APPENDIX A - SITE OPERATIONAL PROCEDURES

A1 Introduction

A major factor in ensuring high quality 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;

(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 MU, 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 MU, 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 MU 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.

A2 Preparation

1. Upon arrival at the site the PC's monitor may be switched off, this is often done to preserve the life of the screen. If the monitor is found switched off then the power button on the monitor should be switched on. The screen will now display the overview screen of the logging program. The top half of the screen shows the current pollutant levels in numeric format. The format of the displayed data can be either as raw mV or scaled in ppb/ppm. The units are displayed at the top of each numeric value. Corrected, ppm/ppb data can be selected by pulling down the "Display" menu, selecting the "Data" sub menu and then choosing "Processed". Select raw mV data by pulling down the "Display" menu, selecting the "Data" sub menu and then choosing "raw".

Beneath each display box are three “LEDs”, which indicate whether that analyser is in Run mode, whether there is an alarm active (instantaneous exceedence) or whether there is an active analyser fault.

2. Check that there are no faults active on any of the analysers. If any faults are active then this will be indicated by a caption at the top right of the screen reading "Master Fault". Which analyser has the active fault is flagged by the fault “LED” under the numeric pollutant level being red.

   The fault condition can be further investigated by changing the screen displayed to the screen for the particular analyser, which is being flagged as having an active fault. This is done by pulling down the "Screen" menu at the top left of the screen, and then selecting the desired analyser screen.

   Once the analyser screen is being displayed, the active faults can be viewed by selecting the faults list box. Note which faults are active and consult the MU before proceeding further with the calibration. Return to the overview screen using the "screen" menu at the top left corner of the screen

3. The overview screen displays the current pollutant levels. Check that the data is being displayed scaled with the current calibration factors, this will be indicated by the units (ppb) or (ppm) being displayed above each numeric pollutant value. If the units are displayed as (mV) then the data display should be changed to "Processed", using the "Display" menu. Check these levels on the screen to see if an episode is occurring i.e. the current pollution levels 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 MU before proceeding any further. When the calibration procedure is started, the last hours data is automatically displayed, this is discussed below in Section A5.

A3 Precalibration Checks

1. The lower panel of the Ambilog overview screen shows 6 thermometer style indicators, each of these displays the output of an internal sensor, measuring the system operating conditions. Note the values for each of these sensors on the precalibration sheet, at the appropriate place and record any fault indication that is displayed, in the comments section of the pre-calibration check list.

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

3. Ensure that the toolkit supplied with the site is complete.

A3.1 CO Analyser

Ensure the display is reporting raw data units by following the procedure in section A3 paragraph 1.

The dedicated screen for the CO analyser can be accessed through the "Screens" menu. This displays the following screen:

The Ambirak CO analyser has three status “LEDs” which indicate the analyser status.

The Sample “LED” is green when the analyser is drawing gas from the sample manifold inlet. Otherwise it is grey.

The Alarm “LED” is yellow if the instantaneous pollutant level exceeds the user configurable threshold. Otherwise it is grey.

The Fault “LED” is red if any analyser fault or warning conditions are active.

During normal sample operation the status of the “LEDs” will be:

Sample “LED”	ON
Alarm “LED”	OFF
Fault “LED”	OFF

The Ambilog software can be operated in two modes. The mode can be changed via the "Access" menu option.

Logging Mode: One minute averages are logged, the controls in the bottom panel on the screen are inactive. They are visible to allow the user to inspect the current status, but are greyed out so that the status cannot be changed.

Control Mode: This mode can only be accessed by entering a user password. The controls at the bottom of the screen are active and the mode of the analyser can be changed. The one minute

averages are not logged while in control mode, but are buffered by dedicated hardware in the Ambirak. When the system returns to logging mode, these buffered averages are collected. After 45 minutes in Control mode, the system automatically reverts to Logging mode.

If the system automatically reverts to logging mode then each analyser is automatically put into run mode. If the user manually switches to Control mode, via the "Access" menu, then the current analyser mode is retained in Logging mode. In this way it is possible, for instance, to log while the analyser is in zero mode, to check the zero stability.

At the bottom left of the screen is a mode switch. While in control mode this can be used to select the analyser mode. Each analyser can be in one of four modes:

Sample mode: Gas is drawn through the analyser from the sample manifold. The system and analyser are automatically configured for data sampling.

Zero mode: Gas is drawn from an integral zero air generator. This mode is used for regular checks of the zero response, and is not used for calibration. A separate zero air source is used during the calibration. The system and analyser are automatically configured for data sampling.

Span mode: Gas is drawn from a gas bottle. This mode is used for regular checks of the span response, and is not used for calibration. A separate gas bottle source is used during the calibration. The system and analyser are automatically configured for data sampling.

Standby Mode: The system and analyser are not automatically configured for data sampling. All controls are enabled. This mode is used for service and maintenance.

The other controls available are:

Pump button: The pump is always on, unless the analyser is in standby mode. This should never be changed without reference to the MU.

Range switch: The range of the analyser should never be changed without reference to the MU.

Record the status of each of the above indicators on the pre-calibration checklist at the appropiate places.

A3.2 NO_X Analyser

Ensure the display is reporting raw data units by following the procedure in section A3 paragraph 1.

