Water Storage

“Best Practices from Various Publications”

The intent of this document is to summarize important water storage considerations. The information has been distilled from various government/society publications with hyperlinked footnotes included if further information is desired. The document is divided into three main sections:

* Amount of Water to Store
* Storage Methods
* Water Purification

# Amount of Water to Store[[1]](#footnote-1) [[2]](#footnote-2) [[3]](#footnote-3)

* The recommended water storage is 1 gallon per person per day for drinking, hygiene and cooking.
	+ Minimum: At least 3 gallons per person (1 gallon per person per day for 3 days).
	+ Recommended: At least 14 gallons per person (1 gallon per person per day for 14 days).
* Additional water above the 1 gallon per person per day recommendation may be required for:
	+ Children, nursing mothers, and people who are ill.
	+ Medical emergencies.
	+ Very hot temperatures (water needs can double).
* It is recommended not to ration drinking water unless ordered to do so by authorities.
* It is recommended not to drink carbonated or caffeinated beverages instead of drinking water. Caffeinated drinks (and alcohol) dehydrate the body which increases the need for water.

# Storage Methods

The three most common sources of stored water in the home are

* Purchased Bottled Water
* Self-Stored Water in Water Storage Containers
* Other Water Sources in your Home

## Purchased Bottled Water[[4]](#footnote-4) [[5]](#footnote-5)

* Purchased bottled water in the sealed original container is the simplest and one of the most highly recommended methods of storing water.
* The International Bottled Water Association (IBWA)advises consumers to store bottled water:
	+ At room temperature or cooler
	+ Out of direct sunlight
	+ Away from solvents and chemicals such as gasoline, pesticides and household cleaners.
* Bottled Water Shelf Life
	+ The U.S. Food and Drug Administration (FDA), which regulates bottled water as a packaged food product, has determined that there is no limit to the shelf life of properly stored bottled water.
	+ Some companies place date-based lot codes or “best by” dates on bottled water; these are typically used by distribution and retail points to assist in managing stock rotation.

## Self-Stored Water[[6]](#footnote-6) [[7]](#footnote-7) [[8]](#footnote-8)

When self-storing water the following steps are recommended:

* Water Container Types
	+ It is preferred to use food-grade water storage containers that have a top that can be closed tightly made from durable, unbreakable materials (i.e., not glass).
	+ If you decide to repurpose storage containers, it is recommended to use two-liter plastic soft drink bottles – **NOT** plastic jugs or cardboard containers that have had milk or fruit juice in them.
* Cleaning Water Containers
	+ Wash the storage container with soap and rinse completely with water.
	+ Sanitize the container with a solution made by mixing 1 teaspoon of unscented liquid household chlorine bleach (5%–9% sodium hypochlorite) in 1 quart of water.
	+ Cover the container tightly and shake it well, making sure the sanitizing bleach solution touches all inside surfaces of the container.
	+ Wait at least 30 seconds and then pour the sanitizing solution out of the container.
	+ Let the empty sanitized container air-dry before use or rinse the container with clean water.
* Filling Water Containers
	+ Fill the bottle to the top with regular tap water.
	+ If your tap water comes from a well or untreated water source, add two drops of **unscented** liquid household chlorine bleach (5%–9% sodium hypochlorite) to each gallon of water.
	+ Tightly close the container using the original cap.
	+ Be careful not to contaminate the cap, container or water by touching it with your fingers.
* Storing Filled Water Containers
	+ Label container as “drinking water” and include storage date.
	+ Check/Replace stored water every six months.
	+ Store containers at room temperature or below.
	+ Do not store water containers in direct sunlight.
	+ Store away from solvents and chemicals such as gasoline, pesticides, and household cleaners.

## Other Water Sources In Your Home[[9]](#footnote-9)

* Other safe water sources in your home include the water in your hot-water tank, pipes, and ice cubes.
	+ It is recommended that you should not use water from toilet flush tanks or bowls, radiators, waterbeds, or swimming pools/spas for consumption.
* Protecting the Water in Pipes and Hot Water Tank from Contamination:
	+ You may need to protect these water sources from contamination if you hear reports of broken water or sewage lines or if local officials advise you of a problem.
	+ This can be done by closing the incoming house water valve
	+ Be sure you and other family members know where the valve is and how to close it.
* Using Water in Your Pipes
	+ Let air into the plumbing by opening the highest faucet (both hot and cold) in your home.
	+ Then obtain water from the lowest faucet in the home.
* Using Water in Your Hot Water Heater
	+ Turn off the electricity and/or gas to the Hot Water Heater
	+ Let air into the plumbing by opening the highest faucet (both hot and cold) in your home.
	+ Open the drain at the bottom of the tank to obtain the water from the hot water heater.
	+ Refill the hot water tank before turning the gas and/or electricity back on.

