

Water and Sanitation: Keys to Staying Healthy

Many of the problems that make us sick can be easily prevented. Some ways of preventing illness take extra time, effort, and money in the beginning, but they save time and money in the long run by avoiding illnesses.

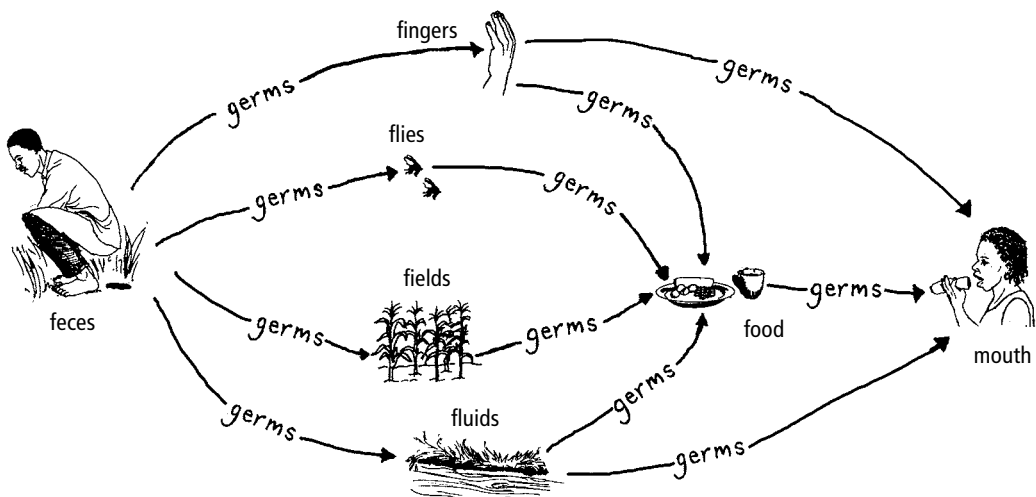
This chapter explains how to prevent diarrhea and other sicknesses caused by germs in human and animal waste (feces). Most belly and gut problems can be avoided by washing hands, using clean methods of preparing and storing food, using toilets, and drinking water that is safe to drink.

To learn how to prevent:

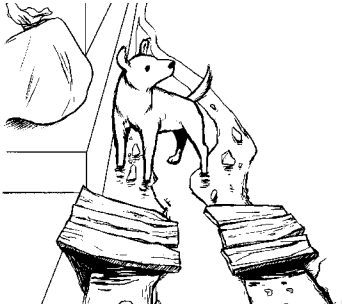
- malnutrition, diabetes, heart disease, and other problems caused by poor nutrition, see the Good Food Makes Good Health chapter.
- pneumonia, tuberculosis, and other breathing problems, see the Problems with Breathing and Coughing chapter (in development).
- health problems caused by garbage and other solid waste, see the Garbage, Medical Waste, and Pollution chapter (in development).
- malaria, dengue, and other diseases spread by mosquitoes, see the Some Serious Infectious Illnesses chapter (in development).

How diarrhea disease is spread

Germs and worms cause disease by traveling these paths from human or animal waste.



Germs also spread from one person to another. Since family members are in close contact with each other, germs and illness can spread easily to the whole family.



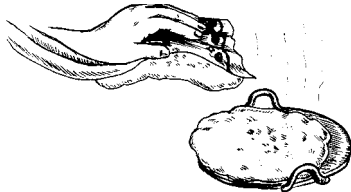
1. Heavy rains cause an open sewer to flood. A dog walks through the streets and gets feces on its feet.



2. The dog goes into a house and a child plays with it. The child gets feces on his hands.



3. Later the child cries and his mother comforts him. He holds onto her skirt making it dirty.



4. The busy mother prepares dinner. She uses her soiled skirt, to keep from burning her hands.



5. The family eats the food. Soon everyone has diarrhea.

What could have prevented the family's illness?

If any of these was true, the spread of illness could have been prevented:

- If the community did not have open sewers
- If the dog had not been allowed to come inside the house
- If the family helped the child wash his hands
- If the child had not wiped his hands on his mother's skirt

To the health worker

Promoting cleanliness and improving water are some of the best ways health workers can make their communities healthier. But when too many things need doing or changing, it can be overwhelming. Encourage people in your community to do the things they are already doing that keep them healthy, and find one or two important things to work on. To be successful and long-lasting, improvements to people's cleanliness and water should:

- **be simple and affordable** — they should fit local people's needs and abilities, and be easy to maintain.
- **be culturally acceptable** — they should fit local customs, beliefs, and desires.
- **work for everyone** — they should address the health needs of children, people with disabilities, women and men, and the elderly.

Washing Hands

One of the best ways to avoid getting sick from germs and worms is to wash hands with soap and water. Even if your hands look clean, germs and worm eggs can be on them. These can make you sick if they get into your mouth or on your food.

1. Run water over your hands to wet them.



2. Use soap and rub your hands together. The rubbing is what gets the germs off. Be sure to rub in between the fingers and around the fingernails too.



3. Run clean water over your hands to rinse them well.



4. Dry your hands with a clean cloth.



It is best to use soap to remove dirt and germs. If no soap is available, you can use sand or ashes.

Always wash your hands:

- after passing stool or cleaning a baby's bottom.
- before preparing food or eating.
- after touching animals.
- after sneezing or coughing.
- if you are sick.



Your health is in your hands. Wash often.

The tippy-tap

This simple hand-washing device allows you to wash your hands using very little water. It also allows you to rub both hands together while water runs over them, which removes germs. Put it wherever people need to wash their hands, such as where food is prepared, at the toilet, or at the market.

How to make a tippy-tap

To make this tippy-tap you need 1) a plastic bottle with a screw-on cap, like a soda bottle, and 2) the tube from a ball point pen, or some other small, stiff, hollow tube.

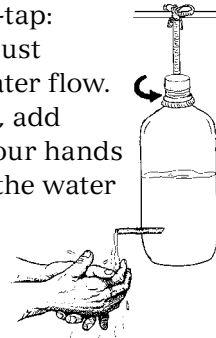
1. Clean the bottle.
2. Using a heated piece of wire, make a small hole in the lower part of the bottle.
3. Remove and clean the inside tube from a ball-point pen. Cut it off at an angle, and push it through the hole in the bottle. The tube should fit tightly.



4. Fill the bottle with water and replace the cap. When the cap is tight, no water should flow through the tube. When the cap is loose, water should flow out in a steady stream. When you are sure it works, put it where people can use it for hand-washing. Keep soap nearby or tie a bar of soap to the bottle.



