Lightning Safety Guidelines and Event Safety Plan

By Leland L. Hite

While your chance of being struck by lightning in your lifetime is estimated at 1 in 5,000, it is much better than winning the lottery. Participating in high-risk outdoor activities when lightning approaches can increase your odds of a lightning experience. You can significantly reduce your risk by practicing these guidelines.

YES

It is okay to ask your outdoor event planners about their event safety plan for lightning.

ASK

The Coach –The Referee – The Umpire – The Administrators
The Parents – The Event Planner or the Sponsor

See Page 9

Seek Safe Shelter Sooner and Remain There Longer
When Thunder Roars – Go Indoors

Lightning Prediction and Warning Guidelines
Seek Shelter Sooner and Stay in Longer

When to implement a lightning safety rule depends on your ability to accurately learn about an unsafe condition while there is still time to respond. Below are detailed several methods available to assist your decision.

(1) The first suggestion is an early warning electronic device that can predict an unsafe condition. The

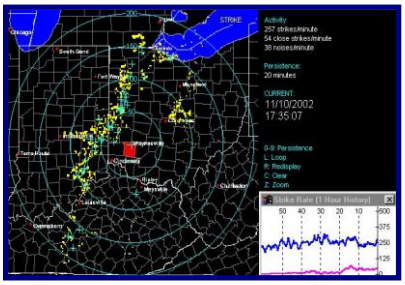
Thor Guard Lightning Prediction and Warning System measures the electrical charge buildup from the cloud to predict and warn of the danger. This approach does not depend on a previous lightning strike as a reference for warning and can warn you when the first strike is about to happen. See www.thorguard.com for additional details on this early warning device. If you have this device at your event, learn what the warning signals mean.

(2) The second suggestion is to use common sense by employing your eyes and ears regardless of any electronic device that may be in use.

When you observe lightning, stop your outdoor activity and seek safe shelter. Lightning can travel much farther than you can see. If you see lightning, any lightning, you are in danger even if the flash appears to be at a considerable distance from you.

When you hear thunder, immediately stop your outdoor activity and seek shelter. The sound of thunder dissipates rapidly in the atmosphere. Lightning can be dangerously close, yet the sound of its thunder may cause you to conclude that it is at a considerable distance. When you hear thunder, you are in immediate danger.

(3) The third suggestion is to take advantage of the lightning detection technology available via the internet or TV. Many sources provide a real-time lightning display map for your area. Use an at-home observer to monitor the display map and call on-site personnel about an approaching storm containing lightning. Mobile internet devices can often provide a good lightning display map.



When to resume activities:

Remain in your safe location for 30 minutes after the last sight of lightning or the last sound of thunder. If you are in an area that employs the Thor Guard Lightning Prediction and Warning System, wait until you hear 3 short blasts from the horns and the strobe light extinguishes, indicating a safe return to activities.

The 30/30 Rule: Caution is advised when using this rule!

You may have heard of—or used—the 30/30 rule, which suggests that you predict danger by determining how close you are to lightning. The rule depends on you to measure that distance by asking you to count to 30 using the method of saying one-thousand and one, one-thousand and two, and so on. If the flash to bang count is under 30 seconds, indicating a distance of 6 miles, you are in danger and need to seek safe shelter. Remain in the shelter for 30 minutes after the last sound from thunder or the last flash from lightning.

Used today by the National Weather Service and the National Oceanic and Atmospheric Administration, this rule should not be the only method you employ for determining danger because the 30-second recommendation can be highly inaccurate. Rather than traveling straight down from the storm cloud to the ground, lightning often travels at an angle and will move horizontally about 40% of the time. An inaccurate prediction using the 30-second rule can occur when the bolt begins at the top of the storm cloud, about 6 miles high, and travels at an angle of 45° before striking the ground 6 miles away. The flash to bang count would indicate that the danger is six miles away, when the danger is directly over you. The next strike could propagate straight to your location.

The second problem with using the 30-second method to determine danger is that the maximum distance you can hear thunder can be as short as 2 miles and seldom exceeds 10 miles. The 30-second rule depends on you hearing thunder that is 6 miles away. This can be difficult depending on wind direction, background noise, terrain, and the direction of travel for the strike. Wind shear can have a pronounced effect upon sound propagation in the lower atmosphere, where waves can be "bent" by refraction phenomena. The audibility of sounds from distant sources, such as thunder or gunshots, is very dependent on the amount of wind shear.

The speed of sound varies with temperature. As temperature and sound velocity normally decrease with increasing altitude, sound is refracted upward, away from listeners on the ground, creating an acoustic shadow at some distance from the source. In 1862 during the Battle of Iuka in the Civil War, an acoustic shadow believed to have been enhanced by a northeast wind kept 2 divisions of Union soldiers out of the battle because they could not hear the sounds of battle only 6 miles downwind.

