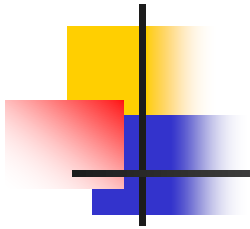
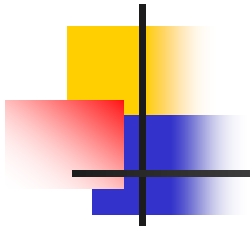
Water! Water! Water!

A Quick Guide to Water Storage and Emergency Preparedness

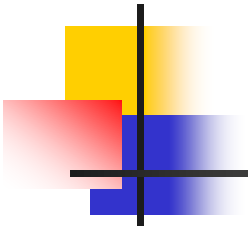


- Many disasters can result in an interruption of the water supply, including drought, hurricanes, tornadoes, floods, winter storms, and even accidental or intentional contamination.

- Within a few short hours after emergency situations arise, drinking-quality water usually becomes a critical issue. Set goals which will make it possible for you and your family to have enough water.



- Emergency water storage is actually more important than emergency food storage, since, in a pinch, a person can theoretically last much longer without food than without water.



- In addition, water is easier than food to acquire and store, and cheaper to stock up on, and you only need to store a two week supply!
- In times of emergency need, water may not be available "at the tap" nor at the store.
- When it has been available in emergency areas, it has sometimes been sold at prices that make gasoline seem cheap!

Amount of Water Needed for Emergencies

- On average, people need to drink about a half gallon of water per day, and use an additional half gallon for other uses, including hygiene, food preparation and cleaning, etc. The accepted emergency storage amount, then, is one gallon per person per day.

Amount of Water Needed for Emergencies

- If pets are involved, add an additional quart per day per cat or dog.

Emergency Kit Water

- This means that each individual ***72 hour emergency kit*** should have three gallons of stored water.

Home Supply Volume

- In a "years supply" stockpile, the Church's recommendation is actually to store a ***two week supply***, or 14 gallons per person. It is assumed that water supply will be the government's highest priorities in the aftermath of an emergency, and if it can't be restored they would try to truck in potable water.

Home Supply

- Larger amounts are generally not practical, although of course if you have the space and capacity, feel free to store more.
- (My wife says a gallon a day is not enough… she wants to take showers.)
- (She especially wants ***me*** to take showers.)

Home Supply

- Hot environments or conditions where people must exert themselves will increase the amount needed.
- Storage and use of water-containing juices, drinks, high-moisture foods, soups, etc. may reduce the water amount.

Home Supply

- Elderly, sick, young usually need more
- If your food storage leans toward dehydrated or freeze-dried foods you will need additional water for reconstituting them.

Storage Containers

- For *72 hour emergency kits*, which are designed to be portable, the three gallons per person in the family should be stored in easily carried containers.
- These might include commercially bottled water, backpacking or sports water bottles, or cleaned and refilled 1- or 2-liter soda bottles, juice, water, punch plastic bottles, etc.

Storage Containers

- ***Two week storage supplies*** are not designed to be as portable, so five gallon totes or 55 gallon drums are the ideal option – preferably new, thick, food-grade plastic containers.
  - 55 gallon polyethylene drums: for longer term, consider getting a siphon pump, siphon hose, spigots, drum dollies, etc.

Storage Containers

- The heavy duty, food grade plastic, 5 gallon tote is perhaps the most versatile option. Most are made for handy stacking, they weigh just shy of 45 pounds full (about the most you would want to carry if you had to), they are manageable in terms of treatment, and in addition they can be handy for extended emergency situations where you might need to refill from water trucks or other sources.
- Spigots for horizontal dispensing are a nice option.

Storage Containers

- Wash used containers thoroughly in hot tap water and dish soap.
- Rinse completely with hot tap water.
- If contamination is possible, rinse with chlorine solution.