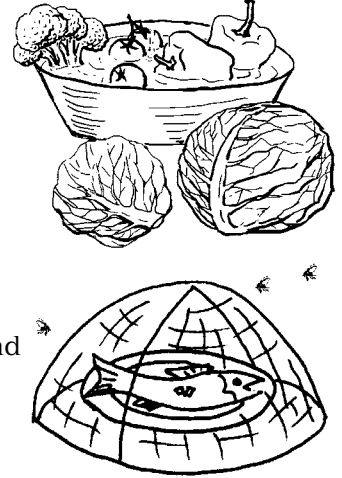
5. To use the tippy-tap: Loosen the cap just enough to let water flow. Wet your hands, add soap, and rub your hands together under the water until they are clean. Close the cap when you are done.



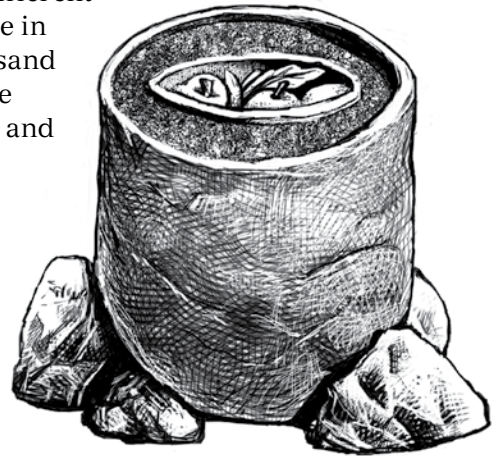
Preparing and Storing Food

Sickness can be spread by germs and worms that enter our bodies through the food we eat. To avoid getting sick from food:

- wash your hands before touching food or cooking.
- wash or peel fruits and vegetables, or cook them well before eating. This kills germs from the soil where they were grown, and any germs that got on them during transportation.
- cook meat products well before eating. Wash cooking surfaces after preparing meat so germs from uncooked meat, seafood, and eggs do not spread to food that is already cooked or to food you eat raw.
- eat food right away, or keep prepared food covered and safe from flies and dirt until it is ready to be eaten.
- reheat street food, or any food that has been left out, until it is hot. This will kill any germs before eating.
- store food in a way that keeps it safe from insects and rodents which can spread germs.
- keep the cooking area clean. Wash dishes, cutting surfaces, and utensils after each use and allow them to dry well.
- feed left-over food scraps to animals, or put them in a compost pile so they do not attract insects.
- keep food cold, which prevents it from spoiling as quickly.



Make a cooler using 2 unglazed clay pots of different sizes. Place 1 inside the other and fill the space in between the pots tightly with sand. Keep the sand wet by pouring water on it twice a day. Put the food you want to keep cool in the smaller pot, and keep the pots covered.



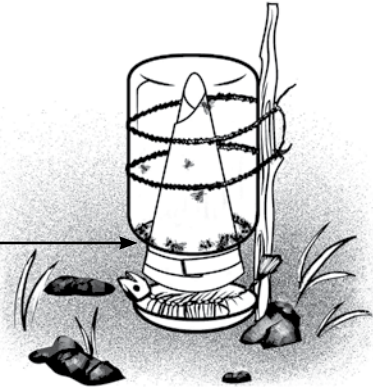
Keep flies off food



Flies spread germs and cause illness by landing on human and animal feces and then landing on the food we eat. Cover food and make fly traps to prevent flies from spreading germs.

How to make a fly trap

1. Tape or glue paper to make an open cone, then fit the cone inside a jar or bottle.
2. Seal around the opening of the bottle so there is no space between the cone and the bottle.
3. Hang the bottle from a string or attach it to a stick in the ground.
4. Put fruit, fish, or some other bait just under the trap. Flies will land on the food and then fly through the cone and into the bottle.
5. To empty the trap, turn it mouth up, remove the cone, fill with water to make sure the flies are dead, and then dump it out.



Put the fly trap near toilets and places where food is prepared to reduce flies.

Toilets for Health (Sanitation)

Cleanliness in the community is just as important as cleanliness for individuals and families. Sanitation means public cleanliness — using clean and safe toilets, keeping water sources clean, and disposing of garbage safely (see Garbage, Medical Waste, and Pollution - in development). Poor sanitation causes a great deal of unnecessary sickness and death.

Any community effort to improve sanitation must help people overcome the challenges they face in their daily lives. Poverty and lack of access to enough water often make it difficult for people to improve sanitation.

Experts may offer technical solutions, such as flush toilets or complex sewage treatment systems. These kinds of technical solutions may work in some places, but that does not mean they will solve the problems of your community or that people will use them. A health worker who knows and listens to the needs of the people will have important information the expert does not have. Experts and community members should work together to solve problems.



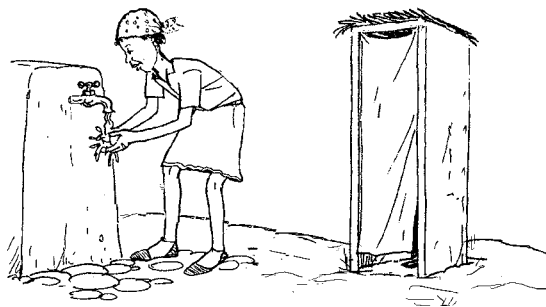
Include women in the discussions about the community's needs and possible solutions. Women often care for children and the home, so they may recognize sanitation and water issues that the men do not see. When everyone is involved in making decisions and works together to improve sanitation, everyone benefits.

Use toilets to manage human waste

When human waste (feces) is not managed well, it pollutes water, food, and soil with germs, and leads to diarrhea and other serious health problems. Using toilets prevents germs from getting into the environment, and protects the health of the whole community.

Health is not the only reason to build and use toilets. People also want:

- **Privacy:** A toilet can be as simple as a deep hole in the ground. But the need for privacy makes it important for a toilet to have a good shelter with a door or curtain. Shelters can be made from local materials, or they can be made from concrete.
- **Safety:** For a toilet to be safe it must be well built and in a safe place. No one will use a toilet if they are worried about it collapsing. And if the toilet is far from the home, or in an isolated place, women may not feel safe using it.
- **Comfort:** People will more likely use a toilet with a comfortable place to sit or squat, and a shelter large enough to stand in. They will also be more likely to use a toilet that is nearby the house and is sheltered from wind, rain, or snow.
- **Cleanliness:** If a toilet is dirty and smelly, no one will want to use it. A toilet also must be clean to prevent the spread of germs. Sharing the task of cleaning will help make sure that toilets are properly used and cared for.
- **Respect:** A well-kept toilet brings status and respect to its owner. This can be what motivates people to spend the money and effort to build one.

