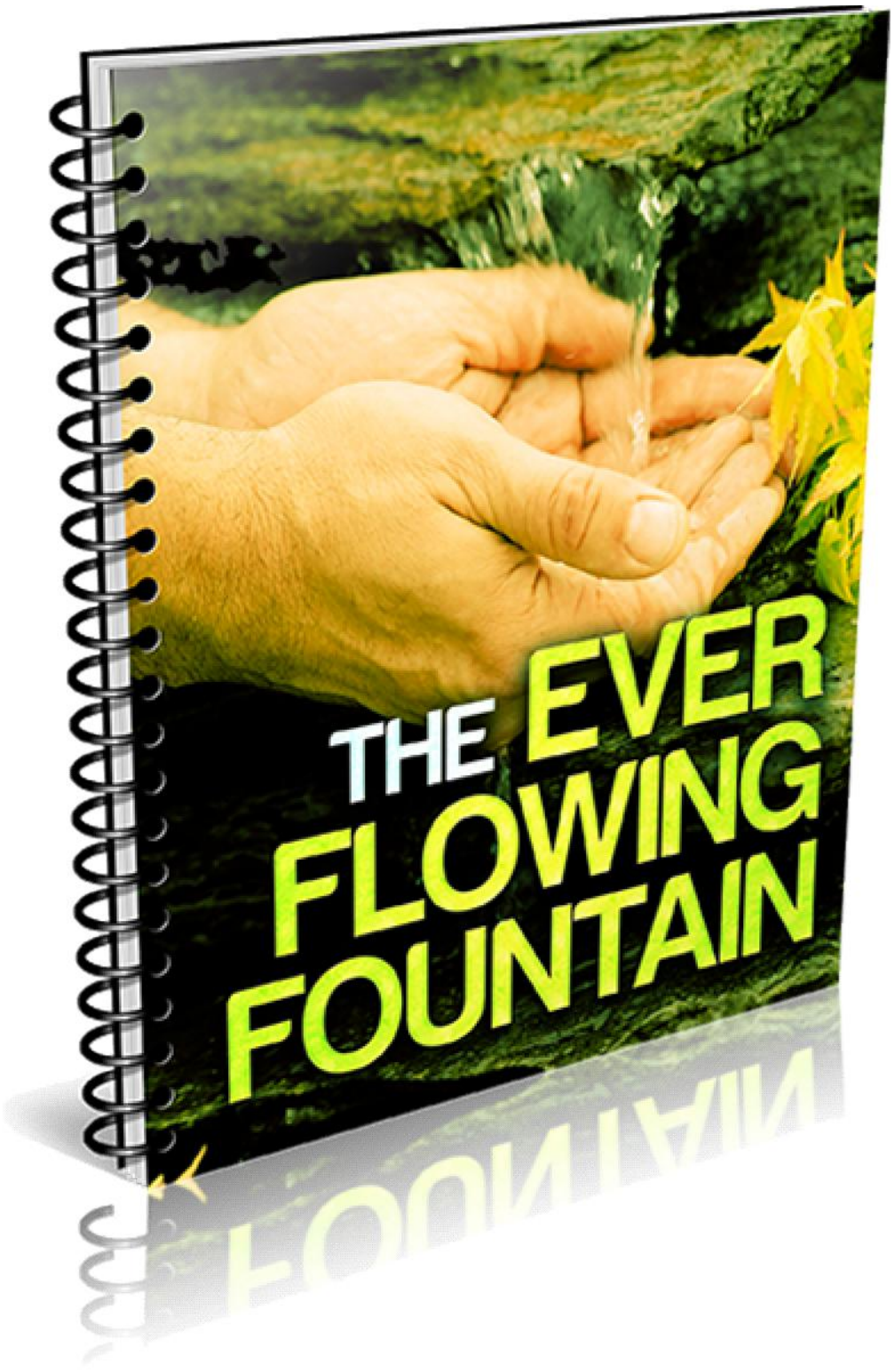

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CLEANING AND STORING DRINKING WATER

In most Western nations, the availability of clean, safe drinking water is easy to take it for granted. Purified water is widely available at drinking fountains in parks, in cases of bottled water and out of the tap at home. In much of the developing world, however, access to safe water is much more restricted, and in a survival situation, you may be faced with the same problem. Contaminated water is a very serious threat to your health. Worldwide, millions of people get sick from contaminated water, and more than 2 million children are killed from waterborne diseases each year.

