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

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

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Jane Vallance-Plews
Brian Stacey

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<thead>
<tr>
<th>Name</th>
<th>Signature</th>
<th>Date</th>
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<tbody>
<tr>
<td><strong>Authors</strong></td>
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<td>Jane Vallance-Plews</td>
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<td>Brian Stacey</td>
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<td>Geoff Dollard</td>
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PART A: Data Ratification
January - March 2004
1 Introduction

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

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

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

Part B: Winter 2004 Intercalibration
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Appendix B1 Network certificate of calibration

1.1 Recent Changes in the Network

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

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

Wigan Leigh
The Wigan Leigh site will be relocated to Wigan College, following the redevelopment of the Police Station. This will be a permanent relocation of the AURN affiliated site to the college, even though the Wigan Leigh site will recommence operation at some point in the future. The problems at this site have meant that the NO₂ diffusion tube intercomparison has been moved to the Liverpool Speke site.

Birmingham East and Centre
The Birmingham East site will be closed down by the end of July, as the school will not renew the lease. QA/QC Unit is working closely with Birmingham County Council to try to identify suitable sites for relocation, especially as the Birmingham Centre site will also need to be relocated by the end of March 2005.
Scunthorpe/Scunthorpe Town
Due to health and safety reasons the site at Scunthorpe was closed on 18th March 2004 and relocated to a nearby site in Rowland Road. The new site commenced monitoring on 6th June 2004 and has been renamed Scunthorpe Town.

London Harlington
An affiliated site at London Harlington (Heathrow airport) measuring NO2, O3, CO and PM10 was integrated into the network from 1st January 2004.

DD3 Requirements
Additional ozone and rural NOx analysers have been installed in the network in order to comply with the Third Daughter Directive (DD3) which came into force on 9th September 2003. Installation and commissioning of the analysers has been completed at 12 out of the 13 selected sites. Up-grading of the site power supply to at Glazebury was completed and NOx analyser commissioned on 26/1/04. Arrangements have been made to install the NOx and PM10 analysers at the remaining site (Eskdalemuir) during summer 2004. Plans are also underway to add a further 4 new DD3 sites at Brighton Preston Park, Fort William, Sunderland Silkworth and Leominster. Progress on the affiliation of the remaining DD3 analysers is summarised in Table 1.1 and discussed in more detail in Section 2.1

<table>
<thead>
<tr>
<th>Sites</th>
<th>Date Commenced</th>
<th>Pollutants</th>
</tr>
</thead>
<tbody>
<tr>
<td>New sites</td>
<td></td>
<td></td>
</tr>
<tr>
<td>London Harlington</td>
<td>1/01/04</td>
<td>NO2, CO, O3, PM10</td>
</tr>
<tr>
<td>Site Relocations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scunthorpe relocated to Scunthorpe Town</td>
<td>18/4/04</td>
<td>SO2, PM10</td>
</tr>
<tr>
<td>Scunthorpe Town started 6th June 04</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Additional O3 and/or NOx (DD3)       |                |                |
|--------------------------------------|                |                |
| Eskdalemuir                          | Awaiting installation of a new air conditioning unit prior to installing NOx and PM10 analysers | NOx and PM10 |
| Glazebury                            | NOx commissioned on 26th January 2004 | NOx |

1.2 Overview of Network Performance

Ratified hourly average data capture for the network averaged 92% for all pollutants (O3, NO2, SO2, CO, PM10 and PM2.5) during the 3-month reporting period January to March 2004 (see Table 1.2 below). Overall, this has been a good quarter in terms of data capture especially since this period includes the winter intercalibration and service exercise. On average, data capture for all the pollutants was above the 90% target with the NO2 data capture being the lowest at 90.3%. This is mainly due to the fact that 3 sites had very low NO2 data capture for this period (Camden Kerbside (5%), Southwark Roadside (6%) and Wicken Fen (15%)). See Sections 3 and 4 for details.

<table>
<thead>
<tr>
<th>Table 1.2 AURN Ratified Data Capture (%) January to March 2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Using the start date of any new site)</td>
</tr>
<tr>
<td>Data Capture (%)</td>
</tr>
<tr>
<td>Q1 Jan - March 2004</td>
</tr>
</tbody>
</table>
Overall, 336 out of the 420 analysers (80%) achieved data capture levels above the required 90% target during this reporting period (See Table 1.3). This is lower than in the previous quarter (Oct-Dec 2003) when 84% of analysers achieved the data capture target. In this period a relatively high proportion (25%) of NOx and (21%) SO2 analysers in the network failed to meet the target. The reasons for data loss were varied but these were mainly due analyser malfunction including a few NOx converter failures. (See Section 2.5 for details).

Table 1.3 Number of Analysers with Data Capture below 90%

<table>
<thead>
<tr>
<th></th>
<th>Total Number of Analysers</th>
<th>Analysers with Data Capture &lt;90% Q1 Jan-March 2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>79</td>
<td>16 (20%)</td>
</tr>
<tr>
<td>NO2</td>
<td>106</td>
<td>26 (25%)</td>
</tr>
<tr>
<td>O3</td>
<td>84</td>
<td>14 (16%)</td>
</tr>
<tr>
<td>PM10</td>
<td>71</td>
<td>12 (17%)</td>
</tr>
<tr>
<td>PM2.5</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>SO2</td>
<td>76</td>
<td>16 (21%)</td>
</tr>
<tr>
<td>All sites</td>
<td>420</td>
<td>84 (20%)</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Site</th>
<th>Owner</th>
<th>Site Average Data Capture (%) Q1 Jan-March 04</th>
</tr>
</thead>
<tbody>
<tr>
<td>England</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blackpool</td>
<td>DEFRA</td>
<td>77.6</td>
</tr>
<tr>
<td>Bristol Old Market</td>
<td>Affiliate</td>
<td>79.1</td>
</tr>
<tr>
<td>Bury Roadside</td>
<td>Affiliate</td>
<td>74.7</td>
</tr>
<tr>
<td>Camden Kerbside</td>
<td>Affiliate</td>
<td>51.9</td>
</tr>
<tr>
<td>Exeter Roadside</td>
<td>Affiliate</td>
<td>85.4</td>
</tr>
<tr>
<td>Hull Freetown</td>
<td>DEFRA</td>
<td>89.5</td>
</tr>
<tr>
<td>London Bexley</td>
<td>Affiliate</td>
<td>86.5</td>
</tr>
<tr>
<td>London Haringey</td>
<td>Affiliate</td>
<td>84.7</td>
</tr>
<tr>
<td>London Lewisham</td>
<td>Affiliate</td>
<td>88.1</td>
</tr>
<tr>
<td>London Southwark</td>
<td>Affiliate</td>
<td>82.3</td>
</tr>
<tr>
<td>London Westminster</td>
<td>DEFRA</td>
<td>86.1</td>
</tr>
<tr>
<td>Newcastle Centre</td>
<td>DEFRA</td>
<td>78.9</td>
</tr>
<tr>
<td>Northampton PM10</td>
<td>Affiliate</td>
<td>87.9</td>
</tr>
<tr>
<td>Norwich Centre</td>
<td>DEFRA</td>
<td>87.4</td>
</tr>
<tr>
<td>Nottingham Centre</td>
<td>DEFRA</td>
<td>89.2</td>
</tr>
<tr>
<td>Plymouth Centre</td>
<td>DEFRA</td>
<td>89.7</td>
</tr>
<tr>
<td>Reading New Town</td>
<td>DEFRA</td>
<td>80.2</td>
</tr>
<tr>
<td>Salford Eccles</td>
<td>Affiliate</td>
<td>89.4</td>
</tr>
</tbody>
</table>
Netcen carried out the winter intercalibration and site audits at 120 operational urban and rural sites during January to March 2004. (Market Harborough site had just had a satisfactory commissioning audit in December 2003 so was not revisited). Results from this intercalibration exercise have been used to assess the accuracy and consistency of the data for this reporting period. Details of the Winter 2004 intercalibration are provided in Part B (Sections 6-18) of this report.

### 1.3 LSO Manual

QA/QC Unit up-dated the AURN Site Operator’s manual in November 2003 and an electronic version of the manual has recently been put on disc and will be issued to the LSOs in the near future. The new manual is already available electronically on the following web sites:

- **AURN Hub** [http://www.aeat.co.uk/com/AURNHUB/lsoman.html](http://www.aeat.co.uk/com/AURNHUB/lsoman.html)
- **Air Quality Archive** [http://www.aeat.co.uk/netcen/airqual/reports/lsoman/lsoman.html](http://www.aeat.co.uk/netcen/airqual/reports/lsoman/lsoman.html)

### 1.4 AURN Hub Updates

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

- Updated edition of the Local Site Operator’s Manual including new analyser instruction sets
- Presentations from LAQN Annual Site Operator’s meeting, April 2004 (pdf files)
- Monthly $\text{PM}_{10}$ (Gravimetric) exceedences for June 2004
- QA/QC Unit’s Summer 2004 intercalibration and audit schedule
- ESU’s Summer service schedules (where provided)
- QA/QC Unit’s ratification report and annual review Oct - Dec 2003
- Recent Management Unit reports (January- March 2004)
The AURN project information hub web site is located at 1.
http://www.aeat.co.uk/com/AURNHUB/index.html

1.5 AURN Equipment Replacement Programme

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

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

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

---

1 Password protected site: username and password available from Jane.vallance-plews@aeat.co.uk
2 Generic Data Quality Issues

2.1 Progress on Monitoring Requirements of the EU Daughter Directives

In order to comply with the third Daughter Directive (DD3 implementation date 9th September 2003), an additional 6 ozone and 7 rural NOx monitors were required at a number of existing sites in the network. Further details on the third Daughter Directive can be found at:


All of these analysers are now fully operational with the exception of the NOx analyser at Eskdalemuir. A new air conditioning unit is required at this site before the NOx and PM10 analysers can be installed. This is scheduled to take place during the summer 2004.

