Part B
Site Operations

11 ELECTRONIC CALIBRATION SHEET

The Electronic Calibration Sheet (Figure 11.1) is the recommended method of recording calibration and diagnostics information for LSOs. The software allows all information collected during the calibration to be readily used to improve the quality of the validated and ratified data.

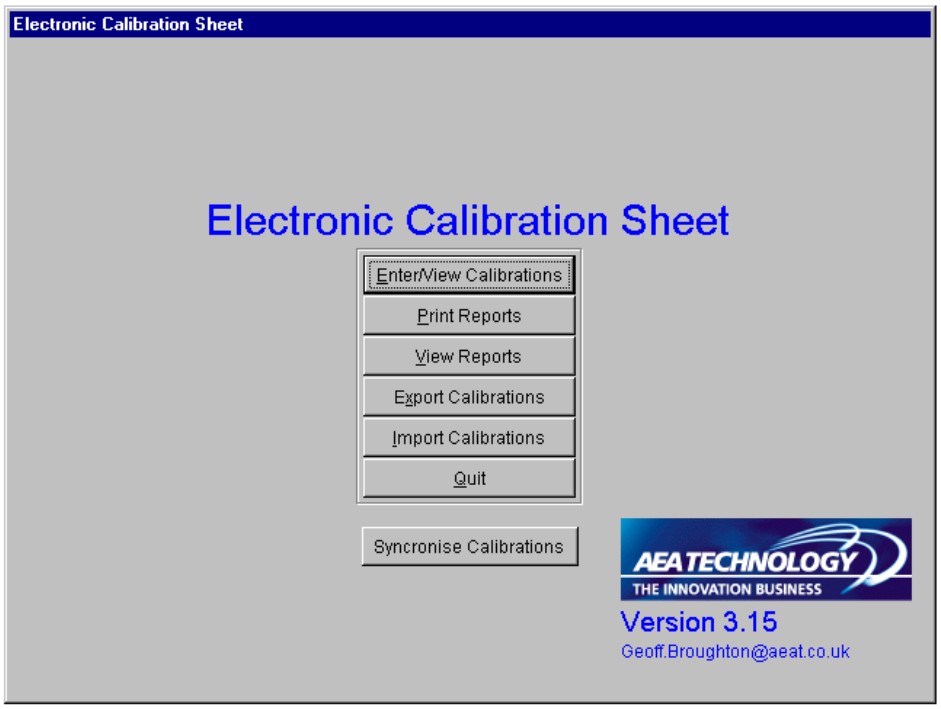

Figure 11.1: Opening screen for the Electronic Calibration Sheet

Information is entered in a series of forms (Figure 11.2) that follow a similar format to the traditional paper forms. LSO's are prompted when data is out of range, allowing data to be re-entered or problems to be identified.

Values from the previous visit may be viewed in "tool tips" by placing the cursor over the boxes.

Various data is now standardised eliminating any confusion with site name, dates, times, cylinders and decimal places.

