Annex 8: ITDG – SMOKE, HEALTH AND HOUSEHOLD ENERGY

SUPERVISORS MANUAL – AIR POLLUTION AND EXPOSURE

PART A: PUMP PREPARATION AND CALIBRATION: Step 2 of the data collection form

Items required

- Calibrator
- Pump and power supply
- Tubing (2 lengths of ~0.5m)
- Cassette, containing clean filter ('the calibration cassette')
- Cyclone

I. Preparation

Check that the calibrator has a *small amount* of soap solution (about 1 teaspoonful or 5ml) in the bottom of the glass cylinder (enough to cause a bubble to form around the glass). If not sufficient, top up through the lower tube (Figure 1).

Fig 1: Placing a few drops of soap solution into the bubble chamber through the lower opening

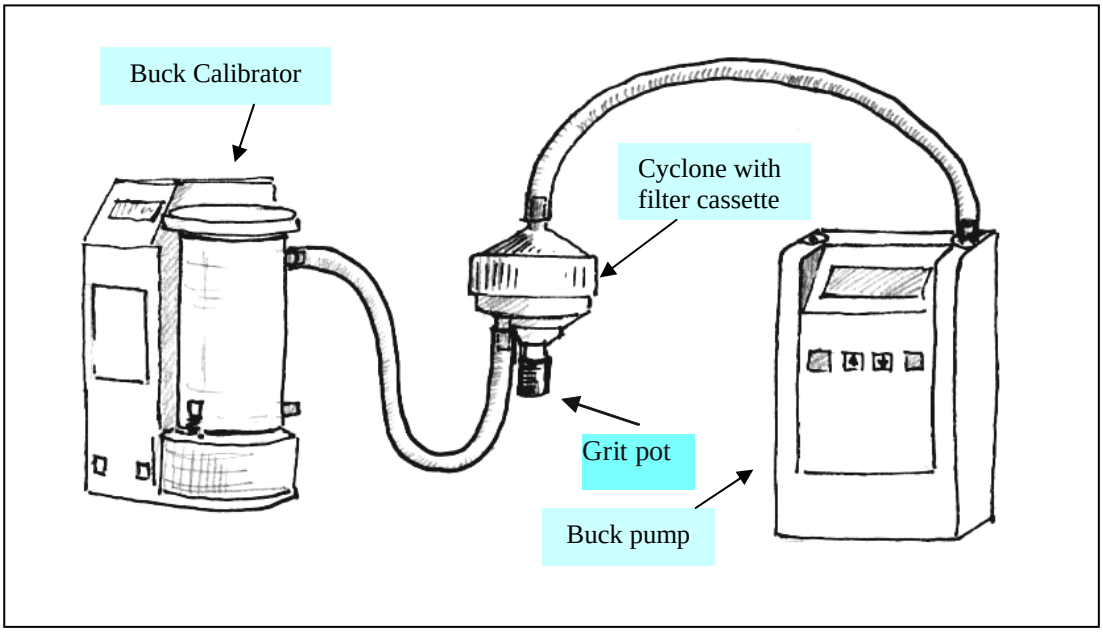

Figure 2: Connection of pump and cyclone to the Buck calibrator. The tube between the pump and cyclone should be the length normally used when sampling in the home, and the cyclone must have the (clean) practice filter cassette installed

1. Place the calibration cassette in a cyclone, ensuring it is the right way up. (TOP is shown on the cassette.) Ensure that the cyclone lid is securely tightened to avoid leaks (but do not over-tighten), and that the O-ring in the upper part of the cyclone is in place.Connect the cyclone outlet (top, horizontal pipe) to the pump, and the inlet (lower vertical pipe) to the Buck calibrator as shown (Figure 2). Note that the cyclone inlet should be connected to the upper tube on the calibrator (Figure 3).
2. Place the equipment on a flat stable surface.
3. Connect the pump to its power supply **(+)** to the red and **(-)** to the black. Note that the calibrator has an internal rechargeable battery, estimated operating time 6-8hours, and there is a low battery indicator. Battery should be kept adequately charged.

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II. Clear current pump settings:

4. Switch on pump
5. Down arrow to CONFIGURE MODE . Press ENTER
6. [If configure security code is ON – press keys (On/Hold – Enter - Up arrow – Down arrow) in that order]
7. Clear ***all*** pump settings YES
8. Temperature: Select NO
9. Press ON / HOLD which will take you to SAMPLING MODE

Figure 3: *tube to cyclone connects to upper outlet of calibrator*

III. Check and calibrate the pump flow rate:

10. Press ENTER - Adjust pump flow rate? Change to YES and press ENTER to start the pump.
11. Switch on the Buck calibrator: the display should read **0.000.**
12. Press button down, and then let go to release a bubble (Figure 4). Repeat this several times until soap film ascends freely to top of tube (Figure 5). It does not matter if two bubbles are discharged as the machine will only calibrate on the first one.

