




Water Survival Skills

WHAT DO YOU DO WHEN THE WATER STOPS FLOWING?



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Hello everyone, welcome and good health! I'm Bill Hall.

Last year, we did a presentation on Water, Sanitation and Hygiene – the WASH program, and it seems to have made a splash – lots of feedback, questions, and thousands of views of our YouTube video.

After watching 2021's many disasters around the country, and reading about perennial droughts globally, we've done additional research on preparedness topics, done some testing of our local sources, and we've decided to revisit the topic of WATER tonight.

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A reminder: This program is brought to you by Cedar Hills Ready! Quake Up! Our mission is to create caring, connected, and resilient neighborhoods. We are committed to making sure every neighbor is prepared and has the best chance of survival in the event of a disaster.


I want to thank the Cedar Hills Ready team who worked on creating this program, and who continue to devote hours weekly to helping neighbors get prepared. This is a knowledgeable group of volunteers who are experienced planners and activists, who would love any new members who are interested in joining our efforts.



I wanted to show our calendar of events for 2022 briefly, and let you know that it is available on our website if you want to check it out in detail.

You will see that along with a couple of in-person workshops, one in June on the water filter system that we'll talk about tonight, and our April meeting on the Neighborhood Ready! program, we are very much focused this year on covering our Cedar Hills community with Neighborhood Ready! gatherings, street by street. This FEMA-sponsored program is the most important thing we can do to get our neighborhoods ready for mutually supportive plans in the event of major disasters. We'll be doing both ZOOM and in-person gatherings, and if you are interested in this program, please contact us at info.cedarhillsready@gmail.com.

Because you've signed up for this meeting, you'll be getting follow-up email notifications for upcoming meetings and tips about things you can do to get ready now! You can cancel this newsletter at anytime.



AGENDA

- 7:00 PM – Introduction & Welcome
- 7:10 PM – Why Water?
 - Our vulnerabilities
 - How much water?
- 7:20 PM – What to Do
 - Plan A – Store Emergency Water
 - Plan B – Acquire & Treat Water
 - Plan C – Test the Strategy
- 7:50 PM – Question & Answer
- 8:00 PM – Meeting Adjourns

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Tonight! Of all the preparedness topics we have covered, Water is the by far the most important, highest priority for surviving in an extended emergency or disaster situation. It is also one that has generated an awful lot of questions about how much water, how to do it safely, when, where to store water, etc. Tonight, these are the topics we want to focus on.

First, a review:

1. Your body requires a constant intake of water in one form or another in order to replenish and stay healthy. Human bodies are 65-70% water, and if you fail to sustain this ratio, you get dehydrated, and sick. Fairly quickly, your body starts shutting down critical organs, and you can die. You can survive a couple of weeks without food, but not without water.
2. In our culture, we are used to consuming incredible amounts of inexpensive water; even in areas in drought; this is what we are comfortable with, are used to, and a sudden change will be frightening if and when it happens.
3. In the kinds of disasters we are planning for, our urban supply of water is likely to be severely disrupted, perhaps for an extended period of time. This threatens #1 – your need for a regular supply of clean water.
4. How much water do you personally, and your family need to survive, to stay healthy, to enable you to do the other things required to live? If you find yourself without water or a regular supply, what are your options?

This is what we will talk about today. At the end of the meeting, we'll have a Q&A session, which may go past 8 PM if you want to stay.



Our Vulnerabilities

DISASTERS & INFRASTRUCTURE DAMAGE

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Okay, a preamble. So, what's the big deal? Why do we think of this as such a priority for *our* community. Why now?

Let's talk a little about our vulnerabilities, first.

Infrastructure

Water & Sewer Lines Together



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Much of it is hidden. We don't pay much attention to how we get water. Just call the water district, and they hook us up to the system.

What we don't think about is that, the development of our urban communities have taken place . . . well, like this picture shows. Water and sewer lines have for the most part been installed underground, and typically in the same trench or tunnel. Then, covered up. In a large earthquake, this can be a major vulnerability. If both of these pipes break underground, there will be cross-contamination and you won't have clean drinking water until it is fixed everywhere.

Cross Contamination Risk



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This picture shows what can happen. This is an actual shot of what was found after an earthquake in San Fernando in 1971. Notice the red arrows – there were breaks in both water and sewer pipes in the same tunnel. This invites cross-contamination of these two systems, and the water from your tap is no longer safe to drink when this happens.

Because of this vulnerability, our emergency response agencies and utility companies recommend that you shut off your water main in your house in order to prevent contaminated water from getting into your system, and to protect the water already in the pipes of your house from running out when they turn off the pressure.

Water systems can be disrupted by earthquakes, hard freezes, by major floods. Think about Texas two years ago. No electricity or water for more than a week.

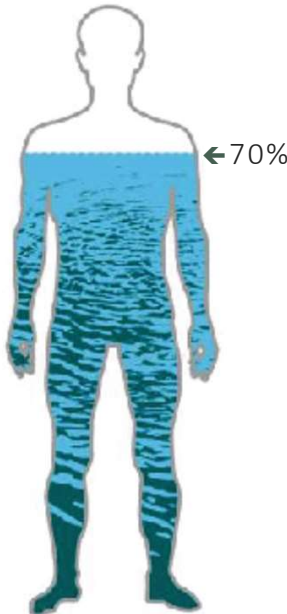
These kinds of events are happening more frequently. If one hits Oregon, what does it mean for us at the neighborhood level?

Risk from Cascadia Subduction Zone Quake

Critical Service	Zone	Estimated Time to Restore
Electricity	Valley	1 to 3 months
Electricity	Coast	3 to 6 months
Police and Fire Stations	Valley	2 to 4 months
Drinking Water and Sewer	Valley	1 month to 1 year
Drinking Water and Sewer	Coast	1 to 3 years
Top-priority highways (partial restoration)	Valley	6 to 12 months
Healthcare facilities	Valley	18 months
Healthcare facilities	Coast	3 years

In a major earthquake, like the overdue Cascadia Subduction quake, how long could the water systems be disrupted and shut down? This slide comes from a joint study of our emergency response agencies a few years ago, and shows the estimated time to restore basic services after the expected big quake.

- Cascadia is likely to be an 8-9 level seismic event which will last anywhere from 3 to 5 minutes, shaking and rolling the level ground, splitting roads, collapsing buildings and violently smashing and breaking apart utility supply systems like water.
- You can see here, roads, electricity and healthcare facilities will be severely impacted for a long time as well.
- Today, let's focus on just the water supply. They are predicting that for at least a month to anywhere up to a year, you won't have access to functioning toilets and faucets in your home. That's a long time!
- Now, We should understand how our utility companies and emergency management agencies plan to restore services, and we have a representative of the Tualatin Valley Water District on our line tonight to answer questions you may have about water supply system plans after this presentation.
- But I can summarize, after having contacted all of our emergency planning agencies – city, county utility and state: ALL of them say that while there is coordinated planning going on in each of these agencies, it is clear that there are no neighborhood level distribution plans in place for major disasters like this.
- It's really hard to predict what our transportation infrastructure will look like in the event of a major earthquake, fire or flood. So, every one of these agencies has told us, it is imperative that people be prepared themselves to manage their own family's survival.
- Their bottomline advice to us is that if a scenario like the Cascadia Quake happens, you and your neighbors are very likely to be on your own for water supply for a long time. They all strongly recommend that you, me, all of us, keep a minimum of 2 weeks supply of drinking water available for emergency use at all times.



