Report

QA/QC Data Ratification and Intercalibration Report for the Automatic Urban and Rural Network, January-March 2006

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

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Executive Summary

Part A Ratification Report for January-March 2006

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 2006.

In general this has been a fairly good 3-month period for the AURN with a network average data capture of 90.4% being achieved. The overall data capture for NO_2 for this quarter was 89.9%, the only pollutant not to achieve the target of 90%. There were some sites affected by relocation or temporary closure, which resulted in low data capture.

Part B Winter 2006 Intercalibration Results

A total of 122 sites were calibrated by netcen during January-March 2006. The results show that the majority of the network analysers are working satisfactorily and that data are generally of high quality. A total of 69 out of 438 analysers deviated by more than the appropriate acceptance criteria (see Section 7), and a further 4 NOx converters were found to be unacceptably inefficient. The concentrations of the on-site calibration gas cylinders were also checked. The certificate of calibration is provided in Appendix B1.

DATA RATIFICATION REPORT JANUARY-MARCH 2006

This report comprises two separate sections. Part A describes the general performance of the network for the first quarter of 2006, including any changes to the network, site specific problems, and recommendations for improving the network performance. The major reasons for data loss are also given.

Part B describes the results from the winter 2006 intercalibration exercise. A summary is provided of the performance of each of the analysers tested, and of the on-site checking of calibration cylinder concentration. This section also includes site information such as location, altitude and sample inlet specification.

PART A – Ratification Report for the Automatic Urban and Rural Network, January-March 2006

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 2006. During this period there were 124 monitoring sites in the Network of which there are 88 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 61 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 125, 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.

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 period is given in Table 1.1.

Table 1.1 Changes in the Network, January-March 2006

Site	Date closed	Date commissioned	Comments
London Bromley (CO)	1 Jan 2006	-	Deaffiliated due to poor data capture.
Auchencorth Moss	-	1 Jan 2006	PM_{10} and PM_{10} Partisols incorporated into the network; no data available yet.
Belfast Clara Street	-	-	Analyser chaged to TEOM from BAM

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

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.

London Bromley
Following a significant period of data logger problems with the CO analyser at London Bromley, a decision was made to de-affiliate this analyser with effect from 1 January 2006.

Southwark Roadside
The analysers at Southwark Roadside were switched off on 21 February following failure of the air conditioning unit. Subsequently, requests have been received from the occupants of the building housing the site to remove the monitoring site. It is hoped that the site will be relocated (with the inlet in the same location, and with a NOx analyser only) in the near future.

Auchencorth Moss
The installation of the analysers at this site has taken place over a period of time. The PM_{10} and $PM_{2.5}$ Partisols commenced operation on 1 January 2006, although the data from these have not yet been supplied to the QA/QC Unit. A commissioning audit was, however, carried out in Spring 2006.

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.

The last DD3 site to be commissioned, Fort William, was commissioned in June 2006.

The analysers at Exeter Roadside were replaced with temporary instruments on 23 March, pending delivery of new equipment in June. The QA/QC Unit has performed a site audit on the temporary equipment to ensure continuity of data quality.

1.2 Overview of Network Performance

Ratified hourly average data capture for the network averaged 90.4% for all pollutants (O_3, NO_2, SO_2, CO, PM_{10} and $PM_{2.5}$) during the 3-month reporting period January-March 2006 (see Table 1.2 below). All pollutants except NO_2 had average data captures above the required 90% during this quarter. The annual average network data capture for the calendar year 2005 was 91%.

Table 1.2 AURN Ratified Data Capture (%) by Quarter, 2006 (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 2006	90.1	89.9	91.0	94.7	98.1	90.9	90.4

Overall, 347 out of the 422 analysers (82%) achieved data capture levels above the required 90% target during this reporting period (See Table 1.3).

Table 1.3 Number of Analysers with Data Capture below 90%

Total Number of Analysers		Q1 Jan-Mar 2006
CO	77	17
NO_2	109	20
O_3	87	14
PM_{10}	70*	8
$PM_{2.5}$	4	0
SO_2	75	16
Total <90%	422	75

*Includes TEOMs and Partisols

In total, 33 out of the 124 operational network sites (27%) had an average data capture rate below the required 90% level for the January-March 2006 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 2006 (Data capture calculated from site start date)

Network Data Capture for 01/01/2006 to 31/03/2006 from start date of any new site

Site	Owner	Site Average
England		
Barnsley Gawber	Affiliate	79.9
Bolton	Affiliate	76.1
Brentford Roadside	Affiliate	56.6
Bury Roadside	Affiliate	70.1
Exeter Roadside	Affiliate	88.3
Haringey Roadside	Affiliate	79.2
Hull Freetown	DEFRA	88.3
London Hackney	Affiliate	63.7
London Haringey	Affiliate	3.8
London Southwark	Affiliate	32.0
London Westminster	DEFRA	82.7
Lullington Heath	DEFRA	65.1
Manchester South	Affiliate	86.4
Manchester Town Hall	DEFRA	52.3
Plymouth Centre	DEFRA	81.9
Reading New Town	DEFRA	85.0
Rotherham Centre	Affiliate	64.6
Scunthorpe Town	Affiliate	89.1
Sheffield Centre	DEFRA	84.9
Sheffield Tinsley	DEFRA	88.6
Somerton	Affiliate	63.4
Southampton Centre	DEFRA	87.8
Southwark Roadside	Affiliate	47.5
Sunderland Silksworth	Affiliate	88.4
Walsall Willenhall	Affiliate	80.0
West London	DEFRA	89.5
Weybourne	Affiliate	55.0
Wicken Fen	DEFRA	85.7
Wirral Tranmere	DEFRA	85.3
N Ireland		
Belfast Centre	DEFRA	85.4
Derry	Affiliate	85.5
Scotland		
Wales		
Aston Hill	DEFRA	86.6
Swansea	Affiliate	89.1

The winter intercalibration was completed in March 2006. Results from this intercalibration exercise are presented in Part B of this report.

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 (July 2006) and critical site list (October 2005)
- Monthly PM_{10} (Gravimetric) exceedences up to June 2006
- QA/QC Unit's data ratification and intercalibration report, October-December 2005, and the 2005 Annual Review.
- Recent Management Unit reports (January-March 2006)

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

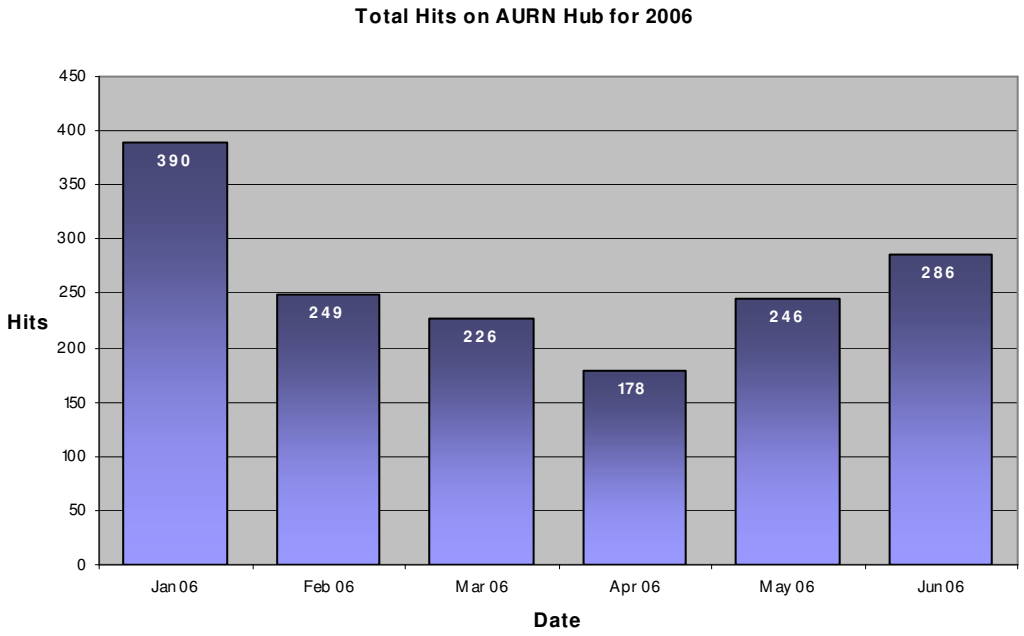

Figure 1.1 AURN Hub Monthly Usage Statistics January-May 2006

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

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 at existing sites required to comply with the third Daughter Directive (DD3) 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

The remaining site needed to meet the requirements of DD3 has been installed at Fort William. This site commenced operation on 22 June 2006.

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 (195 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-March 2006 is given in Section 5, Table 5.2. The critical sites with less than 90% total data capture and the main reasons for data loss at these sites are given in Table 2.1 below. In total, 15 out of the 195 critical site analysers (8%) did not meet the required 90% data capture during the period January-March 2006. Note that some critical sites also measure other pollutants, which are not themselves critical.

[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

Table 2.1 Critical sites with <90% data capture, January-March 2006

Site	CO	PM_{10}	NO_2	O_3	SO_2	Site Avg.	Main reasons for loss
England							
Barnsley Gawber	**95.8**	-	**32.1**	**97.4**	94.4	**79.9**	NOx converter failure, unstable NOx output
Hull Freetown	**90.1**	**96.6**	**61.5**	**96.6**	**96.5**	**88.3**	NOx baseline did not correlate with calibrations-suspected sampling problem
Plymouth Centre	96.8	**86.1**	46.0	96.8	83.9	**81.9**	NOx analyser imbalance/converter fault (not critical)
Reading New Town	**96.9**	**92.7**	**50.4**	**93.2**	**91.6**	**85.0**	NOx PMT fault-see section 3.1
Scunthorpe Town	-	**96.9**	-	-	81.3	**89.1**	SO_2 analyser PMT fault (note SO_2 is not critical at this site)
Sheffield Centre	97.0	**97.1**	41.4	96.5	92.4	**84.9**	Spurious NO_2 data
Somerton	-	-	**47.0**	**79.9**	-	**63.4**	NOx switching valve fault, poor quality NOx data
Southampton Centre	**88.4**	**88.8**	**86.4**	**90.2**	**85.0**	**87.8**	Site switched off due to air con fault
Sunderland Silksworth	-	-	**93.6**	**83.2**	-	**88.4**	O_3 pump fault
Wicken Fen	-	-	**98.1**	**61.0**	98.1	**85.7**	O_3 sample flow fault
Wirral Tranmere	**95.4**	**94.5**	**94.7**	**91.6**	**50.4**	**85.3**	SO_2 lamp fault
N Ireland							
Belfast Centre	**54.9**	95.0	**90.9**	**94.7**	91.4	**85.4**	CO blockage and chopper fault
Derry	**89.9**	**95.9**	**65.6**	**86.2**	**89.8**	**85.5**	NOx converter fault, CO pump failure, electronics fault affecting all gas channels
Wales							
Aston Hill	-	-	**91.1**	**82.0**	-	**86.6**	O_3 analyser fault
Swansea	**84.2**	94.9	94.2	94.5	77.7	**89.1**	Analysers unstable following power cut; rectified at service
Number of sites < 90%	5	6	11	5	6	15	
Number of critical sites	31	34	45	45	29	15	
Number of critical sites < 90%	5	4	8	5	3	15	
Network Mean (%)	88.9	93.9	70.9	88.8	86.0	84.4	

Bold data captures are for critical instruments and sites

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 eight sites in the network (Bournemouth, Northampton, Wrexham, Dumfries, Inverness, London Westminster, Auchencorth Moss and Brighton Roadside PM_{10}). The gravimetric PM_{10} analyser at Northampton is also co-located with a TEOM analyser, which provides a comparison of data from the two techniques. Gravimetric PM_{10} concentrations and the daily mean TEOM scaled by 1.3 at Northampton for the 3-month period January-March 2006 are shown in Figure 2.1.

