

# Flood Recovery Resource Materials

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## FACT SHEET

### Key Facts About Flood Readiness

#### Preparing for a Flood

##### *Here are some basic steps to take to prepare for the storm:*

- Contact the local county geologist or county planning department to find out if your home is located in a flash-flood-prone area or landslide-prone area.
- Learn about your community's emergency plans, warning signals, evacuation routes, and locations of emergency shelters.
- Plan and practice a flood evacuation route with your family. Ask an out-of-state relative or friend to be the "family contact" in case your family is separated during a flood. Make sure everyone in your family knows the name, address, and phone number of this contact person.
- Post emergency phone numbers at every phone.
- Inform local authorities about any special needs, i.e., elderly or bedridden people, or anyone with a disability.
- Identify potential home hazards and know how to secure or protect them before the flood strikes. Be prepared to turn off electrical power when there is standing water, fallen power lines, or before you evacuate. Turn off gas and water supplies before you evacuate. Secure structurally unstable building materials.
- Buy a fire extinguisher and make sure your family knows where it is and how to use it.
- Buy and install sump pumps with back-up power.
- Have a licensed electrician raise electric components (switches, sockets, circuit breakers and wiring) at least 12" above your home's projected flood elevation.
- For drains, toilets, and other sewer connections, install backflow valves or plugs to prevent floodwaters from entering.
- Anchor fuel tanks which can contaminate your basement if torn free. An unanchored tank outside can be swept downstream and damage other houses.

##### *If you are under a flood watch or warning:*

- Gather the emergency supplies you previously stocked in your home and stay tuned to local radio or television station for updates.
- Turn off all utilities at the main power switch and close the main gas valve if evacuation appears necessary.
- Have your immunization records handy or be aware of your last tetanus shot, in case you should receive a puncture wound or a wound becomes contaminated during or after the flood.
- Fill bathtubs, sinks and plastic soda bottles with clean water. Sanitize the sinks and tubs first by using bleach. Rinse and fill with clean water.
- Bring outdoor possessions, such as lawn furniture, grills and trash cans inside or tie them down securely.

#### Emergency Supplies You Will Need

You should stock your home with supplies that may be needed during the emergency period. At a minimum, these supplies should include:

- Several clean containers for water, large enough for a 3-5 day supply of water (about five gallons for each person).

## Key Facts About Flood Readiness

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- A 3-5 day supply of non-perishable food and a non-electric can opener.
- A first aid kit and manual and prescription medicines and special medical needs.
- A battery-powered radio, flashlights, and extra batteries.
- Sleeping bags or extra blankets.
- Water-purifying supplies, such as chlorine or iodine tablets or unscented, ordinary household chlorine bleach.
- Baby food and/or prepared formula, diapers, and other baby supplies.
- Disposable cleaning cloths, such as "baby wipes" for the whole family to use in case bathing facilities are not available.
- Personal hygiene supplies, such as soap, toothpaste, sanitary napkins, etc.
- An emergency kit for your car with food, flares, booster cables, maps, tools, a first aid kit, fire extinguisher, sleeping bags, etc.
- Rubber boots, sturdy shoes, and waterproof gloves.
- Insect repellent containing DEET or Picaridin, screens, or long-sleeved and long-legged clothing for protection from mosquitoes which may gather in pooled water remaining after the flood. (More information about these and other recommended repellents can be found in the fact sheet "Updated Information Regarding Insect Repellents" at [www.cdc.gov/ncidod/dvbid/westnile/RepellentUpdates.htm](http://www.cdc.gov/ncidod/dvbid/westnile/RepellentUpdates.htm).)

## Preparing to Evacuate

Expect the need to evacuate and prepare for it. When a flood watch is issued, you should:

- Fill your vehicle's gas tank and make sure the emergency kit for your car is ready.
- If no vehicle is available, make arrangements with friends or family for transportation.
- Fill your clean water containers.
- Review your emergency plans and supplies, checking to see if any items are missing.
- Tune in the radio or television for weather updates.
- Listen for disaster sirens and warning signals.
- Put livestock and family pets in a safe area. Due to food and sanitation requirements, emergency shelters cannot accept animals.
- Adjust the thermostat on refrigerators and freezers to the coolest possible temperature.

## If You Are Ordered to Evacuate

You should never ignore an evacuation order. Authorities will direct you to leave if you are in a low-lying area, or within the greatest potential path of the rising waters. If a flood warning is issued for your area or you are directed by authorities to evacuate the area:

- Take only essential items with you.
- If you have time, turn off the gas, electricity, and water.
- Disconnect appliances to prevent electrical shock when power is restored.
- Follow the designated evacuation routes and expect heavy traffic.
- Do not attempt to drive or walk across creeks or flooded roads.

## If You Are Ordered NOT to Evacuate

To get through the storm in the safest possible manner:

- Monitor the radio or television for weather updates.
- Prepare to evacuate to a shelter or to a neighbor's home if your home is damaged, or if you are instructed to do so by emergency personnel.

For more information, visit [www.bt.cdc.gov/disasters/floods](http://www.bt.cdc.gov/disasters/floods)  
or call CDC at 800-CDC-INFO (English and Spanish) or 888-232-6348 (TTY).

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## Floods: Sanitation and Hygiene

It is critical for you to remember to practice basic hygiene during the emergency period. Always wash your hands with soap and water that has been boiled or disinfected:

- before preparing or eating food;
- after toilet use;
- after participating in flood cleanup activities; and
- after handling articles contaminated with flood water or sewage.

Flood waters may contain fecal material from overflowing sewage systems, and agricultural and industrial byproducts. Although skin contact with flood water does not, by itself, pose a serious health risk, there is some risk of disease from eating or drinking anything contaminated with flood water. If you have any open cuts or sores that will be exposed to flood water, keep them as clean as possible by washing well with soap to control infection. If a wound develops redness, swelling, or drainage, seek immediate medical attention.

In addition, parents need to help children avoid waterborne illness. Do not allow children to play in flood water areas, wash children's hands frequently (always before meals), and do not allow children to play with flood-water contaminated toys that have not been disinfected. You can disinfect toys using a solution of one cup of bleach in 5 gallons of water.

For more information, visit [www.bt.cdc.gov](http://www.bt.cdc.gov)  
or call CDC at 800-CDC-INFO (English and Spanish) or 888-232-6348 (TTY).