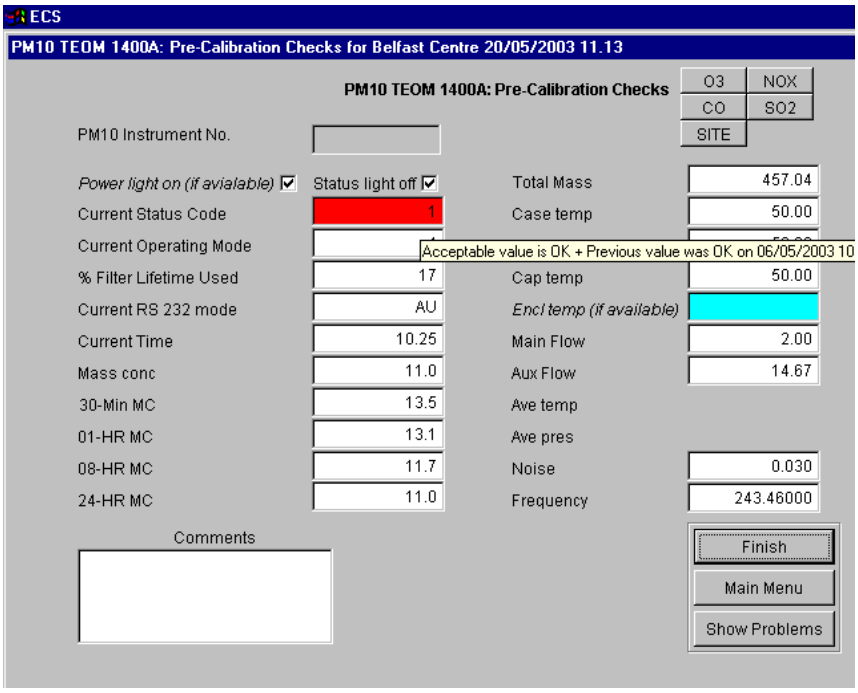

Figure 11.2: An example form showing tool tip information

Calibration information is sent to the CMCU and QA/QC Unit via e-mail. The LSO's selects an option that generates two small data files that need to be e-mailed to Nick@tbvsci.co.uk and Geoff.Broughton@aeat.co.uk. Additional information can be added to the e-mail or faxed.

The software operates under Windows 95, 98, ME, NT 4, 2000, XP or later operating systems. The software will not work with Windows CE (common for palmtops), Windows 3.1 or Macs. No software needs to be purchased and QA/QC Unit will fully support the Electronic Calibration Sheet. The software is not demanding on memory and a portable PC is ideal but not essential, allowing the electronic calibration sheet to be completed on site. Installation is straight forward using the standard Microsoft setup process. Data files must be e-mailed.

New versions of the software are regularly sent to LSO's when new instrument models or new sites are added to the AURN. The software has been field tested by LSO's for several years and modifications are regularly made based on feedback.

Printable copies of calibration sheets are available on the AURN hub for recording relevant data on site; these may then be typed into the electronic calibration sheet later, if, for instance, no laptop is available on site.

Requests for copies of the software and any comments or suggestions should be to sent to Geoff.Broughton@aeat.co.uk

12 NON-ROUTINE SITE VISITS

Data from the AURN is inspected daily by the Management Units. Full consideration will be given to ambient pollution levels being measured, and the range of available autocalibration and instrument status data.

In the event of "suspect" data being identified from a particular location, checks will be carried out remotely by the MU. If these checks further indicate the possibility of an instrument or infrastructural malfunction, the Local Site Operator will be called on to investigate the problem at the site.

By considering ambient and autocalibration data, it should be possible to diagnose, with a good degree of reliability, the instrumental problem. The site operator will then be instructed as to what further manual tests, if any, should be performed on-site.
It is not possible to anticipate all potential problems, but basic guidelines for fault diagnosis are given in the following chapter.

Having carried out tests as directed, the local site operator should convey their results to the CMCU for further instruction, and document any remedial action taken in each case. The site operator is expected to perform basic remedial action to rectify any faults. Such action may take the form of ensuring electrical supplies to the instruments or changing instrument fuses.

Site operators will not, however, be expected to effect repairs which require detailed knowledge of the instruments operation. Such problems will be referred to the Equipment Support Unit for subsequent action.

In all instances of site problems, it will be the responsibility of the site operator to fully document the results of any tests which they perform. If the problem is rectified by the site operator, then subsequent calibration of the analyser, according to standard procedures, should be carried out if requested by the CMCU. As with all routine calibrations, the results must be forwarded to the CMCU and QA/QC Unit as soon as possible in order to allow data to be scaled correctly.

Similarly, all action taken by the Equipment Support Unit will be documented and forwarded to the CMCU and QA/QC Unit. In the event of the instrument being repaired on site, it will be the responsibility of the Equipment Support Unit to recalibrate the instrument after a suitable stabilization period. If, however, the instrument is removed and repaired off-site, a calibration must be undertaken by the ESU before removal (where possible).

Any replacement instruments must be calibrated by the Equipment Support Unit upon installation. The documentation forwarded to the CMCU and the QA/QC Unit must show clearly that this is a replacement instrument, and the time allowed between instrument power up and calibration must be recorded.

