A SITE OPERATIONAL PROCEDURES

A.1 Introduction

A major factor in ensuring high quality data from the Automatic Urban and Rural Network will be the regular visits to each monitoring site carried out by locally based personnel. These site visits will allow the following functions to be undertaken:

(1) Precalibration checks;

(2) Changing the particulate monitor filter (if applicable);

(3) Calibration of analysers;

(4) Postcalibration checks, safety and security inspection.

Together with these routine functions, there will be instances when non-routine site visits will be necessary, in the event of apparent instrument or system malfunction.

Local site operators will be trained in all aspects of normal equipment operation by the CMCU, and in the relevant calibration procedures by the QA/QC Unit. Operators must retain copies of instrument manuals at each site, and are required to familiarise themselves with normal operating principles and characteristics of the instrumentation.

Calibration procedures differ from instrument to instrument, but the basic principle is common to all analyser types, with the exception of the particulate analyser. As described in Chapter 10, routine calibrations will take the form of a simple two-point calibration. More detailed instrument tests will be undertaken by QA/QC Unit personnel, in combination with the 6 monthly instrument intercalibration and servicing exercises (see Chapter 13).

Each analyser must be calibrated exactly *as found*. In this way, any instrumental drifts which may have occurred since the previous calibration will be exactly quantified, with there being no possibility that changes in response have been caused by any operator action.

Acting only on advice from the CMCU, instrument adjustments may be performed to optimise analyser sensitivity. If such adjustments are found to be necessary, the instrument will be recalibrated after a suitable initial stabilisation period typically 15 minutes, so allowing the production of provisional revised calibration factors. However, full stabilisation of the instrument may take several hours and hence, ideally the instrument should be recalibrated after a further 24 hours. The CMCU will advise on this. It is not anticipated that instrument adjustments of this sort will be required frequently.

The following sections of the manual describe step-by-step procedures which must be followed during site visits. It is essential that the procedures are followed as written, for both routine and non-routine site visits, to ensure that reliable and accurate air quality measurements are made. However, the sequence in which zero and span calibrations are performed is not critical.

A.2 Preparation

1. Upon arrival at the site, check the pollutant levels on the front panel of each analyser to see if an episode is occurring i.e. pollution levels during the last hour are above, or close to, the trigger values as discussed in Section 10.6 (O_3 >~70 ppb, NO_2 >~75 ppb, SO_2 >~90 ppb and CO >~10 ppm). If an episode is occurring phone CMCU before proceeding any further.

2. Take a new set of check and calibration sheets and enter Site, Date and Operator and Start Time.

3. Ensure the Operational Manual is to hand, and follow the instructions carefully.

4. Ensure that the site toolkit (if provided) is complete.

A.3 Precalibration Checks

In this section, a number of initial visible checks are made on the equipment. Some checks require a tick and some require a value to be recorded on the precalibration sheet. Complete all the checks for all the analysers and ancillary equipment. When all checks are complete, inform the CMCU if any are not correct, before proceeding with the calibration.

A.3.1 CO Analyser

The Monitor Labs model ML9830 CO analyser has a liquid crystal display which in normal operation shows the current CO concentration, the operation mode of the analyser, time of day, date and a main menu option. This display is termed the 'primary screen'. If a failure condition is detected, a fault will be displayed on the status line above the operating mode line. If there are multiple failures, the failure at the top of the list will be displayed on the status line. When this failure clears, the next failure on the list will be displayed. The entire list of failures is displayed on the SYSTEM FAULTS menu screen.

1. Check the display and record the current readings and the current time on the precalibration checklist. Telephone the CMCU if the time displayed differs by more than 5 minutes from **G**reenwich **M**ean **T**ime.

2. If any fault messages are displayed, record these. Access to the faults list is by pressing SELECT when the cursor is flashing in the MAIN MENU option. Use the down arrow to move the cursor to the SYSTEM FAULTS option and then press SELECT. To return to the primary screen press EXIT twice.

3. Access the analysers internal parameters from the primary screen by pressing SELECT when the cursor is flashing in the MAIN MENU option. Using the down arrow move the cursor to the INSTRUMENT STATUS option and then press SELECT. Note the values of the parameters on the precalibration checklist. To return to the primary screen press EXIT twice.