← 70%

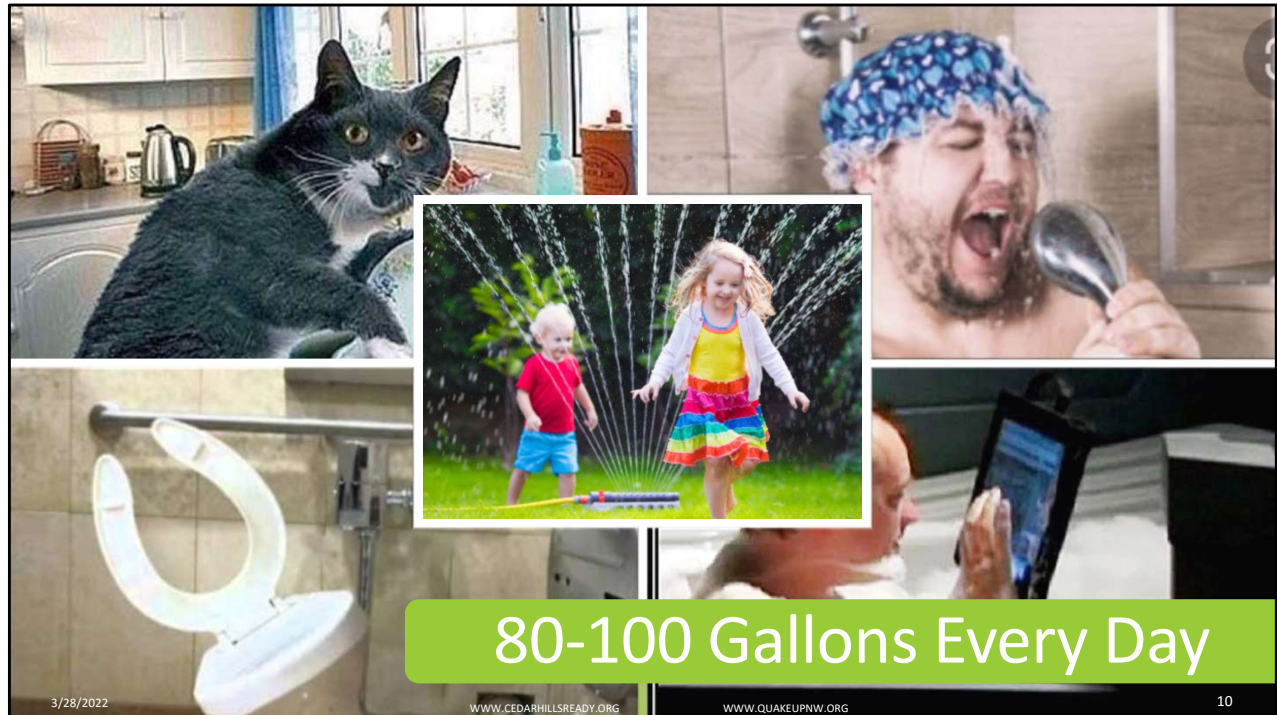
How much H₂O to store?

HOW MUCH DO WE TYPICALLY USE?

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Okay, let's take a breath. We want to be ready, We want to plan ahead. It can feel overwhelming, so let's bring it down to earth and do some practical planning. Let's start by quantifying the need, and then figure out how much water YOU and your family need.

I have some fun, and startling, facts which might help explain why it feels overwhelming.



You remember I said that we in the United States consume “incredible amounts of inexpensive water?”

The United States Geological Survey says Americans use 80-100 gallons of water per day per person. According to the National Environmental Education Foundation, the average Oregon resident uses 113 gallons of water per day, not counting watering the yard.

Hard to believe? I checked my water & sewer bill. It’s actually true. And, according to our utility companies, most of that 100 gallons per day per person is heavy use of the toilet and showers & baths. Hmm. Must be really clean! We take it all for granted. We don’t think much about where the water is coming from, or where it goes after we use it. It runs through our faucets and showers and toilets at a prodigious rate and it’s hard to picture my personally saving 2 weeks worth of water at 100 gallons a day in one place. 100 gallons times 14 . . . That’s 1400 gallons in my garage . . . I would have my own flood!

So let’s break down our real needs and do some more workable water math . . .

The infographic is enclosed in a black border. On the left, three circular icons are stacked vertically: a person drinking, hands being washed, and a pot on a stove. To the right of each icon are four small glass icons representing cups. A large green bracket on the right side of these icons points towards the main text. The main text reads 'How much water Do you need to survive?' followed by '1 gallon per person & pet every day' in large blue font. To the right of '1 gallon' is an icon of a one-gallon jug. Below the main text are silhouettes of a person and a dog.

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How much water you REALLY NEED to live, not necessarily what you are using in our society today. Think survival. Think of what the Ukrainians are having to struggle with. The U.S. National Academies of Sciences, Engineering, and Medicine has determined that people need a minimum of ONE GALLON of water per person and pet per day to stay healthy. About half of that is for drinking, in one form or another; the rest is for washing and cooking, both vital for good health.

That's a lot less than 100 gallons, but it's a bare minimum for staying healthy. A gallon per day per person. And don't forget Rover & Kitty.

We want to pause at this point and give the audience participants a chance to think about how this applies to each of you. How much do YOU think you really need? How many pots of pasta do you cook a week? How much coffee or tea? Let's take a few minutes to think about this. Write down what you and your family would need for an extended emergency – say, two weeks, or a month. Survival amounts. Keeping in mind no toilets, no faucets . . .

Give us some numbers in the chat and we'll share. (PAUSE 2 MINUTES)

OKAY, KAREN, WHAT ARE SOME OF THE IDEAS WE ARE GETTING FROM PEOPLE?

Emergency Water Math

This is conservative: 1 gallon of water per day

4 each person and pet in your home

4 x 14 days = 56 gallons

add 4 batches of rice or noodles you cook

Put 60 gallons on your calendar or shop list now.

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Okay, let's use the FEMA and our emergency response agency requirement of a 2 week supply of drinkable water stored for emergencies.

Here's how you calculate the number of gallons of water you'll need in a major disaster. Take a photo of this page so you can do this for your family, and put water on your TO DO LIST for tomorrow.

- So lets' do the math. I'll use a family of 4 as an example.
- Multiply 4 x 14 days, and we get 56 gallons of water.
- Maybe your family likes pasta, so I'll estimate 4 batches of rice and noodles over two weeks plus some extra for pets, in addition to the basic gallon per person.
- That makes a total of 60 gallons of water you'll need to store.
- Okay, that's a number most of us can work with! It's still a lot of water, but it's not going to sink the house.
- 60 Gallons. Minimum!



PLAN A

Acquire & Store Emergency Water

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But let's not get complacent. Even 60 gallons is a storage challenge. But, remember that, When a disaster hits, you are not in a planning mode. You're in the thick of it, taking care of family and home. It's highly unlikely you'll be able to drive to the store to get your 30 or 60 gallons; fire hydrants will be shut off; and your neighbors will be in the same boat (sorry about the pun) and probably won't have enough for both their family and yours.

So, PLAN A FOR YOUR FAMILY:

Emergency Plan A should be to have enough potable water stored so that you can take care of yourself and your family while you are in the throes of the early stages of a disaster, so you won't have to worry about "where the heck are we going to get water to drink, to cook with?" while you are taking care of your family and adjusting to big changes in everything else.

Most Important: Start saving water!

		
	For a family of 4: 12 bottles, 5-gallons ea	For a family of 4: 20 cases, 16 oz bottles

1 gallon per person/pet per day for 2 weeks

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Okay. Plan A: How do you store 60 gallons of drinking water? Well, already safe water can come in three forms:

1. Pre-bottled water:
 - You can buy cases of bottled water at the grocery store. A case of bottled water is about 3 gallons, and costs around \$6.00. It would take 20 of these cases to store 60 gallons.
 - You can also buy pre-bottled water in larger containers. Costco has 5 gallon bottled water for \$10-12. This would mean around \$100 for 60 gallons, and you would need 10-11 of these to store that much. Can you lift 40 lbs? That's how much these handsome jugs weigh.
 - Note that plastic containers should not be stored directly on concrete or on the ground. Concrete attracts fluids and 'bleeds.' Any chemicals in have been on that concrete could find its way into your plastic water containers, including hazardous materials like gasoline or oils. It's usually not enough to make it toxic, but it will taint the water enough to make the taste unbearable. And no amount of pouring it from container to container will take that taste away. So, put cardboard or wood or a tarp between jugs and floor.
 - How long does Pre-bottled water last? It can be used indefinitely if stored properly, but the recommended shelf-life of bottled water is **no more than two years for non-carbonated water, and one year for sparkling water.**

Storing Tap Water

Family of 4 (~60 gallons)

Don't store H₂O in old milk jugs!





