
04-Feb	Cardiff Centre	168	0	3	1.014	3.1	1.0000
03-Feb	Cwmbran	402009	-1	3	1.001	3.3	1.0000
01-Feb	Narberth	H-RS458	0	3	1.147	3.1	0.9996
31-Jan	Port Talbot	339	3	3	0.509	3.1	1.0000
31-Jan	Swansea	156	6	3	0.099	3.1	1.0000
	N.Irish Sites						
08-Feb	Belfast Centre	m1626-m335	220	3	0.098	3.1	0.9999

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UKAS CALIBRATION
0401

Certificate No: 01323

AEA Identification Number: 45077030

Date Year =2005	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*R^2
09-Feb	Derry	j-ar-012	18	3	1.857	3.6	0.9983
22-Feb	Lough Navar	14376	-9	3	0.494	3.1	1.0000
	English Sites						
09-Mar	Barnsley Gawber		2	3	1.090	3.1	0.9991
15-Mar	Birmingham Centre	92379	-15	3	0.106	3.1	1.0000
24-Feb	Birmingham Tyburn		1	3	0.793	3.3	0.9999
17-Feb	Bolton	2371	1	3	0.971	3.2	1.0000
31-Jan	Bottesford	49c-EA357	3	3	0.987	3.1	0.9999
14-Mar	Bournemouth	824	2	3	0.981	3.2	1.0000
09-Feb	Bradford Centre		2	3	1.017	3.1	0.9998
16-Mar	Brighton Preston Park	542	0	3	0.506	3.1	1.0000
24-Jan	Bristol Centre	155	2	3	0.946	3.1	0.9998
16-Feb	Bury Roadside	1453	0	3	1.058	3.8	0.9997
03-Feb	Coventry Memorial Park		0	3	0.907	3.3	0.9998
26-Jan	Exeter Roadside	94	20	3	0.979	3.1	0.9998
17-Jan	Glazebury	m400e-138	6	3	0.463	3.1	0.9999
23-Mar	Great Dun Fell	14456	2	3	0.518	3.1	0.9996
10-Jan	Harwell	367	-7	3	0.511	3.1	0.9988
21-Feb	High Muffles	346	-18	3	0.481	3.1	0.9997
07-Feb	Hull Freetown		270	3	0.096	3.3	0.9997
20-Jan	Ladybower	125b-101	30	3	0.506	3.2	0.9997
02-Mar	Leamington Spa	110	20	3	0.957	3.1	1.0000
09-Feb	Leeds Centre	m400-056	251	3	0.108	3.1	0.9978
02-Feb	Leicester Centre	205006	30	3	0.103	3.1	1.0000
07-Apr	Liverpool Speke	m331	262	3	0.096	3.3	1.0000
24-Jan	London Bexley	403	0	3	1.002	3.1	1.0000
11-Jan	London Bloomsbury	014907et	0	3	0.122	3.1	1.0000
14-Feb	London Brent	1608	21	3	0.983	3.2	0.9999
23-Feb	London Eltham	375	8	3	0.968	3.1	0.9999
18-Jan	London Hackney	36870-254	6	3	1.013	3.3	0.9998
13-Jan	London Haringey	538	10	3	1.030	3.1	0.9999
24-Mar	London Harlington	107	7	3	1.035	3.1	1.0000
10-Jan	London Hillingdon	0427-012	6	3	0.082	3.3	0.9997
11-Feb	London Lewisham	939B-187	1	3	0.723	3.2	0.9999
27-Jan	London Marylebone Rd	769	0	3	0.994	3.2	1.0000
13-Jan	London N. Kensington	497	10	3	0.988	3.1	1.0000
10-Feb	London Southwark	5776	6	3	0.821	3.7	0.9997
16-Mar	London Teddington	58811-320	-21	3	0.248	3.1	1.0000
03-Feb	London Wandsworth	491	10	3	1.105	3.7	0.9989
17-Mar	London Westminster	879	7	3	0.493	3.1	1.0000
26-Jan	Lullington Heath	m337	100	3	0.471	3.1	0.9999
18-Jan	Manchester Piccadilly	0427-017	-4	3.8	0.178	3.4	0.9975
19-Jan	Manchester South	427-0102	-10	3	0.094	3.3	0.9998
31-Jan	Market Harborough	60894	-203	3	0.046	6.5	0.9984
22-Feb	Middlesbrough	944	0	3	1.036	3.1	1.0000
24-Feb	Newcastle Centre	841b-176	51	3	0.496	3.1	1.0000

