WEDC

MOBILE NOTE 35

# Emergency treatment of drinking-water

TECHNICAL NOTES ON DRINKING-WATER, SANITATION & HYGIENE IN EMERGENCIES

**Originally designed for print, this is one of the series of highly illustrated notes prepared by WEDC for WHO to assist those working immediately or shortly after an emergency to plan appropriate responses to the urgent and medium-term water, sanitation and hygiene needs of affected populations.**

TN 5

World Health Organization

Loughborough University

# Contents



**Normally, drinking water supplies need to be treated during and after an emergency to make them safe and acceptable to the user. Treatment at the point of use is generally quicker and less expensive to implement than a centralized system, but it can be more difficult to manage. Only water used for drinking and preparing food needs to be treated.**

**Nevertheless, this still amounts to about five litres per person per day. This technical note describes some of the most common and simple treatment options suitable for use during an emergency.**

## Pre-treatment

There are a wide variety of technologies for treating water at the point of use. The methods described below will remove physical and microbiological pollution, but not chemical contamination.

Water treatment can make drinking-water that is unsafe at the source or drinking-water that becomes contaminated during handling and storage safer. There are a number of different methods and the preferred method or combination of methods depends on a number of factors such as source water quality, including turbidity or number of suspended particles in the water, availability of different methods and supply chains, user preferences and cost.

## Aeration

Aeration brings water into close contact with air which increases the oxygen content of the water.

This will:

- remove volatile substances such as hydrogen sulphide and methane which affect taste and odour;
- reduce the carbon dioxide content of the water; and

- oxidize dissolved minerals such as iron and manganese so that they can be removed by sedimentation and filtration.

Water can be aerated in a number of ways.

One simple method for householders is to rapidly shake a container part-full of water for about five minutes (Figure 1), then leaving it standing for a further 30 minutes to allow any suspended particles to settle.

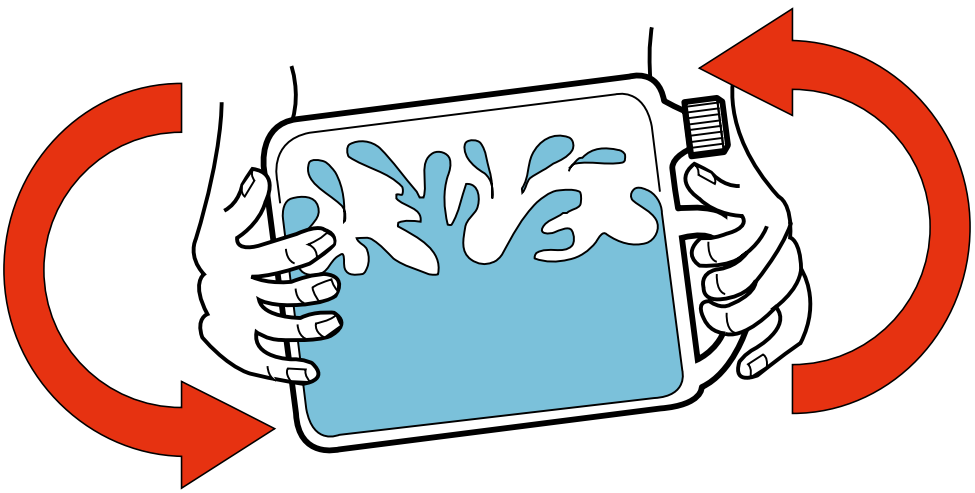


**Figure 1.** Aeration by vigorously shaking water

## Storage and settlement

If water is turbid it can be allowed to 'stand and settle' to remove larger particles. However, even after settling, water should be treated with a proven method to ensure it is safe to drink. Additionally, the suspended solids and some of the pathogens will settle to the bottom of the container, removing further risk. Storage for two days reduces contamination further still, and also reduces the number of organisms which act as intermediate hosts for diseases such as Guinea worm infection *(dracunculiasis).*

## Filtration

A filter removes contamination by physically blocking particles while letting the water pass through.

### Membrane filters

Membrane filters operate using similar removal mechanisms as other filters and can be highly efficacious in removing

even smaller organisms such as viruses. The manufacturer's instructions on use should be adhered to as often such filters require regular cleaning.

## Sand filters

Household filters may be assembled inside clay, metal or plastic containers. The vessels are filled with layers of sand and gravel and pipework arranged to force the water to flow upwards or downwards through the filter.

