



Increased extreme weather events challenge golf course lightning safety practices

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According to the National Oceanic and Atmospheric Administration (NOAA), lightning strikes the United States approximately 25 million times a year, and it can kill instantaneously, sometimes striking with little warning. It is just one safety concern that results from the estimated 100,000 thunderstorms that develop nationwide each year. In addition to lightning, thunderstorms often produce damaging winds, torrential rains, hail, and even tornadoes — each creating potential safety risks for golfers. Experts note that weather volatility has risen in recent years, which, in turn, increases the need for golf course professionals to continue to evolve their safety systems and protocols. The United States Golf Association (USGA), the PGA Tour, and other event organizers take player safety seriously with thorough safety plans and rules that allow play to be suspended without penalty in the event of lightning.

25 million

The number of lightning strikes that occur in the United States each year.

Many would say that golf is one of the most weather-dependent sports, with potential sun exposure, heat and cold stress, wind, and rain that can wreak havoc on a golfer's performance and personal safety. While a recent study found that golfing accounted for 4% of lightning strike fatalities (as compared to 13% under trees and 8% around water), the need for safety regulations and education continues to grow with more extreme weather events occurring, coupled with recent increases in golf participation. In 2020, seen as an escape from quarantine during the pandemic, golf emerged as the sport of choice for more and more people. The National Golf Foundation (NGF) reported that play was up nearly 14% nationally from the previous year, equating to up to 8 million additional rounds.

In 2020, play increased by 14% — resulting in up to 8 million additional rounds.

Experienced golfers flocked to the courses, but so did new players, in search of an outdoor activity during stay-at-home and social distancing orders. The NGF estimates that participation by beginners and junior golfers was up 20%.

The impact of extreme weather

According to the American Meteorological Society, the global climate has warmed 1.4 degrees Fahrenheit since 1901, which has ultimately impacted global weather every year. To provide more perspective, nine out of the 10 warmest years on record worldwide have occurred since 2005. The main impact on the golf industry is increased weather volatility. The global temperatures referenced represent an average over all of the earth's surface, which given the size and tremendous heat capacity of the oceans is quite significant. The 1.4-degree change in climate temperature has contributed to more frequent, volatile, and severe weather events, which increases safety concerns for golf course operators.

9 of 10
of the hottest years on record occurred since 2005.

Of those extreme weather conditions, lightning is the most substantial concern for golfers due to its sudden and somewhat unpredictable nature. The odds of being hit by lightning in your lifetime are one in 600,000, but golfing exposes people to lightning in a more significant way. Most famously, professional golfer, Lee Trevino was struck by lightning three times during his career, including while playing in the

1975 Western Open — one of the most high-profile, golf-related lightning incidents in modern history. During the event at Butler National in Illinois, Trevino was struck by lightning near the 13th hole, knocked unconscious, and hospitalized for two days as a result. Four other golfers were affected by the lightning strike. It's not just golfers that are harmed, event spectators are also impacted. At the 1991 US Open at Hazeltine National near Minneapolis, a 27-year-old man was one of six spectators struck by lightning; he died of cardiac arrest as a result. Just eight weeks later at the PGA Championship in Indiana, a man was struck by lightning and killed in the parking lot after the first round had been suspended due to lightning.

At any given time around the globe, there are 1,800 thunderstorms producing lightning, which is an electric current that most often results from small bits of ice bumping into each other as they move around in a cloud, causing a build-up of electrical charge. Thunderstorms produce both negative and positive lightning bolts. Almost 80% of bolts occur within the storm and are considered cloud-to-cloud. The rest are called cloud-to-ground strikes, which occur 20 to 25 million times every year in the United States.

A negative bolt occurs when positively-charged particles form and collect at the top of a cloud while negatively-charged particles form and collect at the bottom. A cloud-to-ground discharge then happens as a negatively-charged channel from the storm connects as a stepped leader with positively-charged particles being drawn upwards near the ground.

A more powerful type of lightning is the positive bolt, and it originates high up in thunderstorms. They form similarly, as described above, but contain positively-charged particles that connect with a negative charge at ground level. Less than 5% of bolts are this type, yet they tend to do the most damage. That's because the distance they travel is much more significant and builds up a larger electrical field. The additional path length leads them to be up to 10 times more powerful than negative lightning bolts.

The greater the distanced traveled, the larger the bolt's electrical field.

Positive lightning can strike up to 25 miles away from the core of a thunderstorm, which means it can hit far outside of the area where it is raining — where the sky appears to be clear. These are known as "bolts from the blue" and contradict the common myth that lightning only strikes when it's raining.

25 miles

How far outside of a thunderstorm a positive lightning bolt can strike.

In addition to the danger of its electric charge, lightning is extremely hot. The flash of light that we see can produce nearby air temperatures that are up to five times hotter than the surface of the sun. This immense heat causes the surrounding air particles to expand rapidly, and the accompanying vibrations of the air help to create the thunderous noises we hear after seeing the flash of lightning. These extreme temperature changes can cause power surges and even fracture concrete and brick.

50,000 degrees Fahrenheit

The temperature of lightning.