The second number of the 30/30 rule represents 30 minutes and remains as a good guideline. It recommends that you remain in your safe location for 30 minutes after the last sight of lightning or the last sound of thunder. Research indicates that 50 percent of lightning-related deaths occur after the storm has passed and most people think the storm is over. This rule is by no means a 100% guarantee of your safety.

Replacement for the 30/30 Rule
When you see lightning or when you hear thunder, go indoors and stay there for 30 minutes after the last sound of thunder or sight of lightning.

The Need to Act Quickly

- When you experience a close strike, you will hear a loud crack and you may see the bright light of the flash. When the strike is within 20 to 50 feet, you need to immediately do 2 things.

    1. First check that everyone is alive. If the magnetic field from the strike synchronizes with the heart's T-wave, the heart can stop. Check everyone from babies to the elderly. The magnetic field does not discriminate, and you generally cannot feel the magnetic field.

       If breathing or pulse are absent, immediately begin CPR. Even if the brain was not damaged by the energy of the strike, permanent brain damage can occur after about 4 ½ to 6 minutes of oxygen starvation to the brain. It is especially important to immediately get the 911 response agency in route. Begin CPR and know how to locate and use your AED. See the first aid section on page 8.

    2. Secondly, inspect your attic and see if it's on fire. A lightning strike to the roof of a residential structure can easily flame the inside of the attic without your knowledge. Fire doubles in size about every 30 to 45 seconds and precious seconds' count. (This rate varies and depends on fuel supply, oxygen supply, heat source, containment, and other site-specific conditions). A 2-minute delay in response could mean the fire is 8 times larger. When your attic is on fire, the danger may not be obvious until fire begins dropping from the ceiling, possibly trapping you inside the structure, or your neighbors call and comment that the moisture on your roof is steaming.

Installing a combination fire and smoke detector in the attic is a good idea. The problem with relying on this detection method is that smoke detectors are not designed to operate within the extreme temperature ranges of the attic. Typical attic temperatures can reach a high of 175° Fahrenheit and a low of your outside winter temperature. A typical temperature range for a smoke detector can be 32° to around 130°. Clearly, that range is not suited for the typical attic. The NFPA (National Fire Protection Association) has no guidelines to help here.

Many have used a combination photoelectric and ionizing detector (aka smoke and fire detector) in the attic with considerable success. Locating the detector in the attic close to your living area is also a good idea. To facilitate changing the battery with minimal effort, you could locate the detector directly over the access point to the attic. Remember, when you change your clocks—change your smoke and fire detector battery.

Safety Guidelines for Lightning

- No location outdoors is safe from lightning! *Again:* No location outdoors is safe from lightning!
- Develop your safety plan prior to the event and designate someone responsible for event safety. See Event Safety Plan on Page 9.
- Everyone is ultimately responsible for his or her own safety.
- Adults must take responsibility for the safety of children and pets in their care during thunderstorms.
- At the first sign of danger, immediately implement your "Safety Plan."
- Move quickly to a safe location, preferably a "Lightning Safe Shelter" or a hardtop metal vehicle with the windows rolled up. Move to the center of the vehicle, do not touch any metal, and stay off the 2-way radio connected to an outside antenna.
- Indoors, stay off a PlayStation® and similar devices and stay off a corded phone inside or outside a structure. It's okay to use a cell phone or portable phone inside a structure but never outdoors when there is a threat of lightning.
- Remove metal from the body such as watchbands, necklaces, bracelets, earrings, barrettes, rings, chains, belts, or a bra containing an underwire. Encourage the use of sports bras that contain no metal. Body metal is dangerous for 2 reasons. The first is that any jewelry that is formed in the shape of a full circle (a closed loop like a ring, necklace, or bracelet) acts as a *magnetic antenna* for the magnetic pulse from the lightning strike. This will cause the metal to become red hot when lightning strikes nearby (typically 20 to 50 feet), and it can burn deep into the skin. The second reason is that any metal on the body increases the risk of being hit by lightning.
- Do not touch anything that could conduct electricity.
- Concrete is highly conductive to lightning. Avoid concrete roofs and bridges, roads, driveways, sidewalks, buildings, patios, and airport runways. The high temperature of the lightning bolt causes the concrete to explode, sending chunks of concrete in all directions.
- Avoid water. Water can transmit current 600 feet from a distant lightning strike, exposing swimmers, boaters, and fishermen to risk.

