WEDC Developing knowledge and capacity in water and sanitation

GUIDE 34

Water sampling

For many people, the quality of water available can be poor. Analysis of a water supply may be required to find out whether the water is safe to drink or whether it needs to be treated before consumption. First, however, it is important to collect a sample of water representative of the water supply as a whole. Methods of analysing the quality of water are discussed in a series of fims produced by WEDC. This guide is a transcript from the WEDC film of the same title which is available here: http://wedc.lu/water-sampling

Contents

When a water sample is collected, care needs to be taken to ensure that there is no accidental contamination of the sample from the container the sample is collected in; during the process of sampling; during transportation of the sample from field to laboratory (if no portable field testing equipment is available); and by the way it is stored.

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Designed and produced by WEDC Publications

Published by WEDC, Loughborough University

ISBN 978 1 911252 12 2

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Preparation and sterilization of sample bottles

Several types of bottle may be used for sampling. Glass, plastic or aluminium containers are all suitable, although it may be easier to clean and sterilize glass bottles (Figure 1).

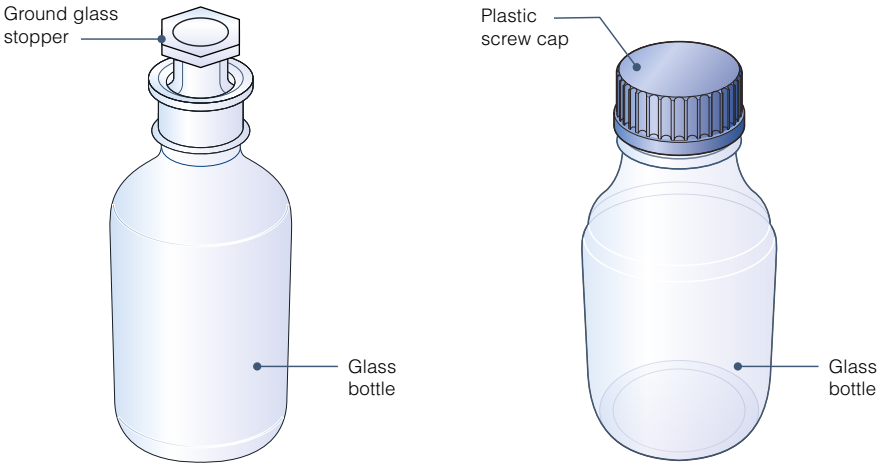

Figure 1. Glass bottles for water sampling

There are several steps to the preparation and sterilization of the sample bottle.

1. The first step is to clean and wash the sample bottle or container thoroughly, and rinse with distilled or de-ionized water (Photos 1 & 2, p.3).
2. Next, for a 200 millilitre sample, add four or five drops of aqueous sodium thiosulphate solution to neutralize any residual chlorine which could distort the results of the analyzed sample (Photo 3, p.3).

   Screw bottle caps should only be loosely fastened prior to sterilization and then only tightened when they have cooled following sterilization.

   For a ground-glass bottle with a stopper, a strip of paper or aluminium foil should be placed inside the neck of the bottle to prevent the stopper from getting stuck during sterilization (Photo 4, p.3).
3. Now fasten a piece of paper, or preferably aluminium foil (although any thick paper would do), over the

cap and neck of the bottle. Tie it on with an open bow knot which can be released by a single tug. The cover helps to protect the bottle from contamination (Photo 5 and inset).

Quality aluminium foil may not require the addition of the string as it will naturally retain its shape and cling to an object it envelopes. If in doubt, however, use string too.

4. Sterilize the sample bottles in an autoclave – a strong, heated container used for chemical reactions and other processes including steam sterilization. Operate according to the manufacturer's instructions (Photo 6). Usually bottles will require steam sterilization at 120 degrees centigrade for 20 minutes.

   Alternatively, glass bottles can be heated in a dry oven at 170 degrees centigrade for 1 hour (Photo 7, p.4).

5. Once sterilized, allow the bottles to cool and then tighten the tops and store in a refrigerator until required (Photo 8, p.4).