## Reentering Your Flooded Home

When returning to a home that's been flooded after natural disasters such as hurricanes, tornadoes, and floods, be aware that your house may be contaminated with mold or sewage, which can cause health risks for your family.

### When You First Reenter Your Home

- If you have standing water in your home and can turn off the main power from a dry location, then go ahead and turn off the power, even if it delays cleaning. If you must enter standing water to access the main power switch, then call an electrician to turn it off. **NEVER turn power on or off yourself or use an electric tool or appliance while standing in water.**
- Have an electrician check the house's electrical system before turning the power on again.
- If the house has been closed up for several days, enter briefly to open doors and windows to let the house air out for awhile (at least 30 minutes) before you stay for any length of time.
- If your home has been flooded and has been closed up for several days, presume your home has been contaminated with mold. (See "Protect Yourself from Mold" at [www.bt.cdc.gov/disasters/mold/protect.asp](http://www.bt.cdc.gov/disasters/mold/protect.asp).)
- If your home has been flooded, it also may be contaminated with sewage. (See "After a Hurricane or Flood: Cleanup of Flood Water" at [www.bt.cdc.gov/disasters/floods/cleanupwater.asp](http://www.bt.cdc.gov/disasters/floods/cleanupwater.asp).)

### Dry Out Your House

If flood or storm water has entered your home, dry it out as soon as possible. Follow these steps:

- If you have electricity and an electrician has determined that it's safe to turn it on, use a "wet-dry" shop vacuum (or the vacuum function of a carpet steam cleaner), an electric-powered water transfer pump, or sump pump to remove standing water. If you are operating equipment in wet areas, be sure to wear rubber boots.
- If you do not have electricity, or it is not safe to turn it on, you can use a portable generator to power equipment to remove standing water. **Note: If you must use a gasoline-powered pump, generator, pressure washer, or any other gasoline-powered tools to clean your home, never operate the gasoline engine inside a home, basement, garage, carport, porch, or other enclosed or partially enclosed structures, even if the windows and doors are open. Such improper use can create dangerously high levels of carbon monoxide and cause carbon monoxide poisoning.**
- If weather permits, open windows and doors of the house to aid in the drying-out process.
- Use fans and dehumidifiers to remove excess moisture. Fans should be placed at a window or door to blow the air outwards rather than inwards, so not to spread the mold.
- Have your home heating, ventilating, and air-conditioning (HVAC) system checked and cleaned by a maintenance or service professional who is experienced in mold clean-up **before you turn it on**. If the HVAC system was flooded with water, turning on the mold-contaminated HVAC will spread mold throughout the house. Professional cleaning will kill the mold and prevent later mold growth. When the service determines that your system is clean and if it is safe to do so, you can turn it on and use it to help remove excess moisture from your home.
- Prevent water outdoors from reentering your home. For example, rain water from gutters or the roof should drain away from the house; the ground around the house should slope away from the house to keep basements and crawl spaces dry.
- Ensure that crawl spaces in basements have proper drainage to limit water seepage. Ventilate to allow the area to dry out.

For more information, visit [www.bt.cdc.gov](http://www.bt.cdc.gov)  
or call CDC at 800-CDC-INFO (English and Spanish) or 888-232-6348 (TTY).

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## After a Flood

### Precautions When Returning to Your Home

Electrical power and natural gas or propane tanks should be shut off to avoid fire, electrocution, or explosions. Try to return to your home during the daytime so that you do not have to use any lights. Use battery-powered flashlights and lanterns, rather than candles, gas lanterns, or torches. If you smell gas or suspect a leak, turn off the main gas valve, open all windows, and leave the house immediately. Notify the gas company or the police or fire departments or State Fire Marshal's office, and do not turn on the lights or do anything that could cause a spark. Do not return to the house until you are told it is safe to do so.

Your electrical system may also be damaged. If you see frayed wiring or sparks, or if there is an odor of something burning but no visible fire, you should immediately shut off the electrical system at the circuit breaker.

Avoid any downed power lines, particularly those in water. Avoid wading in standing water, which also may contain glass or metal fragments.

You should consult your utility company about using electrical equipment, including power generators. Be aware that it is against the law and a violation of electrical codes to connect generators to your home's electrical circuits without the approved, automatic-interrupt devices. If a generator is on line when electrical service is restored, it can become a major fire hazard. In addition, the improper connection of a generator to your home's electrical circuits may endanger line workers helping to restore power in your area. All electrical equipment and appliances must be completely dry before returning them to service. It is advisable to have a certified electrician check these items if there is any question. Also, remember not to operate any gas-powered equipment indoors. (See also "Carbon Monoxide Poisoning" at [www.bt.cdc.gov/disasters/carbonmonoxide.asp](http://www.bt.cdc.gov/disasters/carbonmonoxide.asp).)

See also "Reentering Your Flooded Home" at [www.bt.cdc.gov/disasters/mold/reenter.asp](http://www.bt.cdc.gov/disasters/mold/reenter.asp).

### Cleanup

Walls, hard-surfaced floors, and many other household surfaces should be cleaned with soap and water and disinfected with a solution of 1 cup of bleach to five gallons of water. Be particularly careful to thoroughly disinfect surfaces that may come in contact with food, such as counter tops, pantry shelves, refrigerators, etc. Areas where small children play should also be carefully cleaned. Wash all linens and clothing in hot water, or dry clean them. For items that cannot be washed or dry cleaned, such as mattresses and upholstered furniture, air dry them in the sun and then spray them thoroughly with a disinfectant. Steam clean all carpeting. If there has been a backflow of sewage into the house, wear rubber boots and waterproof gloves during cleanup. Remove and discard contaminated household materials that cannot be disinfected, such as wallcoverings, cloth, rugs, and drywall.

See also "Protect Yourself from Mold" at [www.bt.cdc.gov/disasters/mold/protect.asp](http://www.bt.cdc.gov/disasters/mold/protect.asp).

## **After a Flood**

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### **Immunizations**

Outbreaks of communicable diseases after floods are unusual. However, the rates of diseases that were present before a flood may increase because of decreased sanitation or overcrowding among displaced persons. Increases in infectious diseases that were not present in the community before the flood are not usually a problem. If you receive a puncture wound or a wound contaminated with feces, soil, or saliva, have a doctor or health department determine whether a tetanus booster is necessary based on individual records.