Storage Containers

- Do not boil clean water before storing – it will not stop problems that happen during storage, and can concentrate contaminants through evaporation.
- Before storage, if there is any question of disinfection quality, add 1/2 teaspoon (8 drops) per gallon of household bleach (or half that if pool strength).
- Keep water storage containers tightly sealed until use or until time to pour the water on the garden and refill your containers.

Storage Containers

- Used containers should be food grade, and have a taste/smell that you wouldn't mind your water tasting/smelling like
- Avoid milk containers – protein and fat residue difficult to completely remove, which can then be food for bacteria later as well as affecting taste

Storage Containers

- Lighter weight gallon plastic jugs become brittle sooner, break easier, and are more permeable to other odors, tastes than heavier plastic.
- Broken storage containers may cause water damage to surrounding storage.

Storage Containers

- Some bottles (such as chlorine bleach bottles) may be fine for bleach storage, but contain anti-static agents that may not be compatible with water storage
- Avoid using used plastic containers that contained chemicals (or even foods) that may not be compatible with water storage

Storage Containers

- Glass may not be the best because of breakage concerns.
- In addition, there can be weight issues, and some old glass contains lead which can leach into the water.
- However, many use canning jars, which are OK when not in use for canning, take the same amount of room as when stored empty, and can even be heat treated after filling to sterilize the water inside (leave 1 inch of head space, and process 20 minutes for quart jars).

Making and Keeping Water Safe

- **Potable**
  - For drinking, food preparation, other ingestion. Comes from tap – is treated by a water company
  - Also bottled water, other water intended for "internal use"
- **Non-potable**
  - Not safe for untreated consumption
  - May be able to be made potable through boiling, chemical treatment, filtration, etc.
  - Can be used for washing people, clothing, etc., - perhaps even washing dishes

Making and Keeping Water Safe

- **Potable tap water** that has been put into clean food-grade plastic containers generally does not need any pretreatment before storage.
- Bacteria-free water stored in tightly shut, opaque containers in cool dark locations will last several years.

Making and Keeping Water Safe

- Studies have shown that properly stored water is indistinguishable from fresh tap water in terms of taste and quality.
- Any water that has acquired an odor, color or turbidity should be replaced sooner. How will you know if your storage strategies are working? By rotating the water!
- The recommended rotation interval is six months. (Although commercially bottled water may be good up to two years, and will often have an expiration date on the bottle.)
- Mark stored water containers with the last date they were refreshed.

Making and Keeping Water Safe

- Stored water can taste "flat" because of oxygen off-gassing. Although it is still fine for use, you may re-oxygenate by pouring repeatedly from one container to another, or vigorously shaking or stirring (think eggbeater). If practical, even leaving them open to the air will restore dissolved gasses.
- In emergency conditions, stored water should generally be used rather than conserved – your body needs the water, and it is usually considered a better strategy to give it what it needs while finding more than to not ingest enough.
- If needed and possible, minimize water requirements by reducing activity.

Making and Keeping Water Safe

- **Non-potable water** that needs to be put into use will require treatment, usually meaning heat sanitization, chemical disinfection, filtration, or a combination of methods.

Making and Keeping Water Safe

- The most effective methods, in descending order of efficacy, for sanitizing water are distillation, boiling, chemical disinfection, and filtration.
  - Distillation is not likely practical except in extreme circumstances.
  - Heat is next best but has limitations.
  - Otherwise, consider chemicals, filtration, or better a combination of those two options.

