

What Are Severe Thunderstorms, and What Causes Them?

Despite their small size, all thunderstorms are dangerous. Every thunderstorm produces lightning, which kills more people each year than tornadoes. Heavy rain from thunderstorms can lead to flash flooding. Strong winds, hail, and tornadoes are also dangers associated with some thunderstorms.

Thunderstorms affect relatively small areas when compared with hurricanes and winter storms. **The typical thunderstorm is 15 miles in diameter and lasts an average of 20 to 30 minutes.** Of the estimated 100,000 thunderstorms that occur each year in the United States, only about 10 percent are classified as severe.

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The National Weather Service (NWS) considers a thunderstorm severe if it produces hail at least three-quarters of an inch in diameter, has winds of 58 miles per hour or higher, or produces a tornado. When a severe thunderstorm WARNING is issued, review what actions to take under a tornado warning or a flash flood warning.

Thunderstorms may occur singly, in clusters, or in lines. Some of the most severe weather occurs when a single thunderstorm affects one location for an extended time. Lightning is a major threat during a thunderstorm. It is the lightning that produces thunder in a thunderstorm. Lightning is very unpredictable, which increases the risk to individuals and property. **In the United States, 75 to 100 people are killed each year by lightning,** although most lightning victims do survive. **Persons struck by lightning often report a variety of long-term, debilitating symptoms, including memory loss, attention deficits, sleep disorders, numbness, dizziness, stiffness in joints, irritability, fatigue, weakness, muscle spasms, depression, and an inability to sit for long.** It is a myth that lightning never strikes the same place twice. In fact, lightning will strike several times in the same place in the course of one discharge.

Learn more about severe thunderstorm risk in your area. Contact your local emergency management office, National Weather Service (NWS) office, or American Red Cross chapter.

Awareness Information

A National Weather Service WATCH is a message indicating that conditions favor the occurrence of a certain type of hazardous weather. For example, a severe thunderstorm watch means that a severe thunderstorm is expected in the next six hours or so within an area approximately 120 to 150 miles wide and 300 to 400 miles long (36,000 to 60,000 square miles). The NWS Storm Prediction Center issues such watches. Local NWS forecast offices issue other watches (flash flood, winter weather, etc.) **12 to 36 hours in advance of a possible hazardous-weather or flooding event.** Each local forecast office usually covers a state or a portion of a state.

An NWS WARNING indicates that a hazardous event is occurring or is imminent in about **30 minutes to an hour**. Local NWS forecast offices issue warnings on a county-by-county basis.

- **Lightning often strikes outside of heavy rain and may occur as far as 10 miles away from any rainfall.** "Heat lightning" is actually lightning from a thunderstorm too far away for thunder to be heard. However, the storm may be moving in your direction.
- **You are in danger from lightning if you can hear thunder.** Because light travels so much faster than sound, lightning flashes can sometimes be seen long before the resulting thunder is heard. When the lightning and thunder occur very close to one another, the lightning is striking nearby. To estimate the number of miles you are from a thunderstorm, count the number of seconds between a flash of lightning and the next clap of thunder. Divide this number by five.
- **Many strong thunderstorms produce hail.** Large hail, or flying glass it may have broken, can injure people and animals. Hail can be smaller than a pea, or as large as a softball, and can be very destructive to automobiles, glass surfaces (skylights and windows), roofs, plants, and crops. In a hailstorm, take cover immediately. Pets and livestock are particularly vulnerable to hail, so bring animals into shelter before storms begin.
- **Downbursts and straight-line winds associated with thunderstorms can produce winds 100 to 150 miles per hour, enough to flip cars, vans, and semitrucks.** The resulting damage can equal the damage of most tornadoes. If a severe thunderstorm warning is issued, take shelter the same way you would if a tornado were approaching your area. Leave structures that are susceptible to being blown over in high winds, such as a mobile home.

Plan for a Thunderstorm

Develop a Family Disaster Plan. Please see the "[Family Disaster Plan](#)" section for general family planning information. Severe thunderstorm specific planning should include the following:

- **Learn about your area's severe thunderstorm risk.** Severe thunderstorms can occur year-round and at any hour. Contact your local emergency management office, local National Weather Service office, or American Red Cross chapter for more information.
- **Discuss how you would know if a thunderstorm may produce a tornado.** Tornadoes develop from severe thunderstorms along and ahead of cold fronts. (See the "[Tornado](#)" section for more information.)
- **Pick a "safe place" in your home where family members can gather during a thunderstorm.** This should be a place where there are no windows, skylights, or glass doors, which could be broken by strong winds or hail, causing damage or injury. Severe thunderstorms do, at times, produce tornadoes.
- In preparation for possible tornado warnings, **consider making your severe thunderstorm "safe place" on the lowest floor of the building**, near your tornado safe space.

