

Thunderstorms, Severe

Learn about your area's severe thunderstorm risk. Severe thunderstorms can occur year-round and at any hour. Contact your local emergency management office, National Weather Service office, or American Red Cross chapter for more information.

More information about lightning and lightning safety is available at www.lightningsafety.noaa.gov/.

AWARENESS MESSAGES

Why talk about thunderstorms?

Despite their small size, all thunderstorms are dangerous. Every thunderstorm produces lightning, which kills more people each year than tornadoes and hurricanes. Heavy rain from thunderstorms can lead to flash flooding. Strong winds, hail, and tornadoes are also dangers associated with some thunderstorms. High winds from thunderstorms can cause damage to homes, overturn vehicles, and blow down trees and utility poles, causing widespread power outages.

Many strong thunderstorms produce hail. Large hail, and the glass it may break, 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.

Downbursts and straight-line winds associated with thunderstorms can produce winds of 100 to 150 miles (161 to 241 kilometers) per hour—enough to flip cars, vans, and pickup trucks. The resulting damage can equal the damage of most tornadoes.

What are severe thunderstorms?

Thunderstorms affect relatively small areas when compared with hurricanes and winter storms. The typical thunderstorm is 15 miles (24 kilometers) in diameter and lasts an average of 20 to 30 minutes. Of the estimated 100,000 thunderstorms occurring each year in the United States, only about 10 percent are classified as severe.

The National Weather Service (NWS) considers a thunderstorm severe if it produces hail at least three-quarters of an inch (2 centimeters) in diameter, has wind gusts of 58 miles (93 kilometers) an hour or higher, or produces a tornado.

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.

How can I protect myself in a severe thunderstorm?

Each year, many people are killed or seriously injured by severe thunderstorms despite advance warning. While some did not hear the warning, others heard the warning but did not heed it. The following preparedness information, combined with timely severe weather watches and warnings could save your life. Once you receive a warning or observe threatening skies, you yourself must make the decision to take shelter before the storm arrives. It could be the

most important decision you will ever make.

In a hailstorm, take cover immediately. Pets and livestock are particularly vulnerable to hail, so bring animals into shelter before storms begin.

If a severe thunderstorm warning is issued, take shelter. Get out of structures, such as mobile homes, that are susceptible to being blown over in high winds. Stay away from downed power lines and report them immediately.

How dangerous is lightning?

Lightning is a major threat during a thunderstorm. Lightning produces thunder in a thunderstorm and is very unpredictable, increasing the risk to individuals and property.

According to the National Weather Service, lightning kills on average more than 70 people and injures at least 300 others each year in the United States. While only about 10 percent of those struck are killed, the large majority of the 90 percent who survive suffer long-term injuries, such as memory loss, dizziness, muscle spasms, depression, and fatigue. Lightning also causes about \$5 billion in economic loss each year in the United States.

Lightning often strikes outside the area of heavy rain and may occur as far as 10 miles (16 kilometers) from any rainfall. Heat lightning is actually lightning from a thunderstorm too far away for thunder to be heard.

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.

More than 50 percent of lightning deaths occur after the thunderstorm has passed. The National Weather Service encourages you to practice the 30/30 lightning safety rule: If the time between seeing the lightning and hearing the thunder is less than 30 seconds, you are in danger. Stay indoors for 30 minutes after hearing the last clap of thunder.

What is the best source of information about severe thunderstorms in my area?

Local radio or television stations or NOAA Weather Radio are the best sources of information about severe thunderstorms and other weather-related bulletins in your area.

NOAA Weather Radio is the prime alerting and critical information delivery system of the National Weather Service (NWS). NOAA Weather Radio broadcasts warnings, watches, forecasts, and other hazards information 24 hours a day over more than 650 stations in the 50 states, adjacent coastal waters, Puerto Rico, the U.S. Virgin Islands, and the U.S. Pacific territories.

The NWS encourages people to buy a weather radio equipped with the Specific Area Message Encoder (SAME) feature. This feature automatically alerts you when important information is issued about severe thunderstorms or other weather-related hazards in your area. Information on NOAA Weather Radio is available from your local NWS office or at www.nws.noaa.gov/nwr.