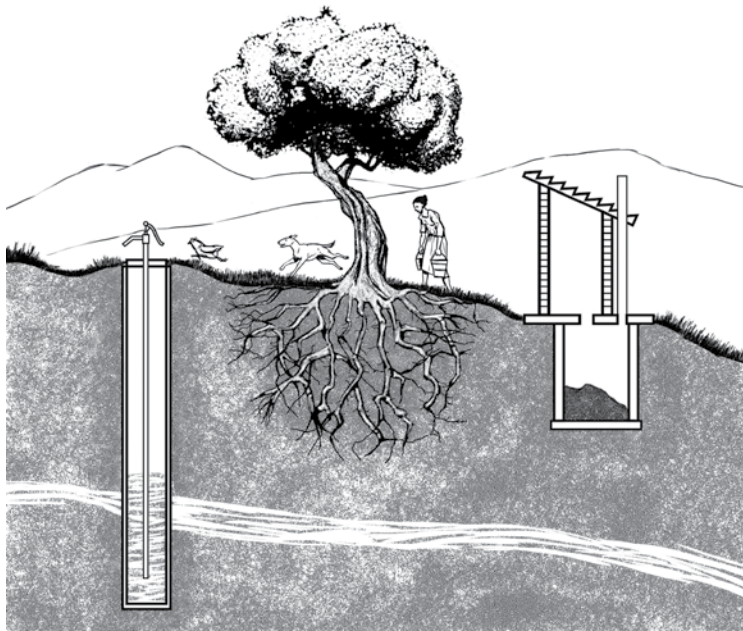


Where to build a toilet

When deciding where to build a toilet, make sure it will not pollute any water sources such as rivers, wells, or springs. A toilet should be at least 20 meters from all water sources.

Also be sure the toilet will not pollute the groundwater. Groundwater flows at different depths underground in different places. The risk of groundwater pollution depends on the type of soil, the amount of rain or moisture in the area, and the depth of the groundwater. Keep in mind that water levels are much higher in the rainy season than in the dry season. But some general rules include:

- The bottom of the pit should be at least 2½ meters above the groundwater.
- If you dig a pit for a toilet and the soil is very wet, or if the pit fills with water, this is a bad place to put a toilet. Germs from the human waste will contaminate the groundwater.
- Do not build pit toilets on ground that gets flooded.
- When there is a risk of groundwater pollution from pit toilets, consider building an above-ground toilet. If there is no choice but to build a toilet in a place where there is a risk of groundwater pollution, place the toilet downhill from nearby wells so the germs will flow away from the wells.



Groundwater is water that has soaked into the earth and flows underground. When building a toilet, make sure the pit is not so deep that it will pollute the groundwater.

Types of toilets

There are many kinds of toilets, and no one kind is right for every community or household. When deciding what kind of toilet to build, think about the needs of those who will be using it and the kind of space you have for it. Also think about whether you and your family will want to use and maintain a composting toilet; if not, then the pit toilet may be best for you.

There is no perfect toilet. Each has its drawbacks. But the 3 types of toilets described in this chapter are good at keeping communities clean and safe, with the least harm to the environment and to people.

These toilets also use no water. That is because most water flush toilets only move the problem (feces and germs) from one place to another. They do not make human waste safe, and they contaminate a lot of water while doing so (see below). But if you use water to clean after passing stool, there are safe toilets you can build, for example, the pour-flush toilet. To learn how to make this toilet, see *A Community Guide to Environmental Health*, chapter 7.

Flush toilets and sewage systems

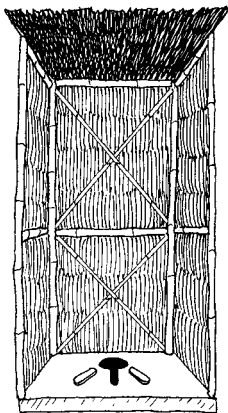
Flush toilets use water to carry waste away through pipes called a sewage system. They improve health, especially in crowded urban areas, and are often the kind of toilets people want.

But flush toilets have a lot of problems that may not be obvious. The sewage must be treated to make the water safe to return into waterways or for reuse. This is costly, so often sewage is dumped into rivers, lakes, or the ocean without being correctly treated. This spreads the germs from the sewage into our water systems or those of our neighbors.



Many of the chemicals used to treat sewage contaminate sources of drinking water and land where people live and farm. Flush toilets also waste fresh water that is needed for drinking and farming. While so many people lack enough water to drink, it is wrong to flush so much water down the drain.

Closed pit toilet



A closed pit toilet has a platform with a hole in it and a lid to cover the hole when it is not in use. The platform can be made of wood, concrete, or logs covered with earth. Concrete platforms keep water out and reduce health problems because they are easy to clean. A closed pit toilet should have a lining or concrete ring beam to prevent the platform or the pit itself from collapsing. See the next page.

Adding a vent pipe to reduce smells and flies (called a “ventilated improved pit,” or VIP, toilet) is an improvement that makes pit toilets much more pleasant to use.

A closed pit toilet that is 2 meters deep will take about 5 years for a family of 5 people to fill.

A problem with pit toilets is that once the pit is full, the toilet can no longer be used. However, you can easily take advantage of the waste in a full — but unlined — pit by moving the structure and planting a tree on the site. Or, with only slightly different daily maintenance, you can turn the waste in a lined pit toilet into useful compost. See page 13.

To make a closed pit toilet

1. Choose a location that will be easy for people to get to and does not risk contaminating water sources.
2. Dig a hole less than 1 meter across and at least 2 meters deep. If the soil is very sandy, you can line the pit with empty oil drums stacked on top of each other or cement bricks, so the pit does not collapse.
3. Line the top of the pit with logs, stones, brick, a concrete ring beam, or other material that will support a platform and prevent the walls of the pit from falling in.
4. Make a platform and a shelter to put over the pit. The platform can be made from concrete or local materials like logs or bamboo and mud. If you make a platform from logs, use wood that does not rot quickly.