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CERTIFICATE OF CALIBRATION

551 Harwell, Didcot, Oxfordshire OX11 0QJ. Telephone 0870 1906465 Facsimile 0870 1906377

UKAS CALIBRATION
0401

Certificate No: 01323

AEA Identification Number: 45077030

Date Year =2005	Site	Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*R^2
12-Jan	Northampton	89052401	2	3	0.903	3.1	1.0000
17-Jan	Norwich Centre	ws123	-1	3	1.015	3.1	0.9999
31-Jan	Nottingham Centre	0427-011	-14	3	0.100	3.1	0.9999
25-Jan	Plymouth Centre	0	19	3	0.039	3.1	0.9999
10-Jan	Portsmouth	205002	0	3	0.929	3.1	1.0000
05-Apr	Preston	0	0	3	1.056	3.2	0.9995
21-Mar	Reading New Town	H-AR-004	2	3	1.033	4.4	0.9995
22-Feb	Redcar	799	-1	3	1.012	3.1	1.0000
27-Jan	Rochester	95063	2	3	0.979	3.1	1.0000
09-Mar	Rotherham Centre	d4270106	2	3	0.968	3.1	0.9997
17-Jan	Salford Eccles	9800-2363	-1	3	0.919	3.2	1.0000
04-Feb	Sandwell West Bromwich	121	-2	3	0.489	3.1	1.0000
28-Feb	Sheffield Centre	427-010	0	3	0.097	3.5	0.9999
18-Jan	Sibton	338	15	3	0.678	3.1	0.9994
27-Jan	Somerton	427	4	3	0.501	3.1	1.0000
25-Jan	Southampton Centre	m354	273	3	0.099	3.2	0.9999
14-Mar	Southend-on-Sea	l-ar-01	0	3	1.054	3.1	0.9999
15-Mar	St Osyth	60869	-1	3	0.549	3.3	0.9999
15-Feb	Stoke-on-Trent Centre		2	3	1.208	4.0	0.9979
24-Feb	Sunderland Silksworth	436	0	3	1.050	3.2	1.0000
22-Mar	Thurrock	1040	1	3	0.495	3.1	0.9999
18-Jan	Weybourne	70532-366	0	3	1.030	3.1	1.0000
20-Jan	Wicken Fen	14345	-5	3	0.492	3.1	1.0000
16-Feb	Wigan Leigh		3	3	0.970	3.3	
06-Apr	Wirral Tranmere		2	3	1.032	3.2	0.9997
21-Feb	Wolverhampton Centre	0427-009	2	3	0.110	4.3	0.9955
26-Jan	Yarner Wood	347	-9	3	0.477	3.1	0.9997

4. Oxides of Nitrogen

Date Year =2005	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
	Scottish Sites								
21-Mar	Aberdeen	NO NOx	10268	0 -1	5 5.5	1.691 1.691	5 5.5	2.9 2.9	 97.2
15-Mar	Bush Estate	NO NOx	1756	102 102	5 6.5	0.995 0.973	6.5 6.3	not tested	not tested
23-Mar	Dumfries	NO NOx	12189	1 4	5 5.2	0.511 0.510	5 5.4	4.7 4.8	 100
15-Mar	Edinburgh St Leonards	NO NOx	14327	2 3	5 5.3	0.959 0.916	5 5.4	2.6 2.6	 99.8
07-Mar	Eskdalemuir	NO NOx	347	-1 -2	5 5.3	0.820 0.812	5 5.3	1.7 0.6	 98.9

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UKAS CALIBRATION
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Certificate No: 01323