Watch, Warning

A **Severe Thunderstorm WATCH** means severe thunderstorms are possible in and near the watch area. People in a watch area should keep informed and be ready to act if a severe thunderstorm warning is issued.

A **Severe thunderstorm WARNING** means severe weather has been reported by spotters or indicated by radar. Warnings indicate imminent danger to life and property.

Is your community StormReady? To help Americans prepare for the ravages of hazardous weather, the NWS has designed StormReady, a program aimed at arming America's communities with the communication and safety skills necessary to save lives and property. More information is available at www.stormready.noaa.gov/.

See "[Floods and Flash Floods](#)," "[Tornadoes](#)," "[Hurricanes and Tropical Storms](#)," and "[Evacuation and Sheltering and Post-disaster Safety](#)."

ACTION MESSAGES

Be Prepared for Severe Thunderstorms Protect Yourself

CORE ACTION MESSAGES

- Determine your risk.
- Prepare members of your household.
- Pick a safe place.

For general preparedness, every household should create and practice a Family Disaster Plan and assemble and maintain a Disaster Supplies Kit. In addition, every household should take precautions for severe thunderstorms and lightning and plan for and practice what to do if a thunderstorm occurs.

You should:

- **Discuss thunderstorm safety with members of your household.** Be aware that a thunderstorm could produce a tornado. Tornadoes develop from severe thunderstorms along and ahead of cold fronts. (See "Tornadoes.")
- **Pick a safe place in your home for household members to 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 and cause damage or injury. In preparation for possible tornado warnings, consider making your severe thunderstorm

safe place on the lowest floor of the building. See “Wind Safe Room” for information on how to build a reinforced room in your home or school.

- **Learn about your community’s warning system for severe thunderstorms.** Make sure all members of your household understand the system. Use a NOAA Weather Radio or listen to a local radio or television station to keep aware of watches and warnings while you are indoors. Make sure everyone in your household knows the name of the county or parish where you live because severe thunderstorm watches and warnings are issued for counties or parishes. People should also know the name of the county or parish they are in if they are away from home.
- **Learn how to crouch low to the ground on the balls of your feet.** Place your hands on your knees and your head between your knees. Minimize your body's surface area, and minimize your contact with the ground. Lightning current often enters a victim through the ground rather than by a direct overhead strike.

Protect Your Property

CORE ACTION MESSAGES

- **Actively prepare your home.**
- **Check your insurance coverage.**

You should:

- **Make a list of items to bring inside in the event of a severe thunderstorm.** 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.
- **Remove any debris or loose items from around your home and outbuildings and from pastures.** Branches and firewood may become missiles in strong winds.
- **Protect your animals.** Ensure that any outbuildings, pastures, or corrals that house animals are protected in the same way as your home. When installing or changing fence lines, consider placing them in such a way that your animals are able to move to higher ground in the event of flooding.
- **Consider installing permanent shutters to cover windows.** Shutters can be closed quickly and provide the safest protection for windows.
- **Install lightning rods on your home and on barns or any other building that house animals.** 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 that 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.

What to Do Before a Severe Thunderstorm

CORE ACTION MESSAGES

- Stay informed.
- Prepare to shelter.

You should:

- **Use a NOAA Weather Radio to keep you informed of watches and warnings issued in your area.**
- **If planning a trip or extended period of time outdoors, be aware of the weather forecast.** Knowing what the weather could be will help 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 use a NOAA Weather Radio during practice sessions and games. Threatening weather can endanger athletes, staff, and spectators. Remember that many people struck by lightning are not in an area where rain is falling. 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.
- **Be aware of your surroundings.** Look for places you could go if severe weather threatens.
- **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.
- **Even if there is no official thunderstorm warning, if you see signs of a thunderstorm, take precautions.**

What to Do During a Severe Thunderstorm Watch

CORE ACTION MESSAGES

- Keep informed.
- Prepare to shelter.
- Avoid lightning attractors.