18 Jugs, 3.5 gallon ea



12 Jugs, 5 gallons ea



1 Barrel, 55 gallons

<https://www.survivopedia.com/8-tips-for-reusing-containers-for-water-storage/>

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2. Can you store water if you don't want to buy it?

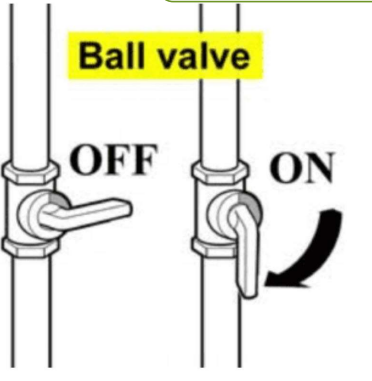


- You can store water from your tap at home in a variety of food-safe jug sizes. It's not particularly safe to use jugs and bottles that previously had milk or juice in them, because the lids are not robust, and bacteria can grow pretty quickly in these, even if you clean them. [Some juice jugs might be okay; you should research the type of plastic used; if it is PET, you should be okay. We'll have a Survivopedia article on our list of internet sites with details on this topic. See the link on this slide.]
- You can buy food-grade storage containers at the grocery store or places like REI, or on-line. They come in a variety of shapes and sizes. We were able to get stackable 3.5 and 5 gallon bricks for around \$15 - \$30 each. The smaller bricks are easier to pick up (weigh about 25 to 30 lbs) and can be stored under beds and other tight locations. Again, you would need 18 3.5-gallon jugs OR 12 5-gallon jugs to store 2 weeks of water for a family of 4.
- We also bought food grade 55 gallon barrels, cleaned and disinfected them, and store them outside, covered on a wooden pallet, out of the sun. One of these would hold a 2-week supply of water for a family of four. This is an efficient way to store water, but keep in mind that when full, these weigh nearly 500 lbs, so you will want to get the barrel located and secured before filling it. You should also only use food-grade hoses if you fill them outside – garden hose water isn't safe and doesn't taste very good. [We have a paper on how to clean and store water in 55 gallon barrels that's available on our website.]
- When filling containers with tap water that you plan to store for a long time, you need to be careful to disinfect hose bibs, faucets, spigots and anything that touches the water you are

putting into your containers. Use bleach or rubbing alcohol for this.

- To clean the containers themselves, rinse with bleach, let dry. Disinfect the lids. Then add water, and unscented bleach to preserve the water. (The amount of bleach you use depends on the volume of water.)
- And just in case, remember that stored tap water should be recycled once or twice a year just in case there has been bacterial growth. So date them, and use the recycled water on the garden or to wash the car, and then re-disinfect and re-fill your containers. Even if you don't do this on a regular schedule, this water will be easier to treat and make drinkable than water in the outside environment.

After a Disaster

Preserve the Water You Have

 <p>Ball valve</p> <p>OFF ON</p>		
Shut off water main	Fill up tub	Drain the H ₂ O Heater*

*RegionalH2O.org video: <https://www.regionalh2o.org/emergency-preparedness/emergency-water-sources>

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3. A third possible source of clean water after a disaster is the municipal water already in your pipes, bathtub, and hot water heater once you have shut off the water main. These can be captured at the time of the disaster, if you get your water main turned off and learn how to access that water.

In a disaster like an earthquake that may contaminate your water supply:

- 1) Shut off you water main to protect the water already in your house from cross contamination.
- 2) Once you have done that, the water in your pipes should be safe. You can access it from the lowest point in the house.
- 3) Some people buy a WaterBob or some kind of bladder that you can use to line the tub for water storage. It's a good quantity of water, but it's not clear how much time you have to fill it up before you turn off the water main. You can find Water Bob on the SurvivalCache site, included on our list of websites.
- 4) If you have a tank water heater, you can count this water as part of your emergency water supply, typically between 30 to 50 gallons of water. You'll want to make sure you have a food grade hose and bucket. It's also good idea to drain your water from your tank annually to reduce sediment from the water. This practice is good for other reasons, including preserving the lifetime of your water heater and getting practice on draining the water tank, which could come in handy in a disaster. Sediments can build up in your water heater, in an emergency, you may want to filter this water.
- 5) Do not use water from your swimming pool or hot tub, as these have a strong mix of chemicals that can be toxic. A swallow won't hurt you, but drinking any quantity of this water can be dangerous.

RegionalH2O.org has a webpage on how to find water in your house, and a great video on how to drain your tank to get the water: <https://www.regionalh2o.org/emergency-preparedness/emergency-water-sources>



Other Sources of Water You Have

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There are smaller sources of liquid if you are in dire need – ice cubes made from uncontaminated water, commercially bottled beverages and canned fruits.

Two notes:

1. don't consume any beverages or canned food from containers that have been submerged in floodwater. You never know where a flood has been.
2. Be aware that caffeinated and alcoholic drinks can cause dehydration, so drinking them will just make you need more water.




Okay, PLAN A: you can acquire the water, and now you have to decide where to store all that water.

- It's best to store emergency water in cool, dark places. You can store water under beds, in closets and in the trunk of your car, in addition to the garage and yard if shaded from the sun.
- Keep your clean emergency water away from any toxic chemicals, like household cleaners. And don't put your water up on shelves if you can avoid it, because a big quake just might toss them off and burst your containers on the floor.
- As mentioned before, it is not a good idea to store plastic containers on a concrete floor, because there can be a chemical reaction over time between the plastic and the concrete, so if you store your containers in the garage, you need something underneath those containers so they don't touch the concrete.
- If you store your water outside, be sure to elevate it off the ground, on a pallet for example. Store it in the shade, or under a tarp in a secure area. That's what we are doing with the 55 gallon barrels I mentioned earlier.
- Remember that it's possible to introduce contaminants like bacteria when you are filling and re-filling tapwater storage containers, so you need to make sure all hoses, lids and spigots are cleaned with alcohol or bleach when you are going to fill them up again.

So, that's Plan A. It's the most important, highest priority preparedness action you can take today. You don't have to do it all at once. Get started. Buy a case of water tomorrow, and another one each week at the grocery store. Order a couple of food-grade containers and figure out where to store them, then change your mind when they arrive.

Don't let the challenge or inconvenience of getting started mean you are caught flat footed without emergency water supplies when disaster suddenly hits! That's PLAN A!



PLAN B

Acquiring & Treating Outside Water

WHAT TO DO IF YOU RUN OUT OF EMERGENCY WATER SUPPLIES

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[1 min]