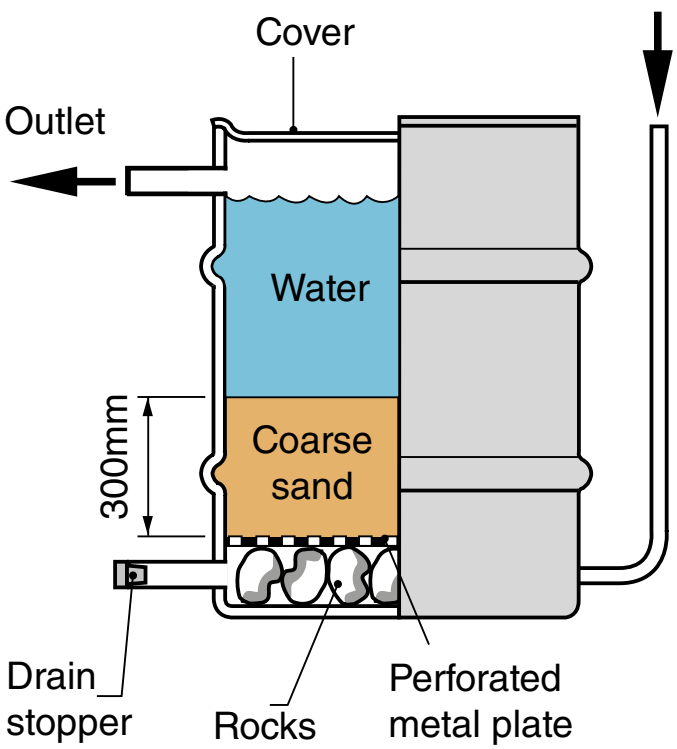
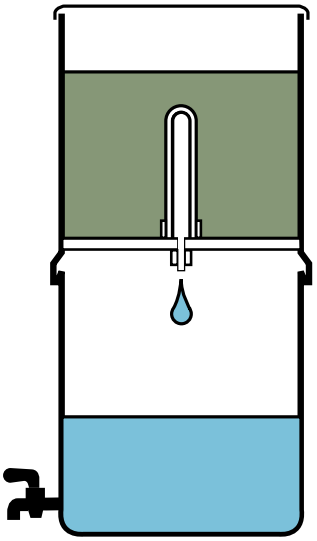


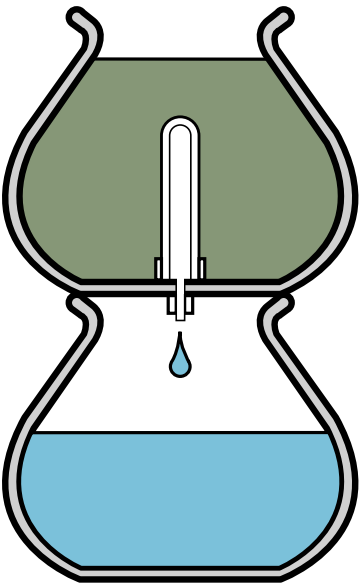

**Figure 2.** A simple upward, rapid flow filter

## Ceramic filters

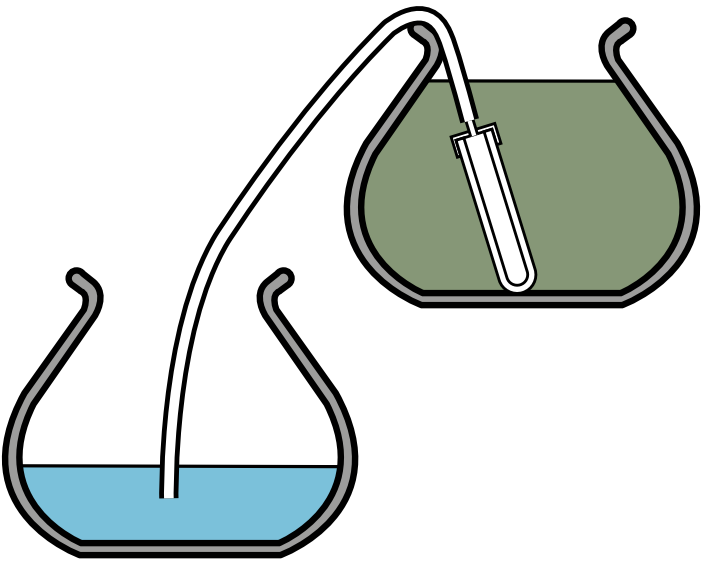
Water passes slowly through a ceramic or ‘candle’ filter (Figure 3).