Specific recommendations for vaccinations should be made on a case-by-case basis, or as determined by local and state health departments.

### **Swiftly Flowing Water**

If you enter swiftly flowing water, you risk drowning -- regardless of your ability to swim. Swiftly moving shallow water can be deadly, and even shallow standing water can be dangerous for small children. Cars or other vehicles do not provide adequate protection from flood waters. Cars can be swept away or may break down in moving water.

### **Chemical Hazards**

Use extreme caution when returning to your area after a flood. Be aware of potential chemical hazards you may encounter during flood recovery. Flood waters may have buried or moved hazardous chemical containers of solvents or other industrial chemicals from their normal storage places.

If any propane tanks (whether 20-lb. tanks from a gas grill or household propane tanks) are discovered, do not attempt to move them yourself. These represent a very real danger of fire or explosion, and if any are found, police or fire departments or your State Fire Marshal's office should be contacted immediately.

Car batteries, even those in flood water, may still contain an electrical charge and should be removed with extreme caution by using insulated gloves. Avoid coming in contact with any acid that may have spilled from a damaged car battery.

For more information, visit [www.bt.cdc.gov](http://www.bt.cdc.gov)  
or call CDC at 800-CDC-INFO (English and Spanish) or 888-232-6348 (TTY).



## Protect Yourself from Mold

After natural disasters such as hurricanes, tornadoes, and floods, excess moisture and standing water contribute to the growth of **mold** in homes and other buildings. When returning to a home that has been flooded, be aware that mold may be present and may be a health risk for your family.

### People at Greatest Risk from Mold

People with asthma, allergies, or other breathing conditions may be more sensitive to mold. People with immune suppression (such as people with HIV infection, cancer patients taking chemotherapy, and people who have received an organ transplant) are more susceptible to mold infections.

### Possible Health Effects of Mold Exposure

People who are sensitive to mold may experience stuffy nose, irritated eyes, wheezing, or skin irritation. People allergic to mold may have difficulty in breathing and shortness of breath. People with weakened immune systems and with chronic lung diseases, such as obstructive lung disease, may develop mold infections in their lungs. If you or your family members have health problems after exposure to mold, contact your doctor or other health care provider.

### Recognizing Mold

You *may* recognize mold by:

- **Sight** (Are the walls and ceiling discolored, or do they show signs of mold growth or water damage?)
- **Smell** (Do you smell a bad odor, such as a musty, earthy smell or a foul stench?)

### Safely Preventing Mold Growth

Clean up and dry out the building quickly (within 24 to 48 hours). Open doors and windows. Use fans to dry out the building. (See the fact sheet for drying out your house, "Reentering Your Flooded Home" at [www.bt.cdc.gov/disasters/mold/reenter.asp](http://www.bt.cdc.gov/disasters/mold/reenter.asp).)

- **When in doubt, take it out!** Remove all porous items that have been wet for more than 48 hours and that cannot be thoroughly cleaned and dried. These items can remain a source of mold growth and should be removed from the home. Porous, noncleanable items include carpeting and carpet padding, upholstery, wallpaper, drywall, floor and ceiling tiles, insulation material, some clothing, leather, paper, wood, and food. **Removal and cleaning are important because even dead mold may cause allergic reactions in some people.**
- To *prevent* mold growth, clean wet items and surfaces with detergent and water.
- Homeowners may want to temporarily store items outside of the home until insurance claims can be filed. See recommendations by the Federal Emergency Management Agency (FEMA) at [www.fema.gov/hazards/floods/whatshouldidoafter.shtm](http://www.fema.gov/hazards/floods/whatshouldidoafter.shtm).
- If you wish to disinfect, refer to the U.S. Environmental Protection Agency (EPA) document, *A Brief Guide to Mold and Moisture in Your Home* at [www.epa.gov/iaq/molds/images/moldguide.pdf](http://www.epa.gov/iaq/molds/images/moldguide.pdf).

## Protect Yourself from Mold

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**If there is mold growth in your home, you should clean up the mold *and* fix any water problem, such as leaks in roofs, walls, or plumbing.** Controlling moisture in your home is the most critical factor for preventing mold growth.

To *remove* mold growth from hard surfaces use commercial products, soap and water, or a bleach solution ([www.cdc.gov/mold/faqs.htm](http://www.cdc.gov/mold/faqs.htm)) of no more than 1 cup of bleach in 1 gallon of water. Use a stiff brush on rough surface materials such as concrete.

If you choose to use bleach to remove mold:

- Never mix bleach with ammonia or other household cleaners. Mixing bleach with ammonia or other cleaning products will produce dangerous, toxic fumes.
- Open windows and doors to provide fresh air.
- Wear non-porous gloves and protective eye wear.
- If the area to be cleaned is more than 10 square feet, consult the U.S. Environmental Protection Agency (EPA) guide titled *Mold Remediation in Schools and Commercial Buildings*. Although focused on schools and commercial buildings, this document also applies to other building types. You can get it free by calling the EPA Indoor Air Quality Information Clearinghouse at (800) 438-4318, or by going to the EPA web site at [www.epa.gov/mold/mold\\_remediation.html](http://www.epa.gov/mold/mold_remediation.html).
- Always follow the manufacturer's instructions when using bleach or any other cleaning product.
- More information on personal safety while cleaning up after a natural disaster is available at [www.bt.cdc.gov/disasters/workers.asp](http://www.bt.cdc.gov/disasters/workers.asp).

If you plan to be inside the building for a while or you plan to clean up mold, you should buy an N95 mask at your local home supply store and wear it while in the building. Make certain that you follow instructions on the package for fitting the mask tightly to your face. If you go back into the building for a short time and are not cleaning up mold, you do not need to wear an N95 mask.

## Other Mold Resources

- Clean Up Safely After a Natural Disaster ([www.bt.cdc.gov/disasters/cleanup.asp](http://www.bt.cdc.gov/disasters/cleanup.asp))
- Reentering Your Flooded Home ([www.bt.cdc.gov/disasters/mold/reenter.asp](http://www.bt.cdc.gov/disasters/mold/reenter.asp))
- Mold - General Resources ([www.cdc.gov/mold](http://www.cdc.gov/mold))

For more information, visit [www.bt.cdc.gov/disasters](http://www.bt.cdc.gov/disasters),  
or call CDC at 800-CDC-INFO (English and Spanish) or 888-232-6348 (TTY).