12.1 On-site Procedures in the Event of Non-Routine Site Visits

As mentioned earlier, it is impossible to devise an exhaustive list of potential on-site problems and methods of diagnosis and solution. However, it is generally possible to systematically test the measurement chain in order to discover the cause of the problem and effect its solution.

The non-routine call-out of site operators will be at the request of the CMCU, who will supply information on which piece of equipment has malfunctioned, together with relevant fault symptoms and possible causes.

At every non-routine site visit, the site operator should complete a "Emergency Call-Out Visit Record" (see Appendix B2). CMCU may fax a partially completed Emergency Call-Out record sheet to the LSO as notification of the fault, giving where possible, the reason and steps to be taken to rectify the fault. The LSO then completes this record sheet on site. If however, fault notification from CMCU is by phone or paged message, the LSO must then complete a blank emergency call-out site visit record sheet. In either case, this should be sent, by FAX, to the CMCU and QA/QC Unit. It is vitally important that all checks and remedial action carried out are fully documented.

It will not be necessary for the site operator to carry out tests on analysers or ancillary equipment which have not been reported faulty: as far as possible, the site should be left "free running" to maintain instrument response continuity and maximise data capture.

On-site problems, when they occur, generally fall into five categories:

- Loss of mains or telephone connection to the site. This will be detected by CMCU being completely unable to contact the site by telemetry;
- Analyser malfunction. This will generally affect data from only one analyser;
- Data-logging or telemetry malfunction. This may have the same symptoms as (a) above, or may result in normal line connection to the site but inability to receive any meaningful data;
- Autocalibration malfunction; and
- Site vandalism.

12.2 Trouble-shooting: On-site test procedures

12.2.1 Loss of mains or telephone connection.

1) Verify that mains power is being supplied to all site circuits, i.e. lighting, air conditioning, and instrument circuits;

2) Verify that the telephone connection to the data-logger modem line is working. Initiate two way test of line, i.e. make an outgoing call and receive an incoming call; and

3) In the case of mains failure having occurred, the complete site operation should be thoroughly checked subsequent to reconnection. Many electronic units are susceptible to losing their program after mains failure.

12.2.2 Analyser malfunction

1) Is the analyser receiving mains power? Check for blown fuses in the electricity supply unit, the instrument plug and the current protect fuse on the instrument itself.

2) Verify that the analyser is properly connected to the data-logger. Examine the electrical connecting cable at both the logger and analyser terminations. Ensure, by using a Digital Volt Meter, that there is electrical continuity along the cable.

3) Is the instrument sampling ambient air? Check the following:
   (a) The manifold system is functioning and is not blocked in any way;
   (b) The instrument is connected solely to the manifold, and is not sampling from autocalibration units or indoor air;

(c) The instrument pump is functioning;
(d) There are no obvious restrictions to air flow through the instrument, ensuring the instrument flow rates fall within manufacturer guidelines
(e) Sample inlet filter holders are closed, tightly and not leaking.

Having verified that the instrument samples ambient air, the introduction of span gas through the ambient inlet should produce a detectable response from the system.

(4) Perform the routine instrument checks on the instrument, as described in Appendix A, to verify optimum performance of the analyser.

(5) Connect a calibration gas cylinder to the instrument and conduct a calibration check following the procedures detailed in the relevant part of Appendix A.

(6) Having allowed the appropriate stabilisation times, observe the reading on the instrument front panel. If this shows that the analyser has responded to the calibration gas, as would normally be expected, the problem does not lie in the actual measurement process.

(7) Verify that the analyser response on the data logger or front panel is normal.

12.2.3 Data-logging or telemetry malfunction

(1) Are the datalogger and modem receiving mains power? Check for blown fuses in the electricity supply unit, the equipment plugs and the current protect fuses on the equipment itself.

(2) Verify that the cables connecting logger to modem and modem to BT phone socket are in place and are not damaged in any way.

