# Community Health through Hygiene:

*Keeping Water Safe:*

*Household Water Treatment & Storage*

*Facilitator's Guide*
*Edition 2.1*

**Introduction -** Lifewater Inc. (d.b.a. Lifewater International) is a Christian registered nonprofit 501(c)(3) organization established in 1977, which partners with non-governmental organizations, churches and businesses to help communities in Africa, Asia, and Latin America gain access to safe Water, adequate Sanitation, and effective Hygiene practices (WASH). Focusing on sustainability, Lifewater and its qualified field trainers build capacity and equip partner organizations through hands-on training. All of Lifewater's materials are designed for use in a participatory environment. To make the most of Lifewater's training materials, attending a workshop taught by a certified Lifewater trainer is strongly encouraged; courses are offered in the USA and internationally.



**Lifewater aims to maintain relationship with users of this work in order to learn from one another and obtain feedback on implementation. Therefore, organizations wanting to use this work are asked to sign a simple partnership agreement outlining specific terms of use. Please contact Lifewater International for more information:**

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## Table of Contents

# Using the Facilitator Manual

1. The beginning of most lessons include facilitator preparation information surrounded by a box. This information should not to be read to the participants. It contains:

   - The **purpose**
   - **Objectives** (what the participants will accomplish)
   - **Materials** needed for the lesson
   - **Preparation** needed before the lesson starts
   - The approximate **time** the lesson will take (without translation)
   - The **steps** or activities that will happen and how much time each will take
   - **Key Learning Points** of the Lesson

2. Information surrounded by a box in the lesson is also for the facilitator only. Do not read this out loud. Information includes:

   - Lesson steps: these explain the next step in the lesson, for example:

     1. Observe a drama **-** 10 minutes

   - Facilitator notes: these give instructions, tips, or information to the facilitator, for example:

     *Lay out the drawings of feces and the mouth about 2 meters apart.*

3. Bible verses are represented with a book and a verse reference. They can be read out loud to participants or written on flipchart paper and read out loud by participants:

   *Deuteronomy 31:8*

   "The LORD himself goes before you and will be with you; he will never leave you nor forsake you. Do not be afraid; do not be discouraged."

4. Drama scripts are also surrounded by a boxe. Prepare actors/actresses for their parts before the lesson begins. Some drama scripts are stories to be read by facilitators; other scripts are for participants to learn and speak.

5. Questions for participants are indented with an "arrow". Some questions may also give possible answers in boxes. Do not read the answers out loud.

   ➢ What are some of the ways that the sickness traveled? Hands, food, flies

   Be sure to pause and allow time after each question for participant answers and ideas**.**

## Introduction to Participatory Methodology

This training material uses a participatory teaching methodology. This methodology encourages participants to become actively involved in their own learning through sharing their ideas and working together with others to complete learning tasks.

Research has shown that we remember

- 20% of what we **hear**
- 40% of what we **see** and **hear**
- 80% of what we **hear, see** and **do**

These methods are effective, but they can be frustrating. It is much easier to read a list of answers than to have to develop answers with others through a learning process.
Different people enjoy different types of learning activities. There will be many different activities throughout the training that are aimed at various learning preferences.
Please be patient with the participatory learning process. It takes time but is an effective process. Look for a variety of types of activities during the workshop.

## Purpose of this Manual

This manual is indented for training with field workers and community trainers, within a Training of Trainer (TOT) context.

This manual assumes that participants within the TOT training will have, at minimum, basic literacy skills. Once trained, the material can be adapted by the individual users (trainers) to suit their context. Activities within the lessons are designed to work with both literate and non-literate audiences in community trainings.

Posters used with the manual for TOT trainings are meant to serve as examples only. It is recommended that they be adapted by a local artist to fit each individual context and culture.

## Training Groups

*Training Groups* are small groups that you will meet in for discussion and feedback at the end of each day. Your training group members will be the same throughout the training.

**Daily Review**
With your Community Groups, discuss the following:

1. What went well during the day?
2. What could have gone better during the day?
3. Was there anything that was unclear or needs further explanation?
4. What suggestions do you have for the rest of the training?

After small group discussion, write down your group's comments in **complete thoughts** on an index card, then give the card to a facilitator.

We encourage you to answer these questions on your own at the end of the day and record them in your workbook:

1. What was something you learned today?
2. What about today's lessons challenged you?
3. How will you respond to that challenge?

**Other Activities**
The Training Groups will also take turns doing the following activities throughout the course:

1. **Worship and Prayer**: The responsible group will lead the class in 5-10 minutes of worship and prayer in the morning.
2. **Energizer**: The responsible group will prepare a short energetic activity to do one time in the morning and one time in the afternoon. It should involve the whole group and go no longer than 5 minutes.
3. **Time Keeping**: The responsible group will find a creative way to alert the participants when it is time to return from breaks and lunch.
4. **Host**: The responsible group will be in charge of making sure the room is kept in order throughout the day and (additional tasks such as filling tippy taps, etc.).

| Activity | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 |
|---|---|---|---|---|---|
| **Worship and Prayer** | Facilitators | ___ | ___ | ___ | ___ |
| **Energizer – morning and afternoon** | Facilitators | ___ | ___ | ___ | ___ |
| **Time Keeping** | Facilitators | ___ | ___ | ___ | ___ |
| **Host** | Facilitators | ___ | ___ | ___ | ___ |

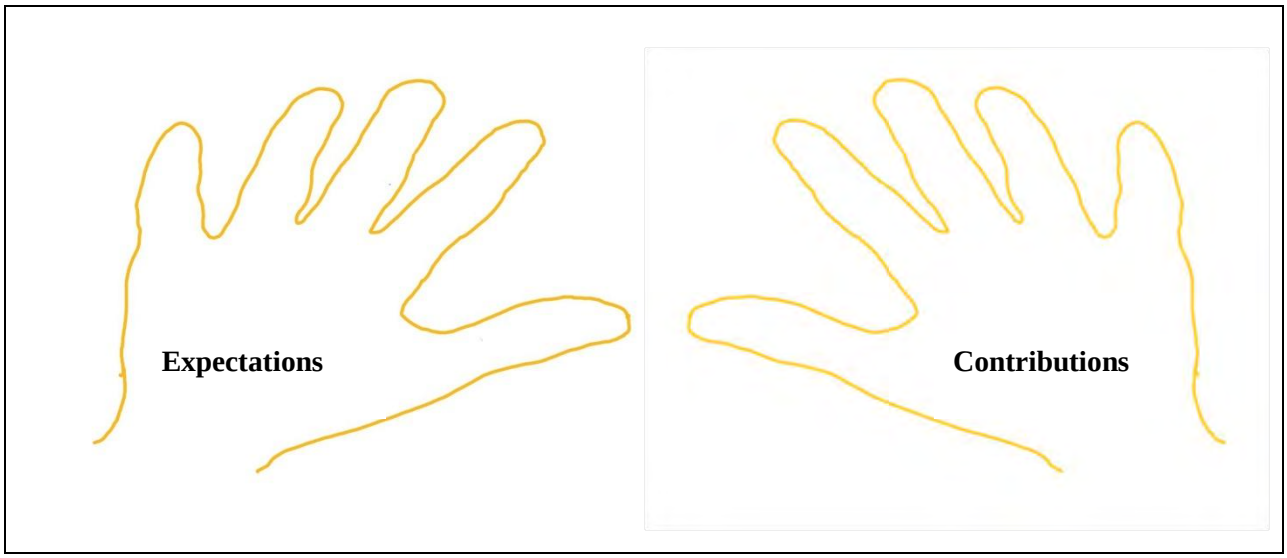
Your Training Group's name _____

## Expectations & Contributions

***Materials: Flipchart or A4 paper per group; markers***

Take a few moments to think about your expectations for this course, as well as what you have to contribute. Think of 2-3 for each category.

*Allow 2-3 minutes for participants to think of ideas and write them down.*




Meet with your Training Groups and discuss your expectations and contributions.

- Together choose 5 expectations and five contributions to share with the rest of the group.
- Label the hand diagram with your ideas, one per finger.
- Finally, select a name for your community group and write it on your group's drawing

Choose a spokesperson to present to the class and post your group's hand on a wall with other group's expectation hands.

*Allow 8-10 minutes, then ask groups to present their ideas.*
*Note: During the evaluation portion at the end of the course, have participants re-examine their expectations & contributions and see which were met*

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# Lesson 1: The Water Cycle

## Purpose

*To understand the importance of the water cycle and the harmful effects of contamination.*

## Objectives

*By the end of this Lesson, participants will have:*

- **Analyzed** the water cycle
- **Represented** effects of water contamination in drawings

## Materials

- Bottle, jerry can, or other container to demonstrate water amounts (Step 1)
- Flipchart paper & markers
- Tape
- "Water Contamination" poster
- A4 paper & markers (1 per participant)

## Preparation

- Prepare example of minimum daily water amounts needed using water and a container
- Copy Water Cycle drawing onto flipchart paper
- Create water cycle labels: cut 6 strips paper and label Rain, Evaporation (x2), Surface Water (x2), Ground Water
- Optional: write Safe Water / Unsafe Water definitions and Bible verses on flipchart
- Optional: write Key Learning Points on flipchart

## Time

60 minutes

## Steps

1. Understand the difference between safe and unsafe water – 10 minutes
2. Analyze the water cycle – 20 minutes
3. Consider the Bible's comments on the water cycle – 5 minutes
4. Identify the effects of water contamination – 20 minutes

5. Lesson Review – 5 minutes

*Key Learning Points:*

1. Safe water is water that is free from harmful substances and disease-causing microbes
2. Unsafe water, also called contaminated water, is water containing harmful substances and disease-causing microbes
3. The water cycle shows how water travels from the air to the earth and back again

## 1. Understand the difference between safe and unsafe water – 10 minutes

***Materials: bottle, jerry can, or other container and water***

During this training we are going to learn about household water treatment and storage. We will discuss why it is important, and practical steps to make and keep water safe.

- What are common uses for water in households? Washing, drinking, cooking, etc.

*Use a bottle, jerry can, or other container to demonstrate approximate amounts below:*

Water has many uses at a household level. Water is necessary to keep our bodies alive. A person needs a minimum 2 to 4.5 liters per day for drinking.

Water is also necessary to help us do the things of daily life, such as drinking, cooking, personal hygiene, washing. The United Nations recommends that people need 20-50 liters of water per day in order to meet their basic needs.

*Water scarcity* in regions or communities makes it difficult for people to get the water they need. *Water is contamination* is another threat. Even if people are able to get the water they need, it may cause more harm than good if the water is contaminated, or unsafe.

**UNSAFE WATER**, also called contaminated water, is water containing harmful substances and disease-causing microbes

**SAFE WATER** is water that is free from harmful substances and disease-causing microbes

- How can someone know if water is safe or unsafe?

Sometimes you can tell by looking whether water is safe or unsafe. But other times water may look safe but not be. Water can look clear and clean, but still be contaminated.

Understanding how water becomes contaminated and how it can be protected is the main focus of this course. Learning this will help you protect your families, your communities, and yourselves.

## 2. Analyze the water cycle – 20 minutes

***Materials:*** *"Water Cycle" flip chart*

Before we talk about how water is contaminated or made safe, let's talk about where water comes from.

- Where are places that water can be found?

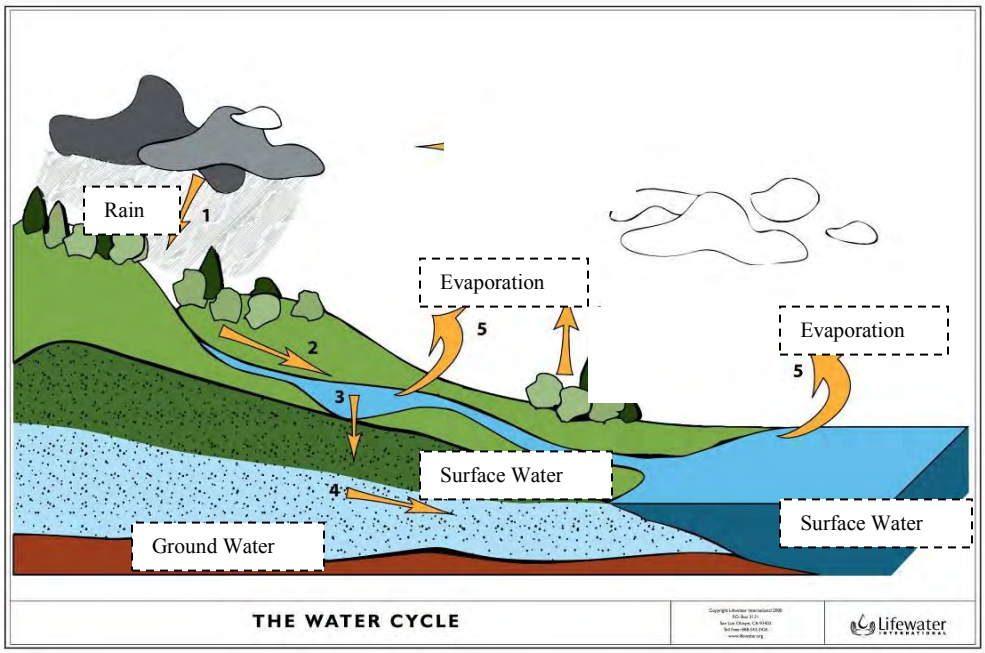
*Examples: rivers, lakes, wells, puddles, etc.*

- How do you think the water gets there?

*Allow participants to share their ideas freely without attempting to correct them.*

***Hang "Water Cycle" flip chart** without the labels (these will be added by participants).*

Here is a picture showing how water comes from the air, or sky, to the ground and back to the air. This is called the **water cycle.** The water cycle is a natural process; water moves continuously from the air to land, and back again.



Water comes to the earth primarily in the form of **rain**. It can also come as mist or fog.

*Ask for a volunteer to hang the label for rain on the drawing.*

When it rains, water generally collects in or flows into larger bodies of water.

The water we see on the ground is called **surface water**. One example of surface water is a lake.

- What are other kinds of surface water?

*Examples: rivers, puddles, ponds, ocean, etc.*

*Ask for a volunteer to hang the 2 labels for surface water on the drawing.*

Water can also be found under the ground. This is called **ground water**. Ground water is found below the ground in spaces between rocks and soil. It can be deep under the ground or close to the surface. When someone digs or drills a well, they are trying to access ground water.

*Ask for a volunteer to hang the label for ground water on the drawing.*

Surface water dries up and returns to the air. This is called **evaporation**. For example, if you leave a cup or bowl with a little water in it you might find when you come back a while later that the water is gone. It has changed form and become part of the air.

*Ask for a volunteer to hang the 2 labels for evaporation on the drawing.*

Water returns to the earth in the form of rain, and the cycle begins again.

*Have 1 or 2 participants to review the cycle. Encourage help from others if needed or anything is unclear. Optional: Remove water cycle labels for review. Distribute to participants, asking them to place it in the correct place on the poster and explain that part in the water cycle. Repeat exercise several times to allow each person a chance to explain one part.*

## 3. Consider the Bible's comments on the water cycle – 5 minutes

The bible talks about the water cycle. Listen to these words from the Bible:

**Isaiah 55:10 (NIRV)**

**The rain and the snow come down from the sky. They do not return to it without watering the earth. They make plants come up and grow. The plants produce seeds for farmers. They also produce food for people to eat.**

**Ecclesiastes 1:7**

**Every stream flows into the ocean, but the ocean never gets full. The streams return to the place they came from.**

- What do these verses say about the water cycle?
- How are these verses still relevant today?

## 4. Identify the effects of water contamination – 20 minutes

***Materials: "Contaminated Water" poster***

We interact with water constantly, and what we do affects the quality of water -- whether it's water on the ground (surface water), in the ground (ground water), or in the air.

- What do people do that can contaminate water?

*Show "Contaminated Water" poster.*

- What is happening in this picture to contaminate water?
- Which of these happen in your community?

The way we dispose of rubbish, where we defecate, the fertilizers or pesticides we use on farms and in gardens, oil or petrol spills, or chemicals from factories all can contaminate water.

There are also chemicals that occur naturally in rocks and soil, such as arsenic, iron, fluoride, and manganese. If these are very concentrated in an area then the water can be contaminated by them as well.

Water **contamination is harmful** to our health and to the environment.

With 1 or 2 people near you, discuss this question and draw pictures to represent your ideas:

- What are some of the negative effects of contaminated water that you have experienced?

*Hand out A4 paper & markers. After 5 minutes ask small groups to show their pictures and share what they discussed. Answers may vary from health issues to social issues to environmental issues, etc. Encourage participants to think broadly and discuss the negative effects of contaminated water.*

Your examples show that the effects of contaminated water can be very costly. They are especially damaging to people's health. In this training we will be determining ways to reduce water contamination and its negative effects on people.

Lesson Review – 5 minutes

In this lesson we introduced the water cycle, the need for safe water, and the idea that physical thirst can help us understand spiritual thirst.

- What are some things that you have learned today?

Optional Review Questions:

- How many liters of water per days does a person need for their basic needs? 2-4.5 for drinking or 20 to 50 total
- What is a definition for unsafe, or contaminated, water? Water containing harmful substances and disease-causing microbes

- What is a definition for safe water? Water free from harmful substances and disease-causing microbes

- What are the parts, or stages, or the water cycle? Rain, Evaporation, Surface Water, Ground Water

Optional: Hang flipchart with key learning points from lesson.

***Key Learning Points:***

1. Safe water is water that is free from harmful substances and disease-causing microbes
2. Unsafe water, also called contaminated water, is water containing harmful substances and disease-causing microbes
3. *The water cycle shows how water travels from the air to the earth and back again*

# Lesson 2: Diarrhea Transmission and Water

## Purpose

*To understand the connection between feces, water and the spread of diarrhea and to consider ways to block the spread of diarrhea.*

## Objectives

*By the end of this Lesson, participants will have:*

- **Applied** blocking strategies to stop the spread of diarrhea transmitted from feces to water.
- **Determined** ways to show love to their neighbor through WASH

## Materials

- "Diarrheal Transmission" poster set
- String/ tape/ or branches
- "Diarrheal Blocking" poster set
- Optional: Flipchart & marker for Bible verse

## Preparation

- Create pie chart or simple demonstration of 88% for step 1
- Optional: write verses on flipchart
- Optional: write Key Learning Points on flipchart

## Time

55 minutes

## Steps

1. Connect contaminated water and diarrhea – 5 minutes
2. Review disease transmission pathways – 15 minutes
3. Determine where blocking strategies stop diarrheal transmission – 20 minutes
4. Consider how our actions can help or harm others – 10 minutes
5. Lesson Review – 5 minutes

*Key Learning Points:*

4. Feces contain microbes that cause disease and sickness, such as diarrhea

5. Microbes can travel from feces on hands, flies, animals and through water or fields to reach our food and mouths.
6. There are simple ways to block feces from making us sick. Practicing these ways will show love to our neighbors.

## 1. Connect contaminated water as a cause of diarrhea – 5 minutes

The water cycle is a wonderful process that allows water to move from the ground to the air and back to the ground again.

- What else do you remember about the water cycle?

Safe water is critical for life and health. Unsafe, or contaminated water, can be very harmful to our health.

Let's review the definitions of safe and unsafe water:

**UNSAFE WATER**, also called contaminated water, is water containing harmful substances and disease-causing microbes

**SAFE WATER** is water that is free from harmful substances and disease-causing microbes

In the last lesson you shared examples of how contaminated water affects people. We saw that it can be very costly to people's health and the environment. One of the most common health effects of contaminated water is diarrhea.

In fact, together with inadequate sanitation and insufficient hygiene, unsafe water is the cause of 88% of diarrhea cases worldwide.

*Draw a pie chart or do a simple demonstration to represent 88% WASH causes of diarrhea.*

- How does diarrhea affect your family or community?

## 2. Review disease transmission pathways – 15 minutes

***Material: "Diarrheal Transmission" poster set** and **string/ tape/ or branches.***

Let's look more closely at how unsafe water can cause diarrhea. Many of you may be familiar with this idea, but for some it will be new.

One of the main ways disease is passed from one person to another is through feces.