The dedicated screen for the NOx analyser can be accessed through the "Screens" menu. This displays the following screen:

The Ambirak NOx analyser has three numeric values displayed, one each for NO, NOx and NO2. Underneath each of these are three status “LEDs” which indicate the analyser status.

The Sample “LEDs” are green when the analyser is drawing gas from the sample manifold inlet. Otherwise they are grey.

The Alarm “LEDs” are yellow if the instantaneous pollutant level exceeds the user configurable threshold. Otherwise they are grey.

The Fault “LEDs” are red if any analyser fault or warning conditions are active.

During normal sample operation the status of the “LEDs” will be:

Sample “LED”	ON
Alarm “LED”	OFF
Fault “LED”	OFF

The Ambilog software can be operated in two modes. The mode can be changed via the "Access" menu option.

Logging Mode: One minute averages are logged, the controls in the bottom panel on the screen are inactive. They are visible to allow the user to inspect the current status, but are greyed out so that the status cannot be changed.

Control Mode: This mode can only be accessed by entering a user password. The controls at the bottom of the screen are active and the mode of the analyser can be changed. The one minute averages are not logged while in control mode, but are buffered

by dedicated hardware in the Ambirak. When the system returns to logging mode, these buffered averages are collected. After 45 minutes in Control mode, the system automatically reverts to Logging mode.

If the system automatically reverts to logging mode then each analyser is automatically put into run mode. If the user manually switches to Control mode, via the "Access" menu, then the current analyser mode is retained in Logging mode. In this way it is possible, for instance, to log while the analyser is in zero mode, to check the zero stability.

At the bottom left of the screen is a mode switch. While in control mode this can be used to select the analyser mode. Each analyser can be in one of four modes:

Sample mode: Gas is drawn through the analyser from the sample manifold. The system and analyser are automatically configured for data sampling.

Zero mode: Gas is drawn from an integral zero air generator. This mode is used for regular checks of the zero response, and is not used for calibration. A separate zero air source is used during the calibration. The system and analyser are automatically configured for data sampling.

Span mode: Gas is drawn from an internal permeation tube oven that generates NO_2. This mode is used for regular checks of the span response, and is not used for calibration. A separate gas bottle source is used during the calibration. The system and analyser are automatically configured for data sampling.

Standby Mode: The system and analyser are not automatically configured for data sampling. All controls are enabled. This mode is used for service and maintenance.

The other controls available are:

Converter mode: The analyser bench itself always measures NO. By drawing the sampled gas through a converter, any NO2

can be converted to NO. The analyser is then reading the total NOx value. The converter switch can be used to lock the analyser into either NO mode, NOx mode, or cycle mode. In cycle mode the converter is cycled between measuring NO and NOx. In this was the NO2 level can be calculated. The analyser should always be in cycle mode.

Pump button: The pump is always on, unless the analyser is in standby mode. This should never be changed without reference to the MU.

Ozonator button: The ozonator is always on, unless the analyser is in standby mode. This should never be changed without reference to the MU.

Range switch: The range of the analyser should never be changed without reference to the MU.

Record the status of each of the above indicators on the pre-calibration checklist at the appropiate places.

A3.3 SO_2 Analyser

Ensure the display is reporting raw data units by following the procedure in section A3 paragraph 1.

The dedicated screen for the SO_2 analyser can be accessed through the "Screens" menu. This displays the following screen:

The Ambirak SO2 analyser has three status “LEDs” which indicate the analyser status.

The Sample “LED” is green when the analyser is drawing gas from the sample manifold inlet. Otherwise it is grey.

The Alarm “LED” is yellow if the instantaneous pollutant level exceeds the user configurable threshold. Otherwise it is grey.

The Fault “LED” is red if any analyser fault or warning conditions are active.

During normal sample operation the status of the “LEDs” will be:

Sample “LED”	ON
Alarm “LED”	OFF
Fault “LED”	OFF

The Ambilog software can be operated in two modes. The mode can be changed via the "Access" menu option.

Logging Mode: One minute averages are logged, the controls in the bottom panel on the screen are inactive. They are visible to allow the user to inspect the current status, but are greyed out so that the status cannot be changed.

Control Mode: This mode can only be accessed by entering a user password. The controls at the bottom of the screen are active and the mode of the analyser can be changed. The one minute averages are not logged while in control mode, but are buffered by dedicated hardware in the Ambirak. When the system returns

to logging mode, these buffered averages are collected. After 45 minutes in Control mode, the system automatically reverts to Logging mode.

If the system automatically reverts to logging mode then each analyser is automatically put into run mode. If the user manually switches to Control mode, via the "Access" menu, then the current analyser mode is retained in Logging mode. In this way it is possible, for instance, to log while the analyser is in zero mode, to check the zero stability.

At the bottom left of the screen is a mode switch. While in control mode this can be used to select the analyser mode. Each analyser can be in one of four modes:

Sample mode: Gas is drawn through the analyser from the sample manifold. The system and analyser are automatically configured for data sampling.

Zero mode: Gas is drawn from an integral zero air generator. This mode is used for regular checks of the zero response, and is not used for calibration. A separate zero air source is used during the calibration. The system and analyser are automatically configured for data sampling.

Span mode: Gas is drawn from a permeation tube oven that generates SO2. This mode is used for regular checks of the span response, and is not used for calibration. A separate gas bottle source is used during the calibration. The system and analyser are automatically configured for data sampling.

