



MANUAL FOR WATER QUALITY TESTING

KIRIBATI 2018

SURVEY COORDINATORS:

TRANSLATE THIS MANUAL INTO THE LANGUAGE(S) OF FIELD TEAM MEMBERS.

DURING WATER QUALITY TRAINING ENSURE THAT THIS MANUAL IS PROVIDED TO ALL FIELD TEAM MEMBERS - MEASURERS, INTERVIEWERS AND FIELD SUPERVISORS.

MEASURERS SHOULD CARRY THIS MANUAL WITH THEM AT ALL TIMES IN THE FIELD.

IT IS IMPORTANT THAT ONLY THE EQUIPMENT RECOMMENDED BY UNICEF IS USED DURING DATA COLLECTION. PLEASE SEE THE SUPPLY PROCUREMENT INSTRUCTIONS.

DELETE THIS BOX AS IT IS MEANT ONLY FOR SURVEY COORDINATORS.

NOTE THAT THESE INSTRUCTIONS ARE DESIGNED FOR PAPER-BASED SURVEYS AND WILL REQUIRE MINOR CUSTOMIZATION IF THE SURVEY IS CONDUCTED USING TABLETS / PDAS.

INTRODUCTION TO THE MANUAL

This Manual is intended for all KSDIS field staff and outlines the required steps that need to be taken during KSDIS data collection in order to accurately assess drinking water quality. Measurers in particular should carry these instructions with them in the field and review them regularly to make sure they are always following the correct procedures. Supervisors should also frequently refer to this Manual in the field when observing the work of measurers.

BACKGROUND ON WATER QUALITY TESTING

The objective of this water quality module is to obtain a nationally-representative view of the quality of water that people drink in their home and the quality of their drinking water source. In each cluster of the survey, a number of households will be randomly selected for *E. coli* testing. *E. coli* is a faecal indicator bacteria, meaning that it is likely to be present when faeces or raw sewage has entered the water supply. The presence of *E. coli* in drinking water does not necessarily mean that the person drinking it will become sick, but it indicates that over time the household is at a higher risk for waterborne diseases. The World Health Organization recommends as a guideline that there should be no *E. coli* present in a 100 mL sample of water.

In Kiribati a quantitative test is used involving Compact Dry plates, allowing for the interpretation of the testing results using the 4 WHO risk levels for microbiological water quality:

<i>E. coli</i> per 100 ml of water (CFU)	WHO Risk level
> 100	Very High Risk
11 - 100	High Risk
1 - 10	Medium Risk
< 1	Low Risk

RESPONSIBILITIES OF FIELD TEAM MEMBERS DURING THE COLLECTION OF WATER QUALITY MEASUREMENTS

Measurers will be responsible for conducting *E. coli* tests in the field, and for completing the water quality questionnaire. They will be responsible for maintaining the equipment and notifying Supervisors if the equipment is faulty or short in supply.

Supervisors will verify the household selection for water quality testing in CAPI and share this with the measurers after reaching each cluster. They will be responsible for coordinating the work of the measurer by making sure he/she knows where to find the households where samples are to be collected at the source and in the home. Supervisors will advise measurers when they should visit the household and provide bottled water for the blank test when needed. The supervisors will be responsible for ensuring that measurements are taken following the exact steps and procedures outlined in this Manual. In situations where measurers are routinely making errors in taking and/or reading a measurement, or in reporting the information on the questionnaire, the supervisor should consult with the fieldwork director and/or survey coordinator about corrective actions.

GENERAL PRECAUTIONS FOR MEASURERS**(1) Preventing contamination: aseptic technique**

Care must be taken during sampling and testing to prevent contamination of the sample by bacteria in the environment or from previous water samples. Aseptic technique for field sampling can be summarized as follows:

- Always wash hands with soap or apply gel hand sanitizer before starting a new sample or touching equipment that will touch the sample.
- Sanitize any equipment that comes in contact with the sample using alcohol before each new sample.

(1) Time management

The actual water quality test itself requires approximately 20 minutes. However, the measurer must also plan time to visit the household's drinking water source and to read the sample results the next day. Results should be read within 24 – 48 hours of the time the test is started.

(2) Transport of samples

In some cases, it may be more convenient to collect a sample and process it for testing at another location. In this case, short transit times (up to 30 minutes) are acceptable - provided samples are kept out of direct sunlight.