Lightning is one of the more unpredictable aspects of severe weather. Many meteorologists report that they are most afraid of lightning — more than tornadoes and hurricanes — due to its erratic nature. Lightning strikes are nothing short of random, which is why it is dangerous to wait for an indication of that first nearby lightning strike before taking appropriate shelter.

Layers of safety responsibility

When determining how and when to put safety plans in place, everyone, including the USGA, the club management and pro shop, the players and guests, and the course superintendent, need to understand the weather and evacuation plans, particularly how much time is required to move everyone to safety. While NOAA advises, "when thunder roars, go indoors!" for outside activities, it may already be too late to successfully shelter or evacuate players at the first raindrops or rumble of thunder.

On average, most storms move at about 30 miles per hour (mph), so making evacuation decisions when lightning is eight miles out is a good standard, but ongoing monitoring is essential. For example, what if storms that day are expected to move at 50 mph? How might that impact the lead time needed to get golfers to safety? Often, larger golf operations and events, like the PGA Tour, employ an on-site meteorologist to provide better guidance on a potential storm's speed and impact to help them make more confident safety decisions.

30 mph

The average speed at which a thunderstorm moves.

Most golfers know that rule 5.7 in the USGA Rules of Golf allows them to discontinue play if they think there is a danger from lightning. This rule allows players to put aside their competitive play in the name of safety. But in addition to allowing for match suspension, the USGA and all others involved with the game are responsible for making sure players are empowered with information to make weather-related safety decisions.

The USGA provides a variety of resources to clubs and pro shops to educate guests on thunderstorms and extreme weather safety. There is a variety of marketing materials, including signage and stickers, for use. These materials provide not only universal lightning safety tips but also those specific to golf — such as don't use your golf cart for shelter or stand under a tree to wait out the storm. These tips also remind people to avoid contact with metal, including golf clubs and umbrellas, and to not wait until the last minute to stop play as it may take longer than expected to safely get back to the clubhouse.

A club's management is responsible for keeping written records of lightning safety procedures and copies of all posted materials. Many leaders keep formal files and lightning safety policies and widely share recommendations with the superintendent's office and the pro shop, so all employees are clear on the policies.

The pro shop staff is typically responsible for monitoring changing weather conditions and notifying players of threats. They may post daily weather advisories and use an air horn or sirens to alert players to dangerous weather. The pro shop will often use USGA-provided lightning education materials to raise awareness of the dangers with guests.

It's not just the guests that need to be aware of lightning and extreme weather dangers. Golf course superintendents need to be informed of daily weather conditions, whether from free services or private weather companies, to protect their staff, equipment, and assets from lightning and severe weather. Employees should be educated on lightning warning signs and dangers and be empowered to suspend work activities and seek shelter when necessary.

Even with weather safety protocols and warning systems, it is ultimately each individual's personal responsibility to decide to discontinue play and seek shelter. It is not always possible to monitor conditions on an entire course, force people to seek appropriate shelter, and not safe to put golf course staff at risk. Golfers and golf-course operators should ensure that players know the club's weather policy, especially if a player is new to the game.

Supporting a successful lightning safety plan

For organized outdoor activities, including golf, the U.S. National Weather Service recommends that organizers have a lightning safety plan and follow it — without exception. Critical to those plans are reliable, accurate weather information and alerting resources, which allow for fast and effective execution of a safety plan when conditions warrant. There are a number of considerations when choosing weather and alerting products.

First, is to make sure the weather resource and alerting system adheres to regulatory, safety, and USGA rules and guidelines. There are many options for finding weather information and it can come in many forms, including free or basic mobile applications or even local TV. However, this information will likely be delayed and inadequate for supporting confident, informed decisions. A paid weather service provides a variety of benefits along with greater accuracy and detail in its forecasts and weather information. The right tool will push alerts across desktop, mobile, and integrated siren systems, so everyone has the same information and greater control over alerts and protocols.

Some weather products are highly customizable and allow course management to set thresholds for range rings, triggering alerts when hazardous weather, such as lightning strikes, enters pre-set warning zones. When paired with the right siren system, large numbers of people can be alerted within moments, ensuring instant implementation of a safety plan.

The right tools allow management to run operations more efficiently and only stop events or activities and evacuate when necessary. And, with the most accurate tools, "go/no-go" decisions can be made in a timely fashion, so people can quickly get to safety and minimize the negative effects of severe weather, like physical injury, property damage, and suspension or delay of play.

Course management can instill confidence and credibility with stakeholders by using the right weather and alerting systems, particularly when they provide validation for event or activity suspension and delay decisions. A reliable, accurate weather and alerting system offers peace of mind when everyone impacted knows the decision-makers have the right information to make the right safety decisions.

Making the right choice

Having a thoughtful, comprehensive lightning safety plan in place is not something to leave to chance. With increased weather volatility and more and more people hitting the links, the ability to monitor weather conditions in real-time with accurate information and communicate threats in a timely matter is imperative. Investing time and resources in a lightning safety plan and the right weather and alerting tools help reduce potential weather safety risks. Talk with our weather experts for help with plans and resources — and support golfers by playing it smart when it comes to health and weather safety.