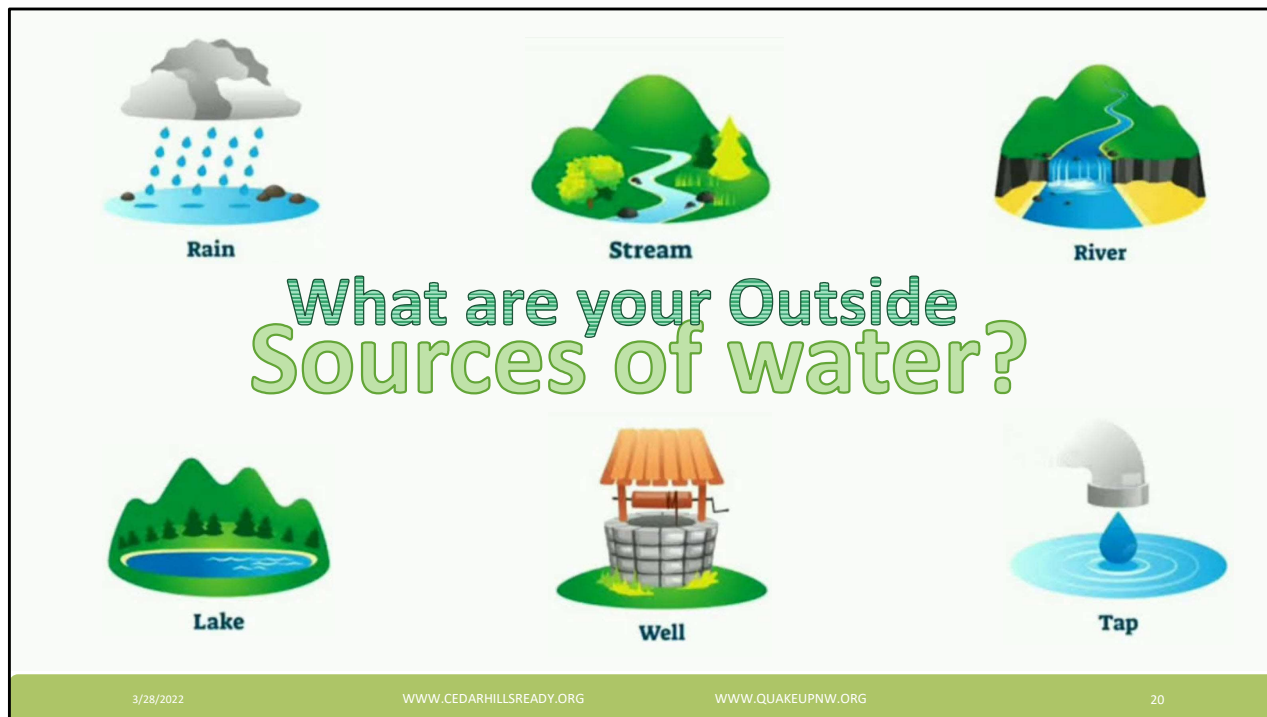
Well, nobody's perfect, and as Mike Tyson said, everybody has a plan until they get punched in the mouth. I believe in always having PLAN B, just in case.

What happens if disaster hits and you haven't stored enough water, or the shutdown goes on past your two-week supply? It's a good idea to have a PLAN B.

If you're out of drinkable water, and the system is still down and the national guard isn't distributing water to neighborhoods, and the family is thirsty. . . . At that point, you may need to look outside your own resources and get water that is available outside your home. PLAN B is knowing where to find it, how to acquire it, and how to treat the water to make it safe to drink.

Obviously, you should be listening to radio and social media to see if and when government agencies are going to be delivering water to the neighborhood or community and have those storage containers ready for collecting it at distribution stations if they are available.

But, if there are no emergency delivery sites, where do you look for water?



You may have some ideas. Let's gather some quick thoughts on CHAT to share – in a dire situation like I described, where would you go for an adequate supply of water for your family – remember, a gallon a day per person.

Again, let's pause the presentation and let our audience use their imaginations. Use the chat function to tell us some of the sources you think might work if the worst happens. (PAUSE 2 MINUTES)

Okay, good ideas. Let's break these down. . .

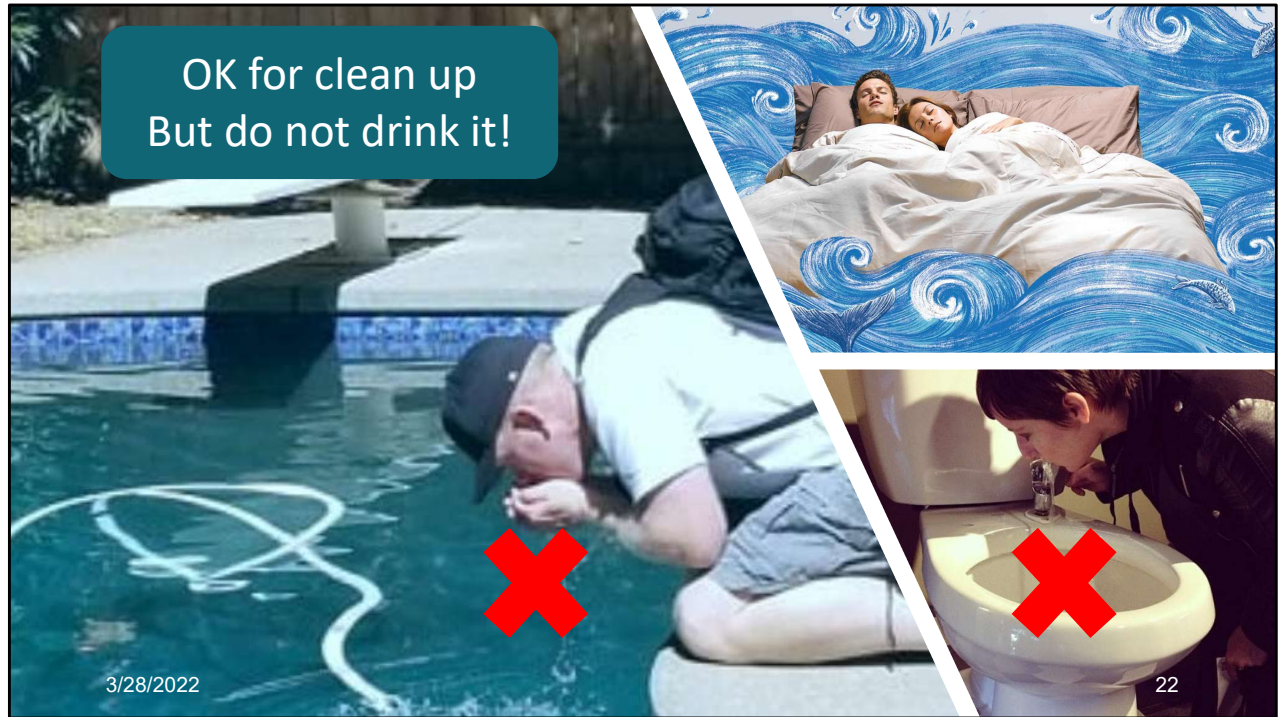


Let's start with water sources you should avoid.

Do NOT drink or use for sanitation:

- Flood water
- Water that has floating materials in it or that has an unusual odor or color
- Water that you know or suspect might be contaminated with fuel, heavy metals, or toxic chemicals
- If you suspect or know the water is contaminated, it cannot be made safe, so a different source of water needs to be found.
- Stay away from and don't come in contact with water that:
 - Smells bad
 - Looks discolored
 - Has foam, scum, algal mats, or paint-like streaks on the surface
 - Has dead fish or other animals washed up on its shore or beach

Plan now: know where you will go for water if this situation happens in your neighborhood.



You might be tempted to think of your hot tub or pool as a source for drinking water, but it's not a good idea because the chemicals, human skin cells and other contaminants in this water make it unsafe for consumption. This also goes for the water in your toilet tank, water feature, or waterbed. These sources are ok for sanitation, such as flushing toilets or washing dishes, but not for drinking.