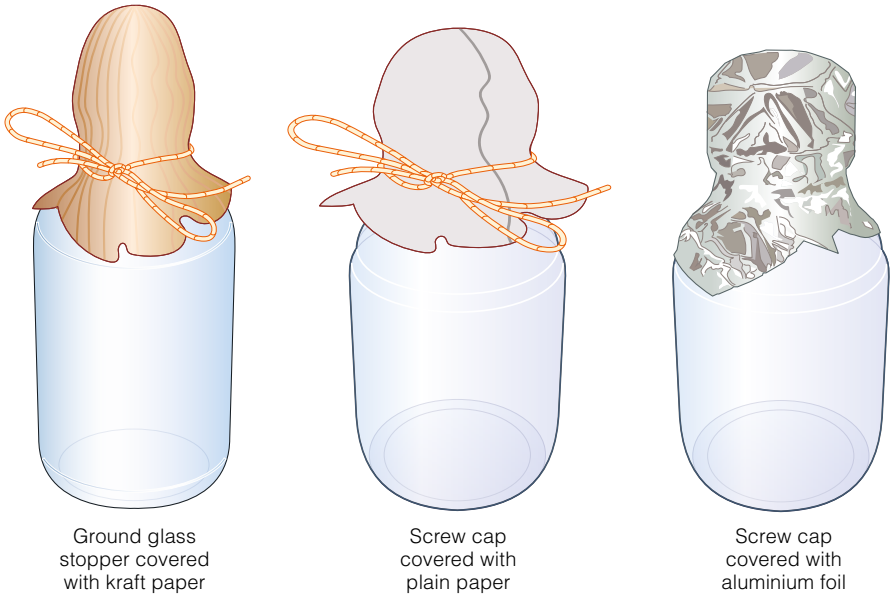

Figure 2. Glass bottles covered with kraft paper, plain / newspaper, aluminium foil

Photo 1. Washing the bottle

Photo 2. Rinsing with de-ionized water

Photo 3. Adding a few drops of aqueous sodium thiosulphate solution

Photo 4. A strip of aluminium foil to prevent the stopper from sticking during sterilization

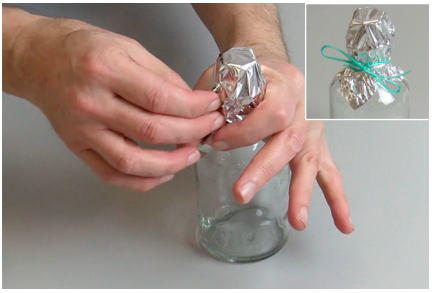

Photo 5. String to secure the foil

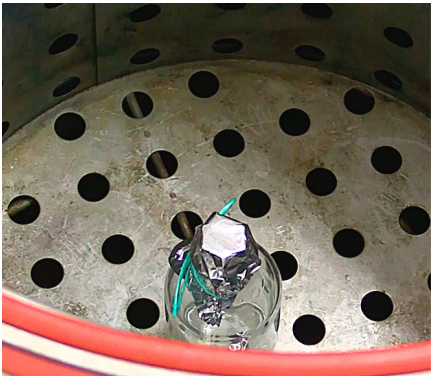

Photo 6. Sterilization in an autoclave

Photo 7. Sterilization in an oven

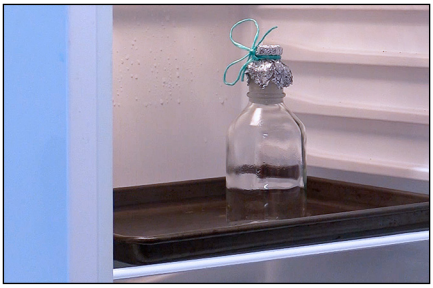

Photo 8. Storage in a refrigerator

Sampling from a tap or standpost

To draw a sample from a tap or a standpost, first wash your hands and clean the tap (Figures 3 & 4). Remove any attachments that may cause splashing and, using a clean cloth, wipe the outlet to remove any dirt. If the tap is leaking it must be repaired before sampling.

Figure 3. First, wash your hands

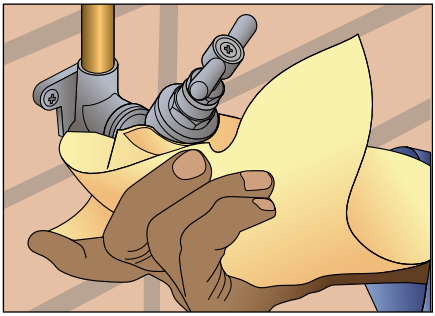

Figure 4. Clean the tap

After cleaning the tap or spout, wash your hands again. Then open the tap until it reaches its maximum rate of flow. Let the water flow from the tap for 1 to 2 minutes to clear the service line. Close the tap.