(3) Sample incubation

To provide the right conditions for *E. coli* to grow into countable colonies, the Compact Dry plate must be kept at approximately 37 °C for 24 hours. If the temperature is too low for an extended period of time, the *E. coli* will grow too slowly to be visible, and if the temperature is too high, the *E. coli* might be killed or overtaken by other bacteria suited for the hotter conditions. There is a simple belt that is worn around the body that keeps the plate close to body temperature (37 °C).

COLLECTION OF SAMPLES

All samples are collected using a sterilized Whirl-Pak Bag. Tests are performed after completion of the questionnaire. The test may be performed at the location, or the measurer may perform the test at a more convenient location

Household drinking water sampling

Since a main purpose of this part of the survey is to determine the quality of water as it is actually consumed, samples will be household drinking water taken from the point of consumption. The measurer will ask the survey respondent for "a glass of water that members of your household would drink". The water sample will be collected using a Whirl-Pak bag

Source sampling

The source should be determined based on the responses given by the household. The water sample will be collected using a Whirl-Pak bag. When water samples are collected from the source, water should be flushed for 30 seconds whenever this is feasible. For example, a tube-well should be pumped for 30 seconds minute, or the tap should be opened for 30 seconds, before collecting the sample. If the water is collected from the source by hand (as in an unprotected spring or dug well with bucket), flushing is not necessary. If the water is being collected from a spring, stream or a river, the sample should be collected by facing the mouth of the container/bag towards the opposite direction of the flow.

Blank test sampling

Supervisors will provide the measurer with water for the blank test. This will be a bottle of water known to be of high quality. This water sample will also be collected using a Whirl-Pak bag. The water should be poured directly from the bottle into the Whirl-Pak bag.