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## FACT SHEET

### After a Hurricane or Flood: Cleanup of Flood Water

When returning to your home after a hurricane or flood, be aware that flood water may contain sewage. Protect yourself and your family by following these steps:

#### Inside the Home

- Keep children and pets out of the affected area until cleanup has been completed.
- Wear rubber boots, rubber gloves, and goggles during cleanup of affected area.
- Remove and discard items that cannot be washed and disinfected (such as, mattresses, carpeting, carpet padding, rugs, upholstered furniture, cosmetics, stuffed animals, baby toys, pillows, foam-rubber items, books, wall coverings, and most paper products).
- Remove and discard drywall and insulation that has been contaminated with sewage or flood waters.
- Thoroughly clean all hard surfaces (such as flooring, concrete, molding, wood and metal furniture, countertops, appliances, sinks, and other plumbing fixtures) with hot water and laundry or dish detergent.
- Help the drying process by using fans, air conditioning units, and dehumidifiers.
- After completing the cleanup, wash your hands with soap and water. Use water that has been boiled for 1 minute (allow the water to cool before washing your hands).
  - Or you may use water that has been disinfected for personal hygiene use (solution of 1/8 teaspoon of household bleach per 1 gallon of water). Let it stand for 30 minutes. If the water is cloudy, use a solution of 1/4 teaspoon of household bleach per 1 gallon of water.
- Wash all clothes worn during the cleanup in hot water and detergent. These clothes should be washed separately from uncontaminated clothes and linens.
- Wash clothes contaminated with flood or sewage water in hot water and detergent. It is recommended that a laundromat be used for washing large quantities of clothes and linens until your onsite waste-water system has been professionally inspected and serviced.
- Seek immediate medical attention if you become injured or ill.

#### Outside the Home

- Keep children and pets out of the affected area until cleanup has been completed.
- Wear rubber boots, rubber gloves, and goggles during cleanup of affected area.
- Have your onsite waste-water system professionally inspected and serviced if you suspect damage.
- Wash all clothes worn during the cleanup in hot water and detergent. These clothes should be washed separately from uncontaminated clothes and linens.
- After completing the cleanup, wash your hands with soap and water. Use water that has been boiled for 1 minute (allow the water to cool before washing your hands).
  - Or you may use water that has been disinfected for personal hygiene use (solution of 1/8 teaspoon of household bleach per 1 gallon of water). Let it stand for 30 minutes. If the water is cloudy, use solution of 1/4 teaspoon of household bleach per 1 gallon of water.
- Seek immediate medical attention if you become injured or ill.

The information in this fact sheet is general in nature and is not intended to be used as a substitute for professional advice. For more information, please contact your local health department.

For more information, visit [www.bt.cdc.gov](http://www.bt.cdc.gov)  
or call CDC at 800-CDC-INFO (English and Spanish) or 888-232-6348 (TTY).

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## Clean Up Safely After a Natural Disaster

When returning to your home after a hurricane, flood, or other natural disaster protect yourself and your family by following these tips.

### Reentering Buildings

- Stay away from damaged buildings or structures until they have been examined and certified as safe by a building inspector or other government authority. You may want to wait to return to buildings during daylight hours, when it is easier to avoid hazards, particularly if the electricity is off and you have no lights.
- Leave immediately if you hear shifting or unusual noises that signal that the structure may fall or if you smell gas or suspect a leak. If you smell gas, notify emergency authorities and do not turn on the lights, light matches, smoke, or do anything that could cause a spark. Do not return to the house until you are told it is safe to do so.
- Keep children and pets out of the affected area until cleanup has been completed.

### General Safety Measures

- Have at least two fire extinguishers, each with a UL rating of at least 10A, at every cleanup job.
- Wear hard hats, goggles, heavy work gloves, and watertight boots with steel toe and insole (not just steel shank) for cleanup work.
- Wear earplugs or protective headphones to reduce risk from equipment noise.
- Use teams of two or more people to move bulky objects. Avoid lifting any material that weighs more than 50 pounds (per person).
- When using a chain saw, operate the saws according to manufacturer's instructions, wear appropriate protective equipment, avoid contact with power lines, be sure that bystanders are at a safe distance, and take extra care in cutting trees or branches that have gotten bent or caught under another object. Use extreme caution to avoid electrical shock when using an electric chainsaw. For tips on safely operating a chain saw, see [Preventing Chain Saw Injury During Tree Removal](http://www.bt.cdc.gov/disasters/hurricanes/chainsaws.asp) (<http://www.bt.cdc.gov/disasters/hurricanes/chainsaws.asp>).
- If there has been a backflow of sewage into your house, wear rubber boots, rubber gloves, and goggles during cleanup of the affected area.
- In hot weather, try to stay cool by staying in air-conditioned buildings, taking breaks in shaded areas or in cool rooms, drinking water and nonalcoholic fluids often, and wearing light and loose-fitting clothing. Do outdoor activities during cooler hours. For more information on protecting yourself against heat-related illness, see the [CDC Extreme Heat website](http://www.bt.cdc.gov/disasters/extremeheat/) (<http://www.bt.cdc.gov/disasters/extremeheat/>).

### Carbon Monoxide Exposure

- Never use generators, pressure washers, or other gasoline, propane, natural gas, or charcoal-burning devices inside your home, basement, garage, or camper—or even outside near an open window, door, or vent. Carbon monoxide—an odorless, colorless gas from these sources that can cause sudden illness and death—can build up indoors and poison the people and animals inside.

## Clean Up Safely After a Natural Disaster

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For more information, see [Protect Yourself from Carbon Monoxide Poisoning After an Emergency](http://www.bt.cdc.gov/disasters/carbonmonoxide.asp) (<http://www.bt.cdc.gov/disasters/carbonmonoxide.asp>).

### Cleanup Issues

- Remove and discard items that cannot be washed and disinfected (such as mattresses, carpeting, carpet padding, rugs, upholstered furniture, cosmetics, stuffed animals, baby toys, pillows, foam-rubber items, books, wall coverings, and paper products).
- Remove and discard drywall and insulation that has been contaminated with sewage or flood waters.
- Thoroughly clean all hard surfaces (such as flooring, concrete, molding, wood and metal furniture, countertops, appliances, sinks, and other plumbing fixtures) with hot water and laundry or dish detergent.