AEA Identification Number: 45077030

Date Year =2005	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
08-Mar	Glasgow Centre	NO NOx	447-011	0 0	5 5.9	2.828 2.828	5.1 5.9	4.6 4.8	 102
08-Mar	Glasgow City Chambers	NO NOx	575	0 0	5 5.3	1.149 1.161	5 5.4	2.6 1.7	 98.5
09-Mar	Glasgow Kerbside	NO NOx	h-ar-002	-9 -9	5 5.6	2.187 2.158	5 5.5	1.6 1.1	 97.4
14-Mar	Grangemouth	NO NOx	700B-312	0 1	5 5.3	1.095 1.086	5 5.6	1.2 1.1	 100.9
22-Mar	Inverness	NO NOx	12184	2 3	5 5.3	1.206 1.180	5 5.4	4.2 3.2	 101.9
	Welsh Sites								
04-Apr	Aston Hill	NO NOx	m200a-2221	17 15	5 5.3	1.086 1.116	5 6.3	0.5 1.3	 97.9
04-Feb	Cardiff Centre	NO NOx	71	1 0	5 5.3	1.114 1.094	5 5.5	1.2 1.2	 96.2
03-Feb	Cwmbran	NO NOx	406003	4 -4	5 5.3	1.010 0.939	5 5	0.7 1.3	 97.4
01-Feb	Narberth	NO NOx	H-RS458	41 42	5 5.3	0.764 0.758	5 5	0.7 0.9	 96.6
31-Jan	Port Talbot	NO NOx	320	-1 -2	5 5.3	1.138 1.098	5 5.4	3.1 2.6	 102.3
31-Jan	Swansea	NO NOx	148	-3 4	5 5.3	0.426 0.419	5 5	2.3 2.4	 101.2
07-Feb	Wrexham	NO NOx	12185	12 12	5 5.2	0.499 0.518	5 5	3.3 4.3	 99.3
	N.Irish Sites								
08-Feb	Belfast Centre	NO NOx	m1804-m733	248 251	5 5.4	0.406 0.410	5 5	1.7 1.5	 98.8
09-Feb	Derry	NO NOx	j-ar-009	40 41	5 6.2	2.156 2.184	5.1 5.1	4.1 4.1	 99.1
	English Sites								
09-Mar	Barnsley Gawber	NO NOx		73 74	5 6.9	2.797 2.949	5.4 5.4	1.0 0.5	 96.2
02-Mar	Bath Roadside	NO NOx	12758	4 2	5 5.4	1.170 1.159	5 5	2.2 3.0	 98.1
23-Feb	Billingham	NO NOx	574	-1 -1	5 5.3	1.176 1.175	5 5	1.3 0.4	 99.5
15-Mar	Birmingham Centre	NO NOx	58	-12 -10	5 5.2	0.644 0.648	5 5.3	2.3 1.4	 100.0
24-Feb	Birmingham Tyburn	NO NOx		0 0	5 5.3	0.980 0.964	5 5	1.4 0.7	 95.7
17-Feb	Bolton	NO NOx	2359	1 2	5 5.4	0.968 0.928	5 5.9	2.3 1.1	 101.1
14-Mar	Bournemouth	NO NOx	522	0 1	5 5.3	1.170 1.148	5 6.3	0.5 0.5	 97.7
09-Feb	Bradford Centre	NO NOx		26 26	5 5.7	2.086 2.258	5.1 5	1.6 2.2	 103.1
28-Jan	Brentford	NO	m1759-	-2	5	1.084	5	4.3	