(3) Verify that the logger set-up programme has not become corrupted by checking carefully the display screen.

(4) Verify that the correct modem LEDs are illuminated.

(5) Observe the modem display while telemetry communications from CMCU to the site are being attempted.

12.2.4 IZS Unit Malfunction

CMCU will advise on the need for checking IZS units, if problems are identified.

12.2.5 Site Vandalism

Record details of site vandalism and report them to the relevant CMCU. If the sampling manifold is damaged it is important to note whether the damage occurs above or below the roof level. A sketch to show exactly where breakages occur should be provided. The CMCU will advise on temporary repairs, where possible.

12.2.6 Troubleshooting

Further examples of common problems and faults that may arise during the routine operations or calibration of the automatic analysers is given in the troubleshooting section, Appendix H

13 SITE AUDITS AND INTERCALIBRATION VISITS

An important part of the QA/QC programme for the AURN network are the audits and intercalibration visits. All sites will be visited for audit and intercalibration service as detailed below. QA/QC unit is also responsible for the training of LSOs. Site audit/intercalibration schedules are listed on the AURNHUB website, normally starting in the first week of January and July and lasting approximately 10 weeks. During these periods QA/QC staff will contact LSOs to arrange for entry to the monitoring stations and for the LSO to attend for audit purposes.

13.1 Site Audit

In order to ensure that proper procedures, as detailed in this manual, are being carried out, the QA/QC Unit will audit sites as part of the site intercalibrations. In addition, short notice or unannounced audits may also be performed. The QA/QC Unit reserves the right to visit sites as often as is necessary to ensure that correct procedures are being followed.

During site audits, which may or may not coincide with a normal fortnightly/monthly calibration visit, the site operator must be present and be able to produce for the QA/QC Unit all records relating to the site operation. The site operator may be asked to demonstrate any routine site operational procedure and show that this can be competently carried out.

13.2 Intercalibration Visits

Every 6-months QA/QC Unit will undertake detailed checks on analyser performance and calibration prior to the sites being serviced by the ESU. As noted above, the QA/QC Unit will also use their visit to audit site records and LSO procedures.

It is not the purpose of this manual to describe fully operations to be undertaken at these intercalibration visits, but the sections below indicate the scope and range of the functions to be performed. During the intercalibration exercise these will include:

(1) Full network intercomparison covering all pollutants and analyser types;
(2) Production of ozone data scaling factors by performing reference ozone photometer intercalibrations at all sites;
(3) Verification of site transfer gas standard integrity;
(4) Calibration of the particulate analyser electronic, flow measurement, and mass measurement systems.
(5) Analyser operational performance tests.

On completion of the intercalibration site visit, a form is left at the monitoring station by QA/QC Unit. The form summarises the results of the instrument tests. Any problems identified (eg failed NOX converter) will be reported immediately to the Management Unit. An example is shown in Appendix B4. Full details and results of the intercalibrations are reported in conjunction with the data ratification reports (see section 8.6).

As part of the overall QA/QC process, LSO's will be expected to attend the intercalibration visits as required for audit of their site responsibilities. A representative from the LSO organization will also be expected to attend the annual LSO meeting organized by the CMCU.

14 LSO TRAINING

It is essential that all LSOs are fully conversant with the site operation procedures documented in this manual and to this end QA/QC Unit will undertake to train at least one LSO per site. Each LSO trained by the QA/QC Unit may subsequently train further local site operators under the following conditions:

- The LSO conducting the training has had at least 6 months operational experience at an AURN site and has either been originally trained or successfully audited by QA/QC Unit
- An experienced LSO oversees the first one or two fortnightly calibrations conducted by the newly trained LSO
- After being trained, the new LSO is audited by QA/QC Unit at the earliest possible opportunity, for example, during the 6-monthly intercalibration exercise or ad-hoc site audit
- QA/QC Unit should be informed if training has taken place and the name of the new Site Operator

Formal retraining of LSOs by QA/QC Unit will only be mandatory if *all* the original trained LSOs have left the local authority.