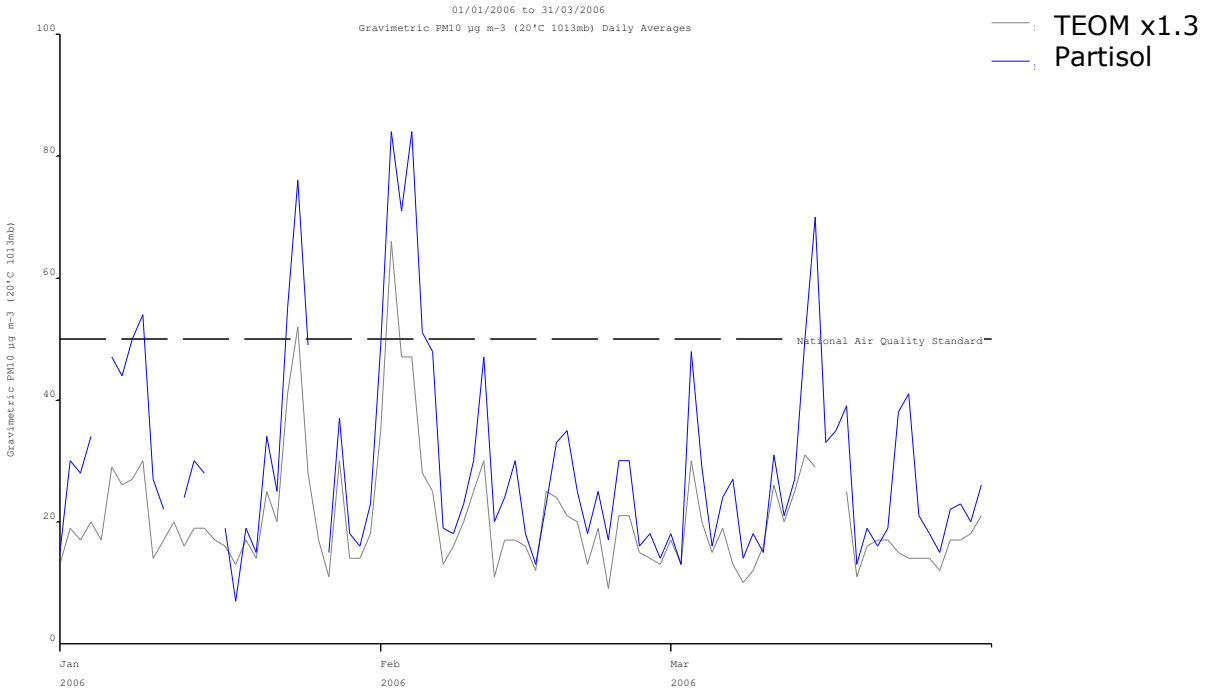

Figure 2.1 Partisol and TEOM (x1.3) Concentrations at Northampton (January-March 2006)

Data capture for the gravimetric PM_{10} (Partisol) analysers for the period January-March 2006 is given in Table 2.3. Six of the seven sites (excludes Auchencorth Moss) exceeded the 90% data capture target in this quarter, with average data capture over all seven analysers of 93.8%. 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.

Bureau Veritas has supplied the measured data, undertaken the filter weighing and calculated the particulate concentrations; netcen has ratified the results.

Table 2.3 Gravimetric PM_{10} Data Capture (%) 2006

Site	3-months Data Capture (%) January-March 2006
Bournemouth	96.7
Brighton Roadside PM_{10}	98.9
London Westminster	97.8
Northampton	95.6
Dumfries	84.4
Inverness	85.6
Wrexham	97.8
Average	**93.8**

2.4 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 pollutant 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 or silica gel driers. In most cases this has improved the situation but it has not always eliminated the problem completely. The 42 sites showing continuing problems with the autocalibration run-on during January-March 2006 are given in Table 2.5. Any autocalibration run-on data that look visibly significant have been deleted from these data sets during ratification.

Table 2.5 Estimate of Spike or Dip due to Auto-calibration Run-on: January-March 2006

Site	Pollutant	Run-on conc (ppb)	Autocal Conc (ppb)	No hours lost	Period	Comments
Barnsley Gawber	NO_2	3	350	1	Mar	
Belfast Centre	NO_2	5	300	1	Jan-Mar	
Birmingham Centre	NO_2	3	750	1	Feb-Mar	
Bolton	NO_2	13	1600	1	Mar	
Bournemouth	NO_2	3	600	1	Jan-Mar	
Bury Roadside	NO_2	4	700	1	Jan-Mar	
Cardiff Centre	NO_2	5	350	1	Jan-Mar	
Derry	NO_2	9	300	1	Jan-Feb	Very bad.

Site	Pollutant	Run-on conc (ppb)	Autocal Conc (ppb)	No hours lost	Period	Comments
						Mar ok
Dumfries	NO_2	9	700	1	Jan-Mar	
Edinburgh St Leonards	NO_2	3	500	1	Jan-Mar	
Eskdalemuir	NO_2	1.4	500	2	Jan-Mar	
Exeter Roadside	NO_2	12	491	1	Jan-Mar	
Glazebury	NO_2	1.2	150	1	Jan-Feb	
Harwell	NO_2	4.5	200	2	Jan-Mar	
Hove Roadside	NO_2	4	450	1	Jan-Mar	
Hull Freetown	NO_2	1	200	1	Feb-Mar	
Leamington Spa	NO_2	3	750	1	Jan-Feb	
Leominster	NO_2	5	500	1	Jan-Mar	
London Bloomsbury	NO_2	5	700	1	Jan-Mar	
London Bromley	NO_2	9	450	1	Jan-Mar	
Lullington Heath	NO_2	1.6	300	1	Jan-Feb	
Manchester Town Hall	NO_2	6	450	1	Jan-Mar	
Market Harborough	NO_2	2.5	350	1	Jan-Mar	
Middlesbrough	NO_2	2	450	1	Jan-Mar	
Preston	NO_2	3	500	1	Jan-Mar	
Redcar	NO_2	2	300	1	Jan-Mar	
Rochester	NO_2	1.6	200	1	Feb-Mar	
Southampton Centre	NO_2	4	850	1	Jan-Mar	
St Osyth	NO_2	2.5	300	1	Jan-Mar	
Stockport Shaw Heath	NO_2	4	1100	1	Jan	
Thurrock	NO_2	5	400	1	Jan-Mar	
West London	NO_2	5	650	1	Jan-Mar	
Wrexham	NO_2	2	350	1	Jan-Mar	
Yarner Wood	NO_2	2.3	200	2	Jan-Mar	
Blackpool Marton	O_3	-3	700	1	Jan-Mar	
Bradford Centre	O_3	-2	1200	1	Jan-Mar	Zero run-on
Derry	O_3	-3	1000	1	Jan-Mar	Zero run-on
Narberth	O_3	-4	700	1	Jan-Mar	Zero run-on
Preston	O_3	-3	650	1	Jan-Mar	Zero run-on
Reading New Town	O_3	-2	3000	1	Jan-Mar	Zero run-on
Stoke-on-Trent Centre	O_3	-2	1000	1	Jan-Mar	Zero run-on
Wirral Tranmere	O_3	-3	600	1	Jan-Mar	Zero run-on
Blackpool Marton	SO_2	1	500	1	Jan-Mar	
Bradford Centre	SO_2	-1	500	1	Mar	Zero run-on
London Brent	SO_2	1	900	1	Jan-Mar	
Narberth	SO_2	0.4	500	1	Jan-Mar	
Stoke-on-Trent Centre	SO_2	-1	250	1	Jan	

The number of sites showing run-on had significantly reduced during the latter half of 2005, but the number of sites showing problems has risen again in the first quarter of 2006. Eskdalemuir, Harwell and Yarner Wood NOx should be prioritised as 2 hours per day are being lost at these sites.

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 have held meetings with the Equipment Support Units to discuss the autocalibration run-ons and to identify ways to resolve the problem. Solutions to the problems have been identified in many cases, and the necessary hardware upgrades are being installed either at routine services, or through call-outs.

Eskdalemuir, Harwell and Yarner Wood should be prioritised as 2 hours per day are being lost at these sites.

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 Reading New Town NO_2

During the three-month period, the PMT cooler in the NOx analyser developed a fault. A plot of cooler temperature is shown in Figure 3.1:

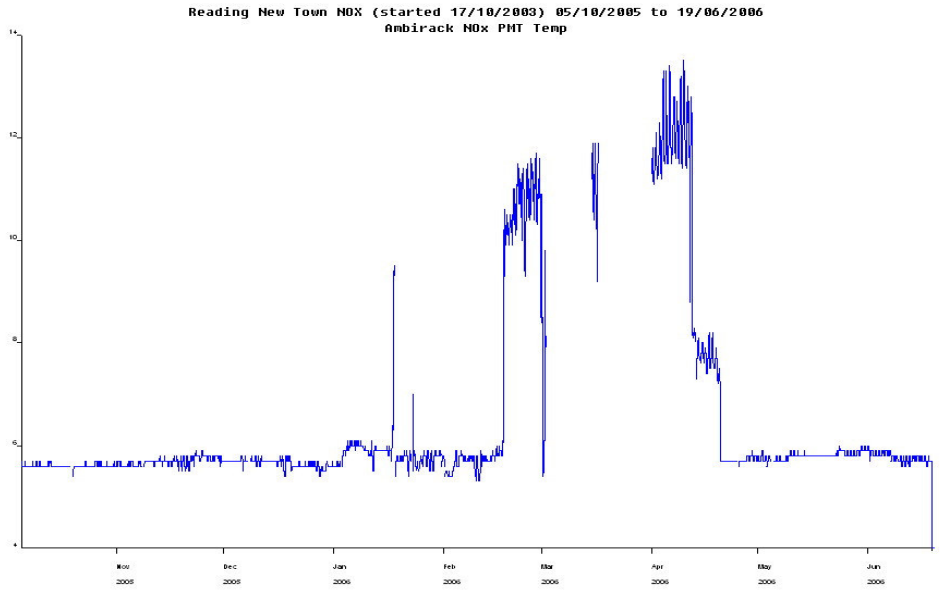

Figure 3.1 Reading New Town NOx PMT Temperature

A plot of the corresponding NOx mV signal is shown in Figure 3.2

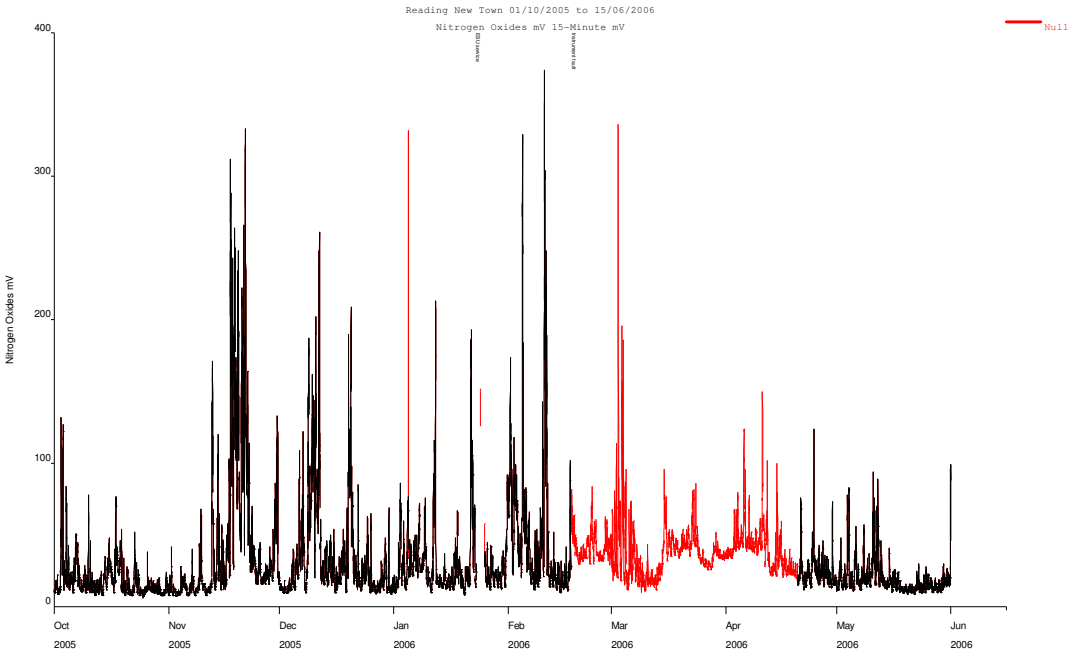

Figure 3.2 Reading New Town NOx (mV)

The raised baseline caused by the warm cooler can be clearly seen. The data from mid February to the end of the quarter (and beyond-shown in red) have been deleted.

This is a good example of additional information logged by the site being useful in the identification of instrument problems.

3.2 Weybourne O_3

It is noted that the O_3 analyser at Weybourne has no internal ozone generator; as a consequence, there are no daily autocalibration checks or LSO calibrations carried out. Although this analyser has performed reliably for a number of years, the information from calibrations may be useful in the event of analyser malfunction in the future.