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Date Year =2005	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
	Roadside	NOx	m712	2	5.3	1.127	5	4.9	97.8
16-Mar	Brighton Preston Park	NO NOx	2222	0 2	5 5.3	1.006 1.038	5 5.3	0.9 0.7	98.7
17-Mar	Brighton Roadside	NO NOx	1225	-2 1	5 5.3	1.213 1.230	5 5.4	0.4 0.3	99.0
24-Jan	Bristol Centre	NO NOx	77	2 2	5 5.3	0.920 0.940	5 5	12.7 2.9	103.6
24-Jan	Bristol Old Market	NO NOx	653	0 0	5 5.4	1.416 1.386	5 5	2.0 2.1	100.0
16-Feb	Bury Roadside	NO NOx	1710	17 20	5 5.5	1.216 1.227	5 7.2	3.0 3.9	100.0
19-Jan	Cambridge Roadside	NO NOx	42c-55355-303	-1 -2	5 5.3	1.066 1.066	5 5	2.7 2.6	100.9
12-Jan	Camden Kerbside	NO NOx	623	0 0	5 5.4	1.340 1.345	5 5.6	8.6 7.5	102.2
25-Jan	Canterbury	NO NOx	11666	2 3	5 5.4	1.322 1.318	5 5	1.3 1.9	96.6
03-Feb	Coventry Memorial Park	NO NOx		0 -2	5 5.3	1.097 1.071	5 5	0.5 0.4	96.4
26-Jan	Exeter Roadside	NO NOx	85	20 22	5 6.1	2.939 3.141	5 5	1.1 1.4	96.4
17-Jan	Glazebury	NO NOx	m200e-078	3 2	5 5.2	0.597 0.579	5 5	3.8 3.9	98.5
13-Jan	Haringey Roadside	NO NOx	397	2 2	5 5.5	1.031 1.352	5 5.2	5.6 4.8	96.4
10-Jan	Harwell	NO NOx	79	-7 -10	5 5.4	1.462 1.444	5 5	0.5 0.6	98.9
21-Feb	High Muffles	NO NOx	1783	15 7	5 5.2	0.532 0.539	5 5	3.1 0.2	102.0
16-Mar	Hove Roadside	NO NOx	199	0 3	5 5.3	1.069 1.102	5 5.3	1.9 1.8	98.6
07-Feb	Hull Freetown	NO NOx		218 226	5 5.3	0.358 0.356	5 5	0.8 0.3	95.6
20-Jan	Ladybower	NO NOx	m200e-072	7 7	5 5.2	1.042 0.630	5 5	1.2 2.9	97.8
02-Mar	Leamington Spa	NO NOx	228	23 20	5 5.9	2.732 2.753	5 5.1	0.5 0.6	99.0
09-Feb	Leeds Centre	NO NOx	hsp0009	259 252	5 5.5	0.486 0.498	5 5.4	2.1 0.9	98.0
02-Feb	Leicester Centre	NO NOx	210004	-16 -40	5 5.2	0.102 0.099	5 5	1.0 1.0	99.3
07-Apr	Liverpool Speke	NO NOx	m1805-m734	244 256	5 6.7	0.425 0.447	5.3 6.5	1.6 1.9	97.5
13-Jan	London A3 Roadside	NO NOx		59 60	5 6.1	2.092 2.041	5 5.5	2.3 0.9	101.5
24-Jan	London Bexley	NO NOx	327	1 -2	5 5.3	0.963 0.946	5 5	0.3 0.4	97.0
11-Jan	London	NO	014328et	15	5	0.547	5	0.9	

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UKAS CALIBRATION
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Certificate No: 01323