In order to satisfy the requirements of DD3 there are also plans to commission 3 new direct-funded NOx and O3 sites and affiliate one Local Authority owned site at the following locations:

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

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

Table 2.1 New DD3 Monitoring Stations, July 2004

<table>
<thead>
<tr>
<th>New Site</th>
<th>Pollutants</th>
<th>Progress to date</th>
<th>Expected integration date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brighton Preston Park</td>
<td>O3 and NOx</td>
<td>All equipment has been installed. Issues with air conditioning unit and logger still to be addressed</td>
<td>August 2004</td>
</tr>
<tr>
<td>Fort William</td>
<td>O3 and NOx</td>
<td>Planning consent has now been granted but still awaiting the lease.</td>
<td>End of year</td>
</tr>
<tr>
<td>Sunderland Silksworth</td>
<td>O3 and NOx</td>
<td>Arrangements in hand to affiliate Local Authority NOx analyser and install a new O3 analyser.</td>
<td>August 2004</td>
</tr>
<tr>
<td>Leominster</td>
<td>O3 and NOx</td>
<td>Planning consent and lease have now been granted. Arrangements for site installation going ahead.</td>
<td>End Oct 2004</td>
</tr>
</tbody>
</table>

2.2 PM10 Episodes

Overall there have been many fewer exceedences of the daily mean gravimetric PM10 standard recorded this year compared to the same time last year. The sites that have recorded the highest number of days with exceedences of 50µg/m³ from January to the end of June 2004 (based on provisional data) are as follows:
34 days - London Marylebone Road (Kerbside)
26 days - Port Talbot (Industry)
21 days - Camden Kerbside (Kerbside)
19 days - Glasgow Kerbside (Kerbside)
13 days - Bury Roadside (Roadside)
13 days – Liverpool Speke (Urban background/local source)

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

2.3 Data Capture for Critical Sites in Zones and Agglomerations

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

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

- Southend on Sea CO
- Grangemouth CO
- Wicken Fen NO$_2$
- Reading New Town O$_3$
- Lough Navar O$_3$
- Stoke-on-Trent PM$_{10}$
- Blackpool SO$_2$
- Wigan Leigh SO$_2$

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2 A definition of zones and agglomerations can be found under “Article 5 Assessment Zones and Agglomerations Monitoring Maps” at http://www.defra.gov.uk/environment/airquality/index.htm
2.4 Gravimetric PM$_{10}$ Data Ratification

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

![Gravimetric Data and TEOM scaled by 1.3 concentrations at Northampton (Jan-Mar 2004)](image)

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

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

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

<table>
<thead>
<tr>
<th>Site</th>
<th>Data Capture (%) January - March 2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bournemouth</td>
<td>95.6%</td>
</tr>
<tr>
<td>Brighton Roadside PM$_{10}$</td>
<td>94.5%</td>
</tr>
<tr>
<td>London Westminster</td>
<td>90.1%</td>
</tr>
<tr>
<td>Northampton</td>
<td>87.9%</td>
</tr>
<tr>
<td>Dumfries</td>
<td>81.3%</td>
</tr>
<tr>
<td>Inverness</td>
<td>95.6%</td>
</tr>
<tr>
<td>Wrexham</td>
<td>98.9%</td>
</tr>
<tr>
<td>Average</td>
<td>91.9%</td>
</tr>
</tbody>
</table>
Six out of the seven Partisol sites have now been connected to telemetry. This allows the exposure data and filter numbers to be downloaded automatically and regular checks on the operational status of the analyser can be carried out remotely. The one remaining Partisol unit at Bournemouth needs to be connected via a separate mobile phone system, as the existing line is not compatible with the Partisol software.

**Recommendation**

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

### 2.5 NO₂ Converter Efficiencies

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

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

<table>
<thead>
<tr>
<th>Site</th>
<th>Converter Efficiency</th>
<th>Resulting Effect on Data Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blackpool</td>
<td>89.6%</td>
<td>1-minute calibration data reviewed and a drop in NO₂ calibration response was seen in late February. 2 weeks data were deleted from the audit on 26/2 to the service on 9/3 when the converter was replaced.</td>
</tr>
<tr>
<td>Dumfries</td>
<td>94%</td>
<td>Borderline – no data loss</td>
</tr>
<tr>
<td>Edinburgh St Leonards</td>
<td>93.1%</td>
<td>NO₂ span drift seen in January. Data deleted from last good calibration on 22/1 to service on 18 February (1 month)</td>
</tr>
<tr>
<td>London Marylebone Road</td>
<td>94.5%</td>
<td>Borderline – no data loss</td>
</tr>
<tr>
<td>London Westminster</td>
<td>83.1%</td>
<td>Data deleted from 25th November 2003 until service on 13th February 2004 when the converter was replaced (2.5 months)</td>
</tr>
<tr>
<td>Manchester Piccadilly</td>
<td>93.8%</td>
<td>Borderline – no data loss</td>
</tr>
<tr>
<td>Manchester South</td>
<td>92.8%</td>
<td>Borderline – no data loss</td>
</tr>
<tr>
<td>Nottingham Centre</td>
<td>90%</td>
<td>NO₂ calibration span response falling from end October. Data deleted from 22 October 2003 until the service on 16th January when the converter was replaced. (3 months)</td>
</tr>
<tr>
<td>Redcar</td>
<td>94.7%</td>
<td>Borderline - no data loss</td>
</tr>
<tr>
<td>Rotherham Centre</td>
<td>93.3%</td>
<td>Borderline - no data loss</td>
</tr>
<tr>
<td>Sheffield Centre</td>
<td>93.1%</td>
<td>Borderline - no data loss</td>
</tr>
<tr>
<td>Southwark Roadside</td>
<td>89%</td>
<td>Data rejected from January 2004 until the service on 25th March 2004 as there were no NO₂ calibrations (empty cylinder) and the autocalibrations appeared unstable. (3 months) Repeat offender – failed previous audit in summer 2003.</td>
</tr>
</tbody>
</table>
### Tower Hamlets

94%  Borderline - no data loss.

### Wirral Tranmere

92.1%  Data deleted between audit on 24th February and ESU service on 10th March 2004 (2 weeks).

### RECOMMENDATION

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

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

LSOs should also continue to pay careful attention to the short-term stability of the NO$_2$ calibration response and notify the CMCU if a declining NO$_2$ span response is recorded during the calibration. This early warning indication of a potential converter fault may help to avoid large periods of data being rejected. Full details of this check can be found in the “Trouble-shooting” section of the Site Operator’s Manual.

### 2.6 Ozone Outliers

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

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

### 2.7 TEOM k$_0$

Only 1 of the TEOM instruments tested during the Winter 2004 intercalibration was found to be operating with a calibration constant (k$_0$) outside the acceptable ± 2.5% deviation. This was at Sheffield Centre where the k$_0$ deviation was −3.1%. This result will be checked again at the forthcoming summer 2004 service and if necessary the data from this analyser will be rescaled. In addition 12 TEOMs were found to be operating outside of the expected flow rates (see Section 12.2 in Part B of this report). Major flow leaks were identified during the audits at Swansea and Stoke-on-Trent resulting in significant data loss during this period (see Sections 3.3 and 3.4).

### 2.8 Auto-Calibration Run-ons

A generic problem affecting many analysers in the network has been identified due to autocalibration gas leaking into the sampling system during the ambient measurement period immediately after the autocalibration cycle. Invalid measurements (usually between 01:30 and 02:00) have been removed during data ratification. This can be a serious source of data loss resulting in one hour out of twenty four being lost, which is 4% of the annual data capture. This problem was identified by examining graphs of the
diurnal variation of concentrations for the individual sites. An example of a large NO$_2$ autocalibration run-on seen at High Muffles during the period April-June 2004 is shown in Figure 2.2. At this site up to 3 hours data have been deleted each day resulting in NO$_2$ data capture below the 90% data capture target for the period.

![Nitrogen Dioxide Diurnal Means](image)

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

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

<table>
<thead>
<tr>
<th>Site</th>
<th>Site Type</th>
<th>Pollutant</th>
<th>Run-on (ppb)</th>
<th>Autocal conc (ppb)</th>
<th>Data loss (Hours)</th>
<th>Problem continuing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aberdeen</td>
<td>Urban</td>
<td>NO$_2$</td>
<td>5</td>
<td>200</td>
<td>1</td>
<td>No</td>
</tr>
<tr>
<td>Aston Hill</td>
<td>Rural</td>
<td>NO$_2$</td>
<td>4.3</td>
<td>300</td>
<td>2</td>
<td>?</td>
</tr>
<tr>
<td>Belfast Centre</td>
<td>Urban</td>
<td>NO$_2$</td>
<td>8</td>
<td>300</td>
<td>2</td>
<td>Yes</td>
</tr>
<tr>
<td>Birmingham Centre</td>
<td>Urban</td>
<td>NO$_2$</td>
<td>4</td>
<td>750</td>
<td>1</td>
<td>Yes</td>
</tr>
<tr>
<td>Bristol Centre</td>
<td>Urban</td>
<td>NO$_2$</td>
<td>6</td>
<td>500</td>
<td>1</td>
<td>No</td>
</tr>
<tr>
<td>Bush Estate</td>
<td>Rural</td>
<td>NO$_2$</td>
<td>1.6</td>
<td>240</td>
<td>1</td>
<td>Yes</td>
</tr>
<tr>
<td>High Muffles</td>
<td>Rural</td>
<td>NO$_2$</td>
<td>17.9</td>
<td>500</td>
<td>3</td>
<td>Yes - very bad</td>
</tr>
</tbody>
</table>

Table 2.4 Estimate of Spike or Dip due to Auto-calibration Run-on (15-minute average) January-March 04.
<table>
<thead>
<tr>
<th>Site</th>
<th>Site Type</th>
<th>Pollutant</th>
<th>Run-on (ppb)</th>
<th>Autocal conc (ppb)</th>
<th>Data loss (Hours)</th>
<th>Problem continuing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leamington Spa</td>
<td>Urban</td>
<td>NO₂</td>
<td>6</td>
<td>1700</td>
<td>1</td>
<td>Yes</td>
</tr>
<tr>
<td>London Brent</td>
<td>Urban</td>
<td>NO₂</td>
<td>5</td>
<td>1400</td>
<td>1</td>
<td>Yes</td>
</tr>
<tr>
<td>London Southwark</td>
<td>Urban/LAQN</td>
<td>NO₂</td>
<td>8</td>
<td>150</td>
<td>1</td>
<td>Yes</td>
</tr>
<tr>
<td>Lullington Heath</td>
<td>Rural</td>
<td>NO₂</td>
<td>3</td>
<td>300</td>
<td>1</td>
<td>Yes</td>
</tr>
<tr>
<td>Market Harborough</td>
<td>Rural</td>
<td>NO₂</td>
<td>2.1</td>
<td>350</td>
<td>1</td>
<td>Yes</td>
</tr>
<tr>
<td>Middlesbrough</td>
<td>Urban</td>
<td>NO₂</td>
<td>7</td>
<td>700</td>
<td>1</td>
<td>Yes</td>
</tr>
<tr>
<td>Narberth</td>
<td>Rural</td>
<td>NO₂</td>
<td>1.8</td>
<td>150</td>
<td>1</td>
<td>Yes</td>
</tr>
<tr>
<td>Somerton</td>
<td>Rural</td>
<td>NO₂</td>
<td>2</td>
<td>180</td>
<td>1</td>
<td>Yes</td>
</tr>
<tr>
<td>St Osyth</td>
<td>Rural</td>
<td>NO₂</td>
<td>4</td>
<td>300</td>
<td>1</td>
<td>Yes</td>
</tr>
<tr>
<td>Stoke-on-Trent</td>
<td>Urban</td>
<td>NO₂</td>
<td>4</td>
<td>335</td>
<td>1</td>
<td>No</td>
</tr>
</tbody>
</table>

One recommendation to reduce the magnitude of the autocalibration run-on is to lower the concentration of the NO₂ autocalibration span gas, especially at the rural network sites where small run-ons are very visible in the ambient data. Figure 2.3 shows the range of NO₂ autocalibration span values used throughout the network. As seen, there are several sites where the span concentrations are in excess of 500ppb NO₂.