Standby Mode: The system and analyser are not automatically configured for data sampling. All controls are enabled. This mode is used for service and maintenance.

The other controls available are:

Pump button: The pump is always on, unless the analyser is in standby mode. This should never be changed without reference to the MU.

Lamp button: The lamp is always on, unless the analyser is in standby mode. This should never be changed without reference to the MU.

Range switch: The range of the analyser should never be changed without reference to the MU.

Optic Check: This is used as an internal check of the analyser bench. This is only used for maintenance and service and should never be changed without reference to the MU.

Record the status of each of the above indicators on the pre-calibration checklist at the appropiate places.

A3.4 Ozone Analyser

Ensure the display is reporting raw data units by following the procedure in section A3 paragraph 1.

The dedicated screen for the ozone analyser can be accessed through the "Screens" menu. This displays the following screen:

The Ambirak ozone analyser has three status “LEDs” which indicate the analyser status.

The Sample “LED” is green when the analyser is drawing gas from the sample manifold inlet. Otherwise it is grey.

The Alarm “LED” is yellow if the instantaneous pollutant level exceeds the user configurable threshold. Otherwise it is grey.

The Fault “LED” is red if any analyser fault or warning conditions are active.

During normal sample operation the status of the “LEDs” will be:

Sample “LED”	ON
Alarm “LED”	OFF
Fault “LED”	OFF

The Ambilog software can be operated in two modes. The mode can be changed via the "Access" menu option.

Logging Mode: One minute averages are logged, the controls in the bottom panel on the screen are inactive. They are visible to allow the user to inspect the current status, but are greyed out so that the status cannot be changed.

Control Mode: This mode can only be accessed by entering a user password. The controls at the bottom of the screen are active and the mode of the analyser can be changed. The one minute averages are not logged while in control mode, but are buffered by dedicated hardware in the Ambirak. When the system returns

to logging mode, these buffered averages are collected. After 45 minutes in Control mode, the system automatically reverts to Logging mode.

If the system automatically reverts to logging mode then each analyser is automatically put into run mode. If the user manually switches to Control mode, via the "Access" menu, then the current analyser mode is retained in Logging mode. In this way it is possible, for instance, to log while the analyser is in zero mode, to check the zero stability.

At the bottom left of the screen is a mode switch. While in control mode this can be used to select the analyser mode. Each analyser can be in one of four modes:

Sample mode: Gas is drawn through the analyser from the sample manifold. The system and analyser are automatically configured for data sampling.

Zero mode: Gas is drawn from an integral zero air generator. This mode is used for regular checks of the zero response, and is not used for calibration. A separate zero air source is used during the calibration. The system and analyser are automatically configured for data sampling.

Span mode: Gas is drawn from an internal source of ozone. This mode is used for regular checks of the span response, and is not used for calibration. A separate gas bottle source is used during the calibration. The system and analyser are automatically configured for data sampling.

Standby Mode: The system and analyser are not automatically configured for data sampling. All controls are enabled. This mode is used for service and maintenance.

The other controls available are:

Pump button: The pump is always on, unless the analyser is in standby mode. This should never be changed without reference to the MU.

Lamp button: The lamp is always on, unless the analyser is in standby mode. This should never be changed without reference to the MU.

Range switch: The range of the analyser should never be changed without reference to the MU.

PT Compensation: This is used to correct the raw output of the analyser for pressure and temperature. This should never be changed without reference to the MU.

Digital Filter: This is used to correct the raw output of the analyser to make the output less noisy. This should never be changed without reference to the MU.

Rolling Mean: This is used to correct the raw output of the analyser to make the output less noisy. This should never be changed without reference to the MU.

Interleave: This is used to select whether the frequency at which the sampled data is updated.. This should never be changed without reference to the MU.

Record the status of each of the above indicators on the pre-calibration checklist at the appropiate places.

A3.5 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. This top line is fixed, whilst 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 checks 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.

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.

A3.6 Air Sampling Manifold

Return to the Ambilog overview screen.

The lower panel of the Ambilog overview screen shows 6 thermometer style indicators, each of these displays the output of an internal sensor, measuring the system operating conditions.

All of these values are saved in a diagnostic log, and a red fault "LED" will be illuminated if a parameter is outside the normal operating limits.

Check that the sample pipe and the Ambirak vent pipes are connected and not obstructed in any way.

A3.7 Modem

There are two modems and a line switch fitted. The line switch allows a single telephone line to be shared between two modems, each connected to a separate communications port on the PC. One modem is used for data collection by the MU. The other modem allows the caller to connect to the system for diagnostic maintenance.

A3.8 Data Logger

Date logging is an integral function of the Ambilog software.

A3.9 Chart Recorder

The historical logs of raw, one minute data for each day may be viewed using the "View" program. This may be run at the same time as the Ambilog logging program. This is done as follows:

1. Minimise the Ambilog program. This is done by selecting the square box with a downward pointing arrow in the top right corner of the screen.

2. Select "View" form the Ambisoft main menu

3. This will display the View main screen. Pull down the "History" menu, and select chart. This will now display a pop up box, that allows the required day to be chosen. The date should be entered, as well as choosing raw data, which is the one minute mV data.