Figure 4: *depress the button to release a soap bubble*

Figure 5: *Soap bubble moving up the chamber. Make sure it reaches the top freely before starting measurements*

13. Check the flow rate of the pump as follows:

Release a bubble to obtain a reading on the calibrator and record this on the **Calibration Test Sheet** (Annex 1Repeat until you obtain THREE CONSECUTIVE READINGS all within 100ml (0.1 on the calibrator display). Wait until the calibrator display stops flashing before releasing the next bubble). NOTE: The readings on the calibrator are in litres/minute – please ignore the decimal point to produce readings in ml/minute (eg. 2.197litres /minute =2197ml/minute). An example is given in Table S1 (below):

Table S1: 3 consecutive flow rates meeting calibration criteria

Reading	**Value (ml/minute)**	
1	2186	These are *acceptable* results
2	2204	
3	2193	

Set the pump to the correct flow rate if it is not already doing so:

14. The criteria for a correct flow are that the average of the 3 measurements should be close to **2200** ml/minute, and that all three **must be in the range 2150 to 2250** ml/minute.
15. If the criteria for the flow rate **ARE ACHIEVED** (Step 14), adjust the flow rate display (see Section IV, below – "Adjusting the Display").
16. If the criteria for the flow rate are **NOT ACHIEVED** (Step 14), and an example where criteria are not met is provided in Table S2, adjust the flow using the UP and DOWN arrow keys on the pump. You will hear the pump slowing down or speeding up and see the % change on the display. Allow 20-30 seconds for the pump to stabilize after each change you make in the flow rate. Carry out a further three test readings with the calibrator, and check whether these meet the criteria. This procedure needs to be repeated, by 'trial and error', until the criteria are met.

Table S2: 3 consecutive flow rates NOT meeting calibration criteria

Reading	**Value (ml/minute)**	
1	2103	These results are NOT acceptable
2	2086	
3	2135	
Average	**2108**	

17. Note that the final three readings (that you enter on the data sheet) must be within 20ml/minute of each other. If this precision cannot be achieved, check all connections, and that the grit pot is in place on the cyclone. If this level of consistency is still not achieved, contact UK and we will get in touch with suppliers.

IV. Adjusting the display on the pump:

18. Wait until the display on the pump shows: SET! press ENTER, then do so.
19. You will now adjust the four-digit display on the pump to read the average of the final three readings, which have been entered on the data sheet. Each digit will flash in turn, starting with the left hand one. Use the up and down keys to set the number. Press ENTER to move on to the next digit (which will then start to flash), until all are correct. Then press ENTER again – the pump will stop.
20. 'Activate keypad security?' - set to YES – press ENTER. This will take you to SAMPLING MODE
21. Press 'up' arrow to go to ENDING MODE press ENTER
22. 'Sampling flow verify?' – say YES press ENTER. This will start the pump and provides a final opportunity to ensure that the displayed flow rate is correct. Allow the pump to run for 1-2 minutes to stabilise, and confirm the flow rate is ± 10mls of the 'average value' that you entered in step 19. If the display flow rate is outside this limit, repeat the calibration procedure. If this fails to resolve the problem, contact the UK.
23. If step 22 is completed, press ENTER – QUIT? set to YES–press ENTER pump switches off
24. The pump is now calibrated and ready for survey work.
25. Place the pump and cyclone (with practice cassette removed) into the house survey kitbag.

PART B: FILTER CASSETTE PREPARATION
Step 3 of the data collection form

1. Refer to the **Annex 2** to identify the number of the filter cassettes for the first (A) and second (B) periods in the household for which you are making preparations.
2. Select the correct numbered filter cassettes that have been pre-weighed and labelled (numbered) by the laboratory.
3. Record the two cassette serial numbers that you have selected onto the data form.
4. Check that for each cassette the plastic clip is in place and the cassette bag sealed
5. Place the cassettes (in their bags) in the house survey kitbag: the cassettes for periods A and B will be inserted into the cyclone in the field by the Interviewer.