15 EQUIPMENT SUPPORT UNIT PROCEDURES

15.1 Introduction

Monitoring systems can only be relied on to operate satisfactorily and reliably for extended periods of time if they are properly supported and maintained. In the AURN, the maintenance and support of the analysers and associated site infrastructure is undertaken by a number of Equipment Support Units (ESUs), which are usually equipment manufacturers, distributors or service agents.

Equipment Support Units are appointed and managed by the Management Units for defra and the DAs funded sites. In the case of affiliated sites, however, the local authority itself may be directly responsible for arranging the service and maintenance contract. A 'model' ESU contract specification is included in Appendix F for reference for affiliated site owners who appoint their own ESU.

Service and maintenance is of vital importance to the successful operation of the Network. As there are several different Equipment Support Units involved in the network, it is important to ensure that consistent operating procedures are followed, in order to achieve satisfactory data quality and capture rates throughout the network.

In order to ensure ESUs have sufficient resources (manpower and equipment) to carry out the work correctly, they may be subject to audit by the CMCU and/or the QA/QC Unit. The ESUs are expected to retain suitable and sufficient records of staff training, competence, equipment records (including proof of traceability) and service sheets for each contracted site visit.

A full technical description of the equipment service and maintenance procedures is not provided here, as these will differ from instrument to instrument and will be carried out following the manufacturer's recommendations. Instead, this section of the manual contains the basic operating guidelines for Equipment Support Units, describing the required service and maintenance support for the equipment used in the AURN.

The main tasks performed by ESUs are as follows:
i) Routine equipment service (6-monthly)
ii) Non-routine maintenance and breakdown repairs (emergency call-out)

Each of these tasks is described in more detail in the following sections. ESUs are also expected to attend the annual LSO meeting organised by the CMCU.

15.2 General Considerations for ESU Site Visits

The following considerations must be adhered to at all sites during both routine ESU service and emergency call-out visits:

1. On arrival at the site, check the pollutant levels on the analyser front panels and chart traces to see if an episode is occurring (i.e. pollution levels are above or close to the trigger values set out in Section 10.6). In the event of a pollution episode taking place contact the Management Unit before proceeding.

2. While analysers are being serviced or under test of any kind, activate the logger status switches (or "out-of-service" switches) to ensure that the analyser response outputs are not treated as ambient data. Reset the switches at the end of the visit. If no such mechanism for flagging data as invalid exists, then the Management Unit should be contacted and instructed to stop dissemination of the data until such time as the tests/service are complete.
3. Where appropriate, clearly mark the chart recorder traces with time/date and an indication of the test undertaken. The chart recorder settings should be appropriately selected to ensure all response outputs are within the scale of the chart trace.

Before each six-month service exercise, the ESU should make arrangements with the QA/QC unit to have their photometer(s) calibrated against the network reference instrument. The QA/QC unit will

contact all ESU's and request them to make photometers available for calibration one month prior to the start of the intercalibration exercise. ESUs are responsible for taking their photometers to the QA/QC Unit by arrangement for this work to be carried out.

15.3 Routine Equipment Service and Maintenance

Routine service and maintenance of the equipment at each site is carried out every six months, in conjunction with the QA/QC Unit intercalibration exercise. The servicing usually begins in January and July each year and is completed in accordance to a site visit schedule determined by the QA/QC and Management Units or Local Authority.

The ESUs must provide a timetable for the site service visits and this made available on the AURNHUB prior to each 6-monthly service exercise.

The service is carried out in three stages:

- Pre-service analyser tests and calibration,
- Equipment servicing,
- Post-service analyser calibration and tests.

Details of these procedures are as follows:

15.3.1 Pre-Service instrument checks and calibration

Immediately before the analysers are switched off-line for servicing, a full site calibration is undertaken together with basic analyser performance tests (See Table 15.1 below). The pre-service calibration is required to ensure that the analysers are functioning correctly prior to the service and that up-to-date calibration factors for the instruments are obtained for data scaling purposes.