![Figure 2.3 NO₂ Autocalibration span concentrations at AURN sites](image-url)
Table 2.5 below lists all sites with NO$_2$ autocalibration concentrations greater than 500ppb.

**Table 2.5 Sites with NO$_2$ Autocalibration Spans Above 500ppb**

<table>
<thead>
<tr>
<th>Site name</th>
<th>NO$_2$ ppb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leamington Spa</td>
<td>1700</td>
</tr>
<tr>
<td>London Brent</td>
<td>1400</td>
</tr>
<tr>
<td>Exeter Roadside</td>
<td>1200</td>
</tr>
<tr>
<td>Salford Eccles</td>
<td>900</td>
</tr>
<tr>
<td>Southampton Centre</td>
<td>850</td>
</tr>
<tr>
<td>Billingham</td>
<td>800</td>
</tr>
<tr>
<td>Oxford Centre</td>
<td>800</td>
</tr>
<tr>
<td>Plymouth Centre</td>
<td>800</td>
</tr>
<tr>
<td>Southwark Roadside</td>
<td>800</td>
</tr>
<tr>
<td>Wicken Fen</td>
<td>800</td>
</tr>
<tr>
<td>Birmingham Centre</td>
<td>750</td>
</tr>
<tr>
<td>Hove Roadside</td>
<td>750</td>
</tr>
<tr>
<td>Bury Roadside</td>
<td>700</td>
</tr>
<tr>
<td>Dumfries</td>
<td>700</td>
</tr>
<tr>
<td>London Bloomsbury</td>
<td>700</td>
</tr>
<tr>
<td>Manchester Town Hall</td>
<td>700</td>
</tr>
<tr>
<td>Middlesbrough</td>
<td>700</td>
</tr>
<tr>
<td>Glasgow City Chambers</td>
<td>650</td>
</tr>
<tr>
<td>Bolton</td>
<td>600</td>
</tr>
<tr>
<td>Bournemouth</td>
<td>600</td>
</tr>
<tr>
<td>London Cromwell Road 2</td>
<td>600</td>
</tr>
<tr>
<td>Sheffield Tinsley</td>
<td>600</td>
</tr>
<tr>
<td>Northampton</td>
<td>557</td>
</tr>
<tr>
<td>Walsall Willenhall</td>
<td>550</td>
</tr>
</tbody>
</table>

**Recommendation**

We recommend that, at the sites listed in Table 2.5, the NO$_2$ autocalibration devices be adjusted to reduce the concentration of the span gas to below 500ppb. At rural sites even lower concentrations of approximately 100ppb would be advisable.

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

3.1 Noisy CO analysers

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

3.1.1 Sheffield Tinsley CO

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

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

3.1.2 Exeter Roadside CO

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

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

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

Figure 3.3 Southend-on-Sea CO high noise and negative response, Feb-May 04
3.1.4 Southampton CO

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

![Figure 3.4 Southampton CO Unstable Response August 2003 to February 2004](image)

3.2 Reading New Town SO₂

The SO₂ analyser at Reading New Town has shown a history of response instability mainly due to UV lamp faults in the previous quarter (Oct-Dec 2003). The baseline response has however continued to drift throughout January-March 2004. (See Figure 3.5). There were also problems with the Ambirack PC which was replaced on March 22nd 2004 and as a result data capture for O₃, CO and SO₂ was below 90% for this period.

**Recommendation**

We recommend that the SO₂ analyser should be upgraded with the modified bench (if not already carried out) as this is a critical site (Defra-funded). If the SO₂ analyser and PC continue to be unreliable, then this site should be a selected as a priority for any future equipment up-grading exercise.
3.3 Swansea PM$_{10}$

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

3.4 Stoke on Trent PM$_{10}$

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

Figure 3.5 Reading New Town Unstable SO2 Response October 2003 – May 2004
Figure 3.6  Stoke-on-Trent low PM10 data due to leak, July 03 to Feb 04.

3.5 Zero Response Truncation

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

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

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

3.6 Camden Kerbside NOx Response Instability

Four months of NOx data from Camden Kerbside site have been deleted from the service on 5th January to the repair of the analyser on 5th May 2004 because of the rapid NO sensitivity drift seen over this period. During ratification of the January to March 2004 data set, the data ratifier identified an indication of potential oxidation of the NO cylinder (i.e. high NO₂ response to NO cylinder calibration). The calibration control charts showed that the NO channel sensitivity was drifting significantly (see Figure 3.8) whilst the NOx channel sensitivity was stable (See Figure 3.9). The cylinder was therefore removed from the site for recalibration at Netcen on 17/5/04. Results of the cylinder recalibration showed that the NO concentration in the cylinder was stable and agreed well with the original calibration certificate.

The response problem was therefore due to an instrument fault and this was subsequently confirmed following an ESU report in May which identified a blocked ozone orifice. Provisional data for June 2004 indicate that response stability has improved following the repair but CMCU will need to confirm this with the up-to-date calibration data.
Figure 3.8 Camden Kerbside NO calibration sensitivity Jan-March 04

Figure 3.9 Camden Kerbside NOx calibration sensitivity Jan-March 04
## 4 Sites with Data Capture Below 90%

The following section provides a summary of the main site operational problems which have resulted in data capture below the required 90% level during the reporting period January to March 2004 (Table 4.1). The number of days and hours of data lost for each cause is also given. In some cases the data gap extends beyond this three-month reporting period.

### Table 4.1 Sites with data capture below 90% January to March 2004

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

<table>
<thead>
<tr>
<th>Data Capture (%)</th>
<th>Start date</th>
<th>End date</th>
<th>Reason</th>
<th>Comments</th>
<th>Days</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGLAND</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birmingham Centre</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO₂</td>
<td>87.5%</td>
<td>03-Feb-04</td>
<td>04-Feb-04</td>
<td>Telemetry Problems with data logger and communications</td>
<td>0.9</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>19-Feb-04</td>
<td>21-Feb-04</td>
<td>Telemetry</td>
<td>As above</td>
<td>1.7</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>06-Mar-04</td>
<td>07-Mar-04</td>
<td>Analyser fault</td>
<td>Instrument fault</td>
<td>0.3</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>09-Mar-04</td>
<td>11-Mar-04</td>
<td>ESU service</td>
<td>Service</td>
<td>2.3</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>24-Mar-04</td>
<td>25-Mar-04</td>
<td>Power cut</td>
<td>Power cut</td>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>Birmingham East</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO₂</td>
<td>82.6%</td>
<td>22-Feb-04</td>
<td>23-Feb-04</td>
<td>Power cut</td>
<td>Power cut</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>11-Mar-04</td>
<td>25-Mar-04</td>
<td>Response drift</td>
<td>Step change in baseline and spurious low NOx response between routine calibrations</td>
<td>13.9</td>
<td>334</td>
</tr>
<tr>
<td>Blackpool</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO₂</td>
<td>84.2%</td>
<td>26-Feb-04</td>
<td>11-Mar-04</td>
<td>NO₂ converter fault</td>
<td>Converter fault (89%) identified at audit. Data deleted to repair at service. See Section 2.5</td>
<td>13.9</td>
</tr>
<tr>
<td>SO₂</td>
<td>18.6%</td>
<td>11-Aug-03</td>
<td>14-Mar-04</td>
<td>High noise</td>
<td>History of high noise response</td>
<td>All data deleted until new optical bench fitted at service</td>
</tr>
<tr>
<td>Bristol Centre</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O₃</td>
<td>88.4%</td>
<td>21-Jan-04</td>
<td>26-Jan-04</td>
<td>Instrument fault</td>
<td>Ozone generator fault</td>
<td>4.7</td>
</tr>
<tr>
<td></td>
<td>02-Feb-04</td>
<td>04-Feb-04</td>
<td>ESU service</td>
<td>Service</td>
<td>2.2</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>02-Mar-04</td>
<td>04-Mar-04</td>
<td>Monitoring suspended</td>
<td>Odessa logger removed. Code activated switches installed</td>
<td>2.4</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td>31-Mar-04</td>
<td>31-Mar-04</td>
<td>No mV data</td>
<td>Data missing – no information provided</td>
<td>0.5</td>
<td>11</td>
</tr>
<tr>
<td>Bristol Old Market</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO</td>
<td>60.0%</td>
<td>05-Feb-04</td>
<td>06-Feb-04</td>
<td>ESU service</td>
<td>ESU service</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>25-Feb-04</td>
<td>31-Mar-04</td>
<td>Response truncation and analyser fault</td>
<td>CO zero baseline drifting downward in early February resulting in response truncation from 25/2/04. Analyser removed for repair of pump and cooling fan and reinstalled on 31/3/04</td>
<td>35</td>
<td>841</td>
</tr>
</tbody>
</table>
## Bury Roadside

**General**

Continuation of PC problems from previous period causing intermittent data loss especially in March. Fault due to corruption of PC configuration and resolved on 23 March.

<table>
<thead>
<tr>
<th>CO</th>
<th>Date</th>
<th>Date</th>
<th>Event</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14-Jan-04</td>
<td>14-Jan-04</td>
<td>Logger fault</td>
<td>Intermittent PC fault</td>
</tr>
<tr>
<td></td>
<td>22-Jan-04</td>
<td>23-Jan-04</td>
<td>Logger fault</td>
<td>As above</td>
</tr>
<tr>
<td></td>
<td>03-Feb-04</td>
<td>03-Feb-04</td>
<td>Logger fault</td>
<td>As above</td>
</tr>
<tr>
<td></td>
<td>10-Feb-04</td>
<td>11-Feb-04</td>
<td>ESU service</td>
<td>Service</td>
</tr>
<tr>
<td></td>
<td>21-Feb-04</td>
<td>23-Feb-04</td>
<td>Logger fault</td>
<td>Intermittent PC fault</td>
</tr>
<tr>
<td></td>
<td>06-Mar-04</td>
<td>06-Mar-04</td>
<td>Logger fault</td>
<td>As above</td>
</tr>
<tr>
<td></td>
<td>14-Mar-04</td>
<td>23-Mar-04</td>
<td>Logger fault</td>
<td>As above</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NO$_2$</th>
<th>Date</th>
<th>Date</th>
<th>Event</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>22-Jan-04</td>
<td>23-Jan-04</td>
<td>Logger fault</td>
<td>As above</td>
</tr>
<tr>
<td></td>
<td>03-Feb-04</td>
<td>03-Feb-04</td>
<td>Logger fault</td>
<td>As above</td>
</tr>
<tr>
<td></td>
<td>10-Feb-04</td>
<td>11-Feb-04</td>
<td>ESU service</td>
<td>Service</td>
</tr>
<tr>
<td></td>
<td>06-Mar-04</td>
<td>06-Mar-04</td>
<td>Logger fault</td>
<td>Intermittent PC fault</td>
</tr>
<tr>
<td></td>
<td>14-Mar-04</td>
<td>23-Mar-04</td>
<td>Logger fault</td>
<td>As above</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>O$_3$</th>
<th>Date</th>
<th>Date</th>
<th>Event</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>22-Jan-04</td>
<td>23-Jan-04</td>
<td>Logger fault</td>
<td>As above</td>
</tr>
<tr>
<td></td>
<td>03-Feb-04</td>
<td>03-Feb-04</td>
<td>Logger fault</td>
<td>As above</td>
</tr>
<tr>
<td></td>
<td>10-Feb-04</td>
<td>11-Feb-04</td>
<td>ESU service</td>
<td>Service</td>
</tr>
<tr>
<td></td>
<td>04-Mar-04</td>
<td>25-Mar-04</td>
<td>Instrument fault</td>
<td>UV lamp fault</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>PM$_{10}$</th>
<th>Date</th>
<th>Date</th>
<th>Event</th>
<th>Details</th>
</tr>
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<tr>
<td></td>
<td>08-Jan-04</td>
<td>12-Jan-04</td>
<td>Operator error</td>
<td>Deleted after routine filter change</td>
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<table>
<thead>
<tr>
<th>SO$_2$</th>
<th>Date</th>
<th>Date</th>
<th>Event</th>
<th>Details</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>12-Jan-04</td>
<td>11-Feb-04</td>
<td>Instrument fault</td>
<td>Unstable data rejected due to series of UV lamp faults. UV lamp replaced</td>
</tr>
</tbody>
</table>

## Camden Kerbside

**NO$_2$** 5.1% 05-Jan-04 05-May-04 Instrument fault Blocked ozone orifice resulting in rapid NO sensitivity drift. See Section 3.6

## Coventry Memorial Park

**PM$_{10}$** 89.3% 08-Dec-03 09-Jan-04 High noise Site decommissioned on 8th January in order to install new equipment. TEOM response stability problems when site restarted. Improved after commissioning audit on 9/1/04.