AEA Identification Number: 45077030

Date Year =2005	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
	Bloomsbury	NOx		7	6.8	0.540	5.5	1.6	96.0
14-Feb	London Brent	NO	1852	23	5.4	2.277	5.8	0.5	
		NOx		28	8.1	2.254	6.3	1.3	101.6
02-Feb	London Bromley	NO	10669	-1	5	1.222	5	2.7	
		NOx		-1	5.5	1.223	5	2.3	97.9
23-Mar	London Cromwell Rd2	NO	10-775	-2	3	1.964	5	1.4	
		NOx		0	5.6	1.976	5.4	1.1	100.0
23-Feb	London Eltham	NO	307	3	5	1.490	5	1.3	
		NOx		3	5.6	1.450	5	0.4	98.8
18-Jan	London Hackney	NO	532B-234	101	5	1.032	5	0.8	
		NOx		103	5.4	1.063	5	2.1	96.7
24-Mar	London Harlington	NO	1090	0	5	1.289	5	3.3	
		NOx		3	5.4	1.331	5.3	2.8	98.4
10-Jan	London Hillingdon	NO	G-RA0447-010	-36	5	0.442	6.3	2.1	
		NOx		-32	5.4	0.445	5.7	4.8	95.2
11-Feb	London Lewisham	NO	M1231-M530	1	5	1.287	5	3.9	
		NOx		2	5.4	1.434	5	1.7	97.8
27-Jan	London Marylebone Rd	NO	439	1	5	1.841	5.7	3.0	
		NOx		-3	5.5	1.801	5	1.9	95.7
13-Jan	London N. Kensington	NO	459	2	5	0.965	5	7.5	
		NOx		7	5.3	0.985	5	6.9	97.4
10-Feb	London Southwark	NO	197	5	5	1.116	5	2.1	
		NOx		2	5.4	1.088	5	1.4	96.8
16-Mar	London Teddington	NO	94550	-2	5	1.241	5	2.0	
		NOx		0	5.5	1.253	5	1.5	97.6
03-Feb	London Wandsworth	NO	378	2	5	1.049	5	2.3	
		NOx		5	5.3	0.920	5.1	0.7	100.0
17-Mar	London Westminster	NO	573	2	5	2.681	5	2.6	
		NOx		1	5.9	2.886	5.2	2.0	101.3
26-Jan	Lullington Heath	NO	m675	100	5	1.014	5	0.5	
		NOx		102	5.4	1.014	5.2	0.7	94.2
18-Jan	Manchester Piccadilly	NO	ra0447-006	-49	5	0.339	5	3.8	
		NOx		-40	5.7	0.328	5	3.4	95.9
19-Jan	Manchester South	NO	447-0100-v2	3	5	0.408	5	8.1	
		NOx		14	5.3	0.415	5.3	7.5	96.2
18-Jan	Manchester Town Hall	NO	m200-846	1	5	2.487	5	2.5	
		NOx		3	6.2	2.414	5.9	2.4	98.1
31-Jan	Market Harborough	NO	61963	203	5	0.044	5	0.8	
		NOx		211	5.2	0.044	5	0.8	99.8
22-Feb	Middlesbrough	NO	2287	2	5	1.049	5	0.8	
		NOx		2	5.3	1.175	5	2.8	100.0
24-Feb	Newcastle Centre	NO	m730	51	5	2.064	5	2.1	
		NOx		52	5.6	2.116	5	0.9	100.9
12-Jan	Northampton	NO	apna360-6513180	1	5	0.963	5	1.4	
		NOx		0	5.3	0.894	5	1.3	98.7
17-Jan	Norwich Centre	NO	ws123	75	5	0.770	5	not	not

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UKAS CALIBRATION
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Certificate No: 01323

AEA Identification Number: 45077030

Date Year =2005	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
		NOx		75	5.3	0.779	5	tested	tested
17-Jan	Norwich Roadside	NO	94604	1	5	1.090	5	3.2	
		NOx		2	5.3	1.114	5	2.5	98.6
31-Jan	Nottingham Centre	NO	gra0447-009	10	5	0.576	5	1.7	
		NOx		7	5.6	0.563	5	1.0	98.9
11-Jan	Oxford Centre Roadside	NO	411b-179	99	5	1.329	5	0.7	
		NOx		100	5.5	1.333	5	0.3	95.2
25-Jan	Plymouth Centre	NO		11	5	0.234	5	0.9	
		NOx		-11	5.2	0.229	5	0.7	97.9
10-Jan	Portsmouth	NO	903005	0	5	1.261	5	3.8	
		NOx		1	5.3	1.127	5	2.8	96.0
05-Apr	Preston	NO		53	5	2.158	7.2	0.5	
		NOx		54	5.9	1.773	6.2	1.6	97.2
21-Mar	Reading New Town	NO	H-AR-004	11	5	1.012	5	3.7	
		NOx		15	5.3	1.085	6.7	3.9	95.5
22-Feb	Redcar	NO	497	2	5	1.437	5	2.2	
		NOx		2	5.4	1.457	5	0.7	95.5
27-Jan	Rochester	NO	95059	-2	5	1.078	5	3.8	
		NOx		-2	5.3	1.089	5	2.9	99.2
09-Mar	Rotherham Centre	NO	q-ra0447-001	5	5	1.287	5	1.7	
		NOx		4	5.4	1.303	5	0.5	97.9
17-Jan	Salford Eccles	NO	9800-2381	-1	5	1.009	5.2	1.0	
		NOx		4	6.4	1.737	6.6	3.4	103.4
04-Feb	Sandwell West Bromwich	NO	114	-3	5	0.990	5	0.3	
		NOx		-4	5.3	1.000	5	1.5	98.3
28-Feb	Sheffield Centre	NO	0447-008	-3	5	0.386	5	2.1	
		NOx		-9	5.3	0.388	5	2.4	95.5
28-Feb	Sheffield Tinsley	NO	487	-4	5	2.193	5	1.1	
		NOx		-5	5.6	2.167	5	1.2	96.6
27-Jan	Somerton	NO	2120	6	5	0.477	5	1.4	
		NOx		7	5.2	0.491	5	1.2	100.4
25-Jan	Southampton Centre	NO	m1781-m1723	227	5	0.401	5	0.9	
		NOx		248	6.1	0.413	5.5	1.3	95.1
14-Mar	Southend-on-Sea	NO	l-ar-01	50	5	1.700	7.9	1.9	
		NOx		50	5.8	1.749	7.3	1.9	95.9
28-Jan	Southwark Roadside	NO	1443	3	5	1.379	5	2.0	
		NOx		3	5.4	1.393	5	1.2	94.9
15-Mar	St Osyth	NO	60988	0	5	0.389	5	0.4	
		NOx		-1	5.2	0.417	5	1.5	98.2
19-Jan	Stockport Shaw Heath	NO		19	5	2.896	5.4	0.6	
		NOx		19	6	2.956	5.7	0.9	95.5
23-Feb	Stockton-on-Tees Yarm	NO	1356	2	5	1.302	5	1.6	
		NOx		0	5.4	1.331	5	0.8	96.9
15-Feb	Stoke-on-Trent Centre	NO		43	5	1.066	5	1.4	
		NOx		44	5.3	1.058	5	1.8	99.6
22-Mar	Thurrock	NO	920	-1	5	1.138	5	1.2	
		NOx		3	5.4	1.159	7.1	1.1	97.6
03-Feb	Tower Hamlets	NO	306	2	5	1.261	5	1.7	