Now sterilize the spout. Sterilize it for a minute with a flame from an ignited cotton wool swab soaked in alcohol or a gas burner or portable lighter (Figure 6). If the tap or spout is made from plastic do not use a flame. Instead, wipe thoroughly with a solution of hypochlorite. Failing this, use an alcohol wipe.

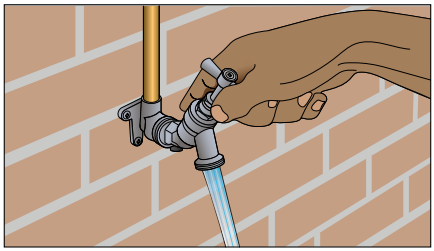

Figure 5. Open the tap until it reaches its maximum rate of flow

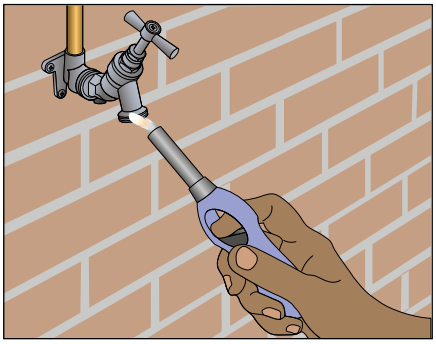

Figure 6. Sterilize the spout

When you have done this, open the tap again, this time allowing the water to flow for 1 to 2 minutes at normal rate.

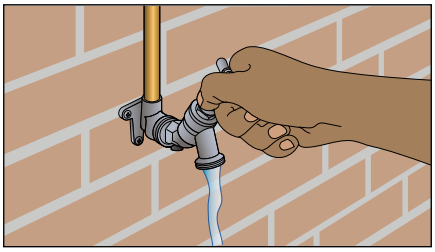

Figure 7. Open the tap at the normal rate

Open the sterilized bottle carefully. Untie the string fixing the protective paper to the cap and unscrew or remove the stopper, keeping your fingers on the paper or foil (Figure 8).

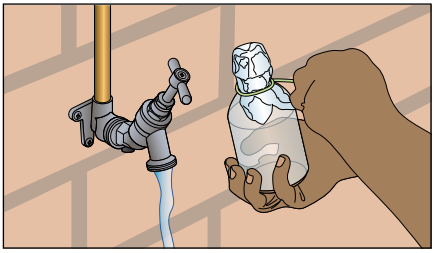

Figure 8. Open the bottle

Whilst holding the cap and protective cover face downwards (so as to prevent entry of dust that could carry micro-organisms into the bottle) immediately hold the bottle under the water jet and fill the bottle to the shoulder only.

Leaving space in the bottle makes shaking before analysis easier (Figure 9).

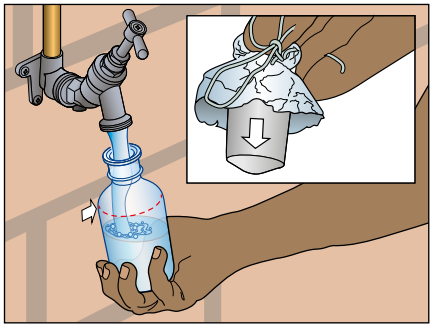

Figure 9. Fill the bottle

Turn off the tap, then replace the cap or stopper and re-fix the paper or foil to cover the cap again and tie it on with the string (Figure 10).

Securely attach a label to the bottle (or write on the bottle itself) giving the location, the time of sampling, the date and the sampler's name. Place it in a transport box and return it to the laboratory within 24 hours if stored in melted ice.

Alternatively, analyze the sample using a field test kit as soon as possible after collecting the sample.

Figure 10. Two filled bottles

Sampling from handpumps, wells and boreholes fitted with a pump

For wells and boreholes equipped with a pump, the pump should be operated for at least 20 to 30 minutes, depending on the depth and diameter of the borehole, to clear any standing water in a water column (Figure 11).

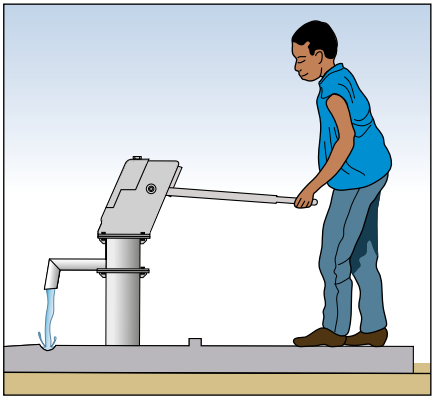

Figure 11. Pump for 20 to 30 minutes

Clean the pump outlet thoroughly and, using the same process described earlier, sterilize for a minute with a flame unless the spout is made from plastic in which case wipe thoroughly with a solution of hypochlorite or an alcohol wipe if no hypochlorite solution is available. Operate the pump for a further two minutes and take a sample from the flowing stream of water. To protect the container from contamination, follow the same precautionary process that you would use if drawing a sample from a tap.