## Exeter Roadside

**CO** 79.9% 31-Jan-04 17-Feb-04 Instrument fault Chopper motor fault prior to service and excessive
response drift after service. Analyser’s processor board repaired. See Section 3.1.2

SO₂ 66.1% 03-Feb-04 04-Feb-04 ESU service
      05-Mar-04 19-Apr-04 Sampling fault
Intermittent flow fault throughout period. Repair
delayed due to Local Authority cost considerations. Flow
circuit board eventually replaced on 19/4/04.

Harwell
NO₂ 89.3% 08-Jan-04 15-Jan-04 Instrument fault
      18-Feb-04 19-Feb-04 Power cut
      23-Mar-04 24-Mar-04 Power cut
Erratic data and response drift. Analyser replaced at service.
Air conditioning problems causing site power to trip out
As above

High Muffles
NO₂ Throughout period Autocal run on
Extreme autocalibration run on problem (18 ppb). 3 hours data
deleted per day. Permeation bench and IZS valves cleaned
on 8 January. ESU noted problem continuing in March
(See Section 2.8)

Hull Freetown
NO₂ 89.3% 01-Jan-04 07-Jan-04 Logger fault
      15-Jan-04 15-Jan-04 QAQC audit
      20-Jan-04 22-Jan-04 ESU service
O₃ 83.9% 03-Jan-04 07-Jan-04 Logger fault
      15-Jan-04 15-Jan-04 QAQC audit
      20-Jan-04 29-Jan-04 Unstable response
Logger corrupted
QA/QC audit.  Service
Logger corrupted
QA/QC audit.  Service
Unstable high concentration data deleted. Reconfigured
correctly with photometer.

Ladybower
NO₂ 84.3% 09-Jan-04 21-Jan-04 Sampling fault
      24-Feb-04 25-Feb-04 ESU service
Sample line not connected to manifold.  Service

Leeds Centre
O₃ 88.9% 22-Mar-04 07-Apr-04 Instrument fault
Low data deleted due to lamp fault

Leicester Centre
CO 81.0% 06-Jan-04 12-Jan-04 Unstable response
Unstable baseline response throughout period. New CO
analyser installed as part of equipment up-grading exercise

EA Technology  A 24
### London Bexley

**General**

<table>
<thead>
<tr>
<th>Gas</th>
<th>Percentage</th>
<th>Start Date</th>
<th>End Date</th>
<th>Issue</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>82.5%</td>
<td>14-Jan-04</td>
<td>20-Jan-04</td>
<td></td>
<td>Instrument fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td>26-Jan-04</td>
<td>27-Jan-04</td>
<td></td>
<td>ESU service</td>
</tr>
<tr>
<td></td>
<td></td>
<td>23-Mar-04</td>
<td>31-Mar-04</td>
<td></td>
<td>Monitoring suspended</td>
</tr>
<tr>
<td>NO₂</td>
<td>88.6%</td>
<td>26-Jan-04</td>
<td>27-Jan-04</td>
<td></td>
<td>ESU service</td>
</tr>
<tr>
<td></td>
<td></td>
<td>23-Mar-04</td>
<td>31-Mar-04</td>
<td></td>
<td>Monitoring suspended</td>
</tr>
<tr>
<td>O₃</td>
<td>86.5%</td>
<td>26-Jan-04</td>
<td>29-Jan-04</td>
<td></td>
<td>ESU service</td>
</tr>
<tr>
<td></td>
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<td>23-Mar-04</td>
<td>31-Mar-04</td>
<td></td>
<td>Monitoring suspended</td>
</tr>
<tr>
<td>PM₁₀</td>
<td>88.7%</td>
<td>26-Jan-04</td>
<td>27-Jan-04</td>
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<td>ESU service</td>
</tr>
<tr>
<td></td>
<td></td>
<td>23-Mar-04</td>
<td>31-Mar-04</td>
<td></td>
<td>Monitoring suspended</td>
</tr>
<tr>
<td>SO₂</td>
<td>86.2%</td>
<td>26-Jan-04</td>
<td>29-Jan-04</td>
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<td>ESU service</td>
</tr>
<tr>
<td></td>
<td></td>
<td>23-Mar-04</td>
<td>31-Mar-04</td>
<td></td>
<td>Monitoring suspended</td>
</tr>
</tbody>
</table>

All analysers noisy during this period. New set of instruments installed 25th March and commissioned on 1/4/04.

- IR source fault and faulty power supply.
- Services.
- Monitoring suspended until new equipment installed.
- As above.

### London Eltham

**O₃**

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Start Date</th>
<th>End Date</th>
<th>Issue</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>88.3%</td>
<td>05-Feb-04</td>
<td>13-Feb-04</td>
<td></td>
<td>Instrument fault</td>
</tr>
<tr>
<td></td>
<td>26-Mar-04</td>
<td>29-Mar-04</td>
<td></td>
<td>Flat response</td>
</tr>
</tbody>
</table>

Cooling fan fault causing intermittent data loss.

Flat response data nulled after LSO calibration.

### London Haringey

**O₃**

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Start Date</th>
<th>End Date</th>
<th>Issue</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>84.7%</td>
<td>04-Feb-04</td>
<td>17-Feb-04</td>
<td></td>
<td>Sampling fault</td>
</tr>
<tr>
<td></td>
<td>12-Mar-04</td>
<td>13-Mar-04</td>
<td></td>
<td>Flat response</td>
</tr>
</tbody>
</table>

Low response data deleted due to sample line/manifold fault. Sample inlet repositioned by LSO.

No mV data recorded.

### London Lewisham

**O₃**

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Start Date</th>
<th>End Date</th>
<th>Issue</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>67.1%</td>
<td>09-Feb-04</td>
<td>09-Mar-04</td>
<td></td>
<td>Instrument fault</td>
</tr>
</tbody>
</table>

Spurious low response data investigated by ESU but no obvious fault. Replacement analyser installed.

### London Marylebone Road

**SO₂**

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Start Date</th>
<th>End Date</th>
<th>Issue</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>89.0%</td>
<td>12-Jan-04</td>
<td>19-Jan-04</td>
<td></td>
<td>Instrument fault</td>
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<tr>
<td></td>
<td>25-Jan-04</td>
<td>26-Jan-04</td>
<td></td>
<td>Power cut</td>
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<tr>
<td></td>
<td>27-Mar-04</td>
<td>27-Mar-04</td>
<td></td>
<td>Instrument fault</td>
</tr>
</tbody>
</table>

UV lamp fault caused by loose wires. Power failure. UV lamp and photomultiplier tube replaced.

### London N. Kensington

**PM₁₀**

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Start Date</th>
<th>End Date</th>
<th>Issue</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>85.5%</td>
<td>19-Jan-04</td>
<td>20-Jan-04</td>
<td></td>
<td>Unstable response</td>
</tr>
<tr>
<td></td>
<td>18-Feb-04</td>
<td>01-Mar-04</td>
<td></td>
<td>High noise</td>
</tr>
</tbody>
</table>

TEOM response unstable after QA/QC audit. High noise data deleted after LSO visit. Sensor unit replaced.
and insulator fitted on exposed sample tube.

<table>
<thead>
<tr>
<th>Location</th>
<th>Gas</th>
<th>Date Range</th>
<th>Issue</th>
<th>Cause</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NO₂</td>
<td>09-Mar-04 - 24-Mar-04</td>
<td>SAMPLING FAULT</td>
<td>As above</td>
<td>15.3 366</td>
</tr>
<tr>
<td></td>
<td>O₃</td>
<td>10-Mar-04 - 24-Mar-04</td>
<td>SAMPLING FAULT</td>
<td>As above</td>
<td>14.1 339</td>
</tr>
<tr>
<td></td>
<td>SO₂</td>
<td>10-Mar-04 - 24-Mar-04</td>
<td>SAMPLING FAULT</td>
<td>As above</td>
<td>14.1 338</td>
</tr>
<tr>
<td>London Westminster</td>
<td>NO₂</td>
<td>25-Nov-03 - 13-Feb-04</td>
<td>CONVERTER FAULT</td>
<td>NOx converter fault (83%) found at audit. (See Section 2.5)</td>
<td>80.3 1928</td>
</tr>
<tr>
<td></td>
<td></td>
<td>19-Feb-04 - 20-Feb-04</td>
<td>ESU SERVICE</td>
<td>Service</td>
<td>1.2 28</td>
</tr>
<tr>
<td>Newcastle Centre</td>
<td>CO</td>
<td>03-Mar-04 - 31-Mar-04</td>
<td>POWER CUT</td>
<td>Air conditioning problem causing site power to trip off</td>
<td>28.6 686</td>
</tr>
<tr>
<td></td>
<td>NO₂</td>
<td>03-Mar-04 - 31-Mar-04</td>
<td>POWER CUT</td>
<td>Power cut</td>
<td>28.6 686</td>
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<tr>
<td></td>
<td>SO₂</td>
<td>03-Mar-04 - 27-Apr-04</td>
<td>NO CALIBRATIONS</td>
<td>Power cut and no calibrations until end April 04.</td>
<td>55.6 1334</td>
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<tr>
<td>Norwich Centre</td>
<td>CO</td>
<td>29-Jan-04 - 13-Feb-04</td>
<td>AIR CONDITIONING</td>
<td>Air conditioning unit overheating causing site power cut followed by a chopper motor fault</td>
<td>15.1 363</td>
</tr>
<tr>
<td></td>
<td>NO₂</td>
<td>25-Jan-04 - 06-Feb-04</td>
<td>AIR CONDITIONING</td>
<td>Photomultiplier tube fault followed by site power cut</td>
<td>13 312</td>
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<tr>
<td></td>
<td></td>
<td>17-Feb-04 - 18-Feb-04</td>
<td>UNSTABLE RESPONSE</td>
<td>Response stabilisation after site visit</td>
<td>0.5 11</td>
</tr>
<tr>
<td></td>
<td>SO₂</td>
<td>29-Jan-04 - 04-Feb-04</td>
<td>AIR CONDITIONING</td>
<td>Air conditioning fault causing power cut.</td>
<td>6.7 160</td>
</tr>
<tr>
<td>Nottingham Centre</td>
<td>CO</td>
<td>14-Jan-04 - 16-Jan-04</td>
<td>SERVICE</td>
<td>Service</td>
<td>2.3 54</td>
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<tr>
<td></td>
<td>NO₂</td>
<td>22-Oct-03 - 16-Jan-04</td>
<td>CONVERTER FAULT</td>
<td>NOx converter fault (90%) found at audit (See section 2.5)</td>
<td>86 2063</td>
</tr>
<tr>
<td>Plymouth Centre</td>
<td>NO₂</td>
<td>09-Jan-04 - 05-Feb-04</td>
<td>NO MV DATA</td>
<td>Intermittent NO₂ data loss due to site temperature problems. Instrument cooling fans, rack thermostat control and air conditioning adjusted.</td>
<td>27.5 659</td>
</tr>
<tr>
<td></td>
<td></td>
<td>19-Feb-04 - 19-Feb-04</td>
<td>QA/QC AUDIT</td>
<td>QA/QC audit</td>
<td>0.3 6</td>
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<td></td>
<td>24-Feb-04 - 26-Feb-04</td>
<td>NO MV DATA</td>
<td>Missing data due to</td>
<td>1.3 30</td>
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</tbody>
</table>
### Portsmouth