# Water Purification[[10]](#footnote-10) [[11]](#footnote-11) [[12]](#footnote-12) [[13]](#footnote-13)

* Use bottled water if possible; it is the safest choice for drinking and all other uses.
* There are three main categories of water risks during emergencies that may require you to purify water: sediments, biological organisms, and toxins. More specifically:
	+ **Sediment**: Particulate like dirt, sand, silt, debris, plant and animal matter and algae.
	+ **Bacteria**: From human and animal fecal waste, like E. coli, salmonella, cholera, shigella, and campylobacter jejuni.
	+ **Protozoa**: Larger than bacteria these single-cell organisms feed on organic matter; examples are giardia, cryptosporidium, and cyclospora.
		- **Cysts**: These are dormant forms of bacteria/protozoa waiting to ‘turn on’ once inside your body.
	+ **Viruses**: For example, Hepatitis, norovirus, rotavirus poliovirus and enterovirus.
	+ **Chemicals, heavy metals, & society’s waste**: Countless contaminants like oil, salts, pesticides, cleaning agents, industrial runoff, or heavy metals like lead and mercury.
* If bottled water is not available, contaminated water can often be made safe to drink in a variety of ways shown in the following table. Each method has its pros and cons.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Method** | **Sediment** | **Bacteria** | **Protozoa** | **Virus** | **Salts** | **Heavy Metals** | **Chemicals** |
| **Pre-Filter** |  |  |  |  |  |  |  |
| **Disinfecting** |  |  |  |  |  |  |  |
| **Filtering** |  |  |  |  |  |  |  |
| **Boiling** |  |  |  |  |  |  |  |
| **UV Light** |  |  |  |  |  |  |  |
| **Distillation** |  |  |  |  |  |  |  |

**KEY:** **Effective** **Effective Under Certain Conditions (See Disinfecting and Filtering)**

## Pre-Filtering

* Water containing sediments may need to be prefiltered prior to drinking, boiling, disinfecting, distilling, filtering, or exposing to UV light.
* This can be accomplished by:
	+ Filtering/straining it through a clean cloth, paper towel, or coffee filter, or
	+ Allowing the water to settle and/or skimming floating particles from the water surface

## Disinfecting[[14]](#footnote-14) [[15]](#footnote-15) [[16]](#footnote-16)

* Disinfectants can kill most harmful viruses and bacteria, but are not as effective in controlling more resistant organisms, such as the protozoa Cryptosporidium and Giardia.

### Disinfecting Approach #1: Bleach

* Liquid household chlorine bleach (5%–9% sodium hypochlorite) can be used to [disinfect your water](https://www.cdc.gov/healthywater/emergency/drinking/making-water-safe.html). Do not use scented, color safe, or bleaches with added cleaners.
	+ **2 Drops (0.1ml) Per Quart**
	+ **8 Drops (0.5ml) or 1/8 Teaspoon Per Gallon**
	+ **40 Drops (2.5ml) or ½ teaspoon Per 5 Gallons**
* Bleach is **NOT** effective against protozoa.

### Disinfecting Approach # 2: Tablets

* All tablets are **NOT** effective against all waterborne pathogens
	+ Follow the manufacturer’s instructions.
* Iodine and iodine-containing tablets or chlorine tablets are **NOT** effective against protozoa.
	+ Water disinfected with iodine is **NOT** recommended for pregnant women, people with thyroid problems, those with known hypersensitivity to iodine, or for continuous use.
* Chlorine dioxide tablets **can be** effective against protozoa, though may take up to 4 hrs.

## Filtering[[17]](#footnote-17) [[18]](#footnote-18) [[19]](#footnote-19) [[20]](#footnote-20) [[21]](#footnote-21) [[22]](#footnote-22) [[23]](#footnote-23) [[24]](#footnote-24) [[25]](#footnote-25)

* There are numerous portable water filters available. Filters use physical restrictive pathways to block unwanted particles/organisms, allowing purified water to pass through the filter.
* Filter effectivity is dependent on the effective filter pore size (1 micron = 1 millionth of an inch).

|  |  |  |
| --- | --- | --- |
| **Contaminant** | **Contaminant Size (micron)** | **Required Filter Size (Absolute microns)** |
| **Human Hair:** | 50 | 1 micron or smaller |
| **Algae** | 5 – 20 |
| **Mold** | 3 – 12 |
| **Protozoa** | 1 – 50 |
| **Asbestos** | 0.7 – 90 | 0.1 – 0.2 micron or smaller (Microfiltration) |
| **Bacteria** | 0.2 – 1.0 |
| **Larger Virus** | 0.004 – 0.3 | 0.01 micron or smaller (Ultrafiltration) |
| **Smaller Virus** | 0.004 – 0.1 | 0.001 micron or smaller (Nanofiltration) |

