



Tsunamis: Water Quality

A tsunami creates a surge of ocean water that can sometimes engulf large geographic areas. As the ocean water comes ashore, drinking water wells can become submerged and potentially contaminated with microorganisms (bacteria, viruses, parasites) and chemicals that can adversely affect human health. The sea salts associated with saltwater flooding of coastal drinking water supplies are not an immediate health threat.

Because of the unpleasant taste of saltwater, most people will not ingest (swallow) a large enough amount to cause immediate health problems. However, disease-causing microorganisms spread by the flood do not normally produce a strong taste. If water containing disease-causing microorganisms is ingested, even in small amounts, it may cause immediate, life-threatening health problems such as chronic diarrhea, cholera, and serious infections. Using contaminated water to clean small cuts and open wounds also poses a danger of serious infections.

Additionally, chemical contaminants often found in floodwater can easily contaminate wells. Chemical contaminants can include fuel products from overturned fuel tanks, or pesticides that may have been stored in flooded areas. Ingesting water containing these types of chemical contaminants may result in threats to life and health.

After wells have been properly cleaned out and they begin to refill with water from the aquifer, much of the increase in salinity (saltiness) should subside. Shallow wells may be more affected than deeper wells because of the higher loading of saltwater in the upper layer of soil. Although recovery of shallow wells may be slower than that of deeper wells, the salinity of shallow wells should lessen over time.

After a tsunami, people in affected areas should listen for public announcements on the safety of the water supply. Flooded private wells will need to be tested and disinfected after flood waters recede. If odor, taste, unusual discoloration, or the results of preliminary water testing lead people to suspect that area wells are contaminated by fuel, pesticides, or other chemicals, a chemical analysis of drinking water is strongly recommended. Questions about testing should be directed to local authorities.

Water for Drinking, Cooking, and Personal Hygiene

Safe water for drinking, cooking, and personal hygiene includes bottled, boiled, or treated water. After a tsunami, water sources may be contaminated with saltwater. Using brackish water (a mixture of saltwater and fresh water) for drinking and cooking for an extended period can cause health problems from the increased level of salts that may be ingested. Your local authorities can make specific recommendations for boiling or treating water in your area. If you get your water from a cistern or a well, please refer to the information on disinfecting [cisterns](#) or [wells](#). If you do not get your water from a cistern or a well, follow these general rules concerning water for drinking, cooking, and personal hygiene.

- Do not use contaminated water to wash dishes, brush your teeth, wash and prepare food, wash your hands, make ice, or make baby formula. If possible, use baby formula that does not need to have water added. You can use an alcohol-based hand sanitizer to wash your hands.

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- If you use bottled water, be sure it came from a safe source. If you do not know that the water came from a safe source, you should boil or treat it before you use it. Use only bottled, boiled, or treated water until your supply is tested and found safe.
- Boiling water, when practical, is the preferred way to kill harmful bacteria and parasites. Bringing water to a rolling boil for 1 minute will kill most organisms. However, boiling brackish water for longer than 5 minutes can increase concentrations of sea salts and other contaminants.
- When boiling water is not practical, you can treat water with chlorine tablets, iodine tablets, or unscented household chlorine bleach (5.25% sodium hypochlorite):
 - If you use chlorine tablets or iodine tablets, follow the directions that come with the tablets.
 - If you use household chlorine bleach, add 1/8 teaspoon (approximately 0.75 milliliter) of bleach per gallon of water if the water is clear. For cloudy water, add 1/4 teaspoon (approximately 1.50 milliliters) of bleach per gallon. Mix the solution thoroughly and let it stand for about 30 minutes before using it.

Note: Treating water with chlorine tablets, iodine tablets, or liquid bleach will not kill parasitic organisms.

Use a bleach solution to rinse water containers before reusing them. Use water storage tanks and other types of containers with caution. For example, fire truck storage tanks and previously used cans or bottles may be contaminated with microbes or chemicals. Do not rely on untested devices for decontaminating water.