It is not feces itself that causes sickness. It is tiny **microbes** found in feces that make people sick -

- Microbes are tiny organisms that can't be seen by the eye alone, but can be seen with powerful lenses (microscope)
- Microbes are found by thousands in even small amounts of feces
- Microbes include bacteria, viruses, protozoa, and worms (helminthes)

*If further explanation is needed, use one of the following ideas:*

***Can't be seen with the eye alone:*** *use eyeglasses as an example of lenses that can help you see things you can't see without them*

***Tiny organisms causing so much destruction:*** *use the example of tiny ants who, together, can cause a tremendous amount of damage to crops, etc.*

**All feces**, including baby, children, adult, and animal feces contain microbes that can cause sickness and diarrhea.

Do people like touching feces? Most people do not; they think that it is disgusting. Do people eat feces? Again, most people do not, especially adults. The idea is even more disgusting to us than touching it.

But would you believe that all of us touch and even eat feces without realizing it? We are going to look at examples of how this happens.

- When microbes from feces get into someone's mouth, they cause diarrhea and sickness.
- Microbes from feces travel different paths to get into someone's mouth.

Here are drawings that show many of the ways that feces reach our mouths

*Show the **"Diarrheal Transmission" posters** one at a time and then lay them down as demonstrated in the reference diagram. Leave room for placing the string between the pathways. (Fingers, flies, fields, water, and food)*

Watch an example of one pathway that the microbes might travel from feces to the mouth.

*As the 1st pathway is described, place **string, tape, or branches** showing that pathway. An example might be: feces→ fly→ food → mouth.*

- Who would like to show another pathway?

*Allow volunteers to show pathways one at a time.*

Microbes from feces travel different paths to get into someone's mouth. They end up in mouths by traveling on

- Hands
- Flies
- Food
- Animals
- Water
- List others ideas that were mentioned by participants

## 3. Determine where blocking strategies stop diarrheal transmission – 20 minutes

***Materials: "Diarrheal Blocking" poster set.***

There are simple things that can keep us from touching feces or getting it in our mouths. Doing these things will reduce diarrhea, save the lives of many children, and improve the health of communities.

A roadblock, or **barrier**, will stop travel on the roads or paths. We can also put up barriers to keep feces from traveling.

***Optional:*** *show a short demonstration of how a barrier can stop someone from passing.*

Here are some posters that represent some of the ways to block the sickness.

*Show the picture of a girl boiling water from the* ***"Diarrheal Blocking" poster set****. Place it on the blocking diagram on the pathway between the river and the mouth.*

This picture shows a girl boiling her water before she uses it. This will kill the microbes found in the river water. We will place it between the river and someone who drinks the water. This will block feces and microbes from travelling from the water to our mouths.

We will pass out the rest of the pictures to groups of two or three people. Talk about where your picture could be a barrier on the disease transmission diagram.

In a moment we will have one person from each group come up and

- Describe what is in your picture, and
- Place it on the diagram where it might block the sickness.

*Pass out the blocking posters to groups of 2-4 people.*

*After 1-2 minutes ask for volunteers to explain their poster and place it on the diagram.*

- *What does this activity show us?*

All the blocking behaviors are good to practice, but during the next several lessons we are going to focus on safe water behaviors.

## 4. Consider how our actions can help or harm others – 10 minutes

Practicing unhealthy water behaviors that contaminate water is not only harmful to our selves, but also to our families and neighbors. Practicing healthy water behaviors, can improve our lives and those of our families and neighbors.

Let's listen to these words from the bible:

**Romans 13:10**

**"Love does no harm to its neighbor. Therefore love is the fulfillment of the law."**

With one or two people near you discuss these questions:

- What are things we do with water that can show love to our family and neighbors?

- What are things we do with water that can harm our neighbors?

*After 3-4, ask volunteers to share what they discussed.*

- Why do you think this reminder from the Bible is important for us?

## Lesson Review – 5 minutes

In this lesson we discussed how microbes cause diarrhea and other diseases, and how microbes travel, or are transmitted.

- What are some things that you have learned today?

Optional Review Questions:

- What are microbes and where are they found? Microbes are tiny organisms that can't be seen by the eye alone, but can be seen with powerful lenses (microscope). They include bacteria, viruses, protozoa, and worms (helminthes). Microbes are found many places, including feces.
- Whose feces contain microbes? Adult, child, infant, animal, bird – all feces contain microbes.
- What are some ways feces/microbes are transmitted? By hands, flies, fields, animals, food, and water.
- What are some ways of blocking the transmission of microbes/feces and thereby preventing diarrhea? Any examples from blocking strategies.
- What does Romans 13:10 teach us? That love does no harm to its neighbor.

Optional: Hang flipchart with key learning points from lesson.

***Key Learning Points:***

4. Feces contain microbes that cause disease and sickness, such as diarrhea

5. Microbes can travel from feces on hands, flies, animals and through water or fields to reach our food and mouths.
6. *There are simple ways to block feces from making us sick. Practicing these ways will show love to our neighbors.*

# Lesson 3: The Safe Water Chain

## Purpose

*To understand how safe water can become contaminated (unsafe) and how to prevent contamination*

## Objectives

*By the end of this Lesson, participants will have:*

- **Suggested** ways water can become unsafe
- **Identified** water behaviors as good, bad, or in-between ways to keep safe water from becoming unsafe
- **Grouped** water behaviors along the safe water chain

## Materials

- *"Safe Water Chain" poster set*
- "Water Behavior" poster set
- Good, Bad, In-Between labels
- A4 paper & marker for labels
- Tape
- Optional: flipchart paper for Key Learning Points

## Preparation

- Create paper chain: cut 4 long strips of paper using flipchart paper. On each strip largely write 1 of 4 points of safe water chain: Source, Transport, Storage, Use. Create a circle with strip 1 by taping ends together. Loop another strip through the circle and tape ends together to create a link. Do the same with 2 additional strips.
- Prepare 4 actors for drama: Maria, Paul, chicken, small brother
- Create 3 labels: Good, Bad, In-Between (see step 2 for example)
- Optional: write Key Learning Points on flipchart

## Time

60 minutes

## Steps

1. Introduce the safe water chain – 15 minutes
2. Categorize water behaviors into good or bad for your health – 15 minutes
3. Group healthy water behaviors along the safe water chain– 10 minutes
4. Create safe water chain songs – 15 minutes

5. Lesson Review – 5 minutes

*Key Learning Points:*

7. The 4 points of the safe water chain are access, transport, storage, and use.
8. Behaviors at these 4 points will either harm (contaminate) the water or help to keep it safe.

1. Introduce the safe water chain – 15 minutes

***Materials: "Safe Water Chain" poster set; Paper chain example***

The affects of contaminated water can be very harmful to our bodies, our communities, our economies, and the environment.

- As review, what different things or activities contaminate water?

*Rubbish, defecation, fertilizers or pesticides, oil or petrol spills, chemicals from factories, natural chemicals such as arsenic, iron, fluoride, and manganese*

- What are some of the harmful effects that result of contaminated water you mentioned in the previous lesson?

- Which of these harmful effects are most common in your family or community?

*Show posters from **"Safe Water Chain" poster set** as each point is mentioned. Lay paper chain across top to demonstrate linkage.*

When we discuss safe water use at the household level, there isn't just one point at which contamination is possible – there are many.

Water can become unsafe:

- During collection – at the point of **ACCESS**

- As you **TRANSPORT** the water
- During **STORAGE**
- When you **USE** the water

These four points are called the **'safe water chain'**. A chain is something that connects one thing to another. We call this a safe water chain because the safety of the water is connected from one point to the next.

We are going to watch a drama about how water can become unsafe. As you watch the drama notice things that can happen to contaminate the water.

*Read drama as actors perform what is said.*

**Safe Water Chain Drama**

Maria is on her way to the river to get water for her family. She is carrying a bucket. As she nears the river she meets her friend Paul. They greet one another. While Maria continues to the area to collect water, Paul feels some stomach pain. He quickly finds a private place by the river to defecate.

Maria fills her bucket and then begins the journey home. It's a hot day and the water is heavy, so she decides to rest in the shade of a tree. She sets the bucket of water beside her. A chicken jumps on the edge of the container and flaps its wings. Maria chases it away. Realizing that she is thirsty, she reaches into the bucket with her hands to get a drink.

When she has finished resting, she picks up the bucket and continues her walk. When she reaches home, she pours the water into a large storage container. Her small brother comes in from playing in the dirt. He is thirsty. Since there is no lid on the container, he picks up a cup and reaches his dirty hand in to fill the cup. Maria pats his back, then sends him back outside to play. The end.

In this drama, we saw many points at which the water could become unsafe.

- What are some ways water became unsafe at the point of access (the river)?

- What are some ways water became unsafe while it was being transported?

- What are some ways water became unsafe while it was stored?

- What are some ways water became unsafe while it was being used?

## 2. Categorize water behaviors into good or bad for your health – 15 minutes

***Materials: "Water Behavior"*** *poster set,* ***Good, Bad, In-Between labels***

*Choose 1-2 pictures from poster set to demonstrate. Lay down "Good", "Bad" and "In-between" labels on ground in middle of circle.*

*Good* *In-between* *Bad*

We will distribute pictures of different behaviors related to water. For each picture, decide what behavior the picture shows and whether the behavior is:

- GOOD: The water behavior is good for your health.
- BAD: The water behavior is bad for your health.
- IN-BETWEEN: The water behavior is neither good nor bad for your health or it shows both good and bad behaviors.

*Use one poster to demonstrate.*

There is no right or wrong answer. We are simply hearing your opinions about these behaviors.

*Hand out posters to groups of 2-3 participants. After a few minutes ask groups to present their behavior and place it in the category where they think it fits.*

- What observations do you have about the posters or behaviors?

- Are there any that you have questions about or would change?

*Allow for discussion about behaviors and movement of posters if participants feel that it is necessary.*

3. Group healthy water behaviors along the safe water chain– 10 minutes

***Materials: Paper Chain; Optional: Safe Water Chain posters;***
*Remove 'bad' pile and the three labels. Then pick up the '**good'** behaviors to use in this activity. Decide whether to include the 'in-between' pile or remove as well. Lay the **Paper Chain** in middle of floor. Optional, place 4 points on the water chain posters (Access, Transport, Storage, Use) below the link.*

We are going to look at the water behaviors that are good for your health and decide at what point along the safe water chain they occur. As I show each picture, tell me if it happens at the point of:

- Access
- Transport
- Storage
- Use

*Hold up each picture separately and let the group decide where it belongs. If there is disagreement, allow all sides to discuss then place or poster below paper chain link label where there is the most consensus.*

- Are there other healthy water behaviors for access, transport, storage, or use that we haven't mentioned yet?

*As other ideas are mentioned, determine as a class whether they are in fact healthy behaviors and, if so, where along the chain they belong. Ask someone to draw a picture of them and place them with the others.*

Over the next several lessons we are going to look carefully at each point along the safe water chain and examine the things we can do to protect the water and our health.

*Hang paper chain on wall with grouped posters below each link, to be used in future lessons.*

## 4. Create safe water chain songs – 15 minutes

We will use songs to help us remember the safe water chain.

In small groups, you will:

- Create a short song that explains the safe water chain
- Include ways to keep water safe at the 4 points
- You will have 8 minutes to prepare, then you will perform them to the whole class

*Divide participants into small groups. After 8 minutes ask each group to perform their song.*

## Lesson Review – 5 minutes

In this lesson we learned about the safe water chain and ways that water can be contaminated and protected along the chain.

- What are some things that you have learned today?

Optional Review Questions:

- What are the 4 points in the safe water chain? Access, Transport, Storage, Use
- What are 2 good behaviors that keep water safe during access? Answers will vary
- What are 2 good behaviors that keep water safe during transport? Answers will vary
- What are 2 good behaviors that keep water safe during storage? Answers will vary
- What are 2 good behaviors that keep water safe during use? Answers will vary

Optional: Hang flipchart with key learning points from lesson.

***Key Learning Points:***

7. The 4 points of the safe water chain are access, transport, storage, and use.
8. Behaviors at these 4 points will either harm (contaminate) the water or help to keep it safe

# Lesson 4: Keeping Water Safe During Access

## Purpose

*To determine appropriate ways to keep water safe at the point of access*

## Objectives

*By the end of this Lesson, participants will have:*

- **Identified** ways to keep water safe during access
- **Voted** on point of access behaviors to implement

## Materials

- Paper chain & set of 'Good' Behaviors posters from previous lesson
- Common and Uncommon labels
- 3 stones per participant
- A4 paper & markers for additional participant ideas (step 2)
- Optional: flipchart paper for Bible verse

## Preparation

- Optional: write Bible verses on flipchart
- Optional: write Key Learning Points on flipchart

## Time

60 minutes

## Steps

1. Consider what it means to thirst for God – 15 minutes
2. Identify ways to keep water safe during access – 15 minutes
3. Sort access point behaviors as common or uncommon – 15 minutes
4. Choose focus behavior for point of access – 10 minutes
5. Lesson Review – 5 minutes

*Key Learning Points:*

9. There are numerous ways to keep water safe at the point of access including:

- *Minimizing water contaminants such as rubbish, etc.*

- *Proper latrine siting*
- *Lining wells*
- *Proper drainage*
- *Fencing or protective structure around water point*
- *_(others)_____*

## 1. Consider what it means to thirst for God – 15 minutes

*This section may not be appropriate for all contexts. If not, adapt it or move to next step.*

People will go to great effort to get water.

- Why is water important for life?

- What is it like to be really thirsty, and then have a drink?

The Bible uses thirst for water as a way to describe our longing and need for God's love.

**Listen** to what the bible says:

*Read, or have participants read, the scripture twice. OPTIONAL: hang the scripture on a flip chart and ask for a volunteer to read it.*

**Psalms 63:1 (NIV)**

**"O God, you are my God, earnestly I seek you; my soul thirsts for you, my body longs for you, in a dry and weary land where there is no water."**

In groups of two or three, discuss the following question. In a few minutes, we will hear your responses.

- What do you think it means to thirst for God?

*After 2-3 minutes, ask for their responses.*

Everyone has physical thirst – it is part of being human. We also have **spiritual thirst**. Our spiritual thirst is what brings us to desire a relationship with God.

Jesus Christ compares himself to water that can satisfy our spiritual thirst. Let's listen to these words from the Bible:

**John 7:37-39**

**“Anyone who is thirsty may come to me! Anyone who believes in me may come and drink! For the Scriptures declare, ‘Rivers of living water will flow from his heart.’” (When he said “living water,” he was speaking of the Spirit, who would be given to everyone believing in him.)**

Jesus said these words to all the people who were gathered at a festival.

- What do you think Jesus was talking about?

- What do you think is meant by the phase, “living water will flow from his heart”?

*These questions introduce a discussion about Jesus. If appropriate, include a more thorough explanation of sin and how Jesus died for our sins.*

Sin is our desire to seek relief from our spiritual thirst in something other than God. To let God quench our thirst is to recognize that **Jesus is living water and is necessary for life**.

The very last chapter of the Bible contains this important promise: “Let the thirsty ones come – anyone who wants to. Let them come and drink the water of life without charge.” (Revelation 22:17)

- What do you like about these words?

- How can someone accept Jesus as living water in their life?

*Close the conversation with prayer.*

## 2. Identify ways to keep water safe during access – 15 minutes

***Materials: set of 'Good' Behaviors posters*** *from previous lesson****. Common and Uncommon labels.***

In the last lesson we looked at different water behaviors and whether they were good for health, bad for health, or in-between.

- What are some water behaviors that are good for your health?

We took the ones that were good for your health and decided where along the safe water chain they belong. In this lesson we're going to look at what can help keep water safe at the point of access and during transport.

- What are common water sources used in this community?

*Rivers, ponds, lakes, puddles spring, tap (pipe), rainwater tanks, well, handpump, etc.*

- What are ways water can be contaminated at the source?

*Rubbish or animals around water point; open defecation; latrine uphill from water point; bathing or washing in water pint; etc.*

Let's review the behaviors you've already identified in the last sorting activity.

*Refer to paper chain and good behavior posters from previous lesson that are hanging on wall, and ask participants to describe good behaviors at the source.*

- What other activities will help keep water safe at the source?

*For example:*
- *Minimize water contaminants such as rubbish, etc.*

- *Proper latrine siting*
- *Line wells to prevent surface water from contaminating ground water*
- *Ensure proper drainage for wastewater around taps/wells*
- *Fence, clean, maintain water point*
- *Organize to raise money for spring capping, tanks, pump*
- *Maintain protective structures around water points*

*As other ideas are mentioned, determine as a class whether they will, in fact keep water safe at the source. If so, ask someone to draw a picture of them and place them with the others.*

These are all good ideas for how to keep water safe at the point of access. Some of these are already commonly practiced behaviors. Others are not commonly practiced.

3. Sort access point behaviors as common or uncommon – 15 minutes

*Pick up posters and distribute to participants. Place **Common** and **Uncommon labels** on ground.*

Look at your poster of a behavior you have said will protect water at the point of access.

- Determine whether the behavior is commonly practiced in this community (many people do it) or is uncommon (few or no people do it)
- When I give the signal, stand up and place your poster by the label you think fits

*Give a signal. Wait until all participants have placed their poster by the Common or Uncommon labels.*

Look at where the posters have been placed.

- Do you have questions or concerns about where any posters have been placed?

*Allow participants to ask questions of one another, and person who placed poster originally to answer. Move posters around as agreed upon to reach general consensus.*

## 4. Choose focus behavior for point of access – 10 minutes

**Materials: 3 stones per participant**

The behaviors that are common are ways of caring for yourself and showing love to your families and neighbors. Keep encouraging one another to do these!

Of the behaviors that are uncommon, think about whether there are ones what you would like to begin doing or using? We will use a vote to select some to focus on for this lesson.

- Each person will receive 3 stones.
- When I give the signal everyone will stand at the same time to vote.
- To vote you will place a stone on the poster you would most like to begin using or doing. You can place one stone on three posters, all 3 on one poster if you think that one is most important, 2 stones on one poster and 1 on another, or 1 stone on 3 different posters.

*Demonstrate an example of voting. If there are no questions, give a signal to begin the vote. When voting is complete ask a volunteer to count the votes. Record the top 1 or 2 items to focus on for lesson 7. Optional: hang top 1-2 posters on the wall.*

We will revisit these behaviors you have chosen in a future lesson. At that time you will have the opportunity to make a plan for them.

Even if it is safe at the source, it has to be transported. In the next lesson we will discuss how we can keep water safe during transport.

OPTIONAL ACTIVITY: If training is taking place in a community, you can plan a visit to a water point to assess the condition and needs of that access point.

## Lesson Review – 5 minutes

In this lesson we looked more closely at how to keep water safe at the point of access. We also considered what it means to thirst for God.

- What are some things that you have learned today?

Optional Review Questions:

- What are the 4 points in the safe water chain? Access, Transport, Storage, Use
- What are some behaviors that keep water safe during access? Answers will vary

Optional: Hang flipchart with key learning points from lesson.

***Key Learning Points:***

9. There are numerous ways to keep water safe at the point of access including:

- *Minimizing water contaminants such as rubbish, etc.*
- *Proper latrine siting*
- *Lining wells*
- *Proper drainage*
- *Fencing or protective structure around water point*
- *(others)*

# Lesson 5: Keeping Water Safe During Transport

## Purpose

*To determine appropriate ways to keep water safe at the transport stage*

## Objectives

*By the end of this Lesson, participants will have:*

- **Identified** ways to keep water safe during transport
- **Voted** on transport stage behaviors to implement
- **Practiced** cleaning transport / storage containers

## Materials

- Paper chain & set of 'Good' Behaviors posters from previous lesson
- Common and Uncommon labels
- 3 stones per participant
- A4 paper & markers for additional participant ideas (step 1)
- Water container cleaning supplies (step 4): several dirty or used water transport / storage containers; water; soap (powder or bar); ash; stiff bristle brush and/or sand; optional: bleach

## Preparation

- Prepare space and materials to practice cleaning transport & storage containers
- Optional: write Key Learning Points on flipchart

## Time

60 minutes

## Steps

1. Identify behaviors for keeping water safe during transport – 15 minutes
2. Sort transport behaviors as common or uncommon – 10 minutes
3. Choose focus behavior for transport stage – 5 minutes
4. Practice cleaning transport & storage containers – 25 minutes
5. Lesson Review – 5 minutes

*Key Learning Points:*

10. There are numerous ways to keep water safe during transport including:

- *Ensuring the container has a lid and a narrow mouth*
- *Cleaning container regularly*
- *_(others)_____*

## 1. Identify behaviors for keeping water safe during transport – 15 minutes

***Materials: set of 'Good' Behaviors posters*** *from previous lessons.* ***Common and Uncommon labels.***

In the last lesson you developed some good ideas for how to keep water safe at the first point along the safe water chain.

