



Church safety solutions

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Inside this issue

Lightning and electrical safety

- When lightning strikes . . . 1
- Surge protection 2
- Lightning rods 3
- If damage occurs 3

- Lightning safety for outside activities 4
- Lightning safety tips . . . 5

- “Lessons of loss”:
 Real-life examples of costly (and preventable church losses) 6

Coming soon:

May – Loss control for sports and recreational activities

When lightning strikes

What is lightning and how is it caused?

Between 2003 – 2007, Zurich church customers incurred 945 lightning strikes costing millions of dollars of losses and untold hours of interruption of church ministries. This means that each week, 3-4 churches Zurich insures are struck by lightning, with an average claim cost of \$12,500. The costliest lightning strike occurring within the past two years resulted in a \$3.9 million total church loss. Exposures to lightning strikes are most prevalent in the Southeast and Midwest states, with losses occurring mostly in Florida, Mississippi and Texas.

Interesting enough, scientists are not exactly certain how lightning works, or with any degree of certainty just where and when it will strike. We do know that lightning is an enormous electrostatic discharge, similar to the type of static electric shock you can receive while walking on carpeting and touching metal surfaces.

Key exposures:

All parts of the U.S. are susceptible to lightning strikes. Taller buildings, particularly churches with spires or steeples and properties located on hilltops, have an increased risk of receiving a lightning strike. Geography can also add to the risk of exposure.

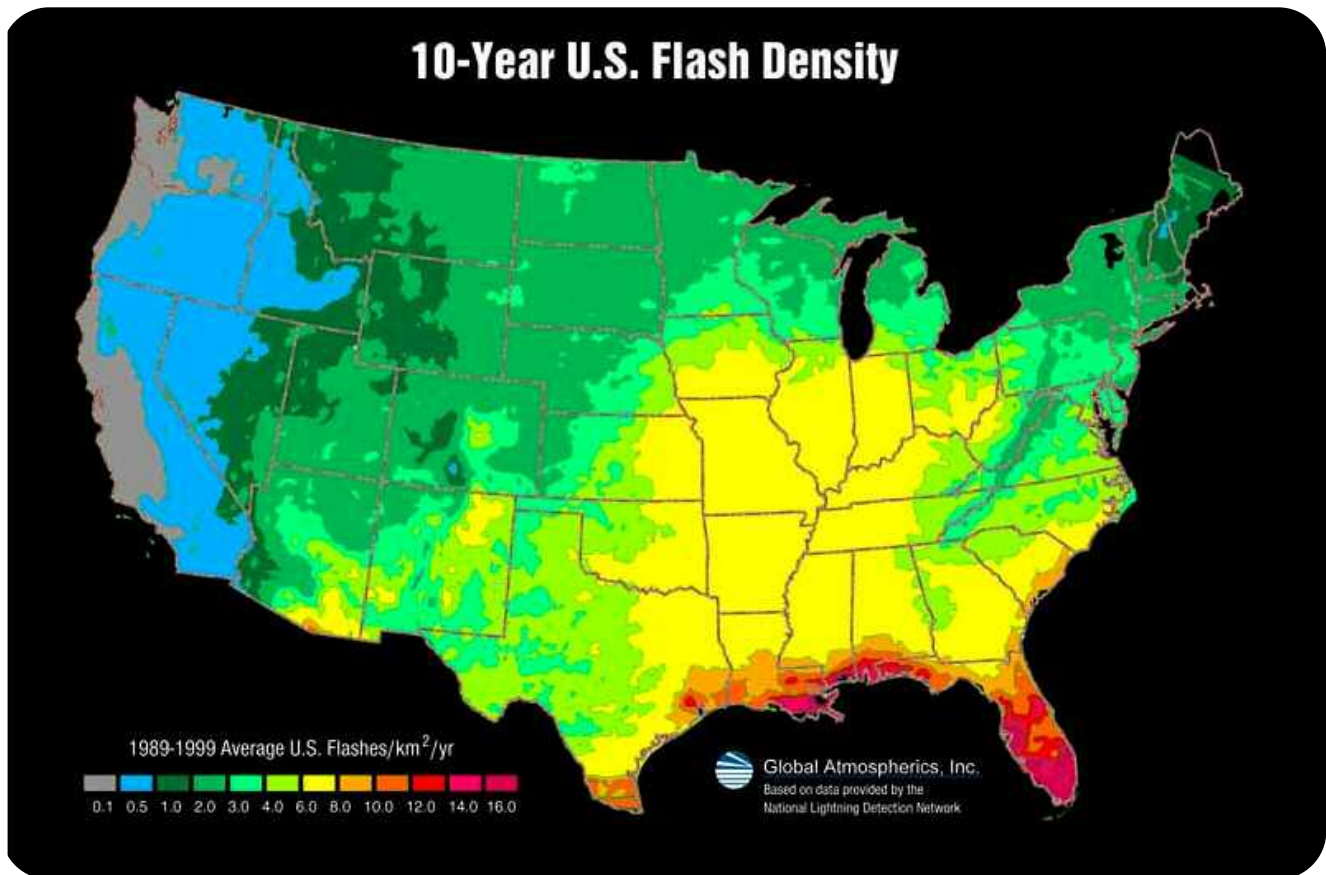
According to the National Oceanic and Atmospheric Administration (NOAA), the highest frequency of cloud-to-ground lightning over the entire year exists in Florida between Tampa and Orlando. This is due to the frequent presence of a large moisture content in the atmosphere at low levels (below 5,000 feet), as well as high surface temperatures that produce strong sea breezes along the Florida coasts. The western mountains of the U.S. also produce strong upward motions and contribute to frequent cloud-to-ground lightning. In addition to this, there are high frequencies along the Gulf of Mexico coast westward to Texas, the Atlantic coast in the southeast U.S. and inland from the Gulf. Regions along the Pacific west coast have the least cloud-to-ground lightning.