There are many threats to the water supply, and many events that could render public water too dangerous to consume. If you experience one of these emergencies, listen in for instructions from the authorities, who will let you know if the city's water has been compromised. Some examples are below:

- Flooding: Heavy rains, storm surges or tsunamis can damage water treatment plants and contaminate reservoirs and other water sources.
- Severe Storms: Tornadoes, hurricanes and major thunderstorms can cause flooding and widespread power outages, which can cripple the community's water treatment system. While power can usually be restored quickly, it can take days or even weeks before the water is deemed safe again.
- Earthquakes: Like a severe storm, earthquakes can cause major power outages. They can also cause landslides and flooding from tsunamis, and may also cause crippling damage to a water treatment plant.
- Wildfires: The smoke and ash from a wildfire can seriously contaminate reservoirs and other water sources. Never drink any water that may have been contaminated by ash.
- Pollution/Contamination: Not all water emergencies are caused by natural disasters. A community's water could also be compromised by oil spills, leaky sewage systems, chemical spills or even illegal chemical dumping.

Procuring Water

Even if your city's water has been compromised, some water is still available, both in your home and, if absolutely necessary, outdoors. When you're in a survival situation, it's easy overlook some possible water sources, and there are plenty of sources to be had. In your home, you can drink melted ice from the freezer when it thaws, or drink the juices from canned goods like sliced peaches, peas and tuna. (just make sure the power is off first). Another source is the water that's still in your home's pipes. After shutting off the water, set containers under the lowest faucet in the house and turn it on. A steady trickle should flow out for a short while that is safe to drink.

Do's and Don'ts

- Don't assume that running, clear water is safe

- Don't drink salt water, ever!
- Don't eat snow for hydration
- Don't drink your urine
- Don't drink floodwater
- Do consider all water options, including melted ice in the freezer, cooled off hot water heaters, water sources found in some plants
- Do collect rain for drinking water

Purifying Water

Before beginning the purification or filtering process, check the quality of your water, and take note of where it came from. Did this come from a natural source? Was the water stagnant or running? What possible contaminants are nearby? If you found water that could be runoff from a city, keep in mind that chemicals or other heavy metals may be present.

Next, check the water's visibility. Is it murky, cloudy or mostly clear? If there are any particles present, or if the water isn't completely clear, consider filtering it through a simple handmade filter before purifying. This will remove any large particles that would inhibit purification. For a simple filter, try to pour the water through cheesecloth, coffee filter or t-shirt. You can also leave the dirty water in a large bucket. The mud and other particles will eventually settle at the bottom, leaving you with relatively clean clear water at the top that you could then use for boiling and purifying.

Boiling:

Boiling water is the safest and most effective purification technique. This method has been used for centuries. It works by heating up and killing parasites, pathogens and other microorganisms, including the worst and most common water contaminants, including Leptospirosis, Giardia and Cholera. For boiling to work, you need to have your water at a rolling boil for a minimum of 5 minutes (many authorities recommend at least 10 minutes). Because of its effectiveness, and relative ease that someone can procure wood and a pot for boiling, this should be the first method that you use.

Note that boiling times also vary at altitude. The general rule of thumb is boiling water for 5-10 minutes, and that adding a minute per 1000 feet in elevation. So if you're at 5,000 feet elevation, you will need to boil water an additional 5 minutes.

Below are the boiling temperatures at altitude:

- Sea level: 212F
- 5,000ft: 203F
- 10,000ft: 194F
- 14,000ft: 187F

Caution: Never boil water using gas, coal, wood or other burning material indoors or in an enclosed space! The carbon monoxide (CO) released by the fumes from burning coal, wood, propane or other gas can be fatal. Only boil water outside in a well-ventilated area.

Filtering

There are numerous filtration methods and materials that you can use. Keep in mind, however that filtration is not the same as purification – filtration can only remove the large particles found in water. Even the nicer water filters available can only filter out parasites such as Giardia and large bacteria such as E. coli and Cholera. Viruses such as Hepatitis A can still get through.