But our water isn't safe yet! Even if water is safe at the source, it has to be transported. By transport we mean moving water from one place to another -- for example from the source to a home, or from home to school. Let's look at how we can keep water safe during transport.

- What are common methods of transporting water in this community? *Jerry cans, donkeys, buckets, etc.*

- What are ways water can be contaminated during transport? *Containers without lids, animals, reaching in with hands, dirty containers, etc.*

Let's review the behaviors you've already identified as good for keeping water safe during transport.

*Refer to paper chain and good behavior posters from previous lesson that are hanging on wall, and ask participants to describe good behaviors during transport.*

- What other activities will help keep water safe during transport?

*For example:*

- *Container with lid*
- *Narrow mouthed container*
- *Clean container regularly (with soap, ash or bleach and water, for example)*

*As other ideas are mentioned, determine as a class whether they will, in fact keep water safe at the source. If so, ask someone to draw a picture of them and place them with the others.*

These are all good ideas for how to keep water safe during transport. Some of these are already commonly practiced behaviors. Others are not commonly practiced.

## 2. Sort transport behaviors as common or uncommon – 10 minutes

*Pick up posters and distribute to participants. Place **Common** and **Uncommon labels** on ground.*

Look at your poster of a behavior you have said will protect water during transport.

- Determine whether the behavior is commonly practiced in this community (many people do it) or is uncommon (few or no people do it)
- When I give the signal, stand up and place your poster by the label you think fits

*Give a signal. Wait until all participants have placed their poster by the Common or Uncommon labels.*

Look at where the posters have been placed.

- Do you have questions or concerns about where any posters have been placed?

*Allow participants to ask questions of one another, and person who placed poster originally to answer. Move posters around as agreed upon to reach general consensus.*

## 3. Choose focus behavior for transport stage – 5 minutes

Once again, the behaviors that are common are ways of caring for yourself and showing love to your families and neighbors. Keep encouraging one another to do these!

Of the behaviors that are uncommon, think about whether there are ones what you would like to begin doing or using? We will repeat the 3-stone vote to select some to focus on for this lesson.

- Each person will receive 3 stones.
- When I give the signal everyone will stand at the same time to vote.

- To vote you will place a stone on the posters you would most like to begin using or doing. Remember, you can place one stone on three posters, all 3 on one poster if you think that one is most important, 2 stones on one poster and 1 on another, or 1 stone on 3 different posters.

*Give a signal to begin the vote. When voting is complete ask a volunteer to count the votes. Record the top 1 or 2 items to focus on. These will be used in lesson 7.*

We will revisit these behaviors you have chosen in a future lesson. At that time you will have the opportunity to make a plan for them.

Even if it is safe at the source, it has to be transported. In the next lesson we will discuss how we can keep water safe during transport.

## 4. Practice cleaning transport and storage containers – 25 minutes

**Materials: Several dirty or used water transport / storage containers; water; soap (powder or bar); ash; stiff bristle brush and/or sand; optional: bleach**

*Even if participants have identified cleaning water containers as a common practice, this step encourages them to develop ways to teach others the proper process and allows for peer feedback on how to improve.*

*If cleaning containers is not a common practice, consider doing a demonstration and then have participants practice in small groups. They could still write out steps or develop a fun and interactive way to remember the steps.*

One of the important parts of keeping water safe during transport is to transport it in clean containers. Yet the practice of cleaning containers is often done carelessly, infrequently, or not done at all. The same is true for water storage containers.

- ➢ Why is it important to clean transport or storage containers frequently? Bacteria easily grows in containers, and containers are always at risk of being contaminated.

It is important to clean transport and storage containers at minimum once a week to slow the growth of microbes.

- ➢ What materials are commonly used for cleaning water containers in your community?

In small groups, determine a *fun* and *interactive* way of how you would teach someone the steps of properly cleaning a transport or storage container. Each group will receive flipchart paper; on your paper:

- Write out materials needed
- Steps for cleaning
- Recommended times for cleaning

Remember that your method should be fun and interactive and help the learner remember the steps. You will have 10 minutes to prepare, then each group will demonstrate their process to the class. The group will offer feedback on your method.

*Determine whether each group will demonstrate the same method (most common method for context) or whether each group uses different materials (one group bleach, one group sand, one group soap, etc.) Divide participants into small groups. Distribute flipchart paper, markers, and cleaning containers and supplies. After 10 minutes ask groups to present their demonstrations. Optional: ask participants to offer feedback on their steps and method to their peers.*

## Lesson Review – 5 minutes

In this lesson we looked more closely at how to keep water safe during transport. We also practiced cleaning transport and storage containers.

- What are some things that you have learned today?

Optional Review Questions:

- What are the 4 points in the safe water chain? Access, Transport, Storage, Use
- What are some behaviors that keep water safe during transport? Answers will vary

Optional: Hang flipchart with key learning points from lesson.

***Key Learning Points:***

10. There are numerous ways to keep water safe during transport including:

- *Ensuring the container has a lid and a narrow mouth*
- *Cleaning container regularly*
- *(others)*

# Lesson 6: Keeping Water Safe During Storage

## Purpose

*To determine appropriate ways to keep water safe during storage*

## Objectives

*By the end of this Lesson, participants will have:*

- **Identified** ways to keep water safe during storage
- **Voted** on transport stage behaviors to implement
- **Practiced** cleaning tanks (Optional)

## Materials

- Paper chain & set of 'Good' Behaviors posters from previous lesson
- Common and Uncommon labels
- 3 stones per participant
- A4 paper & markers for additional participant ideas (step 1)
- Optional: Water tank cleaning supplies (step 4) – see appendix for supplies and preparation
- Optional: flipchart paper for Bible verse

## Preparation

- Optional: Review materials needed and steps for maintaining & cleaning tanks in 'Caring for Water Tanks' lesson in appendix
- Optional: write Bible verse on flipchart
- Optional: write Key Learning Points on flipchart

## Time

70 minutes

## Steps

1. Identify behaviors for keeping water safe during storage– 15 minutes
2. Sort transport behaviors as common or uncommon – 10 minutes
3. Choose focus behavior for transport stage – 5 minutes
4. Option: Caring for water storage tank OR Review the first 3 safe water chain links – 20 minutes
5. Examine the idea of broken spiritual cisterns – 15 minutes

6. Lesson Review – 5 minutes

*Key Learning Points:*

11. There are numerous ways to keep water safe during storage including:

- *Having a lid/cover*
- *Cleaning the container or tank regularly*
- *Limiting access to the container/ keeping it off floor*
- *Replacing/rotating water frequently*
- *Ensuring no cracks in containers/tanks*
- *_(others)_____*

## 1. Identify behaviors for keeping water safe during storage– 15 minutes

***Materials: set of 'Good' Behaviors posters*** *from previous lessons.* ***Common and Uncommon labels.***

Let's review the 4 points along the safe water chain.

- What are they? Access, transport, storage, use

- What are ways to keep water safe at the point of access?

- What are ways to keep water safe during transport?

In the last lesson you had good ideas for how to keep water safe at the second point along the safe water chain.

But once again, our water isn't safe yet! Even if it is safe at the points of access and transport, it can be contaminated during storage. By storage we mean keeping water in a container for future use. The container can be small, like a bucket or bottle, or large, like a tank.

- What are common methods or containers for water storage in this community?

  Rain tanks, jerry can, clay pot, etc.

- What are ways water can be contaminated during storage?

  *Containers without lids, hands or dirty utensils/cups, dirty storage containers, wide mouthed containers, etc.*

Let's review the behaviors you've already identified as good for keeping water safe during storage.

*Refer to paper chain and good behavior posters from previous lesson that are hanging on wall, and ask participants to describe good behaviors during storage.*

- Which of these activities will help keep water safe during storage?

- What other activities will help keep water safe during storage?

*For example:*
- *Lid/cover*
- *Clean container*
- *Limited access/off floor*
- *Replace/rotate water frequently*
- *Clean tanks*
- *Ensure no cracks in containers/tanks*

*As other ideas are mentioned, determine as a class whether they will, in fact keep water safe at the source. If so, ask someone to draw a picture of them and place them with the others.*

These are all good ideas for how to keep water safe during storage. Some of these are already commonly practiced behaviors. Others are not commonly practiced.

2. Sort transport behaviors as common or uncommon – 10 minutes

*Pick up posters and distribute to participants. Place* ***Common*** *and* ***Uncommon labels*** *on ground.*

Look at your poster of a behavior you have said will protect water during storage.

- Determine whether the behavior is commonly practiced in this community (many people do it) or is uncommon (few or no people do it)
- When I give the signal, stand up and place your poster by the label you think fits

*Give a signal. Wait until all participants have placed their poster by the Common or Uncommon labels.*

Look at where the posters have been placed.

- Do you have questions or concerns about where any posters have been placed?

*Allow participants to ask questions of one another, and person who placed poster originally to answer. Move posters around as agreed upon to reach general consensus.*

## 3. Choose focus behavior for storage stage – 5 minutes

We are going to vote on storage behaviors that you would like to begin using or doing.

Of the behaviors that are uncommon, think about whether there are ones what you would like to begin doing or using? We will repeat the 3-stone vote to select some to focus on for this lesson.

- Each person will receive 3 stones.
- When I give the signal everyone will stand at the same time to vote.
- To vote you will place a stone on the posters you would most like to begin using or doing. Remember, you can place one stone on three posters, all 3 on one poster if you think that one is most important, 2 stones on one poster and 1 on another, or 1 stone on 3 different posters.

*Give a signal to begin the vote. When voting is complete ask a volunteer to count the votes. Record the top 1 or 2 items to focus on. These will be used in lesson 7.*

We will revisit these behaviors you have chosen in a future lesson. At that time you will have the opportunity to make a plan for them.

There's one more point left along the safe water chain. In the next lesson we will look at how to keep water safe during use.

## 4. OPTIONAL ACTIVITY: Caring for water storage tank OR Review the first 3 safe water chain links – 20 minutes

*A lesson on caring for water tanks should be done only if communities in the area use rainwater or other storage large tanks, and participants express interest in learning about or reviewing the cleaning & maintenance of tanks. This lesson can also be inserted at another point in the training.*

*Refer to lesson 'Caring for Water Storage Tanks' in the appendix. If at all possible, use an actual interactive demonstration of cleaning a water storage tank to walk through steps of preventing contamination and cleaning the tank. Note: if actually cleaning a tank, Step 4 will last longer than 20 minutes (likely up to 60 minutes).*

***If the lesson on caring for water storage tanks is not appropriate, use this ALTERNATE Lesson:***

You have been doing a great job of thinking through the different stages of the water chain. Before we get to the last one, we will review the first 3. We will divide the class into 3 groups:

- Each group will receive one point along the safe water chain – access, transport, or storage
- Develop a short drama that teaches ways to keep water safe at your point
- You will have 10 minutes to prepare, then you will perform them for the class

*Divide participants into 3 groups. Assign each group a different point along the safe water chain. After 10 minutes have groups perform their dramas in order of the safe water chain.*

5. Examine the idea of broken spiritual cisterns – 15 minutes

*This section may not be appropriate for all contexts. If not, adapt it or move to next step.*

Jeremiah was a prophet, a man whom God spoke to and gave messages to. In this Old Testament book, God shares his disappointment and sorrow over the nation of Israel. Israel was a nation of people who God loved and whom he had rescued from slavery.

At first Israel was full of thanks and love for God. But after time they turned away from the true God and began worshipping idols – images found in nature or made of human hands.

At this point God spoke these words to the people through Jeremiah:

**Jeremiah 2:13**

**"My people have committed two sins: They have forsaken me, the spring of living water, and have dug their own cisterns, broken cisterns that cannot hold water."**

With 2 or 3 people near you discuss these questions:

- How does God describe himself in this verse? The spring of living water

- Why do you think God describes himself in this way?

*Allow a few minutes of discussion, then ask for 2-3 volunteers to share their group's ideas.*

- What were the 2 sins, or wrongdoings, Israel has committed? 1) Forsaken God, the spring of living water 2) dug their own cisterns that can't hold water

One reason to describe God as a living spring is because he has no beginning and no end. Another is because he is the source and giver of life.

God uses the picture of springs and cisterns to help us understand what was happening.

Imagine a community that has a wonderful source of safe fresh water – a spring that never fails, whether the season is rainy or dry. Now imagine if that same community decided one day to simply stop up that spring, or even to block it up so that it no longer runs.

And in its place they decide to build a cistern, or tank. This tank cannot fill itself, it can only hold what is put in there. To make it worse, the tanks the community build are cracked so they won't hold water!

With the same people around you, discuss:

- What is the spiritual meaning of this story?

*Allow a few minutes of discussion, then ask for 2-3 volunteers to share their group's ideas.*

The people of Israel had turned away from something that was life-giving and true, and turned instead towards their own worthless way of doing things.

- How is this warning still relevant for us today?

*Ask a volunteer to close the discussion in prayer.*

## 6. Lesson Review – 5 minutes

In this lesson we looked more closely at how to keep water safe during storage.

- What are some things that you have learned today?

Optional Review Questions:

- What are the 4 points in the safe water chain? Access, Transport, Storage, Use
- What are some behaviors that keep water safe during storage? Answers will vary
- Optional: What are important steps in maintaining and cleaning a water tank? Refer to steps in appendix

Optional: Hang flipchart with key learning points from lesson.

***Key Learning Points:***

11. There are numerous ways to keep water safe during storage including:

- *Having a lid/cover*
- *Cleaning the container or tank regularly*
- *Limiting access to the container/ keeping it off floor*
- *Replacing/rotating water frequently*
- *Ensuring no cracks in containers/tanks*
- *(others)*

# Lesson 7: Keeping Water Safe During Use

## Purpose

To determine appropriate ways to keep water safe during storage and make a plan for change

## Objectives

*By the end of this Lesson, participants will have:*

- **Identified** ways to keep water safe during use
- **Voted** on use stage behaviors to implement
- **Created** a plan for change

## Materials

- Paper chain & set of 'Good' Behaviors posters from previous lesson
- Common and Uncommon labels
- 3 stones per participant
- A4 paper & markers for additional participant ideas (step 1)
- Flipchart or A4 paper for group work (step 4)

## Preparation

- Optional: write Making a plan for Change (step 4) instructions on flipchart
- Optional: write Key Learning Points on flipchart

## Time

65 minutes

## Steps

1. Identify behaviors for keeping water safe during use – 15 minutes
2. Sort transport behaviors as common or uncommon – 10 minutes
3. Choose focus for uncommon use behaviors – 5 minutes
4. Make plans for change – 30 minutes
5. Lesson Review – 5 minutes

Key Learning Points:

12. There are numerous ways to keep water safe during use:

- No contact with hands
- Small-mouthed containers so no hands or cups fit in
- Storage container with a tap/spigot
- Clean ladle or dipping cup
- Using a clean cup for drinking
- Using a drying rack
- _(others)_____

*13.* Recap participant plans for creating change

## 1. Identify behaviors for keeping water safe during use – 15 minutes

***Materials: set of 'Good' Behaviors posters*** *from previous lessons.* ***Common and Uncommon labels.***

In the last several lessons we have discussed how to keep water safe during access, transport, and storage.

- What were some of the ways discussed?

There is one more point in the safe water chain. Even if water is kept safe at the points of access, transport, and storage it can be contaminated during use.

- What are ways water can be contaminated during use?

Let's review the behaviors you've already identified as good for keeping water safe during transport.

*Refer to paper chain and good behavior posters from previous lesson that are hanging on wall, and ask participants to describe good behaviors during use.*

- What other activities will help you keep water safe during use?

*For example:*
- No contact with hands
- Small-mouthed containers so no hands or cups fit in
- Storage container with a tap/spigot
- Clean ladle or dipping cup
- Using a clean cup for drinking
- Using a drying rack

*As other ideas are mentioned, determine as a class whether they will, in fact keep water safe at the source. If so, ask someone to draw a picture of them and place them with the others.*

These are all good ideas for how to keep water safe during use. Some of these are already commonly practiced behaviors. Others are not commonly practiced.

## 2. Sort transport behaviors as common or uncommon – 10 minutes

*Pick up posters and distribute to participants. Place **Common** and **Uncommon labels** on ground.*

Look at your poster of a behavior you have said will protect water during use.

- Determine whether the behavior is commonly practiced in this community (many people do it) or is uncommon (few or no people do it)
- When I give the signal, stand up and place your poster by the label you think fits

*Give a signal. Wait until all participants have placed their poster by the Common or Uncommon labels.*

Look at where the posters have been placed.

- Do you have questions or concerns about where any posters have been placed?

*Allow participants to ask questions of one another, and person who placed poster originally to answer. Move posters around as agreed upon to reach general consensus.*

## 3. Choose focus for uncommon use behaviors – 5 minutes

We are going to vote one last time. Think about good use behaviors that you would like to begin practicing.

We will repeat the 3-stone vote to select some to focus on for this lesson.

- Each person will receive 3 stones.
- When I give the signal everyone will stand at the same time to vote.
- To vote you will place a stone on the posters you would most like to begin using or doing. Remember, you can place one stone on three posters, all 3 on one poster if you think that one is most important, 2 stones on one poster and 1 on another, or 1 stone on 3 different posters.

*Give a signal to begin the vote. When voting is complete ask a volunteer to count the votes. Record the top 1 or 2 items to focus on.*

## 4. Make plans for change – 30 minutes

All of the behaviors we have discussed are good to practice, but you have chosen specific ones to begin with. We will divide into groups. Each group will receive one of these behaviors you have voted for. Together decide:

- What resources will you need for this behavior or activity?
- Who (what people) need to be mobilized to practice or do this behavior or activity?
- What attitudes might prevent people from wanting to do it and how can you overcome those?

You will have 10 minutes to develop your plan. Then you will share them with the rest of the group.

*Optional: Hang flip chart paper with questions. Give participants paper and markers to record their ideas. After 10 minutes have each group report their ideas.*

## 5. Lesson Review – 5 minutes

In this lesson we looked at safe water use, the final point on the safe water chain. You also developed plans of how to begin practicing some of the behaviors that are uncommon in your community.

- What are some things that you have learned today?

Optional: Hang flipchart with key learning points from lesson.

***Key Learning Points:***

12. There are numerous ways to keep water safe during use:

- No contact with hands
- Small-mouthed containers so no hands or cups fit in
- Storage container with a tap/spigot
- Clean ladle or dipping cup
- Using a clean cup for drinking

- Using a drying rack
- _(others)_____

13. Recap participant plans for creating change

# Lesson 8: Household Water Treatment Methods

## Purpose

*To understand three processes of water treatment and examine methods that use them*

## Objectives

*By the end of this Lesson, participants will have:*

- **Viewed** demonstration of 3 water treatment methods
- **Created** demonstrations of water treatment methods

## Materials

- Paper chain from previous lessons
- A4 paper & markers for labels
- Sedimentation demonstration: clear 2 liter plastic bottle; cloudy or muddy water
- Filtration demonstration: clear 2 liter plastic bottle filled with sand, small rocks/gravel, and larger rocks; cloudy or muddy water; basin to catch run-off
- Disinfection demonstration: bucket or jerry can with water; locally available chlorine disinfectant such as Sur Eau, Aqua Guard, etc. OR small stove, matches, pot with water and lid
- Flipcharts & markers for group work (Step 5)

## Preparation

- Create 3 labels: Sedimentation, Filtration, Disinfection
- Filtration demonstration: Fill clear 2 liter plastic bottle filled with a layer of sand (approximately 15 cm), then a layer of small rocks/gravel (10 cm), and larger rocks (10 cm)
- Optional: write Key Learning Points on flipchart

## Time

70 minutes

## Steps

1. Introduce household water treatment methods – 5 minutes
2. Describe sedimentation and treatment methods using this process – 15 minutes
3. Describe filtration and treatment methods using this process – 15 minutes

4. Describe disinfection and treatment methods using this process – 15 minutes
5. Research household water treatment methods – 20 minutes

*Key Learning Points:*

14. There are 3 processes that can help make water safe:
- Sedimentation
- Filtration
- Disinfection

15. Some of the treatment methods that use these processes are: (mention methods demonstrated in step 5)

## 1. Introduce household water treatment methods – 5 minutes

***Materials: 3 Water treatment process labels***

You have successfully brought water safely from the point of access to the point of use. Taking care at each point will increase the health of your family and community.

