

EMERGENCY PREPAREDNESS WORKSHOP:



Water

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• The Average Human body can survive:



•3 Minutes Without Air



•3 Hours Without Shelter (in inclement weather)



•3 Days Without Water



3 Weeks Without Food



Why Store Water?

- We are fortunate to have clean water piped directly to our homes.
- However, situations may arise that can interrupt or contaminate this supply of safe drinking water.
- These interruptions may include earthquakes, hurricanes, flooding, hazardous material spills, terrorist attacks, disease, strikes, etc...
- Some disasters, like earthquakes may rupture water mains and create a water shortage for days or even weeks.

Clean drinking water is the single most important item you should include in your food storage. (My Opinion)



- Most experts believe that you should store:
 - 1 gallon of water per person per day.
 - 2qt. for drinking
 - 2 qt. for food preparation / cleaning purposes
 - Enough water to last 2 weeks.
- That equals 14 gallons per person.





- I believe 1 gallon per day is too low.
- The calculation is based on an adult in cool weather without physical activity.
- Serious health risks may result due to drinking so little in hot or active situations.
- Babies, children, nursing-mothers, the sick, and the elderly will need more than 2 qt. per day. (think hygiene)
- An emergency situation may require you to be more active than you normally are, thus increasing your daily water requirement. (Evacuation, Search and Rescue, Rebuilding, etc.)

How Much Water?

- Remember, we live in the DESERT, our daily water requirement is even greater.
- I recommend storing no less than 2 gallons per person per day.
- 28 gallons of water for each person for your 14 day supply.
- If you have the means, store as much water as possible.
 - You can always share your extra water with family or neighbors.





Water Storage

- What Kind of Water Should I Use?
 - Use Tap Water
 - Clean, inexpensive & easy to rotate frequently.
 - Storing in clean, opaque containers in a cool and dark location, you probably don't need to treat your water at all.
 - Under these conditions the water can actually get more pure with time.
 - Since there is no guarantee that the water or the container is actually bacteria-free I recommend treating it.

Water Storage

- - The easiest way to store the bulk of your water is in 55 gallon, polyethylene (plastic) water barrels.
 - These can be found on the internet for \$45-\$65 or obtained locally from food storage or container companies.
 - Make sure your containers are food grade quality.





Water Storage

- 55 gallon barrels are often available through companies that distribute beverages or syrups (Coke, Pepsi).
- If you clean them well, they can provide a good container that costs considerably less than a new one. (\$17-\$22)
- For a list of used barrel distributors in AZ. Click <u>Here</u>.
- Be aware! Some syrup flavors may remain. The flavor will diminish each time you refill the barrel. Consider a barrel that contained Lemon-Lime Soda over Soy Sauce.

55 Gallon (Blue)

55 Gallon (Translucent)

55 Gallon (Black)

15 Gallon (Blue)

15 Gallon (Translucent)

30 Gallon (Blue)

Other Possible Water Storage Methods

GILBERT



Underground Rainwater Storage Tank



Storage Tanks

275 Gallon Totes

Water Pillow Storage Tanks





Aqua Pod



- 55 gallon barrels are a good water storage option as long as you are staying at home.
- What if you have to evacuate?
- 55 gallon barrels are too large, heavy and awkward to transport.
 - 1 gallon of water weighs approximately 8.3 lbs.
 - A 55 gallon drum will weigh about 460 lbs.





- In addition to your 55 gallon drums, store water in smaller, portable containers.
- Some possible portable storage containers include:
 - 2-liter soda bottles
 - 1 gallon apple juice bottles
 - 5 gallon water jugs.
- Store enough water in portable containers to supply each person 2 gallons for at least 3 days. (longer is better)
- Portable water containers also make refilling at streams, water trucks, or emergency water stations more practical.



- Make sure that the bottles you select are food grade quality and have tight fitting screw-cap lids.
- Opaque containers are best.
- Translucent containers may allow algae growth, but rotating your water every 6-12 months will reduce this risk.
- Do not use milk jugs. Milk jugs do not seal well and are biodegradable. They will break down within 6 months.



• Plastic Containers are Permeable

• Since plastic is permeable to certain vapors, water stored in plastic should not be near gasoline, kerosene, pesticides, or similar substances. It is advisable to store plastic water containers away from direct sunlight. If sunlight is unavoidable, replace the water every 6-12 months.