Making and Keeping Water Safe

- Heat sterilization
  - Easiest and effective. Will kill *giardia* and *cryptosporidium*.
  - Uses fuel
  - Takes time
  - Best done in smaller batches for smaller needs
  - Usually recommended to boil for 3 to 5 minutes. EPA says 1 minute, FEMA says 10…
  - Some will steam off
  - Allow to cool before drinking!
  - Water will taste flat – You can aerate by pouring, agitation, etc. (This also helps stored water.)
  - At higher elevations (6000+ feet), boil a few minutes longer

Making and Keeping Water Safe

- Chlorination
  - Household bleach (sodium hypochlorite – plain, without soaps, scents, phosphates, color-safe features, etc.), commonly sold at 5.25% available chlorine
  - Dose = ½ teaspoon, or about 8 drops per gallon of clear water. Double dose for murky, turbid water. Let sit for 30 minutes. If no discernable chlorine odor, repeat with half a dose and let sit for another 15 minutes.
  - Pool liquid chlorine (not powders or solids), commonly sold at 10.3% available chlorine. Dose = half that of household bleach

Making and Keeping Water Safe

- Chlorination
  - Times need to be increased for **colder** water
  - Times need to be increased for **cloudy** water
  - Chlorine can be removed by heating the water (fast), repeatedly agitating or pouring from one clean container to another (medium), or by letting it stand exposed to air (slow).
  - Chlorine bleach loses potency over time. Minimize strength loss by storing in cool dark places, and minimizing agitation.
  - Store an eyedropper with your bleach supply.

Making and Keeping Water Safe

- Iodine treatment
  - Available from camping/backpacking supply stores.
  - Taste (many people can't handle the taste)
  - Flavoring additives (can disguise the taste)
  - Health (can cause problems with infants, pregnant or nursing mothers, those with thyroid problems)
  - Dose (commonly 12 drops of 2% strength product per gallon of water)
  - Has medicinal applications

Making and Keeping Water Safe

- Filters and Purifiers
  - **Filters** remove suspended particulates
  - **Purifiers** filter, and also add chlorine or iodine
  - Likely only necessary for contaminated water, and in conjunction with chemical treatment or boiling

Making and Keeping Water Safe

- Filters and Purifiers
  - Micron ranges of common pathogens (things that can make you sick):
    - 1-3 microns (viruses)
    - 3 to 5 microns (bacteria)
    - 6 to 9 microns (protozoa)
  - Protozoa are hardest to kill with chlorine, so 1 micron filtration plus chlorination is a good system.
  - Micron ranges of common filters
    - Backpacking filters commonly filter to around 0.5 to 1 micron
    - Filters need to be cleaned, changed, serviced according to manufacturer's instructions

Making and Keeping Water Safe

- Removal of suspended particulates increases effectiveness of chemical treatment.
- Emergency filters can be made with layers of paper towel, paper coffee filters, layered cloth, etc. This may be a good practice before chlorinating in emergencies.

Making and Keeping Water Safe

- Of course, after all is said and done, it is always better to store ahead of time the good, sanitary water flowing from your faucet than to have to prepare non-potable water in emergency situations!

Storing the Water

- Plastic water containers are semi-permeable, so store water away from anything with a strong odor, especially including petroleum products such as gasoline or kerosene, pesticides, etc.
- Algae and other life processes usually require or thrive in sunlight, so use opaque containers and keep them in as dark a location as practical.

Storing the Water

- Cool dry place
- Away from environmental contaminants or anything with a strong odor
- Away from sunlight
- Where it can be used
- Where weight is supported (ca. 8 1/3 pounds per gallon)

A Few Notes on Emergency Water Issues

- In emergency situations, you may need to take extra water-related steps in addition to your stored water.
- Here are a few notes for your consideration:

A Few Notes on Emergency Water Issues

- **Potable Water** – If there is any danger of source water contamination (reports of broken sewage or water lines, problems at the treatment plant, etc.), shut off the home water supply.
- Do you know how?

A Few Notes on Emergency Water Issues

- If water supplies may become interrupted, fill all sinks, tubs, water coolers, buckets, etc.

A Few Notes on Emergency Water Issues

- After the water supply is turned off, opening the highest faucet in the house to let air in allows the lowest faucet in the house to be used to drain the water home piping for your use.

A Few Notes on Emergency Water Issues

- It is a good idea to store some potable water in your car trunk. But realize that heat can promote algae growth, so keep it in the dark and rotate it regularly.