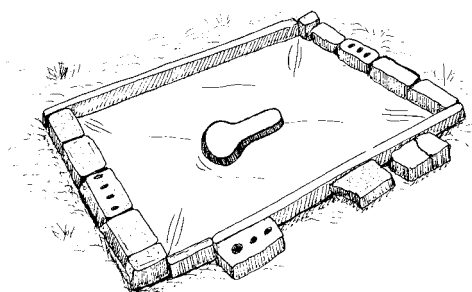
How to make a concrete toilet platform and ring beam

A well-made concrete platform and ring beam will prevent a pit toilet from collapsing. A concrete platform also makes it easier to keep the toilet clean.

One 50 kilo bag of cement is enough to make 2 platforms and 2 ring beams. It is easiest to make them both at the same time. You will also need reinforcing wires, bricks, and boards to form the mold, and a piece of wood cut to the shape of a keyhole to mold the hole. The platform and ring beam shown here are square, but you could make round ones.

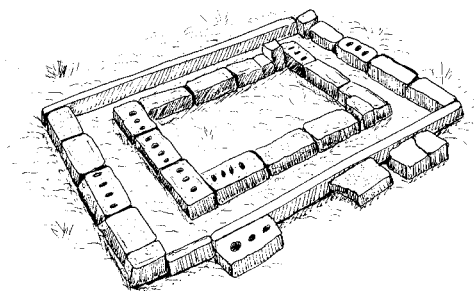
1. Lay down a plastic sheet or used cement bags on flat ground. On top of this make a mold of bricks or boards.

Toilet Platform



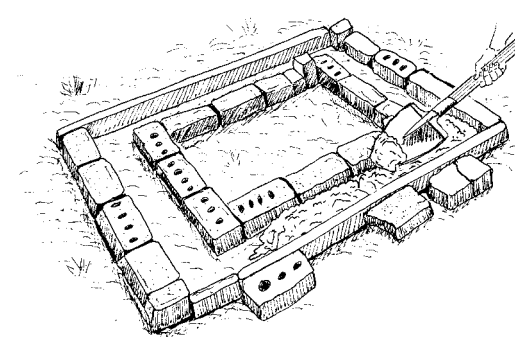
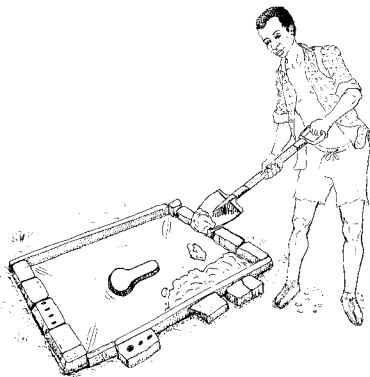
Make the platform about 120 cm long, 90 cm wide, and 6 cm deep. Place a wooden "keyhole" mold, or a few bricks in the center to shape the toilet hole.

Ring Beam



Make the ring beam 130 cm long and 1 m wide on the outside, and 1 m long and 70 cm wide on the inside.

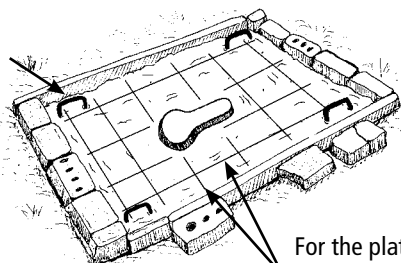
2. Make a concrete mix of 1 part cement, 2 parts gravel, 3 parts sand, and water. Pour the concrete into the mold until it is half-way to the top.



3. Place 3 mm thick reinforcing wires on top of the wet concrete.

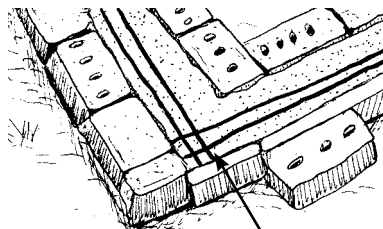
Toilet Platform

Make handles from wire 8 to 10 mm thick and set them in the concrete near the corners.



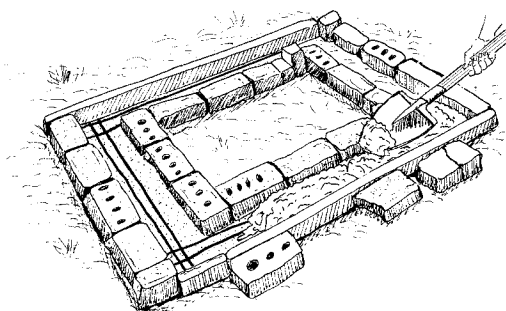
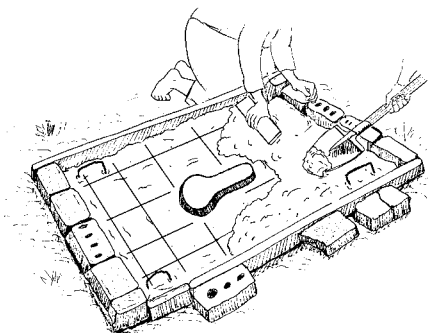
For the platform:
use 4 to 6 wires
in each direction.

Ring Beam

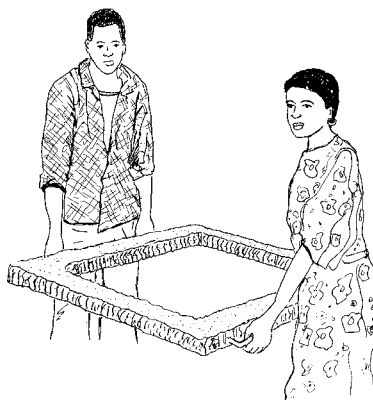


For the ring beam:
lay wire on each
side of ring beam.

4. Pour the rest of the concrete and level it with a block of wood.



5. Remove the keyhole mold from the platform when the concrete begins to harden (after about 3 hours). If you used a brick mold, remove the bricks and form the hole into a keyhole shape.
6. Cover the concrete with wet cement sacks, damp cloth, or a plastic sheet. Wet it several times a day to keep it damp for 7 days. Keeping it damp makes the concrete dry more slowly and become stronger.
7. When the concrete is completely hardened, carry the ring beam to the toilet site. Level the ground, place the ring beam and dig a pit inside of it. Pack soil around the outside of the ring beam to set it in place. Then place the platform over the pit.
8. Make a cover for the hole from concrete or wood. It can have a handle, or can be made to be moved by a person's foot, to avoid getting germs on the hands.