- **Learn how to squat low to the ground.** Make yourself the smallest target possible for lightning and minimize contact with the ground. Lightning current often enters a victim through the ground rather than by a direct overhead strike. Assume a crouched position on the ground with only the balls of the feet touching the ground, place your hands on your knees, and lower your head. Minimize your body's surface area, and minimize contact with the ground.
- **Discuss how you would be warned of an approaching thunderstorm.** Different communities have different ways of providing warnings. Many communities have sirens intended for outdoor warning purposes. Use a NOAA Weather Radio with a tone-alert feature to keep you aware of watches and warnings while you are indoors. Learn about your community's warning system. Make sure all family members know the name of the county or parish where you live or are traveling, because severe thunderstorm watches and warnings are issued for counties or parishes.
- **Get training.** Take an American Red Cross first aid and CPR course to learn how to treat burns and how to give rescue breathing and administer CPR. Everyone should know how to respond, because severe thunderstorms can strike almost anywhere at anytime.
- **Discuss severe thunderstorms with your family.** Everyone should know what to do in case all family members are not together. Discuss-ing disaster ahead of time helps reduce fear and lets everyone know how to respond during a severe thunderstorm.

What to Tell Children

The sound of thunder can be especially frightening for young children. Take the "scareness" away by teaching them what to expect during a thunderstorm and how to be safe.

- **Postpone outdoor activities if thunderstorms are likely.** Many people take shelter from the rain, but most people struck by lightning are not in the rain! Postponing activities is your best way to avoid being caught in a dangerous situation.
- **If you see or hear a thunderstorm coming, go inside a sturdy building or car.** Sturdy buildings are the safest place to be. If no building is nearby, a hard-top vehicle will offer some protection. Keep car windows closed and avoid convertibles. Rubber-soled shoes and rubber tires provide no protection from lightning. However, the steel frame of a hard-topped vehicle provides increased protection if you are not touching metal. Although you may be injured if lightning strikes your car, you are much safer inside a vehicle than outside.
- **If you can't get inside, or if you feel your hair stand on end, which means lightning is about to strike, hurry to a low, open space immediately. Crouch down on the balls of your feet, place your hands on your knees and lower your head.** Make yourself the smallest target possible and minimize contact with the ground.
- **Practice the "crouch down" position.** Show children how to practice squatting low to the ground to be the smallest target possible for lightning in case they get caught outside in a thunderstorm. Show them how to place their hands on their knees and lower their head, crouching on the balls of their feet.
- **Stay away from tall things like trees, towers, fences, telephone lines, or power lines.** They attract lightning. Never stand underneath a single large tree out in the open, because lightning usually strikes the highest point in an area.

- **Stay away from metal things that lightning may strike, such as umbrellas, baseball bats, fishing rods, camping equipment, and bicycles.** Lightning is attracted to metal and poles or rods.
- **If you are boating or swimming, get to land immediately.** Stay away from rivers, lakes, and other bodies of water and get off the beach. The saturated sand conducts electricity very well. Water is an excellent conductor of electricity. When lightning strikes nearby, the electrical charge can travel through the water. Each year people are killed by nearby lightning strikes while in or on the water or on the beach.
- **Turn off the air conditioner and television, and stay off the phone until the storm is over.** Lightning can cause electric appliances, including televisions and telephones, to become dangerous during a thunderstorm.
- **Stay away from running water inside the house; avoid washing your hands or taking a bath or shower.** Electricity from lightning has been known to come inside through plumbing.

Assemble a Disaster Supplies Kit

Please see the section "[Disaster Supplies Kit](#)" for general supplies kit information. Severe Thunderstorm - specific supplies should include the Disaster Supplies Kit basics.

How to Protect Your Property

- **Make a list of items to bring inside in the event of a storm.** Having a list will help you remember things that may be broken or blown away in strong winds.
- **Keep trees and shrubbery trimmed.** Make trees more wind resistant by removing diseased or damaged limbs, then strategically remove branches so that wind can blow through. Strong winds frequently break weak limbs and hurl them at great speed, causing damage or injury when they hit.
- **Remove any debris or loose items in your yard.** Branches and firewood may become missiles in strong winds.
- **Consider installing permanent shutters to cover windows.** Shutters can be closed quickly and provide the safest protection for windows.
- **Install lightning rods.** Lightning rods will carry the electrical charge of lightning bolts safely to the ground, greatly reducing the chance of a lightning-induced fire.
- **Insure crops against financial loss from storm damage through the Federal Crop Insurance Corporation of the U.S. Department of Agriculture.** If applicable, it is recommended you obtain separate specific insurance to cover your crops. Losses are not covered through usual insurance policies. Each year severe storms cause millions of dollars in crop damage. Hail, in particular, has been known to wipe out entire fields.