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Date Year =2005	Site		Analyser number	[1]Zero output	Uncertainty (ppb)	[2]Calibration Factor	Uncertainty (%)	*Max residual (%)	*Converter efficiency (%)
	Roadside	NOx		9	5.3	1.182	5	0.9	96.8
22-Feb	Walsall	NO	10771	1	5	1.124	5	4.8	
	Alumwell	NOx		1	5.3	1.135	5	4.8	98.6
03-Mar	Walsall	NO	119	-1	5	0.975	5	1.0	
	Willenhall	NOx		0	5.3	0.985	5	1.0	97.7
29-Mar	West London	NO	10-774	1	5	1.331	5	3.0	
		NOx		4	5.4	1.372	10.5	2.2	99.4
20-Jan	Wicken Fen	NO	13069	16	5	0.497	5	2.2	
		NOx		12	5.2	0.491	5	1.9	97.7
16-Feb	Wigan Centre	NO		2	5	1.200	5	3.8	
		NOx		11	5.4	1.211	7.2	4.1	108.9
06-Apr	Wirral Tranmere	NO		43	5	1.390	6.6	0.5	
		NOx		42	5.5	1.336	6.7	0.4	100.0
21-Feb	Wolverhampton Centre	NO	G-RA0447-007	-23	5	0.397	5	1.7	
		NOx		-34	5.3	0.395	5	3.1	97.5
26-Jan	Yarner Wood	NO	1784	2	5	0.975	5	4.1	
		NOx		4	5.3	0.990	5	4.3	98.2

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2 , providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

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UKAS CALIBRATION
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5. Particulate Analysers