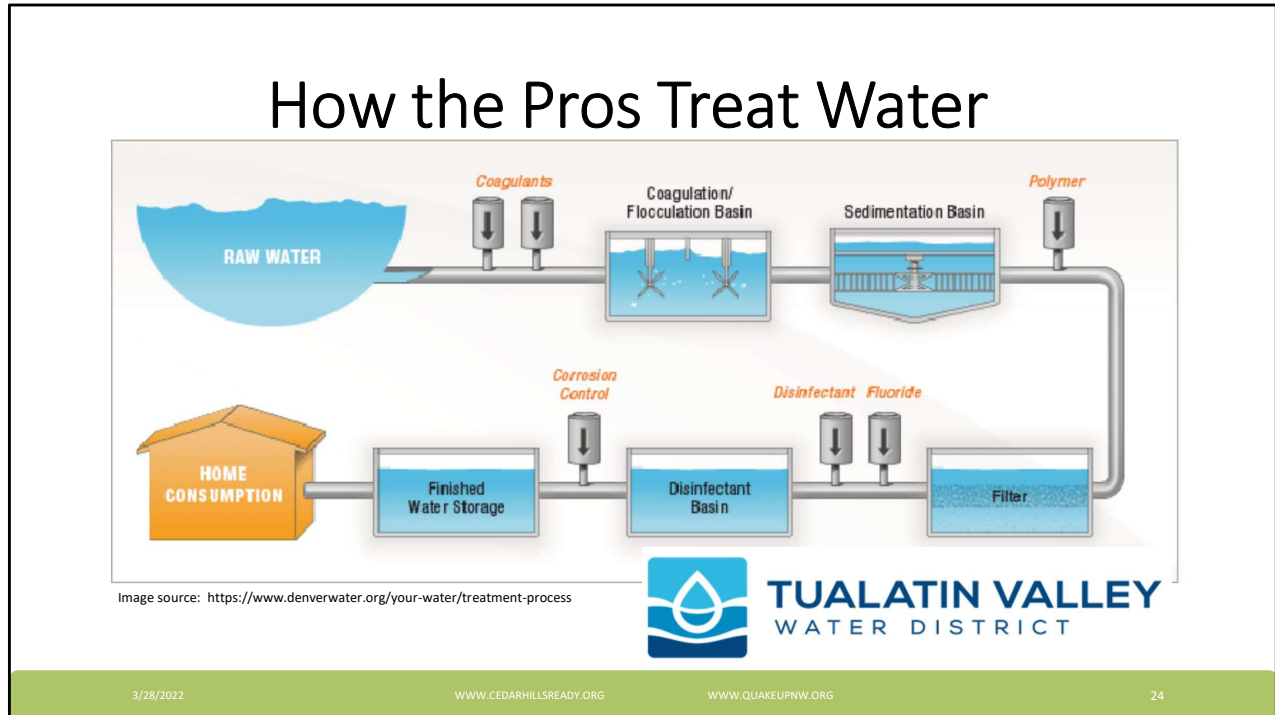
There are really only three sources of water for survival other than what you've already got stored. All these sources of water will require treating before drinking:

- Rain: You can install rain barrels for a good source of free water. But if it comes from your roof, it's going to need treatment to make it safe to drink. We have a video on how to create a rain barrel catchment device that you can check out; it is included on the handout we sent to you. [CHR rain barrel video: <https://www.youtube.com/watch?v=rkz3RJ70xts>]
- Lakes & Ponds: We have Commonwealth Lake and lots of ponds in our area. Limited by the guidelines already mentioned, these can be sources of water to be treated to make them drinkable.
- Streams: We have a number of streams and creeks in the Beaverton area, which vary in volume as weather changes. Johnson Creek and Beaverton Creek are running pretty full right now. Experts indicate that running water is always a better bet than stagnant water as sources of raw water. But local streams are not safe to drink without significant treatment.

Water water everywhere and not a drop to drink? A ton of dirty water, so once you know where it is and how you can acquire it, how do treat this water to make it safe to drink? And after you treat it, how do you know if it really safe and ready for the family to drink? Well, we've been studying that and have some information to share.

Now, I'm going to turn this over to my partner, Karen Ronning-Hall, to talk about treating water, and describe OUR attempts to turn water from Johnson Creek into potable water.

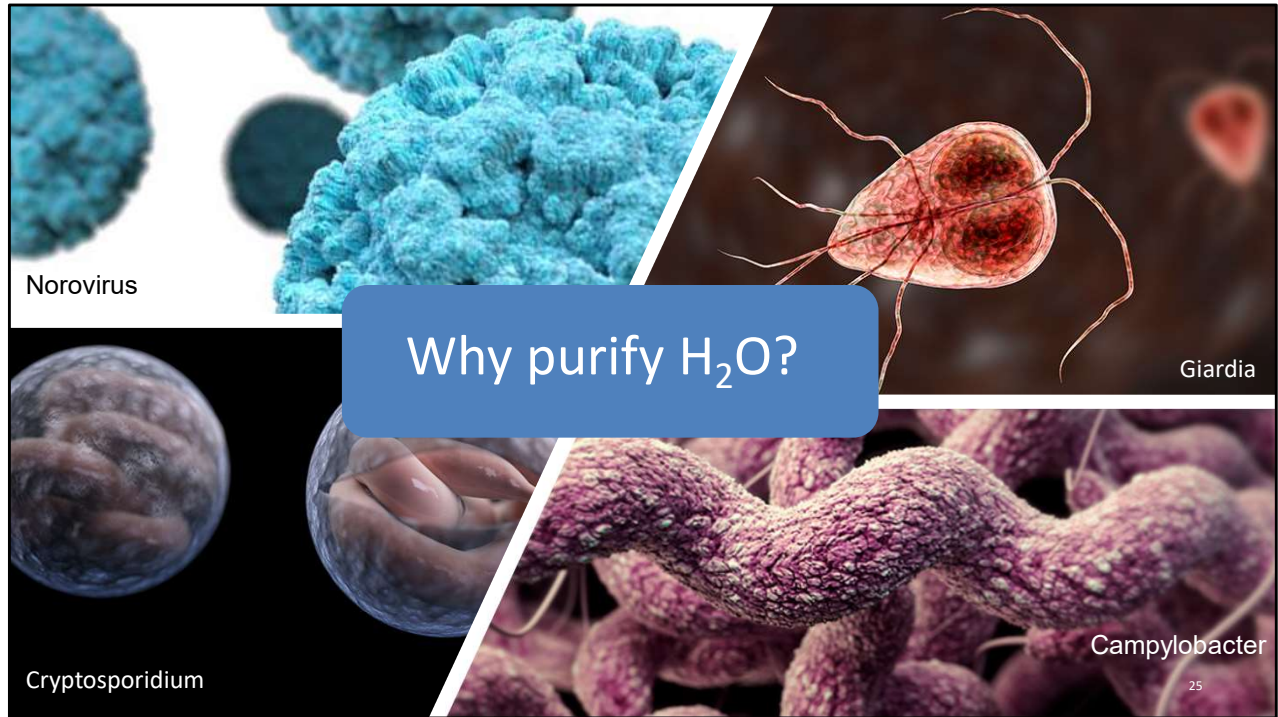
Karen, I'll stop my screen sharing and give the reins to you.



Thank you, Bill.

Where do we start with making water drinkable? You've seen water in Commonwealth Lake, and in the local streams. It's not something anyone should consume in its raw state. So, what does treating water mean? This chart shows how the professionals treat our water. It includes multiple steps. They remove the big stuff in the early stages, then they filter out the smaller stuff, and finally, they disinfect the water to kill the microscopic bad bugs that slip through the filters. We will have to learn how to replicate these three steps to make water potable. It's actually not as complicated as it sounds. But you need some tools and information about how to do it.


Image source: <https://www.denverwater.org/your-water/treatment-process>




Just to emphasize: Water from the environment that looks clean, even after filtering, is not necessarily safe to drink. There are bad bugs—parasites, bacteria, and viruses—that you want to make sure to remove with filtration and disinfection. They look kind of cool in these lovely microscopic photos and they even have catchy names, but you don't want these bad actors in your water – or in your body. They will make you very sick. If you get sick, you'll need to drink more water—which is not good when access to clean water is limited. This photo shows you 4 of the most common waterborne pathogens in our water systems. These biological contaminants need treatment beyond filtering; because of their microscopic size, many will slip right through many filters, even the top rated microfilters. Thus, disinfection is important.

Make Water Safe During an Emergency


1 FILTER
To remove parasites & inorganic impurities




2 DISINFECT
To kill disease causing organisms.
Most common methods include:




Add bleach to water.
(1/8 tsp/gal H₂O)



Mix well.



Boil for 1-3 minutes



Wait at least 30 minutes before using.

Source: <https://www.cdc.gov/healthywater/emergency/making-water-safe.html>

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So, we need to use a combination of methods to make raw water safe to drink. Two steps are really important:

1. Filtration gets rid of the big stuff, and most of the smaller stuff, such as parasites and inorganic impurities – things like arsenic, nitrates and heavy metals.
2. Disinfection kills disease-causing bugs.

