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A locally made rope pump providing water in Zambia

Safe and Sufficient Water

3 • Introduction

Water is life! Without water there would be no life on the planet. We all use water every day; to drink, wash ourselves, to cook, to wash our clothes, flush our toilets and water our gardens. Animals and plants will die without water. Our daily existence depends on water. In rural areas of developing countries, a large portion of women's daily work is to secure an adequate amount of potable water for their families.

The world's economy also depends on water. Industries and especially agriculture spend enormous quantity of water in their production.

This manual introduces the two main water related problems that the human race has yet to solve:

- Resources of fresh water are coming to an end
- 1.2 billion people do not have access to potable water



Water resources are coming to an end

About 70% of the water that is taken from rivers or pumped from the water table is used for irrigation. In many regions of the world the use of water at this rate is unsustainable. The ground water is being used faster than it is being replaced by the rain water that filters through the earth to replenish the water tables. The result is that the water tables fall, and wells run dry.

Water tables are falling in many countries, including China, India, and the United States, which, put together, produce half of the world's grains. Under the northern plain of China, where half of the wheat and a third of the country's maize is produced, the annual fall of the water table has increased from 1.5 metres per year a decade ago to its current rate of 3 metres a year. In the areas surrounding Beijing, the capital of China, it is necessary to drill up to 1000 metres to reach water.

Recent data from India, from studies of Punjab and Haryana, indicates that the water tables are falling at a rate of one metre per year. It is estimated that the reduction of the water supply will re-

duce the grain crops of India by one fifth. (Information from Worldwatch Institute - www.wwi.org.br)

Today it is no longer enough to build more dams or drill more wells. The only option is to reduce the growing demand through stabilization of the population and to improve the efficiency of using water - in the

same manner that agricultural productivity was improved in the second half of the 20th century. This means that water must be used more efficiently in agriculture and agricultural systems that promote better infiltration of the water into the ground must be adopted. It means we must promote water and water source preservation systems to raise the level of the water tables.

Lack of potable water

Many places in the world lack potable (drinkable) water and many people die because of this. An estimated two million people die each year because of water related diseases. One third of humanity lives in a constant state of sickness or disability as a result of unsafe water.

It is possible to avoid these diseases. Water can be treated with chlorine, but many people do not have the money to buy it, or it is not available for purchase in their area. Water can also be boiled before it is used, but many families do not have sufficient fire wood, and obtaining more would mean even more work for the women. For these reasons it is good to learn other methods of making water safe to drink.

This chapter

This chapter presents the following low cost solutions:

- making water potable (sections 4-6),
- economizing water resources (sections 7-8),
- providing water for domestic use and small scale irrigation (sections 9-14).



Water is life. For fishermen in Lochinvar, and everyone else

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4 • Solar Disinfection

Idea

The idea is to spread a simple system for cleaning water which can be used when people cannot boil water.

Introduction

Access to clean water is a problem in many parts of the world. In many places people have to use water from rivers or lakes, or use rainwater collected in containers. This water is often full of microorganisms that spread diseases. The diseases are spread when people use the water for cleaning food or drinking. To avoid getting sick it is necessary to disinfect the water. This can be done in many ways:

- boiling - this will kill nearly all microorganisms
- disinfecting with chlorine - this is done in many larger cities
- treating with radiation - this will also kill the microorganisms

For many people in Africa getting enough firewood is a problem. It is a difficult task on which most rural women spend several hours a day, or, in the towns where there is no possibility of gathering firewood, firewood or charcoal must be purchased.

This means that even when people know that they should boil all water used for drinking or cleaning foods and eating utensils, it is often not done. Hence, it is good to promote other simple methods that could help people get safe drinking water and, therefore, avoid diseases.

Although the radiation method mentioned is used in many developed countries with

special equipment, ultraviolet rays in sunlight are also capable of destroying microorganisms. These rays can go through glass or clear plastic bottles. The Swiss Federal Institute of Environmental Science and Technology (EA-WAG) developed the SODIS method and showed that 6 hours of normal sunlight will disinfect surface water so that it is safe to drink.

Solar radiation does not kill all bacteria but it inactivates the bacteria causing diarrhoea, cholera and typhus. The system can be used even when the water contains many more microorganisms than normal.

If the temperature gets over 50 degrees for just one hour many other parasites like worms and amoebae are also killed. It is therefore good to place the bottles on a black surface. If the water used is fairly clear and the correct steps are followed it is possible to obtain safe drinking water.

How to disinfect water with sunlight

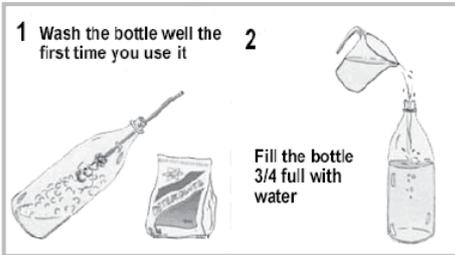
- Fill some clear plastic bottles (PET) with screw caps 3/4 with clear (transparent) water.
- Close and shake at least 20 times to get air into the water. The oxygen helps to kill the bacteria.
- Fill up the bottles completely with more water and close well (no air inside as the bubbles will reflect the sun).



6 hours of exposure to the sun are enough to disinfect transparent water



- Place the bottles lying down in a sunny place - for example on a roof or on some sheet metal.



- The warmer the better, so it is good to place them on a black surface - or paint half of the side black (and place the black side down!)

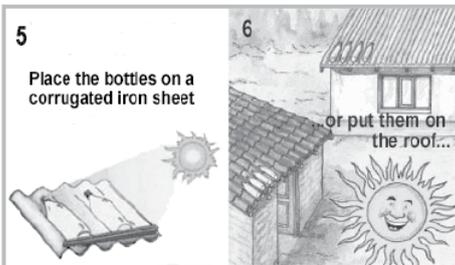
• After 6 hours of sunlight (do not place in shade!) the water is disinfected.

- If it is very cloudy, leave the bottles for 2 days. The system does not work if it rains during the 2 days.



• Place the bottles in a cool place or in water to cool.

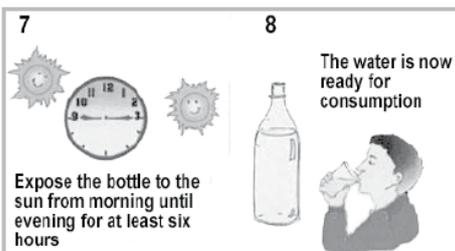
• Keep the water in the same bottles and use it. Do not fill it into other containers unless they have been disinfected.



To get a good result it is important that the bottles are PET bottles as they let more of the ultraviolet rays

through. Clear Coca Cola plastic bottles are an example of PET bottles. Do not use coloured bottles (green, brown, etc.). The ultraviolet light does not go through.

PVC bottles are not so good. (PVC does not burn easily. PET burns easily and smells sweet when burned). Avoid using scratched bottles as less light will get in.



Change them when they are not clear any more or after one year. Glass bottles can also be used.

To be sure that the water is clear enough to use perform the following test:

- Fill the bottle with water.
- Place it (normally - not lying down) on top of a piece of paper with some letters of 3 cm.
- Look through the opening from the top through the bottom of the bottle.
- If you can see the letters (read them) the water is clean enough for SODIS.
- If you cannot read the letters you have to clean the water through a fine filter (cloth) or use moringa seeds to clean it (see next section).

*** SODIS does not remove any chemical pollution from farms, factories, garbage dumps etc. from the water ***

Information and drawings adapted from www.sodis.ch, website of EAWAG, the Swiss Federal Institute of Environmental Science and Technology