While effective at sieving out large particles in water, try to avoid filtering very muddy or dirty water – most filters clog very easily and will then need to be cleaned or replaced.

Chemical Purification

If boiling is not an option, using one of several chemicals can help purify water for drinking. Many of these chemicals can cause the human body harm, so it's important to use these only when necessary, and to avoid using too much. Keep in mind that while chemical treatments help a lot, they do not work 100%, and do not kill off all harmful microorganisms. Some portable water purifiers, however, are available and are a combination of a water filter and a chemical treatment.

Iodine:

One traditional chemical purification treatment is iodine. This chemical is... and has been used for decades to treat water during camping and traveling. Iodine is available in tablets, crystal and liquid form. Although popular, especially before recent technology for purification became widely available, iodine has some drawbacks, and not everyone can safely consume water treated with this chemical. Do not use iodine if one or more members of your group is:

- allergic to shellfish
- pregnant
- over 50
- taking lithium
- experiencing thyroid problems

Iodine is a light-sensitive chemical (hence the dark tincture bottle it comes in) and is most effective for water that is at least 68F.

How-To:

1. If you're using liquid iodine, add 20 drops per gallon of clear water (40 drops if the water is cloudy).
2. If you're using iodine tablets or crystals, follow the manufacturer's instructions.
3. Let the water sit for *at least* 30 minutes before drinking.

Chlorine:.

In a pinch, simple household bleach can be a lifesaver, effectively killing off most pathogens present in drinking water. In fact, many cities currently treat their water with chlorine. Household bleach is cheap and readily available, and is the easiest source of chlorine. Household bleach, such as Clorox, contains about 4-6% of its active ingredient, Sodium hypochlorite, which is its primary source of chlorine.

Before using household bleach for water purification, make sure to read the label! Never use household bleach that contains perfumes, dyes, additives or other active ingredients, and double-check the chlorine concentration before you add it to the water.

How-To:

- Make sure the water is completely cool; warm temperatures reduce the chlorine's effectiveness.
- Add between 8-16 drops of household bleach per gallon of water (the American Red Cross recommends 16 drops, while the EPA recommends 8 drops).
- Gently stir to mix in the chlorine.
- Let the water sit for at least 30 minutes
- Test the water by carefully smelling it. It should have a mild chlorine or bleach scent. If you don't smell bleach at all, add another 8-10 drops and let stand again. For your safety, never use more than 33 drops of bleach per gallon of water. If your water still doesn't smell like chlorine after more than 30 drops of bleach, then discard it – the water is too contaminated to drink.

Solar power

One water disinfection method that is gaining popularity is using the power of the sun. Sometimes called the solar water disinfection, or SODIS method, this procedure can decrease the number of bacteria by 99.999% when done correctly – that's arguably more effective than boiling! This is due in part to the sun's UVA rays, which have been proven to kill icky pathogens such as E. coli, cholera, salmonella, rotavirus, giardia and even cryptospordium.

If you have the sunlight and right tools, solar power has a number of benefits. For one, it doesn't require using precious fuel for boiling or chemical treatments that need to be carried and alter the taste of the water. And because the sun's rays are not a finite resource, this is a purification and cooking resource that can be counted on for the long-term if needed.

Another benefit is the sun's UVA rays, which also work to kill pathogens along with the sun's heat. Perhaps the biggest limitation in using solar power is that it can only work when the sun's out. You can't effectively use solar power for water purification on a rainy, cloudy day or at night. Fortunately, this method works any time of the year. Outside temperature doesn't matter, as long as there's sufficient sunlight.

To use solar power to pasteurize your water, you'll need a solar cooker or even just a clear, clean bottle made of clear glass or plastic. You may also want to invest in a simple thermometer or

water pasteurization indicator (WAPI) as well to make sure that the water was heated sufficiently to kill off any pathogens.