There are multiple methods for disinfection, with varying degrees of efficacy. Two of the simplest methods are shown above. If you have the fuel, boiling is the most effective way to kill all of bugs. Bleach kills most of the bugs, if used in the right quantities. For both methods, you want to combine with filtration.

The CDC has specific instructions on each of these methods on their website. We'll show you how we did it, later in this presentation.

See <https://www.cdc.gov/healthywater/emergency/making-water-safe.html>



Personal Water Filter Systems

Immediate emergency use for one person

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Let's talk about filtrations systems, starting with Personal Water Filter Systems

- If you run out of your water supplies and you are away from home, you'll need to collect water and treat it by filtering it through a micro-filter.
- Small, personal filters like the LIFE STRAW can be used in an emergency for one person. There are micro-filters available on the market which remove over 99% of contaminants. These can range in price from \$20 – \$70. Check REI, Dick's Cabellas, and lots of options on the internet.
- In a dire emergency, you can usually stick it into a stream and get a fairly quick drink, but we want to caution you on this. This way of consuming water is risky, and your stored supply of clean water will always be safer than personal filters.
- One word of caution: If you are using your personal water filter, don't let it freeze. Under freezing conditions, the water in the filter expands and renders the filter useless. A friend of mine says she puts her filter in her sleeping bag at night when she is backpacking in cold weather. Not as good as sleeping with the cat, but it saves her filter.
- These are great devices for camping and for your go-bag, but they aren't going to solve your family supply challenge.
- It's always a good idea to travel with a couple of gallons of emergency water in your car! Because it's always the safest water you'll have.



DYI Two-Bucket System

Large Capacity Filter Systems

Filtered water for the family

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There are larger capacity water filter systems that can serve a family's needs

- Some, like the ones on the left and right, cost a few hundred dollars, and will last for the duration of an extended outage; capacity depends on the one you buy. Berkey and Katadyn are trusted brands, and you can find these on the internet. We don't endorse any particular brands.
- The two-bucket DIY system shown in the middle picture here is a much less expensive alternative, and it is highly recommended by emergency services organizations. It includes a ceramic microfilter, shown here to the left of the bottom bucket, which is inserted inside for use. They are long-lasting – as much as a year, and several hundred uses before it needs replacement. And these filters can be cleaned somewhat if they are used over long period of time.

Whatever filtration system you use, we recommend that you purchase backup filters, in case one breaks. The ceramic ones can be fragile, and I've broken one by accidentally dropping it.

Not all filters are created equal

Small Pore Size = Better Filtration

The diagram illustrates the effectiveness of different filter pore sizes. Unfiltered water contains various pathogens: Bacteria (0.2 – 5 μm), Parasites (1 – 50 μm), and Viruses (0.2 - .02 μm). A filter with pores of <1 MICRON* allows only viruses to pass through, while a filter with pores of >1 MICRON* allows both bacteria and parasites to pass through. A filter with a 1 MICRON* pore size allows only viruses to pass through. A filter with pores of >1 MICRON* allows both bacteria and parasites to pass through. A 0.2 Micron (μm) Filter is highlighted as removing 99% of pathogens.

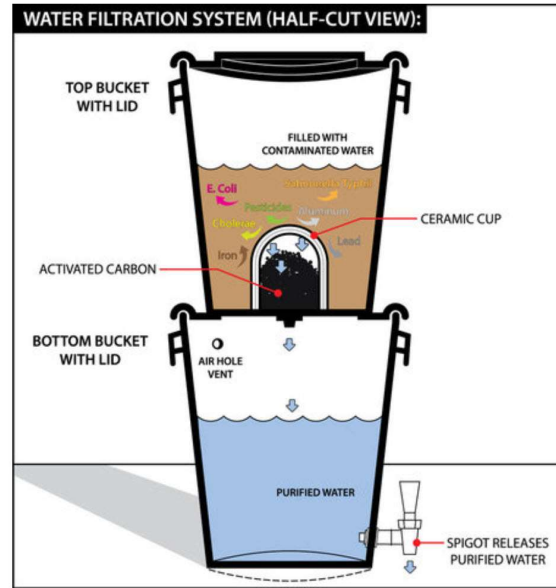
<https://www.cdc.gov/healthywater/drinking/home-water-treatment/water-filters.html>

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When shopping for a water filter, be aware that not all filters are created equal. Pay attention to the pore size. Think of a strainer or colander: The smaller the pores, the better the filter--the more contaminants the filter will remove. Look for a filter that has 0.2 micron pore size or smaller; it'll filter out 99% of the pathogens. As you can see, some viruses will slip right through. Thus, disinfection is recommended.

Check out that CDC website for more detailed explanation than we have time for here.
[Source: <https://www.cdc.gov/healthywater/drinking/home-water-treatment/water-filters.html>]

Homemade Two-Bucket Water Filtration System



Source image: <https://portlandprepares.org/author/susanronning/>

The TWO-BUCKET SYSTEM is worth spending a little bit of time on, because it's cheap, easy to assemble, and can generate 15 to 50 gallons of drinkable water a day if set up right. OUR direct experience is that the flow rate is a bit slower, more like a gallon per hour, but this is still plenty for a large family's needs for an extended period. All you need to do is keep the top bucket filled with water from your raw source.

Source image: <https://portlandprepares.org/author/susanronning/>

Building a 2-bucket filter system



How to build a 2-bucket water filtration system:
https://www.youtube.com/watch?v=XLyOd_2tFV0

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We will be holding a Saturday morning workshop on June 25th to demonstrate and help you assemble the two-bucket filtration system, and we'll sell the kits at our cost if you come to the workshop. We have an outdoor and indoor space and we'll get together and make filter kits, COVID permitting. The total cost of the filter system kit is about \$50, including the buckets with lids and a high-quality 0.2 micron ceramic filter. It's easy to assemble, and there are videos on how to do it, including one from us. If you want to attend the workshop, we'll be sending out registration forms in May.

https://www.youtube.com/watch?v=XLyOd_2tFV0

Tualatin River – Our first test



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Many emergency experts recommend the 2-bucket system. But, does this two-bucket system really work? We decided to put it to the test, using water from our local sources.

- In our first test, Barbara Bracken and her Tualatin Ready CERT group sampled water from the Tualatin River, in an area they envisioned would be their primary source of raw water in a disaster.
- They bottled the water after running it through the filter and sent to Alexin Analytical Labs, which is located in Tigard, for testing.
- The results showed that the filtration system was effective in removing nonbiological contaminants, (H'ray!) but it still showed some microscopic coliforms which meant the water still might not be safe to drink. (The presence of coliform bacteria in water means that there is a risk that pathogens also could be present in the water.)
- So, Tualatin Ready! repeated the test, but added a disinfection step to the filtered water.

Disinfection Guidelines 

DISINFECT
To kill disease causing organisms.

Add 8 drops or a little less than 1/8 of a teaspoon of 5%-6% unscented household bleach to 1 gallon water.
For cloudy tap water, use 16 drops or 1/4 teaspoon

Add bleach to water.
(1/8 tsp/gal H₂O)

Mix well.

Wait at least 30 minutes before using.

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- They chose the recommended method for large quantities of water, liquid bleach.
- They added 8 drops (1/8 of a teaspoon) of (5% - 6%) unscented household bleach to a gallon of the filtered water and sent a sample of that to the lab.
- Any time you use liquid bleach, be sure it is fresh (less than 6 months old) with no thickeners, additives, or scents.
- The problem with household bleach is that it has a shelf life of only 6 months. As time passes the chlorine level decreases and it is less effective. Frequent rotation is critical for bleach to be effective at killing pathogens.
- What happened?
- Big surprise. The test results came back showing the treated water *still* had some coliforms in it.
- This was puzzling, and disappointing. But, Defeat is NOT an option!
- We wanted to find out why Tualatin Ready! got these results and how we could do better.