There is still a problem, however. What if the water at the point of access is already contaminated? Or what if, despite your efforts, the water becomes contaminated at some point along the safe water chain?

*Hold the chain by the "Access" link, with the "Health" link at the bottom. Give, or ask for, an example of what can contaminate water at access. Using scissors cut the link allowing "Health" and other links to drop to the ground. Re-tape and show examples for other links.*

If this is the case, you will need to use a **TREATMENT METHOD**. There are many different ways to treat water to make it safe at the household level. We will discuss several options in this lesson, and decide which ones will work best for your household and community.

There are three processes that can help make water safe. They are **most** effective when they are used together. These processes are:

*Show label for each one as it is mentioned.*

- Sedimentation
- Filtration
- Disinfection

## 2. Describe sedimentation and treatment methods using this process – 15 minutes

***Materials: clear 2 liter plastic bottle, cloudy or muddy water***

We will look at each process and the methods that use it.

1. **The first process is sedimentation.**

   **Sedimentation** is a process that allows cloudy or dirty water to sit undisturbed for a period of time so that particles can settle to the bottom of the container (separation of solid and liquid).

This process can reduce some contaminants, such as mud or sand, and larger protozoa (for example Giardia) and helminthes (worm-like parasites). The process can take several hours to several days, depending on the amount of water and contaminants.

Certain chemicals or specific native plants can be added to the water to improve the sedimentation process. These additives, known as '**coagulants'**, cause particles to stick together making them larger, heavier, and more likely to settle to the bottom of the container.

When the particles have settled the water can be carefully poured into another container, leaving the sludge at the bottom. This process can be repeated 2-3 times, as needed.

- Are there native plants or certain chemicals that are commonly used here?

Examples of sedimentation include: *Lay out posters under label.*

- Settling
- Additives such as chemicals or plants to aid the process

*Note: PUR packets are an example of a treatment that combines chemically induced sedimentation and disinfection.*

*Set up* ***sedimentation demonstration****: Pour cloudy (muddy or sandy) water into a clear container (such as a plastic bottle with the top 1/4 cut off). Allow container to sit for a minimum 24 hours. When the 'cloudy' has settled, gather group around container and review sedimentation process.*

*Further information on sedimentation is located in the appendix.*

- What questions do you have?

3. Describe filtration and treatment methods using this process – 15 minutes

***Materials: clear 2 liter plastic bottle filled with sand, small rocks/gravel, and larger rocks; cloudy or muddy water; basin to catch run-off***

2. **The second process is filtration.**

**Filtration** is a process that allows contaminated water to pass through a layer, or layers, of something such as sand, gravel, cloth, or ceramic that will catch or absorb particles. What you use as a filter determines how effectively contaminants are removed.

Some filtration devices, such as the biosand filter, also contain a biological film (biofilm) layer. The biofilm layer, found at the top of the filter, is made up of bacteria and protozoa that – in this case – are helpful rather than harmful. As water filters through the layer, the biofilm traps and dissolves other microbes in the water.

Filtration also happens naturally as part of the water cycle. Remember that water comes to the earth as rain. It then collects as surface water. As surface water, it can become dirty and contaminated in many different ways.

When surface water is absorbed in the ground, it is filtered by the small rocks and sand below the surface. As the water continues to travel down a long distance, this filtering can purify it. Let's see an example of this.

***Show Filter Example*** *and* ***Dirty Water.*** *Demonstrate pouring the dirty water through the clean sand and rocks. Be sure and have a container to collect the water as it drains off.*

This container has rocks and sand in it, similar to what can be found below the ground. There are holes in the bottom of the container so that water can pass through it.

Watch what happens when I pour this water through the rocks and sand. Notice that this water is cleaner than the water that went in. The dirt was removed by the rocks and sand. For it to be more effectively filtered, it would need to run through a well-constructed filter.

- What filtration methods are you familiar with?

*Lay out posters under filtration label as they are mentioned. If a method is suggested for which there is no poster, have that person make a simple drawing of it.* ***Reminder: only introduce the methods below which are appropriate for and available in the context of the participants.***

Examples of filtration methods include:

- Biosand
- Ceramic pot filter
- Ceramic candle filter
- Kanchan Arsenic filter
- Lifestraw
- Straining (cloth)*
- Water cycle
- (Chulli Pasterurization – uses a rapid sand filter as part of the process)

*Further information on each of these methods is located in the appendix.*
** Additional step-by-step instructions in appendix.*

- What questions do you have about these methods?

4. Describe disinfection and treatment methods using this process – 15 minutes

***Materials: bucket or jerry can with water; locally available chlorine disinfectant such as Sur Eau, Aqua Guard, etc. OR small stove, matches, pot with water and lid***

3. **The third process is disinfection.**

   **Disinfection** is a process that destroys contaminants that are in water using chemicals (chlorine), the sun (SODIS), or heat (boiling or pasteurization).

Chlorine destroys microbes by killing them chemically. SODIS destroys microbes through long exposure of clear bottles of water to the sun's heat and ultraviolet rays. Boiling destroys microbes through a period of short intense heat.

*Set up **disinfection demonstration** using a chlorine disinfectant commonly available, such as Aqua Guard, Sur Eau, etc. and a container of water. ALTERNATE demonstration: boil water using a small stove.*

- What disinfection methods are you familiar with?

*Lay out posters under filtration label as they are mentioned. If a method is suggested for which there is no poster, have that person make a simple drawing of it.* ***Reminder: only introduce the methods below which are appropriate for and available in the context of the participants.***

Examples of disinfection methods include:
- PUR*
- SODIS*
- Solar pasteurization
- Boiling*
- Chemical (chlorine)*

- Solar distillation
- UV disinfection
- Chulli Pasteurization or WAPIC (Water Pasteurization through Improved Cook Stove) use a combination of aluminum and plastic tubing and an improved cooking stove (and rapid sand filter for the Chulli) to heat and pasteurize water during daily cooking.

*Further information on each of these methods is located in the appendix.*
** Additional step-by-step instructions in appendix.*

- What questions do you have about these methods?

Disinfecting water is important for all people, but especially important for people with weakened immune systems such as people with HIV/AIDS, diabetes, or any sickness as well as the very young and very old.

## 5. Research household water treatment methods – 20 minutes

***Materials: flipchart paper & markers***

*Optional: hang flipchart with written group activity instructions.*

We are going to review these 3 processes in 3 groups. Each group will be assigned one of the processes – sedimentation, filtration, or disinfection. In your groups:

- Explain the process in your own words and write it on a flipchart
- Choose a method you want to learn more about that uses the process
- Using the additional resources in the appendix of your manual, research that method
- Draw a picture of that method to use in explaining it to the class

Each group will receive flipchart paper and markers. You will have 10 minutes for this activity. There are additional resources on the treatment methods in the appendix of your manual.

*Allow 10 minutes for group work, then ask each group to present and answer any questions.*

## 6. Lesson Review – 5 minutes

In this lesson we looked at 3 processes that can make water safe. Then you created demonstrations of methods that use these 3 processes.

- What are some things that you have learned today?

Optional Review Questions:

- How does sedimentation work? Describe process
- How does filtration work? Describe process
- How does disinfection work? Describe process

Optional: Hang flipchart with key learning points from lesson.

***Key Learning Points:***

14. There are 3 processes that can help make water safe:
- Sedimentation
- Filtration
- Disinfection

15. Some of the treatment methods that use these processes are: (mention methods demonstrated in step 5)

# Lesson 9: Analyzing Water Treatment Methods

## Purpose

*To analyze household water treatment methods to assess the resources and cost involved, and its effectiveness, sustainability, and acceptability.*

## Objectives

*By the end of this Lesson, participants will have:*

- **Analyzed** a household water treatment method
- **Demonstrated** a household water treatment method

## Materials

- Flipchart paper & markers for group work

## Preparation

- Write group activity instruction on flipchart
- Optional: write Key Learning Points on flipchart

## Time

50 minutes

## Steps

1. Examine and explain household water treatment methods – 45 minutes
2. Lesson Review – 5 minutes

Key Learning Points:

16. Optional: use participant lessons learned as key learning points for this lesson

## 1. Analyze and explain household water treatment methods – 45 minutes

***Materials: flipchart paper & markers***

*Select water treatment methods to examine, or have participants choose. Depending on interest and time available, groups can present on one or several methods. Additional information on each method is available in the appendix.*

In the last lesson you used one household water treatment method to demonstrate. In this lesson we are going to look even more closely at some methods to see which are most appropriate for your community. We are going to divide into groups. Each group will be assigned a household water treatment method to discuss and explain. Your assignment has 2 parts.

1. Discuss the following questions and create a flipchart to share your answers with the rest of the group:

- What resources are needed to use this method? (Remember to include physical resources as well as things such as time, literacy, etc.)
- What is the cost of this method?
- What is the method effective for (diseases, chemicals, cloudiness, odour / taste, etc.)?
- How durable / sustainable is the method?
- What will make it acceptable or unacceptable to the community?

2. Prepare a demonstration of your treatment method using an actual step-by-step demonstration or drawings to represent each step.

*Divide participants into groups and give each group paper and a marker. Divide the methods among the groups. Depending on the number of methods per group, allow 10-20 minutes for discussion and preparation. Ask groups to present their findings and demonstrations.*

You have taken the time to carefully look at several different methods, identifying what resources are needed, and their cost, effectiveness, sustainability and acceptability.

- What observations do you have about these methods?

## 2. Lesson Review – 5 minutes

In this lesson you looked more closely at several different treatment methods.

- What have you learned from this activity?

| Optional: Hang flipchart with key learning points from lesson. |
|---|

***Key Learning Points:***

16. Optional: use participant lessons learned as key learning points for this lesson

# Lesson 10: Making a Plan for Change

## Purpose

*To use the "Five Finger Planning" method to help implement behavior change in participant communities*

## Objectives

*By the end of this lesson, participants will have:*

- **Identified** a healthy behavior change to promote in their community
- **Established** a plan of how to achieve the healthy behavior change

## Materials

- Flipchart paper
- A4 paper & markers for group work
- Optional: Flipchart paper

## Preparation

- Optional: write Bible verses on a flipchart
- Draw "Five Finger Planning" hand on a flipchart (see Step 3)
- Optional: write Key Learning Points on flipchart
- Optional: if Key Learning Points have been written on flipchart paper, hang these together for end of training summery (step 6)
- Prepare an appropriate activity to end the training

## Time

60 minutes

## Steps

1. Build on the biblical foundation for sharing knowledge with others – 10 minutes
2. Review what was learned in the course – 10 minutes
3. Introduce the "Five Finger Planning" Method – 10 minutes
4. Make a plan to share information – 20 minutes
5. Encourage one another – 10 minutes
6. Training Summary

Key Learning Points

17. It is important to practice healthy behaviors and teach them to others who will teach others
18. The "Five Finger Planning" method is a helpful tool to develop a plan of action

## 1. Build on the biblical foundation for sharing knowledge with others – 10 minutes

In the previous lessons, we talked about healthy water behaviors that stop the spread of disease. These behaviors are good news that can save lives. And they are a practical way of showing love to yourself and others.

The Bible encourages us to teach people what we know, so that they can share it with even more people. Listen to the Bible verse 2 Timothy 2:2. In it Paul, a great preacher and teacher in the time just after Jesus, challenges Timothy who was a young student and friend of his.

*Optional: Hang the flipchart with the Bible verse.*

***2 Timothy 2:2***

**"You have heard me teach things that have been confirmed by many reliable witnesses. Now teach these truths to other trustworthy people who will be able to pass them on to others."**

- What do you hear in this verse?

Paul has taught Timothy many trustworthy things. Now he is telling Timothy to go and teach those things to others who can be trusted to go and teach them to even more people.

- How does this verse apply to what we have been doing in this training?

During this training, we shared life-saving information with you. Now, we trust you to take this knowledge and share it with others.

In this lesson you will have an opportunity to make a plan to do this.

## 2. Review what was learned in the course – 10 minutes

During this course we have discussed many different things.

- Of the things we have discussed, what will help people in your community practice healthy behaviors??

*List responses on a piece of flipchart paper. Remind participants of activities done and topics discussed if needed.*

These are good things that will have a positive impact on people's health and lives.

- Of these things, which do you think are important to focus on first or immediately?

*Allow for discussion and circle the ones chosen.*

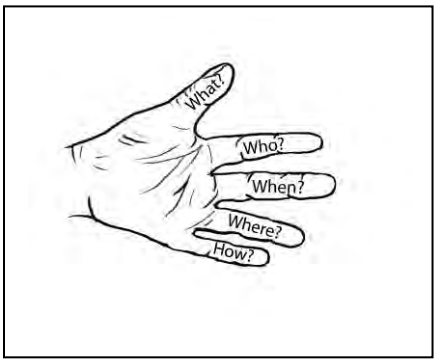
In a few minutes, we will assign you to a group. Each group will choose one of the circled things and make a plan of how they will share their idea with their community.

Before you get into groups, we will learn a method for making a plan to achieve your goal.

## 3. Introduce the "Five Finger Planning" Method –10 minutes

A method that can help you create a plan is called "Five Finger Planning."

*Hang the "Five Finger Planning" flipchart.*




We use a hand to help us remember 5 questions. Each finger represents a question in the "Five Finger Planning" method. Listen to each question and then repeat it after me.

*Use the fingers on one hand to represent each question.*

Repeat these as I say them:

- **What** do I want to do?
- **Who** is involved?
- **When** will I do it?
- **Where** will I do it?
- **How** will I do it?

*Have participants **repeat** the questions several times.*

If you can answer each of these questions for your idea, those answers will add up to a plan you can use to achieve it!

Let's try a simple example to see how this works. Imagine that a woman needs to buy a school uniform for her child. See if you can answer the five finger planning questions for her. First ask:

- **What** does she want to do?

*She wants to buy a school uniform for her child.*

- **Who** is involved?

*The answer might be something like this: She will do it.*

*Ask for additional details. **Who else will be involved and how?** For example, her husband is also involved. He will help her with some of the money and lend her the bicycle. Her child is also involved since the uniform is for him. He will need to be measured and tell her what sort of uniform he needs. Lastly, the tailor who makes the uniform will also be involved.*

- **When** will she do it?

*The answer might be something like this: On Saturday in two weeks.*

- **Where** will she do it?

*The answer might be something like this: At the large market in the center of town. She will go to a certain tailor that she knows.*

- **How** will she do it?

*These are the steps that need to be taken. Ask for details. The answer might be something like this: She will save a part of the money she earns over the next two weeks and ask her husband for a certain amount. On that certain Saturday she and her son will travel to the market on the bicycle. She will find the tailor who will measure her son and sew the uniform.*

Let's **review** the five questions.

- Who can name one of the questions we ask to make a plan?

***Repeat** until all five questions are stated.*

Now it is your turn to try "Five Finger Planning". Only this time, you will develop a plan for sharing the knowledge from this training.

**4. Make** a plan to share information – 20 minutes

Let's review the list we made earlier and look at the things we decided were important for the community to learn.

*Read the items that the participants agreed the community needed to know now.*

We will divide into groups.

- Each group will **choose** one thing from the list that they want to share with their community
- **Make a plan** for how to share that knowledge by answering the 5 questions of Five Finger Planning
- **Draw or write** your answers to the questions on flipchart paper

Be sure that you:

- Make your plan as **simple** as possible but also be creative – don't just assume that by teaching people they will change their behavior
- Make it something you can actually do with the **resources** and **people** already in your community
- Make it something you could begin to do **tomorrow** if you chose to

***Divide*** *participants into small groups. Groups can be random or can be by factors such as community they belong to, profession, sphere of influence, etc.*

*Allow at least 15-20 minutes for planning. Ask groups to share their plans/drawings.*

- What do you like about these plans?

There are some wonderful ideas here. We hope that you will work to put these plans into action.

*Coordinate with host/partner organization about how to follow up with or encourage implementation of the plans. Share appropriate information at this point.*

5. Encourage one another – 10 minutes

We have learned a lot from each other in our time together. Although we have a good plan started, we may run into barriers along the way.

Listen to God's instructions for us when we come across challenges:

***1 Thessalonians 5:11***

**Therefore encourage one another and build each other up, just as in fact you are doing.**

- What would it look like for you to encourage one another when taking steps towards improving our health behaviors?

God calls us to encourage and love one another. Let's end this session in prayer. We can ask God to guide us as we take the steps to improve our healthy behaviors.

## 6. Lesson Review – 5 minutes

In this lesson you looked more closely at several different treatment methods.

- What have you learned from this activity?

Optional: Hang flipchart with key learning points from lesson.

***Key Learning Points:***

17. It is important to practice healthy behaviors and teach them to others who will teach others
18. The “Five Finger Planning” method is a helpful tool to develop a plan of action

## Training Summary

Many of you came to this training to learn about household water treatment and how to stop the sickness of diarrhea from traveling in your families and communities. This is especially important for children under the age of five. In the last several lessons we have discussed many methods and ways of implementing them.

We want to encourage you in these two things:

- **Practice** what you have learned
- **Share** the information with someone else.

*Review the Key Learning Points of the training together.*

***Key Learning Points:***

1. Safe water is water that is free from harmful substances and disease-causing microbes
2. Unsafe water, also called contaminated water, is water containing harmful substances and disease-causing microbes
3. The water cycle shows how water travels from the air to the earth and back again
4. Feces contain microbes that cause disease and sickness, such as diarrhea
5. Microbes can travel from feces on hands, flies, animals and through water or fields to reach our food and mouths.
6. There are simple ways to block feces from making us sick. Practicing these ways will show love to our neighbors.
7. The 4 points of the safe water chain are access, transport, storage, and use.
8. Behaviors at these 4 points will either harm (contaminate) the water or help to keep it safe
9. There are numerous ways to keep water safe at the point of access including:
   - *Minimizing water contaminants such as rubbish, etc.*
   - *Proper latrine siting*
   - *Lining wells*
   - *Proper drainage*
   - *Fencing or protective structure around water point*
   - *_(others)_____*
10. There are numerous ways to keep water safe during transport including:

- *Ensuring the container has a lid and a narrow mouth*
- *Cleaning container regularly*
- *_(others)_____*

11. There are numerous ways to keep water safe during storage including:
    - *Having a lid/cover*
    - *Cleaning the container or tank regularly*
    - *Limiting access to the container/ keeping it off floor*
    - *Replacing/rotating water frequently*
    - *Ensuring no cracks in containers/tanks*
    - *_(others)_____*
12. There are numerous ways to keep water safe during use:
    - No contact with hands
    - Small-mouthed containers so no hands or cups fit in
    - Storage container with a tap/spigot
    - Clean ladle or dipping cup
    - Using a clean cup for drinking
    - Using a drying rack
    - *_(others)_____*
13. Recap participant plans for creating change
14. There are 3 processes that can help make water safe:
    - Sedimentation
    - Filtration
    - Disinfection
15. Some of the treatment methods that use these processes are: (mention methods demonstrated in step 5)
16. Optional: use participant lessons learned as key learning points for this lesson
17. It is important to practice healthy behaviors and teach them to others who will teach others
18. The "Five Finger Planning" method is a helpful tool to develop a plan of action

These behaviors help stop the sickness of diarrhea from traveling in your families and in your communities.

- What will less sickness mean for you and your community?

You have learned many ways to share this information and now you have made a simple plan to do this.