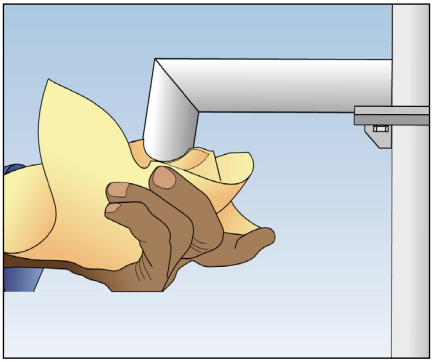

Figure 12. Cleaning the pump spout

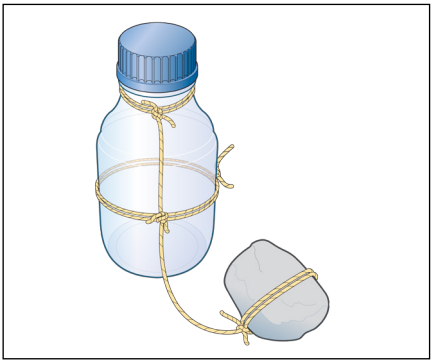

Figure 13. Stone attached to the bottle

Sampling from an open well

To draw a sample from an open well, a weighted bottle or shallow sampling device may be used.

First, with a piece of string, attach a clean and washed stone to the sterilized sampling container (Figure 13).

Then attach the bottle to a longer length of clean string or wire rolled around a stick and tie this onto the first piece used to attach the stone to the bottle. The second length may need to be several metres long, depending on the distance from the surface to the water level in the well (Figure 14).

Once the bottle is securely attached to the coiled string or wire, open the bottle (Figure 15).

Lower the bottle into the well, weighted down by the stone, unwinding the string slowly. Do not allow the bottle to touch the side of the well (Figure 16).

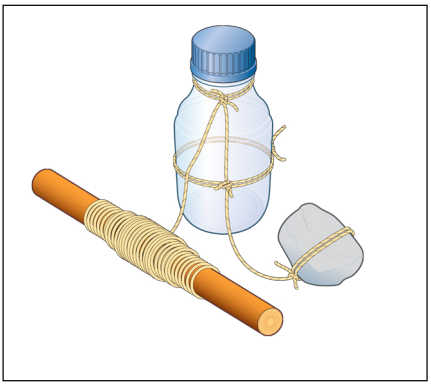

Figure 14. Attach string to the bottle

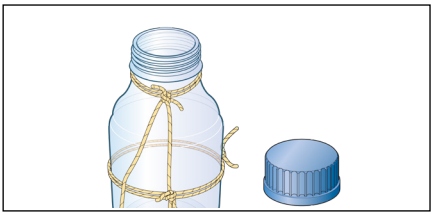

Figure 15. Open the bottle

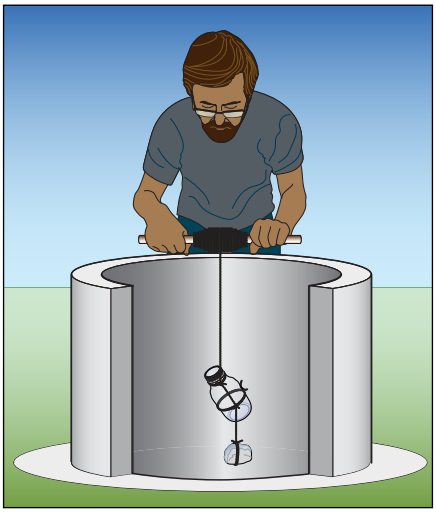

Figure 16. Lower the bottle into the well

Immerse the bottle completely in the water and lower it to the bottom of the well (Figure 17).

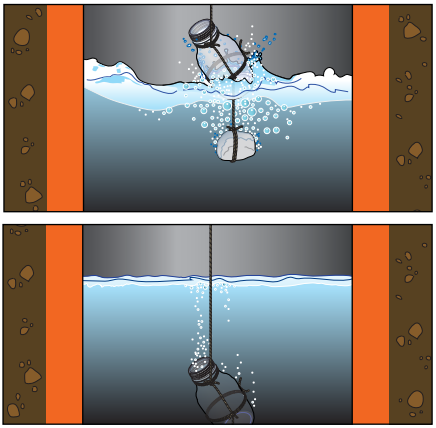

Figure 17. Immerse the bottle completely

Once the bottle is filled, rewind the string around the stick to raise the bottle (Figure 18). If the bottle is completely full when raised, discard a little to provide space for shaking prior to analysis. Replace the cap or stopper on the bottle.