What are other methods of disinfecting water? There are a number of different methods, and we'd be here all night if I went through everyone of them. Most import thing to remember is that you need to combine filtration and disinfection to get the purest water.

- The tried and true method is to boil water 1-3 minutes. We know that works, but it doesn't remove inorganics, so filtering first is important. The drawback of boiling over the long term is that it uses fuel you might need for cooking or heating. You are limited to quantities you can boil at a time.
- Another disinfection method, UV light from the sun, can kill bugs, too. The water has to be filtered first because the radiation needs to have a clear path to all of the water. The drawbacks are that it's weather dependent, and it takes 6-12 hours in the sun to be effective. There are UV FLASHLIGHTS, but they are small and can only be used on small amounts at a time. They also require electric power to run.
- Tincture of Iodine and campers' Iodine tablets can disinfect water at the right concentrations, but iodine is not always effective against parasites. If you combine it with filtration, this method can work.
- Finally, in addition to bleach, there are powdered or tablet chlorine treatment methods that can be effective – we are all familiar with it in our tap water, pools, hot tubs. The advantage of these treatment methods are that you can treat large amounts of water at once. Again, you need to micro-filter dirty water first to remove inorganic material from the raw water, and then disinfect it with the chlorine treatment. I'll talk more about this when I go through our testing procedure; we took a slight twist from the Tualatin Ready! approach.

What we learned

- Store lots of water
- Combine methods
 - Boiling
 - Water filtration
 - Disinfection
- Testing is a good idea.



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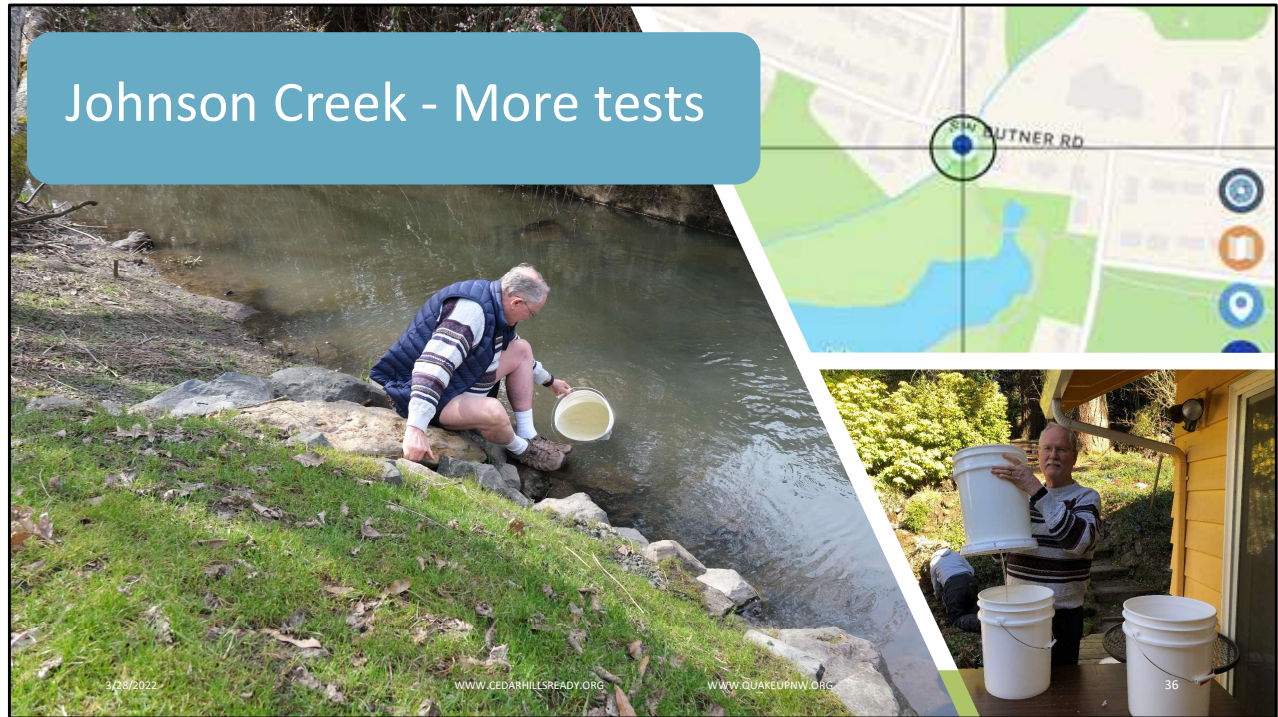
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Why didn't the combination of treatments that Tualatin CERT used work? Some possibilities:

- Bleach is known to kill some, but not all, types of disease-causing organisms that may be in the water.
- It's possible that the concentration of bleach used was not enough to kill the germs in the water. CDC guidelines suggest doubling the dosage, if the water is cloudy, murky, colored, or very cold. It's a judgment call. Maybe this water needed a higher concentration of bleach to kill everything. How could one know for sure!
- Perhaps the bleach was too old? Probably not, since Barbara had recently purchased the bleach. How long on the shelf? Who knows.
- Finally, it's also possible that Tualatin CERT may have collected water from an unusually polluted spot in the Tualatin River, downstream from agricultural areas. If that was the case, this collection spot couldn't be trusted as a water source for making potable water in an emergency.

What we learned from this initial experiment:


- Where you collect your raw water matters. Testing is a good idea to find out what works in your neighborhood.
- Effective water treatment requires several steps, and you may need to simply boil your water after treating it.
- This also emphasized the importance of PLAN A for us. Store lots of potable emergency water. After seeing these results, we went out and got ourselves a couple of 55-gallon barrels to store extra water. It's the cleanest water you'll have when trouble strikes!




We then decided to replicate water tests with water collected in Cedar Hills, to see if we got different results. We also decided to test a couple of additional treatment methods. This picture shows the first scene of what could have been an award-winning funniest home video, as Bill nearly fell into the creek going down the bank. In spite of the risks to Bill, we chose Johnson Creek over Commonwealth Lake as the source to test because experts tell us that moving water is a better source than stagnant water.

Three Treatment Methods

1 Filtration Alone




2 Filter + Disinfection



Calcium Hypochlorite

3 P&G Purifier of Water



Ferric Sulfate + Calcium Hypochlorite

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Besides testing raw water, the 3 treatment options we chose are shown on this slide. We'll discuss each of these in the next few slides. We sent samples to the same professional lab, Alexin Analytical, and we also ran tests using inexpensive kits you can purchase for home use.

1 Filtration Alone



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Our first method – our two-bucket filtration system alone (REFER TO THE PHOTOS DURING TALK)
This is a repeat of the first test that Barbara ran, except that we are using our source water from Johnson Creek instead of the Tualatin River.

1. We constructed our two-bucket gravity filtration system in about 30 minutes.
 - We added a tube to increase the water flow.
 - We pre-filtered the water through a terrycloth towel into the top bucket of the filtration system to remove visible particles before micro-filtering.
 - Pre-filtration extends the life of the filter. You can use other materials for this step, including clean cheese cloth, coffee filters or paper towels.
2. And then, we waited for the water to drip through the filter, from the top bucket into the lower bucket.
 - We clocked the rate at around a gallon per hour.
 - Before collecting our sample, we ran a gallon through the filter to flush out potential dust particles from the activated charcoal in the filter.

2 Filtration + Disinfection

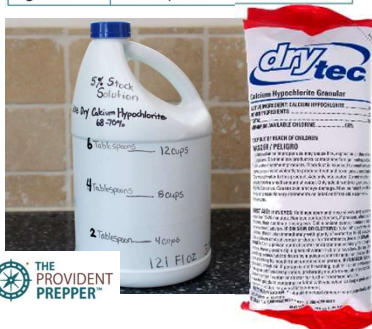
A) Pre-filter & filter H₂O



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B) Make Stock Chlorine Bleach (5%)

5 % Chlorine Stock Solution Recipe Homemade Liquid Bleach	
Water	Dry 68% Calcium Hypochlorite
1 cup	1 ½ teaspoon
1 quart	2 Tablespoon
2 quarts	4 Tablespoons
1 gallon	8 Tablespoons



THE PROVIDENT PREPPER

C) Add bleach to water to disinfect it

Chlorine Bleach - Water Disinfection

Amount of Water	Amount of Bleach	
	Clear Water	Cloudy or Questionable Water
1 quart	2 drops	4 drops
2 quarts	4 drops	8 drops
1 gallon	8 drops	16 drops
5 gallons	½ teaspoon	1 teaspoon



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Our second test sample is the filtration plus disinfection. This is similar to Barbara's second test, except we made up our own bleach solution. We used a chemical which is used to boost bleach levels in swimming pools and hot tubs.