A.3.2 NO_X Analyser

The Monitor Labs model ML9841A NO_X analyser has a liquid crystal display which in normal operation shows the current NO concentration, the operation mode of the analyser, time of day, date and a main menu option. This display is termed the 'primary screen'. If a failure condition is detected, a fault will be displayed on the status line above the operating mode line. If there are multiple failures, the failure at the top of the list will be displayed on the status line. When this failure clears, the next failure on the list will be displayed. The entire list of failures is displayed on the SYSTEM FAULTS menu screen.

1. Check the display and record the current readings and the current time on the precalibration checklist. Telephone the CMCU if the time displayed differs by more than 5 minutes from **G**reenwich **M**ean **T**ime.

2. If any fault messages are displayed, record these. Access to the faults list is by pressing SELECT when the cursor is flashing in the MAIN MENU option. Use the down arrow to move the cursor to the SYSTEM FAULTS option and then press SELECT. To return to the primary screen press EXIT twice.

3. Access the analysers internal parameters from the primary screen by pressing SELECT when the cursor is flashing in the MAIN MENU option. Using the down arrow move the cursor to the INSTRUMENT STATUS option and then press SELECT. Note the values of the parameters on the precalibration checklist. To return to the primary screen press EXIT twice.

A.3.3 SO_2 Analyser

The Monitor Labs model ML9850 SO_2 analyser has a liquid crystal display which in normal operation shows the current SO_2 concentration, the operation mode of the analyser, time of day, date and a main menu option. This display is termed the 'primary screen'. If a failure condition is detected, a fault will be displayed on the status line above the operating mode line. If there are multiple failures, the failure at the top of the list will be displayed on the status line. When this failure clears, the next failure on the list will be displayed. The entire list of failures is displayed on the SYSTEM FAULTS menu screen.

1. Check the display and record the current readings and the current time on the precalibration checklist. Telephone the CMCU if the time displayed differs by more than 5 minutes from **G**reenwich **M**ean **T**ime.

2. If any fault messages are displayed, record these. Access to the faults list is by pressing SELECT when the cursor is flashing in the MAIN MENU option. Use the down arrow to move the cursor to the SYSTEM FAULTS option and then press SELECT. To return to the primary screen press EXIT twice.

3. Access the analysers internal parameters from the primary screen by pressing SELECT when the cursor is flashing in the MAIN MENU option. Using the down arrow move the cursor to the INSTRUMENT STATUS option and then press SELECT. Note the values of the parameters on the precalibration checklist. To return to the primary screen press EXIT twice.

A.3.4 Ozone Analyser

The Monitor Labs model ML9850 O_3 analyser has a liquid crystal display which in normal operation shows the current O_3 concentration, the operation mode of the analyser, time of day, date and a main menu option. This display is termed the 'primary screen'. If a failure condition is detected, a fault will be displayed on the status line above the operating mode line. If there are multiple failures, the failure at the top of the list will be displayed on the status line. When this failure clears, the next failure on the list will be displayed. The entire list of failures is displayed on the SYSTEM FAULTS menu screen.

1. Check the display and record the current readings and the current time on the precalibration checklist. Telephone the CMCU if the time displayed differs by more than 5 minutes from **G**reenwich **M**ean **T**ime.

2. If any fault messages are displayed, record these. Access to the faults list is by pressing SELECT when the cursor is flashing in the MAIN MENU option. Use the down arrow to move the cursor to the SYSTEM FAULTS option and then press SELECT. To return to the primary screen press EXIT twice.

3. Access the analysers internal parameters from the primary screen by pressing SELECT when the cursor is flashing in the MAIN MENU option. Using the down arrow move the cursor to the INSTRUMENT STATUS option and then press SELECT. Note the values of the parameters on the precalibration checklist. To return to the primary screen press EXIT twice.

A.3.5 TEOM Particulate Monitor

The R & P TEOM instrument has a 4 line display screen, as shown in Figure D6 Appendix D. The top line is fixed, and displays, from left to right, current status code, current operating mode, percentage of filter lifetime used, current RS-232 mode and current time. The other 3 lines of the display can be used to scroll through a list of 16 information lines displaying various parameters. Use the cursor keys on the keypad to scroll up and down.

Two lights marked "POWER" and "STATUS" are also visible on the front panel.

Record the following information on the precalibration checklist.

1. In normal operation, the "POWER" switch will be on and the "STATUS" light off. Check these and record on the precalibration checklist.

2. Record current status code, current operating mode, percentage of filter lifetime used, current RS-232 mode and current time from the top line of the display. Telephone the CMCU if the time displayed differs by more than 5 minutes from **G**reenwich **M**ean **T**ime.