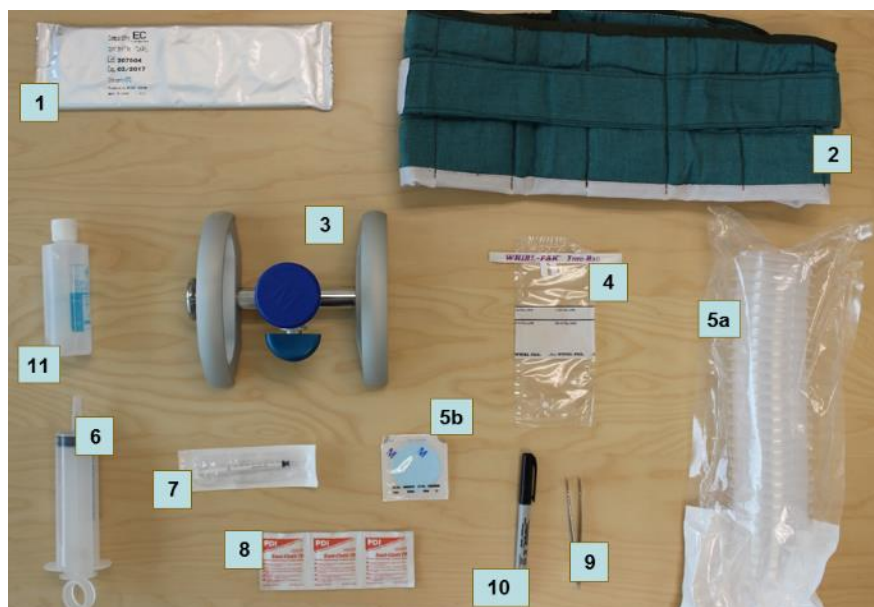






WATER QUALITY TESTING MATERIALS


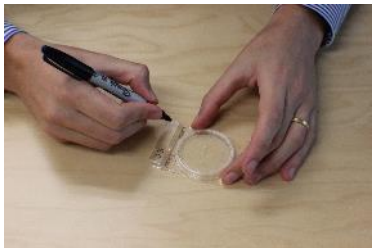


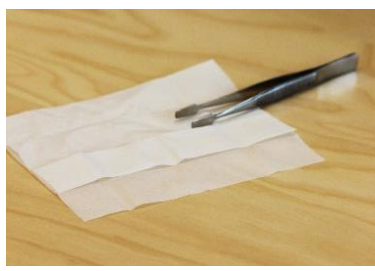






Figure 1: Equipment required for water quality testing

<ol style="list-style-type: none"> 1. Compact Dry plates (<i>E. coli</i>) 2. Incubation belt 3. Membrane filtration manifold 4. Whirl Pak bags for sample collection 5a. Funnels 5b. Filter membrane (included in the box with Microfil Funnels) 6. A large syringe (100 mL) 7. 1 mL disposable syringe 8. Alcohol wipe 8. Incubation belt 9. Marker pen 10. Forceps (tweezers) 11. Hand sanitizer gel 	<p>Additional equipment:</p> <ul style="list-style-type: none"> • Bags for transporting the water testing kit • Tissue paper • Waste disposal bags • Blank water bottles (or deionised water) • Water purification tablets <p>Notes:</p> <ul style="list-style-type: none"> • Millipore membrane filtration manifold needs to be assembled prior to first use.
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THE TESTING PROTOCOL**A) Taking a sample with the Whirl-Pak Bag**

 <p>A. Write sample code on Whirl-Pak bag per instructions in the questionnaire</p>	 <p>B. Sanitize hands then Open Whirl-Pak bag</p>	 <p>C. Collect water sample in Whirl Pak-bag (110 ml)</p>
 <p>D. Close the Whirl-Pak bag by rolling over the white tab</p>	 <p>E. Flip the Whirl-Pak 3 times</p>	 <p>F. Fold white tabs closed to seal the Whirl-Pak</p>

B) Performing water quality tests

 <p>1. Sanitize hands</p>	 <p>2. Use the Marker pen to label the Compact Dry plate per instructions in Step 3</p>	<p>3. Labelling instructions</p> <p>Example label: H-012-03</p> <p>Label codes: 1st letter: H = household sample, S = source sample, B = blank test Numbers: cluster + household</p>
 <p>4. Tear open an alcohol wipe</p>	 <p>5. Using a flat hand, use the alcohol wipe to sterilize the top of the filtration. Then sterilize the forceps (clean both very well)</p>	 <p>6. Place the forceps on top of an alcohol wipe to keep it sterile</p>
 <p>7. Remove one membrane filter from the box</p>	 <p>8. Remove the white gridded filter (discard the blue paper) – <i>do not allow the filter to touch any other surfaces; if dropped accidentally, use a new one.</i></p>	 <p>9. Place the filter, gridded side up, on top of the filtration stand</p>
 <p>10. Remove funnel from the plastic sleeve; <i>be careful not to touch the inside of the funnel</i></p>	 <p>11. Lock the funnel onto the filtration stand, touching only the outside of the funnel</p>	 <p>12. Fill the funnel with the water sample up to the 100 mL mark</p>

Performing water quality tests (continued)

		
<p>13. Open one sterile 1 mL disposable syringe and withdraw 1 mL of sample water</p>	<p>14. Use the other hand to lift off the cover of the Compact Dry plate and add the 1 mL from the syringe</p>	<p>15. Connect the large syringe to the manifold</p>
		
<p>16. Open the blue valve and use the large syringe to pull the entire water sample through the filter; discard the water in the syringe</p>	<p>17. Carefully remove and discard the funnel, leaving the filter on the filtration stand</p>	<p>18. Use the sterile forceps to remove the filter from the filtration stand</p>
	 	
<p>19. Place the filter, gridded side up, onto the plate</p>	<p>20.</p> <ul style="list-style-type: none"> -Draw-out the remaining water from the filtration stand with the large syringe (2x), apply some force when doing this -Wipe down the surface of the filtration stand. -Allow any water still inside to drain out 	
 <p>21. Collect all garbage and dispose of properly; show respect to households and do not leave behind any materials</p>	 <p>22. Place the Compact dry plate into the incubation belt</p>	<p>23. Incubate for 24-48 hours and then record result in water quality questionnaire.</p>

INTERPRETING RESULTS

General guidelines for incubation and interpretation of Compact Dry Plate results:

- Keep the temperature between 25 °C and 40 °C at all times.
- Read results between 24 and 48 hours after performing the water quality test.

Compact Dry plates contain a dried agar growth medium which is rehydrated by the sample. The medium contains a chemical that can be used by only certain bacteria for growth (X-Gluc). When *E. coli* is present, it consumes the chemical, forming **blue/green** colonies.