Composting toilets

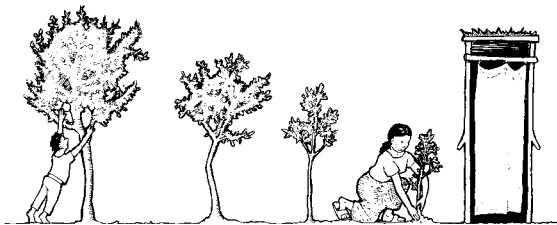
A composting toilet stores human waste until it breaks down and becomes compost. The mix will heat up and over time will kill the harmful germs, including roundworm eggs which are the hardest to kill. Composting toilets may seem like a strange idea at first, but when used properly they are a very safe way to manage human waste and improve soil quality at the same time.

Dig a pit 1 meter deep, and less than 1 meter across. Line the pit and build a platform as you would for any other pit toilet. But make the structure moveable.



To use and maintain a composting toilet

- Before using, put dry leaves or straw in the pit. This will help feces decompose.
- Add a handful of soil mixed with ashes or dry leaves after every use. This reduces smells and helps the waste to break down.
- Do not put plastic, tins, or other garbage in the toilet.
- Sweep and wash the platform often. Be careful not to get much water or cleaning chemicals in the pit.
- When the hole is nearly full, remove the shelter, platform, and ring beam. (It will take about 1 year for a family of 5 to nearly fill a composting toilet that is 1 meter deep.)
- Fill the hole with 15 cm of soil mixed with plant matter. After several weeks, the waste will settle.
- Add more soil and plant matter, water, and plant a tree. Fruit trees grow well and bear safe and abundant fruit.



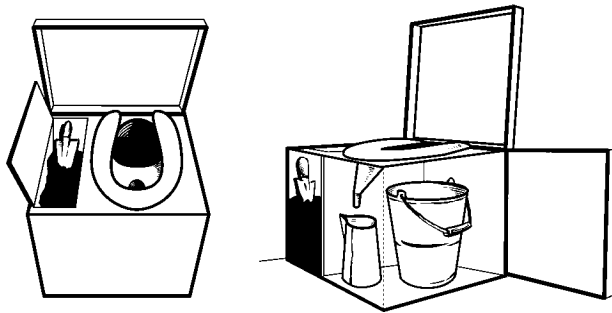
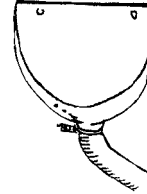
- Alternatively, the compost can also be dug out and used to fertilize other trees or food crops, but only if it is completely broken down. So let it decompose for at least 1 year and only use it if it has become an odorless, crumbly soil.
- Move the shelter, platform, and ring beam to another place, dig a hole, and do it again.

A composting toilet for places with little land

This toilet is useful for places where people live very close together and do not have extra outdoor space for pit toilets. It can even be built inside a home and should not smell much if it is maintained and cleaned regularly.

For this toilet, you must separate urine so feces can dry out and turn into compost more quickly. Separating urine also reduces the smell.

1. Build a wood box that is large enough to fit a 5 gallon bucket inside.
2. Put in a urine diverting toilet bowl. You may be able to buy this, or make one by cutting the bottom and side from a plastic jug, and then attaching it to the front of the hole.
3. Attach one end of a tube to the part of the toilet bowl (or spout of the plastic jug) that diverts the urine. Put the other end of the tube in a jug to collect the urine.
4. Put a 5 gallon bucket under the toilet bowl to collect feces.



To use and maintain this toilet

It is important that everyone who uses the toilet is taught how to use it correctly.

- Before using, put a layer of dry leaves or straw in the bucket. This will help keep the bucket clean.
- Add a handful of soil mixed with ashes or dry leaves to the bucket after every use. This reduces smells and helps break down the feces. Do not put garbage such as plastic or tins in the toilet. Keep liquids, including urine, out of the bucket. If the bucket contents are very wet, add more soil or ash.

- The urine will flow through the tube to be collected in a container. The urine can be mixed with water and used as fertilizer. Use 3 parts water to 1 part urine and add to plants up to 3 times a week. Or pour out urine away from homes.
- When the bucket is filled with feces (about 2 weeks for a family of 5) empty it into a large container with a lid. This is where the waste will be stored. When this container is full, store it for 1 year (in a sunny place, if possible) until the waste has turned into compost. After 1 year, the compost can be added to fields, gardens, or potted plants. A family may need several large containers to store all the waste.
- After each time you empty the bucket, clean it with water mixed with chlorine to kill the germs.
- When the toilet is not in use, close the lid of the box. This will reduce smell.



Composting toilets like these take work to maintain. But when used properly, they are a great way for communities without a lot of space to manage their human waste, and even make a valuable product from it.

Composting toilets for urban areas

A lot of people in a small area means a lot of human waste, and often a lot of sickness caused by germs from human waste.

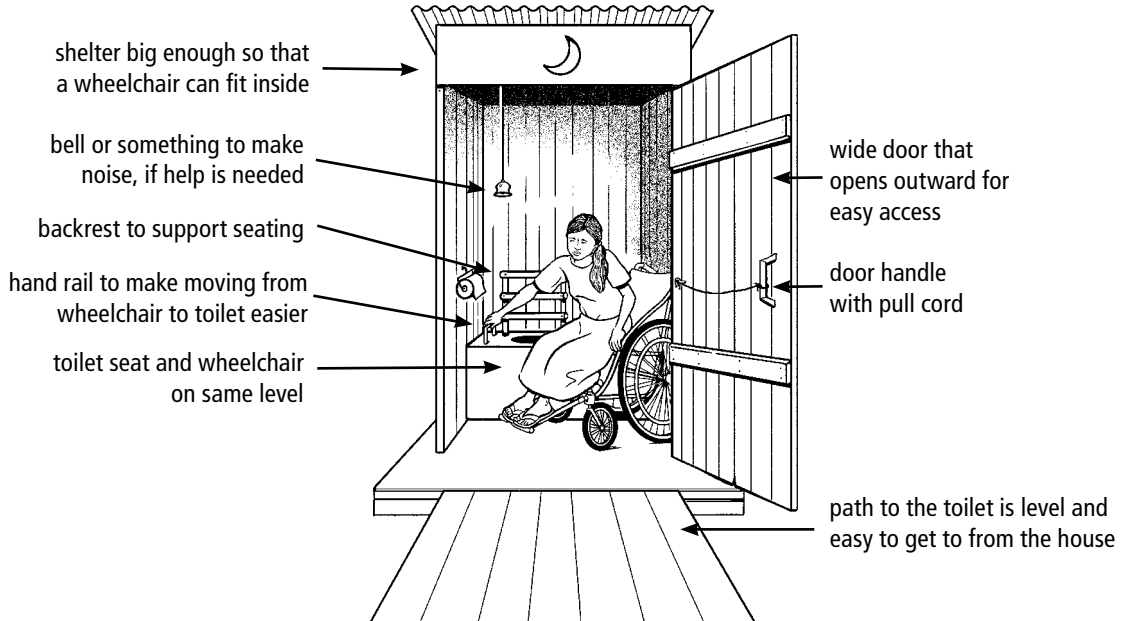
A group in Haiti called Sustainable Organic Integrated Livelihoods (SOIL) works in urban communities to transform wastes into resources. SOIL has developed a program that (for a small fee) rents out toilets like the one above to families, and collects the waste from each home every week. The waste is transported to a site where it is turned into valuable compost which is then sold or used to grow food.