PART C: CO MONITOR (T82) PREPARATION
Steps 4 & 5 of the data collection form

Loading T82 software

1. Install CD-Rom onto the smoke computer and plug in the datalogger
2. Click onto logo on computer screen desktop to open programme
3. Check room CO- monitor is OFF
4. Put monitor into cradle, making sure the three dots on the monitor line up with three points on the cradle & monitor clicks into position & bleeps once
5. To the prompt 'Verify that the instrument is turned OFF – click 'Yes'
6. Click 'Connect to the T82' – monitor will bleep once
7. Click 'check/set instrument settings
8. Click 'change'
9. Click TWA time base and change to 24hours if not already set for 24 hours – wait for set of blue bars to show it has been done. Click 'set'
10. Click 'Exit
11. Click 'Clear data'
12. There is no need to open the 'Download preferences' as they should be left as set currently
13. Click 'exit'

Before sampling for the first time:

1. Label clearly which T82 is for the woman and which is for the room. (The third T82 is a spare, and for if we want to do any monitoring at two heights)
2. Record the number of the T82 and whether it is for the woman or for the room.

Before each household sampling

The T82 CO monitor does not require extensive preparation each day, but the following simple checks must be made before each house survey is carried out.

For each monitor (Room and Personal), carry out the following**:**

1. Check to ensure that the monitor is undamaged
2. Ensure that the sensor (circular bit on the top with a mesh over) is clean.
3. Ask yourself whether you sure that all the T82 has been cleared or has only one monitoring session stored on it. If you are not sure, download any data from the T82, save the data, back-up the data and clear the instrument. **The T82 will not save more than 90 hours of datalogging at any one time.**
4. Label the monitor with the number of the house to be monitored
5. When the above checks have been completed on both monitors, place the two T82 CO Monitors, together with the pouch/strap to carry the personal monitor, into the house survey kit bag.

PART D: CHECKING THE HOUSE SURVEY KITBAG
Step 6 data collection form

The House Survey Kitbag is to be prepared by the supervisor on completion of all the equipment preparation described in Parts A-C (above). The kit bag should include the following:

1. Field survey work sheet
2. Interviewer data collection forms
3. Pens
4. Torch
5. Pump, cyclone and tubing
6. 12 volt lead-acid battery for pump
7. Power leads for connecting pump to battery
8. 2 x labelled filter cassettes
9. 2 x T82 Carbon Monoxide monitors
10. Carrier for T82 personal (woman) monitor
11. Materials for fixing pump, cyclone and T82 (house) in suitable position in home.
12. Tape measure
13. Watch or clock for recording start / finish time

PART E: TEMPERATURE MEASUREMENT
Steps 7 & 12 data collection form

The idea of determining the temperature is to find out what effect the weather is having on the use of household energy, so it is necessary only to measure the outdoor temperature in the region in which the work is being done. It is very expensive to get an average temperature, and the amount the temperature changes in a day make measuring it at any one time unrepresentative. A good compromise is the maximum and the minimum outdoor temperature measured approximately over the time the monitoring is being done – but this can be done at the local ITDG office. If it is +/- a couple of hours either side of the 24 hours, this is not a problem

PART F: PUMP CHECKING ON COMPLETION OF MONITORING Step8 of the data collection form

1. Fit calibration cassette in cyclone, and ensure securely closed.
2. Switch pump on, change to ENDING MODE, and press ENTER.
3. You will see the message **"Flow verify?"** Change the option to **Yes**, and press ENTER.
4. The pump will start and display the following data:
   - The elapsed time
   - Volume sampled
   - Flow rate (allow to stabilise over 1-2 minutes)
5. These were the values when sampling was stopped at the house. Record the values on the data form.

PART G: FILTER CASSETTE HANDLING ON COMPLETION OF MONITORING
Step 9 of the data collection form

The most important checks that you need to make on the filter cassettes when these are brought back from the house survey, are:

- You have the correct cassettes for the house just sampled
- The cassettes are correctly sealed with the plastic clip and bag.

Accordingly, inspect the cassettes and record (a) the number, and (b) the condition and packing of the cassette. Record these on the data form.

Check the cyclone is not damaged and empty out any deposits in the grit pot. **Note**: The cyclones must not be used or calibrated without the grit pot as it will greatly affect the air flow rate in the pumps.