4. This will now show the days data as a chart trace on the screen. using the cursor bars and the "Zoom In"/ "Zoom Out" buttons, the data can be investigated more closely. The chart is closed by selecting the "OK" button.

5. The "View" program can be closed form the "File" menu option on the top menu bar.

A3.10 Zero Air Generator

This is integral to the Ambirak, and may be viewed by opening the pull down door in the side panel of the cabinet.

Check the condition of the scrubbers, two of which are self indicating; silica gel turns from orange to clear and purafil from purple to brown as it becomes exhausted. A diagram of the zero air generator is shown in Figure D5, Appendix D.

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 A3.11 - 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 this fact should be recorded in this "Comments" box on the calibration record sheet.

3. Check that all connections are secure and tight.

A3.11 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. The fact that the silica gel needed replacing should be recorded in this "Comments" box on the pre-calibration checklist.

Inefficient silica gel will only affect the zero on the CO analyser.

1. Remove the canister containing the silica gel. The PTFE tubing is connected to the scrubber canister with quick release fittings. The canister itself is held in place by Terri-clips.

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

3. 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.

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

5. The packing order of the components should be as shown in Figure D5, Appendix D.

6. 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 of the canister on to the canister.

7. Reconnect the PTFE tubing by pushing into the fittings, this is automatically held in place.

8. Mark the date on the "Date of Change" sticker on the silica gel canister.

A3.12 Completion of Precalibration Checks

If any difficulty has been experienced with the pre-calibration checks then inform the MU before proceeding with calibration.

If all correct, proceed to section A4.

A4 TEOM Particulate Monitor

The TEOM particulate monitor filter cartridge must be changed either every 4 weeks 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. This should be noted on the calibration record sheet along with the reason for the change of filter.

The analyser requires at least an hour to stabilise after changing the filter, for this reason the filter change takes place before any of the other analysers are calibrated.

A4.1 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 cabinet roof. Extra care should be taken if raining as the roof of the cabinet 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 and wiped dry with a lint-free tissue.

A4.2 Removing the PM_{10} Head

1. Switch the TEOM "out of service" switch to ON. The control will show a flashing red indicator when activated.

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 cabinet.

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

A4.3 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.

A4.4 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.

A4.5 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.

A4.6 Filter Cartridge Exchange Procedure

1. Refer to Figs D8 and D9 of 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.

2. Check that the TEOM 'out of service' switch is ON. The control will show a flashing red indicator when activated.

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 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.

A 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 and allow one hour for system to reset.

14. Switch the TEOM 'out of service' switch to 'off'.

15. After one hour check that TEOM noise level on the chart recorder trace is within 60 mg/m^3 If greater than this, attempt to re-seat the filter. If still excessively noisy, contact MU. The logged TEOM data can be viewed from the View program, see section A3.9. The full scale of the display will be 500μg/m3. The vertical axis of the chart displays the scale of the chart, the intermediate divisions can be used to estimate the noise level.

16. If the logged TEOM data indicates that the trace is too noisy, the instantaneous data can also be viewed in chart format. From the Ambilog overview screen, pull down the "Display" menu and select "Mode"/ "Trend". This will display the analyser data as a virtual chart recorder. Switch the chart speed to 1 minute per division. Now pull down the screen menu and select "Met Gear". This will now display the TEOM data as a trace. The full scale of the display will be 500μ g/m3. The vertical axis of the chart displays the scale of the chart, the intermediate divisions can be used to estimate the noise level..

A5 Analyser Calibration Procedure

During normal operation the Ambirak samples the pollutant levels every second and then logs one minute averages.

During calibration the pollutant levels are logged every second into a separate file on the PC's hard disk. This is the Calibration Log. Another separate file is maintained with the stable zero and span measurements for each analyser, this is the Calibration Record Log. The zero and span correction factors are saved in a Calibration Factors Log.

When closing the 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.

In order to have a full and complete set of instructions for each analyser, instructions for opening gas cylinder valves are contained within the calibration procedure for each analyser. However, when all analysers are being calibrated, it will be advantageous for all cylinders to be opened at the same time, after ensuring that the needle valves in the cabinet are closed. All cylinders can then be closed at the same time at the end of the calibration session.

The calibration software steps through the sequence of analysers presenting a separate screen for each analyser. Once that analyser has been calibrated, then the screen for the next analyser appears. This sequence continues until all the analysers have been calibrated.

A5.1 Instructions for starting the calibration procedure.

In order to commence the calibration of the analysers it is necessary to close the Ambilog, logging program, and then start the Calibration program. To close Ambilog, pull-down the "Access" menu and then select "Exit". A pop up box will appear and the password must be entered. If the password has been forgotten, contact the MU.

The Ambisoft main menu will now be displayed. Select the button marked "Calibrate".

A pop up box will again appear and the password must be entered. If the password has been forgotten, contact the MU.

This will start the calibration program. The first screen displayed shows the last hours data as a graph. Check these levels to see if an episode is occurring i.e. the current pollution levels 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 MU before proceeding any further. If a pollution incident is occurring the calibration procedure may be aborted at this stage by selecting the "Abort" button. This will return to the Ambisoft Main menu: select the "Ambilog" button, this will start the logging program.

If an incident is not occurring then press the "Accept" button. This will now reveal the calibration overview screen.

To start the calibration procedure, pull down the "Calibrate" menu from the top menu bar. This pull down menu allows either all analysers to be calibrated one at a time, or for an individual analyser to be selected for calibration. Select "All".