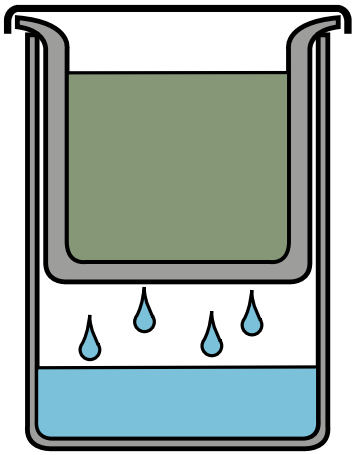
(a) Manufactured unit



(b) Candle with jars



(c) Using candle with siphon



(d) Porous jar

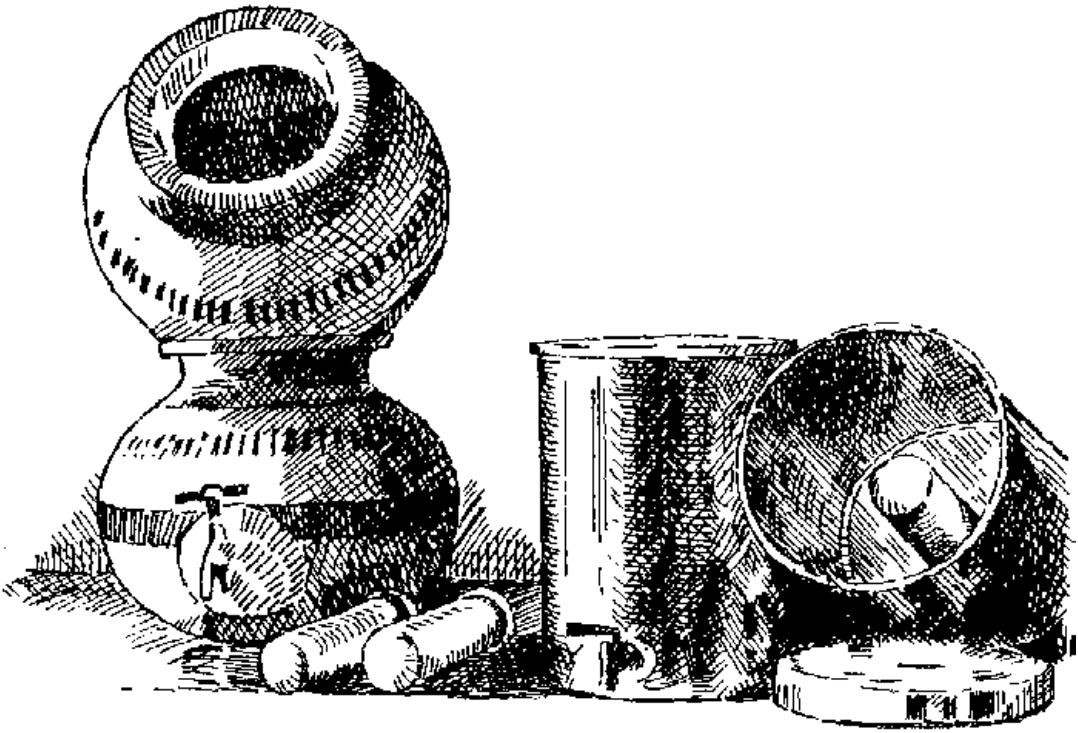


**Figure 3.** Ceramic or ‘candle’ filters

In this process, suspended particles are mechanically filtered from the water.

Some filters, for example, are impregnated with silver which acts as a disinfectant and kills bacteria, removing the need for boiling the water after filtration.

Ceramic filters can be manufactured locally, but are also mass-produced. They have a long storage life so can be stored in preparation for future emergencies.

Impurities retained by the surface of the candle need to be brushed off under running water at regular intervals.

## Disinfection

Disinfection destroys all harmful organisms present in the water, making it safe to drink.

### Boiling

Boiling is a very effective method of disinfecting water, but it is energy consuming. The water should be brought to a 'rolling' boil. Apart from the high

cost of the energy involved in boiling, the other disadvantage is the change in taste of the water. This can be improved by aeration, by vigorously shaking the water in a sealed container after it has cooled.

## Chemical disinfection

Many chemicals can disinfect water but the most commonly-used is chlorine. With appropriate dosing, chlorine will kill most viruses and bacteria, but some species of protozoa (notably *cryptosporidium*) are resistant to chlorine. There are several different sources of chlorine for home use; in liquid, powder and tablet form. They vary in size and strength (i.e. in how much chlorine they contain) so different quantities are required depending on the formulation.

Always follow the manufacturer's instructions for use. To prevent misuse, clear instructions must be given to all users. (see Figure 4 available here.)

Chlorine compounds should not be given out to users outside of the container they are supplied in by the manufacturer. People cannot tell how much of the product to use or how to use it simply by looking at it!

## Solar disinfection (SODIS)

Ultra-violet rays from the sun will destroy harmful organisms present in the water.

Fill transparent one- or two-litre plastic containers with clear water and expose them to direct sunlight. The length of time needed for inactivation of pathogens will vary depending on the transparency of the container, intensity of sunlight, and clarity of the water. In areas near the equator, on a sunny day 24 hours is likely sufficient or 48 hours for a cloudy day. Devices are now available which can be attached to the bottles to indicate when sufficient temperatures have been reached for inactivation. (See Figure 5.)