Disinfecting Cisterns and Other Rain-Catchment Systems After Floods

In many areas of the world, people get drinking water from catchment (collection) systems that trap and store rainwater. Even when these systems are constructed and used properly, they are easily contaminated by germs that can cause sickness. Some water supply systems use surfaces such as rooftops to capture and channel water to a cistern (storage tank). If you do not get your water from a cistern or a well, refer to "[Water for Drinking, Cooking, and Personal Hygiene](#)" for information on disinfecting your water.

When cisterns and similar systems come in contact with floodwater, people should assume that their drinking water is contaminated. If you are concerned about contamination of your drinking water source, please refer to the [information at the beginning of this fact sheet](#) and in the section titled "[Water for Drinking, Cooking, and Personal Hygiene](#)" concerning saltwater contamination, chemical contamination, and health effects.

One of the following methods can be used to disinfect cisterns and other rain-catchment systems in disaster situations on the basis of whether another source of drinkable water is available while the cistern or catchment system is being disinfected (Method 1) or whether the cistern or rain-catchment system needs to be used more quickly as a drinking water source (Method 2). If fuel products or other chemical contaminants have come in contact with the cistern or rain-catchment system, or if there is a smell of fuel or other chemicals in the vicinity of the system, use only Method 1 for disinfection.

Method 1—Use this method if clean drinking water is available from another source while the cistern or catchment system is being disinfected. This method is a better method, but it takes longer, because the cistern/system must be drained and refilled twice.

1. Thoroughly clean the surface catchment area (for example, rooftop) and remove all debris.
2. Drain the cistern or storage tank completely.
3. Remove all debris from the tank.

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- Without entering the tank, scrub the inside as well as you can with a stiff brush or broom and a solution of 1 cup (8 ounces; approximately 0.25 liter) of 5.25% unscented chlorine bleach (sodium hypochlorite) in 10 gallons (approximately 38 liters) of water.
- Refill the tank with rainwater or potable water.
- If you don't know the capacity of the tank, use the following formula to determine the amount of water it will hold: For a rectangular tank, multiply the depth of the tank (in feet) times the length (feet) times the width (feet), and multiply the result by 7.5 to get the number of gallons the tank will hold. For a round tank, multiply the length (feet) by the square of the tank radius, multiply the result by 3.14, and then multiply that result by 7.5 to get gallons. If neither of these methods is practical, you can estimate the capacity in gallons by making an "educated guess," and then double the amount of bleach to be used in the disinfection solution.
Metric: In metric units, multiply length (meters) X width (meters) X height (meters) X 1,000 = capacity in liters. For round tanks, multiply height X the radius squared (meters) X 3,140 = capacity in liters.
- Add 4 cups (32 ounces; approximately 1 liter) of 5.25% unscented household bleach for every 100 gallons (approximately 380 liters) of water in the holding tank. This should give you a chlorine concentration of approximately 100 parts per million (ppm).
- Run water through all plumbing used for drinking water in your home until you notice a strong chlorine odor.
- Let the solution sit undisturbed for 24 hours.
- Drain the whole tank.
- Let the tank refill with rainwater, or fill the tank with drinkable water.
- Flush all piping in your home until the odor of chlorine is completely gone before you use the system again.

Method 2—Use this method if clean drinking water is not available from another source while the cistern/system is being disinfected. This method is not as good as Method 1, but it takes less time, because the cistern/system needs to be drained and refilled only once.