3. Record the first three information lines in the appropriate space on the precalibration checklist.

4. Press ↓ to scroll through all information lines and record the information.

5. Press ↑ to return to the top of the information lines.

6. Carry out a visual check that the PM10 head is intact.

A.3.6 Air Sampling Manifold (where fitted)

Record the following checks on the precalibration checklist.

1. Check that the sample manifold is intact and shows no sign of possible leakage.

2. Check that the blower motor is operating by listening and feeling for vibration on the motor housing.

3. Check that the instrument sample inlet tubes are connected to the manifold and the sample inlet port at the back of the instruments and that these connections are secure and leak-tight.

In the case of a passive manifold sampling system (i.e. Tubing from an inverted funnel) check that the tubing from the funnel is connected to the sample inlet port at the back of the instruments and that these connections are secure and leak tight. Check that the end of the sample tubing is just inside the lip of the funnel. Check the sample lines for visible obstructions and kinks and that the funnel is orientated so as to prevent rainwater entering the tubing.

A.3.7 Modem (where fitted)

1. Check that the lights on the modem are lit, the 25 way connector is secure, and the phone line is plugged into the BT socket. Record on the precalibration checklist.

A.3.8 Data Logger

The ENVIDAS logger is a fully integrated data-logger and system controller. There are few controls or indicators for the operator to interface with, therefore the operator is only required to observe and record the status of each pollutant channel.

1. Open the door on the front of the ENVIDAS logger module.

2. Observe (and record on the pre-calibration checks form) the status of the indicator lights for each pollutant channel.

3. Close the door on the logger module.

If any of the pollutant channels are switched to any state other than 'SAMPLE' (ie 'ZERO', 'SPAN', 'FILTER' or 'SERVICE') the management unit should be informed.

A.3.9 Chart Recorder (where fitted)

Perform the following visual check and record on the precalibration checklist.

1. Check that the RCD light on the display is on.

2. Check that the appropriate number of traces are clearly visible on the chart paper.

3. Inspect the chart paper to see that it is not jammed.

4. If the BAT light appears in the display then the battery back-up is low. Contact CMCU as soon as possible.

A.3.10 Zero Air Generation (where fitted)

Check the condition of the scrubber materials in the canisters, two of which are self indicating; silica gel turns from orange to clear and purafil from purple to brown as it becomes exhausted.

1. Check that at least 25% of the silica gel is still orange. If less than 25% of the silica gel is orange proceed to section A.3.11 - Changing the Silica Gel.

2. Check that at least 25% of the purafil is still purple. If less than 25% of the purafil is purple, note on the calibration record sheet, but continue with calibration.

3. Check the tubing from the canisters is secure and the lid is tight.

A.3.11 Changing the Silica Gel

If it is necessary to change the silica gel proceed as follows.

NOTE: If no silica gel is available, proceed with the full calibration of all analysers as normal, noting the fact that the silica gel needs replacing on the record sheet. Inefficient silica gel will only affect the zero on the CO analyser.

1. Remove the metal screw top, spring, metal and fabric spacer from the canister.

2. Empty the spent silica gel into a suitable container. The spent silica gel can be regenerated in an oven by the LSO or returned to NETCEN for

regeneration. Take care not to breathe in any silica gel dust, as it is harmful.

3. Refill the canister with the fresh silica gel retained on site.

4. The packing order of the components should be as shown in Figure D5.

5. Replace the metal and fabric spacers. Replace the spring. Ensure that the rubber "O" ring is situated in the screw on top of the canister. Screw the metal top on to the canister.

6. Mark the date of the change with a sticker on the silica gel canister.

7. Check the tubing from the canister is secure and the lid is tight.

A.3.12 Completion of Precalibration Checks

If any of the above checks are not correct, inform CMCU before proceeding with calibration.

If all correct, proceed to section A.4.

A.4 TEOM Particulate Monitor

The TEOM particulate monitor filter cartridge must be changed every 2/4 weeks (As advised by your CMCU) or when the "percentage of filter lifetime used", as shown on the top line of the instrument display is 80% or greater. It is recommended that the TEOM filter cartridge box is stored in the sensor unit of the TEOM analyser so they are pre-conditioned before they are changed with existing filters.