Much of SOIL's work is educating people about the safety of composting toilets. One of the best ways they do this is to show the final product from the toilets. Once people see for themselves that what was once human waste has now become nutrient-rich compost, they soon become excited to transform something that was making them sick into a resource that helps them and their environment.

Toilets should work for everyone in the community

Talk with everyone who will use the toilet to find out what might make it easier for them to use. This picture shows ways to adapt a toilet for a wheelchair rider.



Remember, a person with a disability feels the same need for privacy as anyone else and should get the privacy he or she needs.

Water and Health

Water is essential for life. We need it, as do the animals and plants that we depend on for our survival. In communities that lack adequate water, many health problems arise.

- Without water, people cannot grow enough food to eat, leading to malnutrition and the many health problems that go along with it.
- Infections of the eyes and skin arise when people cannot use water to bathe. Other illness also spreads more quickly when people cannot stay clean.
- Those who collect the water (usually women and children) spend much of their time in the exhausting work of traveling and carrying water. This leaves little time for school, other work at home, or community life.



Water that is safe to drink

In addition to enough water, people also need water that is safe to drink, free of dangerous germs and harmful chemicals. Contaminated water causes:

- hepatitis A, typhoid fever, and other deadly diseases.
- diarrhea, which leads to dehydration and can cause death especially for children.
- infections such as schistosomiasis that can lead to anemia and malnutrition.



Different methods for making water safe are described on the following pages. It is also important for your community to prevent water from being polluted or made scarce in the first place.

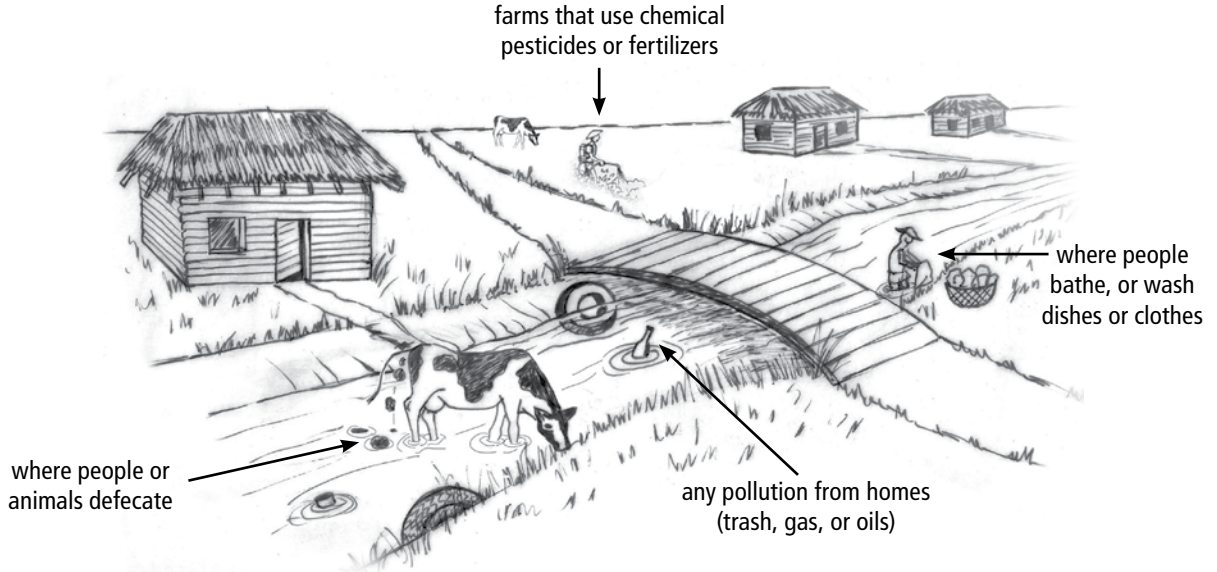
Chemical contamination

In places with industrial activity such as mining or factories, water may be overused and polluted. Poisonous chemicals get in water from agriculture, mining, industry, and dumping trash. This causes skin rashes, cancers, and other serious health problems. **Water that has been contaminated with chemicals is never safe to drink.** Chemical pollution of our water can be solved only when a community puts pressure on governments and enforces rules on industry. For more on protecting water sources, see chapter 6 in *A Community Guide to Environmental Health*.

*With enough safe water, children grow healthier
and have less diarrhea disease.*

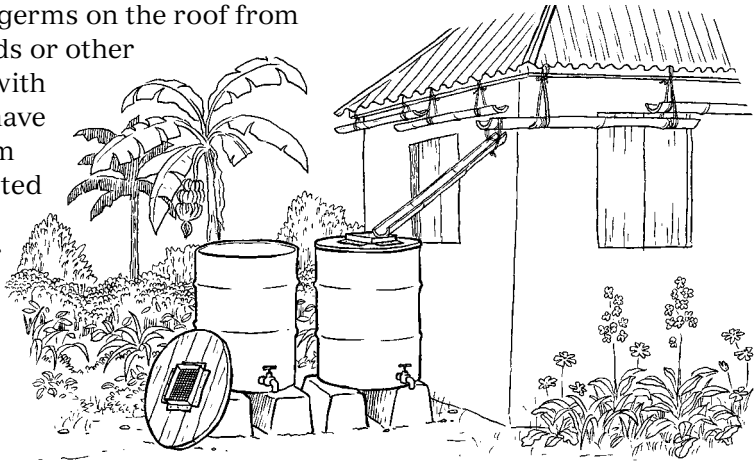
Collecting water

Water should be taken from the cleanest possible place. When collecting water from rivers, collect upriver from:



Collecting rainwater

Rainwater is easy to collect off roofs and into containers placed next to the house. Roofs made of tin or corrugated metal are best to catch water. The water needs to be treated (see the next page) to make it safe to drink because there may be germs on the roof from dirt, or feces from birds or other animals. Roofs made with lead, asbestos, or tar have toxic chemicals in them that make water collected on them unsafe to drink. Make sure your container is clean and was never used to store chemicals, such as oil or pesticides.



