

LIGHTNING PROTECTION

During every second of every day on Planet Earth, approximately 100 cloud-to-ground lightning strikes occur. Each can carry millions of volts of electricity at tens of thousands of amps—and that’s one heck of a wallop. Giant trees can be instantly exploded into toothpicks by these discharges and concrete can be fractured into worthless rock by a single strike.



The following paragraphs discuss these important points:

- Because electronic devices are far more susceptible to surge-related damage than analog equipment, your communications facilities are now at greater risk than ever.
- Massively damaging electric surges can reach your equipment not only via direct hits to your tower and/or structure, but also on inbound utility lines.
- Commonly adopted mitigation techniques and standards are limited in their ability to prevent damage from high-energy, high-frequency (or “HEHF” surges above 10,000 amps).
- Becoming familiar with the grounding features of your site—even at a basic level—is helpful, both operationally and financially.
- A thorough professional audit of your lightning protection systems can be a relatively low-cost way to dramatically reduce the probability (and hence expense) of future lightning-related losses.

The myriad of electronic devices on which it seems our daily lives are dependent are easy prey for lightning and electrical surges which are often triggered by lightning. Any operator of communications facilities knows this. Modern electronics are more sensitive to all types of electrical surges.

Given this background, the importance of highly capable lightning protection at public safety and dispatch communications facilities (along with their often-adjacent antenna towers) becomes quickly apparent. Being “knocked off the air” is simply not an option for these mission-critical operations.

While the general perception regarding lightning-related losses is that communications towers of any type are “lightning magnets”, there is more to lightning protection at tower sites than simply installing ground rods around the tower and support structures. That’s because lightning induced surge events that damage or destroy electronic equipment in and around tower sites and shelters can originate on inbound power or communications lines versus on the tower itself. Electric power and communications utilities grounding systems are not designed to dissipate the most electronically damaging part of a lightning-induced surge event. Failing to properly guard against HEHF flows

can easily lead to a catastrophic downtime event. Importantly, so-called “surge suppressors” are poorly equipped to mitigate HEHF currents, hence relying on these devices is not entirely prudent.

However, by understanding how and where lightning-level surges can invade and damage your equipment, developing a strategy to prevent this damage becomes possible. Damage prevention means dramatic reductions in downtime, minimized equipment replacement (and the vendor difficulties associated therewith) and serious cost savings. Traditional grounding such as is specified for most residential and commercial electrical service does not address what is needed for proper protection of a mission critical location.

Hence, learning how to analyze lightning risk may appear pretty challenging. But by answering a few simple questions, a more-than-rudimentary grasp of the immediate level of risk can be gained. And that’s a great first step.

Start by thinking like an electron that just wants to “go home” to Earth. Then ask these questions on a quick inspection of your facilities:

- Are the “paths” that have been built for grounding electric charge in good condition and made with permanent, secure connections? (Is the “highway” to get home wide and clear?)
- Is the gauge (i.e. “thickness”) of the grounding conductors of a large diameter, meaning at least 3/8 of an inch? This is typically at least AWG 2/0-gauge wire or larger.
- Is every equipment rack and or every piece of electronic equipment bonded to a grounding conductor that carries a stray current away from your electronic equipment?
- Does your emergency power transfer switch have a significant grounding conductor attached?
- Are there “grounding kits” attached to each of the coaxial lines on your tower? (Grounding kits are connections from the coaxial lines to a grounding plate or bulkhead.)
- Are there any obvious “bottlenecks” where electric current may encounter resistance?
- Have you had a lightning or surge-related equipment loss in the last 10 years?

If any of the first five bullet points are answered as “no”, or either of the last two are “yes”, there may be shortcomings in your site grounding system that need further inspection, improvement or replacement. Calling in a trained lightning protection auditor to complete a grounding system review is a very wise choice—and VFIS strongly recommends this action.

The bonus of engaging the services of a lightning protection auditor is that the much more complicated parts of your site inspection will be done without additional time commitments by your staff personnel, and most likely completed by individuals that know exactly what works and what doesn’t in terms of lightning mitigation.

A detailed report highlighting areas of concern should be made available by your auditor. This document will go a long way in both building an action plan for bringing your lightning protection up to necessary performance levels, and in conveying your interest in risk prevention to your insurance carrier, which can yield a “win-win” for everyone.