Thus, it is not just the energy of a surge that has to be considered, but the frequency of surges. Lightning is hazardous to equipment when the strike is very close and also at great distances. The intense electric and magnetic fields surrounding a strike will induce a high voltage charge at a distance of 300 feet in just three feet of wire and will still induce hundreds of volts at a distance of one-half mile. This is why equipment failures occur during a storm, when there is apparently no evidence of a strike in the immediate area.

Although it cannot be precisely predicted where lightning will strike, there are some

(Continued on page 2)

When lightning strikes *(continued)*



factors that increase the risk of a lightning strike. These include:

- Prior lightning damage
- Structures that are located or isolated in open areas, on top of hills and/or near a large body of water
- Structures that are located in areas that have a high number of thunderstorms
- Buildings that have trees overhanging the roof
- Buildings that are constructed with a metal, brick, or stone chimney, with metal ridge vents, or with aluminum siding
- Buildings that have no surge protection

Where and how often does lightning usually strike?

Lightning strikes the ground somewhere in the U.S. nearly every day of the year.

Thunderstorms and lightning occur most commonly in moist warm climates. Data from the National Lightning Detection Network shows that over the continental U.S., an average of 20 million cloud-to-ground flashes occur every year. Around the world, lightning strikes the ground about 100 times each second or eight million times a day.

Surge protection

Sensitive electronic systems (e.g., worship sound systems, phone systems, computers and computer modems, printers, fax machines and electronic pianos or organs) are susceptible to damage caused by lightning strikes and their resulting power surges. With billions of dollars' worth of equipment now being lost each year to the effects of electronic overstress, surge protection is no longer a luxury but a recommended best practice. Fortunately lightning, to some degree, can be controlled. A properly installed lightning system can safely direct massive electrical currents to the ground.

There is absolutely no way to protect a piece of equipment in a part of a building that takes a direct hit by lightning. When a building is struck directly by lightning, the structure may be damaged. Usually, the building's wiring will carry the electric surge to all vulnerable electronic equipment. A lightning protection system is a passive means of preventing property damage from the effects of a lightning strike. Protection systems work by directing lightning-produced electrical charges through a "path of least resistance" into the ground – avoiding a lightning discharge.