Reading Results

There are 4 general rules when recording the results

1. Only **count blue/green** colonies - > Ignore colonies of any other colour
2. Always record using 3-digits.
3. If there are more than one hundred colonies on the membrane, the result can simply be recorded as “101”. If the bacteria levels are very high, no individual colonies may be seen, but the entire plate may turn blue/green. In this case, the result should also be recorded as “101”.
4. If for any reason it is not possible to interpret the results or incubation could not be completed this should be recorded as “998” (plate lost, forgot to add the paper filter, plate not incubated etc.)

In case there are many colonies on a plate, the number of colonies in one quarter of the plate may be counted, and this number multiplied by four.


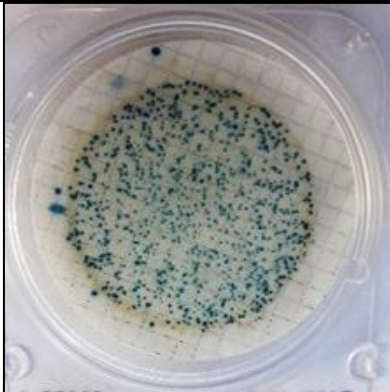
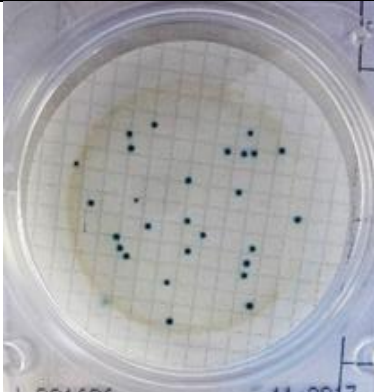
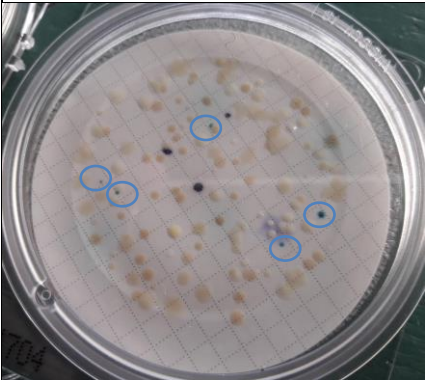
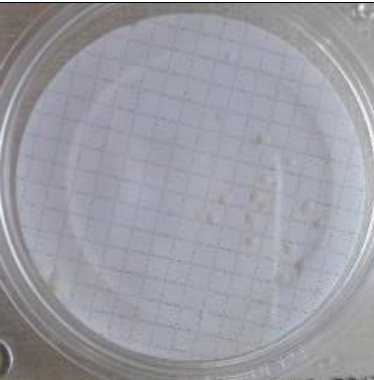
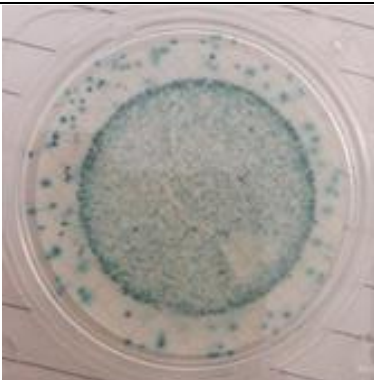
		
Number of colonies (<i>E. coli</i>): 000	Number of colonies (<i>E. coli</i>) 101	Number of colonies (<i>E. coli</i>) 027
		
Purple or yellow colonies should <u>Not</u> be counted The small blue/green colonies <u>should</u> also be counted (see the 5 circled colonies) Number of colonies : 005	White colonies should not be counted Number of colonies : 000	Blue colour may indicate many, many colonies: '101.' Number of <i>E. coli</i> colonies : 101

Figure 2 : Examples of how to interpret the plates

DISPOSAL OF USED COMPACT DRY PLATES

The Compact Dry plates and other test consumables are not kept and transported back at the end of the survey but are appropriately disposed of in the field. Water filtered during the test can simply be disposed of and does not have contamination. Most test components will pose minimal risk and should be disposed of with other solid waste.

After incubation, however, the Compact Dry Plates can contain high levels of *E. coli* and other bacteria, some of which could potentially be pathogenic and must, therefore, be disposed of appropriately as they might otherwise come into contact with children for example.

Protocol for disinfecting the dry plates

- Open a Dry Plate. Use the 1 ml syringe to add between 0,3 and 0,4 ml of water to the plate. Add 1 water purification tablet to the plate. Let the tablet dissolve completely (around 5 min).
- Put the plates in the plastic garbage bag together with the other plastic waste of the water quality test.