The user will now be prompted to enter their name.

A pop up box now appears: enter the serial number and cylinder pressure of each of the calibration gas bottles. Read cylinder pressure from right hand dial and cylinder number from tag on cylinder, and enter these on the calibration record. Do not

attempt to use the cylinder if the pressure indicated is less than 300 psi. In this event contact MU.

Once this information has been entered, select "OK".

A5.2 CO Analyser

The two point calibration of a carbon monoxide analyser will be carried out as follows. A full record will automatically be saved to the Calibration Log File.

1. The following screen appears:

   The numeric pollutant value at the top of the screen is given in ppm, based upon the last valid calibration. This figure is indicative and is given for guidance only.

   The chart displayed at the bottom of the screen shows the output of the analyser in raw mV.

   In the panel at the right hand of the screen there is a timer, which is reset as each part of the calibration is carried out. The time is given in analogue and digital format. The flow rate is also shown in a box labelled "calibration flow", this gives the flow in litres/ minute. The calibration flow must be at least 0.1 litres/min. more than the analyser sample flow, which is shown in a box labelled "Sample flow"

   There are two fault “LEDs”, the “LED” underneath the numeric pollutant display is red if a fault is active for the analyser. The fault “LED” in the right hand panel is red if a fault is active with the calibration system. The fault can be further investigated by pulling down the faults list box.

   In the right hand panel there is a column of 4 “LEDs” these indicate progress through the calibration routine. For instance, the calibration cycle starts by zeroing the analyser, and this is indicated by the Zero “LED” being active. At the end of the zero phase, the user manually presses the "Accept" button, and the software will automatically progress to the span phase, the Span “LED” will then be active.

2. Allow zero air to pass through the analyser on for a period of not less than 10 minutes. In the right hand panel is a stable “LED” which goes green when the zero has been stable for a

continuous period of 30 seconds. This "LED" is for indication only, verification that the output is stable is given by examining the trace on the chart at the bottom of the screen. If the flow of zero air through the analyser is insufficient then a fault will become active, this will be indicated by the Calibration Fault "LED" going red, and the text message "Manual Cal Flow Low" appearing in the fault list box.

Once the stable "LED" indicator turns green, wait a further ten minutes then take three readings of raw and processed values and record these on the calibration sheet. Now press the accept button, the software will now step to the next phase of the calibration cycle.

3. Open CO in air cylinder main valve by turning it fully anticlockwise. Do not attempt to use the cylinder if the pressure indicated is less than 300 psi. In this event contact MU.

4. Adjust the regulator secondary pressure to 15 psi, as read from left hand dial, by turning regulator primary (right hand) valve. Slowly open the regulator outlet (left hand) valve fully.

5. Allow the analyser to stabilise on this sample for a period of not less than 10 minutes. Ensure that the flow measured by the flow meter remains stable during this time. Adjust the Pressure, if necessary, to 1.2 litres per minute. The signal should show a large deflection from the zero point previously obtained.

   In the right hand panel is a stable "LED" which goes green when the span reading has been stable for a continuous period of 30 seconds. This "LED" is for indication only, verification that the output is stable is given by examining the trace on the chart at the bottom of the screen.

   Once the stable "LED" indicator turns green, wait a further ten minutes then take three readings of raw and processed values and record these on the calibration sheet. Now press the

accept button, the software will now step to the next phase of the calibration cycle.

6. The signal should now begin to fall. The values measured during the purge part of the cycle are not used for calibrating the analyser, the purge part of the cycle is used to clear the span gas out of the analyser, before returning to normal logging. Once the reading is stable press the accept button. The software will now step to the "Change Filter" part of the cycle.

7. Change the CO analyser sample inlet filter, following the instructions given in part A5.6 of this section. Once this has been done press the accept button.

8. In the following order, fully close the CO regulator outlet valve (do not overtighten), the main cylinder valve (tightly) and the primary regulator valve. This traps gas in the regulator, thus ensuring a positive pressure and hence, no ingress of ambient air. Note that the pressure regulator dials should remain at their previous setting, if a marked decrease is observed there is a leak in the system, and the MU should be informed.

9. The software will compare the analyser outputs measured during this calibration with the last valid calibration to establish whether the calibration has proceeded successfully. The zero value should not differ by more than 5 mV (~0.25 ppm) from the previous calibration. The span calibration value should not differ by more than 5% from that obtained during the previous calibration. A pop up box will appear giving the calculated zero and span correction factors. The option is given to accept or reject the calibration. If the recommendation is to Accept then press the "Accept" button. If in doubt, press the "Reject" button and repeat the relevant procedure. If the results of this are also unsatisfactory, contact the MU.

A5.3 NO_X Analyser

The two-point calibration of the nitrogen oxides analyser will be carried out as follows. A full record will automatically be saved to the Calibration Log File.

1. The following screen appears:

   The numeric pollutant values at the top of the screen are given in ppb, based upon the last valid calibration. These figures are indicative and are given for guidance only.

   The chart displayed at the bottom of the screen shows the outputs of the analyser in raw mV.