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Percentage</th>
<th>Start Date</th>
<th>End Date</th>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM$_{10}$</td>
<td>76.7%</td>
<td>21-Jan-04</td>
<td>10-Feb-04</td>
<td>Instrument fault</td>
<td>TEOM auxiliary flow fault after service. Mass flow controller replaced.</td>
</tr>
</tbody>
</table>

### Reading New Town

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Percentage</th>
<th>Start Date</th>
<th>End Date</th>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>88.6%</td>
<td>25-Jan-04</td>
<td>27-Jan-04</td>
<td>Sampling fault</td>
<td>Pump failure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>09-Feb-04</td>
<td>11-Feb-04</td>
<td>ESU service</td>
<td>Service</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20-Feb-04</td>
<td>23-Feb-04</td>
<td>PC/logger fault</td>
<td>PC crashed and rebooted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>19-Mar-04</td>
<td>22-Mar-04</td>
<td>PC/logger fault</td>
<td>PC crashed again and replaced</td>
</tr>
<tr>
<td>O$_3$</td>
<td>47.4%</td>
<td>06-Jan-04</td>
<td>08-Jan-04</td>
<td>Sampling fault</td>
<td>Faulty sample flow pump replaced</td>
</tr>
<tr>
<td>SO$_2$</td>
<td>84.3%</td>
<td>09-Dec-03</td>
<td>02-Jan-04</td>
<td>Sampling fault</td>
<td>Drifting response data deleted.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>07-Jan-04</td>
<td>08-Jan-04</td>
<td>No mV data</td>
<td>ESU on site to repair ozone analyser</td>
</tr>
<tr>
<td></td>
<td></td>
<td>09-Feb-04</td>
<td>11-Feb-04</td>
<td>ESU service</td>
<td>Service</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20-Feb-04</td>
<td>23-Feb-04</td>
<td>PC/logger fault</td>
<td>PC crashed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>19-Mar-04</td>
<td>25-Mar-04</td>
<td>Unstable response</td>
<td>PC changed and UV lamp replaced</td>
</tr>
</tbody>
</table>

### Rotherham Centre

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Percentage</th>
<th>Start Date</th>
<th>End Date</th>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO$_2$</td>
<td>85.6%</td>
<td>23-Jan-04</td>
<td>04-Feb-04</td>
<td>Unstable response</td>
<td>Unstable response caused by pump fault. Pump diaphragm replaced</td>
</tr>
</tbody>
</table>

### Salford Eccles

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Percentage</th>
<th>Start Date</th>
<th>End Date</th>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO$_2$</td>
<td>83.1%</td>
<td>15-Jan-04</td>
<td>20-Jan-04</td>
<td>PC/logger fault</td>
<td>PC hard drive failure resulting in deletion of fragmented data set.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01-Feb-04</td>
<td>08-Feb-04</td>
<td>ESU Service</td>
<td>Unstable data removed after service</td>
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### Scunthorpe

<table>
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<tr>
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<th>Percentage</th>
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<th>End Date</th>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM$_{10}$</td>
<td>82.6%</td>
<td>27-Feb-04</td>
<td>28-Feb-04</td>
<td>No mV data collected</td>
<td>No details provided.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18-Mar-04</td>
<td>31-Mar-04</td>
<td>Monitoring suspended</td>
<td>Site closed for relocation</td>
</tr>
<tr>
<td>SO$_2$</td>
<td>83.5%</td>
<td>27-Feb-04</td>
<td>28-Feb-04</td>
<td>No mV data collected</td>
<td>No details provided</td>
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<tr>
<td></td>
<td></td>
<td>18-Mar-04</td>
<td>31-Mar-04</td>
<td>Monitoring suspended</td>
<td>Site closed for relocation</td>
</tr>
</tbody>
</table>

### Southampton Centre

#### General

In general the CO and Ozone analysers have been unstable and unreliable since it was replaced in August 2003 (See section 3.1.4)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Percentage</th>
<th>Start Date</th>
<th>End Date</th>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>69.7%</td>
<td>03-Jan-04</td>
<td>16-Jan-04</td>
<td>Power cut</td>
<td>Power tripping out due to defective pump associated with</td>
</tr>
</tbody>
</table>

AEAT ENV/R/1792
<table>
<thead>
<tr>
<th>Issue</th>
<th>Date</th>
<th>Date</th>
<th>Event/Reason</th>
<th>Details</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>06-Feb-04</td>
<td>16-Feb-04</td>
<td>Instrument fault</td>
<td>Reoccurrence of range fault. IR source and chopper wheel replaced</td>
</tr>
<tr>
<td></td>
<td>14-Mar-04</td>
<td>17-Mar-04</td>
<td>ESU service</td>
<td></td>
</tr>
<tr>
<td>O₃</td>
<td>03-Jan-04</td>
<td>06-Jan-04</td>
<td>Power cut</td>
<td></td>
</tr>
<tr>
<td></td>
<td>21-Jan-04</td>
<td>21-Jan-04</td>
<td>Instrument fault</td>
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</tr>
<tr>
<td>SO₂</td>
<td>03-Jan-04</td>
<td>09-Jan-04</td>
<td>Instrument fault</td>
<td></td>
</tr>
<tr>
<td></td>
<td>15-Mar-04</td>
<td>17-Mar-04</td>
<td>ESU service</td>
<td></td>
</tr>
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<td>Southend-on-Sea</td>
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<td></td>
<td>CO</td>
<td></td>
</tr>
<tr>
<td></td>
<td>44.0%</td>
<td>10-Feb-04</td>
<td>19-May-04 High noise</td>
<td>High noise and negative data deleted. IR source and pump replaced in May. (See section 3.1.3)</td>
</tr>
<tr>
<td>Southwark Roadside</td>
<td></td>
<td></td>
<td>NO₂</td>
<td></td>
</tr>
<tr>
<td></td>
<td>01-Jan-04</td>
<td>26-Mar-04</td>
<td>Converter fault</td>
<td>NOx converter failed at audit a (89%). See Section 2.5</td>
</tr>
<tr>
<td>Stoke-on-Trent Centre</td>
<td></td>
<td></td>
<td>CO</td>
<td></td>
</tr>
<tr>
<td></td>
<td>89.0%</td>
<td>02-Feb-04</td>
<td>11-Feb-04 Sampling fault and service</td>
<td></td>
</tr>
<tr>
<td></td>
<td>06-Mar-04</td>
<td>06-Mar-04</td>
<td>No mV data collected</td>
<td></td>
</tr>
<tr>
<td></td>
<td>08-Mar-04</td>
<td>08-Mar-04</td>
<td>No mV data collected</td>
<td></td>
</tr>
<tr>
<td>PM₁₀</td>
<td>27.3%</td>
<td>29-Jul-03</td>
<td>12-Feb-04 Low flow rate</td>
<td></td>
</tr>
<tr>
<td>Sunderland</td>
<td></td>
<td></td>
<td>Sample inlet filter leak after LSO calibration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SO₂</td>
<td>88.4%</td>
<td>17-Feb-04 Sampling fault</td>
<td></td>
</tr>
<tr>
<td>Thurrock</td>
<td>NO₂</td>
<td>67.0%</td>
<td>01-Jan-04 Instrument removed for repair</td>
<td>Excessive instrument response drift. Analyser removed for repair.</td>
</tr>
<tr>
<td></td>
<td>PM₁₀</td>
<td>88.0%</td>
<td>15-Jan-04 High noise</td>
<td>High noise response. Filter reseated</td>
</tr>
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</table>
### Issue 1

<table>
<thead>
<tr>
<th>Location</th>
<th>Pollutant</th>
<th>Percentage</th>
<th>Start Date</th>
<th>End Date</th>
<th>Description</th>
<th>Notes</th>
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<tr>
<td><strong>Wicken Fen</strong></td>
<td>NO$_2$</td>
<td>15.2%</td>
<td>12-Dec-03</td>
<td>17-Mar-04</td>
<td>Instrument fault</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Baseline truncation after repair in mid-December until replacement analyser</td>
<td>95.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>installed in March. (See Section 3.5)</td>
<td>2296</td>
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<tr>
<td><strong>Wigan Leigh</strong></td>
<td>SO$_2$</td>
<td>33.6%</td>
<td>03-Jan-04</td>
<td>15-Apr-04</td>
<td>Power cut</td>
<td>2</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Power cut</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No calibrations and step change in baseline. Audit showed 22% outlier. Data</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>deleted until new cylinder installed in April.</td>
<td>1752</td>
</tr>
<tr>
<td><strong>Wirral Tranmere</strong></td>
<td>NO$_2$</td>
<td>83.0%</td>
<td>24-Feb-04</td>
<td>10-Mar-04</td>
<td>Converter fault</td>
<td>15.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Converter fault identified at audit (92.1%). See section 2.5</td>
<td>364</td>
</tr>
<tr>
<td><strong>Wolverhampton Centre</strong></td>
<td>CO</td>
<td>84.8%</td>
<td>01-Feb-04</td>
<td>31-Mar-04</td>
<td>Instrument fault</td>
<td>3.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Chopper motor failure</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Further chopper motor failure. Motor replaced.</td>
<td>8.9</td>
</tr>
<tr>
<td><strong>N IRELAND</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Belfast Centre</strong></td>
<td>NO$_2$</td>
<td>88.0%</td>
<td>18-Mar-04</td>
<td>23-Mar-04</td>
<td>Monitoring suspended over the weekend in order to renovate the exterior of the</td>
<td>5.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>hut. Worked delayed by rain.</td>
<td>130</td>
</tr>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Belfast Clara St</strong></td>
<td>PM$_{10}$</td>
<td>88.8%</td>
<td>10-Jan-04</td>
<td>13-Jan-04</td>
<td>No mV data</td>
<td>3.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Communications problems resulting in data loss</td>
<td>93</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>As above</td>
<td>1</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>As above</td>
<td>24</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Service</td>
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<td></td>
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<td></td>
<td></td>
<td>As above</td>
<td>22</td>
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<td></td>
<td>As above</td>
<td>1</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>As above</td>
<td>24</td>
</tr>
<tr>
<td><strong>Derry</strong></td>
<td>NO$_2$</td>
<td>88.6%</td>
<td>14-Jan-04</td>
<td>14-Jan-04</td>
<td>No mV data</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>No details provided</td>
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<td></td>
<td>No mV data</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
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<td>Audit</td>
<td>6</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Fault after service. Problem with span calibration</td>
<td>8.8</td>
</tr>
<tr>
<td></td>
<td>SO$_2$</td>
<td>89.6%</td>
<td>05-Feb-04</td>
<td>11-Feb-04</td>
<td>Pump fault and hydrocarbon kicker replaced</td>
<td>5.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No details provided</td>
<td>136</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Service</td>
<td>2.8</td>
</tr>
</tbody>
</table>