Recommendation

Weybourne O3 analyser should be upgraded to allow monthly LSO calibrations and daily autocalibrations

3.3 Salford Eccles CO

The CO zero readings on the Salford Eccles CO analyser have been consistently zero for some period of time-this is shown in Figure 3.3

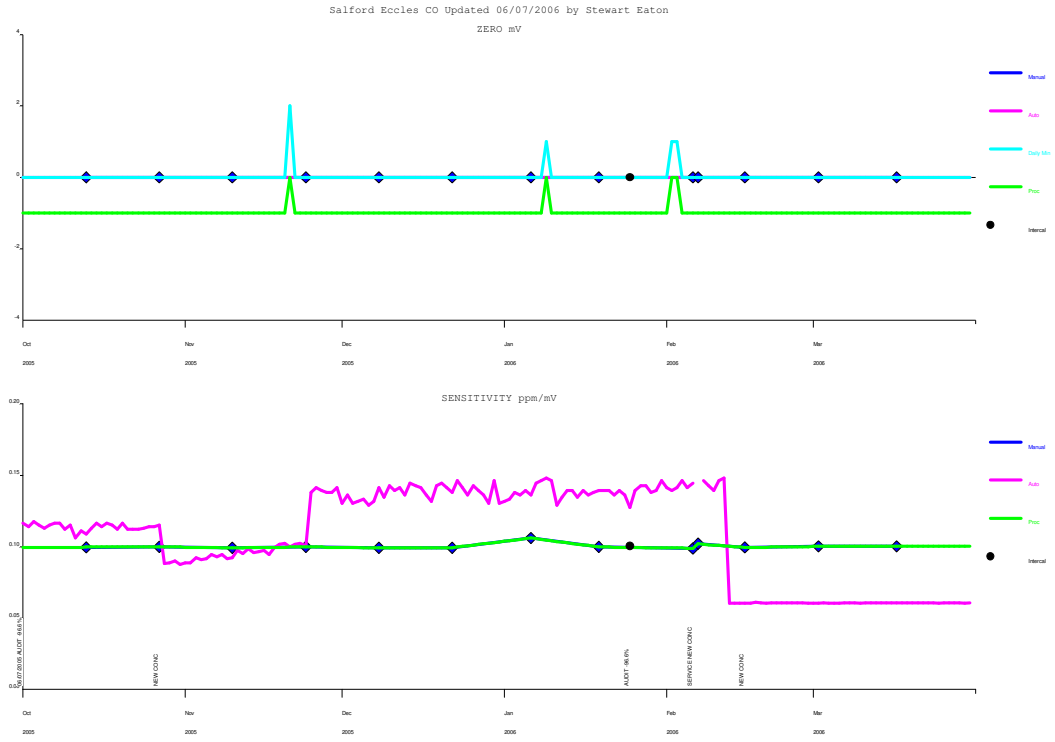

Figure 3.3 CO calibration plots for Salford Eccles

The upper plot shows the manual calibrations (dark blue), daily minimum ambient (light blue) and intercalibration zero (black spot). Typically at urban sites, some variation might be expected, especially in the daily minimum values. The analyser did, however, perform acceptably at the intercalibration. The matter has been referred to the ESU for investigation.

3.4 Rural CO Analysers

The high sensitivity CO analysers currently installed at St Osyth and Market Harborough both show considerable baseline drift (~100-200mV in three months) between services. This can be seen in Figure 3.4. The CO concentrations measured at these sites are low (the annual average for 2005 at St Osyth was <0.2ppm) and the baseline drift means that there is considerable uncertainty in this measurement.

Also of concern is the large deviation of the audit zero from the autocalibration, manual calibration and daily minimum values. This is indicative of the difficulty of accurately determining the zero response of these analysers. In order to investigate the response characteristics of these analysers in more detail, netcen has purchased certified, high purity air mixtures and low-level certified standards. These will be used at the next intercalibration at the rural sites to accurately determine the zero response. The ESU should also investigate the baseline drift of these analysers.

Figure 3.4 St Osyth Calibration Plot 1 Oct 2005-31 March 2006

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 3.2

Table 3.2 Status of Analysers Highlighted in Previous Reports

Site	Analyser	Fault	Current status
Wicken Fen	O_3	Flow	Flow problems continued during Q1 2006
Scunthorpe Town	SO_2	Unstable output and variable calibrations	Fault repaired January 2006
Norwich Centre	SO_2	Large step change between old and replacement analysers	Situation is being closely monitored
Rotherham	SO_2	Very noisy and cyclic response	Analyser replaced on 24 April 2006; all data rejected to this date.
Bush	NOx	Succession of analyser faults	Poor performing analyser replaced again on 15 October. Performance adequate since, but noisy.
Narberth	O_3	Leak	Quality of O_3 data still

Site	Analyser	Fault	Current status
			uncertain; significant outlier at winter 2006 audit. Installation of duplicate analyser still awaited.
Various	Rural ozone analysers	Temporary instruments installed some of which have no autocals	Two analysers have been upgraded by the manufacturer and are currently under test by the ESU

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.

3.6 Building Works at Sites

The QA/QC unit frequently receive reports of building or other works close to monitoring sites, which may produce unrepresentative pollutant levels for a short period of time. This is particularly relevant for PM_{10} and $PM_{2.5}$.

For the period 1 January-31 March, reports of such local works have been received for the following sites:

- Leeds
- Middlesbrough
- Nottingham
- Bradford
- Cwmbran
- Glasgow Centre
- Newcastle Centre

Building work is also anticipated at Stockport Shaw Heath.

4 Sites with Data Capture Below 90%

4.1 Sites with Low Data Capture

The following section provides a summary of the main site analyser operational problems, which have resulted in data capture below the required 90% level during the reporting period January-March 2006 (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-March 2006
(Using the start date of any new site or end date of site closed)

01/01/2006 to 31/03/2006 Gaps in 15-minute table >= 6 hours and data capture <= 90%

Pollutant	Data Capture (%)	Start date	End date	Reason	Comments	No of days lost	No of hours lost
England							
Barnsley Gawber							
NO2	32.10%	01-Jan-06	01-Mar-06	Instrument fault	Unstable and noisy data	59.5	1427
Bolton							
NO2	16.60%	08-Aug-05	15-Mar-06	ESU service		219	5259
		24-Mar-06	25-Mar-06	Unstable response	Spurious negative data	0.6	14
SO2	72.40%	18-Dec-05	23-Jan-06	Instrument fault	UV Lamp failure.	35.9	862
		07-Feb-06	07-Feb-06	Power cut		0.4	9
		14-Mar-06	15-Mar-06	ESU service		1.2	28
Bradford Centre							
O3	89.80%	16-Jan-06	18-Jan-06	ESU service	ENG C/O Various tests carried out by ESU	1.9	46
		11-Mar-06	11-Mar-06	No mV data collected		0.3	8
		24-Mar-06	27-Mar-06	No mV data collected		2.7	65
		31-Mar-06	31-Mar-06	No mV data collected		0.4	10
Brentford Roadside							
CO	14.10%	11-Jan-06	29-Mar-06	Instrument fault	Replaced entire bench then reset logger range.	77.1	1850
Bury Roadside							
CO	5.10%	05-Jan-06	06-Apr-06	Sampling fault	Internal sampling; data deleted up to service	91	2185
NO2	75.50%	12-Jan-06	13-Jan-06	No mV data collected		0.9	22
		19-Jan-06	21-Jan-06	No mV data collected		2.4	58
		16-Mar-06	04-Apr-06	ESU service		19.1	458
SO2	89.70%	12-Jan-06	13-Jan-06	No mV data collected		0.9	22
		19-Jan-06	21-Jan-06	No mV data collected		2.4	58
		16-Mar-06	21-Mar-06	ESU service		4.9	117
		30-Mar-06	30-Mar-06	No mV data collected		0.3	7
Exeter Roadside							
SO2	65.80%	01-Nov-05	26-Jan-06	Instrument fault	UV lamp and motherboard failure	86	2065
		18-Mar-06	23-Mar-06	Monitoring suspended	ENG C/O Installed replacement instruments	5.4	129
Hove Roadside							
NO2	89.00%	11-Jan-06	16-Jan-06	Sampling fault	Sample line not reconnected following analyser calibration	5.1	122
		07-Mar-06	08-Mar-06	ESU service		0.8	20

Hull Freetown							
NO2	61.50%	16-Sep-05	01-Feb-06	Instrument fault	High baseline does not correspond to zero cals	138	3317
Liverpool Speke							
CO	83.60%	21-Feb-06	07-Mar-06	ESU service	Tubing found to be pinched, restricting flow. Data deleted.	14.1	338
London Hackney							
O3	0.00%	01-Dec-05	30-Apr-06	Faulty analyser		151	3624
London Haringey							
O3	3.80%	01-Jan-06	28-Mar-06	Sampling fault	Faulty tubing and connector.	86.5	2077
London Harlington							
O3	86.90%	06-Jan-06	06-Jan-06	Communication fault		0.3	6
		08-Jan-06	09-Jan-06	Communication fault		1.6	39
		11-Jan-06	17-Jan-06	Communication fault		5.5	132
		27-Feb-06	28-Feb-06	Communication fault		1	23
		28-Mar-06	31-Mar-06	Communication fault		2.7	65
London Marylebone Road							
SO2	88.40%	15-Mar-06	25-Mar-06	Pump fault	ENG C/O Fitted external pump - no calibration	9.9	237
London N. Kensington							
CO	88.90%	23-Jan-06	01-Feb-06	Unstable response	after Service - bench cooling fan replaced 1st February.	9.1	219
London Southwark							
CO	33.20%	22-Dec-05	01-Mar-06	Unstable response	Unstable response then removed from site	69	1657
NO2	48.10%	10-Jan-06	24-Feb-06	Air Conditioning fault		45.3	1086
		30-Mar-06	31-Mar-06	ESU service		1	25
O3	0.00%	23-Dec-05	14-Jun-06	Analyser removed for repair		174	4167
SO2	46.70%	10-Jan-06	26-Feb-06	Air Conditioning fault		46.6	1119
		30-Mar-06	31-Mar-06	ESU service	Routine service	1	25
London Westminster							
CO	54.80%	15-Jan-06	22-Jan-06	High noise	Poor quality data	6.3	150
		26-Feb-06	30-Apr-06	High noise	Very noisy	64	1536
SO2	77.50%	04-Jan-06	24-Jan-06	Instrument fault	Unstable analyser rejected data	19.7	472
Lullington Heath							
NO2	63.40%	23-Feb-06	23-Feb-06	Suspected power cut		0.4	10
		02-Mar-06	04-Apr-06	QAQC audit		33.1	795
O3	66.10%	23-Feb-06	23-Feb-06	Suspected power cut		0.4	10
		02-Mar-06	04-Apr-06	QAQC audit		33.1	795
SO2	65.90%	23-Feb-06	23-Feb-06	Suspected power cut		0.6	14

		02-Mar-06	04-Apr-06	ESU service	Replaced manifold fan	33.1	795
Manchester Piccadilly							
CO	88.50%	30-Jan-06	01-Feb-06	ESU service		2	48
		24-Mar-06	03-Apr-06	Operator error	ENG C/O CO was set to range 0-10 instead of 0-50. Reset range	10	240
O3	72.40%	30-Jan-06	01-Feb-06	ESU service		2	48
		02-Mar-06	24-Mar-06	Instrument fault	ENG C/O O3 analyser - spurious data and erratic calibrations	22.1	530
Manchester South							
NO2	64.80%	31-Jan-05	01-Feb-06	ESU service	Data rejected due to low converter efficiency	366	8782
Manchester Town Hall							
CO	31.70%	17-Nov-05	07-Feb-06	Unstable response	unstable baseline	82.1	1970
		08-Mar-06	21-Apr-06	Instrument fault	ENG C/O Source warning. Replaced damaged source	44.4	1065
NO2	72.90%	06-Feb-06	07-Feb-06	ESU service		1.1	26
		12-Mar-06	19-Apr-06	Unstable response		38.4	922
Market Harborough							
O3	83.60%	30-Jan-06	31-Jan-06	ESU service		1	23
		03-Feb-06	03-Feb-06	Power cut		0.3	8
		08-Mar-06	21-Mar-06	Instrument fault	Valve problem then returned with wrong calibration factor	13	312
Middlesbrough							
CO	86.30%	24-Jan-06	25-Jan-06	Sampling fault	ENG C/O Sample Flow Fault. Replaced pump	1.5	36
		08-Feb-06	10-Feb-06	ESU service		1.9	46
		25-Feb-06	28-Feb-06	Instrument fault	ENG C/O Pump and motherboard replaced	4	95
		10-Mar-06	15-Mar-06	High noise	ENG C/O. Replaced with temporary replacement analyser	4.7	113
Plymouth Centre							
NO2	46.00%	05-Jan-06	22-Feb-06	Instrument fault	Faulty solenoid valve	48.4	1161
SO2	83.90%	19-Dec-05	12-Jan-06	High noise	Very noisy output	24.2	580
		20-Feb-06	22-Feb-06	ESU service		2.4	57
Reading New Town							
NO2	50.40%	23-Jan-06	25-Jan-06	ESU service		2.3	54
		18-Feb-06	20-Apr-06	Instrument fault	PMT temperature too high	61.4	1473
Redcar							
SO2	89.00%	30-Jan-06	31-Jan-06	ESU service		1.3	30
		22-Feb-06	02-Mar-06	Sampling fault	Replaced UV lamp	8.1	194