- Thoroughly clean the surface catchment area (rooftop) and remove all debris.
- If you don't know the capacity of the tank, use the following formula to determine how much water it will hold: For a rectangular tank, multiply the depth of the tank (in feet) times the length (feet) times the width (feet), and multiply the result by 7.5 to get the number of gallons the tank will hold. For a round tank, multiply the length (feet) by the square of the tank radius, multiplying the result by 3.14, and then multiply by 7.5 to get the number of gallons the tank will hold. If neither of these methods is practical, you can estimate the capacity by making an "educated guess," and then double the amount of bleach to be used in the disinfection solution.
Metric: In metric units, multiply length (meters) X width (meters) X height (meters) X 1,000 = capacity in liters. For round tanks, multiply height X the radius squared (meters) X 3,140 = capacity in liters.
- Add 4 cups (32 ounces; approximately 1 liter) of 5.25% unscented household bleach for every 100 gallons (approximately 380 liters) of water in the holding tank. This should give you a chlorine concentration of approximately 100 parts per million (ppm).
- Run water through all plumbing used for drinking water in your home until you notice a strong chlorine odor.
- Let the solution sit undisturbed for 24 hours.
- Drain the whole tank.
- Remove all debris from the tank.
- Without entering the tank, scrub the inside as well as you can with a stiff brush or broom and a solution of 1 cup (8 ounces; approximately 0.25 liter) of 5.25% unscented chlorine bleach (sodium hypochlorite) in 10 gallons (approximately 380 liters) of water.
- Drain all of the disinfectant solution from the tank.

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10. Let the tank refill.
11. Flush all piping in your home until the odor of chlorine is completely gone before you use the system again

Disinfecting Wells

After a tsunami, wells in affected areas may be contaminated. Please refer to the [information at the beginning of this fact sheet](#) and in the section titled "[Water for Drinking, Cooking, and Personal Hygiene](#)" concerning saltwater contamination, chemical contamination, and health effects. If you suspect that your well may be contaminated, contact your local authorities for more specific advice. If you do not get your water from a cistern or a well, refer to "[Water for Drinking, Cooking, and Personal Hygiene](#)" for information on disinfecting your water. Here are some general instructions for disinfecting wells.

To Disinfect Bored or Dug Wells

1. Pump the well until the water is clear. (Note: In areas without electrical power, a portable generator may be needed to operate the pump.) Use outside faucets to drain water from the well if they are available.
2. Use [Table 1](#) to calculate how much bleach (liquid or granules) to use.
3. To determine the exact amount to use, multiply the amount of disinfectant needed (according to the diameter of the well) by the depth of water in the well. For example, a well 5 feet in diameter requires 4½ cups of bleach per foot of water. If the water in the well is 30 feet deep, multiply 4½ cups by 30 feet to determine the total cups of bleach required ($4\frac{1}{2} \times 30 = 135$ cups).
Metric: In metric units, a well approximately 1.5 meters in diameter requires approximately 1.1 liters of bleach per meter of water. If the well is approximately 9.1 meters deep, multiply 1.1 liters by 9.1 meters to determine the total liters of bleach required ($1.1 \times 9.1 = 10$ liters). One foot of water depth = 0.305 meters.
4. Add this total amount of disinfectant to about 10 gallons (38 liters) of water. Splash the mixture around the wall or lining of the well. Be certain the disinfectant solution contacts all parts of the well.
5. Seal the well top.
6. Open all faucets and pump water until you notice a strong odor of chlorine (bleach) at each faucet. Then stop the pump and allow the solution to remain in the well for 24 hours or, at a minimum, overnight.
7. The next day, operate the pump by turning on all faucets, continuing until the chlorine odor disappears. Adjust the flow of water faucets or fixtures that discharge to septic systems to a low flow to avoid overloading the disposal system.

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Table 1. Bleach for a Bored or Dug Well					
English			Metric		
Diameter of well (in feet)	Amount of 5.25% laundry bleach chlorine per foot of water	Amount of 70% chlorine granules per foot of water	Diameter of well (in meters)	Amount of 5.25% laundry bleach chlorine per 0.305 meters of water	Amount of 70% chlorine granules per 0.305 meters of water
3	1½ cups	1 ounce	0.9	0.35 liter	28.3 grams
4	3 cups	2 ounces	1.2	0.7 liter	56.6 grams
5	4½ cups	3 ounces	1.5	1.1 liters	85 grams
6	6 cups	4 ounces	1.8	1.4 liters	113.2 grams
7	9 cups	6 ounces	2.1	2.1 liters	170 grams
8	12 cups	8 ounces	2.4	2.8 liters	226 grams
10	18 cups	12 ounces	3.0	4.3 liters	340 grams

Source: Illinois Department of Public Health. Recommendations may vary from state to state.
Note: 1 cup = 8 liquid ounces.