You now have light that you can share with others. It is up to you to hide it or share it.

- What will you do?

Thank you for taking time to come to these sessions. We have enjoyed our time with you and we look forward to hearing how your plans work.

| |
|---|
| *Plan ahead for an appropriate activity to end this training.* |

# APPENDIX:

## Additional Lessons & Resources

## References:

Brikké, François and Maarten Bredero. *Linking technology choice with operation and maintenance in the context of community water supply and sanitation: a reference document for planners and project staff.* World Health Organization and IRC Water and Sanitation Centre (Geneva: 2003). pp. 72-74.

*Colwell, Rita R., Anwar Huq, M. Sirajul Islam, K. M. A. Aziz, M. Yunus, N. Huda Khan, A. Mahmud, R. Bradley Sack, G. B. Nair, J. Chakraborty, David A. Sack, and E. Russek-Cohen. "Reduction of cholera in Bangladeshi villages by simple filtration."* PNAS. Februart 4, 2003, vol. 100. No.3. pp 1051-2055.

Godfrey, Sam and Bob Reed. "Cleaning and disinfecting water storage tankers," *Technical Notes on Drinking-Water, Sanitation and Hygiene in Emergencies.* World Health Organization and WEDC. 2011.

*Community Health through Hygiene: Keeping Water Safe*, Edition 1. Lifewater International (California: 2010).

*Wellness through Water: An Introduction to Household Water Treatment and Safe Storage*. Center for Affordable Water and Sanitation (CAWST) (Calgary: March 2009).

*Maintaining Water Storage Tanks*. Water for the World. Technical Notes No. RWS 5.O.

**Additional Web Sources Consulted:**

International Water and Sanitation Center (IRC)
www.irc.nl

United Nations (UN)
http://www.unwater.org/

World Health Organization (WHO)
www.who.int/water_sanitation_health/hygiene/envsan/technotes/en/

## Water Tank Maintenance

To ensure water quality, the proper maintenance of water storage tanks is important. The two key components to proper maintenance are:

1. Preventing contamination
2. Cleaning the tank periodically

### Preventing Contamination

Check tanks and the area around tanks monthly for potential problems. Address any concerns immediately. Delaying action may allow the problem to get worse or lead to contamination and sickness.

To prevent contamination, check theses five areas monthly:

- **Tank**
  - Structure – look for and repair any chips, cracks, holes or broken edges.
  - Cover – ensure cover fits tightly preventing dust, leaves, and even light from entering the tank. Light can lead to the growth of algae (tiny green plants).
- **Roof & Gutters**
  - Remove or sweep contaminants and debris from roof and gutters
  - Cut away overhanging branches
  - Look for and repair any cracks or holes; replace broken tiles or replace broken nails.
  - Check gutters for rotting (bamboo or wood) and replace as needed
  - Ensure gutters are firmly attached to roof, properly joined, and slanted to promote flow
  - Clean screens to prevent backup; repair any rips or holes
- **Pipes**
  - Examine pipe connections for leaks and valves for functioning. Tighten or repair pipes as needed.
  - Check screens on pipe ends for damage and replace. These are entry points for mosquitoes and small animals.
- **Tap**
  - Check for and repair leaks
  - Check soak pit (stones and gravel) is properly allowing drainage; clean out debris and replace rocks as needed.
- **Environment**

- Remove any rubbish or debris from around the tank
- Ensure no waste or rubbish disposal areas are located nearby and no latrines are being constructed uphill from or near tank
- Ensure trench is dug near the tank to direct surface water away from it and trench is clear of debris
- Check fence for gaps and holes and repair
- Remove any tree roots near the tank

## Cleaning the Tank

To clean a tank with a removable lid or cover, follow the following steps 1-3 times per year.

***Materials needed:***

- Chlorine tablets or liquid chlorine bleach (household grade unscented bleach with 4% active chlorine)
- Broom, stiff brush, and bucket
- Eye and hand protection (glasses and rubber gloves) to protect self from chlorine

***Warnings:***

- Chlorine can damage skin and eyes. Always wear eye and hand protection (preferably glasses and rubber gloves) when handling chlorine.
- Do not climb in the tank if it is filled with water.
- Ensure there is good ventilation when mixing the chlorine. Consider covering your mouth with a cloth if directly applying chlorine to the walls, and take breaks for fresh air.
- Do not clean the tank alone. Be sure another person is present at all times to assist with climbing in and out of the tank and in case of emergencies.

***Steps:***

1. **Calculate** the volume of the tank being cleaned if it is unknown (see "*Calculating the Volume of a Tank*" at the end of this lesson). The tank volume determines how much chlorine is needed.
2. **Drain** all water out of the tank.
   a. Let water supply in the tank reduce over a period of time, then drain the last bit. Or transfer water to another clean temporary storage container.
   b. If tank is shared, notify users of any decision to close off flow well in advance. Encourage them to store extra water for the time period required. Do not attempt to clean the tank during peak demand periods.
3. When the tank is completely drained, **scrub and sweep** out all loose material and dirt with broom and brush.

a. Attaching a brush to a long pole may allow you to clean the tank without entering it.
b. If there is sludge built up in the tank it will need to be removed. If tank is very dirty a mixture of detergent (such as household laundry soap) and water can be used to scrub the walls and floor. Be sure to thoroughly rinse all detergent and collect this water for safe disposal.

4. Use one of the following methods for **disinfection**:

*Method 1*

(World Health Organization recommended)

a. Fill a 20 liter bucket with clean water
b. Add 50 grams of HTH (High Test Hypochlorite) granules or powder (it usually contains 50-70% chlorine)
c. Use 10 liters (half a bucket) of chlorine mixture for every 1,000 liters (or every $m^3$)
d. Slowly pour mixture into tank as you fill tank to its capacity with fresh water. (Adding chlorine during filling allows it to mix in well). Be sure to also clean and disinfect pipes and hoses connected to tank using the same method.
e. Cover the tank and let chlorine stand for 24 hours to ensure it's completely disinfected.
f. Drain the tank and the refill it for general use.

*Method 2*

When less time is available.

(Water for the World recommended)

a. Fill a 20 liter bucket with clean water
b. Make a solution by mixing 4 grams HTH into the water
c. Apply this directly to the inside walls of the tank with a stiff brush
d. Wait 30 minutes, and then refill the tank for general use

*Method 3*

(CAWST recommended)

a. Fill water to the tap level.
b. Add 1 bottle bleach (unscented & uncolored household grade with 4% active chlorine) -- or chlorine tablets according to package instructions – to the water in the bottom of the tank.

c. Scrub the bottom and sides of tank.

d. Remove the bleach water with a bucket.

e. Refill tank with water and allow the water to settle overnight before using it.

5. Note: If this tank is a rainwater catchment system that is the only source of water, it may be difficult to find a time during which to clean it. In this case, consideration of a pot chlorinator is recommended. Another option is to create a tank with 2 compartments. With this method, one side can be used while the other is cleaned.

**Disinfecting the Water Tank & Water**

If one or several of the following situations occur, you will need to disinfect the tank and water in it.

- Diarrhea and stomach pains develop after drinking the water
- Animal or human feces, including bird droppings, has gotten into the tank
- There is a dead animal in the tank
- People have entered the tank or come into contact with the water in the tank for maintenance or repairs
- There are strange odors (sulfide, rotten egg, sewage/feces) coming from the tank
- Water tests show bacterial contamination

*Method*

(CAWST Recommended)

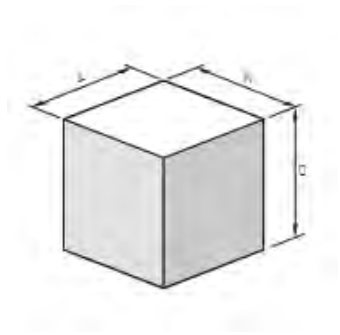
a. Add 125 ml liquid chlorine bleach (unscented & uncolored household grade with 4% active chlorine) to *every* 1,000 liters water currently in tank.
b. After mixing in bleach, wait 24 hours to allow the chlorine to disinfect the water.
c. After 24 hours, water is safe to drink. Any remaining chlorine odor or taste will lessen over time. Boiling the water for 1 minute before drinking can also improve the taste.

## Calculating the Volume of a Tank:

Storage tanks are commonly one of three shapes, rectangular, cylindrical or oval. If the tank is another shape, approximate its volume by using the formula that most nearly fits the shape.

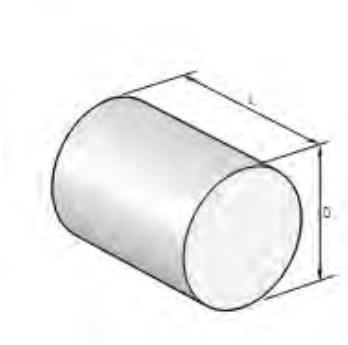
### Rectangular ground storage tanks

Volume (liters) = L x W x D x 1000
Where
D = depth of the tank (m)
W = width of the tank (m)
L = length of the tank (m)



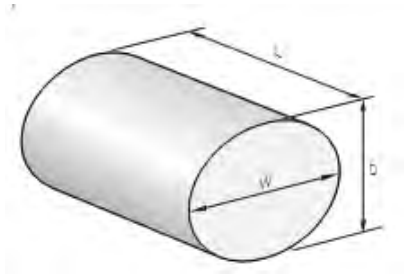
### Cylindrical ground storage tanks

Volume (liters) $= \frac{D^2 L}{4}$ x 1000
Where
D = diameter of the tank (m)
L = length of tank (m)
= 3.142



### Oval water tankers

Volume (liters) = ( x $(D + W)^2$ /16) x L x 1000
Where
D = depth of the tank (m)
W = width of the tank (m)
L = length of the tank (m)
= 3.142



Information in Water Tank Maintenance lesson taken or adapted from:

CAWST, *Wellness through Water: An* Introduction *to Household Water Treatment and Safe Storage*. March 2009 Edition.

Godfrey, Sam and Bob Reed. "Cleaning and disinfecting water storage tankers," *Technical Notes on Drinking-Water, Sanitation and Hygiene in Emergencies.* World Health Organization and WEDC. 2011.

Water for the World, *Maintaining Water Storage Tanks*. Technical Notes No. RWS 5.O

## Treatment Method: Boiling

**Advantages of this method:**

This boiling method is very effective in removing and destroying most of the small organisms which cause water borne diseases. It also can produce large quantities of safe water at one time.

**Disadvantages of this method:**

The disadvantage with this method is the problem of deforestation or lack of available fuel source. The World Health Organization estimates that it requires 1 kilogram of wood to boil 1 liter of water. In some areas this method is simply not possible. Another disadvantage is the possibility of burns while boiling. Also, some people do not like the taste of boiled water. Taste can be improved by vigorously stirring or shaking the water prior to drinking.

**Materials needed:**

- Cooking pot with lid
- Fire or stove
- Optional: clean cloth for filtering

**To use this method:**

1. If the water is cloudy ("turbid") **filter** it through a clean cloth before boiling.
    - Use a clean, **tightly woven cloth** without holes. **Fold** it in half and **place** it over the top of a water container.
    - Use a **rope** to tie the cloth down.
    - **Pour** the collected water through the cloth.
    - After you are done, **wash** the cloth with soap and water and **hang** it up to dry. The sun's rays will help kill any microbes on the cloth.

2. Put the water in a cooking pot. **Cover with a lid** and heat it over a fire or stove.

3. Once the water comes to a rolling boil, **boil** it for **1 minute only**. Some teachings say to boil it longer, but only 1 minute is necessary for areas up to 3,000 meter altitude.

4. If you live at **high altitudes** such as in the mountains, you will need to boil it longer.

- If you are above 3,000-4,500 meters altitude it is best to boil water for 3-5 minutes to make it safe
- If you are at an altitude above 8,200 meters you will need to boil the water for 30 minutes to make it safe
- A general guideline (though not scientific) is, at:
    - 5,000 m boil 5 minutes
    - 6,000 m boil 10 minutes
    - 7,000 m boil 20 minutes

- 8,000 m boil 30 minutes

5. Keep pot covered with a lid and **allow it to cool** completely.
6. When water has cooled, transfer it to a **clean narrow mouthed container with a lid** for safe storage.

**Reflection**

- What advantages do you see when using the SODIS method of water purification?
- What disadvantages do you see when using this method?
- Would this method work in your home/community?

# Treatment Method: Solar Disinfection (SODIS)

**Why it works:**

**SODIS (SO**lar **DIS**infection) **is a simple method for disinfecting water using solar energy.**

Transparent plastic (PET) or glass bottles are filled with contaminated water and exposed to the sun for 6 hours. During this time, the UV-radiation and the heat of the sun kills diarrhea generating pathogens, bacteria, viruses, and most parasites.

Bacteria are highly sensitive to UV-A radiation and are quickly killed by sunlight. Viruses are slightly more resistant, but are also killed within the recommended 6 hours. Parasites are less sensitive to sunlight. While giardia cysts are rendered inactive within 6 hours, cryptosporidia cysts must be exposed to direct sunlight for at least 10 hours before they are neutralized. Amoebas do not die until the water temperature has been warmer than 50°C for over an hour.

**Advantages of this method:**

Aside from initial bottles, SODIS is a no-cost option. Benefits include acceptability to users because of the small cost, ease of use, and little change in water taste. Also, recontamination is unlikely because water is consumed directly from the bottles in which it is treated.

**Disadvantages of this method:**

Disadvantages include the need for pretreatment of cloudy water, limited volume of water that can be treated at once, length of time required to treat water, and the supply of plastic bottles required.

For additional information visit website: www.sodis.ch for more information

**Materials:**

- Clear plastic 2 liter bottle (the bottle cannot have anything covering it or any color to it, or the sunlight will not be able to kill the microbes)
- Optional: clean cloth for filtering

**To use this method:**

1. If the water is cloudy ("turbid") **filter** it through a clean cloth before boiling.
    a. Use a clean, **tightly woven cloth** without holes. **Fold** it in half and **place** it over the top of a water container
    b. Use a **rope** to tie the cloth down.
    c. **Pour** the collected water through the cloth.
    d. After you are done, **wash** the cloth with soap and water and **hang** it up to dry. The sun's rays will help kill any microbes on the cloth.
2. **Wash** a 2 liter clear plastic bottle with soap and water. Remove any labels.
3. **Fill** the bottle with water and close the lid tightly.
4. Set the bottle out in the **sunlight** for a **minimum 6 hours.** Place it on a metal roof or a drying rack (some place it will not be disturbed by animals or people and not be in the shade).
5. If the sky is **cloudy**, leave it out for **2 days**.
6. Keep water in the plastic bottle for storage, or transfer it to a narrow-mouthed container with a lid.




**Reflection**

- What advantages do you see when using the SODIS method of water purification?
- What disadvantages do you see when using this method?
- Would this method work in your home/community?

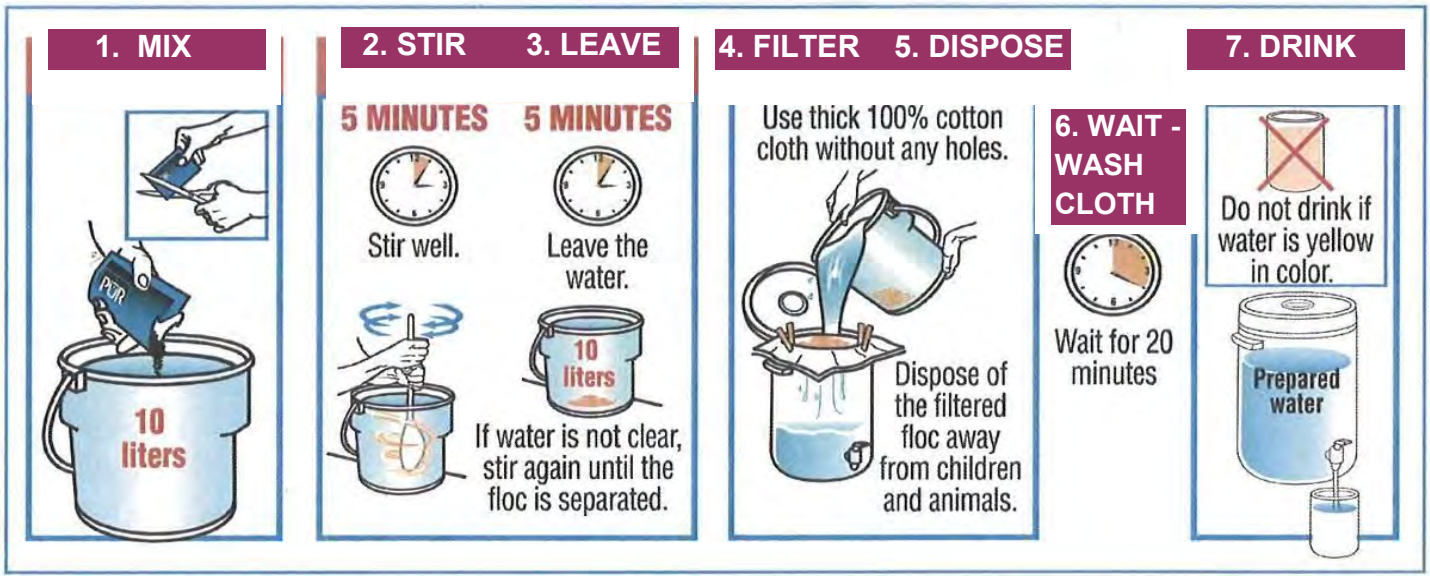
## Treatment Method: PUR

**Why it works:**
PUR by the company PSI is an example of pre-packaged water disinfection. It is a powdered water disinfectant that works in 2 ways. First, it causes solids in the water to stick together and settle to the bottom of the container. Second, its chemicals destroy disease-causing microbes in the water. Studies have shown that using PUR causes a 50-90% reduction in diarrhea.

For additional information visit website: http://www.pghsi.com/pghsi/safewater/

**Materials needed:**
- PUR packet
- 10-20 liter bucket
- Large stirring utensil
- Optional: clean cloth for filtering

**To use this method:**
1. **Mix** contents of 1 PUR packet to 10 liters of un-boiled water.
2. **Stir** the water for 5 minutes or until dirt and microbes visibly separate from clean water.
3. Stop stirring and let water **sit** for 5 minutes. This allows the dirt ("floc") and microbes to settle to the bottom of the container. If water is not clear after 5 minutes, stir again until the dirt has settled.
4. **Filter** the water through a cotton cloth into a storage container that has a lid, like a jerry can, clay pot, or a bottle.
5. **Dispose** of the dirt from the bottom of the container away from children and animals.
6. Cover the container, **wait** 20 minutes. Remember to **wash** and dry the cloth after filtering.
7. After 20 minutes water is safe to drink or use. Do not drink or use if water has a yellow color.



**Reflection**

- What advantages do you see when using the SODIS method of water purification?
- What disadvantages do you see when using this method?
- Would this method work in your home/community?

## Treatment Method: Chlorine

### Why this method works:

Chlorine is a chemical commonly used for disinfection of drinking water. There are several types for home use – liquid, powder and tablet form. Chlorine is commonly available as liquid bleach (sodium hypo chlorite), usually with a chlorine concentration of 1%. Liquid bleach is sold in bottles or packets.

*Chlorine amounts must be* ***calculated correctly*** so that it destroys all microbes but does not affect taste or health. Chlorine must have sufficient contact time with the pathogens (at least 30 minutes). Also, the strength of the chlorine in bleach can decrease over time.
Sûr'Eau and Water Guard are examples of pre-packaged water disinfection. They are a chlorine-based liquid or tablet. The correct dose is pre-determined for each area where they are distributed. Directions are written on the bottle or packet and should be followed exactly, since wrong amounts can be harmful to health.

**Advantages of this method:**

Chlorine is widely available, easy to use, and generally affordable. When used correctly, chlorine will kill all viruses and bacteria. Also, residual chlorine – the chlorine that remains in the water – will help protect the water from recontamination.

**Disadvantages of this method:**

Chlorine and liquid bleach can be harmful to the skin, eyes, and body if used incorrectly. Some species of protozoa and helminthes are resistant. Also, some people do not like the taste of chlorinated water. Taste can be improved by allowing water to sit for a while or bringing it to a boil; this allows the chlorine to evaporate.