Rochester							
NO2	75.20%	05-Jan-06	23-Jan-06	Sampling fault		18.1	435
		20-Mar-06	21-Mar-06	ESU service		1.1	27
Rotherham Centre							
SO2	0.00%	01-Dec-05	24-Apr-06	ESU service		144	3467
Scunthorpe Town							
SO2	81.30%	30-Nov-05	17-Jan-06	Unstable response	Noisy data & PMT fault	48	1152
Sheffield Centre							
NO2	41.40%	01-Oct-05	22-Feb-06	Unstable output	Drifting response	145	3468
Sheffield Tinsley							
CO	79.20%	17-Jan-06	03-Feb-06	Unstable response	Analyser problems cauing unstable data	17	409
		16-Feb-06	17-Feb-06	ESU service		1	25
Somerton							
NO2	47.00%	30-Jan-06	31-Jan-06	QAQC audit	Missing data after audit	0.7	16
		06-Feb-06	07-Feb-06	Suspected power cut		1.1	27
		09-Feb-06	11-Feb-06	Suspected power cut		2.2	53
		12-Feb-06	15-Feb-06	Suspected power cut		2.7	64
		17-Feb-06	29-Mar-06	Suspected power cut		40.7	977
O3	79.90%	30-Jan-06	31-Jan-06	QAQC audit	Missing data after audit	0.7	16
		06-Feb-06	07-Feb-06	Suspected power cut		1.1	27
		09-Feb-06	10-Feb-06	Suspected power cut		1.6	39
		12-Feb-06	14-Feb-06	Suspected power cut		2	48
		17-Feb-06	28-Feb-06	Suspected power cut		12	287
Southampton Centre							
CO	88.40%	10-Jan-06	18-Jan-06	Air Conditioning or Temp fault	Call out: The a/c unit iced up.	7.8	186
		28-Feb-06	02-Mar-06	ESU service		2.2	52
NO2	86.40%	10-Jan-06	16-Jan-06	Air Conditioning or Temp fault	Call out: The a/c unit iced up.	6.1	147
		28-Feb-06	02-Mar-06	ESU service		2.2	52
SO2	85.00%	10-Jan-06	20-Jan-06	Sampling fault	ENG C/O Analyser not going into Sample Measure mode after power cut	9.9	238
		28-Feb-06	02-Mar-06	ESU service		2.2	52
Southwark Roadside							
CO	43.50%	09-Feb-06	14-Jun-06	No mV data collected		126	3012
NO2	56.90%	21-Feb-06	22-Jun-06	No mV data collected		121	2913
SO2	42.00%	08-Feb-06	14-Jun-06	No mV data collected		127	3046
Sunderland Silksworth							
O3	83.20%	05-Jan-06	05-Jan-06	Low flow rate	sample flow fault	0.5	12
		10-Jan-06	16-Jan-06	Pump fault	ENG C/O Replaced pump and performed	6.1	146

					photometer test		
		31-Jan-06	08-Feb-06	Instrument fault	Call out: No response from the O3 analyser.	8.1	195
Walsall Willenhall							
NO2	80.00%	26-Oct-05	18-Jan-06	No mV data collected	NOx analyser cooler failure.	84.3	2023
West London							
CO	85.10%	13-Feb-06	14-Feb-06	Unstable response	Unstable around LSO cal	1.2	28
		07-Mar-06	10-Mar-06	Unstable response	Unstable data	3.2	76
		23-Mar-06	21-Apr-06	ESU service	Service and unstable data	29.1	698
Weybourne							
O3	55.00%	22-Nov-05	10-Feb-06	Sampling fault	Either flow blockage or contamination	80	1919
Wicken Fen							
O3	61.00%	02-Dec-05	03-Feb-06	Low flow rate	Data deleted	62.8	1508
		14-Mar-06	15-Mar-06	ESU service		1.1	27
Wirral Tranmere							
SO2	50.40%	02-Aug-05	11-Feb-06	No mV data collected	site off due to fire	192	4617
		13-Mar-06	14-Mar-06	QA/QC audit		1.4	33
		27-Mar-06	29-Mar-06	ESU service		2	49
Wolverhampton Centre							
CO	88.90%	01-Feb-06	08-Feb-06	Sampling fault	backing paper left in sample inlet filter	7.1	171
		13-Mar-06	15-Mar-06	ESU service		2	48
N Ireland							
Belfast Centre							
CO	54.90%	28-Dec-05	09-Feb-06	Low flow rate	Flow blockage on 9 Jan	42.9	1030
		08-Mar-06	09-Mar-06	Power cut		1	24
Derry							
CO	89.90%	29-Dec-05	06-Jan-06	Instrument fault	Call out: Potential electronic fault flagging of all instruments	7.8	186
		13-Feb-06	16-Feb-06	ESU service		2.9	70
NO2	65.60%	29-Dec-05	06-Jan-06	Instrument fault	Call out: Potential electronic fault flagging of all instruments	7.8	188
		13-Jan-06	13-Jan-06	Unstable response	Negative data	0.5	11
		16-Jan-06	17-Jan-06	Unstable response	Spurious data	0.8	19
		08-Feb-06	08-Feb-06	QA/QC audit		0.3	7
		13-Feb-06	07-Mar-06	Instrument fault	Ozone generator fault	22	529
O3	86.20%	30-Dec-05	05-Jan-06	Instrument fault	Call out: Potential electronic fault flagging of all instruments	6	145
		05-Jan-06	06-Jan-06	Instrument fault	ENG C/O Replaced faulty cooling fan & fuse	0.7	17

		13-Feb-06	16-Feb-06	ESU service		2.9	70
SO2	89.80%	29-Dec-05	06-Jan-06	Instrument fault	Call out: Potential electronic fault flagging of all instruments	7.8	188
		08-Feb-06	08-Feb-06	QAQC audit		0.3	6
		13-Feb-06	16-Feb-06	ESU service		2.9	70
Scotland							
Bush Estate							
NO2	88.70%	04-Mar-06	13-Mar-06	High noise	Gap then internal connection fault	9.4	225
Wales							
Aston Hill							
O3	82.00%	16-Mar-06	04-Apr-06	Unstable response	Ongoing instability fault - UV lamp replaced twice	19.3	463
Cwmbran							
NO2	88.60%	22-Mar-06	04-Apr-06	Instrument fault	Suspected NOx converter fault	12.6	302
Swansea							
CO	84.20%	08-Feb-06	22-Feb-06	Unstable response	Power failure then output drift	13.7	329
SO2	77.70%	09-Jan-06	20-Jan-06	Unstable response	Original instrument drifted.	11.2	268
		08-Feb-06	09-Feb-06	Power cut	Power failure	0.7	17
		14-Feb-06	22-Feb-06	Instrument fault	Noisy output then service.	7.6	183

5 Ratified Data Capture Statistics

Table 5.1 provides the ratified data capture figures for each site for the 3-month period January-March 2006. Data capture values below 90% are shown in the shaded boxes.

Table 5.1 Ratified Network Data Statistics January-March 2006
(Using the start date of any new site or end date of site closed)
Network Data Capture for 01/01/2006 to 31/03/2006 from start date of any new site

Site	Owner	CO	NO_2	O_3	PM_{10}	PM_{25}	SO_2	Site Average
England								
Barnsley 12	DEFRA	-	-	-	-	-	98.1	98.1
Barnsley Gawber	Affiliate	**95.8**	**32.1**	**97.4**	-	-	94.4	**79.9**
Bath Roadside	Affiliate	98.1	97.2	-	-	-	-	97.7
Billingham	DEFRA	-	99.4	-	-	-	-	99.4
Birmingham Centre	DEFRA	96.9	94.3	96.9	97.1	-	97.0	96.4
Birmingham Tyburn	Affiliate	99.4	99.1	99.4	90.8	-	99.4	97.6
Blackpool Marton	DEFRA	**92.7**	**97.2**	**93.5**	**91.5**	-	**93.3**	**93.6**
Bolton	Affiliate	97.0	16.6	97.2	97.3	-	72.4	76.1
Bottesford	Affiliate	-	-	99.7	-	-	-	99.7
Bournemouth	Affiliate	**97.3**	**93.1**	**97.5**	**96.7**	-	**97.3**	**96.4**
Bradford Centre	DEFRA	93.7	91.8	89.8	95.4	-	92.1	92.5
Brentford Roadside	Affiliate	14.1	99.1	-	-	-	-	56.6
Brighton Preston Park	DEFRA	-	**99.4**	**98.0**	-	-	-	**98.7**
Brighton Roadside	Affiliate	97.6	97.7	-	-	-	-	97.7
Brighton Roadside PM10	Affiliate	-	-	-	**98.9**	-	-	**98.9**
Bristol Old Market	Affiliate	90.9	98.5	-	-	-	-	94.7
Bury Roadside	Affiliate	5.1	75.5	90.2	90.2	-	89.7	70.1
Cambridge Roadside	Affiliate	-	95.8	-	-	-	-	95.8
Camden Kerbside	Affiliate	-	99.4	-	91.1	-	-	95.2
Canterbury	Affiliate	-	97.0	-	**98.4**	-	-	**97.7**
Coventry Memorial Park	DEFRA	**99.4**	**99.4**	**99.5**	**99.5**	-	**99.5**	**99.5**
Exeter Roadside	Affiliate	97.1	93.1	97.0	-	-	65.8	88.3
Glazebury	DEFRA	-	**95.4**	**98.2**	-	-	-	**96.8**
Great Dun Fell	DEFRA	-	-	**98.4**	-	-	-	**98.4**
Haringey Roadside	Affiliate	-	93.1	-	65.4	-	-	79.2
Harwell	DEFRA	-	91.3	96.7	96.7	96.9	96.6	95.6
High Muffles	DEFRA	-	**97.9**	**98.1**	-	-	-	**98.0**
Hove Roadside	Affiliate	99.4	89.0	-	-	-	**99.3**	**95.9**
Hull Freetown	DEFRA	**90.1**	**61.5**	**96.6**	**96.6**	-	**96.5**	**88.3**
Ladybower	DEFRA	-	90.8	90.8	-	-	90.5	90.7
Leamington Spa	Affiliate	**99.0**	**94.8**	**99.1**	**99.6**	-	**99.1**	**98.3**
Leeds Centre	DEFRA	98.2	98.2	98.3	98.0	-	98.2	98.2
Leicester Centre	DEFRA	**98.0**	**98.0**	**98.6**	**98.4**	-	**98.6**	**98.3**
Leominster	DEFRA	-	**94.0**	**92.2**	-	-	-	**93.1**
Liverpool Speke	Affiliate	**83.6**	**96.9**	**96.8**	**96.1**	-	**96.9**	**94.1**
London A3 Roadside	DEFRA	94.5	96.9	-	97.7	-	-	96.4

London Bexley	Affiliate	98.3	92.9	95.5	83.8	-	98.4	93.8
London Bloomsbury	DEFRA	95.9	91.9	92.0	98.1	98.1	90.2	94.4
London Brent	Affiliate	98.0	96.9	97.8	98.1	-	93.7	96.9
London Bromley	Affiliate	-	95.0	-	-	-	-	95.0
London Cromwell Road 2	DEFRA	97.5	93.9	-	-	-	97.6	96.3
London Eltham	Affiliate	-	99.4	99.5	99.3	-	99.3	99.4
London Hackney	Affiliate	99.2	91.9	0.0	-	-	-	63.7
London Haringey	Affiliate	-	-	3.8	-	-	-	3.8
London Harlington	Affiliate	99.7	99.4	86.9	99.8	-	-	96.5
London Hillingdon	DEFRA	96.0	93.1	96.7	96.1	-	96.9	95.7
London Lewisham	Affiliate	-	99.4	99.4	-	-	96.1	98.3
London Marylebone Road	Affiliate	98.8	98.4	98.9	99.1	99.5	88.4	97.2
London N. Kensington	Affiliate	88.9	99.0	99.2	99.0	-	99.1	97.0
London Southwark	Affiliate	33.2	48.1	0.0	-	-	46.7	32.0
London Teddington	Affiliate	-	98.2	98.2	-	-	98.1	98.2
London Wandsworth	Affiliate	-	99.0	99.1	-	-	-	99.1
London Westminster	DEFRA	54.8	99.2	99.3	97.8	-	77.5	85.7
Lullington Heath	DEFRA	-	63.4	66.1	-	-	65.9	65.1
Manchester Piccadilly	DEFRA	88.5	96.8	72.4	96.8	-	96.5	90.2
Manchester South	Affiliate	-	64.8	97.3	-	-	97.1	86.4
Manchester Town Hall	DEFRA	31.7	72.9	-	-	-	-	52.3
Market Harborough	DEFRA	96.5	93.8	83.6	-	-	-	91.3
Middlesbrough	Affiliate	86.3	93.3	97.6	97.4	-	97.5	94.4
Newcastle Centre	DEFRA	**96.7**	**96.5**	**96.5**	**96.1**	-	**96.9**	**96.5**
Northampton	Affiliate	**99.5**	**99.4**	**98.2**	**98.1**	-	**99.5**	**99.0**
Northampton PM10	Affiliate	-	-	-	**95.6**	-	-	**95.6**
Norwich Centre	DEFRA	99.6	**99.5**	**99.4**	88.5	-	99.5	**97.3**
Norwich Forum Roadside	Affiliate	-	98.1	-	-	-	-	98.1
Nottingham Centre	DEFRA	**97.0**	**97.0**	**96.9**	**97.2**	-	**96.9**	**97.0**
Oxford Centre Roadside	Affiliate	**98.9**	97.5	-	-	-	**98.8**	**98.4**
Plymouth Centre	DEFRA	96.8	46.0	96.8	**86.1**	-	83.9	**81.9**
Portsmouth	Affiliate	**98.2**	**98.4**	**98.4**	**98.3**	-	**98.5**	**98.4**
Preston	DEFRA	**93.2**	**92.4**	**91.7**	**97.3**	-	**97.4**	**94.4**
Reading New Town	DEFRA	**96.9**	**50.4**	**93.2**	**92.7**	-	**91.6**	**85.0**
Redcar	Affiliate	97.1	93.8	91.0	93.1	-	89.0	92.8
Rochester	Affiliate	-	75.2	97.9	91.6	97.9	97.3	92.0
Rotherham Centre	Affiliate	-	96.9	96.9	-	-	0.0	64.6
Salford Eccles	Affiliate	97.3	97.2	97.3	96.9	-	96.1	96.9
Sandwell West Bromwich	Affiliate	97.6	98.2	97.5	-	-	96.5	97.5
Scunthorpe Town	Affiliate	-	-	-	**96.9**	-	81.3	**89.1**
Sheffield Centre	DEFRA	97.0	41.4	96.5	**97.1**	-	92.4	**84.9**
Sheffield Tinsley	DEFRA	79.2	97.9	-	-	-	-	88.6
Sibton	DEFRA	-	-	**99.5**	-	-	-	**99.5**
Somerton	Affiliate	-	**47.0**	**79.9**	-	-	-	**63.4**