You should:

- **Use a NOAA Weather Radio or listen to a local radio or television station.** 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 take shelter.** A sturdy building is the safest place to be during a severe thunderstorm. Avoid gazebos, rain or picnic shelters, golf carts, baseball dugouts, bleachers, and other isolated structures in otherwise open areas because such places are often struck by 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 that a severe thunderstorm is approaching:**
 - Secure outdoor objects such as lawn furniture that could blow away or cause damage or injury.** Take lightweight objects inside.
 - Bring your companion animals indoors and maintain direct control of them.** Be sure that your pet disaster kit is ready to go.
 - If possible, bring horses and livestock into your barn.** Do not allow horses or livestock to gather under an isolated tree or otherwise present a risk from a lightning strike.
 - Shutter windows and close outside doors securely.** This will help protect your home from damaging winds or flying debris.
 - Avoid electrical equipment and telephones.** Lightning could follow the wire. Television sets are particularly dangerous at this time. Use a battery-powered radio or television.
 - Avoid bathtubs, water faucets, and sinks because metal pipes can transmit electricity.**

What to Do During a Severe Thunderstorm Warning

CORE ACTION MESSAGES

- Stay informed.
- Go to shelter.
- Avoid lightning attractors.

You should:

- **Use a NOAA Weather Radio or listen to a local station on a battery-powered radio or television for updated emergency information.** If the power goes out, you still will have access to important information.
- **Draw the blinds and shades over windows.** If windows break because objects are blown by the wind or large hail, the shades will help prevent glass from shattering into your home.
- **Unplug appliances** and 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.
- **Maintain direct control of your animals.** Many animals are unsettled by thunderstorms and it is more comforting and safe for them to be with you.

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

CORE ACTION MESSAGES

- Get to shelter.
- Avoid likely lightning targets.

You should:

- **Find shelter immediately. 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, people are killed by nearby lightning strikes while in or on the water.
- **Take shelter in a substantial, permanent, enclosed structure**, such as a reinforced building. A sturdy building is the safest place to be. Avoid gazebos, rain or picnic shelters, golf carts, baseball dugouts, bleachers, and other isolated structures in otherwise open areas because such places are often struck by 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 is no reinforced building in sight, take shelter in a vehicle.** Keep the 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 vehicle, 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 beneath 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 suitable structure or vehicle 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. Crouch low to the ground on the balls of your feet. Place your hands on your knees and your head between your knees. Minimize your body's surface area, and minimize your contact with the ground. Lightning current often enters a victim through the ground rather than by a direct overhead strike.
- **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), crouch low to the ground on the balls of your feet.** Place your hands on your knees and your head between your knees. Minimize your body's surface area, and minimize your contact with the ground. Lightning current often enters a victim through the ground rather than by a direct overhead strike.

Note: Coordinators of outdoor events should monitor the weather with a NOAA Weather Radio and evacuate participants when appropriate.

Note: School buses are an excellent lightning shelter due to the amount of metal shielding but a substantial building is still a better shelter due to the high-winds associated with severe storms.

What to Do If You Are Driving During a Severe Thunderstorm or Heavy Rain

CORE ACTION MESSAGES

- Pull over.
- Stay in the vehicle.
- Be alert for flooding.

You should:

- **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 vehicle and turn on the emergency flashers until the heavy rain subsides.** Heavy rain produced by thunderstorms can greatly reduce visibility. Emergency flashers will alert other drivers that you have stopped. Keep the windows closed. You are safer from lightning in a vehicle than out in the open.
- **Avoid contact with metal or other conducting surfaces outside or inside the vehicle.** Lightning that strikes nearby can travel through wet ground to your vehicle. 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 vehicle, you are much safer inside than outside.
- **Avoid flooded roads.** Many 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. As little as six inches of water may cause you to lose control of your vehicle and two feet (0.6 meter) of flowing water will carry away most automobiles, including SUVs and pickup trucks. (See “What to Do When There Is Flooding”)

What to Do After a Severe Thunderstorm

CORE ACTION MESSAGES

- Stay informed.
- Be alert to hazards.
- Help others.