See [Protect Yourself from Mold](http://www.bt.cdc.gov/disasters/mold/protect.asp) (<http://www.bt.cdc.gov/disasters/mold/protect.asp>) and the [CDC Flood website](http://www.bt.cdc.gov/disasters/floods/) (<http://www.bt.cdc.gov/disasters/floods/>) for further guidance on safely reentering flooded homes, cleaning up flood or storm water, worker safety issues, and mold cleanup issues.

### Electrical Issues

- If electrical circuits and electrical equipment have gotten wet or are in or near water, turn off the power at the main breaker or fuse on the service panel. If you must enter standing water to access the main power switch, then call an electrician to turn it off.
- Never turn power on or off or use an electric tool or appliance while standing in water.
- Do not connect generators to your home's electrical circuits without the approved, automatic-interrupt devices. If a generator is on line when electrical service is restored, it can become a major fire hazard and it may endanger line workers helping to restore power in your area.

For more information, see [How to Protect Yourself and Others from Electrical Hazards Following a Natural Disaster](http://www.bt.cdc.gov/disasters/electrical.asp) (<http://www.bt.cdc.gov/disasters/electrical.asp>).

### Hazardous Materials Issues

- Call the fire department to inspect or remove chemicals, propane tanks, and other dangerous materials.
- Wear protective clothing and gear (for example, a respirator if needed) when handling hazardous materials.
- Wash skin that may have come in contact with hazardous materials.
- Wear insulated gloves and use caution if you have to remove a car battery. Avoid any acid that may have leaked from a car battery.

For information about possible dangers posed by chemicals, see the [Chemical Emergencies page](http://www.bt.cdc.gov/chemical/) (<http://www.bt.cdc.gov/chemical/>). For information about possible dangers posed by pollution from large farms and agricultural facilities, see the [CDC Concentrated Animal Feeding Operations \(CAFOs\) website](http://www.cdc.gov/cafos/) (<http://www.cdc.gov/cafos/>).

### Hygiene and Infectious Disease Issues

- After completing the cleanup, wash with soap and water. If there is a boil-water advisory in effect, use water that has been boiled for 1 minute (allow the water to cool before washing). Or you may use water that has been disinfected for personal hygiene use (solution of 1/8 teaspoon of household bleach

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## Clean Up Safely After a Natural Disaster

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per 1 gallon of water). Let it stand for 30 minutes. If the water is cloudy, use a solution of ¼ teaspoon of household bleach per 1 gallon of water.

- If you have any open cuts or sores that were exposed to floodwater, wash them with soap and water and apply an antibiotic ointment to discourage infection.
- Seek immediate medical attention if you become injured or ill.
- Wash all clothes worn during the cleanup in hot water and detergent. These clothes should be washed separately from uncontaminated clothes and linens.

For more tips on washing your hands, see [Hand Hygiene in Emergency Situations](http://www.bt.cdc.gov/disasters/hurricanes/handwashing.asp) (<http://www.bt.cdc.gov/disasters/hurricanes/handwashing.asp>).

## Water Issues

- If the building is flooded, the waters may contain fecal material from overflowing sewage systems and agricultural and industrial waste. Although skin contact with floodwater does not, by itself, pose a serious health risk, there is risk of disease from eating or drinking anything contaminated with floodwater.
- If you have any open cuts or sores that will be exposed to floodwater, keep them as clean as possible by washing them with soap and applying an antibiotic ointment to discourage infection.
- To reduce cold-related risks when standing or working in water which is cooler than 75 degrees F (24 degrees C), wear insulated clothes and insulated rubber boots, take frequent breaks out of the water, and change into dry clothing when possible.

See also [Keep Food and Water Safe after a Natural Disaster or Power Outage](http://www.bt.cdc.gov/disasters/foodwater.asp) (<http://www.bt.cdc.gov/disasters/foodwater.asp>) and [Reentering Your Flooded Home](http://www.bt.cdc.gov/disasters/mold/reenter.asp) (<http://www.bt.cdc.gov/disasters/mold/reenter.asp>).

Monitor your radio or television for up-to-date emergency information.

For more information, visit [www.bt.cdc.gov/disasters/hurricanes](http://www.bt.cdc.gov/disasters/hurricanes), or call CDC at 800-CDC-INFO (English and Spanish) or 888-232-6348 (TTY).

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## FACT SHEET

# Protect Yourself From Chemicals Released During a Natural Disaster

During emergencies such as hurricanes and floods, chemicals that have the potential to harm people's health might be released from businesses, homes, and other sources into the environment. This document provides information and resources that people can use to protect themselves from dangerous chemicals.

## Protect Yourself by Taking These Steps

- If you suspect someone has been poisoned by a chemical, call 911 or the national poison control center at 1-800-222-1222.
- If you suspect that a pet has been poisoned by a chemical, call the Animal Poison Control Center toll-free at 1-888-426-4435.
- Report oil and chemical spills to the local authorities or to the U.S. Environmental Protection Agency (EPA) National Response Center at 1-800-424-8802.
- Each situation is different. Listen to announcements or alerts from authorities concerning chemical safety and disposal issues. Federal agencies such as CDC and EPA, and state and local officials will keep communities informed about what chemicals may have been released into the environment and what actions, if any, people need to take to protect themselves. For example, the results of EPA sampling for chemicals in the environment following Hurricane Katrina are available at [www.epa.gov/katrina](http://www.epa.gov/katrina).
- Some chemical releases may require authorities to advise people to stay out of the area or, depending on where they live, to evacuate or to shelter in place. Listen to local announcements for guidance on what to do. For general information on evacuation, see "Chemical Agents: Facts About Evacuation" ([www.bt.cdc.gov/planning/evacuationfacts.asp](http://www.bt.cdc.gov/planning/evacuationfacts.asp)). For general information on sheltering in place, see "Chemical Agents: Facts About Sheltering in Place" ([www.bt.cdc.gov/planning/shelteringfacts.asp](http://www.bt.cdc.gov/planning/shelteringfacts.asp)).
- After an emergency, federal, state, and local personnel will be working to establish debris-management programs, including household hazardous waste collection and disposal programs. These efforts may take days or weeks to come to all communities. In the meantime, exercise caution and report concerns to local environmental, health, and waste disposal authorities.
- Wash skin that may have come into contact with dangerous chemicals. Coming into contact with a dangerous chemical may make it necessary for you to remove and dispose of your clothing right away and then wash yourself. Removing your clothing and washing your body will reduce or remove the chemical so that it is no longer a hazard. This process is called decontamination. For more information, see "Chemical Agents: Facts About Personal Cleaning and Disposal of Contaminated Clothing" ([www.bt.cdc.gov/planning/personalcleaningfacts.asp](http://www.bt.cdc.gov/planning/personalcleaningfacts.asp)).
- For more information on protecting yourself during clean-up work after a hurricane or flood, see "Clean Up Safely after a Hurricane" ([www.bt.cdc.gov/disasters/hurricanes/cleanup.asp](http://www.bt.cdc.gov/disasters/hurricanes/cleanup.asp)), "Floods" ([www.bt.cdc.gov/disasters/floods](http://www.bt.cdc.gov/disasters/floods)), and "Natural Disasters: Response, Cleanup & Safety for Workers" ([www.bt.cdc.gov/disasters/workers.asp](http://www.bt.cdc.gov/disasters/workers.asp)).