Whenever the filter cartridge is changed, the PM_{10} head must be cleaned as detailed below. Since the analyser requires at least one hour to stabilise after filter cartridge changing, it is recommended that this operation be undertaken before the calibration of the gas analysers. Whenever the filter is changed, complete the TEOM Filter Cartridge record sheet.

A.4.1 Cleaning the PM_{10} Head

The PM_{10} head is located on the sample inlet tube above the roof of the monitoring station. Use the ladder, with due regard to personal safety, to gain access to the monitoring station roof. Extra care should be taken if raining as the roof of the station may be slippery when wet.

The PM_{10} inlet needs to be cleaned each time the TEOM filter cartridge is changed to ensure optimal performance. The cleaning materials required are a small brush, lint free tissues, cotton buds, Decon 90 (1% in H_2O), silicon grease, and distilled water. All components are to be cleaned by soaking Decon 90 on lint-free tissues or cotton buds as appropriate. The component should then be rinsed with distilled water to remove any Decon 90.

A.4.2 Removing the PM_{10} Head

1. Switch the TEOM "out of service" switch to ON. If no switch has been explicitly fitted the ‘Data Stop’ button must be pressed.

2. Carefully lift the complete PM_{10} head assembly from the TEOM inlet tube.

3. Protect the inlet tube so that rain or snow cannot enter at any time whilst the head is removed, and take the head inside the monitoring station.

4. Separate the upper and lower inlet halves by unscrewing (counter-clockwise) the acceleration assembly from the collector assembly (see Fig. D7, Appendix D).

A.4.3 Cleaning the Acceleration Assembly

1. Mark the upper and lower plates of the assembly with a pencil so that the unit can be correctly aligned on reassembly.

2. Unscrew the four Philips screws from the top plate and remove the top plate and four spacers.

3. Clean the top plate, deflector cone, insect screen, internal walls and the underside plate.

4. Inspect the large diameter o-ring for wear and replace if necessary. Wipe any grease off with a tissue, and apply a thin coating of fresh silicon grease to the o-ring and the aluminium threads.

5. Careful reassemble, using the pencil marks to align the top and bottom plates.

A.4.4 Cleaning the Collector Assembly

1. Clean the walls, the three vent tubes and the base of the assembly with a lint-free cloth soaked in Decon 90. Rinse with distilled water.

2. Use cotton buds and Decon 90 to clean the three vent tubes, base of the assembly and weep hole in the collector plate where the moisture runs out to the moisture trap. Rinse with distilled water.

3. Disconnect rain jar assembly from lower collector plate assembly. Clean inside brass tube with cotton buds and Decon 90. Rinse with distilled water.

4. Remove the rain jar and clean. For units with a cork sealing ring inside the cap of the jar, put a thin coating of silicon grease on the gasket and install the jar. If the sealing gasket is neoprene, no silicon grease is required.

5. Reconnect rain jar assembly to lower collector assembly. Ensure rain jar is sitting vertically.

6. Inspect the two inlet tube o-rings for wear and replace if necessary. Wipe off any grease present, and apply a thin coating of fresh silicon grease to the o-rings.

7. Clean the internal threads of the assembly with Decon 90 on a lint-free tissue.

A.4.5 Replacing the Head

1. Screw the Acceleration and Collector assemblies together until the threads are hand tight. DO NOT OVER-TIGHTEN.

2. Place the complete assembly back onto the TEOM inlet tube.

A.4.6 Filter Cartridge Exchange Procedure

1. Refer to Figs D8 and D9 (Appendix D) when following the instructions for filter exchange. It is recommended that the TEOM filter cartridge box is stored in the sensor unit of the TEOM analyser so they are pre-conditioned before changing. Inform the CMCU when the site stock of unused filters reach four.

2. Check that the TEOM 'out of service' switch/'Data Stop' button is ON.

3. Open the door of the TEOM sensor unit.

4. Carefully lift the handle of the mass transducer to swing the transducer into its filter changing position and expose the filter.

5. Carefully insert the filter exchange tool under the filter cartridge so that the filter disk is between the fork and the upper plate of the tool (with the hub of the filter between the tines of the lower form). Gently lift the

filter from the tapered element with a straight pull - DO NOT TWIST OR PULL SIDEWAYS.

6. Discard the exposed cartridge and wipe clean the exchange tool with a tissue.

7. Use the exchange tool to remove a new cartridge from the box - DO NOT TOUCH THE FILTER WITH YOUR FINGERS. Note that the box of new filters should be stored inside the TEOM sensor unit, to maintain them at a constant temperature.