Table 15.1: Pre-service Procedures

Procedure	Details
Pre-service analyser calibration	The analysers are calibrated in full accordance with the site operator's manual using the on-site gas calibration standards. The results are recorded on the routine calibration sheets and should be clearly marked as PRE-SERVICE results.
Ozone photometer calibration	The ozone analyser is calibrated against a reference photometer. A two-point calibration (at 0 and 200 ppb) is used to determine whether the agreement is to within ±5%. If the result is outside ±5%, then a full multi-point calibration (5 points and a zero) must be performed in order to provide a more accurate determination of the response deviation for data scaling purposes.
NOx converter efficiency	This test is undertaken to determine whether the converter needs replacing prior to service. Any reduction in converter efficiency will result in an under-estimation of measured NO_2 concentration. If the converter efficiency is found to be below 95% then the converter should be replaced.

	Converter efficiency is tested as follows: A high concentration of NO is diluted by zero air in a mixing vessel to a level near the upper range limit of the analyser. The NO2 concentration should be 250±20ppb. The response from the NO and NOx channels are recorded. The ozone generator is activated to oxidise a proportion of the NO present in the mixing vessel to NO_2. The converter efficiency is then determined from the relative change in NOx and NO outputs.

If the service is started within 14 days of the QA/QC intercalibration visit and the QA/QC unit did not identify any significant problems with the analysers (NOx converter efficiency was found to be >95%, ozone analyser found to be within ±5% of the reference photometer calibration), then these tests need not be repeated by the ESU.

15.3.2 Site Servicing

Routine service and maintenance of the instruments at each site is carried out according to the equipment manufacturer's recommendations. The visit also provides the opportunity to check, repair and/or replace many items of site infrastructure. Service details are given in Table 15.2 below. Typical procedures carried out during routine service and maintenance include:

- Replacement of all consumable components (e.g filters, scrubber materials, o-rings)
- Dismantling and cleaning of optical and other components
- Checking the integrity of the sampling system and pneumatic systems
- Lubrication of moving parts
- Checking and replacing batteries
- Electrical safety checks on analysers and ancillary site equipment (ie PAT testing in accordance with 'IEE Code of Practice for In-service Inspection and Testing of Electrical Equipment') on an annual basis.
- Testing and certification of the electrical supply circuit is recommended on a 5-yearly basis
- Annual testing and replacement (if necessary) of fire extinguisher units, first aid kits and any ladders at each site.

Table 15.2: General Servicing Procedures

Procedure	Details
Instrument servicing	The analysers are serviced according to the manufacturer's recommended procedures. **NOTE: The ozone analyser must be serviced first, in order to allow sufficient time for it to warm up and stabilise before recalibration**.
Other equipment	Other associated equipment used on site is serviced according to manufacturer's recommendations including, where applicable: ▪ Autocalibration facilities ▪ Loggers ▪ Modems ▪ Temperature probes

Sample manifold	The sample manifold and manifold fan are completely dismantled and cleaned. All PTFE sample lines exposed to ambient air, and up to the first sample inlet filter, are replaced. All other PTFE tubing is cleaned. If no manifold, sample line teflon tubing is to be completely replaced.
Zero air generators	For some sites the ESU will service and maintain the Zero Air Generator (ZAG) pumps and zero scrubbers. If requested by the CMCU the ESU will also change the PTFE lines between the ZAG and the instruments, and between the calibration gas cylinders and the instruments.
Air conditioning units	Service and maintenance of these units is carried out according to the manufacturer's recommendations, either by the ESU or other contracted service engineer.

15.3.3 Post-Service Calibration and Analyser Performance Tests

The process of servicing the instruments and associated equipment will usually change the response of the instrument from that obtained prior to service. For this reason, the instruments must be correctly configured and recalibrated before ambient sampling commences. After-service calibration and performance tests are therefore carried out to ensure that the equipment servicing has been successful and that the analysers are correctly set up for the next six months of operation. Post-service procedures are given in Table 15.3 below.