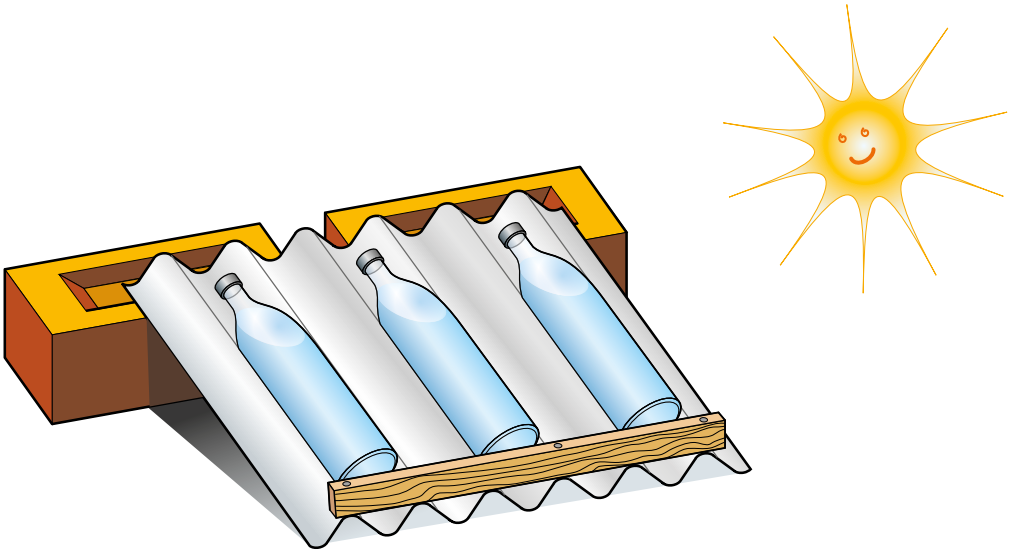


**Figure 5.** Figure 5.6. Solar disinfection (SODIS)

Cool the water and shake vigorously before use.

## Combined treatment systems

A few large companies have developed compounds that both remove suspended particles and disinfect the water. One such compound contains a chemical that helps suspended particles join to make larger, heavier ones that will settle to the bottom of the container. It also contains chlorine that disinfects the water after settlement has occurred.

### Training on use of technology

Successful emergency programs provide and effective treatment method with which the affected population is already familiar, and adequately invest in developing culturally appropriate materials and approaches to support correct use of the selected method(s).

## Looking after clean water

There is no point in treating water if it becomes contaminated again afterwards. The storage and use of treated water is just as important as the treatment process.

### Water storage

Water should be stored in clean, covered containers and kept in a cool dark place. Wide-necked containers such as a bucket fitted with a tight fitting lid are the best as they are easy to clean between uses.

Contamination can also occur as the water is taken out of the storage

container. Hands and utensils may come into contact with the water so it is important to encourage users to wash their hands with soap before handling drinking water; and to fit a tap to the storage container so that water can be poured directly into a cup or bowl (Figure 6).

**Figure 6.** Tap fitted to a water bucket

## Hygiene promotion

The benefit of providing safe drinking-water will be lost if users do not know how they will benefit. Changing

unhygienic behaviour is just as important as the provision of clean water. Emergencies can provide a good opportunity to introduce new hygienic practices. As users settle into a new environment, they are more likely to accept changes to their normal behaviour.

For water supply and sanitation, the most important practice to change relates to handwashing.

Don't assume everyone knows how to wash their hands properly. Show them.

(See Note 47: Handwashing with soap)

## Further information

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## About this note

Prepared for WHO by WEDC.
Authors: Sam Kayaga and Bob Reed
Series Editor: Bob Reed

Illustrations by Rod Shaw courtesy of WEDC / IFRC. Additional graphics by Ken Chatterton.

Designed and produced by WEDC

**Water, Engineering**
**and Development Centre (WEDC)**
**School of Civil and Building Engineering**
**Loughborough University**
**Leicestershire LE11 3TU UK**

**Phone:** + 44 (0) 1509 222885
**Email:** wedc@lboro.ac.uk
**Website:** wedc.lboro.ac.uk
**Twitter:** wedcuk
**YouTube:** wedclboro

**World Health Organization**
**Water, Sanitation, Hygiene and Health**
**Unit, Avenue Appia 20, 1211, Geneva 27,**
**Switzerland**

**Phone:** + 41 22 791 2111
**Phone (direct):** + 41 22 791 3555/3590
www.who.int/water_sanitation_health

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BACK TO TOP