You should:

- **Continue using a NOAA Weather Radio or listening to a local radio or television station for updated information and instructions.** Access may be limited to some parts of the community or roads may be blocked.
- **Help people who require special assistance**—infants, elderly people, those without transportation, large families who may need additional help in an emergency situation, people with disabilities, and the people who care for them.
- **Stay away from storm-damaged areas** to avoid putting yourself at further risk from the residual effects of severe thunderstorms. Sightseers cause additional problems and hamper local responders assisting those in need.
- **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. If assistance is needed in your area and telephone communications are disrupted, go to your nearest fire or police station to request assistance.

- **Watch animals closely.** Keep all your animals under your direct control. Pets may become disoriented before, during, and after severe thunderstorms. If there has been wind damage, pets may be able to escape from your home or your fence may be broken. Be aware of hazards at nose and paw or hoof level, particularly debris, downed power lines—things that can be dangerous to humans. In addition, the behavior of pets may change dramatically after a severe storm, becoming aggressive or defensive, so be aware of their well-being and take measures to protect them from hazards, including displaced wild animals, and to ensure the safety of other people and animals.

For information on **portable-generator safety** and carbon monoxide poisoning, see "[Portable Generators](#)".

What to Do if Someone Is Struck by Lightning

CORE ACTION MESSAGES

- Get help.
- Give first aid.

You should:

- **Call for help.** Get someone to dial 9-1-1 or your local emergency number. Medical attention is needed as quickly as possible.
- **Give first aid.** If the person has stopped breathing, begin rescue breathing. If the person's heart has stopped beating, a trained person should give CPR. If the person has a pulse and is breathing, look for other possible injuries and care for them if necessary.
- **Check the person for burns in two places.** The injured person has received an electrical shock and may be burned both where the current entered and where it exited his or her 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.

Media and Community Education Ideas

- Ask your local newspaper or radio or television station to:
 - Do a series on the dangers of thunderstorms and lightning and place special emphasis on what people should do if they are caught outside.
 - Highlight the importance of staying informed about local weather conditions.
 - Run public service ads about how to protect lives and property from severe thunderstorms and lightning.
 - Interview officials of the U.S. Department of Agriculture about the Federal Crop Insurance Corporation.
 - Inform the community about local public warning systems.
 - 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 kinds of severe

thunderstorm and lightning damage homeowners' insurance does and does not cover.

Help the reporters to localize the information by providing them with the local emergency telephone number for the fire, police, and emergency medical services departments (usually 9-1-1) and emergency numbers for the local utilities and hospitals. Also provide business telephone numbers for the local emergency management office and American Red Cross chapter.

- Ask a local meteorologist to speak to school and youth groups about the dangers of thunderstorms, lightning, and hail.

Facts and Fiction

Fiction: If it is not raining, there is no danger from lightning.

Facts: Lightning often strikes outside heavy rain and may occur as far as 10 miles (16 kilometers) away from any rainfall. This is especially true in the western United States where thunderstorms sometimes produce very little rain.

Fiction: The rubber soles of shoes or rubber tires on a vehicle will protect you from being struck by lightning.

Facts: Rubber-soled shoes and rubber tires do not provide protection from lightning. 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 vehicle, you are much safer inside a vehicle than outside.

Fiction: People struck by lightning carry an electrical charge and should not be touched.

Facts: Lightning-strike victims carry no electrical charge and should be attended to immediately. Contact your local American Red Cross chapter for information on CPR/AED and first-aid classes.

Fiction: Heat lightning occurs after very hot summer days and poses no threat.

Facts: "Heat lightning" is a term used to describe lightning from a thunderstorm too far away for thunder to be heard. All lightning is dangerous.

Fiction: Lightning never strikes twice in the same place.

Facts: Just because lightning struck a place once does not make it less likely that it will strike again in the same place. In fact, it may indicate that the place is more vulnerable to lightning strikes than other places in the immediate area.