- Avoid using glass or metal containers.
- Glass and metal containers are heavier than plastic and glass is more easily broken.
- Metal containers can give water a metallic taste.
- Water stored in metal containers should not be treated prior to storage with chlorine since the chlorine compound is corrosive to most metals.







- Avoid Chlorine Bleach Bottles
- They contain an anti-static agent which prevents accumulation of dust during storage and not healthy for human consumption.



Portable Water Storage



5 Gallon Containers

Portable Water Storage





Notes on Water Storage

- Stored water should be checked occasionally. If any changes, such as cloudiness or an odor are noted, replace the water and treat as before.
- One of the things that affect the taste of water in long term storage is it "going flat". This occurs when your stored water sits still and loses the oxygen trapped between its molecules. You can improve the taste by pouring the water back and fourth between containers to aerate it or by beating it with a hand egg-beater.
- Store some powdered drink mixes (kool-aid, lemonade, etc.) to add to your water. Children (and some adults) need some encouragement to drink their daily requirement of water. Powerade and Gatorade drink mixes contain electrolytes.



Notes on Water Storage

- Other sources of water available in emergency situations are the water heater, water softener containers, and the water storage area of the toilet, water pipes, ice in the freezer, etc.
- If you have freezer space, storing some water in the freezer is a good idea. If you lose electricity, the frozen water could help keep foods in your freezer frozen until the power is restored.
- "Its the water in your body that saves you, not the water in your canteen." If supplies run low, never ration water. Drink the amount you need today, and try to find more for tomorrow. You can minimize the amount of water your body needs by reducing activity and staying cool.
- If you are low on water, Don't Eat! This will only increase your body's need for water.



Method	Taste	Cloudiness	Chemicals	Bacteria	Viruses
Boiling					
Straining (Cloth)					
Chlorine					
Iodine					
Solar Pasteurization					
Sand Filter					
Distillation					
UV Light				Clear Water	Clear Water
Stabilized Oxygen					
Charcoal Filter			Some Yes/ No	New Filter	New Filter
Ceramic Filter					
Reverse Osmosis					
Grapefruit Seed Extract				Some Yes/ No	Some Yes/ No

Ineffective

Moderately Effective

Very Effective

Boiling Water

- Boiling water is one of the best methods for killing organisms in water to make it safe to drink.
 Boiling water as recommended will kill bacterial, parasitic, and viral causes of diarrhea. Adding a pinch of salt to each quart will improve the taste.
- Boil water vigorously for 1 minute and allow it to cool to room temperature (do not add ice).



- Pre-filtering
 - Reduces cloudiness. A preliminary measure before other treatment methods.
 - Cloudy water is filtered through several layers of cloth to remove larger sediment.





Before Pre-filtering

After Pre-filtering

ACADA K

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- Chlorine Bleach (liquid)
 - One gallon of clear water can be treated by the addition of 1/8 teaspoon (about 5-8 drops) of liquid chlorine bleach containing 4% to 6% sodium hypochlorite. (Most bleaches contain 5.25 %)
 - 1/8 cup of bleach will treat 55 gallons.
 1/4 cup if cloudy.
 - The bleach should not contain, phosphates, softeners, fragrances or soap additives.





- Chlorine Bleach (liquid)
 - Bleach will last 6 months at cool temperatures before it starts to breakdown. It will degrade at about 20% per year until it becomes salt water. Stored in warm temperatures it will degrade more rapidly.
 - For long-term storage solutions, what do you do?
 - Answer! Store Sodium Hypochlorite in its dry form... Calcium Hypochlorite.


- Calcium Hypochlorite (Granular)
- Calcium Hypochlorite is widely available for use as swimming pool chlorine tablets or white powder that is much more stable than chlorine. This is often known as "pool shock".
- 1-1 lb. bag can treat 10,000 gallons of water.
- Granular Calcium Hypochlorite, if kept dry, cool and in an airtight container, may be stored up to 10 years with minimal degradation.
- 65%-90% Calcium Hypochlorite; Must be NSF Approved and must be Non-Stabilized Chlorine





- Calcium Hypochlorite (Granular)
- How to Disinfect Water Using Calcium Hypochlorite.
- Using granular calcium hypochlorite to disinfect water is a two step process. Make a solution and then treat water with it.
- To make a stock of chlorine solution (do not drink this!) dissolve 1 heaping teaspoon (about one-quarter of an ounce) of high-test (65-90%) granular calcium hypochlorite for each two gallons (eight liters) of water.
- To disinfect water add one part of the chlorine solution to 100 parts water to be treated.
- Let the mixture sit for at least one-half hour before drinking. Source: <u>http://water.epa.gov/drink/emerprep/emergencydisinfection.cfm</u>