## Protect Yourself From Chemicals Released During a Natural Disaster

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### Be Aware of Local Sources of Chemicals

Be aware of the sources of chemicals and conditions in your area and take steps to protect your health when returning home after an emergency. During emergencies, chemicals are most commonly released from the following sources: businesses and industries (such as chemical plants and oil refineries), storage tanks, agricultural facilities, and homes.

The types and amounts of chemicals released depend on factors such as (1) type of facilities in the area, (2) types of chemicals produced or kept at affected facilities and homes, (3) structural damage to facilities and homes, (4) weather conditions, and (5) the extent of flooding. Amounts of chemicals released may be higher nearer to industrial sources.

### Dispose of Household Chemicals Safely

People can be exposed to dangerous chemicals from everyday items such as household cleaners, fertilizers, and pesticides that may spill in or near the home during an emergency. Be alert for leaking containers and reactive household chemicals, such as caustic drain cleaners and chlorine bleach, and take the following necessary precautions to prevent injury or further damage:

- Keep children and pets away from leaking or spilled chemicals.
- Do not combine chemicals from leaking or damaged containers, because doing so might produce dangerous reactions.
- Do not dump chemicals down drains, storm sewers, or toilets.
- Do not try to burn household chemicals.
- Clearly mark and set aside unbroken containers until they can be properly disposed.
- Leave damaged or unlabeled chemical containers undisturbed whenever possible.

Source: U.S. Environmental Protection Agency (EPA), "Dealing with Debris and Damaged Buildings" ([www.epa.gov/katrina/debris.html](http://www.epa.gov/katrina/debris.html)).

Also see the National Library of Medicine's Household Products Database (<http://householdproducts.nlm.nih.gov>) for information on safely handling household products.

### Avoid Oil Spills

Crude oil is a mixture of chemicals that could be released into the environment during an emergency such as a hurricane and flood. In flood situations, some parts of the oil will float on water and can be seen as a film on the surface, and other parts will sink to the bottom. Other parts of the oil can become fumes in the air. People can come into contact with these chemicals by getting them on their skin or by breathing them in the air. If you notice oil in the water, stay away from it and contact local authorities or EPA at 1-800-424-8802. Emergency responders and workers should use appropriate clothing and personal protective equipment when working in these hazardous conditions.

### Additional Chemical Resources

#### Centers for Disease Control and Prevention (CDC)

- Natural Disasters ([www.bt.cdc.gov/disasters](http://www.bt.cdc.gov/disasters))
- Chemical Emergencies ([www.bt.cdc.gov/chemical](http://www.bt.cdc.gov/chemical))
- Chemical Safety Cards ([www.cdc.gov/niosh/ipcs/icstart.html](http://www.cdc.gov/niosh/ipcs/icstart.html))
- NIOSH Pocket Guide to Chemical Hazards ([www.cdc.gov/niosh/npg](http://www.cdc.gov/niosh/npg))

## Protect Yourself From Chemicals Released During a Natural Disaster

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### Agency for Toxic Substances and Disease Registry (ATSDR)

- Hazardous Substances in the Environment ([www.atsdr.cdc.gov/2p-toxic-substances.html](http://www.atsdr.cdc.gov/2p-toxic-substances.html))

### Department of Energy (DOE)

- Material Safety Data Sheets ([www.eh.doe.gov/chem\\_safety/Msds.html](http://www.eh.doe.gov/chem_safety/Msds.html))

### Environmental Protection Agency (EPA)

- Environmental Protection Agency (EPA): Hurricanes ([www.epa.gov/naturalevents/hurricanes.html](http://www.epa.gov/naturalevents/hurricanes.html))
- Pollutants/Toxics ([www.epa.gov/eftpages/pollutants.html](http://www.epa.gov/eftpages/pollutants.html))

### National Library of Medicine (NLM)

- Chemical Information (<http://sis.nlm.nih.gov/chemical.html>)
- Tox Town ([http://toxtown.nlm.nih.gov/index\\_content.html](http://toxtown.nlm.nih.gov/index_content.html))

For more information, visit [www.bt.cdc.gov/disasters](http://www.bt.cdc.gov/disasters),  
or call CDC at 800-CDC-INFO (English and Spanish) or 888-232-6348 (TTY).

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### Disinfecting Wells Following an Emergency

If you suspect that your well may be contaminated, contact your local or state health department for specific advice. If you do not get your water from a well, see [Keep Food and Water Safe](#) for information on disinfecting your water.

**IMPORTANT:** Fuel and other chemical releases and spills are common during flood events. If your water smells like fuel or has a chemical odor, contact your local or state health department to request a chemical analysis of your water before using it. Until you know the water is safe, use bottled water or some other safe supply of water.

#### Safety Precautions

You will need to clear hazards away from wells before cleaning and disinfecting wells after floods and other natural disasters. The following precautions will help you do that safely:

1. Before beginning any action, carefully inspect the area around the well for electrical and physical hazards. Those may include broken power lines on the ground or in the water; sharp metal, glass, or wood debris; open holes; and slippery conditions.
2. Wear thick rubber-soled shoes or boots to protect against electrical shock.
3. Turn off all power to the well area before clearing debris. Inspect all electrical connections for breaks in insulation and for moisture. Turn power back on only if all connections appear unbroken and dry with no opportunity for shock.
4. Do not turn on any electrical equipment if there is a persistent smell of fuel such as gasoline coming from the well head. Allow the well to vent. If the smell persists, contact your local or state health department. Do not continue with disinfection of the well until the contamination in the well has been removed.
5. Before beginning work on the well, clear debris away from it to avoid inadvertently moving debris into the well.
6. When clearing debris from large-diameter wells (36 inches [approximately 90 centimeters (cm)] or greater), use grappling hooks, nets, and long-handled scoops to remove debris. Do not enter the well pit. Gases and vapors can build up in well pits, creating a hazardous environment.