Making water safe to drink

Making water safe to drink is one of the best ways to prevent diarrhea and disease. Water from any source will need to be treated if there are germs in it. Just because clear water flows from pipes, tanks, or wells does not mean it is not contaminated or does not need treatment.

When deciding which water treatment method to use, think about how much water you need, what it is contaminated with, and what resources are available. The chart below can help you decide which method to use if you know a particular problem is common in your area. The method you use may change depending on the season or where you are. For example, you may use one method at home and another when you are working in the fields.

Problem	Filter methods		Disinfection methods			
	Cloth Filter	Charcoal Filter	Boiling	Chlorine	Sunlight	Lemon or Lime juice
Viruses (such as hepatitis A and typhoid)			☹	☹	☹	
Bacteria (such as shigella and e. coli)		☹	☹	☹	☹	
Amebas		☹	☹			
Giardia		☹	☹	☹	☹	
Cryptosporidia		☹	☹			
Cholera	☹	☹	☹	☹	☹	☹

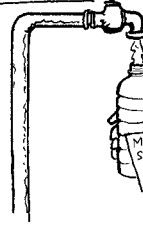
This chart shows which germs and parasites the different methods kill. The water drop means that method is effective at killing that germ.

If there is more than one cause of water-borne disease where you live (which is often the case), the best solution may be to combine two methods: filter and disinfection.

Bottling and selling the right to water

When people do not trust that water from their taps is clean, those who have the money buy bottled or bagged water. If there are germs in tap water, drinking safe bottled water is a way to avoid illness for those who can afford it. But just because water is sold in a bottle does not mean it is safe. In many cases, bottled water is just tap water in a bottle, but sold at a much higher price. Bottling water also causes many health and environmental problems:

MUNICIPAL TAP
WATER



- Making plastic water bottles uses toxic chemicals that harm the health of factory workers.
- Filling bottles often disrupts the natural flow of water, creating water shortages for people who depend on that water source.
- Transporting bottled water from the factory to where it is sold creates air pollution, harming the health of both people and the environment.
- The waste created by used bottles pollutes the environment. If the bottles are burned, we breathe the toxic fumes released into the air, causing health problems.
- Bottled water is often too expensive for most people to afford.
- When more people start drinking bottled water, the public water systems — piped water for everyone — are often neglected. When more people use public water systems, together they can pressure that the system be maintained and improved.

When you consider all the problems, bottled water costs much more than providing safe water for everyone.

Filtering water

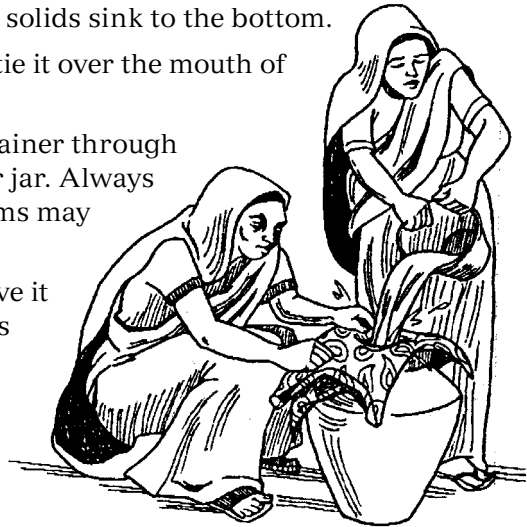
There are many ways to filter water to make it safer. Cloth and charcoal filters are explained below. Other kinds of filters, such as slow sand and ceramic filters, are explained in *A Community Guide to Environmental Health*, chapter 6.

If your water is not clear, first let the water settle in a container for a few hours to allow dirt, solids, and parasites to fall to the bottom of the container. Pour the clear water through the filter. Try not to disturb the dirt that settled to the bottom of the container. Then clean the container.

Cloth filters

In Bangladesh and India, people use a filter made of finely woven cloth to remove cholera germs from drinking water. The cholera germ often attaches to a tiny animal that lives in water, and filtering out these animals also filters out most cholera germs. You can make a cloth filter out of handkerchiefs, linen, or other fabric such as the cloth used to make saris. Old cloth works better because worn fibers make the spaces in the weave smaller and better for filtering.

1. Let water settle in a container so that solids sink to the bottom.
2. Fold the cloth 4 times and stretch or tie it over the mouth of another container or jar.
3. Pour water slowly from the first container through the cloth into the second container or jar. Always use the same side of the cloth, or germs may get into the water.
4. After using the cloth, wash it and leave it in the sun to dry. This kills any germs that may be left in the cloth. In the rainy season, disinfect the cloth with bleach.



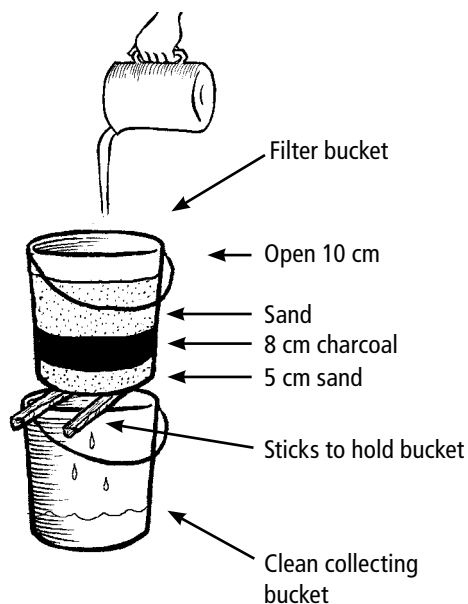
Charcoal filters

To make a charcoal filter, you will need 2 clean metal or plastic buckets, a hammer, 1 or 2 large nails, a bucketful of coarse sand, and $\frac{1}{4}$ bucket of wood charcoal.

1. Make holes in the bottom of one of the buckets. Wash the bucket. This will be the filter bucket.
2. Clean the sand by rinsing it in water and draining until the water that drains is clear.
3. Put a layer of washed sand 5 cm deep into the filter bucket and pour water over it. Water should run out through the holes. If no water runs out, make the holes bigger. If sand runs out, the holes are too large. If this happens, remove the sand, place a thin cloth over the holes, and replace the sand.
4. Crush charcoal into small pieces. Activated charcoal works best, but ordinary wood charcoal will also work. Never use charcoal briquettes, they are poison!
5. Place a layer of crushed charcoal about 8 cm deep on top of the sand. Then fill the bucket with more washed sand until the sand is 10 cm below the top of the bucket.
6. Place 2 sticks on top of the second bucket and set the filter bucket on these sticks. Pour clean water through the filter bucket. When the water comes out clear into the collecting bucket, the filter is ready for use.
7. Allow water to settle before pouring it through the filter.