### Materials needed:

- Jerry can, pot, or bucket filled with water
- Liquid bleach, Sur Eau or Water Guard (or similar) bottle or packet
- Large stirring utensil
- Optional: Clean cotton cloth for filtering
- Freshly cleaned water storage container with a lid

**To use this method:**

1. Since the concentration of chlorine is different in each product, always carefully follow the instructions that come with the product (Sûr'Eau, Water Guard, or liquid bleach, etc.)
2. Chlorination will not be as effective if the water is cloudy. If the water is cloudy or dirty, filter the water through a clean cotton cloth or let the water stand undisturbed in a container 12-24 hours. Carefully pour the clear water from top into another container. Discard remaining dirty water.
3. Pour the correct amount of chlorine solution into the cap or count out the correct number of tablets.
4. Mix the measured amount of solution into a water container with 20 liters of water (or as described on instructions). Stir or shake well.

5. Allow water to sit undisturbed for 20-30 minutes (or as described on instructions).
6. The water is ready for drinking or use, or to be transferred to a narrow mouthed container with a lid for safe storage.

**Reflection**

- What advantages do you see when using a chlorine method of water purification?
- What disadvantages do you see when using this method?
- Would this method work in your home/community?

## Treatment Method: Straining Water
**(to reduce Cholera or Guinea worm)**

**Why this method works:**
Filtering water through a clean cloth – straining – is a simple water treatment method that has been used for centuries Straining is NOT a water treatment method effective in removing microbes, viruses, or bacteria. However it has two useful functions:

1. It can reduce particles and dirt ("turbidity"), therefore making other disinfection treatment more effective
2. It can reduce the contamination of cholera and guinea worm in water
3.

Copepods are tiny "water fleas" that can spread cholera and guinea worm. Cholera is a bacterium that attaches to certain copepods, and is spread to different waters as the copepod travels. Guinea worm, a type of roundworm, larvae is actually eaten by certain copepods, and spread to water and humans as the copepod travels. Copepods are tiny, but they are large enough to be caught in a straining, or filter, cloth.

Nylon straining filters are available, but cotton materials – such as clean old sari or kanga cloth – has been shown to be as effective. The pores (tiny holes in the fabric) on older material are smaller, allowing water to run through but trapping larger particles.

Straining should ALWAYS be used with another treatment method when possible in order to make water safe for drinking.

**Advantages of this method:**
Straining requires very few resources, and is simple and quick to do.

**Disadvantages of this method:**
Straining is very ineffective against most microbes, virus, or bacteria. It must be done carefully and consistently to be effective.

**Materials needed:**
- Large tightly woven cloth for filtering (clean, older cotton material is recommended. Nylon filters can also be purchased in certain areas.)
- Clean container with a lid for filtered water
-

**To use this method:**
1. Fold filtering cloth four to eight times and place it over the top of a water container
2. Use a rope to tie the cloth down.
3. Pour the collected water through the cloth. Or, if the cloth is tightly secured, the entire container can be dipped into a lake or river so the water flows through the cloth into the container.

4. This method will filter out cholera microbes and Guinea worms and dirt. This method does NOT filter out the small microbes from the water that cause most diarrheal diseases.
5. Wash the cloth with soap and water and hang it up to dry. The sun's rays will help kill any microbes left on the cloth.

**Reflection**

- What advantages do you see when using a chlorine method of water purification?
- What disadvantages do you see when using this method?
- Would this method work in your home/community?

## Treatment Method: Biosand Filtration

**Why this method works:**
The biosand filter container can be plastic, concrete, or other non-toxic, rustproof material. Contaminated water is poured through the top and slowly filters through a biological layer and layers of washed and sieved sand and gravel. Microbes are removed in the process, and safe water then flows from the outlet pipe where it is collected in a clean storage container. Maintenance includes regular cleaning of the outlet pipe with chlorine or soap and water, as is periodic cleaning the top layer of sand.

**Advantages of this method:**
Biosand filters are effective in significantly reducing most contaminants. They require an initial investment, but will treat water for a long time (30+ years for concrete and 10+ years for plastic filters). Little effort is required beyond fetching the water and monitoring the filter flow. Also, little maintenance is required for filter upkeep.

**Disadvantages of this method:**
A biosand filter must be kept with a generally steady supply of water to filter; not more than 48 hours should pass between one filling and another. Initial investment (cost) can be high. Also, the construction or manufacturing of filters requires skilled workers as well as numerous materials.

**Materials needed:**
- Biosand filter
- Clean container with a lid to catch and store filter output

**To use this method:**
1. If water is turbid, filter water through a clean tightly woven cloth before pouring it in the filter (see Straining lesson for further instructions).
2. Remove lid from biosand filter, pour water into the top, and replace lid.
3. Water will filter slowly through the filter. (Recommnded rate is 0.4 liters/minute.)
4. Ensure a narrow-mouthed clean container with a lid is in place to catch the filtered water.
5. Allow at least 1 hour to pass before filling the filter again. This allows the biolayer to work on the water running through the filter. However, the filter should not be left longer than 48 hours before filling it again.

**Reflection**
- What advantages do you see when using a chlorine method of water purification?
- What disadvantages do you see when using this method?
- Would this method work in your home/community?

## Treatment Method: Three Pot Filtration

**Why this method works:**
The Three Pot method uses both filtration and sedimentation to remove particles and dirt ("turbidity"), from water as well as contaminants such as cholera, guinea worm, and *some* microbes and viruses. However it does not effective for removing all contaminants.

**Advantages of this method:**
The Three Pot method is useful when other treatment methods are not available and there is a shortage of fuel for boiling. Very few resources are needed for this process, and it can be continued indefinitely by refilling the first container daily and following the steps below.

**Disadvantages of this method:**
The Three Pot method is time consuming, requiring a minimum of 4 days to make water safe. Also, it is only somewhat effective against most microbes (viruses and bacteria).

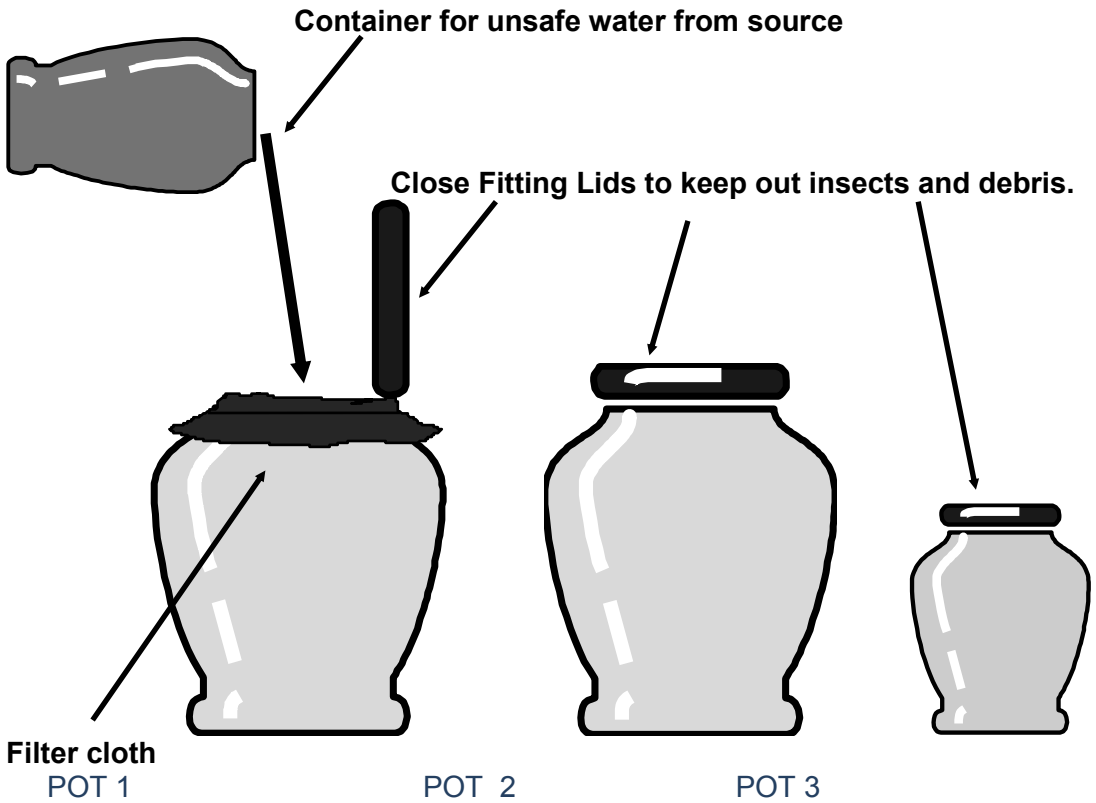
**Materials needed:**

- Container for transporting water from source
- Three large pots or jars made from clay, wood, plastic or metal that can be tightly sealed with lids, cloth or large leaves
- Filter cloth made of tightly woven cotton
- String, leather strap, light rope or more fabric for fastening filter cloth to pot

**To use this method:**

1. Wash container and pots using boiled or treated water and scrub with soap, ash or sand. Containers or pots originally used for hazardous materials should not be used. Always keep pots covered to prevent insects or debris from entering.

2. **Day One:**
   a. Using a clean container, collect water from water source taking care to get the clearest water possible.
   b. Remove the lid from the first pot and securely fasten the filter cloth across the mouth of the pot with string, strap, rope, or fabric.
   c. Slowly pour the collected water into the first pot until the pot is full, allowing the filter cloth to trap any solids in the water.
   d. Carefully remove the filter cloth, making sure that the trapped solids do not fall into the pot of filtered water.
   e. Cover the pot with a lid to keep insects and debris out of the pot.
   f. Place the pot of filtered water in a cool dark place where it will not be disturbed. Many bacteria require light for their survival and will die in a dark environment.
   g. Wash the filter cloth, rinse and hang it in the sun to dry.




3. **Day Two:**
   a. Using a clean container, collect water from water source taking care to get the clearest water possible.
   b. Carefully pour water from the first pot into the second pot. Be sure to pour only water, not the sediment at the bottom of the pot.
   c. Cover the second pot with a lid to keep insects and debris out of the pot.
   d. Place the second pot of water in a cool dark place, where it will not be disturbed.
   e. Rinse the sediment from the first pot with a small amount of freshly collected water (the water does not have to be purified for this step).
   f. In order to keep the water purification process going, repeat steps C-G from Day One for the freshly collected water. There are now two covered pots in a cool dark place.

4. **Day Three:**

   a. Using a clean container, collect water from water source taking care to get the clearest water possible.
   b. Carefully pour water from the second pot into the third pot. Be sure to pour only water, not the sediment at the bottom of the pot
   c. Cover the third pot with a lid to keep insects and debris out of the pot.

d. Place the third pot of water in a cool dark place, where it will not be disturbed.
e. Rinse the sediment from the second pot with a small amount of water from the first pot.
f. Carefully pour water from the first pot into the second pot. Be sure to pour only water, not the sediment at the bottom of the pot.
g. In order to keep the water purification process going, repeat steps C-G from Day One for the freshly collected water. There are now three covered pots in a cool dark place.

**5. Day Four:**

a. On the fourth day of this process the third pot will contain safe water that can be used for drinking or cooking.
b. This water purification process can be continued indefinitely by refilling the first pot daily, and transferring the water in turn, into each pot as detailed in this document.
c. Clean the third pot weekly by scrubbing with soap, ash or sand and rinsing with treated (boiled, chlorinated, etc.) water.

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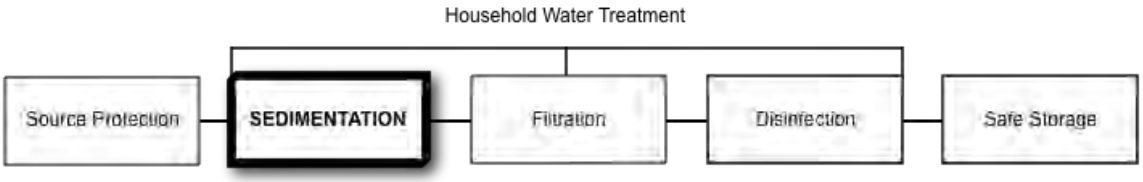
# Household Water Treatment and Safe Storage

## Fact Sheet: Settling

### The Treatment Process




### Effectiveness

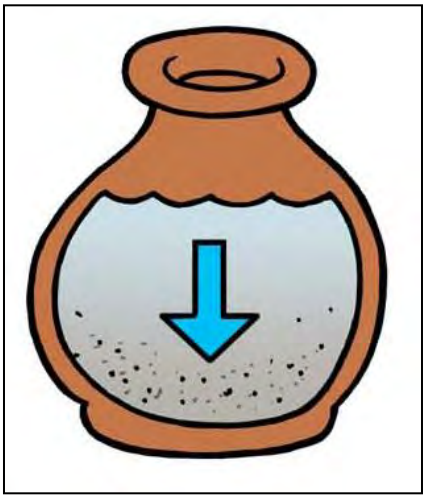
| Highly Effective For: | Somewhat Effective For: | Not Effective For: |
|---|---|---|
| • Turbidity<br>• Protozoa<br>• Helminths | • Bacteria<br>• Taste, smell, colour | • Viruses<br>• Chemicals |

### How Does it Work?

Natural settling can be used to help remove turbidity and some pathogens from water. Let a container of water sit without moving for 24 hours and then pour the clear water into a clean container. This process can repeated 2 to 3 times as needed, sometimes called the three pot settling method.

### Effectiveness

- Quality: Somewhat effective for removing turbidity and some pathogens
- Quantity: Depends on the size of container being used
- Local water: Can be used with any water source



### Appropriateness

- Local availability: Can use any container
- Time: 24 hours
- Operation and maintenance: Simple; need to wash container afterwards
- Lifespan: Containers may need to be replaced

### Acceptability

- Taste, smell, colour: May be improved
- Ease of use: Very easy

### Cost

- Initial purchase cost: Free or low cost since households can use any container
- Operating cost: None

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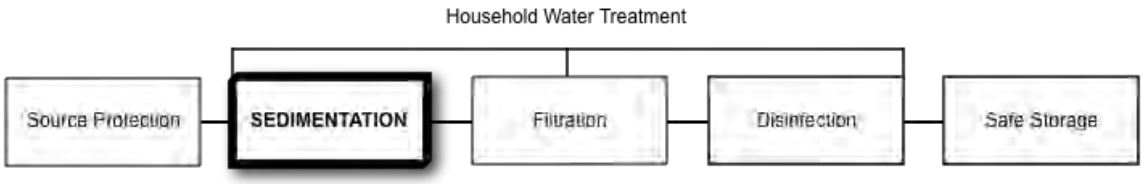
# Household Water Treatment and Safe Storage

## Fact Sheet: Natural Coagulants

### The Treatment Process

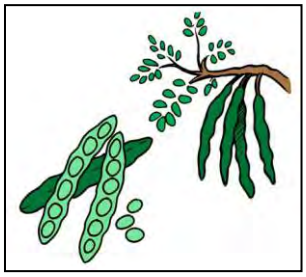


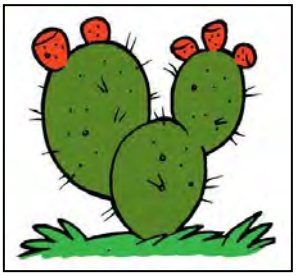

### Effectiveness

| Very Effective For: | Somewhat Effective For: | Not Effective For: |
|---|---|---|
| • Turbidity | • Bacteria<br>• Viruses<br>• Protozoa<br>• Helminths<br>• Taste, smell, colour | • Chemicals |

### How Does it Work?

The sedimentation process can be quickened by adding natural **coagulants** to the water. Coagulants help the sand, silt and clay join together and form larger clumps, making it easier for them to settle to the bottom of the container. There are a variety of natural products which have been used around the world to help with sedimentation, including moringa seeds and prickly pear cactus.





### Effectiveness

- Quality: Effective for removing turbidity and somewhat effective for pathogens; varies depending on the water
- Quantity: Depends on the size of container being used
- Local water: Can be used with any water source

### Appropriateness

- Local availability: Natural coagulants are not always available; can use any container
- Time: 2+ hours
- Operation and maintenance: Need to dry and grind seeds before adding them to water; need to wash container afterwards
- Lifespan: Dried beans and seeds can be stored for a long time; prickly pear cactus needs to be used before the sap dries; containers may need to be replaced

### Acceptability

- Taste, smell, colour: May improve colour; may cause an objectionable taste
- Ease of use: Need to prepare natural coagulants beforehand; easy to add coagulants to water

### Cost

- Initial purchase cost: None
- Operating cost: None

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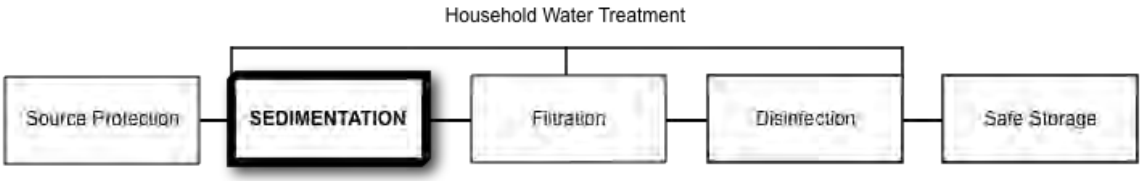
# Household Water Treatment and Safe Storage

## Fact Sheet: Chemical Coagulants

### The Treatment Process




### Potential Treatment Capacity

| Highly Effective For: | Somewhat Effective For: | Not Effective For: |
|---|---|---|
| • Turbidity | • Bacteria<br>• Viruses<br>• Protozoa<br>• Helminths<br>• Hardness<br>• Taste, odour, colour | • Chemicals |

**How Does it Work?**

The sedimentation process can be quickened by adding special chemicals, also known as coagulants, to the water. Coagulants help the sand, silt and clay join together and form larger clumps, making it easier for them to settle to the bottom of the container.

Common chemicals used are aluminium sulphate (alum), polyaluminium chloride (PAC or liquid alum) and iron salts (ferric sulphate or ferric chloride).

**Effectiveness**

- Quality: Effective for removing turbidity and somewhat effective for pathogens; varies depending on the water
- Quantity: Depends on the size of container being used
- Local water: Can be used with any water source

**Appropriateness**

- Local availability: Chemical coagulants are not always available; can use any container
- Time: 2+ hours
- Operation and maintenance: Follow manufacturer's instructions for specific products; need to wash container afterwards
- Lifespan: 6 months in liquid form and 1 year in solid form; containers may need to be replaced


**Acceptability**

- Taste, smell, colour: May be improved
- Ease of use: Follow manufacturer's instructions for specific products

**Cost**

- Initial purchase cost: None
- Operating cost: On-going cost to buy chemical coagulants as they are used

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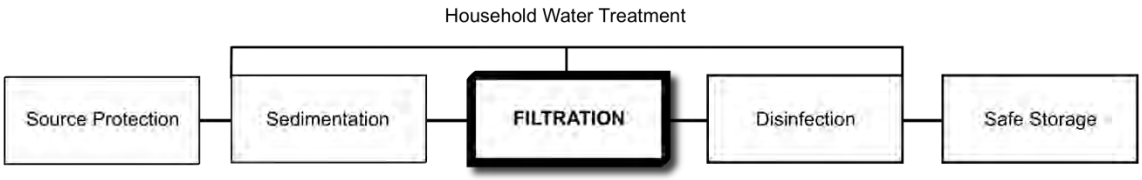
# Household Water Treatment and Safe Storage

## Fact Sheet: Straining

### The Treatment Process




### Effectiveness

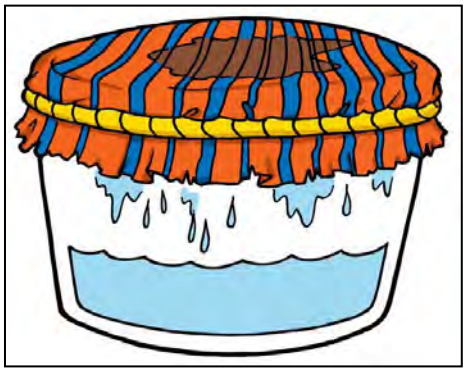
| Very Effective For: | Somewhat Effective For: | Not Effective For: |
|---|---|---|
| • Helminths<br>• Protozoa | • Turbidity<br>• Bacteria<br>• Taste, smell, colour | • Viruses<br>• Chemicals |

**How Does it Work?**

A clean piece of cloth can be used to strain sand, silt, clay and some pathogens out of water. You can use any cotton cloth that is fine and tightly woven, such as a sari cloth. The cloth should be folded into a few layers and tied over a clean container. Afterwards, you should wash the cloth with clean water before using it again.