Follow these additional precautions as you prepare to disinfect the wells:

- Chlorine solutions can cause chemical burns. Use rubber gloves, protective eye wear, and waterproof aprons or rain gear when working with chlorine solutions.
- When mixing and handling chlorine solutions, work in well ventilated areas and avoid breathing vapors. When working in closed spaces, use electrical fans to provide fresh air.
- Warn users not to drink or bathe in water until all the well disinfection steps have been completed and the well has been thoroughly flushed.

## Disinfecting Wells Following an Emergency

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Here are some general instructions for disinfecting wells that may have become contaminated by harmful microorganisms in floods or other natural disasters.

### Steps to Disinfect Drilled, Bored, or Dug Wells

Chlorination is a process of flushing your well water system with a chlorine solution to kill bacteria and other microorganisms. This process is recommended after floods and when a well has tested positive for bacteria. It is an effective method to eliminate germ contamination, but if problems exist with faulty well construction or groundwater contamination, chlorination is only a temporary solution. If contamination persists, further investigation may be needed to determine the problem.

The disinfection process can take from a few hours to a few days to complete. Make sure you store enough water to meet your household needs before you start this process.

Read the safety precaution section before starting the disinfection procedure.

### Disinfection Procedure

**Step 1.** Scrub or hose off foreign material from the well curbing or casing. If the well cover was not properly sealed and flooding has occurred, sand and silt may have deposited in the well, requiring more cleaning.

**Drilled and bored wells:** Remove the well cover and thoroughly clean the well to remove all debris. Special tools or pumps may be required to remove silt and sand. Heavy deposits of silt and sand may damage well pumps if not removed before the pump is started. If sand and silt are present, remove the pump and clean it thoroughly before using.

**Dug wells:** Remove the well cover and thoroughly clean the well to remove all floating debris. If the well is lined, scrub the sides of the well with a brush and a strong solution of chlorine and water. Empty polluted water and debris from the well using buckets or pumps. If sand and silt are present, remove the pump and clean it thoroughly before using. Rinse well walls by pouring water along the edges. Empty polluted rinse water from the well again, then allow it to refill.

*Caution:* In areas without electrical power, a portable generator may be needed to operate pumps and equipment. Read the safety instructions before turning on a generator, pumps, or any electrical equipment.

## Disinfecting Wells Following an Emergency

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- Step 2.** Pump or bail water out of the well until the water is clear. If you have a low-yield well, empty at a slower rate. If available, use outside faucets to drain water from the well. Do not pump contaminated water into any existing pressure tank. Instead, disconnect piping between the pressure tank and pump to allow contaminated water to flow away from the well and tank.
- Step 3.** Using the table below, calculate the amount of bleach granules or unscented liquid to use. To determine the exact amount, find the corresponding well diameter in the left column. Then match the amount of bleach needed for the amount of time the concentration will remain in the well. Multiply the amount of bleach needed by every 10 feet of water in the well.

For example, a well 8 inches in diameter requires 3½ fluid ounces of unscented bleach (for a retention time of 8 hours at 50 parts per million [ppm]) per 10 feet of water. If the water in the well is 30 feet deep, multiply 3½ fluid ounces by 3 to determine the amount of bleach required (3½ x 3 = 11.5 fluid ounces). In a clean bucket, add this total amount of bleach to about 5 gallons of water (or mix this in 5 gallons of water).

If you are unsure about the depth of your well, check the well head and casing to see if a tag indicates the well depth. If a tag is not available, contact neighbors to see if they know the depths of their wells. Well depths are usually similar in neighborhoods. If you are still unable to determine the depth of your well, make your best educated guess, then increase the suggested amounts of chlorine by 50%.

*Système International d'Unités (metric):* A well 20.0 cm (8 inches) in diameter requires roughly 103.5 milliliters (mL) of unscented bleach per 3 meters of water. If the water in the well is approximately 9.1 meters deep, multiply 103.5 mL by 3 to determine the amount of bleach required (103.5 x 3 = 310.5 mL). In a clean bucket, add this total amount of bleach to about 19 liters of water.

- Step 4.** Pour the chlorine solution in the well in a circular pattern to ensure contact with all sides of the casing or lining of the well. If bored and dug wells have no casing or lining, pour the solution down the center of the well hole. If possible, recirculate the water by connecting a garden hose to an outside faucet and place the other end in the well. Allow water to run for approximately 15 minutes to ensure the chlorine solution is mixed in the well.
- Step 5.** For wells connected to a plumbing system, open all inside and outside faucets and pump water until you notice a strong odor of chlorine at each faucet. If you do not smell chlorine after running all faucets for 15 minutes, increase the amount of chlorine by one-half of the original amount used and repeat the procedures.

Stop the pump and allow the chlorine solution to remain in the well and plumbing system. Refer to the table in the "Sampling After Disinfection" section to match amounts of chlorine solution and disinfection times. It is preferable for the solution to remain in the well for 8 hours or overnight, if possible. Do not leave chlorine in wells more than 24 hours because it may affect some pump parts.

- Step 6.** After the disinfectant has set in the well for the recommended period, turn on the pump, attach a hose to an outside faucet, and direct the water to a designated area away from the well. The water in the well contains high concentrations of chlorine that can be harmful to plants, septic tanks, and streams. Empty the water in an area where plants or streams will not be harmed. Continue running the water until the chlorine odor disappears, then drain the remainder of bleach

## **Disinfecting Wells Following an Emergency**

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in the plumbing system from the inside faucets. With low-yield wells, empty plumbing at a slower rate to avoid over pumping. Some wells may require that you stop for periods to allow the well to refill. Depending on the depth and size of the well, this process may take hours to a day or longer.

Water from wells with no plumbing system can simply be pumped or removed in buckets until the chlorine odor disappears.