AEA Technology A 29
## Lough Navar

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Quality</th>
<th>Start Date</th>
<th>End Date</th>
<th>Description</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>O₃</td>
<td>0.4%</td>
<td>01-Jan-04</td>
<td>31-Mar-04</td>
<td>Sampling fault</td>
<td>Analyser power supply fault from 29th Nov. New box installed 3rd December however the sample manifold fan stopped resulting in spurious low data until the service on 31st March 2004</td>
<td>90.6</td>
</tr>
</tbody>
</table>

## SCOTLAND

**Edinburgh St Leonards**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Quality</th>
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<th>End Date</th>
<th>Description</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO₂</td>
<td>67.8%</td>
<td>22-Jan-04</td>
<td>20-Feb-04</td>
<td>NO2 converter fault</td>
<td>Converter fault (93%) identified at audit. See Section 2.5</td>
<td>29.1</td>
</tr>
</tbody>
</table>

**Glasgow Centre**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Quality</th>
<th>Start Date</th>
<th>End Date</th>
<th>Description</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>81.2%</td>
<td>01-Jan-04</td>
<td>10-Jan-04</td>
<td>Instrument fault</td>
<td>Chopper motor failure. Motor and IR lamp replaced.</td>
<td>9.5</td>
</tr>
<tr>
<td></td>
<td>16-Feb-04</td>
<td>18-Feb-04</td>
<td>ESU service</td>
<td>Removed from site</td>
<td>Service</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td>12-Mar-04</td>
<td>17-Mar-04</td>
<td></td>
<td></td>
<td>Further chopper motor failure. Analyser returned to workshop for repair. Replacement analyser installed on 17/3/04</td>
<td>5.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Quality</th>
<th>Start Date</th>
<th>End Date</th>
<th>Description</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO₂</td>
<td>81.4%</td>
<td>03-Feb-04</td>
<td>05-Feb-04</td>
<td>Instrument fault</td>
<td>Analyser not responding to span gas. Ozone generator fault.</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td>16-Feb-04</td>
<td>18-Feb-04</td>
<td>ESU service</td>
<td>Unstable response</td>
<td>Service</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td>18-Mar-04</td>
<td>31-Mar-04</td>
<td></td>
<td></td>
<td>Data deleted between routine calibrations due to spurious step change in baseline.</td>
<td>13</td>
</tr>
</tbody>
</table>

## Grangemouth

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Quality</th>
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<th>End Date</th>
<th>Description</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>31.0%</td>
<td>01-Oct-03</td>
<td>03-Mar-04</td>
<td>Baseline truncated</td>
<td>Baseline truncation. Data deleted until offset applied on 3/3/04. Analyser reconfigured to allow negative mV output in mid April.</td>
<td>155</td>
</tr>
</tbody>
</table>

## WALES

**Cardiff Centre**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Quality</th>
<th>Start Date</th>
<th>End Date</th>
<th>Description</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>O₃</td>
<td>89.1%</td>
<td>22-Jan-04</td>
<td>28-Jan-04</td>
<td>Unstable response</td>
<td>Unstable negative response after calibration</td>
<td>6.1</td>
</tr>
<tr>
<td></td>
<td>28-Mar-04</td>
<td>02-Apr-04</td>
<td>Service</td>
<td></td>
<td>Service. Switched from Odessa logger to code activated switches.</td>
<td>4.8</td>
</tr>
</tbody>
</table>

## Narberth

<table>
<thead>
<tr>
<th>Parameter</th>
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<th>Start Date</th>
<th>End Date</th>
<th>Description</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO₂</td>
<td>82.2%</td>
<td>01-Jan-04</td>
<td>05-Jan-04</td>
<td>Power cut</td>
<td>Power failure</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>07-Jan-04</td>
<td>09-Jan-04</td>
<td>Power cut</td>
<td></td>
<td>As above</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>20-Jan-04</td>
<td>21-Jan-04</td>
<td>Power cut</td>
<td></td>
<td>As above</td>
<td>0.6</td>
</tr>
<tr>
<td></td>
<td>03-Feb-04</td>
<td>04-Feb-04</td>
<td>Power cut</td>
<td></td>
<td>As above</td>
<td>0.9</td>
</tr>
<tr>
<td>Date</td>
<td>Date</td>
<td>Event</td>
<td>Description</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>--------------</td>
<td>------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21-Feb-04</td>
<td>21-Feb-04</td>
<td>Power cut</td>
<td>As above</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26-Feb-04</td>
<td>27-Feb-04</td>
<td>Power cut</td>
<td>As above. Ambirack main power feed and power supply connection repaired.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22-Mar-04</td>
<td>24-Mar-04</td>
<td>ESU service</td>
<td>ESU service</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01-Jan-04</td>
<td>05-Jan-04</td>
<td>Power cut</td>
<td>Power failure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07-Jan-04</td>
<td>09-Jan-04</td>
<td>Power cut</td>
<td>As above</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-Jan-04</td>
<td>21-Jan-04</td>
<td>Power cut</td>
<td>As above</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>03-Feb-04</td>
<td>04-Feb-04</td>
<td>Power cut</td>
<td>As above</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21-Feb-04</td>
<td>21-Feb-04</td>
<td>Power cut</td>
<td>As above</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26-Feb-04</td>
<td>27-Feb-04</td>
<td>Power cut</td>
<td>As above</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22-Mar-04</td>
<td>24-Mar-04</td>
<td>ESU service</td>
<td>Service</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>03-Sep-03</td>
<td>24-Mar-04</td>
<td>Unstable response</td>
<td>Data rejected as interface between temporary Ambirack and TEOM not configured correctly resulting in spurious low data. (Details in Oct-Dec 2003 ratification report)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01-Jan-04</td>
<td>21-Jan-04</td>
<td>Power cut</td>
<td>Power failure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>03-Feb-04</td>
<td>04-Feb-04</td>
<td>Power cut</td>
<td>As above</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21-Feb-04</td>
<td>21-Feb-04</td>
<td>Power cut</td>
<td>As above</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24-Feb-04</td>
<td>24-Feb-04</td>
<td>Unstable response</td>
<td>Unstable response data deleted</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26-Feb-04</td>
<td>27-Feb-04</td>
<td>Power cut</td>
<td>Power failure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22-Mar-04</td>
<td>24-Mar-04</td>
<td>ESU service</td>
<td>Service</td>
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</tbody>
</table>

**Swansea**

<table>
<thead>
<tr>
<th>Date</th>
<th>Date</th>
<th>Event</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>22-Mar-04</td>
<td>24-Mar-04</td>
<td>ESU service</td>
<td>Service</td>
</tr>
<tr>
<td>01-Jan-04</td>
<td>24-Mar-04</td>
<td>Low flow rate</td>
<td>TEOM major leak found at audit and confirmed at service. Low data deleted. Leak due to cracked plastic fitting at the mass flow controller. (See Section 3.3)</td>
</tr>
</tbody>
</table>
4.1 Gravimetric PM$_{10}$ Sites with Data Capture Below 90%

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

**Dumfries (Data capture 81.3%)**

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

<table>
<thead>
<tr>
<th>Month</th>
<th>Comment</th>
<th>Data Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>February</td>
<td>27$^{th}$ Feb – 4$^{th}$ March: filter exchange failure</td>
<td>7 days</td>
</tr>
<tr>
<td>March</td>
<td>22$^{nd}$ March – 1$^{st}$ April: filter exchange failure</td>
<td>11 days</td>
</tr>
</tbody>
</table>

**Northampton (Data capture 87.9%)**

<table>
<thead>
<tr>
<th>Month</th>
<th>Comment</th>
<th>Data Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>1$^{st}$ Jan: unexposed filter</td>
<td>1 day</td>
</tr>
<tr>
<td>March</td>
<td>13$^{th}$ – 22$^{nd}$ March: filter exchange failure</td>
<td>10 days</td>
</tr>
</tbody>
</table>

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

- London Westminster connected 9$^{th}$ March 2004
- Dumfries connected 27$^{th}$ April 2004
- Inverness connected 5$^{th}$ May 2004

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

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

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

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

<table>
<thead>
<tr>
<th>Site</th>
<th>CO</th>
<th>NO₂</th>
<th>O₃</th>
<th>PM₁₀</th>
<th>PM₂.₅</th>
<th>SO₂</th>
<th>Site Average</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>England</strong></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barnsley 12</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>98.4 98.4</td>
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| Number of sites        | 79  | 106   | 84    | 71       | 4         | 76     | 121          |
| Number of sites < 90%  | 16  | 26    | 14    | 12       | 0         | 16     | 32           |
| Network Mean (%)       | **92.0** | **90.3** | **93.1** | **91.1** | **97.9** | **91.7** | **92**       |

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

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**Number of sites < 90%**

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**Key**

- Pollutant monitored but not critical at this site
- Not monitored

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

**RECOMMENDATION**

Every effort should be made to ensure that data capture is maximised for the critical sites. LSOs and ESUs should undertake call-outs and repairs as soon as possible to avoid unnecessary data loss at these sites.
PART B: Summer Intercalibration Results January to March 2004
PART B - Intercalibration Report for the Automatic Urban, Rural and London Networks, January to March 2004

6 Introduction

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

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

1. Analyser accuracy and precision, as a basic check to ensure reliable datasets from the analysers.
2. Instrument linearity, to check that doubling a concentration of gas to the analyser results in a doubling of the analyser signal response. If an analyser is not linear, data cannot be reliably scaled into concentrations.
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 NO₂ to be undertaken, so it must work acceptably.
7. TEOM kₙ 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. SO₂ analyser hydrocarbon interference, as certain hydrocarbons are known to interfere with the SO₂ detector.
10. Evaluation of site cylinder concentrations, using a set of netcen certified cylinders that are taken to all the sites. The concentrations of the site cylinders are used to scale pollution datasets, so it is important to ensure that the concentration of gas in the cylinder does not change.
11. Competence of Local Site Operators (LSO) in undertaking calibrations. As it is the calibrations by the LSOs that are used to scale pollution datasets, it is important to check that these are undertaken competently.