* Filters pore size can be an absolute or nominal rating.
	+ Absolute: 99.9% of particles larger than the micron rating will be trapped within the filter.
	+ Nominal: The approximate size particle, the majority of which will be trapped within the filter.
		- The CDC found that some “Nominal 1 micron” filters allowed 20% to 30% of 1-micron particles (like protozoa) to pass through.
* There are three NSF International standards that you may typically see associated with portable filters:
	+ NSF/ANSI 42: Aesthetic Effects:For systems designed to reduce aesthetic or non-health-related contaminants like the removal of tastes (such as chlorine), odors, colors or particulates.
	+ NSF/ANSI 53: Health Effects:This standard was mostly developed to test for the removal of chemicals from tap water.
	+ NSF Protocol P231: Microbiological Water Purifiers:This is the standard you want if you’ll be treating water which carries the risk of waterborne pathogens.
* Some filters use a mix of filter stages to provide the most effective filtering possible.
	+ Sediments can clog filters with small pores. A pre-filtering stage can remove them.
	+ Carbon stages remove bad odors/tastes and some chemicals. Some filters also use activated carbon (e.g., activated charcoal) to attract and trap the smaller particles/organisms that otherwise would pass through the restrictive pathways.
	+ Some products reduce the effective micron rating by combining small filter pores with an ionized coating around the mesh that attracts particles/organisms as they pass through.
* Salts and other water-soluble elements/chemicals **cannot** be removed with a filter.
* Filters collect germs from water, so someone who is not immunocompromised should change the filter cartridges and should wear gloves and wash their hands afterwards.

## Boiling[[26]](#footnote-26)

* Sediment containing water (cloudy/dirty) should be pre-filtered to remove particulates prior to boiling.
* Boil water for 1 minute
	+ At elevations above 6500 ft (2000m) boil water for 3 minutes.
* Boiling generally does not improve the taste of water. The addition of a pinch of salt or pouring the water from one clean container to another several times may improve its taste.

## Ultraviolet (UV) Treatment[[27]](#footnote-27)

* There are many UV lights available on the market. Use them according to manufacturer’s instructions
* UV Treatment exposes water to ultraviolet light which kills cells by damaging their DNA.
* Sediment containing water (cloudy/dirty) should be pre-filtered to remove particulates as the particulates limit the effectiveness of the UV light.
* Other Considerations for UV lights.
	+ Some UV lamps require batteries – Spare batteries should be stored and rotated.
	+ UV lamps use bulbs that can be damaged – Consider storing Spare Bulbs.

## Distillation[[28]](#footnote-28)

* Distillation involves boiling water and collecting only the vapor that condenses. The condensed vapor will not include most of waterborne impurities.
* A simple method to distill water:
	+ Fill a pot halfway with water.
	+ Tie a cup to the handle on the pot’s lid so that the cup will hang right-side-up when the lid is upside-down (Figure 1) or set a bowl on top of a cup (Figure 2).
	+ Boil the water.
	+ The water that drips from the lid into the cup is distilled.

  

 **Figure 1 Figure 2**

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2. [Creating and Storing an Emergency Water Supply](https://www.cdc.gov/healthywater/emergency/creating-storing-emergency-water-supply.html), Centers for Disease Control – Content: 26 Jan 2021 [↑](#footnote-ref-2)
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4. [BOTTLED WATER STORAGE](https://bottledwater.org/bottled-water-storage/), International Bottled Water Association [↑](#footnote-ref-4)
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15. *Wilderness and Environmental Medicine:* Vol. 8, No. 2, pp. 96–100, Efficacy of iodine water purification tablets against *Cryptosporidium* oocysts and *Giardia* cysts. [↑](#footnote-ref-15)
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17. [A Guide to Water Filters](https://www.cdc.gov/parasites/crypto/gen_info/filters.html), Centers for Disease Control – Content: 3 Apr 2015 [↑](#footnote-ref-17)
18. [Making Water Safe in An Emergency](https://www.cdc.gov/healthywater/emergency/making-water-safe.html), Centers for Disease Control – Content: 23 Feb 2021 [↑](#footnote-ref-18)
19. [Recreational Water Quality Criteria](https://www.epa.gov/sites/production/files/2015-10/documents/rwqc2012.pdf), Environmental Protection Agency. Oct 2015. [↑](#footnote-ref-19)
20. [Bacteria & Virus Issues](https://www.wqa.org/learn-about-water/common-contaminants/bacteria-viruses), Water Quality Association. Jun 2018. [↑](#footnote-ref-20)
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