8. Hold the new filter in line with the tapered element and lightly insert the hub of the filter onto the tip of the tapered element. Apply a gentle downward pressure to set the filter firmly in place and then carefully retract the exchange tool. Problems with excessive response noise may be experienced if the filter is not seated correctly and firmly on the tip of the tapered element. The filter should, therefore, be positioned with particular care.

9. Gently move the horizontal handle downwards to close the mass transducer; allow the springs to pull it closed for the last centimetre.

10. Close the door of the TEOM sensor unit.

11. After 5 minutes, open the sensor unit and mass transducer again and push down on the filter with the base of the exchange tool. This is to ensure that no movement of the cartridge has occurred during heating of the transducer.

12. Close the door of the TEOM sensor unit.

13. Press <F1> on the TEOM control unit . The TEOM will move through its operational modes as internal parameters stabilise. Check the noise value at the bottom of the display reads <0.1 after 10 minutes. If this is not the case reseat the filter. If this does not reduce the 'noise' sufficiently return to A.4.2.1 and repeat the whole procedure. If this is not successful inform the CMCU immediately.

14. Switch the TEOM 'out of service' switch to 'off'. If no out of service switches are fitted the TEOM will return to service automatically on reaching mode 4. If this is not successful inform the CMCU immediately.

15. After one hour check that TEOM noise level on the chart recorder(if present) trace is within 60 µg/m^3 (~7 vertical chart divisions). If greater than this, attempt to re-seat the filter. If still excessively noisy, contact CMCU.

A.5 Analyser Calibration Procedure

Results of the calibration will be taken from the instrument's display for recording on the calibration record sheets. The on-site chart recorder (if present) is to be used to determine that the instrument has fully stabilized in its response to the gas sample being introduced at its inlet.

When closing the calibration gas cylinder valves, care should be taken not to overtighten the valves on the gas regulator. Overtightening can damage the needle valve mechanism resulting in the outlet valve failing to open. The main valve on the top of each cylinder should, however, be tightly closed to avoid venting the cylinder.

A.5.1 Instructions for Changing Chart Speed Prior to Calibrations (where chart present)

1. Instructions for changing the chart speed settings will obviously depend on the make and model. In case of uncertainty contact your CMCU for advise.

A5.2 Analyser Stability Criteria

The ML98XX series analysers show both an instantaneous and an average concentration on the front panel display. By examining both of these values, the analyser stability can be assessed. During calibration, if both values are the same (± 2 ppb for NO, NO_X, SO_2 and O_3 and ±0.1 ppm for CO) then the analyzer can be considered to have stabilised.

A.5.3 CO Analyser

The two point calibration of the carbon monoxide analyser will be undertaken during each site visit or in the rare event of an analyser adjustment. The calibration will be carried out as follows:

1. Record the instrument serial number on the calibration record sheet.

2. Open the door on the front of the ENVIDAS logger module and press the relevant button to set the CO analyser to 'ZERO'. This sets the solenoid valves to indroduce zero gas to the analyser whilst also flagging the data as calibration data and not to be used.

3. Allow the analyser to stabilise on zero air for a period of not less than 10 minutes. Verify that stabilisation has occurred on the chart recorder (if present), i.e. the CO recorder trace does not vary by more than 1 scale division in one centimetre along the time axis or 0.1 - 0.2 ppm on the instrument front panel. The CO trace is channel number 4 and is coloured blue.

4. Record three consecutive CO readings from the instrument display, allow 10 seconds between each reading.

5. On the front of the ENVIDAS logger module press the relevant button to set the CO analyser to 'SPAN'. This sets the solenoid valves to indroduce span gas to the analyser whilst also flagging the data as calibration data and not to be used.

6. Read the cylinder pressure of the CO in air calibration cylinder from the right hand dial and cylinder number from the label on the cylinder, and enter these on the calibration sheet. Do not use the cylinder if the pressure indicated is less than 300 psi (approx. 20 bar). In this event contact CMCU immediately.

7. Allow the analyser to stabilise on this sample for a period of not less than 10 minutes. Verify that stabilisation has taken place by examining the chart recorder (if present), i.e. the CO recorder trace does not vary by more than 1 scale division in one centimetre along the time axis or 0.2ppm on the analyser front panel.

8. Record three consecutive CO readings from the data logger or instrument display (depending on site configuration). The signal should show a large deflection from the zero point previously obtained.