Southampton Centre	DEFRA	**88.4**	**86.4**	**90.2**	**88.8**	-	**85.0**	**87.8**
Southend-on-Sea	DEFRA	**98.7**	**98.7**	**98.7**	**95.7**	-	**98.7**	**98.1**
Southwark Roadside	Affiliate	43.5	56.9	-	-	-	42.0	47.5
St Osyth	DEFRA	98.3	**94.2**	**98.3**	-	-	-	**96.9**
Stockport Shaw Heath	Affiliate	97.7	96.3	-	97.4	-	98.5	97.5
Stockton-on-Tees Yarm	Affiliate	**97.9**	**97.9**	-	**97.7**	-	-	**97.9**
Stoke-on-Trent Centre	DEFRA	**90.4**	**94.1**	**90.6**	**94.6**	-	**93.0**	**92.5**
Sunderland	DEFRA	-	-	-	-	-	**94.5**	**94.5**
Sunderland Silksworth	Affiliate	-	**93.6**	**83.2**	-	-	-	**88.4**
Thurrock	Affiliate	98.0	**93.9**	**98.1**	97.1	-	97.9	**97.0**
Tower Hamlets Roadside	Affiliate	99.4	99.5	-	-	-	-	99.5
Walsall Alumwell	DEFRA	-	97.4	-	-	-	-	97.4
Walsall Willenhall	Affiliate	-	80.0	-	-	-	-	80.0
West London	DEFRA	85.1	93.9	-	-	-	-	89.5
Weybourne	Affiliate	-	-	55.0	-	-	-	55.0
Wicken Fen	DEFRA	-	**98.1**	**61.0**	-	-	98.1	**85.7**
Wigan Centre	Affiliate	**98.0**	**99.1**	**98.0**	**98.4**	-	**99.1**	**98.5**
Wirral Tranmere	DEFRA	**95.4**	**94.7**	**91.6**	**94.5**	-	**50.4**	**85.3**
Wolverhampton Centre	DEFRA	88.9	96.4	97.0	97.2	-	96.9	95.3
Yarner Wood	DEFRA	-	**91.2**	**99.5**	-	-	-	**95.4**
N Ireland								
Belfast Centre	DEFRA	**54.9**	**90.9**	**94.7**	95.0	-	91.4	**85.4**
Belfast Clara St	Affiliate	-	-	-	99.0	-	-	99.0
Belfast East	DEFRA	-	-	-	-	-	98.4	98.4
Derry	Affiliate	**89.9**	**65.6**	**86.2**	**95.9**	-	**89.8**	**85.5**
Lough Navar	DEFRA	-	-	**98.8**	98.9	-	-	**98.9**
Scotland								
Aberdeen	Affiliate	**98.7**	**98.5**	**98.6**	**92.7**	-	**98.1**	**97.3**
Bush Estate	DEFRA	-	**88.7**	**96.0**	-	-	-	**92.4**
Dumfries	DEFRA	**97.1**	**91.6**	-	**84.4**	-	-	**91.1**
Edinburgh St Leonards	DEFRA	**98.1**	**91.6**	**97.4**	**98.1**	-	**98.2**	**96.7**
Eskdalemuir	DEFRA	-	**92.5**	**98.1**	-	-	-	**95.3**
Glasgow Centre	DEFRA	96.8	**96.9**	**97.0**	81.5	-	**96.9**	**93.8**
Glasgow City Chambers	DEFRA	98.0	95.9	-	-	-	-	96.9
Glasgow Kerbside	DEFRA	98.1	97.7	-	81.1	-	-	92.3
Grangemouth	Affiliate	**99.3**	**98.9**	-	**97.8**	-	**99.3**	**98.8**
Inverness	DEFRA	98.4	**98.4**	-	**85.6**	-	-	**94.1**
Lerwick	DEFRA	-	-	98.7	-	-	-	98.7
Strath Vaich	DEFRA	-	-	**97.6**	-	-	-	**97.6**
Wales								
Aston Hill	DEFRA	-	**91.1**	**82.0**	-	-	-	**86.6**
Cardiff Centre	DEFRA	**97.1**	**92.1**	**96.1**	**96.8**	-	**96.9**	**95.8**
Cwmbran	Affiliate	**99.3**	**88.6**	**99.7**	**98.2**	-	**99.6**	**97.1**
Narberth	Affiliate	-	95.8	**92.0**	95.7	-	91.9	**93.9**
Port Talbot	Affiliate	-	96.9	97.0	82.8	-	96.9	93.4
Swansea	Affiliate	**84.2**	94.2	94.5	94.9	-	77.7	**89.1**
Wrexham	DEFRA	**98.3**	**94.1**	-	**97.8**	-	**98.0**	**97.0**
Number of sites		77	109	87	70	4	75	124
Number of sites < 90%		17	20	14	10	0	16	33

Network Mean (%)		90.1	89.9	91.0	94.6	98.1	90.9	90.5

Shaded boxes are for data capture < 90%
Bold data captures are for critical instruments and sites

Table 5.2 shows the ratified AURN data capture for the 60 operational **critical sites** in the network for the 3-month period January to March 2006. Sites with less than 90% data capture are shaded. This table contains the overall data capture for 3 months, regardless of when sites started or finished monitoring. A total of 15 critical sites had a data capture of less than 90%.

Table 5.2 AURN Ratified Data Capture (%) for CRITICAL SITES January to March 2006

Network Data Capture for 01/01/2006 to 31/03/2006 from start date of any new site

Site	Owner	CO	NO_2	O_3	PM_{10}	SO_2	Site Average
England							
Barnsley Gawber	Affiliate	**95.8**	**32.1**	**97.4**	-	94.4	**79.9**
Blackpool Marton	DEFRA	**92.7**	**97.2**	**93.5**	**91.5**	**93.3**	**93.6**
Bournemouth	Affiliate	**97.3**	**93.1**	**97.5**	**96.7**	**97.3**	**96.4**
Brighton Preston Park	DEFRA	-	**99.4**	**98.0**	-	-	**98.7**
Brighton Roadside PM10	Affiliate	-	-	-	**98.9**	-	**98.9**
Canterbury	Affiliate	-	97.0	-	**98.4**	-	**97.7**
Coventry Memorial Park	DEFRA	**99.4**	**99.4**	**99.5**	**99.5**	**99.5**	**99.5**
Glazebury	DEFRA	-	**95.4**	**98.2**	-	-	**96.8**
Great Dun Fell	DEFRA	-	-	**98.4**	-	-	**98.4**
High Muffles	DEFRA	-	**97.9**	**98.1**	-	-	**98.0**
Hove Roadside	Affiliate	99.4	89.0	-	-	**99.3**	**95.9**
Hull Freetown	DEFRA	**90.1**	**61.5**	**96.6**	**96.6**	**96.5**	**88.3**
Leamington Spa	Affiliate	**99.0**	**94.8**	**99.1**	**99.6**	**99.1**	**98.3**
Leicester Centre	DEFRA	**98.0**	**98.0**	**98.6**	**98.4**	**98.6**	**98.3**
Leominster	DEFRA	-	**94.0**	**92.2**	-	-	**93.1**
Liverpool Speke	Affiliate	**83.6**	**96.9**	**96.8**	**96.1**	**96.9**	**94.1**
Newcastle Centre	DEFRA	**96.7**	**96.5**	**96.5**	**96.1**	**96.9**	**96.5**
Northampton	Affiliate	**99.5**	**99.4**	**98.2**	**98.1**	**99.5**	**99.0**
Northampton PM10	Affiliate	-	-	-	**95.6**	-	**95.6**
Norwich Centre	DEFRA	99.6	**99.5**	**99.4**	88.5	99.5	**97.3**
Nottingham Centre	DEFRA	**97.0**	**97.0**	**96.9**	**97.2**	**96.9**	**97.0**
Oxford Centre Roadside	Affiliate	**98.9**	97.5	-	-	**98.8**	**98.4**
Plymouth Centre	DEFRA	96.8	46.0	96.8	**86.1**	83.9	**81.9**
Portsmouth	Affiliate	**98.2**	**98.4**	**98.4**	**98.3**	**98.5**	**98.4**

Preston	DEFRA	**93.2**	**92.4**	**91.7**	**97.3**	**97.4**	**94.4**
Reading New Town	DEFRA	**96.9**	**50.4**	**93.2**	**92.7**	**91.6**	**85.0**
Scunthorpe Town	Affiliate	-	-	-	**96.9**	81.3	**89.1**
Sheffield Centre	DEFRA	97.0	41.4	96.5	**97.1**	92.4	**84.9**
Sibton	DEFRA	-	-	**99.5**	-	-	**99.5**
Somerton	Affiliate	-	**47.0**	**79.9**	-	-	**63.4**
Southampton Centre	DEFRA	**88.4**	**86.4**	**90.2**	**88.8**	**85.0**	**87.8**
Southend-on-Sea	DEFRA	**98.7**	**98.7**	**98.7**	**95.7**	**98.7**	**98.1**
St Osyth	DEFRA	98.3	**94.2**	**98.3**	-	-	**96.9**
Stockton-on-Tees Yarm	Affiliate	**97.9**	**97.9**	-	**97.7**	-	**97.9**
Stoke-on-Trent Centre	DEFRA	**90.4**	**94.1**	**90.6**	**94.6**	**93.0**	**92.5**
Sunderland	DEFRA	-	-	-	-	**94.5**	**94.5**
Sunderland Silksworth	Affiliate	-	**93.6**	**83.2**	-	-	**88.4**
Thurrock	Affiliate	98.0	**93.9**	**98.1**	97.1	97.9	**97.0**
Wicken Fen	DEFRA	-	**98.1**	**61.0**	-	98.1	**85.7**
Wigan Centre	Affiliate	**98.0**	**99.1**	**98.0**	**98.4**	**99.1**	**98.5**
Wirral Tranmere	DEFRA	**95.4**	**94.7**	**91.6**	**94.5**	**50.4**	**85.3**
Yarner Wood	DEFRA	-	**91.2**	**99.5**	-	-	**95.4**
N Ireland							
Belfast Centre	DEFRA	**54.9**	**90.9**	**94.7**	95.0	91.4	**85.4**
Derry	Affiliate	**89.9**	**65.6**	**86.2**	**95.9**	**89.8**	**85.5**
Lough Navar	DEFRA	-	-	**98.8**	98.9	-	**98.9**
Scotland							
Aberdeen	Affiliate	**98.7**	**98.5**	**98.6**	**92.7**	**98.1**	**97.3**
Bush Estate	DEFRA	-	**88.7**	**96.0**	-	-	**92.4**
Dumfries	DEFRA	**97.1**	**91.6**	-	**84.4**	-	**91.1**
Edinburgh St Leonards	DEFRA	**98.1**	**91.6**	**97.4**	**98.1**	**98.2**	**96.7**
Eskdalemuir	DEFRA	-	**92.5**	**98.1**	-	-	**95.3**
Glasgow Centre	DEFRA	96.8	**96.9**	**97.0**	81.5	**96.9**	**93.8**
Grangemouth	Affiliate	**99.3**	**98.9**	-	**97.8**	**99.3**	**98.8**
Inverness	DEFRA	98.4	**98.4**	-	**85.6**	-	**94.1**
Strath Vaich	DEFRA	-	-	**97.6**	-	-	**97.6**
Wales							
Aston Hill	DEFRA	-	**91.1**	**82.0**	-	-	**86.6**
Cardiff Centre	DEFRA	**97.1**	**92.1**	**96.1**	**96.8**	**96.9**	**95.8**
Cwmbran	Affiliate	**99.3**	**88.6**	**99.7**	**98.2**	**99.6**	**97.1**
Narberth	Affiliate	-	95.8	**92.0**	95.7	91.9	**93.9**
Swansea	Affiliate	**84.2**	94.2	94.5	94.9	77.7	**89.1**
Wrexham	DEFRA	**98.3**	**94.1**	-	**97.8**	**98.0**	**97.0**
Number of sites		39	52	48	41	39	60
Number of sites < 90%		5	11	5	6	6	15
Network Mean (%)		95.0	88.9	94.8	95.1	94.0	93.5

Shaded boxes are for data capture < 90%
Bold data captures are for critical instruments and sites

