



The Texas A&M University System

# LIGHTNING SAFETY

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Lightning is responsible for deaths, injuries, wildfires, property damage, and power outages in all parts of the world.

On average, lightning causes more casualties annually in the U.S. than any other storm-related phenomena, except floods. According to the National Oceanic and Atmospheric Administration (NOAA), 756 people were killed by lightning in the U.S. from 1990 to 2003. During that period, Florida had the highest incidence of lightning deaths (126), while Wyoming had the highest lightning death rate (2.02 deaths per one million people). The National Weather Service estimates that during your lifetime, you have a one in 600,000 chance of being struck by lightning.

**Table 1. Number of Lightning Deaths, 1990 to 2003, Top Five State Ranking**

State	Number of Deaths	Rank
Florida	126	1
Texas	52	2
Colorado	39	3
Ohio	31	4
North Carolina	29	5

Source: NOAA

**Table 2. Lightning Death Rates, 1990 to 2003, Top Five State Ranking**

State	Deaths per Million People	Rank
Wyoming	2.02	1
Utah	0.70	2
Colorado	0.65	3
Florida	0.56	4
Montana	0.55	5

Source: NOAA

The U.S. Fire Administration estimates that more than 17,400 fires are attributable to lightning. Annually, these fires result in approximately 10 deaths, 75 injuries, and \$138 million in property damage. Comparatively, lightning fires are more costly than all other fires. Data from the National Fire Incident Reporting System (NFIRS) show a measured loss of \$9,262 per lightning fire, compared to a loss of \$5,619 per fire for all fires.

**Table 3. Where Lightning Fires Occur**

Location of Fire	Percent
Outdoor Fire	55
Structure Fire	41
Other Fire	3
Vehicle Fire	1

Source: NFIRS

## HOW DOES LIGHTNING OCCUR?

Lightning occurs most frequently during thunderstorms; however, it can also occur during dust storms, volcano eruptions, intense forest fires, and nuclear detonations.

### Inner-Cloud Lightning

When thunderstorms develop, air masses rise and fall within clouds. As this occurs, ice and water particles collide and cause particles to build up electrical charge. Positive-charged particles (protons) accumulate in the frozen upper region of the cloud, while negative-charged particles (electrons) accumulate in the lower cloud region.

When the difference in electrical potential between the top and bottom portion of the cloud is large enough, a lightning flash occurs. When this happens, we normally will see the cloud illuminate from the inside. Cloud-to-cloud lightning can also occur between two or more clouds due to the difference in electrical charges.

Thunder is actually the shock wave we hear as lightning superheats air to more than 10,000 degrees Celsius, rapidly expanding gases.

### Cloud-to-Ground Lightning

Normally, the ground will maintain a small negative charge with respect to the atmosphere. However, when a thunderstorm develops, the negative cloud base will induce a positive charge on the ground below the storm. As the storm moves, the positive charge will move with it and will tend to concentrate on elevated objects such as trees, buildings, and higher terrain in an attempt to neutralize the electrical difference between the cloud base and ground.

When the electrical potential between the cloud base and ground is high enough to overcome the insulating properties of air, a conductive channel is established for the current to flow between the two charges, and lightning is formed.

*Have you ever been told that if you are in a thunderstorm and your hair stands on end that you should run for cover?*

Actually, this phenomenon indicates that you are in a positively-charged area. While this does not mean that you in fact will be struck by lightning, the likelihood of being struck is increased. Immediately crouch near the ground. Do not lie flat since that would increase the amount of electrical current your body will receive if lightning were to strike close to you.

### **HOW LIGHTNING CAN KILL**

When a person is struck by lightning, there is a 50 percent chance of survival. A direct lightning strike to the body usually enters the head or one of the ears and exits at the person's contact point with the ground, usually the feet. The person usually suffers cardiac arrest, severe burns, temporary blindness, and deafness. If a person survives, the body's neurons are usually permanently damaged.

A person can also become a lightning victim by virtue of his or her immediate surroundings, and contact with conductive objects and structures. Standing under a tree is dangerous for several reasons. A tree will likely be the highest structure around, and is therefore more likely to be struck by lightning. If a person is in contact with the tree, he

or she becomes part of the conductive circuit for the electrical current to pass through on its way to the ground.

When a tree is struck, the electricity usually travels just underneath the bark to the ground. However, sometimes electricity may travel down the center of the trunk, superheat gasses and liquids inside the tree, and cause the materials inside to explode. Exploding timber will then become high-velocity projectiles.