Media and Community Education Ideas

- **Publish a special section in your local newspaper with emergency information about thunderstorms and lightning.** Place special emphasis on what people should do if they are caught outside. Localize the information by printing the phone numbers of local emergency service offices, the American Red Cross chapter, and the nearest hospitals.
- **Interview officials with the [U.S. Department of Agriculture](#) about the [Federal Crop Insurance Corporation](#).**
- **Periodically inform your community of local public warning systems.**
- **Have your meteorologist speak to elementary schools and youth groups** about the dangers of thunderstorms, lightning, and hail.
- **Interview a representative of the American Red Cross** about giving first aid to people who have been struck by lightning.
- **Interview agents from various insurance companies about what homeowner's insurance does and does not cover in severe weather** (flooding, fallen trees creating no structural damage, etc.).

What to Do Before a Thunderstorm

- **Use a NOAA Weather Radio with a tone-alert feature to keep you informed of watches and warnings issued in your area.** The tone- alert feature will automatically alert you when a watch or warning is issued.
- **If planning a trip or extended period of time outdoors, listen to the latest forecasts and take necessary action if threatening weather is possible.** Knowing what weather could happen helps you be prepared to respond if necessary. Having a raincoat, umbrella, and disaster supplies kit available will make it easier to deal with severe weather if it occurs.
- **Postpone outdoor activities if thunderstorms are imminent. Coaches of outdoor sports teams should have a NOAA Weather Radio with a tone-alert feature during practice sessions and games.** Threatening weather can endanger athletes, staff, and spectators. Many people take shelter from the rain, but most people struck by lightning are not in the rain! Postponing activities is your best way to avoid being caught in a dangerous situation.
- **Keep an eye on the sky.** Pay attention to weather clues around you that may warn of imminent danger. Look for darkening skies, flashes of lightning, or increasing wind, which may be signs of an approaching thunderstorm.
- **Stay aware of your surroundings.** Look for places you might go should severe weather threaten.
- **Listen for the sound of thunder.** If you can hear thunder, you are close enough to the storm to be struck by lightning. Go to safe shelter immediately.

What to Do During a Severe Thunderstorm WATCH

- **Listen to a NOAA Weather Radio, or local radio or television stations for updated information.** Local authorities will provide you with the best information for your particular situation.
- **Avoid natural lightning rods such as golf clubs, fishing poles, tractors, bicycles, and camping equipment.** Lightning is attracted to metal and poles or rods.
- **Be prepared to seek shelter if a severe thunderstorm approaches.** A sturdy building is the safest place to be during a severe thunderstorm. Avoid unprotected gazebos, rain or picnic shelters, golf carts, baseball dugouts and bleachers. While many people take shelter from rain in these locations, they are often isolated structures in otherwise open areas, and, therefore, a target for lightning. In addition, gazebos and picnic shelters are often poorly anchored and subject to being uprooted and blown around in strong thunderstorm winds. They also offer little protection from large hail.

If you perceive a severe thunderstorm approaching:

- **Secure outdoor objects such as lawn furniture that could blow away or cause damage or injury. Take light objects inside.**
- **Shutter windows securely and brace outside doors.** This will help protect your house from damaging winds or flying debris.
- **Avoid electrical equipment and telephones.** Lightning could follow the wire. Television sets are particularly dangerous at this time.
- **Avoid bathtubs, water faucets, and sinks because metal pipes can transmit electricity.**

What to Do During a Severe Thunderstorm WARNING

Listen to a NOAA Weather Radio or a battery-powered radio or television for updated emergency information. If the power goes out, you still will have access to important information.

What to Do at Home during a Thunderstorm WARNING

- **Draw blinds and shades over windows.** If windows break due to objects blown by the wind or large hail, the shades will help prevent glass from shattering into your home.
- **Unplug appliances.** Avoid using the telephone or any electrical appliances. If lightning strikes, telephone lines and metal pipes can conduct electricity. Leaving electric lights on, however, does not increase the chances of your home being struck by lightning.
- **Avoid taking a bath or shower, or running water for any other purpose.** Metal pipes and plumbing can conduct electricity if struck by lightning.
- **Turn off the air conditioner.** Power surges from lightning can overload the compressor, resulting in a costly repair job.