To Disinfect Drilled Wells

1. Pump the well until the water is clear. (Note: In areas without electrical power, a portable generator may be needed to operate the pump.) Use outside faucets to drain water from the well if they are available.
2. Determine the amount of water in the well by multiplying the gallons per foot by the depth of the well in feet ([Table 2](#)). For example, a well with a 6-inch diameter contains 1.5 gallons of water per foot. If the well is 120 feet deep, multiply 1.5 by 120 ($1.5 \times 120 = 180$ gallons).
Metric: In metric units, determine the amount of water in the well by multiplying the liters per meter by the depth of the well in meters. For example, a well with a 15.2-centimeter diameter contains 18.6 liters of water per meter. If the well is 36.5 meters deep, multiply 18.6 liters by 36.5 meters to determine the total liters of water in the well ($18.6 \times 36.5 = 679$ liters).
3. For each 100 gallons (380 liters) of water in the well, use the amount of chlorine (liquid or granules) indicated in [Table 3](#). Mix the total amount of liquid or granules with about 10 gallons (38 liters) of water.
4. Pour the solution into the top of the well before the seal is installed.
5. Connect a hose from a faucet on the discharge side of the pressure tank to the well casing top. Start the pump. Spray the water back into the well and wash the sides of the casing for at least 15 minutes.
6. Open every faucet in the system and let the water run until you smell chlorine. Then close all the faucets and seal the top of the well.
7. Let stand for 24 hours or, at a minimum, overnight.
8. After you have let the water stand, operate the pump by turning on all faucets, continuing until all odor of chlorine disappears. Adjust the flow of water from faucets or fixtures that discharge into septic tank systems to a low flow to avoid overloading the disposal system.

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Table 2. Bleach for a Drilled Well			
English		Metric	
Diameter of Well (in inches)	Gallons per foot of water	Diameter of Well (in centimeters)	Liters per meter of water
3	0.37	7.6	4.6
4	0.65	10.2	8.1
5	1.0	12.7	12.4
6	1.5	15.2	18.6
8	2.6	20.3	32.2
10	4.1	25.4	50.0
12	6.0	30.5	74.4

Table 3. Amount of Disinfectant Required for Each 100 Gallons (380 Liters) of Water	
English	
Laundry Bleach (5.25% Chlorine)	3 cups*
Hypochlorite Granules (70% Chlorine)	2 ounces**
Metric	
Laundry Bleach (5.25% Chlorine)	0.7 liter
Hypochlorite Granules (70% Chlorine)	57 grams***
*1 cup = 8 liquid ounces or 0.24 liter	
**1 ounce = 2 heaping tablespoons of granules	
***28.3 grams = 2 heaping tablespoons of granules	
<i>Source: Illinois Department of Public Health. Recommendations may vary from state to state.</i>	

See Also ...

[World Health Organization \(WHO\) South-East Asia Earthquake and Tsunami List of Guidelines for Health Emergencies: Water](#)

[WHO South-East Asia Earthquake and Tsunami Web Site: Household Water Treatment and Safe Storage Following Emergencies and Disasters](#)

[WHO: The International Network to Promote Household Water Treatment and Safe Storage](#)

[Manitoba \(Canada\) Advice on Flood Recovery of Dugout Wells](#)

[U.S. Environmental Protection Agency Advice on Flooded Wells](#)

For more information, visit www.bt.cdc.gov/disasters/tsunamis, or call the CDC public response hotline at 888-246-2675 (English), 888-246-2857 (español), or 866-874-2646 (TTY).