

TerranearPMC Safety Share

Robert Brounstein

Week of August 19, 2019 – Lightning!

Contrary to the common expression, lightning can and often does strike the same place twice!

Too often during Summertime, when our field crews are in the midst of working and establishing a rhythm and understanding the subtle nuances of fellow team members so that we function like a fine-tuned machine, along comes those dark cumulus clouds during the afternoon hours, ready to rain on our parade. And it's not just rain that can damper our field work – it is the lighting with its accompanying thunder – that is the real threat. For when we are within the potential distance of a lightning strike (typically this is a 6-mile radius), work must cease while we seek shelter.

Yes, the visual effects of lightning can be spectacular, but very dangerous. About 2,000 people are killed worldwide by lightning each year. Hundreds more survive strikes but suffer from a variety of lasting symptoms, including memory loss, dizziness, weakness, numbness, and other life-altering ailments. Strikes can cause cardiac arrest and severe burns.

Lightning is extremely hot. Some literature equates the temperature of a flash to be five times hotter than the sun's surface (aka photosphere which is approximately 10,000° F). This heat will cause the water inside a tree to instantaneously vaporize, creating steam that is capable of blowing a tree apart.

About one to 20 *cloud-to-ground* lightning bolts is "positive lightning:" a type that originates in the positively charged tops of storm clouds. These strikes reverse the charge flow of typical lightning bolts and are far stronger and more destructive. Positive lightning can stretch across the sky and strike "out of the blue" more than 10 miles from the storm cloud where it was born.

Cloud-to-ground lightning bolts are a common phenomenon—about 100 strike Earth's surface every single second. Each bolt can contain up to one billion volts of electricity. A typical cloud-to-ground lightning bolt begins when a step-like series of negative charges, called a stepped leader, races downward from the bottom of a storm cloud toward the Earth along a channel at about 200,000 mph.

When the lowermost step comes within 150 feet of a positively charged object, it is met by a climbing surge of positive electricity, called a streamer, which can rise up through a building, a tree, or even a person. When the two connect, an electrical current flows as negative charges fly down the channel towards earth and a visible flash of lightning streaks upward at some 200,000,000 mph, transferring electricity as lightning in the process.

Some types of lightning, including the most common types, never leave the clouds but travel between differently charged areas within or between clouds. Other rare forms can be sparked by extreme forest fires, volcanic eruptions, and snowstorms. Ball lightning, a small, charged sphere that floats, glows, and bounces along oblivious to the laws of gravity or physics, still puzzles scientists.

While the exact mechanism of electricity developing in a storm is not very well understood, there is a series of events that occur for lightning to develop:

- The development of a thunderstorm causes electrical charges to be separated.
- The updraft of air carries positively charged water droplets with it.
- The downdraft of precipitation transports negatively charged water drops downward to the bottom of the cloud.



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- The negative charges on the bottom attract positive charges on Earth's surface directly below the thunderstorm.
- Then, the difference in charges on the bottom of the cloud and on the ground grows stronger and stronger until there must finally be a release.
- A finger of negative electricity shoots down from the cloud and meets a finger of positive electricity that is shooting up from the ground. They connect and a surge of electricity strikes downward.

Because air is an effective electrical insulator, an electrical charge rising from the Earth minimizes the distance it has to travel through air on its way to meet the stepped leaders coming from the clouds. It therefore climbs through the tallest object in the vicinity of the cloud, which may be a tree or a tall building. If you're caught outside during a storm, you should stay clear of tall objects like trees and buildings because these direct electricity to the ground, and it can travel through your shoes. If there is nothing nearby, you should crouch down to avoid making yourself the tallest object. Don't lie down, because lightning travels through the ground as much as 100 feet from where it strikes.

When you see a lightning flash, count the number of seconds until you hear thunder, and seek shelter if the count is less than 30 (that calculates to lightning striking 6 miles away). Appropriate shelter is any closed building with a roof, four walls and an insulating floor or a vehicle with a roof -- avoid open garages, patios and convertible automobiles. When inside, avoid using water or landline telephones because lightning travels through plumbing and telephone wires. You should stay indoors for 30 minutes after you hear the last clap of thunder -- most casualties happen after a storm has passed and people go outside prematurely. After 30 minutes, you can be sure the storm is too far away to strike you with a bolt of positive lightning.

Many houses are grounded by rods and other protection that conduct a lightning bolt's electricity harmlessly to the ground. Homes may also be inadvertently grounded by plumbing, gutters, or other materials. Grounded buildings offer protection, but occupants who touch running water or use a landline phone may be shocked by conducted electricity. In addition, cars are havens from lightning as the metal frames and tires conduct current and carry a charge harmlessly to the ground.

Some Interesting Lightning facts

- At any time, there are over 2,000 thunderstorms occurring worldwide, each producing over a 100 lightning strikes a second.
- That's over 8 million lightning bolts every day.
- Each lightning flash is about 3 miles long but only about a centimeter wide
- A lightning strike discharges about 1-10 billion joules of energy and produces a current of 30,000 – 50,000 amps.
- A single lightning bolt unleashes as much energy as blowing up a ton of TNT.
- A strike is actually made up of between three and twelve individual lightning 'strokes', each lasting only a few thousandths of a second.

The natural world is a package deal; you don't get to select which facts you like and which you don't. - Bill Nye