What to Do if You Are Outside and a Severe Thunderstorm Is Approaching

- **If you are boating or swimming, get to land, get off the beach, and find shelter immediately.** Stay away from rivers, lakes, and other bodies of water. Water is an excellent conductor of electricity. When lightning strikes nearby, the electrical charge can travel through the water. Each year, numbers of people are killed by nearby lightning strikes while in or on the water.
- **Take shelter in substantial, permanent, enclosed structures, such as reinforced buildings.** Sturdy buildings are the safest place to be. Avoid unprotected gazebos, rain or picnic shelters, golf carts, baseball dugouts and bleachers. While many people take shelter from rain in these locations, they are often isolated structures in otherwise open areas, and, therefore, a target for lightning. In addition, gazebos and picnic shelters are often poorly anchored and subject to being uprooted and blown around in strong thunderstorm winds. They also offer little protection from large hail.
- **If there are no reinforced buildings in sight, take shelter in a car.** Keep car windows closed and avoid convertibles. Rubber-soled shoes and rubber tires provide no protection from lightning. However, the steel frame of a hard-topped vehicle provides increased protection if you are not touching metal. Although you may be injured if lightning strikes your car, you are much safer inside a vehicle than outside.
- **If you are in the woods, find an area protected by a low clump of trees.** Never stand underneath a single large tree in the open. Be aware of the potential for flooding in low-lying areas.
- **As a last resort and if no structure is available, go to a low-lying, open place away from trees, poles, or metal objects. Make sure the place you pick is not subject to flooding.** Have as little contact with the ground as possible. Squat low to the ground. Place your hands on your knees with your head between them. Make yourself the smallest target possible. Do not lie flat on the ground this will make you a larger target.
- **Avoid tall structures such as towers, tall trees, fences, telephone lines, and power lines.** Lightning strikes the tallest objects in an area.
- **Stay away from natural lightning rods, such as golf clubs, tractors, fishing rods, bicycles, and camping equipment.** Lightning is attracted to metal and poles or rods.
- **If you are isolated in a level field or prairie and you feel your hair stand on end (which indicates that lightning is about to strike), drop to your knees and bend forward, putting your hands on your knees. Crouch on the balls of your feet. Do not lie flat on the ground.** The electrical build-up just before lightning strikes will cause your hair to stand on end. Make yourself the smallest target possible and minimize contact with the ground.

What to Do While driving During a Thunderstorm and Heavy Rain

- **Pull safely onto the shoulder of the road and stop, making sure you are away from any trees or other tall objects that could fall on the vehicle. Stay in the car and turn on the emergency flashers until the heavy rains subside.** Heavy rains produced by thunderstorms can greatly reduce visibility. **Vehicles will provide better protection from lightning than being out in the open.** Emergency flashers will alert other drivers with limited visibility that you have stopped. Keep car windows closed.
- **Avoid contact with metal or conducting surfaces outside or inside the vehicle.** Lightning that strikes nearby can travel through wet ground to your car. The steel frame of a hard-topped vehicle provides increased protection if you are not touching metal. Rubber tires provide no protection from lightning. Avoid contact with potential conductors to reduce your chance of being shocked. **Although you may be injured if lightning strikes your car, you are much safer inside a vehicle than outside.**
- **Avoid flooded roadways.** Most flood fatalities are caused by people attempting to drive through water, or people playing in high water. The depth of water is not always obvious. The roadbed may be washed out under the water, and you could be stranded or trapped. Rapidly rising water may stall the engine, engulf the vehicle and its occupants, and sweep them away. Look out for flooding at highway dips, bridges, and low areas. **Two feet of water will carry away most automobiles.**

What to Do After a Thunderstorm

- **Continue listening to local radio or television stations or a NOAA Weather Radio for updated information and instructions.** Access may be limited to some parts of the community, or roads may be blocked.
- **Help a neighbor who may require special assistance - infants, elderly people, and people with disabilities.** Elderly people and people with disabilities may require additional assistance. People who care for them or who have large families may need additional assistance caring for several people in emergency situations.
- **Stay away from storm-damaged areas.** You may be putting yourself at further risk from the residual effects of severe thunderstorms.
- **Watch out for fallen power lines and report them immediately.** Reporting potential hazards will get the utilities turned off as quickly as possible, preventing further hazard and injury.

What to Do if Someone Is Struck by Lightning

- **Call for help.** Get someone to dial 9-1-1 or your local Emergency Medical Services (EMS) number. Medical attention is needed as quickly as possible.
- **Give first aid.** If breathing has stopped, begin rescue breathing. If the heart has stopped beating, a trained person should give CPR. If the person has a pulse and is breathing, look and care for other possible injuries.
- **Check for burns in two places. The injured person has received an electrical shock and may be burned, both where they were struck and where the electricity left their body.** Being struck by lightning can also cause nervous system damage, broken bones, and loss of hearing or eyesight. People struck by lightning carry no electrical charge that can shock other people, and they can be handled safely