PART H: T82 CO MONITOR CHECKING AND DATA DOWNLOAD ON COMPLETION OF MONITORING
Steps 10 & 11 of the data collection form

1. Check room CO- monitor is OFF
2. Put monitor into cradle, making sure the three dots on the monitor line up with three points on the cradle & monitor clicks into position & bleeps once
3. To the prompt ‘Verify that the instrument is turned OFF – click ‘Yes’
4. Click ‘Connect to the T82’ – monitor will bleep once
5. Machine will prompt on the number of sessions available to download – click on 'Download data'
6. Machine will prompt 'Enter the number of the session to download –'1' – go through, downloading all the data for all sessions on the monitor
7. You will be asked to give the file a name: Call each one 'session 1; Session 2; Session 3 etc. as some of them will be when the machine was switched on to test. **Do not clear at this stage**
8. Disconnect, then 'file open' and check that the data is there, and that the date and the times are those that you expected them to be for the house (s) you monitored. You will find this by opening the 'Summary/Comments page (which is the first icon on the left of the opened file)
9. Rename the room files for the sampling period – use format K1-23 for example, where K is Kenya, 1 is round 1 and 23 is house number. Do this by closing the file, going to ‘file open’ highlighting the correct session on the list of files, right clicking and choosing ‘rename’
10. Open this renamed file, click open the Summary/Comments again and alter the filename at the bottom of the text page to the new filename K1-23 for example (this does not happen automatically). Print off this page, and attach to supervisor datasheet. (Note: if anything happens to the electronic files, this will be the only information we have for the house – not perfect, but better than nothing, and similar to the information we had from the stain tubes).
11. Disconnect the T82

BACKUP

12. Please remember that this is the only record that we have of CO levels.

13. Click on 'File open' –highlight the file you have just created
14. Right-click and select 'Send to' and choose $3^1/_2$ Floppy (A)
15. Save onto a labelled floppy disc
16. Go through the same procedure, but this time send to 'mail recipient' and send to UK

Go through the same procedure for the personal monitor

Although it is technically possible to download all the machines and all the sessions at once, it is probably much safer to go through the procedure one instrument at a time, and this is what I have done in the instructions above, because it is so vital that we get this bit right.

Checking CO monitors are working properly and clearing memories :

Once you are **absolutely sure that you have downloaded all the data successfully** – for each monitor;

1. **Checking each monitor**: Switch on – watch to see that the display goes through the following sequence;
   - 'On'
   - CO – this is what is it going to measure
   - A series of bars to show the condition of the battery in a 3-2-1 pattern (if it is less than 3-bars, let the UK know at once)
   - r 1.1 – this is the software which is needed to download the measurements
   - A red light and backlight to the display
   - A countdown set of numbers – 5-4-3-2-1
   - It will then indicate the level of CO in the room (which may be zero, so do not be concerned if it shows 0….the important thing is that there is a number on the screen – it is now working

2. **Checking consistency of readings:** Set all the switched on monitors close to each other. They should read within 1ppm of each other. If they do not, switch their positions relative to each other and see if they still show the same difference. If they do read differently by more than 1ppm consistently, contact the UK for advice. (There may be some CO in the room, and it is possible that they will show small differences as the CO moves around. However, if one is consistently showing higher or lower values, this should be corrected)

3. Clearing the memories

- switch the dataloggers back on
- Click ‘Clear data’
- Click ‘disconnect' - monitor will bleep once

PART I: CHECKING INTERVIEWER DATA COLLECTION FORMS Step 13 of the data collection form

At the end of each house visit (for interview and monitoring), the supervisor should check through the forms that have been completed by the Interviewer. Check that all fields have been completed (that is, none have been omitted), and that the entries appear correct and consistent.

All omissions and possible incorrect entries must be checked with the interviewer, and corrected. If there is any uncertainty about an entry, a return visit to the house should be made by the supervisor should be made.

Record your checks on the forms, together with any remedial action taken for corrections.

Annex 1: Calibration test sheet

This sheet can be used to write down the readings – when three consecutive readings are within the correct range (2135-2265ml), transfer them to datasheet – this sheet is just for your own convenience.

Reading (ml/minute)	**Reading (ml/minute)**	**Reading (ml/minute)**	**Reading (ml/minute)**

Annex 2: Household numbers, name of cook and identifier and serial number of cassette

Round number = 1 Sudan				
House Number	Identifier	Name of woman	Serial number of first cassette	Serial number of second cassette
S01	PD			
S02	WJ			
S03	CL			
S04	VR			
S05	ZU			
S06	WA			
S07	CT			
S08	SD			
S09	QK			
S10	YN			
S11	UM			
S12	CU			
S13	VE			
S14	WV			
S15	RC			
S16	AV			
S17	AX			
S18	BK			
S19	SJ			
S20	AL			
S21	SK			
S22	DJ			
S23	FH			
S24	YT			
S25	EU			
S26	RT			
S27	QU			
S28	WZ			
S29	ZN			
S30	FC			

Confidential information: on completion of this round of monitoring please detach sheet, send copy to UK and file securely