To assure the highest level of protection, churches are encouraged to have a licensed electrician install Underwriters Laboratories (UL)-listed surge protectors on electrical service panels. Often, your church's electrical utility company has full-building surge protectors they will install for you for a monthly lease charge. Surge protectors are the first line of defense against the harmful electrical surges that can enter a structure via power transmission lines. By filtering and dissipating these surges, protectors prevent electrical fires and shield against electrical transient voltage. To protect specific electronic pieces of equipment, you can install UL-listed transient voltage surge suppressors. A

qualified lightning protection specialist can make recommendations for surge protection tailored to the specific needs of a facility.

Keep in mind that most transient (or plug-in type) surge protectors use a component known as an MOV, which wears out with use. The power indication light on your surge protector may not be a reliable indication that the MOV is functioning. Thus, you will need to replace your transient surge protectors periodically. If you do use transient units, look for the following:

- A UL 1449 Suppressed Voltage rating of 330V
- Two or three stage suppression
- Clamping response time on the order of nanoseconds is good, picoseconds is better
- A warranty – especially one that will replace equipment in the event of failure
- Higher quality units, especially with indicator lights that show they are functioning. Many cheaper units may be useless after one surge, but have no indicator light to signify this. Thus, you have no way of knowing that the unit is no longer protecting your church equipment from electrical surges.



Lightning protection systems



Lightning rods or air terminals are rods of pointed copper or aluminum that are placed on roofs to direct currents to the ground, instead of through the building's plumbing or electrical systems. Lightning rods do not attract lightning, but simply provide a preferred path of low resistance for currents to travel to the ground.

Lightning rod systems prevent physical damage and keep the protected structure from burning down by conducting current and the associated heat away from the structure. However, electromagnetic waves produced by lightning can induce current in nearby electrical wiring and circuitry. As mentioned earlier, this

secondary effect of lightning can cause extensive damage to electronics, including computers and modems, televisions, telephones and answering machines.

If your church is at moderate to high risk of lightning strikes, Zurich recommends installing a lightning protection system, including air terminals, conducting straps or wires, and grounding rod(s). The system should carry the UL Master Label and be installed per the NFPA code #780 or to the Lightning Protection Institute's certification requirements. Although lightning protection systems do not prevent lightning strikes, they have proven to be the most effective means of protection. Be sure to inspect and maintain your lightning protection system at least annually against corrosion or other deterioration.

If lightning damage occurs

If your church is damaged by lightning, first call emergency services and follow any advice provided. Before proceeding forward with costly repairs, your next call should be to your insurance agent or Zurich. The sooner Zurich is notified, the sooner cost-effective repairs can be completed. Zurich will help you identify services that are appropriate for your church. Do not assume that all repairs recommended by a service company are necessary or will be

approved for payment. Again, coordination with Zurich is essential.

Do not allow the service company to remove any parts or equipment from your premises until they have been inspected by Zurich or our designee.

When damages occur, call (800) 987-3373 to report the incident and to seek assistance from Zurich.

Lightning safety for outdoor activities

According to NOAA, an average of 67 people are killed by lightning each year and about 300 are injured. Only flash floods and river floods cause more weather-related deaths. Churches are encouraged to establish a policy for church members and leaders conducting outside activities, particularly while at parks or camping areas that may not have adequate shelter from the elements. The following are a few best practices to consider before going to any outdoor event.

Church leaders should monitor the weather conditions and forecast at least 24 hours before the day(s) of the event. In addition, an inexpensive portable weather radio is recommended for obtaining current storm data.