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

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

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

- ±10% of the network average for NOx, CO and SO2 analysers,
- ±5% of the reference standard photometer for ozone analysers,
- ±2.5% of the stated k0 value for TEOM analysers,
- ±10% for particulate analyser flow rates,
- ±10% for the recalculation of site cylinder concentrations.

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

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

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

The procedures used to determine network performance are documented in netcen Work Instructions. These methods are regularly updated and improved and have been evaluated by the United Kingdom Accreditation Service (UKAS). netcen holds UKAS accreditation for the on-site calibration of all the analyser types (NOx, CO, SO2, O3) and for the determination of the TEOM k0 factor, PM10 and PM2.5 analyser flow rates used in the network. A UKAS Certificate of Calibration (Calibration Laboratory number 0401) for the Automatic Urban, Rural and London Networks is appended to this report.

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

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

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Number of outliers</th>
<th>Number audited</th>
<th>% outliers in total</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOx analyser</td>
<td>34</td>
<td>105</td>
<td>32%</td>
</tr>
<tr>
<td>CO analyser</td>
<td>7</td>
<td>77</td>
<td>9%</td>
</tr>
<tr>
<td>SO2 analyser</td>
<td>14</td>
<td>76</td>
<td>18%</td>
</tr>
<tr>
<td>Ozone analyser</td>
<td>22</td>
<td>85</td>
<td>26%</td>
</tr>
<tr>
<td>TEOM and BAM analyser</td>
<td>1 k₀, 10 flow</td>
<td>68 TEOM, 1 BAM</td>
<td>16%</td>
</tr>
<tr>
<td>Gravimetric PM₁₀ analysers</td>
<td>-</td>
<td>7</td>
<td>n/a</td>
</tr>
<tr>
<td>Total</td>
<td>88</td>
<td>419</td>
<td>21%</td>
</tr>
</tbody>
</table>

An outlier is defined as an analyser that shows a deviation from the network mean of greater than 10% for NOx, CO and SO₂ and 5% for O₃. For PM₁₀ and PM₂.₅ analysers, the flow rates must be within 10% of the specified limits and the TEOM k₀ factor must be within 2.5% of the stated value.

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

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

<table>
<thead>
<tr>
<th>SITE</th>
<th>Date visited</th>
<th>NOx</th>
<th>CO</th>
<th>SO₂</th>
<th>O₃</th>
<th>PM₁₀</th>
<th>PM₂.₅</th>
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<td></td>
<td></td>
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<tr>
<td>Barnsley 12</td>
<td>12/03</td>
<td></td>
<td></td>
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<tr>
<td>Barnsley Gawber</td>
<td>18/03</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td>Outlier +25%</td>
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<tr>
<td>Bath Roadside</td>
<td>11/02</td>
<td>OK</td>
<td>OK</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>Billingham</td>
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<td>OK</td>
<td>Outlier +30%</td>
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<td>OK</td>
<td>Outlier +8%</td>
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<td>OK</td>
<td></td>
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<td>Outlier +13%</td>
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<td>Outlier +12%</td>
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<tr>
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<td>OK</td>
<td>Outlier +16%</td>
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<td>Outlier (flow)</td>
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<td>Brentford Roadside</td>
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<td>Outlier +12%</td>
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<td>Outlier +11%</td>
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<td>OK</td>
<td>Outlier (flow)</td>
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AEA Technology B5
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<th>SITE</th>
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<th>SO2</th>
<th>O3</th>
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<td>OK</td>
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<td>Coventry Memorial Park</td>
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<td>Outlier -12%</td>
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<tr>
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<td>OK</td>
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<td>Outlier +30%</td>
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<td>Manchester South</td>
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<td>Manchester Town Hall</td>
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<td>Outlier +13%</td>
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<tr>
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<td>Outlier -21%</td>
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<td>Outlier (flow)</td>
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<td>Outlier +11%</td>
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<td>Outlier -16%</td>
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<td>OK</td>
<td>Outlier (flow + k0)</td>
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<td>17/02</td>
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</tr>
<tr>
<td>Southend-on-Sea</td>
<td>25/03</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td>Outlier -10%</td>
<td>OK</td>
<td></td>
</tr>
<tr>
<td>Southwark Roadside</td>
<td>17/03</td>
<td>OK (CE 89%)</td>
<td>OK</td>
<td>OK</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>St Osyth</td>
<td>22/01</td>
<td>Outlier +24%</td>
<td>OK</td>
<td>Outlier -8%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stockport Shaw Heath</td>
<td>05/02</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td>Not tested</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stockton-on-Tees Yarm</td>
<td>18/02</td>
<td>OK</td>
<td>OK</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stoke-on-Trent Centre</td>
<td>01/02</td>
<td>Outlier +12%</td>
<td>Outlier -29%</td>
<td>Outlier +12%</td>
<td>Outlier -21%</td>
<td>Outlier (flow)</td>
<td></td>
</tr>
<tr>
<td>Sunderland</td>
<td>17/02</td>
<td>OK</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thurrock</td>
<td>23/01</td>
<td>Not tested</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td></td>
</tr>
<tr>
<td>Tower Hamlets Roadside</td>
<td>02/04</td>
<td>OK (CE 94%)</td>
<td>OK</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walsall Alumwell</td>
<td>22/03</td>
<td>OK</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walsall Willenhall</td>
<td>15/03</td>
<td>OK</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West London</td>
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<td>OK</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weybourne</td>
<td>18/02</td>
<td>OK</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wicken Fen</td>
<td>16/02</td>
<td>Outlier -13%</td>
<td>OK</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wigan Leigh</td>
<td>01/04</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td></td>
</tr>
<tr>
<td>Wirral Tranmere</td>
<td>24/02</td>
<td>OK (CE 92%)</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td></td>
</tr>
<tr>
<td>Wolverhampton Centre</td>
<td>22/03</td>
<td>OK</td>
<td>Outlier +20%</td>
<td>OK</td>
<td>OK</td>
<td>OK</td>
<td></td>
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<tr>
<td>Yarner Wood</td>
<td>28/01</td>
<td>Outlier +20%</td>
<td>OK</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

**NORTHERN IRELAND**

| Belfast Centre           | 08/03        | OK      | OK   | OK   | OK   | Outlier (flow) |       |
| Belfast Clara St         | 08/03        |         |      |      |      | OK   |       |
| Belfast East             | 09/03        |         |      |      |      | Outlier +14% |       |
The following sections look at each pollutant in turn, and investigate causes for outliers.

8 Oxides of Nitrogen

8.1 Intercalibration Outliers

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

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

1. Brentford Roadside
2. Bristol Centre
3. Hull Freetown
4. Ladybower
5. London Eltham
6. Reading New Town
7. Redcar
8. Yarner Wood
9. Glasgow Centre
10. Glasgow City Chambers
This has been a significant cause of outliers at this exercise, and will be discussed in detail in the cylinder section. Data from all the affected sites has been carefully examined and rescaled as needed. No data have been lost as a result of the rescaling. A further 16 outliers can be attributed to drifts in calibration factors between LSO calibrations, and no data will be lost as a result of these findings.

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

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

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

As detailed in the introduction of this section of the report, comparison of the network averages to audit cylinder concentrations showed that the network measures concentrations of NO to within 1% of the network standard and NO2 concentrations to within 3.5%. The percentage standard deviations of these results, which is an indication of how close the results are grouped together, was less than 4.5% in both cases. These are very good results, and demonstrate that data from the vast majority of NOx analysers are accurate, harmonised and traceable to national metrology standards.

8.2 Leaking switching valves

This phenomenon has been observed as a significant cause of outliers in NOx analysers. When NO2 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 NO2 will be virtually 100% NO2, very little NO will be present in the mixture.

Analysers that exhibit this behaviour could be underestimating concentrations of NO2, as highlighted by the following five outliers:

1. Yarner Wood – measured 15 ppb NO in an NO2 cylinder
2. Stockport – measured 42 ppb NO in an NO2 cylinder
3. Wrexham – measured 11 ppb NO in an NO2 cylinder
4. Birmingham Centre – measured 11 ppb NO in an NO2 cylinder
5. Wigan Leigh – measured 14 ppb NO in an NO2 cylinder

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

1. Brent – measured 15 ppb NO in an NO2 cylinder
2. Canterbury – measured 11 ppb NO in an NO2 cylinder
3. Northampton – measured 14 ppb NO in an NO2 cylinder
4. Bristol OM – measured 14 ppb NO in an NO2 cylinder
5. Bournemouth – measured 20 ppb NO in an NO2 cylinder
6. Glasgow Kerbside – measured 18 ppb NO in an NO2 cylinder
7. Ladybower – measured 13 ppb NO in an NO2 cylinder
8. Dumfries – measured 20 ppb NO in an NO2 cylinder
9. London Bromley – measured 12 ppb NO in an NO₂ cylinder
10. Preston – measured 30 ppb NO in an NO₂ cylinder
11. Hove – measured 11 ppb NO in an NO₂ cylinder

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

The most likely cause for this observation is a leaking switching valve inside the analyser. The valves cycle the analysers between sampling NOx, NO and, on some models, reference gases, and any leaks within these systems appear to manifest themselves when calibrating the analysers with NO₂ gas. In many ways, this phenomenon is similar to the leaking main valve faults common to ozone analysers. Unfortunately, as the valves are inside the analysers, it is not possible for LSOs or QA/QC to leak check these valves.

**Recommendation**

It is therefore recommended that LSOs pay particular attention to the NO₂ calibration results, to see whether the NO response is significantly higher than that obtained for the zero calibration. These observations should be reported to CMCU as soon as possible.

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

**netcen** will continue to monitor these results at audit visits.

### 8.3 Converter Tests

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

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

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

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

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

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

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

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

10 Sulphur Dioxide

10.1 Intercalibration Outliers

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

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

Comparison of the network average to the audit cylinder concentration showed that the network measures SO$_2$ concentrations to within 1.6% of the network standard. The percentage standard deviation was 4.6%. These are very good results, and demonstrate that data from the SO$_2$ analysers are accurate, harmonised and traceable to national metrology standards.

10.2 m-xylene tests

The efficiency of the hydrocarbon “kicker” was evaluated with a 1 ppm m-xylene cylinder. The kicker selectively removes hydrocarbons from the sample inlet prior to analysis. This is an important test, because m-xylene behaves in a similar manner to SO$_2$ when exposed to UV light within the analyser, and could therefore interfere with the analyser response, if the kicker does not function properly.
To pass the test, the analyser must not respond by more than 1% (10 ppb) of the m-xylene cylinder concentration. However, it should be noted that this particular test is very demanding; typical ambient hourly maximum concentrations of this pollutant rarely exceed 50 ppb, and annual concentrations rarely exceed 5 ppb.