   In the panel at the right hand of the screen there is a timer, which is reset as each part of the calibration is carried out. The time is given in analogue and digital format. The flow rate is also shown in a box labelled "calibration flow", this gives the flow in litres/ minute. The calibration flow must be at least 0.1 litres/min. more than the analyser sample flow, which is shown in a box labelled "Sample flow"

   There are four fault “LEDs”, the “LED” underneath each numeric pollutant display are red if a fault is active for the analyser. The fault “LED” in the right hand panel is red if a fault is active with the calibration system. The fault can be further investigated by pulling down the faults list box.

   In the right hand panel there is a column of 5 “LEDs” these indicate progress through the calibration routine. For instance, the calibration cycle starts by zeroing the analyser, and this is indicated by the Zero “LED” being active. At the end of the zero phase, the user manually presses the "Accept" button, and the software will automatically progress to the span phase, the Span “LED” will then be active.

2. Allow zero air to pass through the analyser on for a period of not less than 10 minutes. In the right hand panel is a stable “LED” which goes green when the zeros for both the NO and

NOx traces have each been stable for two consecutive, continuous periods of 30 seconds. This "LED" is for indication only, verification that the output is stable is given by examining the traces on the chart at the bottom of the screen. If the flow of zero air through the analyser is insufficient then a fault will become active, this will be indicated by the Calibration Fault "LED" going red, and the text message "Manual Cal Flow Low" appearing in the fault list box.

Once the stable "LED" indicator turns green, wait a further ten minutes then take three readings of raw and processed values and record these on the calibration sheet. Now press the accept button, the software will now step to the next phase of the calibration cycle.

3. Open NO in nitrogen cylinder main valve by turning it fully anticlockwise. Do not attempt to use the cylinder if the pressure indicated is less than 300 psi. In this event contact MU.

4. Adjust the regulator secondary pressure to 15 psi, as read from left hand dial, by turning regulator primary (right hand) valve. Slowly open the regulator outlet (left hand) valve fully.

5. Allow the analyser to stabilise on this sample for a period of not less than 10 minutes. Ensure that the flow measured by the flow meter remains stable during this time. Adjust the pressure, if necessary, to 1.2 litres per minute. The signals should show a large deflection from the zero point previously obtained.

   In the right hand panel is a stable "LED" which goes green when the NO and NOx span readings have each been stable for a continuous period of 30 seconds. This "LED" is for indication only, verification that the output is stable is given by examining the traces on the chart at the bottom of the screen.

Once the stable "LED" indicator turns green, wait a further ten minutes then take three readings of raw and processed values and record these on the calibration sheet. Now press the accept button, the software will now step to the next phase of the calibration cycle.

6. In the following order, fully close the NO regulator outlet valve (do not overtighten), the main cylinder valve (tightly) and the primary regulator valve. This traps gas in the regulator, thus ensuring a positive pressure and hence, no ingress of ambient air. Note that the pressure regulator dials should remain at their previous setting, if a marked decrease is observed there is a leak in the system, and the MU should be informed.

7. Turning now to the NO2 in air calibration cylinder repeat steps 3, 4 and 5. Once the readings have become stable, the NO value should be close to that obtained while performing the zero phase of the calibration, the NOx and NO2 signals should both show approximately the same large deflection from this zero point. Once the "accept" button is pressed at the end of the NO2 phase of the calibration cycle the software automatically steps to the purge phase.

8. Repeat step 6, for the NO2 cylinder.

9. In the purge phase of the cycle, the signal should now begin to fall. The values measured during the purge part of the cycle are not used for calibrating the analyser, the purge part of the cycle is used to clear the span gas out of the analyser, before returning to normal logging. Once the reading is stable press the accept button. The software will now step to the "Change Filter" part of the cycle.

10. Change the NOx analyser sample inlet filter, following the instructions given in part A5.6 of this section. Once this has been done press the accept button.

11 The software will compare the analyser outputs measured during this calibration with the last valid calibration to establish whether the calibration has proceeded successfully. The zero value should not differ by more than 10 mV (~4 ppb) from the previous calibration. The span calibration value should not differ by more than 5% from that obtained during the previous calibration. A pop up box will appear giving the calculated zero and span correction factors. The option is given to accept or reject the calibration. If the recommendation is to Accept then press the "Accept" button. If in doubt, press the "Reject" button and repeat the relevant procedure. If the results of this are also unsatisfactory, contact the MU.

A5.4 SO_2 Analyser

The two-point calibration of a sulphur dioxide analyser will be carried out as follows. A full record will automatically be saved to the Calibration Log File.

1. The following screen appears:

The numeric pollutant value at the top of the screen is given in ppb, based upon the last valid calibration. This figure is indicative and is given for guidance only.

The chart displayed at the bottom of the screen shows the output of the analyser in raw mV.

In the panel at the right hand of the screen there is a timer, which is reset as each part of the calibration is carried out. The time is given in analogue and digital format. The flow rate is also shown in a box labelled "calibration flow", this gives the flow in litres/ minute. The calibration flow must be at least 0.1 litres/min. more than the analyser sample flow, which is shown in a box labelled "Sample flow"

There are two fault “LEDs”, the “LED” underneath the numeric pollutant display is red if a fault is active for the analyser. The fault “LED” in the right hand panel is red if a fault is active with the calibration system. The fault can be further investigated by pulling down the faults list box.