Table 15.3: Post-service Procedures

Procedure	Details
Leak tests	After service, the analyser's sampling and associated pneumatic systems are tested to ensure that no leaks are present.
Analyser reconfiguration	After a suitable stabilisation time (usually 24 hours) the NOx, SO_2 and CO analysers are reconfigured to show agreement with the gas calibration cylinders. **The ozone analyser is set to factory-default settings and adjusted to agree with a reference photometer.**
12-hour span drift test	The analysers are left overnight to sample span gas from the autocalibration system in order to determine any response drift. This can be readily quantified from the chart recorder trace. It may be necessary to ensure that the chart recorder is on an appropriate range to record the traces. In the case of the CO analyser and analyser systems which use gas cylinders for the autocalibration system, to conserve autocalibration gas, the instrument can be left sampling periodically between autocalibration, span and zero (e.g. once per hour).
Linearity test	A multi-point calibration of the analyser is carried out using five sample gas concentrations, evenly distributed across the analyser's normal running range, and a zero point. The span gas is generated using a high concentration gas species diluted with zero air. The analyser response is then plotted against the concentration of the span gas generated to give a measure of linearity.

NOx converter efficiency	This test only needs to be carried out if the converter has been replaced, adjusted or repaired during service.
Noise levels	The zero and span response noise are examined during tests or calibrations to ensure that they are within the manufacturer's specifications. The response noise can be easily quantified from the chart and logger outputs.
Response time	The response time for the analyser to reach 90% of its final value is examined during calibration. This can be readily quantified from the chart traces.
Kalman/Adaptive filtering	It is the preference of the QA/QC unit that this function is disabled for all analysers, and the corresponding time constant set to 30 seconds, which is a reasonable compromise between quick response and low noise.
Post-service analyser calibration	Before leaving the site, the NOx, SO_2 and CO analysers are calibrated in full accordance with the site operator's manual using the on-site gas calibration standards. A multi-point (five points and a zero in the range 0-250 ppb) calibration of the ozone analyser against the reference photometer is also performed. All calibration results are recorded on the routine calibration sheets and should be clearly marked as POST-SERVICE results.

15.4 Documentation of Service Visits

Routine service visits must be fully documented and describe in detail any adjustments modification or repairs undertaken. Results of the analyser tests performed during the service are recorded on the "Analyser Performance Test" form (see Appendix B2) provided, or with any other electronic or paper system which has previously been agreed with the QA/QC and Management Units. The service records, together with the pre and post-service calibration sheets, are faxed or e-mailed to the Management Unit and QA/QC Unit at the earliest opportunity and within 7 days at the latest. Contact details are given in Appendix E.

15.5 Emergency Call-out Visits

In the event of equipment breakdown or site problem, the ESU is required to carry out an emergency repair (or call-out) visit. Emergency call-outs are initiated by the management units or local authority responsible for the site.
The ESU is normally only called out to a site following an initial investigation by the local site operator. If the problem cannot be resolved by the site operator, then the ESU will be contacted.

In general, the ESU will be requested to attend the site in circumstances in which:

- Instrument malfunction affects data quality or loss of data;
- There is electronic or pneumatic instability of an instrument;
- Auto calibration checks are outside of acceptable tolerances as determined by the Management Unit;
- Instruments are not operating within the manufacturer's specifications;
- Manual calibration checks are outside acceptable tolerance limits, as determined by the Management Unit;
- Malfunctions are occurring with the sample manifold, data logging/telemetry or gas calibration systems.

The ESU is usually required to attend site and effect repairs within 48 hours of being notified by telephone, fax, e-mail or message pager. Call-out arrangements may, however, vary slightly depending on the agreement between the organisations involved. In many cases, the requirement for weekend cover by the ESU is not requested. It is important, however, that ESUs have adequate manpower and equipment spares provision to ensure that 90% data capture targets can be met.

The procedures undertaken during emergency call-outs are given in Table 15.4 below.