The following 27 analysers were outside the required standard:

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

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

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

To put these results into perspective, at the expected maximum ambient concentrations of m-xylene (50ppb), the worst kicker would show an interference response of around 1.5 ppb. There will be a future requirement that kicker response to 1ppm m-xylene must be lower than 1% (i.e. 10ppb SO2), or data will need to be rejected. This is discussed further in the CEN section of this report.
11 Ozone

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

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

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

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

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

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

12 Particulate analysers

12.1 TEOM k₀

There was one outlier for TEOM k₀ during this intercalibration. The analyser at Sheffield Centre was found to be 3.1% from its stated value. The history of the analyser will be examined, and the dataset will be rescaled as appropriate if a similar result is found at the
summer 2004 audit. All other TEOM calibration factors were calculated to be within 2.5% of their stated values.

12.2 Analyser Flow Rates

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

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

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

The analyser at Stockport Shaw Heath malfunctioned during the audit.

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

13 Site Cylinder Concentrations

During the intercalibration, the concentrations of the on-site cylinders were evaluated using the audit cylinder standards. The calculated results showed that 18 of the 364 cylinders (~5%) used to scale analyser data into concentrations (NO, CO and SO$_2$) appear to be outside the ±10% acceptance criterion. This is much worse than the summer 2003 roadshow, where less than 1% (3 cylinders) were outside the acceptance limits.

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

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

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

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

In addition, the concentrations of 33 NO₂ cylinders appear to have drifted by more than 10%. These NO₂ cylinder concentrations are not, however, used for data scaling so there is no significant impact on data quality.

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

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

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

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

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

14 Site Information

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

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

**Table 15.1 – Site Information**

<table>
<thead>
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<th>Site Name</th>
<th>Manifold type</th>
<th>Grid Reference</th>
<th>6 figure easting</th>
<th>6 figure northing</th>
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TBA – to be advised in a future report

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

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

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

The European Committee for Normalisation (CEN) have prepared a series of documents prescribing how analysers must be operated, to produce datasets that conform to the Data Quality Objectives of the EC Directives. The CEN documents for operation of air pollution analysers; ISO14211 (NOx), ISO14212 (SO2), ISO14626 (CO) and ISO14625 (O3) set out a series of performance criteria for analysers which must be achieved, both in the field and under laboratory conditions.

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

- **Linearity** – the analyser must have a maximum error at any point of less than 5% of the predicted value. This is much tougher to achieve than the current criteria ($r^2$ of 0.99 or better). Netcen has begun to record maximum residuals from linearity tests, to evaluate the performance of current analysers against these tougher requirements. These results will be reported in detail in the next intercalibration report.

- **NOx converter efficiency** must be better than 98%. Data may be rescaled for efficiencies between 95 and 98%, but rejected if below 95%. Again, this is tighter than currently, where we accept “borderline” failures. Netcen already use the CEN method for undertaking converter tests.

- **The sampling system that delivers air to the analyser must remove no more than 2% of the gas to be analysed.** Netcen are currently trialling systems to calibrate sampling systems, but this is not currently undertaken on a routine basis in the UK.

- **The concentration of the site cylinders will need to be determined every six months,** and the revised values used to scale ambient data. This is a change to our current procedures, where no action is taken until a cylinder deviates from its stated value by more than 10%. Netcen are currently in the process of introducing this new procedure. The uncertainty of this calculation will need to be substantially lower than the current 10% limit (in the order of 4-5% maximum).

- **SO2 response to a 1ppm meta xylene cylinder will need to be less than 1% (10ppb).** This is the current requirement, but action is not taken unless the result is very high (>50ppb), or until an analyser repeats a failure six months later.

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

16  Safety

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

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

1. Blackpool
2. London Brent
3. Southend-on-Sea
4. Narberth

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

1. Bolton
2. Coventry Memorial Park

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

17 Certification

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

18 Summary

The intercalibration exercise has demonstrated its value as an effective tool in determining overall site performance and assessing the reliability and traceability of air quality measurements from a large scale network. The results from this intercalibration have been used to assess data quality during the ratification of the network datasets for the 6-month period July to December 2003.
Appendix A1

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

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<th>Definition</th>
<th>Time-scale</th>
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*Note – QA/QC Unit’s practice is to notify CMCU immediately of any high priority issues at the time of the event.

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<th>Action</th>
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</thead>
<tbody>
<tr>
<td>1 Advice on requirements for further AURN equipment up-grades has been given to CMCU (20/1/04)</td>
<td>Critical Site</td>
<td>On-going</td>
</tr>
<tr>
<td>2 Recommend up-grade/modifications to SO₂ Ambirack bench at Blackpool and Norwich Centre to improve response noise. (Already done at Wirral Tranmere and Preston)</td>
<td>Blackpool Critical Site</td>
<td>Blackpool - new SO₂ bench fitted 9th March 2004</td>
</tr>
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</table>

<table>
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<tr>
<th>Recommendations July 2004</th>
<th>Priority</th>
<th>Action</th>
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<tr>
<td>3 Recommend up-grading or modify SO₂ Ambirack bench at Reading New Town</td>
<td>Critical Site (Defra)</td>
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<tr>
<td>4 Sheffield Tinsley CO noisy and drifting response. Recommend up-grading or repair</td>
<td>Medium</td>
<td></td>
</tr>
<tr>
<td>5 Exeter Roadside CO unstable baseline. Recommend up-grading or repair.</td>
<td>Medium</td>
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APPENDIX A2

CRITICAL SITES IN THE AURN (May 2004)

Table A1  Critical Sites in Agglomerations

<table>
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<tr>
<th>Site Name</th>
<th>Agglomeration</th>
<th>Critical Pollutants</th>
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<td></td>
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<td>DD1</td>
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<td>Belfast Urban Area</td>
<td>NO2</td>
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<tr>
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<td>Birkenhead Urban Area</td>
<td>NO2 PM10 SO2 CO NO2 O3</td>
</tr>
<tr>
<td>Blackpool</td>
<td>Blackpool Urban Area</td>
<td>NO2 PM10 SO2 CO NO2 O3</td>
</tr>
<tr>
<td>Bournemouth+</td>
<td>Bournemouth Urban Area</td>
<td>NO2 PM10 SO2 CO NO2 O3</td>
</tr>
<tr>
<td>Brighton Preston Park</td>
<td>Brighton/Worthing/Littlehampton</td>
<td>NO2 O3'</td>
</tr>
<tr>
<td>Brighton Roadside PM10+</td>
<td>Brighton/Worthing/Littlehampton</td>
<td>PM10</td>
</tr>
<tr>
<td>Hove Roadside+</td>
<td>Brighton/Worthing/Littlehampton</td>
<td>SO2</td>
</tr>
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<td>Bristol Urban Area</td>
<td>PM10 SO2</td>
</tr>
<tr>
<td>Cardiff Centre</td>
<td>Cardiff Urban Area</td>
<td>NO2 PM10 SO2 CO NO2 O3</td>
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<tr>
<td>Coventry Memorial Park+</td>
<td>Coventry/Bedworth</td>
<td>NO2 PM10 SO2 CO NO2 O3</td>
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<td>Edinburgh St Leonards</td>
<td>Edinburgh Urban Area</td>
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<td>Glasgow Urban Area</td>
<td>SO2</td>
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<td>Kingston upon Hull</td>
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<td>Portsmouth+</td>
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<td>Preston Urban Area</td>
<td>NO2 PM10 SO2 CO NO2 O3</td>
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<tr>
<td>Reading New Town</td>
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<td>PM10</td>
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<td>Southend Urban Area</td>
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<td>Tyneside</td>
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"+ indicates Affiliate site"

Note 2: PM10 monitored by Gravimetric and TEOM
Note 3: DD3 Critical as Rural Background station
Note 4: If NO2 at West Midlands is Suburban then NO2 at Leamington Spa is no longer critical for DD1
Note 6: Not Affiliated/Monitoring yet.
Note 7: Addresses CO, Benzene not included here
### Table A2  Critical Sites in Zones

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<th>DD3</th>
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<td>CO</td>
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<td>South Wales</td>
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<tr>
<td>Barnsley Gawber+</td>
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<td>CO</td>
<td>NO(_2) O(_3)</td>
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<tr>
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<td>Yorkshire &amp; Humberside</td>
<td>NO(_2) O(_3)</td>
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<td>Scunthorpe+</td>
<td>Yorkshire &amp; Humberside</td>
<td>PM(_{10})</td>
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</table>

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

Note 2: PM\(_{10}\) monitored by Gravimetric and TEOM
Note 3: DD3 Critical as Rural Background station
Note 4: If NO\(_2\) at Leominster is Suburban then NO\(_2\) at Leamington Spa is no longer critical for DD1
Note 6: Not Affiliated/Monitoring yet
Note 7: Addresses CO, Benzene not included here
Appendix  B1

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

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

1. Carbon Monoxide

<table>
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<tr>
<th>Date</th>
<th>Year</th>
<th>Site</th>
<th>Site number</th>
<th>¹Zero output</th>
<th>Uncertainty (ppm)</th>
<th>²Calibration Factor</th>
<th>Uncertainty (%)</th>
<th>²R²</th>
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<tr>
<th>Date</th>
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Culham, Abingdon, Oxfordshire OX14 3ED. Telephone 0870 1906465 Facsimile 0870 1906377

Certificate No: 01090  
AEA Identification Number: 45077030

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AEA Technology
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The above factors have been calculated using certified standards. The analysers listed above have been tested for zero response, calibration factor, linearity, converter efficiency (NOx analysers), m-xylene interference (SO2 analysers), $k_0$/main flow rate (for TEOM analysers) and total flow rate (for particulate analysers), by documented methods. Note that the test results are valid on the day of test only, as analyser drift over time cannot be quantified.

The calibration results for NOx, NO, CO, SO2, O3 and Particulates are those that fall within our scope of accreditation. Results marked with an asterisk (*) on this certificate are not UKAS accredited, but have been included for completeness.

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

2 The calibration factor is the multiplying factor required to scale the reading on the logging system of the analyser into concentration units (ppb for NO, NOx and SO2, ppm for CO – 1ppm = 1000 ppb). It should be used in conjunction with the analyser output and the zero response, according to the following equation:

$$\text{Concentration} = (\text{output} - \text{zero response}) \times \text{Calibration factor}$$

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

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

*R2 is the correlation coefficient of linearity

*Converter is the measured efficiency of the NO2 to NO converter in the Oxides of Nitrogen analyser

*meta-xylene interference is the response of the SO2 analyser when supplied with approx 1ppm meta-xylene

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<th>Uncertainty (%)</th>
<th>$^4k_0$ accuracy (%)</th>
<th>$^3$Measured Main Flow (l/min)</th>
<th>Uncertainty (%)</th>
<th>$^3$Measured Total Flow / Aux Flow (l/min)</th>
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