Process the sample in the same way you would do for a sample drawn from a tap.

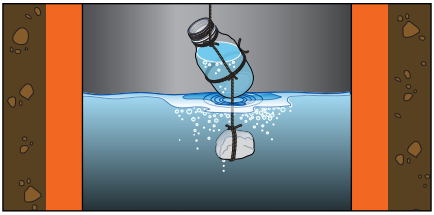

Figure 18. Raise the bottle

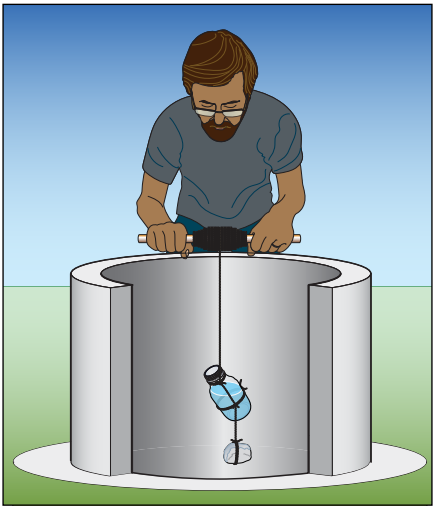

Figure 19. Prevent the bottle from touching the side of the well

Sampling from a watercourse or reservoir

To draw a sample from a watercourse such as a river or a stream, or from a reservoir, first wash your hands thoroughly and carefully undo the bottle cap, without touching the neck of the bottle, to avoid possible contamination.

Holding the bottle by the base, submerge it to a depth of about 30 centimetres with the mouth facing slightly upwards.

If there is a current, the bottle mouth should face towards the current. If there is no current, scoop the bottle away from your body (Figure 20).

If the bottle is completely full, discard some so that the sample can be shaken before analysis

Replace the cap or stopper carefully without touching the neck of the bottle.

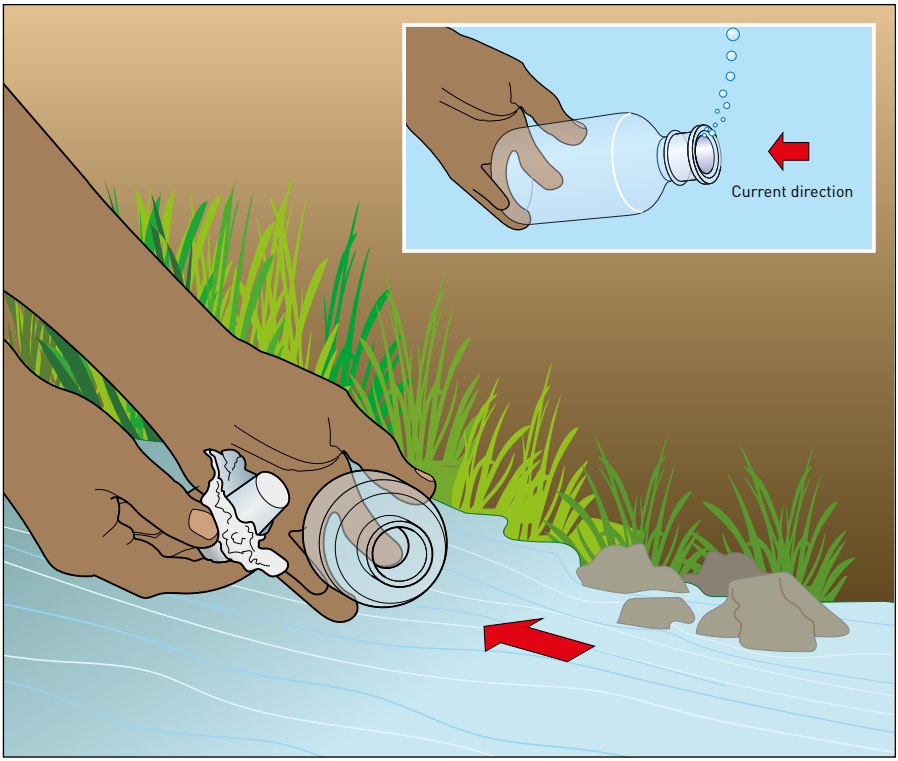

Figure 20. Taking a sample from a watercourse or a reservoir

Sampling water from a water container

A sample from a water carrier's pot or bucket may be more representative of what is actually being drunk, so a sample should be taken from that as well.