Table 15.4: Emergency call-out procedures

Procedure	Details
"As-found" calibration	Immediately before repair, adjustment or replacement of the analyser, it is calibrated "as-found" using the on-site calibration gas. This calibration is very important as it may give an indication of the effect of the response fault on ambient measurements; it is usually during periods when the analyser performance is suspect or faulty that the quality of the data recorded is of most concern. **Note:** **If a problem with the ozone analyser is suspected, then the ESU must take a reference photometer to the site and calibrate the analyser before and after repair.**
Repair	The fault is rectified as appropriate.
Post-repair calibration	The analyser must be allowed sufficient time to warm up after repair, adjustment or replacement. It is then calibrated using the on-site gas calibration standards. The serial number of any analysers being removed or installed must be clearly noted on the calibration records.

15.6 Documentation of Emergency Call-out Visits

All analyser checks and repairs carried out by the ESU must be carefully documented. For every emergency call-out visit a "Service Engineer's Emergency Call-out" form (see Appendix B3), or the form/spreadsheet agreed with the QA/QC and Management Units, is completed giving full details of the remedial action undertaken.

Where appropriate, diagrams or flow-schematics illustrating faults or repairs (e.g. damage to glass sample manifolds or location of sample leak) should also be included as these are useful for data ratification purposes. The emergency call-out form, together with any before and after repair calibration records must be faxed to the Management Unit and QA/QC Unit as soon as possible, and within 7 days at the latest.

15.7 Ad-hoc ESU Visits

It may, from time-to-time, be necessary for the ESU to undertake site visits between servicing to perform analyser checks or carry out modifications. Instrument modifications or repairs which will affect the calibrations of the analysers must not be carried out during these visits without prior agreement of the Management Unit. If adjustments or repairs are agreed, then the same calibration and reporting procedures, as carried out during an emergency call-out visit, should be followed.

15.8 Use of On-site Calibration Gas Standards

The gas standards supplier is responsible for the supply and verification of the on-site gas calibration cylinders. These standards are an expensive resource and as such should not be used for any other purpose other than those stated below.

- "As-found" calibrations either before service or repair;
- Post-service or repair calibrations; and
- Post-service reconfiguration of the analysers to agree with the standards.

Site calibration cylinders should not be used for long-term response drift, linearity tests or as a general source of test gas during servicing or repair without prior agreement of the gas standards supplier.

15.9 Photometer Calibration

All photometers used within the AURN are required to be calibrated traceable to a Reference Photometer. All ESU's must attend a calibration exercise arranged by QA/QC Unit twice a year for this purpose.

16 SUPPLY OF GAS CYLINDERS TO MONITORING SITES

A database of site cylinders, including pressure and concentration, is available on the AURN HUB website on the Internet. This is used by Air Liquide UK Ltd and QA/QC Unit to predict cylinder requirements.

From the details given, Air Liquide UK Ltd can see which cylinders are low and need replacing. Air Liquide UK Ltd will take an accredited cylinder from stock, contact the LSO and agree a convenient day for the cylinder delivery. About an hour before the delivery, the driver will call ahead to warn of his arrival at the site, allowing the LSO time to get there to receive the cylinder. It remains the responsibility of the LSO to unscrew and refit the gas pressure regulator to these cylinders (see Section 9.6). The Air Liquide UK Ltd driver (or contractor) will deliver the full cylinder, and also take away any empty cylinders on the site, whether from Air Liquide UK Ltd or any other supplier, and will return them to the owner. It is important that each cylinder, delivered or collected, is clearly recorded on the delivery note, by serial number.

Should there be a leak, or accidental discharge of gas, call the Air Liquide Emergency telephone number (01675 462695). This is a 24 hour help line who will give immediate advice.

Once the cylinder is empty, please phone Air Liquide UK Ltd Order Office (01675 467053), stating that you are from an AURN site, and they will deliver a replacement cylinder to the site as quickly as possible.

Air Liquide UK Ltd is also responsible for the gas pressure regulators on each site. If any regulators malfunction or are damaged, please contact Air Liquide UK Ltd and they will arrange its repair or replacement. All gas regulators are safety inspected every 5 years. Air Liquide will ask LSOs to return the regulators to them and they should be returned in time for the next scheduled calibration visit.

Air Liquide UK Ltd also supply the daily CO autocal cylinders, and zero air cylinders, to some sites.