9. By considering previous calibration results and the chart recorder trace(if present) obtained from the calibration just performed, satisfy yourself that the calibration has proceeded successfully. The zero value should not differ by more than ~0.5 ppm from the previous calibration. The span calibration value should not differ by more than 5% from that obtained during the previous calibration. If in doubt, repeat the relevant procedure. If the results of this are also unsatisfactory, contact the CMCU.

10. Change the CO analyser sample inlet filter, following the instructions given in part A.5.6 of this section.

11. On the front of the ENVIDAS logger module press the relevant button to set the CO analyser to 'SAMPLE' when the analyser has fallen to the ambient levels seen prior to the calibration.

A.5.4 NO_X Analyser

The two point calibration of the Nitrogen Oxides analyser will be undertaken during each site visit or in the rare event of an analyser adjustment. The calibration will be carried out as follows:

1. Record the instrument serial number on the calibration record sheet.

2. Open the door on the front of the ENVIDAS logger module and press the relevant button to set the NO_X analyser to 'ZERO'. This sets the solenoid valves to indroduce zero gas to the analyser whilst also flagging the data as calibration data and not to be used.

3. Allow the analyser to stabilise on zero air for a period of not less than 10 minutes. Verify that stabilisation has occurred on the chart recorder (if present), i.e. the NO_X and NO recorder traces do not vary by more than 1 scale division in one centimetre along the time axis or 2 ppb on the instrument front panel. The NO_X trace is channel number 1 and the NO trace is channel number 2.

4. Record three consecutive sets of NO_X , NO, NO_2 readings from the instrument display, allow 10 seconds between each reading.

5. On the front of the ENVIDAS logger module press the relevant button to set the NO_X analyser to 'SPAN'. This sets the solenoid valves to indroduce span gas to the analyser whilst also flagging the data as calibration data and not to be used.

6. Read the cylinder pressure of the NO in nitrogen calibration cylinder from the right hand dial and cylinder number from the label on the cylinder, and enter these on the calibration sheet. Do not use the cylinder if the pressure indicated is less than 300 psi (approx. 20 bar). In this event contact CMCU immediately.

7. Allow the analyser to stabilise on this sample for a period of not less than 10 minutes. Verify that stabilisation has taken place by examining the chart recorder (if present), i.e. the NOX and NO recorder traces do not

vary by more than 1 scale division in one centimetre along the time axis or 2ppb on the analyser front panel.

8. Record three consecutive sets of NO_X , NO, NO_2 readings from the instrument display. The signal should show a large deflection from the zero point previously obtained.

9. By considering previous calibration results and the chart recorder trace(if present) obtained from the calibration just performed, satisfy yourself that the calibration has proceeded successfully. The zero value should not differ by more than 4 ppb from the previous calibration. The span calibration value should not differ by more than 5% from that obtained during the previous calibration. If in doubt, repeat the relevant procedure. If the results of this are also unsatisfactory, contact the CMCU.

10. Change the NO_X analyser sample inlet filter, following the instructions given in part A.5.6 of this section.

11. On the front of the ENVIDAS logger module press the relevant button to set the NO_X analyser to 'SAMPLE' when the analyser has fallen to the ambient levels seen prior to the calibration.

A.5.5 SO_2 Analyser

The two point calibration of the Sulphur Dioxide analyser will be undertaken during each site visit or in the rare event of an analyser adjustment. The calibration will be carried out as follows:

1. Record the instrument serial number on the calibration record sheet.

2. Open the door on the front of the ENVIDAS logger module and press the relevant button to set the SO_2 analyser to 'ZERO'. This sets the solenoid valves to indroduce zero gas to the analyser whilst also flagging the data as calibration data and not to be used.

3. Allow the analyser to stabilise on zero air for a period of not less than 10 minutes. Verify that stabilisation has occurred on the chart recorder (if present), i.e. the SO_2 recorder trace does not vary by more than 1 scale division in one centimetre along the time axis or 2 ppb on the instrument front panel. The SO_2 trace is channel number 3.

4. Record three consecutive SO_2 readings from the instrument display, allow 10 seconds between each reading.

5. On the front of the ENVIDAS logger module press the relevant button to set the SO_2 analyser to 'SPAN'. This sets the solenoid valves to indroduce span gas to the analyser whilst also flagging the data as calibration data and not to be used.