Date Year =2005	Site	Analyser number	Calculated Spring Constant k_0	Uncertainty (%)	$^4k_0$ accuracy (%)	^{3}Measured Main Flow (l/min)	Uncertainty (%)	^{3}Measured Total Flow **Aux Flow** (l/min)	Uncertainty (%)
	Scottish Sites								
21-Mar	Aberdeen	24427	11662	1	0.8	**2.83**	2.2	**13.09**	2.2
23-Mar	Dumfries							17.42	2.2
15-Mar	Edinburgh St Leonards	21308	12905	1	0.7	2.02	2.2	16.40	2.2
08-Mar	Glasgow Centre	22980	13048	1	-0.7	**1.92**	2.2	**15.52**	2.2
09-Mar	Glasgow Kerbside	24444	13209	1	-15.5	**1.85**	2.2	**15.97**	2.2
14-Mar	Grangemouth	22763	12454	1	-1.6	**3.04**	2.2	**14.11**	2.2
22-Mar	Inverness	1298-127						16.70	2.2
	Welsh Sites								
04-Feb	Cardiff Centre	24449	14138	1	-1.2	**2.17**	2.2	**15.10**	2.2
03-Feb	Cwmbran	21557	12472	1	-0.5	**3.02**	2.2	**12.88**	2.2
01-Feb	Narberth	21314	10593	1	1.3	**1.73**	2.2	**14.51**	2.2
31-Jan	Port Talbot	9402	10648	1	0.5	**3.08**	2.2	**13.73**	2.2
31-Jan	Swansea	2130	14428	1	-0.9	**1.99**	2.2	**14.53**	2.2
07-Feb	Wrexham								
	N.Irish Sites								
08-Feb	Belfast Centre	24423	14206	1	0.1	**2.08**	2.2	**14.60**	2.2
08-Feb	Belfast Clara St	95366					2.2	16.80	2.2
09-Feb	Derry	49608	10986	1	0.9	**2.13**	2.2	**15.48**	2.2
22-Feb	Lough Navar	21196	12955	1	1.1	**3.14**	2.2	**14.39**	2.2
	English Sites								
15-Mar	Birmingham Centre	2297	12146	1	0.6	3.03	2.2	17.10	2.2
24-Feb	Birmingham Tyburn	24637	13433	1	-1.3	**3.09**	2.2	**13.67**	2.2
17-Feb	Bolton	21197	15229	1	0.4	**3.29**	2.2	**13.98**	2.2
14-Mar	Bournemouth							17.28	2.2
09-Feb	Bradford Centre	21494	11519	1	1.5	2.02	2.2	14.77	2.2
24-Jan	Bristol Centre	24426	12922	1	-1.9	**2.15**	2.2	**15.21**	2.2
16-Feb	Bury Roadside	658	11630	1	0.3	1.98	2.2	16.46	2.2
12-Jan	Camden Kerbside	21306	16559	1	0.9	3.16	2.2	17.74	2.2
25-Jan	Canterbury	20931	14122	1	0.6	**2.94**	2.2	**13.30**	2.2
03-Feb	Coventry Memorial Park	25026	13185	1	0	**2.90**	2.2	not	tested
13-Jan	Haringey Roadside	20695	11417	1	-0.3	2.92	2.2	16.77	2.2
10-Jan	Harwell	21489	14815	1	-0.7	2.97	2.2	16.31	2.2
07-Feb	Hull Freetown	24445	14066	1	-0.3	**1.99**	2.2	**13.74**	2.2
02-Mar	Leamington Spa	2075	10924	1	-0.2	**3.09**	2.2	**14.37**	2.2
09-Feb	Leeds Centre	2032	13162	1	2.5	2.06	2.2	17.98	2.2
02-Feb	Leicester Centre	24442	13831	1	-1.4	**2.06**	2.2	**14.54**	2.2

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2 , providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