Sporting Events

- Trees and open shelters found on and around sporting events offer no protection from lightning and, in fact, are quite susceptible to a lightning strike.
- Get far away from the goalpost or scoreboard. Metal fences around ball parks, backstops, dugouts with metal roofs, metal seating, metal signs, light poles, and flagpoles should also be avoided.
- Get far away from the golf cart, the metal cup on the tee, the ball washer, or signs on metal posts.
- When lightning is a threat, throw your golf clubs on the ground and far away from you.

Actual time exposure photography

Boating

- If caught on the open water during a lightning storm, go below deck if possible and avoid metal objects.
- Stop using metal antennas such as fishing poles, outriggers, umbrellas, and pet leashes.
- Correctly ground your boat for lightning.
- Water can transmit current 600 feet from a distant lightning strike, exposing swimmers, boaters, and fishermen to risk.

Indoors

- Keep people and pets away from all metal, particularly the top-level bathroom, the kitchen, the laundry room, plumbing, heating ducts and vents, electrical outlets, electrical appliances, phone lines, ceiling fans, TVs, windows, metal doors, fireplaces, chimneys, metal radiators, wood stoves, computers, hair dryers, electric toothbrushes, or electric razors.
- Don't touch anything that could conduct electricity.
- Unplug appliances before a storm nears—**never during.** Unplug the phone line from the computer because most computer failures arise from lightning traveling to the computer via the phone line, not the power line.

Outdoors

Nowhere outdoors is safe from the danger, but some locations are more dangerous than others. You may already know that standing under a tree is dangerous, but did you know that 60 feet or more from the tree is lethal? Should lightning strike a tree, a metal flagpole, a streetlight pole, or other tall and isolated object, the energy from the strike will distribute on the surface of the ground at the base of the tall object and remain lethal for a minimum of a 60-foot radius. Beyond 60 feet may not be lethal but can cause lifelong injuries if you choose to stand in this area. Standing in water such as a pool, a lake, or the ocean is lethal for 600 feet from a lightning strike!

- Close all windows, move to the center of a hardtop vehicle, do not touch any metal, and stay off the 2-way radio connected to an outside antenna.
- If no buildings or metal vehicles are available, your best protection is a cave, ditch, canyon, or low ravine, but watch for flooding.
- When in a group and in the open, spread out, keeping people several yards apart.
- Avoid flammable materials in open containers. If open, close them up!
- Avoid all refueling. Completely avoid gas stations. Never fill a vehicle's gas tank during a storm.
- Avoid open metal vehicles such as a motorcycle, a bicycle, a golf cart, a lawn mower, an ATV, a tractor, farm equipment, or a convertible automobile.
- Avoid standing underneath or beside a tree, road sign, telephone pole, electrical pole, light pole, flagpole, radio tower, monument, or metal ladder. Should lightning strike a tree, a metal flagpole, a streetlight pole, or other tall and isolated object, the energy from the strike will distribute on the surface of the ground at the base of the tall object and remain lethal for a minimum of a 60-foot radius. Beyond 60 feet may not be lethal but can cause lifelong injuries if you choose to stand in this area.
- Avoid open areas like the beach, parking lots, open water, swimming pool (indoors and outdoors), the golf course, athletic fields, recreational parks, stadiums, and picnic areas.

- Avoid being the tallest object projecting above the surrounding landscape. Examples include standing in an open field (sports field, stadium, or golf course), riding horseback, standing on a hilltop, or being on a mountain top.
- Avoid standing in small, isolated sheds or other small structures in open areas.
- Avoid metal antennas such as telephones, fishing rods, golf clubs, umbrellas, pet leashes, clotheslines, metal fences, power lines, pipelines, structural steel fabrication, railroad tracks, metal pipes, plumbing, metal gutters, and downspouts. These make great antennas for the electrical field of a nearby strike.

Pets and Farm Animals

- You are responsible for your animals. They cannot protect themselves.
- Do not leave your pets outdoors during a lightning storm. They are particularly susceptible to step-voltage from a nearby lightning strike.
- Lightning causes 80% of accidental outdoor animal deaths.
- Replace metal collars and metal leashes with a nonconductive material.
- Do not chain an animal to a tree during a lightning storm or attach to a metal exercise wire.
- Provide a lightning-safe shelter for your pets and farm animals

Keep a Perspective

It is quite difficult to obtain complete safety from lightning. To provide a perspective on this, the list below is organized into steps of descending safety where 10 is best. This rating system is from Mr. William P. Roeder, Chief Staff Meteorologist of the 45th Weather Squadron for the Air Force.