Because the germs that are filtered out will grow on the charcoal, it is important to remove and clean the charcoal every few weeks if the filter is used daily, or any time the filter has been unused for a few days. To clean the charcoal, take it out of the filter and run water over it until it drains quickly. Let it dry, in bright sun if possible. Then put the charcoal back in the filter.

It is even safer to disinfect water after filtering by boiling, adding chlorine, or using sunlight. (See pages 23 to 24.)



Disinfect Water

Boiling water

Bring water to a rapid boil. Continue boiling for 1 full minute before taking the pot off the fire to cool. In high mountain areas, water must boil for 3 minutes.



Boiling water for 1 minute kills germs and makes water safe for drinking.

Boiling may change the taste of water, especially if boiled over a wood fire. If the taste bothers you, pour the cooled water in a bottle and shake it. Shaking adds air to the water and improves the taste.

Boiling water after food is prepared, but before the fire dies, is one way to use less firewood.




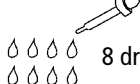




Chlorine

The amount of chlorine needed to disinfect water depends on how contaminated the water is. The more germs there are in the water, the more chlorine is needed to kill them. When the correct amount is used, the water will smell and taste just slightly of chlorine. This tells you it is safe to drink. If it has too much, the smell and taste will be strong and unpleasant.

Chlorine comes in different concentrations. The amounts listed below show how to disinfect water using household bleach with 5% chlorine (sodium hypochlorite). Read the label to see what percent of chlorine is in your bleach. If the bleach is 3% chlorine, you will need to use more. If your bleach label includes instructions for disinfecting water, follow those instructions. Do not use bleach that has soap or perfume added to it.

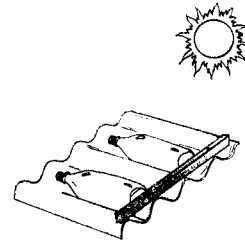
If the water is cloudy or has a lot of solid matter in it, filter the water before adding chlorine.

After adding the right amount of chlorine, stir well and wait at least 30 minutes before drinking. **If the water does not smell or taste just slightly of chlorine** after adding the amount listed, add the same amount again. Stir and wait before drinking.

Water	Add Bleach (5%)
For 1 liter or 1 quart 	 2 drops
For 1 gallon or 4 liters 	 8 drops
For 5 gallons or 20 liters 	 ½ teaspoon
For a 200 liter barrel 	 5 teaspoons

Sunlight

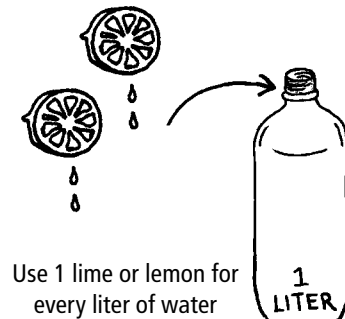
Sunlight (solar disinfection) works best in countries close to the equator, because the sun is strongest there. The farther north or south you are, the more time is needed for sunlight to work.



Filtering the water first to make it clearer will also make it disinfect more quickly. Clean a plastic or glass bottle, or a plastic bag. Clear plastic soda bottles are the best to use. Fill the bottle half full, then shake it for 20 seconds. This adds air bubbles which help disinfect the water faster. Then fill the bottle to the top. Place the bottle where there is no shade and where people and animals will not disturb it, such as the roof of a house. Leave the bottle for at least 6 hours in full sun, or for 2 days if the weather is cloudy.

Lemon or lime juice

Add the juice of a lemon or lime to 1 liter of drinking water and let it sit for 30 minutes. The acid from the juice will kill most cholera and some other germs as well. This method is not very good because plenty of germs may remain in the water, but it is better than no treatment, especially in areas where there is cholera.



Store water safely

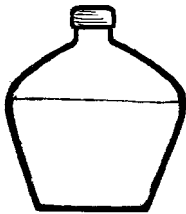
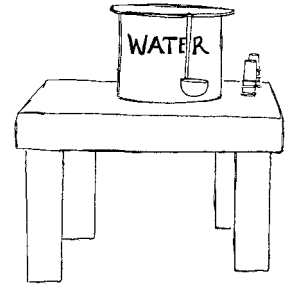
After water has been filtered or disinfected it must be stored safely. Otherwise it can easily become contaminated again. Water stored in tanks with cracked walls may not be safe. Likewise containers with loose, poorly made, or missing covers, do not prevent water from becoming contaminated by germs.

Covered tanks and cisterns are safer for storing water than open tanks because mosquitoes and snails cannot live in closed containers. Locate water storage as close as possible to where the water will be used.

Stored water can also become unsafe when it is touched by dirty cups, dirty hands, when clean water is poured into a dirty container, or when dirt or dust gets in the water.

To prevent water from becoming contaminated during storage:

- pour water out without touching the mouth of the container, or use a clean, long-handled dipper to take water out of the container. Do not let the dipper touch anything else, or it will contaminate the clean water when it is used again.
- empty and clean out the container with hot water every 2 or 3 weeks.
- keep containers covered.
- keep drinking cups clean.
- never store water in containers that have been used for pesticides or toxic chemicals.
- do not treat more water than you need for short-term use, if possible. For drinking and preparing food, that is usually about 5 liters for each person each day.



Narrow mouthed containers keep more germs out, so are safest for storing water.

Water for everyone

Good health depends on having enough good water. This means our right to health depends on our right to water. While we can work to protect water sources, and treat water to make it safe, our health is still threatened if mining, run-off from fertilizers and pesticides, or factories pollute our water.

Governments and communities must work together to protect, improve, and extend water systems so they provide people with enough safe water. Private companies say if we let them take control of our water, they can provide better service than governments and still make a profit. This is called water privatization. But usually what happens is that the price of water goes up, denying people access to their own water. This leads to serious health problems when people use less water than they need or when they collect water wherever they can for free, even if the water is contaminated with germs or toxic chemicals.

To keep people and the environment healthy, we need public water systems that provide water that is safe to drink for everyone. Community controlled water systems can be managed so people's health, not making money, is the top priority.