**Effectiveness**

- Quality: Very effective for removing large particles and pathogens
- Quantity: Depends on the size of container being used
- Local water: Can be used with any water source



**Appropriateness**

- Local availability: Cloth is available around the world, can recycle old clothes
- Time: Flow rate is fast
- Operation and maintenance: Simple; cloth needs to be washed with clean water
- Lifespan: Cloth may need to be replaced

**Acceptability**

- Taste, smell, colour: May be improved
- Ease of use: Very easy

**Cost**

- Initial purchase cost: Free or low cost since households can use old clothes as filters
- Operating cost: None

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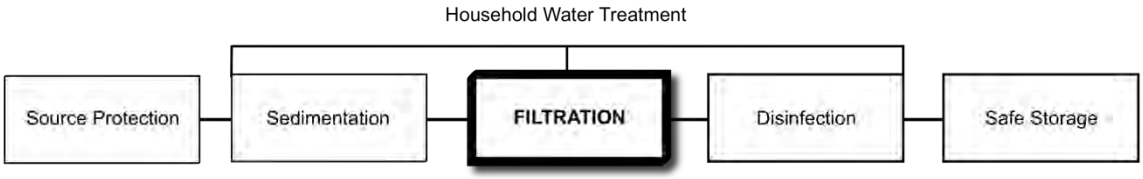
# Household Water Treatment and Safe Storage

## Fact Sheet: Biosand Filter

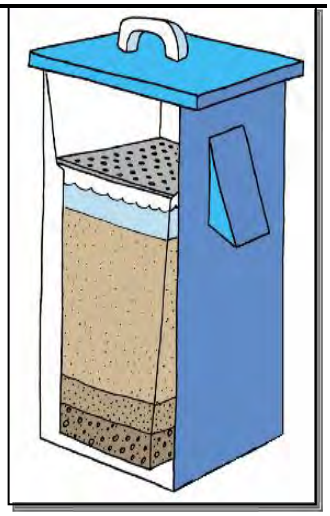
### The Treatment Process




### Effectiveness

| Very Effective For: | Somewhat Effective For: | Not Effective For: |
|---|---|---|
| • Bacteria<br>• Protozoa<br>• Helminths<br>• Turbidity<br>• Taste, smell, colour | • Viruses<br>• Iron | • Chemicals |

### How Does it Work?



A biosand filter is a concrete or plastic box that is filled with layers of sand and gravel. Water is simply poured into the top of the filter and collected in a safe storage container. Pathogens and turbidity are removed by physical and biological processes in the filter sand.

### Effectiveness

- Quality: Very effective in removing turbidity and pathogens
- Quantity: Can filter 12-18 litres each batch; recommended to use at least once a day to ensure effective pathogen removal
- Local water: Can be used with any water source, may need to sediment water before filtering

### Appropriateness

- Local availability: Concrete filters can be constructed any where in the world; plastic filters are imported from the United States
- Time: Concrete filter flow rate is 0.6 litres/minute; plastic filter flow rate is 0.8 litres/minute
- Operation and maintenance: Simple maintenance to clean sand when the flow rate slows down
- Lifespan: Concrete filters 30+ years; plastic filters 10+ years; lids and diffusers may need to be replaced

### Acceptability

- Taste, smell, colour: Usually improved
- Ease of use: Easy for adults; may be difficult for small children to pour water into the filter

### Cost

- Initial purchase cost: US$12-30 for concrete filters; US$75 for plastic filters
- Operating cost: None

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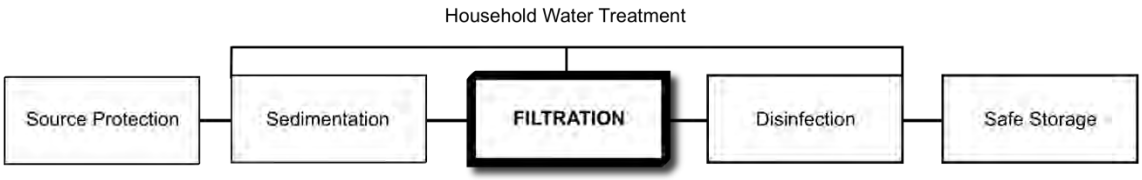
# Household Water Treatment and Safe Storage

## Fact Sheet: Kanchan™ Arsenic Filter

### The Treatment Process

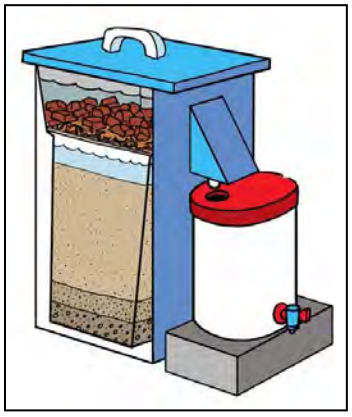



### Effectiveness

| Very Effective For: | Somewhat Effective For: | Not Effective For: |
|---|---|---|
| • Arsenic<br>• Bacteria<br>• Protozoa<br>• Helminths<br>• Turbidity<br>• Taste, smell, colour | • Viruses<br>• Iron | • Chemicals |

### How Does it Work?

The Kanchan™ Arsenic Filter is an adaption of the biosand filter. It is a concrete or plastic box that is filled with layers of sand and gravel. There is also a layer of rusty nails, which remove the arsenic. Brick chips are used on top of the nails to keep them from moving around. Pathogens and turbidity are removed by physical and biological processes in the filter sand. Water is simply poured into the top of the filter and collected in a safe storage container.



### Effectiveness

- Quality: Very effective in removing arsenic, turbidity and pathogens
- Quantity: Can filter 12-18 litres each batch; recommend to use 1-2 times each day to ensure effective arsenic removal
- Local water: Can be used with any water source; may need to sediment water before filtering

### Appropriateness

- Local availability: Concrete filters can be constructed anywhere in the world; plastic filters are used in Nepal
- Time: Flow rate is 0.6 litres/minute
- Operation and maintenance: Simple maintenance to clean sand when the flow rate slows down
- Lifespan: Concrete filters 30+ years; plastic filters 10+ years; nails need to be replaced every 2-3 years to ensure effective arsenic removal; lids and diffusers may need to be replaced

### Acceptability

- Taste, smell, colour: Usually improved
- Ease of use: Easy for adults; may be difficult for small children to pour water into the filter

### Cost

- Initial purchase cost: US$12-30

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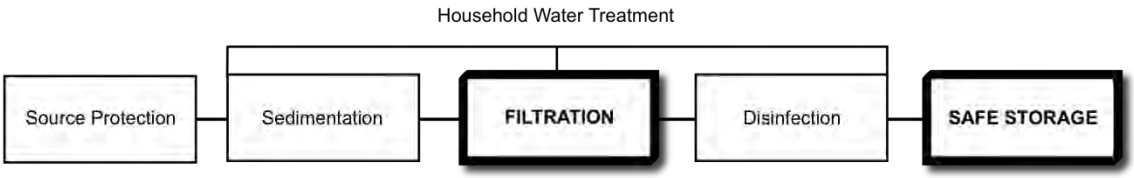
# Household Water Treatment and Safe Storage

## Fact Sheet: Ceramic Pot Filter

### Treatment Type

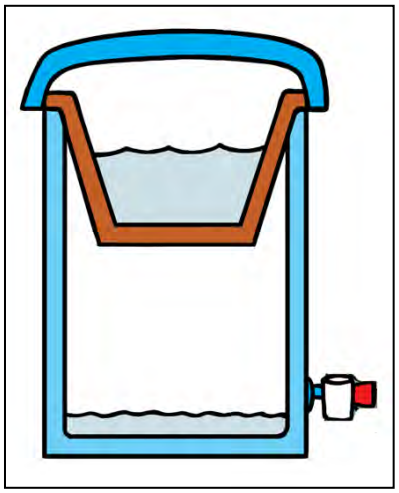



### Effectiveness

| Very Effective For: | Somewhat Effective For: | Not Effective For: |
|---|---|---|
| • Bacteria<br>• Protozoa<br>• Helminths<br>• Turbidity<br>• Taste, smell, colour | • Viruses<br>• Iron | • Chemicals |

### How Does it Work?

Ceramic pot filters are usually made from clay mixed with a combustible material like sawdust, rice husks or coffee husks. Colloidal silver is sometimes used to help with pathogen removal. Water is poured into a ceramic pot, and is collected in another container that has a tap at the bottom. This system also provides safe storage until it the water is used.



### Effectiveness

- Quality: Very effective in removing turbidity and pathogens; provides safe storage to prevent recontamination
- Quantity: Can filter up to 8 litres each batch
- Local water: Can be used with any water source, may need to sediment water before using the filter

### Appropriateness

- Local availability: Can be manufactured and purchased locally
- Time: Flow rate is 1-3 litres/hour
- Operation and maintenance: Simple maintenance to clean the pot when the flow rate slows down
- Lifespan: Up to 5 years, generally 1-2 years; needs to be replaced if there are visible cracks

### Acceptability

- Taste, smell, colour: Usually improved
- Ease of use: Very easy

### Cost

- Initial purchase cost: US$12-25
- Operating cost: None

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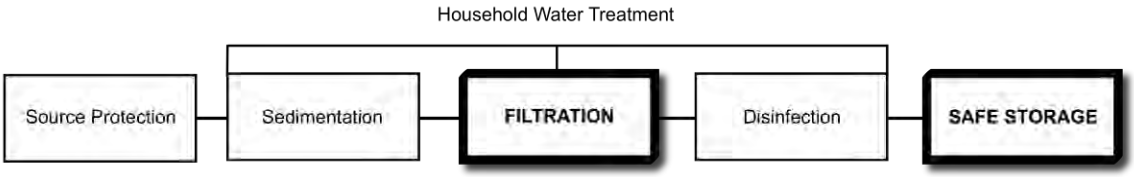
# Household Water Treatment and Safe Storage

## Fact Sheet: Ceramic Candle Filter

### Treatment Type




### Effectiveness

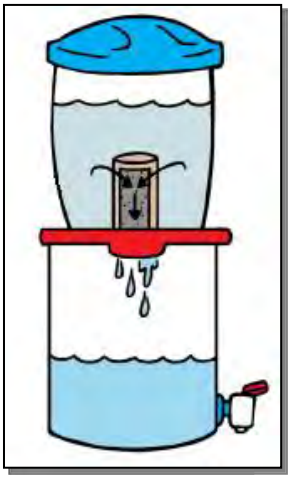
| Very Effective For: | Somewhat Effective For: | Not Effective For: |
|---|---|---|
| • Bacteria<br>• Protozoa<br>• Helminths<br>• Turbidity<br>• Taste, smell, colour | • Viruses | • Chemicals |

### How Does it Work?

Ceramic candle filters are hollow cylinders are usually made from clay mixed with a combustible material like sawdust, rice husks or coffee husks. Colloidal silver is sometimes used to help with pathogen removal. One or more candles are attached into the bottom of a container. Water is poured into the container and flows through the candle, and is collected in another container that has a tap at the bottom. This system also provides safe storage until it the water is used.

### Effectiveness

- Quality: Can be very effective in removing turbidity and pathogens; quality varies depending on the manufacturer; provides safe storage to prevent recontamination
- Quantity: Can filter up to 10 litres of water
- Local water: Can be used with any water source, may need to sediment water before using the filter



### Appropriateness

- Local availability: Can be manufactured and purchased locally
- Time: Flow rate is 0.1-1 litre/hour
- Operation and maintenance: Simple maintenance to clean the candle when the flow rate slows down
- Lifespan: Up to 3 years; usually 6 months to 1 year; candle needs to be replaced if there are visible cracks or leaks

### Acceptability

- Taste, smell, colour: Filtered water has improved taste, smell and colour
- Ease of use: Easy

### Cost

- Initial purchase cost: US$15-30
- Operating cost: None

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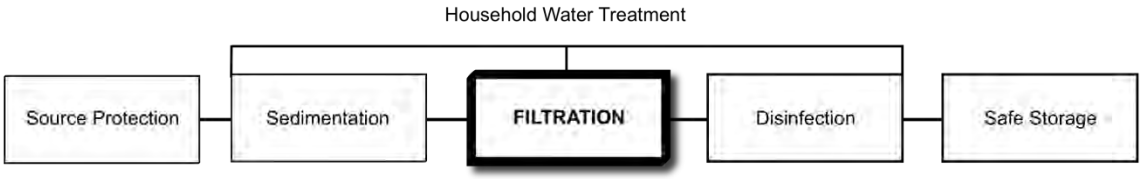
# Household Water Treatment and Safe Storage

## Fact Sheet: Lifestraw®

### The Treatment Process




### Potential Treatment Capacity

| Very Effective For: | Somewhat Effective For: | Not Effective For: |
|---|---|---|
| • Bacteria<br>• Viruses<br>• Protozoa (Family)<br>• Helminths (Family)<br>• Turbidity (Family) | • Turbidity (Personal) | • Protozoa (Personal)<br>• Heavy metals |

**How Does it Work?**

Both systems use a filtration system and a halogenated media for disinfection to treat contaminated water. The filter of the Personal LifeStraw has larger pores than the Family so does not have the same removal efficiency of pathogens or turbidity. The personal LifeStraw is used much like a straw by sucking water through the device, whereas the Family LifeStraw is a bucket that contaminated water is poured into.


**Effectiveness**

- Quality: Personal – very effective in removing bacteria and viruses; Family - Very effective in removing pathogens and turbidity
- Quantity: Can filter up to 700L (Personal) or 18,000 L (Family)
- Local water: Can be used with any water source, may need to sediment water before using the filter

**Appropriateness**

- Local availability: Can be purchased from Vestergaard Frandsen and imported, distributed and sold locally
- Time: Flow rate is 8-10 litres/hour
- Operation and maintenance: Blow into device to clean (Personal); Clean the cartridge and pre-filter everyday to prevent clogging (Family)
- Lifespan: Up to 3 years

**Acceptability**

- Taste, smell, colour: Filtered water has improved taster, smell and colour
- Ease of use: Easy

**Cost**

- Initial purchase cost: US$3 (Personal); US$25-40 (Family)
- Operating cost: None

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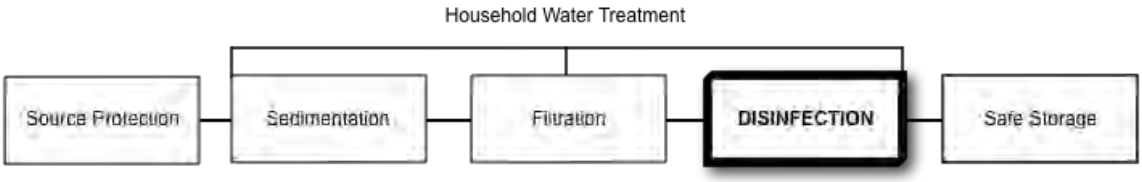
# Household Water Treatment and Safe Storage

## Fact Sheet: Boiling

### The Treatment Process




### Effectiveness

| Very Effective For: | Somewhat Effective For: | Not Effective For: |
|---|---|---|
| • Bacteria<br>• Viruses<br>• Protozoa<br>• Helminths | | • Turbidity<br>• Chemicals<br>• Taste, smell, colour |

### How Does it Work?

Boiling is considered the world's oldest, most common, and one of the most effective methods for disinfecting water. Pathogens are killed when the temperature reaches 100 degrees Celsius. CAWST recommends boiling water for 1 minute and adding 1 minute per 1000 metres of elevation.

### Effectiveness

- Quality: Very effective in killing all pathogens
- Quantity: Depends on the size of pot being used
- Local water: Can be used with any water source

### Appropriateness

- Local availability: Different fuel sources may be locally available (e.g. wood, charcoal, biomass, biogas, kerosene, propane, solar panels, electricity)
- Time: Need to heat water until it boils for 1 minute
- Operation and maintenance: Water is heated over a fire or stove until it boils; potential for burn injuries; cause of respiratory infections associated with poor indoor air quality
- Lifespan: Pots and stove may need to be replaced

### Acceptability

- Taste, smell, colour: Some people believe that boiled water tastes flat; does not change smell or colour
- Ease of use: It may take a lot of time to collect enough fuel

### Cost

- Initial purchase cost: Free or low cost since households can use existing pots
- Operating cost: On-going cost for fuel; cost varies depending on the type of fuel

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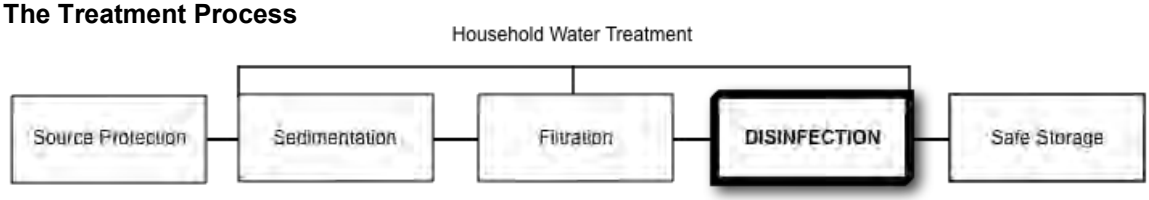
# Household Water Treatment and Safe Storage

## Fact Sheet: Chlorine

### The Treatment Process




### Effectiveness

| Very Effective For: | Somewhat Effective For: | Not Effective For: |
|---|---|---|
| • Bacteria<br>• Viruses | • Some Protozoa<br>• Helminths | • *Cryptosporidium parvum*<br>• Toxoplasma oocysts<br>• Turbidity<br>• Chemicals<br>• Taste, smell, colour |

### How Does it Work?

Chlorine is a popular chemical used to disinfect drinking water. Sodium hypochlorite and NaDCC, also known as sodium dichloroisocyanurate or sodium troclosene, are different types of chlorine that are available. When added to water, NaDCC releases hydrochloric acid which reacts with microorganisms and kills them. There are several different brands of chlorine products that have been manufactured specifically for household water treatment.

### Effectiveness

- Quality: Very effective in removing bacteria; not effective for certain types of protozoa; protects water against recontamination
- Quantity: Depends on the size of container being used
- Local water: Should only be used with clear water; may need to sediment and filter water before using chlorine


### Appropriateness

- Local availability: Available for purchase in most places
- Time: Need to wait at least 30 minutes after adding chlorine
- Operation and maintenance: Follow manufacturer's instructions for specific products; store chlorine away from children
- Lifespan: Up to 5 years for tablets; liquid chlorine products should used within 3 months of being manufactured

### Acceptability

- Taste, smell and colour: Some people do not like the taste or smell of chlorinated water; does not change the colour
- Ease of use: Follow manufacturer's instructions for specific products

### Cost

- Initial purchase cost: None
- Operating cost: On-going cost to buy chlorine products; US$3-11/year depending on product

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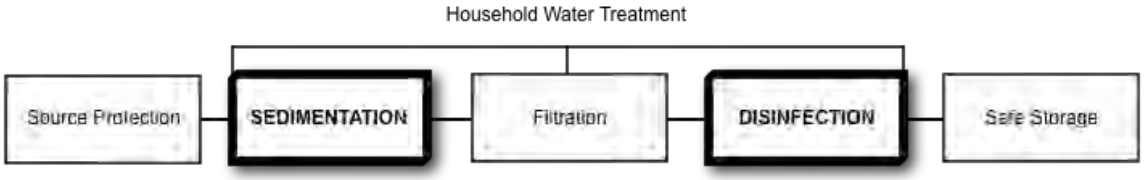
# Household Water Treatment and Safe Storage

## Fact Sheet: PUR

### The Treatment Process




### Effectiveness

| Very Effective For: | Somewhat Effective For: | Not Effective For: |
|---|---|---|
| • Bacteria<br>• Viruses<br>• Some protozoa<br>• Helminths<br>• Turbidity | • Some heavy metals (e.g. arsenic, chromium, lead)<br>• Taste, smell, colour | • *Cryptosporidium parvum*<br>• Toxoplasma oocysts<br>• Dissolved chemicals |

### How Does it Work?

PUR is a powder which contains both coagulants and a timed release form of chlorine. It is sold in single packets designed to treat 10 L of water. The product uses coagulation and disinfection to remove turbidity and pathogens from water at the same time. When added to water, the coagulant first helps the suspended particles join together and form larger clumps, making it easier for them to settle to the bottom of the container. Then chlorine is released over time to kill the remaining pathogens. The treated water contains residual free chlorine to protect against recontamination.