1. Have a plan for suspending and resuming activities. Make sure participants are aware of designated safe areas, including:

- Fully enclosed metal vehicles with windows up
- Substantial buildings
- Low ground – seek cover in clumps of bushes

Avoid the following unsafe areas:

- Outdoor metal objects (i.e., flag poles, fences and gates, light poles and metal bleachers)
- Water, including ponds, lakes, streams, pools and standing water
- Solitary trees
- Caves
- Open fields
- High ground

2. Take shelter when you **see** lightning or **hear** thunder. Wait a minimum of 30 minutes from the last observed lightning or thunder before resuming activities. Be extra cautious during this phase as the storm may not be over. Lightning can strike as far as 10 miles from a thunderstorm.
3. If you are outside during an electrical storm and you begin to feel your hair standing on end, and/or hear a crackling noise, you may be in the lightning's electric field. Immediately remove metal objects, car keys, backpacks, even baseball caps and place your feet together, duck your head, and crouch down low in a baseball catcher's stance with hands on knees.
4. People who have been struck by lightning do not carry an electrical charge and are safe to handle. Apply first aid immediately if you are qualified to do so. Get emergency help promptly by calling 911 or the local emergency service number.



Lightning safety tips

1. **The 30/30 Rule** – If lightning precedes thunder by less than 30 seconds, then the storm is close and you need to take cover. After the storm, wait at least 30 minutes before leaving shelter and resuming outside activities.
2. Seek shelter in an enclosed building if possible. Open shelters, like those at campsites and picnic areas, provide very little protection. Avoid small wooden or metal sheds. If a building is not available, get in a vehicle with a metal roof and close all windows and doors.
3. Stay away from water. Water is an excellent conductor of electricity. Electrical current can easily pass through water – including lakes, ponds, rivers and standing water such as puddles.
4. Do not wait for rain to take shelter. Take shelter as soon as you see lightning or hear thunder.
5. Place yourself at the lowest point possible. Lightning often strikes tall objects first. If no sturdy shelter is available, crouch as low as possible with feet together and place hands over ears to minimize hearing damage from thunder. Keep your distance from other people, allowing 15 feet between.
6. Stay away from trees and tall metal poles. Keep twice as far from a tree as it is tall to avoid current traveling through the ground.
7. Listen to NOAA Weather Radio or other weather sources to keep up with changing weather conditions.
8. Lightning can enter a building directly, through the ground, or through pipes or wires that extend outside.
9. Stay away from windows and doors.
10. Stay off phones and avoid touching electrical equipment and plumbing.
11. Protect property. Typical store-bought surge protectors will not protect electrical equipment from a direct lightning strike. Unplug all valuable electronics as soon as you hear thunder.

Lessons of loss

The following “Lessons of loss” is summarized from a recent study completed by Zurich. The details have been revised to help preserve the anonymity of those involved.

Lightning strikes a father and daughter

A father and daughter were attending a church-sponsored youth fundraiser while a thunderstorm was crossing the area. The two believed that they were safe because they were inside the church building. Lightning struck the unprotected building and carried a current through the metal structural beams and components of the church. The father and daughter were believed to have been touching a metal rail or a door handle when the lightning struck, resulting in an indirect shock to both people. Both were seriously shaken by the event and were transported via Emergency Medical Services to a local hospital. They were released later that day without any long-term effects.

Lightning caused electrical surge and damaged pipe organ

During an electrical storm, a church incurred a direct strike to the building, which caused over \$100,000 damage to the church organ. The cause of loss was listed as a power surge created by a lightning strike. The organ damage was so extensive that it was posted as a total loss.

Fire to church building from direct lightning strike

During a thunderstorm, lightning struck a wood-framed, brick veneer church. A fire started on the roof and quickly engulfed the property in flames. The fire burned the church to the ground. The total loss of the building and its contents cost more than \$1 million. An investigator determined that the property did not have a lightning protection system or a sprinkler system, either of which might have prevented the loss.



References

Zurich – Lightning Protection for Communication Systems, 2-7.002 October 1997 Country of Origin: U.S.

A severe weather primer: questions and answers about lightning
http://www.nssl.noaa.gov/primer/lightning/lgt_climatology.html

Lightning Safety
<http://www.srh.noaa.gov/hun/preparedness/brochures/LightningBrochure2.pdf>

If you have any questions or if you would like to receive electronic copies of any of the referenced materials above, please write to us via email at: churchsafety.solutions@zurichna.com.

You may also contact us for assistance regarding any safety or risk control topic at:

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