- Tincture of Iodine
 - If using tincture of iodine 2% solution, add 5 drops to a quart of clear water. If the water is cloudy, add 10 drops per quart.
 - Allow the water to stand for 30 minutes before drinking when the water temperature is at least 77°F. Increase the standing time for colder water: (e.g., for each 15° less than 77°F), allow the water to stand for double the time before drinking it.
 - Warning! Water that has been disinfected with iodine is NOT recommended for pregnant women, people with thyroid problems, those with known hypersensitivity to iodine, or continuous use for more than a few weeks at a time.





- Water Purification Tablets
 - Either Chlorine or Iodine based.
 - Be sure to follow the manufacturer's directions for treatment and allow sufficient time for the chemical to work before using. (15-30 Minutes)
 - Check the label for expiration date, since the tablets can become ineffective with time. Most tablets have a storage life of approximately 2–5 years unopened. Less if stored in the heat of your garage.
 - Slow working in cold water.





- Water Pasteurization
 - Same concept as Milk Pasteurization
 - Milk is pasteurized at 160°F for 15 Seconds.
 - See table for temperatures at which the most common waterborne pathogens are rapidly killed, resulting in at least 90% of the microbes becoming inactivated in 1 minute at the given temperature. 5 minutes at this temperature would cause at least a 99.999% reduction in viable microbes capable of causing disease.

Microbe	Killed Rapidly At
Worms, Protozoa cysts (Giardia, Cryptosporidium, Entamoeba)	131°F
Bacteria (V. cholerae, E. coli, Shigella, Salmonella typhi), Rotavirus	140°F
Hepatitis A virus	149°F



Boiling



Solar Oven



Solar Panel Cookers



Soda Bottle Water Pasteurizer



SODIS "Solar Disinfection"



Water Pasteurization Indicator

- It's easy to tell when water is pasteurized using the boiling method.
- When water reaches 212°F, the water starts to boil.
- How can you tell if water has reached pasteurization temperature without the use of a thermometer?





Water Pasteurization Indicator

- The WAPI (Water Pasteurization Indicator).
- Soy wax melts at 158°F.
- Once the wax has melted, pasteurization temperatures have been reached.





• Sand Filter



- - Sand Filter
 - These filters are very effective at removing particulate matter.
 - However, in waters where algae are abundant, the water can develop a foul taste and a slight color. Sand and gravel filters will not remove the agents which cause these problems. A layer of charcoal will cure this.
 - Sand filters will not remove soluble materials, such as salt or other chemicals.

• Distillation



120v Water Distiller Yield: 4-6 Gal./Day

Non-Electric Distiller Yield: 1 Gal./1.5 Hours



• Distillation



Water Distillation using a Pressure Canner



• Distillation on campfire or stove





- Solar Distillation (Solar Still)
 - A simple, waterproof insulated box with a piece of glass on top, it uses the sun's energy to distill dirty water. During the summer months a solar still (1 x 2 meter) is able to produce 2.5 3 gallons of clean drinking water a day.





• Solar Distillation (Solar Still)





• Solar Distillation (Solar Still)





- Solar Distillation (Solar Still)
 - Water Cone
 - \$54-69 each
 - www.watercones.com











• UV Light Filters





- UV Light Filters
 - The UV light destroys viruses, bacteria and protozoa (such as giardia and crypto), and exceeds EPA standards for microbiological water purifiers.
 - No need to wait 20-30 minutes for water to be safe.
 - Push button and stir for 90 seconds per liter.
 - Cons: Battery Powered, Not as effective in cloudy water.
 - Optional Solar charger and Pre-Filter available.



• Stabilized Oxygen (Aerobic)





- Stabilized Oxygen (Aerobic)
 - Stabilized Oxygen is a safe, non-toxic stabilized liquid concentrate of electrolytes of oxygen.
 - Kills hostile microbes, anaerobic bacteria and viruses.
 - This includes Salmonella, Cholera, Streptococcus, E. coli, Pseudomonos, Staphylococcus and Guardia-Lamblia, just to name a few.
 - Friendly aerobic bacteria which we need in our digestive systems is not affected by stabilized oxygen. In fact, the good bacteria thrive in its presence.
 - There are many brands, some more efficient than others.

