Lightning protection keeps critical transportation facilities running for 24 years, and counting

Providing power for approximately 1.5 million consumers, Tri-State Generation and Transmission Association, a wholesale electric power supplier owned by 44 electric cooperatives, has built its business by delivering a reliable, cost-based electricity supply. As with all electricity and utility suppliers, managing and preparing for weather-related incidents is key at Tri-State, especially at its operations center in Westminster, Colo.

“For companies like ours, businesses that provide a critical service, it is important to avoid a service disruption or potential service disruption because of how it impacts members’ operations,” according to Jerry Coufal, Tri-State’s telecom network operations supervisor.

And, while all companies might not face the same threats when evaluating risks to their businesses, lightning can be a top-tier concern all across the board. The possible damage from a lightning strike is tremendous for any utility or power transmission firm – something Tri-State learned first hand.

“We had a strike to our Westminster facility that caused pretty severe damage in 1994,” says Coufal. While many people might equate lightning strikes to fire damage, this strike created havoc without igniting a single flame, damaging the company’s telecommunications equipment. And the damage was not confined to any one area: Microwave radio antenna equipment, computers and a host of associated phone systems were rendered useless in a matter of seconds.

As bad as that was, the real problem for a public utility like Tri-State is the service disruption to customers.

“The severity of damage meant we had an extended-duration outage while we acquired new equipment to restore services,” said Coufal. “It took us awhile to restore capacity, and it was the service disruption that caused the greatest grief. No utility wants to lose the use of its equipment and the ability to operate at full capacity.”

Why lightning protection? Because lightning is too unpredictable

Tri-State realized it had to prevent something like that from ever happening again at its telecom network operations center. The company sought out several solutions and selected what it deemed to be the best lightning protection system available, a Dissipation Array® System (DAS®) from Lightning Eliminators & Consultants (LEC), Inc., along with LEC’s Spline Ball Ionizer® terminals and Chem-Rod® Grounding Electrodes.

Lightning, contrary to the saying, can and does strike twice, and Tri-State was unwilling to be unprepared, no matter how big or small the risks seemed to be.

“Like many places, lightning can be fairly intensive here in the Denver area, especially in the summer,” says Coufal. In addition to vertical lightning strikes, he says, it is not all that uncommon to encounter horizontal lightning – the so-called “bolt from the blue” that travels horizontally, miles away from a storm, only to strike unexpectedly somewhere where there are clear skies overhead.

The unpredictability, combined with the risk Tri-State faced, made lightning protection all the more important. Soon after the 1994 lightning strike, Tri-State had installed a hemisphere array LEC DAS at its Westminster headquarters. The company installed another at its main back-up facility in 2010.

Unlike other lightning protection systems, the DAS is a “charge transfer” system – the only type of system where the lightning impulse is not encouraged, but discouraged. The DAS completely isolates facilities from a direct lightning strike by bleeding off the induced charge on the protected area during the course of a thunderstorm, reducing it to a much lower level in relationship to the surrounding environment. This suppresses the formation of an upward rising streamer, one of the required elements of the strike process, thus avoiding the strike.

Tri-State has not had a single lightning strike in its protected area since installing its DAS system. Discouraging lightning ends up being a significant benefit to companies like Tri-State, where a single strike to a mission-critical facility poses unacceptable effects that can cripple operations.

“The proof is in what we have experienced so far,” says Coufal. “We have not had any problems since the DAS installations, even though it is still very common to have bad thunderstorms in the area. When a storm is close by we never experience any problems or loss of equipment due to that. The systems are working very well for us.”

LEC and charge transfer technology
LEC provides innovative, patented charge transfer technology, grounding systems testing, surge protection, design and comprehensive consulting resources, based on physics combined with state-of-the-art engineering principles. To date, the company has installed over 3000 lightning protection solutions in over 69 countries and throughout the United States. The company’s patented DAS technology has proven to be more than 99.87% effective in eliminating all strikes to protected areas.

Roy B. Carpenter, Jr., a former chief engineer for NASA’s Apollo Moon Landing Missions and the Space Shuttle design engineering teams, founded LEC in 1971 to study and apply engineering principles to lightning protection. This unique form of the charge transfer process – the patented technology used in the LEC DAS solution – reduces the rapid transfer of electrons that occurs with lightning to a slow pre-strike drip by dissipating storm-induced electric charge in the atmosphere, above a protected site, and lowering the electric field within the envelope of protection. With more than 40 years of lightning protection success, LEC is able to issue a full no-strike warranty to each of its DAS customers, as long as proper installation and maintenance are observed.

SIDEBAR: Cutting electric fields in half = no strikes at Tri-State

All reputable lightning protection solutions providers do thorough site engineering assessments before an installation. LEC’s in-depth analysis seeks out the best ways to prevent lightning strikes.

After an evaluation, LEC engineers specify system components, placement, and structural interfaces, and their designs account for environmental factors such as wind, ice, and corrosion. The lightning protection system they create is designed to prevent two elements of lightning – upward “streamers” of positively charged ions and “stepped leaders” of negative ions coming down from the clouds – from attaching to each other to create a strike. The naturally occurring electric fields that thunderstorms create give streamers the energy to rise upward in search of stepped leaders.

The overwhelming success at Tri-State – a company based in part of the country known for more-intense lightning activity – led LEC’s R&D department to return several years ago for an in-depth study of the DAS performance. The company placed an electric field monitor on the roof of the Tri-State facility, near where the DAS array was installed, and installed a second monitor 1,040 feet away, outside Tri-State’s lightning protected zone.

After 99 days of analysis, LEC data was able to conclusively report decisive results. During thunderstorm activity, electric fields inside Tri-State’s DAS protected zone was, on average, 55% weaker than the surrounding area, thus suppressing the formation of upward streamers in the protected area and preventing the attachment process.