In the right hand panel there is a column of 4 “LEDs” these indicate progress through the calibration routine. For instance, the calibration cycle starts by zeroing the analyser, and this is indicated by the Zero “LED” being active. At the end of the zero phase, the user manually presses the "Accept" button, and the software will automatically progress to the span phase, the Span “LED” will then be active.

2. Allow zero air to pass through the analyser on for a period of not less than 10 minutes. In the right hand panel is a stable "LED" which goes green when the zero has been stable for a continuous period of 30 seconds. This "LED" is for indication only, verification that the output is stable is given by examining the trace on the chart at the bottom of the screen. If the flow of zero air through the analyser is insufficient then a fault will become active, this will be indicated by the Calibration Fault "LED" going red, and the text message "Manual Cal Flow Low" appearing in the fault list box.

   Once the stable "LED" indicator turns green, wait a further ten minutes then take three readings of raw and processed values and record these on the calibration sheet. Now press the accept button, the software will now step to the next phase of the calibration cycle.

3. Open SO2 in air cylinder main valve by turning it fully anticlockwise. Do not attempt to use the cylinder if the pressure indicated is less than 300 psi. In this event contact MU.

4. Adjust the regulator secondary pressure to 15 psi, as read from left hand dial, by turning regulator primary (right hand) valve. Slowly open the regulator outlet (left hand) valve fully.

5. Allow the analyser to stabilise on this sample for a period of not less than 10 minutes. Ensure that the flow measured by the flow meter remains stable during this time. Adjust the pressure, if necessary, to 1.7 litres per minute. The signal should show a large deflection from the zero point previously obtained.

   In the right hand panel is a stable "LED" which goes green when the span reading has been stable for a continuous period of 30 seconds. This "LED" is for indication only,

verification that the output is stable is given by examining the trace on the chart at the bottom of the screen.

Once the stable "LED" indicator turns green, wait a further ten minutes then take three readings of raw and processed values and record these on the calibration sheet. Now press the accept button, the software will now step to the next phase of the calibration cycle.

6. The signal should now begin to fall. The values measured during the purge part of the cycle are not used for calibrating the analyser, the purge part of the cycle is used to clear the span gas out of the analyser, before returning to normal logging. Once the reading is stable press the accept button. The software will now step to the "Change Filter" part of the cycle.

7. Change the SO2 analyser sample inlet filter, following the instructions given in part A5.6 of this section. Once this has been done press the accept button.

8. In the following order, fully close the SO2 regulator outlet valve (do not overtighten), the main cylinder valve (tightly) and the primary regulator valve. This traps gas in the regulator, thus ensuring a positive pressure and hence, no ingress of ambient air. Note that the pressure regulator dials should remain at their previous setting, if a marked decrease is observed there is a leak in the system, and the MU should be informed.

9. The software will compare the analyser outputs measured during this calibration with the last valid calibration to establish whether the calibration has proceeded successfully. The zero value should not differ by more than 20 mV (~4 ppb) from the previous calibration. The span calibration value should not differ by more than 5% from that obtained during the previous calibration. A pop up box will appear giving the calculated zero and span correction factors. The

option is given to accept or reject the calibration. If the recommendation is to Accept then press the "Accept" button. If in doubt, press the "Reject" button and repeat the relevant procedure. If the results of this are also unsatisfactory, contact the MU.

A5.5 Ozone Analyser

The ozone analyser is included in the calibration only to generate correction factors to offset zero drift. The span correction factors for an ozone analyser are generated by cross-calibration with a reference photometer. This cross-calibration is not included in this procedure.

The zero calibration of the ozone analyser is carried out as follows.. A full record will automatically be saved to the Calibration Log File.

1. The following screen appears:

The numeric pollutant value at the top of the screen is given in ppb, based upon the last valid calibration. This figure is indicative and is given for guidance only.

The chart displayed at the bottom of the screen shows the raw, unscaled output of the analyser.

In the panel at the right hand of the screen there is a timer, which is reset as each part of the calibration is carried out. The time is given in analogue and digital format. The flow rate is also shown in a box labelled "calibration flow", this gives the flow in litres/ minute.

There are two fault “LEDs”, the “LED” underneath the numeric pollutant display is red if a fault is active for the analyser. The fault “LED” in the right hand panel is red if a fault is active with the calibration system. The fault can be further investigated by pulling down the faults list box.

In the right hand panel there is a column of 2 “LEDs” these indicate progress through the calibration routine. For instance, the calibration cycle starts by zeroing the analyser, and this is indicated by the Zero “LED” being active. At the end of the zero phase, the user manually presses the "Accept" button, and the software will automatically progress to the "Change Filter" phase, and the "Change Filter" “LED” will be active.

2. Allow zero air to pass through the analyser on for a period of not less than 10 minutes. In the right hand panel is a stable "LED" which goes green when the zero has been stable for a continuous period of 30 seconds. This "LED" is for indication only, verification that the output is stable is given by examining the trace on the chart at the bottom of the screen. If the flow of zero air through the analyser is insufficient then a fault will become active, this will be indicated by the Calibration Fault "LED" going red, and the text message "Manual Cal Flow Low" appearing in the fault list box.

   Once the stable "LED" indicator turns green, wait a further ten minutes then take three readings of raw and processed values and record these on the calibration sheet. Now press the accept button, the software will now step to the next phase of the calibration cycle.

3. Change the O3 analyser sample inlet filter, following the instructions given in part A5.6 of this section. Once this has been done press the accept button.