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 outstanding issues 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 2006	Priority	Action
19	Weybourne O3 analyser should be upgraded to allow monthly LSO calibrations and daily autocalibrations	Medium	ESU to provide CMCU with quotation for necessary work
	Recommendations April 2006		
	None		
	Recommendations January 2006		
18	Rotherham SO_2 analyser shows excessive noise and baseline drift-recommend upgrade or replacement	High	Replacement has been actioned during Q2 2006
17	The performance of CO analysers needs close attention by all parties, and poorly performing analysers replaced or upgraded	High	LSOs and CMCU to check performance carefully; ESU's to action repairs promptly
	Recommendations July 2005		
14	Several analysers still exhibit poor performance-	High	Repair/replace ment to be actioned by ESUs
13	Continuing problems with some autocal run-ons causing loss of up to 2 hours per day	High	Many sites now cured, but some need attention at next ESU visit
	Recommendations May 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

APPENDIX A2

CRITICAL SITES IN THE AURN (July 2006)

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
Blackpool Marton	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}		
Bristol St Pauls	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
Hove Roadside+	Brighton/Worthing/Littlehampton	SO_2		
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
Newcastle Centre	Tyneside	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
Stoke-on-Trent Centre	The Potteries	NO_2 PM_{10} SO_2	CO	NO_2 O_3
Swansea+	Swansea Urban Area		CO	
Wirral Tranmere	Birkenhead Urban Area	NO_2 PM_{10} SO_2	CO	NO_2 O_3

"+ indicates Affiliate site"

Note 7: Addresses CO, Benzene not included here

Table A2 Critical Sites in Zones

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

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 7: Addresses CO, Benzene not included here

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, August 2006

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	Field support equipment: 1 intercalibration equipment set (includes mass flow controllers and read-out unit) A second intercalibration (commissioned January 2001) UV photometers: API model M401 s/n 123- purchased April 1999 (on temporary loan to Siemens) API model 401 s/n 151 - purchased October 2000 API model 401 s/n 176 – purchased December 2002 (on temporary loan to Horiba) API model 401 s/n 290 – purchased May 2004 API model 401 s/n 291 – purchased May 2004 API model 401 s/n 292 purchased May 2004 API model 401 s/n 293 purchased May 2004 Mass flow controllers - purchased April 2002 (incorporated into existing audit dilution apparatus) 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 Sabio 2010 dilution calibrator – purchased June 2006 Sabio 2020 zero air generator – purchased June 2006 Sabio 2030 ozone photometer – purchased June 2006
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 +5	LSOs and ESUs
2	Autocalibration run-on	Investigate problem of autocalibration run on at sites given in Table 2.5. Eskdalemuir, Harwell and Yarner Wood should be prioritised as 2 hours per day are being lost at these sites. Autocalibration span concentrations to be <200ppb for urban sites and <100ppb for rural sites.	2.4	ESUs
3	Weybourne O_3	Weybourne O_3 analyser should be upgraded to allow monthly LSO calibrations and daily autocalibrations	3.2	CMCU
4	Leaking NOx/NO switching valves	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	8.2	LSOs
5	Leaking NOx/NO 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. The Stockport Shaw Heath analyser should be repaired as soon as possible	8.2	ESUs
6	Stockport Shaw Heath TEOM	The flowrates have been identified as outliers in two successive audits; the ESU should repair this as soon as possible	12	ESU

PART B - Intercalibration Report for the Automatic Urban and Rural Network, January-March 2006

6 Introduction

In January to March 2006, netcen undertook an intercalibration of the 125 monitoring stations in operation in the defra and the Devolved Administrations sponsored Urban and Rural Monitoring Network. 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 correctly.
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 have been evaluated by the United Kingdom Accreditation Service (UKAS). netcen holds ISO17025 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 particulate analyser flow rates used in the network. An ISO17025 certificate of calibration (Calibration Laboratory number 0401) for the AURN is appended to this report.

A total of 122 sites were audited in this exercise; Cwmbran was not audited due to building work at the site.

During this period, a new site was established at Auchencorth Moss, the site at Bristol Centre was closed pending relocation to St Paul's, and the site at Southwark Roadside was closed pending relocation of the analysers into a purpose built enclosure outside the museum building.

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 audited analyser performance

Parameter	Number of outliers	Number in network	% outliers in total
NOx analyser	33	109	31%
CO analyser	0	77	0%
SO_2 analyser	9	75	12%
Ozone analyser	23	87	26%
TEOM and BAM analysers	1 k_0, 4 flow	70 TEOM PM_{10} 1 BAM 4 $PM_{2.5}$	7%
Gravimetric PM_{10} analysers	0	7	0%
Total	69	438	16%

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} and $PM_{2.5}$ analysers, the flow rates must be within 10% of the specified limits and the TEOM k_0 factor must be within 2.5% of the stated value.

In addition to these results, 10 of the 377 site cylinders (~3%) used to scale instrument data into concentrations appeared to have drifted by more than 10% from their certificated values.

Two NO_x converters were found to be lower than the 95% acceptance limit, while a further two converters were found to be higher than 105%.

The number of analyser outliers identified is slightly higher than the previous exercise. At the summer 2005 intercalibration 14% of the analysers in use were identified as outliers.

Table 7.2 below presents a breakdown of the outliers identified, on a site-by-site basis:

Table 7.2 – Performance Breakdown

SITE	Date visited	NO_x	CO	SO_2	O_3	PM_{10}	$PM_{2.5}$
ENGLAND							
Barnsley 12	9 Feb			OK			
Barnsley Gawber	9 Feb	Converter 93%	OK	OK	Outlier -18%		
Bath Roadside	6 Mar	Outlier +11%	OK				
Billingham	24 Jan	Outlier -11%					
Birmingham Centre	6 Feb	OK	OK	OK	OK	OK	
Birmingham Tyburn	8 Mar	OK	OK	OK	OK	OK	
Blackpool Marton	14 Mar	Outlier +30%	OK	OK	OK	OK	
Bolton	1 Mar	Outlier +17% Converter 106%	OK	OK	OK	OK	
Bottesford	20 Jan				OK		
Bournemouth	7 Feb	OK	OK	OK	OK	OK	
Bradford Centre	11 Jan	Outlier -29%	OK	OK	Outlier -19%	OK	
Brentford Roadside	9 Jan	OK					
Brighton Preston Park	20 Feb	OK			OK		
Brighton Roadside	20 Feb	OK	OK				
Brighton Roadside PM_{10}	20 Feb					OK	
Bristol Centre	n/a	not audited	not audited	not audited	not audited	not audited	
Bristol Old Market	30 Jan	Outlier +26%	OK				
Bury Roadside	1 Mar	OK	OK	OK	OK	OK	
Cambridge Roadside	13 Mar	OK					
Camden Kerbside	9 Mar	OK				Outlier main flow +11%	
Canterbury	21 Feb	OK				OK	
Coventry Memorial Park	1 Feb	Outlier +21%	OK	OK	OK	OK	
Exeter Roadside	1 Feb	OK	OK	OK	OK		
Glazebury	23 Feb	Outlier +21%			Outlier -17%		
Great Dun Fell	31 Jan				Outlier -6%		
Haringey Roadside	22 Mar	OK				OK	
Harwell	10 Jan	Outlier -20%		OK	Outlier -12%	OK	OK
High Muffles	1 Feb	Outlier -15%			OK		
Hove Roadside	21 Feb	OK	OK	OK			
Hull Freetown	9 Jan	OK	OK	Outlier +47%	Outlier -8%	OK	
Ladybower	16 Mar	OK		OK	Outlier -9%		
Leamington Spa	22 Feb	OK	OK	Outlier +12%	OK	OK	
Leeds Centre	11 Jan	OK	OK	OK	OK	OK	
Leicester Centre	24 Jan	OK	OK	OK	OK	OK	
Leominster	23 Feb	OK			OK	OK	
Liverpool Speke	15 Feb	OK	OK	OK	OK	OK	
London A3 Roadside	5 Jan	OK	OK			OK	
London Bexley	20 Feb	OK	OK	OK	OK	OK	
London Bloomsbury	18 Jan	OK	OK	OK	OK	OK	OK
London Brent	19 Jan	Outlier +13%	OK	OK	OK	OK	
London Bromley	4 Jan	OK	OK				
London Cromwell Road 2	23 Mar	OK	OK	OK	OK		
London Eltham	28 Mar	OK		OK	OK	OK	
London Hackney	4 Jan	Outlier +45%	OK		OK		

SITE	Date visited	NO_x	CO	SO_2	O_3	PM_{10}	$PM_{2.5}$
London Haringey	22 Mar				Outlier -72%		
London Harlington	8 Feb	OK	OK		OK	OK	
London Hillingdon	16 Jan	OK	OK	OK	OK	OK	
London Lewisham	21 Mar	OK		OK	Outlier +22%		
London Marylebone Road	7 Mar	OK	OK	OK	OK	OK	OK
London N. Kensington	19 Jan	Outlier -16%	OK	OK	OK	OK	
London Southwark	16 Mar	OK	OK	OK	OK		
London Teddington	31 Jan	OK		Outlier +27%	OK		
London Wandsworth	7 Mar	OK			OK		
London Westminster	20 Mar	Outlier -18%	OK	OK	OK	OK	
Lullington Heath	23 Mar	OK		OK	OK		
Manchester Piccadilly	24 Jan	Outlier +12%	OK	OK	OK	OK	
Manchester South	23 Jan	Converter 93%		OK	OK		
Manchester Town Hall	24 Jan	OK	OK				
Market Harborough	17 Jan	OK	OK		Outlier-39%		
Middlesbrough	25 Jan	OK	OK	OK	OK	OK	
Newcastle Centre	23 Jan	OK	OK	OK	OK	OK	
Northampton	11 Jan	Outlier +20%	OK	OK	OK	OK	
Northampton PM_{10} (Grav)	11 Jan					OK	
Norwich Centre	28 Feb	Outlier +13%	OK	OK	OK	OK	
Norwich Forum Roadside	27 Feb	OK					
Nottingham Centre	16 Jan	OK	OK	OK	OK	OK	
Oxford Centre Roadside	20 Jan	OK	OK	OK			
Plymouth Centre	31 Jan	Outlier +12% Converter 108%	OK	OK	Outlier -10%	OK	
Portsmouth	23 Jan	OK	OK	OK	OK	OK	
Preston	14 Mar	OK	OK	OK	Outlier +7%	OK	
Reading New Town	18 Jan	OK	OK	Outlier -17%	OK	OK	
Redcar	25 Jan	Outlier +13%	OK	OK	Outlier +14%	OK	
Rochester	22 Feb	OK		OK	OK	OK	OK
Rotherham Centre	6 Feb	OK		Outlier -32%	OK		
Salford Eccles	25 Jan	OK	OK	OK	Outlier +6%	OK	
Sandwell West Bromwich	26 Jan	Outlier +20%	OK	OK	OK		
Scunthorpe Town	10 Jan			Outlier -60%		OK	
Sheffield Centre	7 Feb	OK	OK	OK	OK	OK	
Sheffield Tinsley	7 Feb	OK	OK				
Sibton	28 Feb				Outlier +8%		
Somerton	30 Jan	OK			OK		
Southampton Centre	21 Feb	OK	OK	OK	OK	OK	
Southend-on-Sea	22 Feb	Outlier +12%	OK	OK	OK	OK	
Southwark Roadside	n/a	not audited	not audited	not audited			
St Osyth	23 Feb	OK	OK		Outlier +6%		
Stockport Shaw Heath	25 Jan	OK	OK	Outlier +18%		Outlier main +14%, aux -18%	
Stockton-on-Tees Yarm	24 Jan	Outlier +18%	OK			Outlier main flow +12%	
Stoke-on-Trent Centre	27 Feb	Outlier +40%	OK	Outlier -11%	OK	OK	
Sunderland	26 Jan			OK			
Sunderland Silksworth	26 Jan	OK			OK		

SITE	Date visited	NO_x	CO	SO_2	O_3	PM_{10}	$PM_{2.5}$
Thurrock	14 Feb	OK	OK	OK	OK	OK	
Tower Hamlets Roadside	30 Jan	OK	OK				
Walsall Alumwell	5 Jan	OK					
Walsall Willenhall	9 Mar	Outlier +12%					
West London	23 Mar	OK	OK				
Weybourne	28 Feb				OK		
Wicken Fen	27 Feb	OK		Outlier +14%	Outlier -9%		
Wigan Centre	28 Feb	OK	OK	OK	OK	OK	
Wirral Tranmere	13 Mar	OK	OK	OK	Outlier -16%	OK	
Wolverhampton Centre	6 Mar	OK	OK	OK	OK	OK	
Yarner Wood	22 Mar	OK			OK		
NORTHERN IRELAND							
Belfast Centre	7 Feb	Outlier -12%	OK	OK	OK	OK	
Belfast Clara St	7 Feb					OK	
Belfast East	7 Feb			OK			
Derry	8 Feb	Outlier -18%	OK	OK	OK	OK	
Lough Navar	14 Feb				Outlier -10%	OK	
SCOTLAND							
Aberdeen	16 Jan	OK	OK	OK	Outlier +11%	OK	
Bush Estate	13 Jan	Outlier +12%			OK		
Dumfries	6 Feb	Outlier -12%	OK			OK	
Edinburgh St Leonards	13 Jan	Outlier -13%	OK	OK	OK	OK	
Eskdalemuir	31 Jan	Outlier +13%			Outlier +16%		
Glasgow Centre	9 Jan	OK	OK	OK	OK	OK	
Glasgow City Chambers	4 Jan	Outlier -30%	OK				
Glasgow Kerbside	5 Jan	OK	OK			Outlier k_0 +3.8%	
Grangemouth	10 Jan	OK	OK	OK	OK	Outlier main flow -16%	
Inverness	18 Jan	Outlier -15%	OK			OK	
Lerwick	16 Feb				Outlier -8%		
Strath Vaich	18 Jan				OK		
WALES							
Aston Hill	20 Mar	OK			OK		
Cardiff Centre	14 Feb	Outlier -15%	OK	OK	OK	OK	
Cwmbran	n/a	not audited	not audited	not audited	not audited	not audited	
Narberth	21 Mar	OK		OK	Outlier -23%	OK	
Port Talbot	12 Feb	OK		OK	OK	OK	
Swansea	13 Feb	OK	OK	OK	OK	OK	
Wrexham	13 Mar	OK	OK	OK		OK	

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

8 Oxides of Nitrogen

8.1 Intercalibration Outliers

The intercalibration highlighted that the results from 33 sites were outside the ±10% acceptance limit from the network mean. This result is worse than the summer intercalibration, when 28 analysers (28%) were identified as outliers.