When a house or other structure is struck by lightning, the electrical current will usually travel down the perimeter of the house through antennas, plumbing, and/or gutters. Any person taking a bath, talking on the telephone, or in contact with water through plumbing pipes could be shocked or killed.

### **COMMON MYTHS ABOUT LIGHTNING**

1. Lightning never strikes the same place twice.

*Actually, the Empire State Building is struck by lightning about 25 times per year.*

2. Rubber tires will insulate me from lightning.

*A few inches of rubber provides little if any protection from lightning that has traveled miles through space.*

3. Lightning can be prevented.

*While there are precautions you can take to reduce the risk of being struck by lightning, it is random and unpredictable.*

### **LIGHTNING SAFETY TIPS**

Many people are killed and injured each year due to misinformation and inappropriate behavior during thunderstorms. Lightning safety is a personal decision we make to avoid being caught in situations and environments that increase the chance of being struck.

The most important safety tip is to recognize the weather conditions and approaching thunderstorms far in advance. Weather experts claim that lightning can strike objects more than 10 miles away from storm clouds. Thus, you should seek shelter at the first sign of lightning or thunder. The National Lightning Safety Institute suggests that you remain in shelter for 30 minutes after the last observed lightning strike.

### **Estimating Lightning Distance**

Since light travels faster than sound, a certain amount of time will pass from when you see lightning and hear the thunder. To determine the distance (in miles) you are from the lightning strike, start counting when you first see the lightning bolt, one-one-thousand, two-one-thousand, three-one-thousand, etc. until you hear the thunder. Then divide that number by 5 to determine the distance in miles between you and the lightning bolt.

There are several things you can do if caught outdoors when a lightning storm strikes. Take shelter inside a building or car, and close the windows and doors. Get off farm machinery. Get out of the water if you are swimming or boating, and get away from it. If boating, stay low and avoid contact with the water.

Do not take refuge under any tall, isolated object, such as a tent or tree. However, standing under a group of trees that is shorter than others in the area is better than being in the open.

Avoid electrical fences, clotheslines, metal pipes, rails, telephone poles, and other conductors. Put down any object that might conduct electricity, such as a rake, hoe, or shovel. Seek low ground, preferably a ditch or gully. If you are outside with no protection, get to a low spot. Make your body low to the ground, but do not lie flat on the earth. Curl on your side, or drop to your knees and bend forward, putting your hands on your knees.

If there is a group of people, spread out. If someone feels his or her hair stand on end, it may mean lightning is about to strike. Stay calm, and crouch near to the ground.

If lightning strikes are suspected, keep clear of windows if inside a dwelling. Turn off the television and any other electrical appliances. Electricians suggest unplugging televisions and other valuable appliances because lightning can strike or cause electrical surges that can destroy these appliances.

Postpone baths, showers, and doing dishes until the storm passes because there is the possibility of electrocution. Stay away from water and gas pipes, electrical appliances, and telephones because

electricity can travel through wiring and cause electrocution.

### **SECONDARY LIGHTNING HAZARDS**

#### Fallen Wires

Do not touch fallen wires. Report them to the police or local utility immediately. If the wire should fall on an occupied vehicle, tell the driver to stay in it and drive away, if possible. If the driver is unable to drive away, tell him or her to wait for help and do not get out. The driver is safe inside the car but should avoid touching the metal parts of the car.

#### Electrical Fires

If an appliance or tool catches fire, try to unplug it or turn off the current at the fuse box. Do not pour water on the fire. Instead, use a Class C fire extinguisher or throw baking soda on the fire. If it gets out of control, call the local fire department and get out.

### **FIRST AID FOR LIGHTNING VICTIMS**

In addition to causing severe burns, lightning can also damage the body's nervous system, may cause falls that break bones, and often results in hearing and vision loss. Victims may also experience confusion and memory loss. First aid for lightning victims should be performed immediately.

Individuals struck by lightning do not carry a charge, and it is safe to touch them to render medical treatment. First, call 911 to notify emergency personnel. Next, if the victim is in an area prone to be struck again (i.e., isolated tree, open field, etc.), move the victim to a safe location to render treatment unless you suspect spinal injury.

Check breathing and pulse if the victim is unconscious. If the victim has a pulse, but is not breathing, begin mouth-to-mouth resuscitation. If there is no pulse, begin cardiopulmonary resuscitation (CPR).

Check for other injuries, such as possible fractures. Cover the electrical burn with a dry, sterile dressing, but do not cool the burn.

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