4. The software will compare the analyser output measured during this calibration with the last valid calibration to establish whether the calibration has proceeded successfully. The zero value should not differ by more than 20 mV (~2 ppb) from the previous calibration. . A pop up box will appear giving the calculated zero correction factor. The option is given to accept or reject the calibration. If the recommendation is to Accept then press the "Accept" button. If in doubt, press the "Reject" button and repeat the relevant procedure. If the results of this are also unsatisfactory, contact the MU.

A5.6 Changing Analyser Sample Inlet Filters

The analyser sample inlet filters can be accessed by opening the access door at the corner of the Ambirak. These 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 MU.

Detailed instructions for sample inlet filter changing:

1. Unscrew 2 nuts on filter holder.
2. Lift top cover of filter holder off bottom section.
3. Remove "O" ring and used filter.
4. Inspect filter for signs of excessive soiling and inspect "O" ring.
5. Take clean filter from box using the tweezers supplied and insert into base of filter holder.
6. Replace "O" ring in filter holder.
7. Replace top of filter holder and secure with nuts. The nuts should be hand tightened.
8. Check that Teflon lines to filter holder are well secured.

A5.7 End of calibration check box.

The final pop up box to appear in the calibration routine requires the operator to inspect the site and complete a tick box.

Carry out the following checks and then tick off on the screen:

1. 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.

2. Check that the roof area and fittings are secure, that there are no loose items left on the roof and then stow the ladder safely inside the hut.

3. Check that all cylinders except the CO autocal cylinder are firmly closed and the cylinder store locked.

4. Ensure the cabinet is clean and tidy.

5. Enter any comments in the box provided. These will automatically be included in the post calibration report.

6 Save the Calibration logs to a floppy disk, to take to your office. This is done by putting a new, formatted 1.44 MByte disk into the PC's disk drive and selecting the button on the Ambisoft main menu labelled "Save Calibration Files"

7. Finally select the “File” pull down menu and then “Exit”, the software will now quit Ambical and restart Ambilog.

A5.8 Changing the daily CO cylinder.

The CO analyser uses a second cylinder to perform daily checks on the performance of the instrument. Because of this, it will be necessary for LSOs to replace this cylinder periodically and check to make sure the flow rates are correctly set.

1. If not already fitted, connect the regulator to the cylinder using the spanner provided. Ensure that the regulator is tightly fitted to the cylinder, and that the Teflon tubing is tightly connected to the analyser.

2. Open the cylinder main valve by turning it fully anticlockwise. Check that there are no leaks from around the regulator seals,

using the SNOOP provided. Tighten the regulator, if necessary. Record the cylinder pressure from the right hand dial.

4. Adjust the regulator secondary pressure to 15 psi, as read from the left hand dial, by turning the regulator primary (right hand) valve. Slowly open the regulator outlet valve (left hand) fully.

5. The CO analyser must be put into Span mode. In order to do this the Ambilog logging software must be put into control mode. This is done by pulling down the "Access" menu, and selecting "Control". This will require a password. Use the "Screen" menu the access the CO analyser screen. Now use the mode selector switch at the bottom left corner of the screen to put the CO analyser into Span mode. The data will now be flagged as invalid. The green "Sample" “LED” under the numeric CO reading should now turn grey.

6. Check the Sample flow shown in the small white box on the screen reads 1.0 $\pm$ 0.1 litres per minute. Adjust the flow if necessary using the CO daily gas regulator inside the bottle store.

7. Allow the analyser to sample calibration gas for a period of not less than 5 minutes. Check that the analyser responds to the calibration gas, and that the flow rate remains stable during this period.

8. To end the calibration, select "Standby" from the mode switch. This will turn off the solenoid so that ambient air rather than calibration gas will go through the analyser. The data will still be tagged as invalid.

9. Once the reading has stabilised, switch the mode to "Sample" The "Sample" “LED” should go green, and the analyser will return to sampling ambient gas.

10. Return the Ambilog software to Logging mode, via the pull down "Access" menu.

A6 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 photo multiplier tube cooling systems, will be immediately apparent by observing the analyser output while sampling zero air.

Operators will also be expected to examine historical data whilst on-site. This 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 traces 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 auto calibration cycle has taken place. The historical data for the auto calibrations should be examined closely to verify that the instrument fully stabilises on both zero and span gas during the auto calibration 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.

The historical data should be viewed using the separate view program, see section A3.9

Obviously, the level to which the 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 A3 must now be repeated and recorded on the check sheet as follows:

   (i) Overview screen

   (ii) CO analyser

   (iii) NOx analyser

   (iv) SO2 analyser

   (v) Ozone analyser

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

   (vi) Air sampling manifold (not required if precalibration check was OK)

   (vii) Modem

2. Complete the final check section of the postcalibration check sheet.

3. Complete the calibration end time.

4. 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.

5. Check that the roof area and fittings are secure, that there are no loose items left on the roof and then stow the ladder safely inside the hut.

6. Check that all cylinders except the CO autocal cylinder are firmly closed and the cylinder store locked.

7. Ensure the cabinet is clean and tidy.

8. Enter any comments in the box provided. These will automatically be included in the post calibration report.

Upon returning to your office, the calibration record sheets should be faxed to the MU, fax number 0207 261 1425 and also to the 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.