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

1. Coventry Memorial Park
2. Northampton ®
3. Norwich Centre

® denotes a repeat offender

The actions arising as a result of cylinder outliers are described in Section 13.

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.

Twenty two outliers can be attributed to drifts in calibration factors between LSO calibrations, and no data will be lost as a result of these findings.

The analysers at Blackpool Marton, Bradford, Stoke-On-Trent and Derry appeared to exhibit sensitivity to pressure differences when calibration gas was supplied to the instrument. The data from these analysers have been carefully examined during ratification; no data have been rejected as a result of these findings.

The analyser at Redcar was found to be leaking at the time of the audit. Despite this finding, ambient data do not appear to be affected, no data have been rejected.

A further three outliers appear to be due to unsuccessful calibrations (Stockton-On-Tees Yarm, Sandwell West Bromwich and High Muffles).

Using the methodology detailed in Section 6, comparison of the network averages to audit cylinder concentrations showed that the network measures concentrations of NOx to within 3% 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 nine analysers:

1. Birmingham Centre - measured 12 ppb NO in an NO_2 cylinder (not outlier)
2. London Bromley – measured 11 ppb NO in an NO_2 cylinder (not outlier)
3. Exeter Roadside - measured 12 ppb NO in an NO_2 cylinder (not outlier)
4. Preston – measured 15 ppb NO in an NO_2 cylinder (not outlier)
5. Somerton - measured 12 ppb NO in an NO_2 cylinder ® (not outlier)
6. Stockport Shaw Heath - measured 45 ppb NO in an NO_2 cylinder ® (outlier)
7. West London - measured 12 ppb NO in an NO_2 cylinder ® (not outlier)
8. Wolverhampton - measured 23 ppb NO in an NO_2 cylinder (not outlier)
9. Glasgow Kerbside – measured 17 ppb NO in an NO_2 cylinder (outlier)

® denotes a repeat offender

These results are the same as those found at the summer 2005 exercise where 9 analysers were also seen to have this response.

The analyser at Stockport Shaw Heath has now caused outliers to be identified on two occasions – it it therefore recommended that the ESU takes urgent action to remedy this fault

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

The Stockport Shaw Heath analyser should be repaired as soon as possible.

Netcen will continue to monitor these results at audit visits.

8.3 Converter Tests

Two converters were found to be less than 95% efficient: Manchester South and Barnsley Gawber, both at 93%.

The converter at Bolton was found to be 106% efficient.

The converter at Plymouth was found to be 108% efficient.

As a result of these findings some data have been rejected from all four sites in the first quarter of 2006.

It is worth noting at this point that the future requirement for NOx data based on 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.

9 Carbon Monoxide

The intercalibration showed that the results from all 80 analysers were inside the ±10% acceptance criterion. This result is much better than the summer intercalibration, when six analysers were identified as outliers.

Comparison of the network average to the audit cylinder concentration showed that the network measures CO concentrations to within 1% 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 9 analysers were outside the ±10% acceptance criterion. This is slightly better than the winter intercalibration, when ten analysers (13%) were identified as outliers.

Five outliers can be attributed to drifts in calibration factors between LSO calibrations, and no data were lost as a result of this.

Two outliers arose as a result of changes in site cylinder concentrations as listed below:

1. Hull Freetown
2. London Teddington

Actions arising from cylinder outliers are described in Section 13.

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.

The analyser at Reading appeared to exhibit sensitivity to pressure differences when calibration gas was supplied to the instrument. The data from this analyser

have been carefully examined during ratification; some data have been deleted as a result.

The outlier at Rotherham appears to be due to an unreliable LSO calibration prior to the audit.

Comparison of the network average to the audit cylinder concentration showed that the network measures SO_2 concentrations to within 1% 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 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. In future, there will be no formal requirement for analysers in the field to pass this test, once type approval has been granted. For these reasons, the acceptance criteria have been relaxed to allow a maximum response of 50ppb.

There were no outliers identified during this intercalibration: the maximum m-xylene response observed for any analyser was 32ppb (which was also the maximum recorded at the summer 05 intercalibration)

11 Ozone

Calibration of the network analysers against the netcen reference photometers showed that 23 analysers were outside the ±5% acceptance criterion. This is worse than the previous exercise, where 17 analysers tested (19%) 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.

8 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 4 analysers had drifted by more than 20%. As a result of these findings and subsequent investigations, 3 months of data from London Haringey were rejected. Data from the remaining sites have been successfully rescaled.

These results are comparable to the summer 2005 intercalibration, when 3 analysers were found to be more than 20% from the reference photometer.

12 Particulate analysers

12.1 TEOM k_0

There were a single outlier for TEOM k_0 during this intercalibration – Glasgow Kerbside at +3.8%. Data from this analyser have been carefully examined and rescaled as necessary.

All other analyser 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 four sites were found to be outside the ±10% acceptance limit:

1. Camden Kerbside (Main Flow +11%)
2. Stockport Shaw Heath ® (Main Flow +14%, Aux Flow -18%)
3. Stockton-On-Tees Yarm (Main Flow +12%)
4. Grangemouth (Main Flow -16%)

® denotes a repeat offender

The TEOM at Stockport Shaw Heath has now been identified as an outlier on two consecutive occasions. It is recommended that the ESU repairs this fault as soon as possible.
Recommendation

It is recommended that the ESU carry out appropriate repair to the Stockport Shaw Heath TEOM as soon as possible

Careful examination of the analyser datasets, and the circumstances surrounding the faults, have resulted in some data rejection from Camden Kerbside; no loss of data was necessary at the remaining three sites.

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 377 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 similar to the Winter 2005 roadshow, where 11 cylinders were outside the acceptance limits. All 10 of the non-NO_2 outlier cylinders were first-time outliers, and so none were replaced. The results for these cylinders will be closely checked at the summer 2006 intercalibration, and appropriate action taken.

In addition, the concentrations of 23 NO_2 cylinders appear to have drifted by more than 10%. NO_2 cylinders are not used for the scaling of data.

Hence, a total of 33 of the 377 cylinders were outside the acceptance limits. This is slightly worse than the previous intercalibration, where 29 of the cylinders were found to be out of specification.

The site cylinder evaluations are performed by calibrating the analysers with site and audit 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.

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, both in compiling and verifying these grid references. It should be noted that while the measurements are stated to within 1 metre, the uncertainty of the GPS system used is typically the order of ±10 metres.

The following Table 14.1 presents the information collated to date:

Table 14.1 – Site Information

Site Name	Manifold type	Grid Reference	6 figure easting	6 figure northing	Longitude	Latitude	Altitude (m)
Aberdeen	Glass	NJ944074	394416	807408	57° 9' 27.1" N	2° 5' 38" W	10
Aston Hill	Glass	SO299901	329902	290062	52° 30' 13.3" N	3° 02' 3" W	370
Auchencorth Moss	N/a						
Barnsley 12	Narrow-bore Teflon	SE343065	434276	406542	53° 33' 16" N	1° 29' 3" W	120
Barnsley Gawber	Wide-bore Teflon	SE325075	432529	407472	51° 33' 46" N	1° 30' 37" W	105
Bath Roadside	Narrow-bore Teflon	ST755658	375473	165845	51° 23' 27.7" N	2° 21' 14.4" W	35
Belfast Centre	Glass				54° 35' 58.8" N	5° 55′ 39.3″W	10
Belfast Clara St	N/A				54° 35' 27.3" N	5° 53' 39.4" W	10
Belfast East	Narrow-bore Teflon				54° 35′ 47.5″N	5° 54′ 2.1″W	10
Billingham	Glass	NZ470237	446962	523650	54° 36' 21" N	1° 16' 28" W	15
Birmingham Centre	Glass	SP063869	406342	286862	52° 28' 47" N	1° 54' 29" W	140
Birmingham Tyburn	Glass	SP116905	411625	290457	52° 30' 43" N	1° 49' 48" W	95
Blackpool Marton	Wide-bore Teflon	SD339347	333863	434745	53° 48' 17.2" N	3° 0' 20.6" W	5

Site Name	Manifold type	Grid Reference	6 figure easting	6 figure northing	Longitude	Latitude	Altitude (m)
Bolton	Wide-bore Teflon	SD710086	371000	408562	53° 34' 22" N	2° 26' 22" W	105
Bottesford	Narrow-bore Teflon	SK798377	479768	337654	52° 55' 49" N	0° 48' 53" W	30
Bournemouth	Narrow-bore Teflon	SZ123933	412320	93344	50° 44' 22" N	1° 49' 36" W	10
Bradford Centre	Wide-bore Teflon	SE166330	416652	433038	53° 47' 36.2" N	1° 44' 55.3" W	102
Brentford Roadside	Narrow-bore Teflon	TQ174780	517425	178074	51° 29' 20.2" N	0° 18' 33"	10
Brighton Preston Park	Wide-bore Teflon	TQ305062	530508	106222	50° 50' 27" N	0° 8' 52" W	30
Brighton Roadside	Glass	TQ313043	531307	104305	50° 49' 24" N	0° 8' 14" W	10
Brighton Roadside $_{PM10}$	N/A	TQ313043	531322	104302	50° 49' 24 N	0° 8' 13" W	10
Bristol Old Market	Glass	ST596732	359570	173173	51° 27' 22" N	2° 35' 59" W	20
Bristol St Pauls	Glass	ST595739	359501	173935	51° 27' 46.3"N	2° 35'4.3"W	15
Bury Roadside	Glass	SD809048	380922	404772	53° 32' 21" N	2° 17' 22" W	100
Bush Estate	Hi Flow wide tube	NT246639	324626	663880	55° 51' 44" N	3° 12' 22" W	185
Cambridge Roadside	Narrow-bore Teflon	TL452582	545248	258155	52° 12' 9" N	0° 7' 26" E	10
Camden Kerbside	Narrow-bore Teflon	TQ266844	526640	184433	51° 32' 41" N	0° 10' 31" W	50
Canterbury	Narrow-bore Teflon	TR162573	616198	157330	51° 16' 25" N	1° 5; 55" E	30
Cardiff Centre	Glass	ST184765	318417	176505	51° 28' 53" N	3° 10' 34" W	12
Coventry Memorial Park	Wide-bore Teflon	SP328773	432801	277340	52° 23' 35" N	1° 31' 10" W	95
Cwmbran	Wide-bore Teflon	ST305954	330510	195436	51° 39' 11.7" N	3° 0' 20.2" W	65
Derry	Wide-bore Teflon				55° 0' 1.5" N	7° 19' 42.1" W	25
Dumfries	Narrow-bore Teflon	NX970763	297012	576278	55° 4' 14" N	3° 36' 52" W	20
Edinburgh St Leonards	Glass	NT263731	326250	673132	55° 56' 44" N	3° 10' 57" W	30
Eskdalemuir	Narrow-bore Teflon	NT235030	323528	603030	55° 18' 55.1" N	3° 12' 22" W	260
Exeter Roadside	Stainless Steel	SX919928	291940	92840	50° 43' 30" N	3° 31' 56" W	35
Fort William	Narrow bore Teflon	NN108744	210849	774421	56° 49' 21.8" N	5° 6' 4.1" W	5