6. Read the cylinder pressure of the SO_2 in air calibration cylinder from the right hand dial and cylinder number from the label on the cylinder, and enter these on the calibration sheet. Do not use the cylinder if the pressure indicated is less than 300 psi (approx. 20 bar). In this event contact CMCU immediately.

7. Allow the analyser to stabilise on this sample for a period of not less than 10 minutes. Verify that stabilisation has taken place by examining the chart recorder (if present), i.e. the SO_2 recorder trace does not vary by more than 1 scale division in one centimetre along the time axis or 2ppb on the analyser front panel.

8. Record three consecutive SO_2 readings from the data logger or instrument display (depending on site configuration). The signal should show a large deflection from the zero point previously obtained.

9. By considering previous calibration results and the chart recorder trace(if present) obtained from the calibration just performed, satisfy yourself that the calibration has proceeded successfully. The zero value should not differ by more than ~4 ppb from the previous calibration. The span calibration value should not differ by more than 5% from that obtained during the previous calibration. If in doubt, repeat the relevant procedure. If the results of this are also unsatisfactory, contact the CMCU.

10. Change the SO_2 analyser sample inlet filter, following the instructions given in part A.5.6 of this section.

11. On the front of the ENVIDAS logger module press the relevant button to set the SO_2 analyser to 'SAMPLE' when the analyser has fallen to the ambient levels seen prior to the calibration.

A.5.6 Ozone Analyser

The two point calibration of the Ozone analyser will be undertaken during each site visit or in the rare event of an analyser adjustment. The calibration will be carried out as follows:

1. Record the instrument serial number on the calibration record sheet.

2. Open the door on the front of the ENVIDAS logger module and press the relevant button to set the O_3 analyser to 'ZERO'. This sets the solenoid valves to indroduce zero gas to the analyser whilst also flagging the data as calibration data and not to be used.

3. Allow the analyser to stabilise on zero air for a period of not less than 10 minutes. Verify that stabilisation has occurred on the chart recorder (if present), i.e. the O_3 recorder trace does not vary by more than 1 scale division in one centimetre along the time axis or 2 ppb on the instrument front panel. The O_3 trace is channel number 5.

4. Record three consecutive O_3 readings from the instrument display, allow 10 seconds between each reading.

5. On the front of the ENVIDAS logger module press the relevant button to set the O_3 analyser to 'SPAN'. This sets the solenoid valves to indroduce span gas to the analyser whilst also flagging the data as calibration data and not to be used.

6. Allow the analyser to stabilise on this sample for a period of not less than 10 minutes. Verify that stabilisation has taken place by examining the chart recorder (if present), i.e. the O_3 recorder trace does not vary by more than 1 scale division in one centimetre along the time axis or 2ppb on the analyser front panel.

7. Record three consecutive O_3 readings from the data logger or instrument display (depending on site configuration). The signal should show a large deflection from the zero point previously obtained.

8. By considering previous calibration results and the chart recorder trace(if present) obtained from the calibration just performed, satisfy yourself that the calibration has proceeded successfully. The zero value should

not differ by more than ~2 ppb from the previous calibration. The span calibration value should not differ by more than 10% from that obtained during the previous calibration. If in doubt, repeat the relevant procedure. If the results of this are also unsatisfactory, contact the CMCU.

9. Change the O_3 analyser sample inlet filter, following the instructions given in part A.5.6 of this section.

10. On the front of the ENVIDAS logger module press the relevant button to set the O_3 analyser to 'SAMPLE' when the analyser has fallen to the ambient levels seen prior to the calibration.

A.5.7 Changing Analyser Sample Inlet Filters

The analyser sample inlet filters situated on the front of the instrument rack will be changed on a fortnightly basis at all sites. In the event of a filter appearing badly soiled, the site operator shall inform the CMCU.

Detailed instructions for sample inlet filter changing:

1. Unscrew the front of the filter holder.
2. Lift the top cover of filter holder off bottom section.
3. Inspect filter for signs of excessive soiling. Inspect the perimeter of the filter holder for signs of wear and the effectiveness of the filter holder clip.
4. Take clean filter from box using the tweezers supplied and insert into base of filter holder.
5. Replace top of filter holder and secure.
6. Check that Teflon lines to filter holder are well secured.

A.5.8 Chart Recorder

A.5.8.1 Instructions for Changing Chart Speed After Calibration:

Instructions for changing the chart speed settings will obviously depend on the make and model. In case of uncertainty contact your CMCU for advise.

Check if the recorder chart paper needs to be replaced by following the instructions below.