## **Sampling After Disinfection**

Until water has been tested, any water for human consumption should be boiled (roiling boil for 1 minute), or an alternative water source used. Wait at least 2 days after disinfection to ensure that the chlorine has been thoroughly flushed from the system. Then sample the water for total coliform and either *E. coli* or fecal coliform bacteria to confirm that the water is safe to drink. Contact the local health department to have your water sampled and tested or contact your state laboratory certification officer to find a certified lab near you. You can also get this number from the U.S. Environmental Protection Agency's Safe Drinking Water Hotline (800-426-4791 or [www.epa.gov/safewater/labs/index.html](http://www.epa.gov/safewater/labs/index.html)).

If the sample results show no presence of both total coliform and *E. coli* or fecal coliforms, the water can be considered safe to drink from a microbial standpoint. Follow up with two additional samples, one in the next 2 to 4 weeks and another in 3 to 4 months. To check the safety of your water over the long term, continue to monitor bacterial quality at least twice per year or more often if you suspect any changes in your water quality.

If sample results indicate the presence of total coliform and *E. coli* or fecal coliforms, repeat the well disinfection process and resample. If tests continue to show the presence of bacteria, contact your local health department for assistance.

## Disinfecting Wells Following an Emergency

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Amount of Chlorine Needed Per 10 Feet (3.1 Meters) of Water in Well*						
Inside Diameter of Well Casing (Standard/SI)	Amount of 5.25% Sodium hypochlorite (Unscented Laundry Bleach) Standard/SI			Amount of 65% Calcium Hypochlorite (Chlorine Granules) Standard/SI		
	<i>Disinfection time for concentration of disinfectant</i>					
	100 ppm for 2 hours	50 ppm for 8 hours	25 ppm for 24 hours	100 ppm for 2 hours	50 ppm for 8 hours	25 ppm for 24 hours
1¼ inches or 3.18 cm	⅛ fluid ounces or 3.7 mL	¾ teaspoon or 3.7 mL	1/3 teaspoon or 3 mL	Not practical to use chlorine granules for these small-diameter well casings		
2 inches or 5.08 cm	½ fluid ounces or 14.79 mL	¼ fluid ounces or 7.39 mL	⅛ fluid ounces or 3.7 mL			
3 inches or 7.62 cm	1 fluid ounces or 29.57 mL	½ fluid ounces or 14.79 mL	¼ fluid ounces or 7.39 mL			
4 inches or 10.16 cm	1½ fluid ounces or 44.36 mL	¾ fluid ounces or 22.18 mL	⅜ fluid ounces or 11.09 mL			
6 inches or 15.24 cm	4 fluid ounces or 118.29 mL	2 fluid ounces or 59.15 mL	1 fluid ounces or 29.57 mL	¼ ounce or 7.09 grams	⅛ ounce or 3.54 grams	1/16 ounce or 1.77 grams
8 inches or 20.32 cm	7 fluid ounces or 118.29 mL	3½ fluid ounces or 103.51 mL	1¾ fluid ounces or 51.75 mL	½ ounce or 14.17 grams	¼ ounce or 7.09 grams	⅛ ounce or 3.54 grams
10 inches or 25.40 cm	10 fluid ounces or 295.74 mL	5 fluid ounces or 146.87 mL	2 fluid ounces or 59.15 mL	¾ ounce or 21.26 grams	⅜ ounce or 10.63 grams	3/16 ounce or 5.32 grams
12 inches or 30.48 cm	2 cups or 473.18 mL	1 cup or 236.59 mL	½ cup or 118.29 mL	1 ounce or 28.35 grams	½ ounce or 14.17 grams	¼ ounce or 7.09 grams
18 inches or 25.72 cm	4½ cups or 1.06 L	2¼ cups or 532.32 mL	1⅛ cups or 266.16 mL	2½ ounces or 70.87 grams	1¼ ounces or 35.44 grams	¾ ounces or 21.26 grams
2 feet or 60.96 cm	7½ cups or 1.77 L	3¾ cups or 887.21 mL	1⅞ cups or 443.60 mL	4½ ounces or 127.57 grams	2¼ ounces or 63.79 grams	1⅞ ounces or 31.89 grams
3 feet or 91.44 cm	17½ cups or 4.14 L	8¾ cups or 7.01 L	4⅞ cups or 1.04 L	10 ounces or 283.5 grams	5 ounces or 141.75 grams	2½ ounces or 70.87 grams

\*Notes: 1 heaping tablespoon of 65% chlorine powder=½ ounces; 8 fluid ounces=1 cup. cm=centimeter; L=liter; mL=milliliter; ppm=parts per million; SI=Systeme International d'Unités

## Disinfecting Wells Following an Emergency

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### Disinfection Issues and Concerns

Bored and dug wells can be difficult to disinfect because of how they are constructed. Many are shallow and have no lining or casing, which can allow contaminants to enter the well hole from upper soil levels. If contamination problems continue, consider upgrading the existing well or drilling a new well.

Water softeners may be damaged by the disinfection process because of the large amounts of chlorine used. Follow your manufacturers' instructions for appropriate methods to disinfect your softener unit. You may need to bypass the unit until the disinfection process is complete.

### Related Resources

- [World Health Organization \(WHO\) South-East Asia Earthquake and Tsunami List of Guidelines for Health Emergencies: Water](http://w3.who.sea.org/EN/Section23/Section1108/Section1835_8188.htm)  
([http://w3.who.sea.org/EN/Section23/Section1108/Section1835\\_8188.htm](http://w3.who.sea.org/EN/Section23/Section1108/Section1835_8188.htm))
- WHO South-East Asia Earthquake and Tsunami Web Site: [Household Water Treatment and Safe Storage Following Emergencies and Disasters](http://www.who.int/household_water/resources/emergencies.pdf)  
([http://www.who.int/household\\_water/resources/emergencies.pdf](http://www.who.int/household_water/resources/emergencies.pdf))
- [WHO: The International Network to Promote Household Water Treatment and Safe Storage](http://www.who.int/household_water/en/)  
([http://www.who.int/household\\_water/en/](http://www.who.int/household_water/en/))
- [U.S. Environmental Protection Agency Advice on Flooded Wells](http://www.epa.gov/safewater/privatewells/whatdo.html)  
(<http://www.epa.gov/safewater/privatewells/whatdo.html>)

For more information, visit [www.bt.cdc.gov/disasters](http://www.bt.cdc.gov/disasters),  
or call CDC at 800-CDC-INFO (English and Spanish) or 888-232-6348 (TTY).

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