How-To:

1. Disinfect the water container that you'll be using. Either a pot for a solar cooker, or a plastic bottle – ideally, one that does not break down and outgas harmful chemicals such as BPA in heat or sunlight. For a quick reference, use plastic bottles labeled with the PETE recycle number 1. You can also use zip-loc baggies.
2. Carefully fill the container to about ¾ full with clear water. Murky or muddy water does not clean well in a solar heater. If your water is cloudy, filter it first through a cheesecloth, t-shirt or cotton-plug filter in a bottle.
3. Replace the bottle cap or shut the container pot lid.
4. If you're using a plastic bottle, shake it well for about 20 seconds.
5. If you're using a solar cooker, set up the cooker and place it in a sunny location facing the sun. If you're using the plastic bottle method, set the bottle down sideways in a sunny location, preferably on a black or reflective surface. Rooftops work especially well, or you can lay down aluminum foil.
6. Let the plastic bottle sit for a minimum of 6 hours. If you use this method during a cloudy day, leave the bottle out for 24 hours. Solar cookers can work much more quickly, pasteurizing up to 1 quart of water in an hour or so in the right conditions.

Note: If you fear cryptospordium is in your water, give it at least 10 hours of direct sunlight exposure (the tough little parasites have protective shells that are difficult to break down).

Other Methods

Sand filters

This is one of the oldest known filtration methods. All you need to do is run water through sand repeatedly until it runs clear. You can also dig a hole in the sand right next to flowing water and use the water that pools through the ground. While this is more effective than doing nothing, sand filtration is not 100% effective and should only be used when other options are unavailable.

Distilling

Distilling can be a very effective method for purifying water. Distillation works by boiling or evaporating the water and catching the steam or condensation for drinking. While this method does not remove all possible contaminants, it does remove most of them, and also acts as a filter. Distillation allows you to get clear drinking water from a pond, muddy puddle or even seawater. There are many distillation methods available. Below is a simple guide:

How-To:

1. Fill a bowl, pot or even a hole in the ground with the water you want to drink.
2. Place a smaller container, such as a small bowl or cup, in the center.
3. Place a sheet of plastic tightly over the container.
4. Weigh the plastic down in the middle, centered above the smaller, empty container. Small stones or something of similar size and weight work great.
5. Secure the plastic edges to prevent any air getting in or out.
6. If using a bowl, place it in a sunny location.

7. Let sit for several hours to allow condensation to accumulate, collect in the center of the plastic sheeting, and drip into the cup.
8. If you're distilling your water by boiling it, follow the above steps with one large pot and one smaller pot in the middle. Instead of plastic, use an inverted lid, which will catch the steam and drip the water into the smaller pot. This method works much faster than waiting for evaporation. If you must, you can also use a cloth over one pot of boiling water. Just wring it out when it gets soggy with steam (beware of burning your hands).

Plants

In a survival situation, you can also depend on some plants to hydrate you safely. If you live in a warmer climate, bamboo, banana, coconut and palms can provide you with fluids. Cacti such as the prickly pear cactus, edible fruits and berries, as well as some vines and roots can also provide water.

Useful Tips

- Always have at least two water purification/filtration methods available to you. Consider having fuel to boil water, a clear bottle or two for solar disinfection and some bleach or iodine in case you're on the move.
- If the taste of chemically-treated water tastes terrible, add powdered drink mix or vitamin C tablets to improve the taste.
- Boiled water or water that's been stored for a long time lacks oxygen and tastes flat. Liven up the water a bit by shaking it up for 10-20 seconds.

Managing Water

During a power outage or other survival situation, you may be faced with losing access to drinkable water. Water is one of the most important elements to survival, and is much more important to have access to than food. If you need to take shelter in your home for awhile and the power is out or the city water has been contaminated, then you need to take immediate steps to properly managing your water. Below are some general tips:

- When the authorities announce that your community's water is unsafe to drink, turn off the main water valves in your home.
- If you have any notice at all of an impending storm or other event that could leave you without running water, fill up your bathtub and any jugs or buckets available. This will give you several days' worth of safe drinking water.
- Do not make the mistake of rationing drinking water: Dehydration is a very real and dangerous condition brought on by drinking too little water. The average adult should drink a minimum of a liter a day, and sometimes up to a gallon or more, depending on activity level, temperature and other factors. It's much better to drink water today and search for more water tomorrow than to conserve and allow yourself to get sick with dehydration.
- Common symptoms of dehydration are dizziness, abdominal cramps, headaches, chapped lips and fainting. If you or a member of your family is showing signs of dehydration, give them safe water to drink immediately.
- Drink safe, clean water that you have available first. Water treatments can work very well, but they are not 100% safe. It's best to put off treating and drinking questionable water for as long

as possible.
- Do not drink soda, beer or caffeinated beverages instead of water. These products can make dehydration worse.