Backpacking Water Filters





Backpacking Filter Buying Guide

- How well a filter works is based on its "absolute" pore size.
 - Protozoa: 2 to 200 microns
 - Bacteria : 0.1 to 15 microns
 - Viruses : 0.01 to 0.03 microns
 - Human Hair (Diameter): 80-100 microns
- Filters with a pore size of less than 2 microns will eliminate Protozoa
- Filters with a pore size of 0.1 1 microns will eliminate most harmful Bacteria
- Filters cannot filter out Viruses because of the inability to achieve a pore size small enough.



- Bleach and Iodine used after filtration or boiling the water will eliminate the viruses.
- Charcoal Filters need replacing more frequently
- Ceramic Filters (replaceable) can develop hairline fractures
- Make sure the filter is field serviceable & easy to clean
- Look for a fast flow rate (at least a liter/quart per minute)

- Berkey Filters
- Consider higher output filters for home use.



\checkmark

Water Treatment

- Berkey Filters
 - Berkey filter elements plus buckets can save you \$200.





Instructions: http://www.alpharubicon.com/kids/homemadeberkeydaire.htm

Other Filters



- MIOX
 - Creates a powerful dose of mixed oxidants (MIOX), which is then added to untreated water, inactivating all viruses, bacteria, Giardia, and Cryptosporidium.
 - Requires Batteries and Salt to operate.
 - No pumping required: Just add water, shake, and press a button.
 - Purifies water without iodine: No health risk or unpleasant iodine taste.
 - Great for large volumes of water: Perfect for groups or extended trips.
 - Ultralight and compact: Fits in your pocket to go anywhere.



Other Filters

COLOCIO COLOCIO

No.

Strow



• Straw Filters





What About Pool Water?



- Swimming pools are full of impurities. (dirt, body oils, lotions, sweat, etc)
- We add chemicals to our water to prevent the growth of organisms.
- Arizona has an average annual evaporation rate of 7 ft.
- This means the chemicals and impurities are left behind as evaporation takes place. New water is added to replace the evaporated water, which is then treated increasing the concentration of chemicals and impurities.
- It is safer to treat canal water than the water in your swimming pool.
- The best practice is to use your pool water for hygiene needs and for flushing your toilet. Leave your other water storage for drinking only.
- Note: In many locations, you do not own the water in your swimming pool. The city can come and claim it at anytime during an emergency. Don't rely on having it.



Filling Water Barrels

- Fill 55 gal. barrels with regular tap water.
- Add 2 Tablespoons (1/8 Cup) of liquid chlorine bleach containing 4 to 6 percent sodium hypochlorite. (Most bleaches contain 5.25 %) Make sure the bleach does not contain any fragrances, perfumes or softeners.
- 30 gal. barrels need 1 Tablespoon bleach,
- 15 gal. barrels need ½ Tablespoon of bleach.
- Ideally you should store your barrels in a cool shady location. If you store your barrels in the sun, make sure to replace your water every 6-12 months.





Filling Water Barrels

- Store your barrels off the ground, like on a stand, a pallet or lay some boards on the ground. This will prevent tastes and toxins from leaking through the plastic of the barrel.
- Most garden hoses now carry a tag like the following: WARNING: "This hose is NOT intended for drinking water use. This product contains lead or a chemical known to the State of California to cause cancer, birth defects or other reproductive harm."
- I bought a flat hose to fill my barrels.




Water Barrel Accessories





• Cleaning water barrels with Dish Soap can be a nightmare. You will be filling and dumping for hours as you try to remove the suds.

• Try using a strong water/bleach solution (1 part bleach to 9 parts water). If you have let mold grow, let it sit overnight. Also have the kids roll the sealed container with the solution inside around the yard for an hour or so. Rinse and repeat if necessary. Empty, Rinse and Fill as you normally would.

• Another method is with vinegar and baking soda. Fill your barrel ¼ full of water. Add ½ gallon of White Vinegar and 1 box of baking soda into the barrel. Let the chemical reaction clean your barrel for you. Rolling it around will help clean the inside evenly. Let the barrel set for a day or two if algae or mold growth is particularly bad. Empty the barrel and fill ¼ full of water, plug and roll to rinse thoroughly. Repeat if necessary. Empty, Rinse and Fill as you normally would.



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