A Few Notes on Emergency Water Issues

- Hot water heaters contain heated, potable water.
- Insulate them to reduce heating costs and to keep the water warm longer in water emergencies.
- If earthquakes are an issue, secure the heater to a wall with metal straps.

A Few Notes on Emergency Water Issues

- Turn off water to the house as soon as a water source emergency is known.
- Then turn off the gas/electric to the heater.
- The drain valve can then be used as a hot water source.
- You may need to open a higher part of the plumbing to relieve vacuum, and to preserve the heat in the water you may want to turn off the supply valve to the heater.
- Do not restart the gas/electric until the valves are all restored to normal positions and the tank is refilled.

A Few Notes on Emergency Water Issues

- As a side issue, water heaters should be drained and refilled on a scheduled basis, every six months to a year. This removes settled precipitates from the bottom of the heater, making the water cleaner and the heater more energy efficient. How long has it been since you drained and refilled yours?

A Few Notes on Emergency Water Issues

- If needed, toilet tanks (not bowls) are potable as long as no blueing, disinfectant, or other chemicals are present.

A Few Notes on Emergency Water Issues

- Storing water in the freezer (i.e., ICE!) makes it stable, safe, and helps keep the food frozen/cold longer if the power goes out! Just make sure to leave enough room for expansion in the container as the water freezes…
- (coin trick for diagnosing a thaw…)

A Few Notes on Emergency Water Issues

- **Non-potable Water** – Pools, spas, waterbeds, rain-catch barrels, etc… are all water sources, but each with its own cautions.

A Few Notes on Emergency Water Issues

- ***Pools and spas*** can be vast reservoirs of emergency water.
- Keep in mind that they may contain disinfection by-products, trace heavy metals such as copper or iron, and built up salts that make them usable, but not perfect.
- Proper filtration and chemical balance make the pool not only nicer to swim in, but better for emergency water use.
- This water is best used for non-potable uses, but if properly chlorinated and filtered it is a viable backup to your regular potable storage.

A Few Notes on Emergency Water Issues

- Consider draining and refilling stand-alone spas at least twice a year, and partially draining (perhaps a few feet) of water annually from pools and refilling with fresh tap water to dilute built up solubles.
- Drained or backwashed pool water may be used for most grass and non-flowering plant irrigation.

A Few Notes on Emergency Water Issues

- ***Waterbeds*** may contain up to a few hundred gallons of water in non-food grade plastic.
- Some contain added algaecides that can be toxic.

A Few Notes on Emergency Water Issues

- If you want to use waterbed mattresses that have not previously contained algaecides as storage vessels, drain and refill annually, and add 2 ounces of non-detergent, unscented household bleach per 120 gallons.
- Do not add algaecides or other additives.
- Boil water before use.
- Best for non-drinking uses.

A Few Notes on Emergency Water Issues

- ***Rainwater harvesting barrels or cisterns*** left under home eaves can be an excellent source of both irrigation water and also emergency water.
- Boil or chemically treat, and possibly filter before using for drinking or food preparation.

A Few Notes on Emergency Water Issues

- ***Surface water (from washes, ponds, etc.)*** should be treated, and filtered if needed before use.
- Do not use if it smells or looks bad.
- Treat ***floodwater*** as potentially contaminated with gas or other harmful chemicals and do not use it for drinking or food preparation even with chemical or filtration treatment.

A Few Notes on Emergency Water Issues

- Freeze/thaw cycles (rare but not entirely unheard of in Tucson) can burst weaker containers.
- Do not overfill containers, and store them in locations less likely to freeze.
- Repetitive freeze/thaw can precipitate calcium (a white film on the water). This is harmless… and removing it actually softens the water!

The children of Israel were worried that they might die of thirst in the wilderness of Sinai.

Moses, by his word according to the power of God which was in him, smote the rock, and there came forth water, that the children of Israel might quench their thirst.

1 Nephi 17:29

if ye are prepared ye shall not fear

Doctrine and Covenants 38:30