For more information, this Red Cross water management handout is very useful.

Storing Water

In order to comfortably ride out a power outage or a need to shelter in place, one of the best things you can do is prepare beforehand with a minimum 3 day stash of drinkable water. Drinkable water is even more important to have on hand than food, so when putting together your emergency kit or bail-out bag, make sure to include plenty of water. Keeping a gallon or two in your care along with a first-aid kit is also a good idea and could save your life should you become stranded or lost.

Storing water for a short while is pretty easy, but what about long-term storage? Some families like to keep a month's supply of water in their home for emergencies, but stored water doesn't stay safe for forever. Just as important as disinfecting water for drinking is keeping it drinkable for a long period of time.

Finding the right container

Not every water container will be appropriate for your situation. You'll want to have containers that are large enough for your needs, or portable, if necessary. If you'll be on the move, you'll also need a way to store and carry water without getting too weighted down. Collapsible containers are compact and easy to carry. Store-bought storage containers, such as such as Camelbacks, are very useful and worth purchasing in advance. In addition, sturdy water bottles made of BPA-free plastic or stainless steel are widely available and are easy to clean and very durable.

Materials

Not all containers are suitable for storing water, even if they can be used for drinking. Effective water containers should be durable, airtight and unable to release harmful chemicals. The material should be free of lead, BPA and other toxins. The material also needs to be resistant to warping, cracking and splitting as well. The safest containers for long-term storage include:

- Food-grade 5-gallon buckets with sealing lids
- 3 and 5-gallon water bottles
- 10+ gallon plastic barrels for storage

Preparing and filling the containers

Most new containers need to be properly cleaned and prepped before filling. Make sure to follow the manufacturer's cleaning instructions. Unless the instructions state otherwise, its best to wash the inside of the containers with a mild dish soap and rinse with clean water. A properly cleaned and stored container can keep water safe for up to 6-12 months, depending on temperature and light exposure. If you'd like to extend the length of storage time, you can also add some water preserver,

which can allow you to store water for up to 5 years.

You'll want to be careful when filling your containers as well. The water should be clean and pure, and never from a standard garden hose, which can be filled with harmful bacteria or even traces of heavy metals. Consider adding a filter when filling your containers for maximum purity. Some experts recommend adding bleach to the water before storing at this point; however, others argue that bleach breaks down after only a couple of months and may do more harm than good during long-term storage.

If you do decide to use bleach to help prevent the growth of any microbes that may have gotten in the container, be sure to measure very carefully. As an alternative, you can treat the water again after you take it out of the container for drinking. Fill the containers halfway and check the seals before filling the rest of the way. Once the containers are full, seal them up.

Setting your water containers in a proper place is just as important as picking the proper container itself. All water containers need to be kept in a cool, dark place away from any sunlight. Some containers need to be kept standing upright, while others are designed to be kept on their side. Read the manufacturer's instructions on proper storage.

Containers should be kept up off cement, which could potentially seep toxins up inside through the bottom. Make sure that your containers are secure. If you are in an earthquake-prone area, or choose to store your water up on a shelf, you may want to strap them down. Don't forget to label each container with the date that you last filled it.

During Storage

Keep in mind that bacteria can start to appear and grow in a container once its opened, so during storage, it's very important to keep your containers sealed.

Although often forgotten, water is one of the most important resources during a survival situation, right up there with shelter and warmth. Clean water is vital to cooking food, and keeping you hydrated and clean.

However, many people forget about storing water, or worse, store it improperly, making it potentially dangerous to drink. In addition, many people also don't know how to properly procure or treat water when safe running water fails. Taking the time to educate yourself on how to find, treat and store water can be one of the most important steps to preparing for and surviving an emergency.

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