- We chose to make up a fresh batch of bleach using calcium hypochlorite, commonly sold as "pool shock." You see here it's labeled "Dry-Tec."
- It's found in a powder or granulated form and has a usable shelf life up to 10 years, which is a huge advantage over liquid bleach.
- You just add water in the right quantity to make a fresh chlorine bleach solution.
- This is a powerful chemical. Be sure to handle and store this carefully. Follow manufacturers instructions.
- I wore a mask and eye protection for safety when mixing it up outside. I put it in a bag within a plastic container to keep it dry for storage.
- Just FYI, A homemade bleach stock solution weakens at a similar rate to household bleach, over a period of about 6 months. It is best to mix up fresh batches each time you treat a quantity of water with this method.

The Provident Prepper has a great blog on how to create a fresh homemade bleach solution with pool shock, calcium hypochlorite. They provide labels that you can download with solution tables. The link is: <https://the ProvidentPrepper.org/disinfecting-water-using-calcium-hypochlorite/>

3 Purifier of Water (PUR)*

Removes 99.9% common bacteria, protozoa, viruses



Pour
2.5 gallons



Stir
5 minutes



Settle
5 minutes



Filter
20 minutes



Purified water
30 minutes

Our third treatment method that we tested is the P&G, Purifier of Water packet, which was developed in collaboration with the CDC and the World Health Organization and is used widely in developing countries as a way to produce clean water. This packet includes powdered ferric sulfate, which causes inorganic solids and dissolved chemicals to clump and settle, which means we did not filter the water before using the packet in a bucket of raw water. After the clumping and settling, Calcium Hypochlorite disinfects the clear water. The World Health Organization classifies P&G Purifier of Water as providing comprehensive protection in that it: reduces kills bacteria, viruses and protozoa and removes metals and chemicals.

Following the Proctor and Gamble steps on the backside of the package, our process involved the steps shown on this slide. It took us about 30 minutes to get purified water. This was by far the simplest process we tried.



While Cedar Hills Ready! doesn't endorse any brand, I must admit that this method was easy, fast, and kind of fun. Instead of waiting for hours for the water to filter, PUR can treat 2.5 gallons of water in about 30 minutes. It's seriously fun to watch the coagulation process settle the solids to the bottom, turning yucky brown turbid water into clear water that can be decanted, as you can see on the slide. In the photos in # 4, 5 and six show the completely clear water that resulted from this treatment method.





Testing Protocol:

- The gold standard for testing water involves sending a sample to a qualified lab. We sent water samples taken after all three treatments to the lab in Tigard. The lab tests cost \$175 per set – for water coming out of the filter, and for the Proctor & Gamble process. The third test, of the filtered water treated with Calcium Hypochlorite, was \$50
- We also tested these samples with three home kits to compare against the lab tests, to see if there is an inexpensive home test kit that would work in a disaster. The three home test kits cost between \$15 up to \$35.
- We tested the raw water ONLY with a home test kit, because we were pretty sure that water was polluted and didn't need to spend more money to demonstrate that.


Our results came in, and here they are. Drum roll please ...

Results - Three Treatments

1 Raw Water & Filtration alone




2 Filter + Disinfection



Calcium Hypochlorite

3 P&G Purifier of Water



Ferric Sulfate + Calcium Hypochlorite

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Results for Raw Water (No Treatment)

As expected, the home tests confirmed that the raw water was contaminated with bacteria and other stuff. The home test that we used that worked the best is called Health Metric Bacteria Test. This test kit could be used in a disaster; other test kits didn't reproduce lab test results, so we wouldn't trust them in a disaster.

- Our lab test results showed that filtration alone filtered out some of the bacteria, but not all – the same result as the Tualatin River water test. Our conclusion from this is that filtration is an important first step, but for drinking water, disinfection is also needed, to kill the bad bugs.
- Both the Filter + Disinfection and the PUR methods worked! All of the tests showed no e-coli and no coliform! Yay! Success!
- So, this was a very useful process to go through, and we have refined our recommended emergency water strategy accordingly. Bill?

Notes:

We used Alexin Analytical Laboratory in Tigard, Oregon.

The home tests we used included: Varify Complete Water Test Kit, Health Metric Bacteria Test, and Aquavial Well Water Test Kit

**We are waiting for the test results from inorganic compounds such as nitrates, arsenic and metals



Summary – Just Do It! One Step at a Time



1. Plan A – Store plenty of emergency water (1 gallon per person and pet for 2 weeks)
2. Plan B – Acquire supplies for making potable water (filters & disinfectants)
3. Practice making potable water from local sources

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Well, that's our pitch. Water is everything. It's the basis of good health, good eating, and living a reasonable life while recovering from a disaster.

To summarize our observations and recommendations:

1. Have a plan A, and get started. Store at least two weeks of water for emergencies. Start accumulating those supplies now.
2. Then, have a backup PLAN B
 - Identify potential sources of raw water for when yours runs out.
 - Make a plan to collect and treat raw water from the environment – creeks or lake
 - Pre-filter and then filter raw water from the environment with a high quality micro-filter designed to produce enough water for you and your family's needs. We recommend the 2-bucket system, and can help you put one together at our June workshop, but whatever you choose – put it together and have it on hand.
 - Have a kit for disinfecting water to make it safe to drink. We recommend either Calcium Hypochlorite like the DryTec product we used, or packets of the Proctor & Gamble PUR system, both of which are available on the internet.
 - Have a high quality test kit on hand to reassure yourself that you have successfully treated your water and made it safe.
3. Don't wait. Don't run the risk of being without good water. Start putting together your stored water now. Be prepared! Practice what you will do when disaster hits so you are ready!

After all this, you probably have questions; I know I do. Our presentation is finished. Before we go to the Q&A, I'd like to tell you about next month's meeting and some online resources.

Neighborhood Ready?

How to win friends & survive a disaster!



Learn 9 steps to take after a disaster
Free Zoom Meeting! Monday 7 PM, April 25th

REGISTER HERE <https://tinyurl.com/pyn042522>

For more info: www.cedarhillsready.org or info.cedarhillsready@gmail.com (971-361-9348)

On Monday, April 25th, at 7 PM, we'll be reviewing our neighborhood ready program, and you'll learn the 9 steps to take after a disaster, and how to engage your neighbors for help. If a natural disaster strikes, our emergency services folks will be overwhelmed, and you'll be on your own, unless you enlist the help of your neighbors. We'll show you how to do that. **Register in advance:** <https://tinyurl.com/pyn042522>



Planning + Preparedness = Resilience

Resources & Q&A

For links and downloads for this program:
tinyurl.com/chrwater

For the Get Prepared Now! Booklet
tinyurl.com/chr-ready-bk

To register for the next meeting, April
Neighborhood Ready? How to win friends & survive a disaster!
tinyurl.com/get-ready-booklet

Contact:
Info.CedarHillsReady@gmail.com

Lastly, we have numerous resources for you to freely download, including our Get Prepared Now! booklet. It includes forms, checkoff sheets, a calendar of recommended purchases & activities to help you not be overwhelmed while getting prepared. Check out the links shown on this page. Remember: Knowledge means confidence and **Planning + Preparedness = Resilience**

Thank you for your attention and great ideas. I hope you will share this information with your family, friends, and neighbors.

Let's go to some Q&A for those who want to stay.

Barbara?