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Date Year =2005	Site	Analyser number	Calculated Spring Constant k_0	Uncertainty (%)	$^4k_0$ accuracy (%)	^{3}Measured Main Flow (l/min)	Uncertainty (%)	^{3}Measured Total Flow **Aux Flow** (l/min)	Uncertainty (%)
07-Apr	Liverpool Speke	24450	15843	1	0.2	1.83	2.2	16.24	2.2
13-Jan	London A3 Roadside	24425	12279	1	3.3	2.07	2.2	17.36	2.2
24-Jan	London Bexley	2000	10510	1	0.4	**2.15**	2.2	**15.32**	2.2
11-Jan	London Bloomsbury	24446	13824	1	0.6	3.12	2.2	17.02	2.2
14-Feb	London Brent	21145	17721	1	1.2	**2.95**	2.2	**11.76**	2.2
23-Feb	London Eltham	2096	14881	1	0.7	**2.99**	2.2	**13.65**	2.2
24-Mar	London Harlington	22835	14000	1	-1.4	**1.93**	2.2	**14.47**	2.2
10-Jan	London Hillingdon	24422	14122	1	-0.8	**2.07**	2.2	**14.65**	2.2
27-Jan	London Marylebone Road	21306	13309	1	-0.2	**3.25**	2.2	**14.01**	2.2
13-Jan	London N. Kensington	20715	10867	1	0.5	3.07	2.2	17.10	2.2
17-Mar	London Westminster	rfps-0694-098					2.2	18.25	2.2
18-Jan	Manchester Piccadilly	2000	12195	1	1.2	**1.91**	2.2	not	tested
22-Feb	Middlesbrough	24325	13792	1	-2.4	**2.07**	2.2	**14.81**	2.2
24-Feb	Newcastle Centre	24448	13496	1	-2.4	**3.01**	2.2	**13.63**	2.2
12-Jan	Northampton	21621	11077	1	-0.6	3.10	2.2	17.02	2.2
17-Jan	Norwich Centre	21495	12175	1	-0.3	**2.20**	2.2	**14.78**	2.2
31-Jan	Nottingham Centre	20904	8821	1	1.7	1.81	2.2	16.77	2.2
25-Jan	Plymouth Centre	24428	12859	1	-0.7	**2.18**	2.2	**14.94**	2.2
10-Jan	Portsmouth	21578	10693	1	1.1	**2.86**	2.2	**12.76**	2.2
05-Apr	Preston	22881	12863	1	-0.7	1.87	2.2	16.31	2.2
21-Mar	Reading New Town	2000	13253	1	0.4	1.99	2.2	16.59	2.2
22-Feb	Redcar	21344	11687	1	-0.8	**3.05**	2.2	**13.81**	2.2
27-Jan	Rochester	24381	12230	1	1.5	**3.04**	2.2	**13.45**	2.2
17-Jan	Salford Eccles	21168	14588	1	1.2	1.83	2.2	16.64	2.2
07-Feb	Scunthorpe Town	2000	12386	1	-0.8	3.24	2.2	18.10	2.2
28-Feb	Sheffield Centre	25024	12223	1	-0.2	2.02	2.2	16.62	2.2
25-Jan	Southampton Centre	4484	14011	1	1	2.14	2.2	**14.78**	2.2
14-Mar	Southend-on-Sea	22927	13460	1	0.5	**1.93**	2.2	**11.19**	2.2
19-Jan	Stockport Shaw Heath	2000	10661	1	2.3	**2.90**	2.2	not	tested
23-Feb	Stockton-on-	22885	14148	1	-1	not	tested	17.39	2.2

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	Tees Yarm								
15-Feb	Stoke-on-Trent Centre	25028	12203	1	-2.4	2.16	2.2	17.74	2.2
22-Mar	Thurrock	25039	12912	1	-0.5	**3.06**	2.2	**14.02**	2.2
28/01	Wigan Leigh	22188	12065	1	0	3.18	2.2	16.62	2.2
06-Apr	Wirral Tranmere	22883	13329	1	0.3	**1.83**	2.2	**14.05**	2.2
21-Feb	Wolverhampton Centre	20917	13895	1	1.1	1.98	2.2	16.33	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 data logging system 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

The scaling factor for gaseous analysers is calculated using mole fraction concentrations.

[3] The measured main flow rate (where this is applicable) is the flow rate through the sensor unit of a TEOM analyser. The measured aux flow rate (where this is applicable) is the flow rate through the bypass tubing of the TEOM particulate analyser under test. The measured total flow rate is the total flow rate through the particulate analyser under test. Units of flow are $l.min^{-1}$. Measurements shown in **bold** are not made at the normal sample inlet and may not therefore accurately represent the actual flow through the inlet.
[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.

* The maximum residual is the percentage maximum deviation of the worst linearity point from the line of best fit
* R^2 is the correlation coefficient of linearity
* Converter is the measured efficiency of the NO_2 to NO converter in the Nitrogen Oxides analyser
* meta-xylene interference is the response of the SO_2 analyser when supplied with approx 1ppm meta-xylene

This certificate is an electronic representation of the original, signed by Stewart Eaton on 28 July 2005. Photocopies can be obtained by writing to Brian Stacey at the address given on the top of the certificate.