### Effectiveness

- Quality: Very effective in removing almost all pathogens, some heavy metals and organic chemicals; not effective for *cryptosporidium* and *toxoplasma.* Protects water against recontamination.
- Quantity: 1 packet for 10 L of water
- Local water: Can be used with turbid to clear water

### Appropriateness

- Local availability: Cannot be made locally. Must be shipped, distributed and sold locally
- Time: At least 30 minutes for coagulation and disinfection
- Operation and maintenance: Follow manufacturers instructions for use; Packets should be protected from extremes of temperature and humidity
- Lifespan: 3 years from manufactured date

### Acceptability

- Taste, smell, colour: Some people do not like the taste or smell of chlorinated water
- Ease of use: Follow manufacturer's instructions

### Cost

- Initial purchase cost: None
- Operating cost: At 20 litres/household/day totals US$73/year

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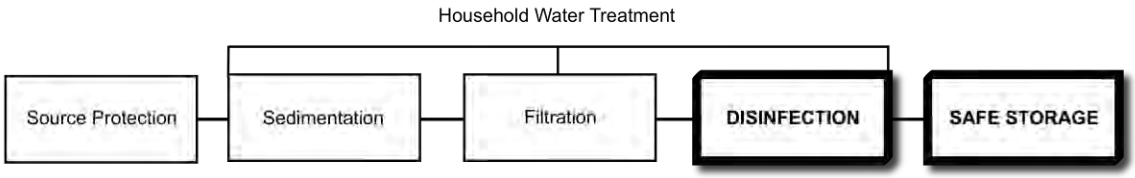
# Household Water Treatment and Safe Storage

## Fact Sheet: Solar Disinfection (SODIS)

### The Treatment Process




### Effectivess

| Very Effective For: | Somewhat Effective For: | Not Effective For: |
|---|---|---|
| • Bacteria<br>• Viruses<br>• Some protozoa<br>• Helminths | | • Turbidity<br>• Chemicals<br>• Taste, smell, colour |

---

### How Does it Work?

SODIS uses the rays from the sun to kill pathogens in the water. It can be used to disinfect small quantities of water with low turbidity. Households fill transparent, non-coloured plastic bottles made from polyethylene terephthalate (PET) and place them in direct sunlight. Water cannot be used directly from the bottle to avoid recontamination.

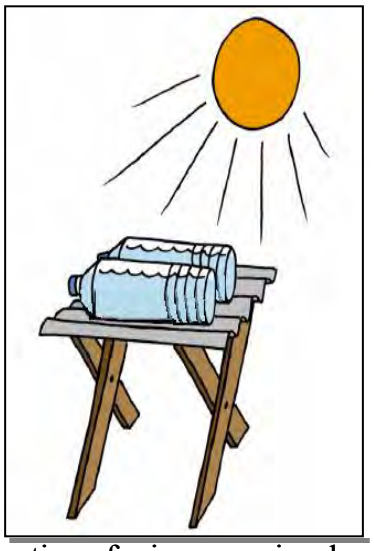
SOlar Water DISinfection

### Effectiveness

- Quality: Very effective in removing pathogens; provides safe storage to prevent recontamination
- Quantity: 1-2 litres/bottle
- Local water: Should only be used with clear water; may need to sediment and filter water before using SODIS

SODIS uses locally available resources

- developing countries have plenty of sunlight
- sunlight is abundant and free of charge
- plastic bottles are often a waste produc



Inactivation of microorganism by UV-A- radiation and thermal treatment

### Appropriateness

- Local availability: Plastic bottles are available in most places
- Time: 6 hours on a sunny, up to 2 days when cloudy; cannot use when raining
- Operation and maintenance: Simple
- Lifespan: Bottles need to be replaced if they have a lot of scratches

### Acceptability

- Taste, smell, colour: People do not like to drink warm water; does not change smell or colour
- Ease of use: Easy

### Cost

- Initial purchase cost: Free or low cost since households can use recycled plastic bottles
- Operating cost: None

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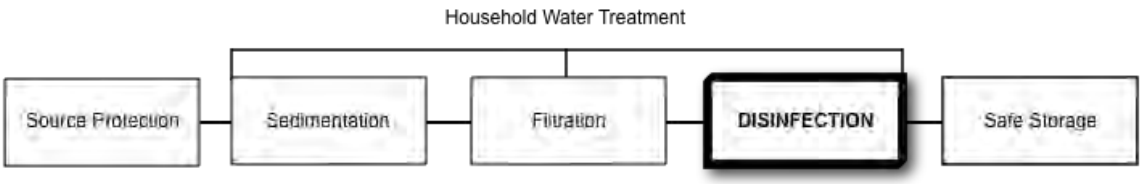
# Household Water Treatment and Safe Storage

## Fact Sheet: Ultraviolet (UV) Disinfection

### The Treatment Process




### Effectiveness

| Very Effective For: | Somewhat Effective For: | Not Effective For: |
|---|---|---|
| • Bacteria<br>• Viruses<br>• Protozoa<br>• Helminths | | • Turbidity<br>• Chemicals<br>• Taste, smell, colour |

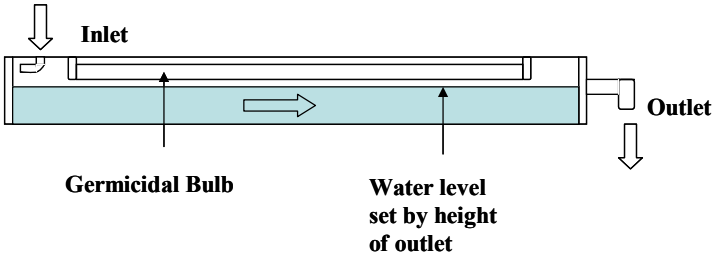
---

### How Does it Work?

The household design uses a UV bulb suspended inside a larger tube or covered trough. The water enters the tube at one end, flows through the tube under the UV bulb, and through the outlet at the other end of the tube. The UV bulb emits UV-C light, which kills microorganisms by damaging their genetic material (DNA). This makes the pathogens unable to reproduce.

### Effectiveness

- Quality: Very effective in removing all types of pathogens; not effective for turbidity, chemicals, taste, smell or colour
- Quantity: Approximately 2000 L/day; Flow and volume depends on system design
- Local water: Should only be used with clear water; may need to sediment and filter water before use




### Appropriateness

- Local availability: Can be manufactured from local materials provided adequate knowledge and UV bulbs are available
- Time: 5 L/min
- Operation and maintenance: Safety precautions necessary; clean bulb as necessary
- Lifespan: System: 10+ years; UV Bulb: every 12 months

### Acceptability

- Taste, smell, colour: No change from source water
- Ease of use: Once equipment is installed, plug it in and make sure the water flows though the system at the prescribed rate

### Cost

- Initial purchase cost: US$60-150
- Operating cost: Depends on cost of electricity; Yearly bulb replacement US$10-25/year

# Household Water Treatment and Safe Storage

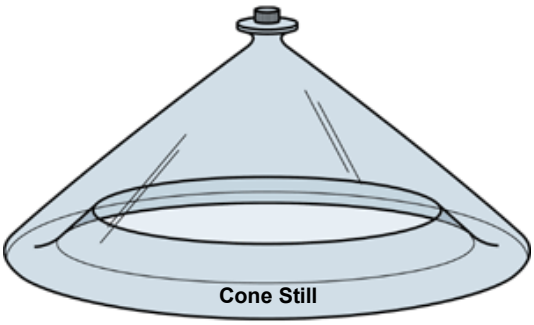
## Fact Sheet: Solar Distillation

### Effectiveness

| Very Effective For: | Somewhat Effective For: | Not Effective For: |
|---|---|---|
| • Bacteria<br>• Viruses<br>• Protozoa<br>• Helminths<br>• Turbidity<br>• Chemicals<br>• Salt<br>• Taste, odour, colour | | |

### How Does it Work?

Solar distillation is an ancient method of using the sun's energy to treat drinking water. Distillation is the process of evaporating water into vapour, and then capturing and cooling the vapour so it condenses back into a liquid. Any contaminants in the water are left behind when the water is evaporated. There are many different designs for solar distillation units (also known as stills).




### Effectiveness

- Quality: Very effective in removing pathogens
- Quantity: Depends on the size of still
- Local water: Can be used with any water source

### Appropriateness

- Local availability: Can be purchased from a manufacturer or built with local materials
- Time: 6 hours on a sunny day; cannot use when raining
- Operation and maintenance: Simple; some stills are self-cleaning
- Lifespan: 5-10 years depending on the still and the construction quality

### Acceptability

- Taste, smell, colour: Some people believe that distilled water tastes flat
- Ease of use: Easy

### Cost

- Initial purchase cost: US$10-400/$m^2$ (box still), US$32 (cone still)
- Operating cost: None

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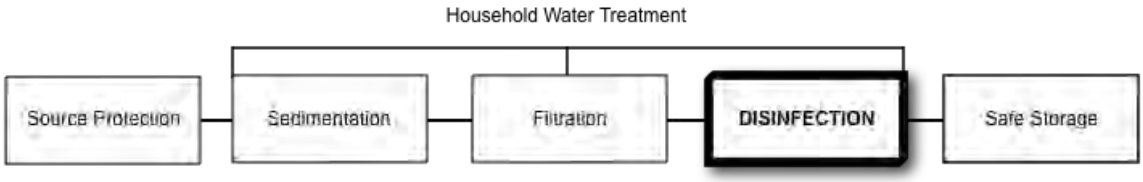
# Household Water Treatment and Safe Storage

## Fact Sheet: Solar Pasteurization

### The Treatment Process




### Effectiveness

| Very Effective For: | Somewhat Effective For: | Not Effective For: |
|---|---|---|
| • Bacteria<br>• Viruses<br>• Protozoa<br>• Helminths | | • Turbidity<br>• Chemicals<br>• Taste, smell, colour |

### How Does it Work?

Pasteurization disinfects water by heat or radiation. Typical water pasteurization achieves the same effect as boiling, but at a lower temperature (usually 65-75°C), over a longer period of time. A simple method of pasteurizing water is to put blackened containers of water in a solar cooker.

### Effectiveness

- Quality: Very effective for all pathogen types; not effective for turbidity, chemicals, taste, smell or color
- Quantity: Depends on size of container being used
- Local water: The less turbid the better

### Appropriateness

- Local availability: Can be constructed with local materials
- Time: 1-4 hours or more to reach optimal temperatures, weather dependant
- Operation and maintenance: Users need to manage a rotation system to ensure availability of treated water; system should be cleaned regularly
- Lifespan: 5+ years

### Acceptability

- Taste, smell, colour: No change from source water
- Ease of use: Solar pasteurization boxes can also be used as solar cookers for cooking meals; Boiling is sometime preferred because it provides a way to see when the water has reached a high enough temperature without needing a thermometer

### Cost

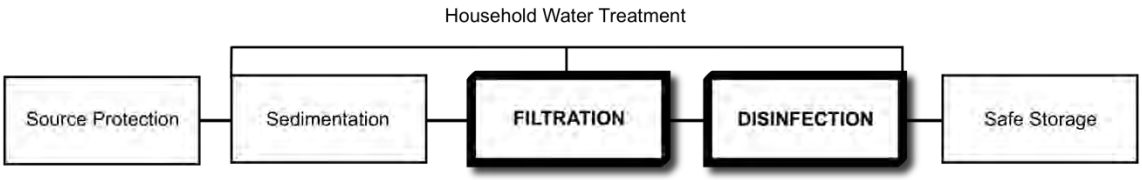
- Initial purchase cost: US$20-25
- Operating cost: US$0/year

Centre for Affordable Water and Sanitation Technology

# Household Water Treatment and Safe Storage

## Fact Sheet: Chulli Pasteurization

### The Treatment Process




### Effectiveness

| Very Effective For: | Somewhat Effective For: | Not Effective For: |
|---|---|---|
| • Bacteria<br>• Viruses<br>• Protozoa<br>• Helminths | • Iron<br>• Taste, smell, colour | • Chemicals |

### How Does it Work?

The chulli stove system combines two water treatment processes: filtration and pasteurization (a form of disinfection). Water flows first through a rapid sand filter and then into aluminium tubing coiled inside a traditional clay stove (chulli). From the stove, the water flows through heat resistant plastic tubing to an outlet tap, where it is collected in a container. The water is pasteurized during daily cooking. By regulating the flow, the water temperature can be maintained at 70°C; sufficient to kill pathogens as it flows through the coil.

### Effectiveness

- Quality: Very effective for removing all types of pathogens; somewhat effective for iron, taste, smell and colour; not effective for chemicals
- Quantity: 60-90 L per day at a flow rate of 0.5 L/min; dependant on cooking time
- Local water: Turbid to clear water

### Appropriateness

- Local availability: This device may be built with off-the-shelf parts available throughout most countries. Anyone can be trained locally to build the chulli stove pasteurizer.
- Time: With a flow rate of 0.5 L/min so 1 hour of cooking would produce approximately 30 L of treated water
- Operation and maintenance: Repairs to leaks and tubing as required; Standard maintenance of the chulli stove
- Lifespan: Not yet determined

### Acceptability

- Taste, smell, colour: Some improvements, heated water to some tastes flat.
- Ease of use: System requires no additional inputs for operation after installation; may require maintenance/repair

### Cost

- Initial purchase cost: US$6-7.50
- Operating cost: None

## Household Water-Treatment Systems and their Effectiveness

Source: Brikké, François and Maarten Bredero. *Linking technology choice with operation and maintenance in the context of community water supply and sanitation: a reference document for planners and project staff.* World Health Organization and IRC Water and Sanitation Centre (Geneva: 2003). pp. 72-74.

| | Effectiveness over factors that affect water quality | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Treatment system** | **Bacteria, amoebas** | **Guinea-worm** | **Cercaria** | **Fe, Mn** | **Fluoride** | **Arsenic** | **Salts** | **Odour, taste** | **Organic matter** | **Turbidity** |
| **Straining through fine cloth** Consists in pouring raw water through a piece of fine, clean, cotton cloth to remove some of the suspended solids. | —[b] | ☺☺☺ | — | — | — | — | — | — | ☺ | ☺ |
| **Aeration** Oxidizes iron (Fe) and manganese (Mn). Good aeration of the water is also important for slow, sand filtration to be effective, especially if there is not enough oxygen in the surface water. Water can easily be aerated by shaking it in a vessel, or by allowing it to trickle through perforated trays containing small stones. | — | — | — | ☺☺☺ | — | — | — | ☺☺ | ☺ | — |
| **Storage/pre-settlement** Storing water for only one day can eliminate some bacteria, but it should be stored for 48 hours to eliminate cercaria (snail larvae). The longer the water is stored, the more the suspended solids and pathogens will settle to the bottom of the container. The top water can then be used after sedimentation. | ☺ | — | ☺☺☺ | ☺ | — | — | — | ☺ | ☺ | ☺☺ |
| **Coagulation, flocculation and settlement** In coagulation, a liquid coagulant, such as aluminium sulfate, is added to the water to attract suspended particles. The water is then gently stirred to allow the particles to come together and form larger particles (flocculation), which can then be removed by sedimentation, settlement or filtration. The amount of coagulant needed will depend on the nature of the contaminating chemical compounds and solids. | ☺ | — | ☺ | ☺ | ☺☺☺ | ☺☺☺ | — | ☺ | ☺ | ☺☺ |
| **Slow sand filtration** Water passes slowly downwards through a bed of fine sand at a steady rate. The water should not be too turbid, otherwise the filter will get clogged. Pathogens are naturally removed in the top layer where a biological film builds up. A potential problem is that some households do not use this technology effectively and the water can remain contaminated. | ☺☺☺ | ☺☺☺ | ☺☺☺ | ☺☺ | — | ☺☺ | — | ☺☺ | ☺ | ☺☺☺ |

[a] Adapted from: Skinner & Shaw (1998).

[b] The treatments were categorized as being: of no effect, or of unknown effectiveness (—); of little effect (☺); moderately effective (☺☺); highly effective (☺☺☺).

## TABLE 6.1 CONTINUED

| Treatment system | Effectiveness over factors that affect water quality | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Bacteria, amoebas | Guinea-worm | Cercaria | Fe, Mn | Fluoride | Arsenic | Salts | Odour, taste | Organic matter | Turbidity |
| **Rapid sand filtration** The sand used is coarser than in slow sand filtration and the flow rate is higher. The method is used to remove suspended solids and is effective after the water has been cleared with coagulation/flocculation. There is no build-up of biological film, hence the water will still need to be disinfected. It is easier to remove trapped debris from upflow sand filters, compared to filters in which the water flows downwards. | ☺ | ☺☺ | ☺ | ☺☺ | — | — | — | ☺ | ☺ | ☺☺ |
| **Charcoal filter** Granular charcoal (or granulated activated carbon) can be used in filtration and is effective in improving the taste, odour and colour of the water. However, it should be replaced regularly, because bacteria can breed in it. | — | ☺☺ | ☺☺ | ☺ | — | — | — | ☺☺☺ | — | ☺ |
| **Ceramic filter** The filter is a porous, unglazed ceramic cylinder and impurities are deposited on its surface. Filters with very small pores can remove most pathogens. Open, porous ceramic jars can also be used. The ceramic filter method can only be used with fairly clear water. | ☺☺☺ | ☺☺☺ | ☺☺☺ | — | — | — | — | ☺☺ | ☺☺ | ☺☺☺ |
| **Solar disinfection** Ultraviolet radiation from the sun will destroy most pathogens, and increasing the temperature of the water enhances the effectiveness of the radiation. In tropical areas, most pathogens can be killed by exposing the contaminated water to sun for five hours, centred around midday. An easy way to do this, is to expose (half-blackened) clear glass/plastic bottles of water to the sun. Shaking the bottle before irradiation increases the effectiveness of the treatment. The water must be clear for this treatment to be effective. | ☺☺☺ | ☺☺ | ☺☺ | — | — | — | — | — | — | — |

## TABLE 6.1 CONTINUED

| Treatment system | Effectiveness over factors that affect water quality | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Bacteria, amoebas | Guinea-worm | Cercaria | Fe, Mn | Fluoride | Arsenic | Salts | Odour, taste | Organic matter | Turbidity |
| **Chemical disinfection** Chlorination is the most widely used method of disinfecting drinking-water. Liquids (such as bleach), powders (such as bleaching powder), and purpose-made tablets can be used. Iodine can also be used as a chemical disinfectant. Deciding on the right amount of chlorine to use can be difficult, because the effectiveness of chlorination depends on the quality of the untreated water, which may vary according to the season. | ☺☺☺ | — | ☺☺☺ | — | — | — | — | ☺ | ☺☺☺ | — |
| **Boiling** Bringing the water to a rolling boil will kill most pathogens, and many are killed at lower temperatures (e.g. 70 ºC). This approach can be expensive, however, because fuel/charcoal is needed to boil the water. | ☺☺☺ | ☺☺☺ | ☺☺☺ | — | — | — | — | ☺ | ☺ | — |
| **Desalination/evaporation** Desalination by distillation produces water without chemical salts and the method can be used at household level. The method can be expensive because of the capital investment needed and because fuel/charcoal is used to heat the water. The volume of water produced is also low. | ☺☺☺ | ☺☺☺ | ☺☺☺ | ☺☺☺ | ☺☺☺ | ☺☺☺ | ☺☺☺ | ☺☺☺ | ☺☺☺ | ☺☺☺ |