A.5.8.2 Instructions on Inspecting Chart Paper Supply and Replacement of Paper

Instructions for inspecting chart paper supply and replacement of paper will obviously depend on the make and model. In case of uncertainty contact your CMCU for advise.

A.5.8.3 Instructions for resetting date/time

Instructions for resetting date/time will obviously depend on the make and model. In case of uncertainty contact your CMCU for advise.

A.5.9 Changing the daily CO cylinder.

Some network sites employ separate cylinders for weekly calibration and daily autocalibration, as this is not the case for ENVIDAS equipped monitoring stations there will be no need to change a daily CO cylinder.

A.6 Postcalibration Checks, Safety and Security Inspection

As the AURN reports time-averaged concentration data, it is important that operators critically assess the operating condition of the analysers over the time scales used in making discrete measurements. Such assessments may not be possible by consideration of averaged data, as the averaging process may mask such factors as excessive analyser noise or cyclic response changes. Information on analyser performance over very short time periods is important, as this will alert network managers and the QA/QC Unit as to whether instrumentation faults are developing.

Performing calibration checks at regular scheduled intervals, as detailed previously, is an excellent means of assessing instrument performance characteristics. For instance, excessive rise or fall times, possibly due to flow constrictions having developed, will be easily noted by a simple calibration of the analyser. Similarly, "noisy" analyser outputs, which may be caused by inefficient photomultiplier tube cooling systems, will be immediately apparent by observing the analyser output while sampling zero air.

Operators will also be expected to examine backup chart recorder traces (if available) whilst on-site. These again may highlight problems which are not apparent by consideration of telemetry data. Considering each trace in turn, the operator should verify that the traces are normal. The trace should show some degree of variation with time: for instance, in the case of primary pollutants such as NO_X and CO, there should normally be a peak corresponding to the morning rush hour. Pollutants such as NO_X and CO would be expected to rise and fall in phase with each other, whereas NO_X and O_3 traces would generally be out of phase. The operator should verify that a continuous trace is being recorded i.e. there are not excessively high levels of instrument noise, and that the daily zero span autocalibration cycle has taken place. The chart traces for the autocalibrations should be examined closely to verify that the instrument fully stabilises on both zero and span gas during the autocalibration cycle. In addition, seemingly unimportant occurrences, such as an analyser air pump being noisy, may be indicative that the unit is liable to malfunction; this should be reported by the operator.

Obviously, the level to which these problems will be detected will depend upon the experience and familiarity with the equipment of each individual operator,

but the operator must critically review the calibration he/she has undertaken and comment on any unusual or suspect results or occurrences. In addition, the postcalibration check sheet must be completed as follows:

1. All checks detailed in section A.3 must now be repeated and recorded on the postcalibration check sheet as follows:

   (i) CO Analyser

   (ii) NO_X Analyser

   (iii) SO_2 Analyser

   (iv) Ozone Analyser

   (v) TEOM (not required when filter not changed)

   (vi) Air Sampling Manifold (not required if precalibration was OK)

   (vii) Modem

   (viii) Data Logger

   (xi) Chart Recorder

   Compare the results of the post calibration checks to the precalibration values. If any there are any large unexpected changes notify the CMCU

2. Complete the final check section of the postcalibration check sheet if no out of service switches are present telephone the CMCU to notify them that the calibration is complete so that they may restore data dissemination.

3. Complete the gas cylinder pressure table at the end of the calibration sheets.

4. Complete the calibration end time.

5. Inspect the cabinet inside and outside for security and safety purposes, paying particular attention to electrical and telephone connections. Check for any signs of vandalism, especially if this may affect safety or

lead to a deterioration in data quality. Immediate action must be taken to rectify any situation which may lead to members of the public or monitoring personnel being at risk.

6. Check that the roof area and fittings are secure, that there are no loose items left on the roof and stow any site ladder safely inside the monitoring station.

7. Check that all cylinders except the CO autocal cylinder are firmly closed and all cylinders are secure.

8. Ensure the cabinet is clean and tidy.

9. Upon completion of the calibration and on returning to your office, photocopy the entire check-lists and calibration sheets. These copies should be faxed to the Casella Stanger (CMCU), fax number 0207 261 1425 and also to **netcen** (QA/QC unit), fax number 0870 190 6610. Keep the copies at your office and when you next visit the site return the original calibration sheets to the monitoring site. In this way a backup will be kept of the calibration history of all the instruments.