Site Name	Manifold type	Grid Reference	6 figure easting	6 figure northing	Longitude	Latitude	Altitude (m)
Glasgow Centre	Wide-bore Teflon	NS589650	258902	665028	55° 51' 28.4" N	4° 15' 21" W	5
Glasgow City Chambers	Narrow-bore Teflon	NS595653	259528	665308	55° 51' 38" N	4° 14' 45" W	15
Glasgow Kerbside	Wide-bore Teflon	NS587652	258708	665200	55° 51' 33" N	4° 15' 32" W	10
Glazebury	Narrow-bore Teflon	SJ687960	368733	396034	53° 27' 36" N	2° 28' 21" W	20
Grangemouth	Wide-bore Teflon	NS938810	293840	681032	56° 0' 38" N	3° 42' 15" W	5
Great Dun Fell	Narrow-bore Teflon	NY710322	371020	532190	54° 41' 2.4" N	2° 27' 4" W	850
Haringey Roadside	Narrow-bore Teflon	TQ339907	533885	190669	51° 35' 56" N	0° 4' 6" W	15
Harwell	Wide-bore Teflon	SU468860	446772	186020	51° 34' 16" N	1° 19' 36" W	125
High Muffles	Wide-bore Teflon	SE775939	477535	493865	54° 20' 4" N	0° 48' 33" W	260
Hove Roadside	Glass	TQ301045	530088	104484	50° 49' 31" N	0° 9' 16" W	30
Hull Freetown	Glass	TA095293	509478	429329	53° 44' 55.1" N	0° 20' 27" W	0
Inverness	Glass	NH657457	265720	845680	57° 28' 53.5" N	4° 14' 29" W	10
Ladybower	Wide-bore Teflon	SK166896	416575	389565	53° 24' 10" N	1° 45' 8" W	360
Leamington Spa	Glass	SP319657	431932	265743	52° 17' 20" N	1° 31' 59" W	55
Leeds Centre	Glass	SE300343	429976	434268	53° 48' 13" N	1° 32' 47" W	60
Leicester Centre	Glass	SK588041	458767	304083	52° 37' 53" N	1° 7' 59" W	65
Leominster	Glass	SO498584	349773	258387	52° 13' 17" N	2° 44' 12" W	75
Lerwick	Narrow-bore Teflon	HU453397	445345	1139685	60° 8' 21" N	1° 11' 8" W	85
Liverpool Speke	Glass	SJ439836	343860	383598	53° 20' 47" N	2° 50' 41" W	35
London A3 Roadside	Wide-bore Teflon	TQ190652	518983	165220	51° 22' 25" N	0° 17' 31" W	30
London Bexley	Glass	TQ519764	551852	176396	51° 27' 58" N	0° 11' 05" E	10
London Bloomsbury	Glass	TQ301820	530107	182041	51° 31' 02" N	0° 07' 14" W	20
London Brent	Glass	TQ196893	519570	189275	51° 35' 23" N	0° 16' 31" W	50
London Bromley	Narrow-bore Teflon	TQ405693	540533	169334	51° 24' 20" N	0° 1' 09" E	65
London Cromwell Road 2	Wide-bore Teflon	TQ265790	526530	178975	51° 29' 44" N	0° 10' 43" W	5
London Eltham	Narrow-bore Teflon	TQ440747	543978	174668	51° 27' 10" N	0° 4' 15" E	65
London Hackney	Wide-bore Teflon	TQ348862	534812	186230	51° 33' 32" N	0° 3' 24" W	20

Site Name	Manifold type	Grid Reference	6 figure easting	6 figure northing	Longitude	Latitude	Altitude (m)
London Haringey	Narrow-bore Teflon	TQ299891	529914	189132	51° 35' 10" N	0° 7' 34" W	40
London Harlington	Narrow-bore Teflon	TQ083778	508299	177809	51° 29' 20" N	0° 26' 30" W	25
London Hillingdon	Glass	TQ069786	506933	178607	51° 29' 47" N	0° 27' 40" W	25
London Lewisham	Narrow-bore Teflon	TQ377737	537680	173685	51° 26' 44" N	0° 1' 13" W	20
London Marylebone Road	Glass	TQ281820	528120	182000	51° 31' 21" N	0° 09' 17" W	30
London N. Kensington	Narrow-bore Teflon	TQ240817	524040	181740	51° 31' 16" N	0° 12' 48" W	20
London Southwark	Glass	TQ322786	532245	178565	51° 29' 26" N	0° 05' 48" W	20
London Teddington	Glass	TQ155704	515538	170427	51° 25' 16" N	0° 20' 23" W	20
London Wandsworth	Narrow-bore Teflon	TQ258747	525778	174677	51° 27' 26" N	0° 11' 28" W	10
London Westminster	Glass	TQ298789	529796	178949	51° 29' 41" N	0° 07' 54" W	0
Lough Navar	Glass				54° 26′ 21.5" N	7° 53′ 55.9" W	
Lullington Heath	Wide-bore Teflon	TQ539018	553855	101740	50° 47' 41" N	0° 10' 54" E	115
Mace Head	Narrow-bore Teflon				53° 19′ 35.2′′N	9° 54′ 14.1′′W	5
Market Harborough	Glass	SP833959	483337	295905	52° 53' 17" N	0° 46' 20" W	145
Manchester Piccadilly	Glass	SJ843983	384310	398325	53° 28' 53"N	2° 14' 16" W	60
Manchester South	Glass	SJ839858	383912	385828	53° 22' 09"N	2° 14' 36" W	65
Manchester Town Hall	Wide-bore Teflon	SJ839980	383874	397976	53° 28' 42"N	2° 14' 40" W	60
Middlesbrough	Glass	NZ505196	450480	519632	54° 34' 10" N	1° 13' 16" W	5
Narberth	Wide-bore Teflon	SN146127	214640	212700	51° 46' 56" N	4° 41' 19" W	160
Newcastle Centre	Glass	NZ250649	425016	564940	54° 58' 42" N	1° 36' 38" W	45
Northampton	Glass	SP761645	476111	264524	52° 16' 25" N	0° 53' 09" W	125
Norwich Centre	Wide-bore Teflon	TG231089	623078	308910	52° 37' 55" N	1° 17' 42" E	20
Norwich Roadside Forum	Narrow-bore Teflon	TG230085	622998	308521	52° 37' 43" N	1° 17' 37" E	35
Nottingham Centre	Glass	SK574401	457420	340050	52° 57' 17" N	1° 08' 48" W	40
Oxford Centre	Wide-bore Teflon	SP514062	451366	206152	51° 45' 06" N	1° 15' 26" W	60

Site Name	Manifold type	Grid Reference	6 figure easting	6 figure northing	Longitude	Latitude	Altitude (m)
Plymouth Centre	Glass	SX477546	247742	54610	50° 22' 18" N	4° 08' 33" W	10
Port Talbot	Glass	SS780882	278036	188249	51° 34' 48" N	3° 45' 42" W	30
Portsmouth	Glass	SU657036	465686	103607	50° 49' 42" N	1° 04' 07" W	5
Preston	Wide-bore Teflon	SD552301	355248	430143	53° 45' 56" N	2° 40' 49" W	45
Reading New Town	Wide-bore Teflon	SU734732	473441	173198	51° 27' 11" N	0° 56' 40" W	45
Redcar	Glass	NZ600246	459975	524563	54° 36' 46" N	1° 4' 22" W	5
Rochester	Narrow-bore Teflon	TQ831762	583133	176220	51° 27' 19" N	0° 38' 04"E	14
Rotherham Centre	Teflon coated metal	SK431930	443088	393028	53° 25' 56" N	1° 21' 11" W	40
Salford Eccles	Glass	SJ779987	377932	398713	53° 29' 05" N	2° 20' 02" W	30
Sandwell West Bromwich	Glass	SP003915	400395	291503	52° 31' 17" N	1° 59' 44" W	165
Scunthorpe Town	Narrow-bore Teflon	SE904108	490421	410812	53° 35' 9.9" N	0° 38' 7.7 W	35
Sheffield Centre	Glass	SK351868	435134	386885	53° 22' 40" N	1° 28' 24" W	75
Sheffield Tinsley	Glass	SK402906	440240	390585	53° 24.639' N	1° 23.770 W	45
Sibton	Wide-bore Teflon	TM363719	636295	271870	52° 17' 39" N	1° 27' 49" E	45
Somerton	Wide-bore Teflon	ST485265	348544	126525	51° 02' 09" N	2° 44' 07" W	45
Southampton Centre	Glass	SU426123	442565	112255	50° 54' 30" N	1° 23' 46" W	5
Southend-on-Sea	Wide-bore Teflon	TQ856861	585566	186130	51° 32' 37.6" N	0° 40' 29" E	35
Southwark Roadside	Wide-bore Teflon	TQ346777	534621	177680	51° 28' 55" N	0° 03' 46" W	5
St Osyth	Glass	TM104132	610426	213205	51° 46' 41" N	1° 02' 56" E	5
Stockport Shaw Heath	Glass	SJ894896	389386	389604	53° 24' 11" N	2° 09' 40" W	75
Stockton-on-Tees Yarm	Wide-bore Teflon	NZ419129	441908	512886	54° 30' 34" N	1° 21' 15" W	10
Stoke-on-Trent Centre	Wide-bore Teflon	SJ883479	388348	347894	53° 01' 42" N	2° 10' 31" W	180
Strath Vaich	Wide-bore Teflon	NH348748	234829	874785	57° 43' 56" N	4° 46' 33" W	270
Sunderland	Narrow-bore Teflon	NZ399570	439855	556990	54° 54' 22" N	1° 22' 48" W	20
Sunderland Silksworth	Wide-bore Teflon	NZ381545	438142	554478	54° 53' 1" N	1° 24' 25" W	110
Swansea	Glass	SS656932	265566	193158	51° 37' 16" N	3° 56' 36" W	20
Thurrock	Glass	TQ610779	561018	177894	51° 28' 38" N	0° 19' 02" E	5

Site Name	Manifold type	Grid Reference	6 figure easting	6 figure northing	Longitude	Latitude	Altitude (m)
Tower Hamlets Roadside	Narrow-bore Teflon	TQ359822	535914	182230	51° 31' 22" N	0° 02' 32" W	10
Walsall Alumwell	Narrow-bore Teflon	SJ994983	399374	298264	52° 34' 56" N	2° 00' 38" W	130
Walsall Willenhall	Glass	SJ979012	397860	201173	52° 36' 30" N	2° 01' 59" W	150
West London	Wide-bore Teflon	TQ250788	525041	178751	51° 29' 38" N	0° 12' 01" W	5
Weybourne	Narrow-bore Teflon	TG098438	609832	343775	52° 57' 01" N	1° 07' 19" E	20
Wicken Fen	Wide-bore Teflon	TL563692	556310	269210	52° 17' 56" N	0° 17' 27" E	10
Wigan Centre	Wide-bore Teflon	SD578060	357825	406025	53° 32' 58" N	2° 38' 17" W	45
Wirral Tranmere	Wide-bore Teflon	SJ321866	332096	386644	53° 22' 20.9"N	3° 01' 17.5" W	30
Wolverhampton Centre	Glass	SO914989	391368	298942	52° 35' 18" N	2° 07' 44" W	150
Wrexham	Glass	SJ329499	332862	349904	53° 02' 32" N	3° 00' 10" W	80
Yarner Wood	Wide-bore Teflon	SX786789	278605	78948	50° 35' 51" N	3° 42' 59" W	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 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 a maximum uncertainty of ±10 metres.

For sites in Northern Ireland and Mace Head in 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.

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

The European Committee for Normalisation (CEN) have prepared a series of documents prescribing how analysers must be operated, to produce datasets that conform to the Data Quality Objectives of the EC Directives. The CEN documents for operation of air pollution analysers; BS EN14211 (NOx), BS EN14212 (SO_2), BS EN14626 (CO) and BS EN14625 (O_3) set out a series of performance criteria for analysers which must be achieved, both in the field and under laboratory conditions.

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

- Linearity – the analyser must have a maximum error at any point of less than 6% of the predicted value. Netcen now reports maximum residuals from linearity tests, to evaluate the performance of current analysers against these tougher requirements.

- NOx Converter efficiency must be better than 95%. Data must be rescaled for efficiencies between 95 and 99.9%, 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 pollutant 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. A report on the evaluation of methodologies to test losses of gases to sampling manifolds has been completed by QA/QC Unit and this is available on the AURN Hub and Air Quality Archive.

- The uncertainty of the site cylinder concentrations is, by and large, the largest single component of the entire measurement uncertainty budget. The winter 2006 intercalibration was used to evaluate a new methodology for calculating site cylinder concentrations and uncertainties. Unfortunately, it was discovered that analyser performance could not be relied upon to allow the scaling of cylinder concentrations with sufficient accuracy, particularly so for NOx analysers. It is likely that site environmental conditions (for example temperature variations) significantly affected these assessments. Netcen are currently investigating alternative methodologies and will report on these in the future.

- The determination of an SO_2 analyser response to meta-xylene will not be required for ongoing field tests. For the AURN, netcen will continue to assess the performance of the hydrocarbon kickers, but action will not be recommended unless the result is very high (greater than 50ppb response to a 1ppm m xylene cylinder)

The CEN operating methodologies are now finalised and published and are, at present, being incorporated into the requirements of the Framework and Daughter Directives. It is likely that Member States will have until 1 January 2008 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. To this end, the procedures used for the winter 2006 intercomparison were fully compliant with the CEN protocols.

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
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 ISO17025 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 2005 to March 2006.