If the water is stored in the house then the household container would also need to be sampled. Positive results showing contamination from a sample of the household container alone would indicate poor hygiene in the home and not that the original source of the groundwater is polluted.

If a bottle can be immersed in the container, then a sample can be taken by fully immersing the sample bottle (see Photo 9).

If this is not possible, then a quantity of water can be poured from the container into the sample bottle (see Photo10). In both cases, the sample bottle should be clean and sterile. Wash your hands before collecting a sample.

Frequency of sampling

Ideal frequencies of sampling are described in G*uidelines for Drinking-water Quality* published by the World Health Organization. However, few countries can afford or are able to meet these recommendations due to a lack of trained staff or resources. The general criteria should, nevertheless, be to test as often as possible; to test as many points in the water network as practically feasible and to keep testing facilities fully employed until an acceptable frequency of sampling is reached.

There should be a concentration of sampling points where maximum benefit will be obtained.

It is essential that treated water entering the distribution network is monitored daily to confirm its safety. The minimum WHO recommendation on frequency of sampling for piped supplies is 1 sample per month per 5,000 people served. Figure 21 shows typical sampling points on a water distribution system.

Photo 9. Immerse the bottle completely

Photo 10. Sample poured into a bottle

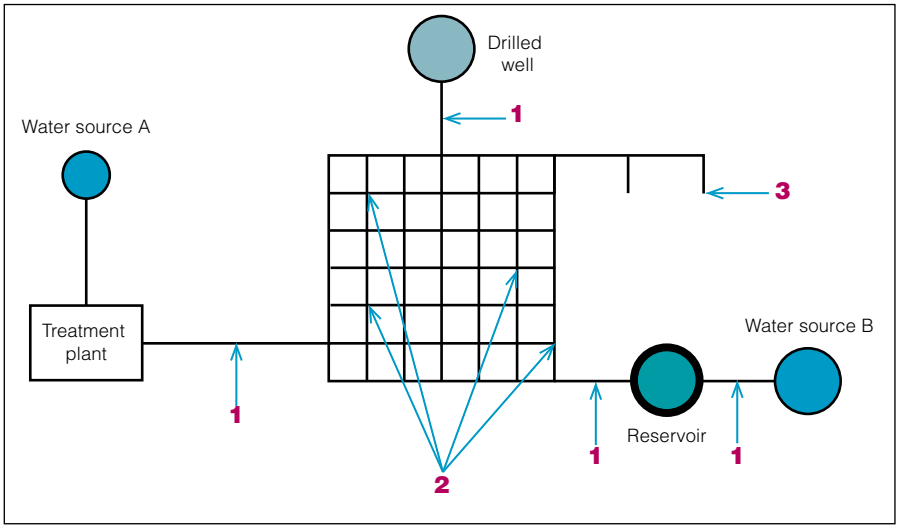

Figure 21. Typical sampling priorities (1 to 3) on a water distribution system

Summary points

DOs

- Collect the bacteriological sample first from a sampling point
- Only collect in sterile bottles
- Keep the bottle closed until the sample is ready to be collected
- Hold the bottle around the base
- Carry some spare sterile bottles
- Wipe clean the outside of the bottle before use
- Re-sample if there is a possibility of contamination
- Transport the sample in a cooled covered container (0 to 4^{0}C – i.e. melting ice) within 24 hours
- Label the sample with a waterproof marker pen with location, time, date and sampler's name
- Test for chlorine residual on site

DO NOTs

- Do not contaminate the sampling point
- Do not allow the top or neck of the bottle to touch anything
- Do not collect samples in dirty bottles
- Do not completely fill the bottle
- Do not put yourself at risk from bilharzia – wear waterpoof gauntlets or waders

Further reading

HUTTON, L.G., 1983. *Field Testing of Water in Developing Countries*. Medmenham, UK: Water Research Centre.

http://wedc.lboro.ac.uk/resources/e/mn/links/hutton.pdf

WHO,1985. *Guidelines for drinking-water quality.* Geneva: WHO.

Fourth edition available here:

http://apps.who.int/iris/bitstream/10665/44584/1/9789241548151_eng.pdf

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