- Rating of 10 = Lightning certified safe shelter.
- Rating of 09 = Lightning protected building.
- Rating of 07 = In the center of a lower-level, large, enclosed, substantially constructed building containing electrical and/or plumbing and away from all electrical connections to the outside.
- Rating of 03 = A hardtop, enclosed metal vehicle with the windows rolled up such as car, bus, airplane, train, tractor, or camper.
- Rating of 0 = Outdoors.

First Aid

- Specific medical advice should be obtained through consultation with a physician or other trained health care practitioner.
- Immediately call 911 and send someone for help.
- If the scene is considered safe from other threats including lightning, you can immediately begin treating the victim. No residual electrical charge remains after the strike.
- Normal triage recommends that you treat the living first. Proper triage for lightning is just the opposite.
  Treat the dead first. A high percentage of lightning victims can be revived. If breathing is absent (aka respiratory arrest) begin cardiopulmonary resuscitation with a combination of mouth-to-mouth rescue breathing and external cardiac compression, aka CPR. Often the person administering CPR will quickly become exhausted, so immediately ask for help administering CPR in a tag-team arrangement. To restart the heart often requires the use of an AED (Automated External Defibrillator). Know the location for your AED and how to use it.

- Others may be stunned or otherwise injured and may need attention. Check for burns, especially at fingers, at toes, or next to buckles and body metal (jewelry).
- Give first aid for shock.
- Do not let victims walk around on their own. Stay with victims until help arrives.
- The Red Cross first aid course provides excellent instruction on how to provide aid to a person who has been struck by lightning.
- Lightning injuries receive less attention than lightning deaths. The survivors are often the untold casualties of lightning strikes. Less than 12% of the lightning that strikes people is fatal, but approximately 70% causes long-term medical problems.
- Lightning injuries are not well understood by the general medical community, and many symptoms and treatment of them can be delayed until long after the strike has passed. It is important that you encourage survivors and their doctors to contact LSESSI.

Lightning Strike & Electric Shock Survivors International
P.O. Box 1156
Jacksonville, North Carolina 28541-1156
Phone and Fax # 910-346-4708
E-mail: steve@lightning-strike.org

Event Safety Plan for Lightning

Who is the lightning spotter? Use multiple spotters. Both on-site and at-home spotters provide an extra measure of safety by keeping a weather eye on the sky, watching for the threat of lightning and other severe weather. At-home spotters can watch a real-time lightning map and call on-site personnel to provide an early warning that a storm containing lightning is approaching, say within 30 miles. On-site spotters should pay much more attention to the threat of lightning than the threat of rain.

What warning devices should be used?

- Check the weather forecast 24 hours in advance and during the activity using your NOAA all hazards radio, AM-FM Radio, TV, cell phone, iPad, or tablet.
- Monitor a Lightning Detection Map. (Watch a real-time lightning display map.)
- The Thor Guard Lightning Prediction and Warning System is a warning system I recommend. A hand-held personal lightning detector is not recommended and should not be used as a warning device.
- Your eyes and ears can be of great help. (If you see lightning, seek shelter, or, if you hear thunder, seek safe shelter immediately.)

What safety rule will stop the activity?

- How much early warning do you require for the orderly movement of people to their safe shelter?
- How many people go where?

Where will you seek safe shelter?

- **Vehicle** Are enough vehicles available to hold everyone? Often people are dropped-off for the event and an insufficient number of vehicles remain as a safe shelter.
- **Building** Is the event on a weekend or in the evening when the safety shelter buildings are locked?

How will you get to the safe shelter? What is the safest path to the shelter? Are you required to walk near the base of a cell-phone tower, a flagpole, a goalpost, a scoreboard, or other tall object that may be a target for lightning? When such conditions exist, look for a safer path to your safe shelter. A strike to a tall object like a flagpole can redistribute the energy across the surface of the ground at the base of the tall object, making it extremely dangerous to be there—even deadly.

Where will you go inside the safe shelter?

- **Vehicle** Close all windows, move to the center of a hardtop vehicle, do not touch any metal, and stay off the 2-way radio connected to an outside antenna.
- **Building** Go to the center of the lower level of a substantial structure containing plumbing and electrical wiring. Avoid contact with any metallic connection to the outside such as plumbing, electrical, showers, bathrooms, kitchen, laundry room, cable-TV, and corded telephones. Prevent people from using a corded phone. If telephone use is necessary, encourage a portable phone or cell phone used on the lower level of the structure. Telephone lines present a good antenna for electrical pickup from the magnetic field of a nearby lightning strike in addition to the susceptibility of a direct strike.

When should the activity resume?

- After the signals have blown (Thor Guard Lightning Prediction and Warning System)
- Or 30 minutes after the last sight of lightning or sound of thunder.