

# *Preventing Lightning Strikes at Utility Substations*

## **A Power Generation/ Smart Grid Case Study**

We examine the challenges of lightning protection in the utilities sector, highlighting how initial “collection” design choices were actually vulnerabilities, and how Lightning Eliminators’ “prevention” systems are much better adapted to real-world operating conditions.



### **Abstract**

A leading provider of electric power, cable, internet, and telephone services selected a lightning protection solution to safeguard operations and minimize costly downtime from outages. However, unforeseen external and environmental factors revealed that their initial design actually contributed to new risks.

### **The Problem**

#### **Vulnerabilities of Legacy Lightning Protection Systems**

A publicly owned electricity power distributor serving 170,000 customers in Tennessee initially installed overhead grounding wires to protect its substations from lightning strikes. The utility, however, determined that in a few cases the ground/shield wires meant to prevent service disruptions from lightning actually caused them.



Lightning protection is part of the utility's specifications for substations, but high winds and other inclement weather incidents would knock the overhead ground wires down, damaging equipment and disabling the substation even when lightning was not present. The utility recognized that while removing the overhead grounding wires was essential to prevent future outages, its substations still required reliable lightning protection. They selected Lightning Eliminators & Consultants (LEC) to design a reliable lightning protection solution using LEC's consultative approach that would not create any additional risks to operational continuity.

substation, eliminating the risk of running wires over critical equipment.

The DAS also uses a patented, innovative method of operation compared to ground/shield wires. While grounding wires are meant to re-direct an incoming lightning strike's energy to the ground, away from substation equipment, the damaging secondary effects of the strike are still experienced. The DAS uses "charge transfer" technology, which prevents lightning within a protected area altogether. The technology is so effective, the DAS has a 99.87% success rate and is the only lightning protection product to offer a full no-strike warranty.

Ensuring maximum power quality, power reliability and asset protection was important to the utility as it sought to upgrade from overhead ground wires. The utility's solution - the DAS charge transfer technology - is the only type of system where the lightning impulse is discouraged instead of encouraged (attracted). The DAS completely isolates facilities from a direct lightning strike by bleeding off the induced charge

on the protected area during 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.

---

*"We had a couple of instances where the overhead ground wires fell on substations and caused outages. As an alternative to overhead ground wire, we started using Dissipation Array® System from Lightning Eliminators in the late 1990s."*

*- Manager of Distribution Standards and Design*

## The Results – Reliable Lightning Prevention and Protection

---

### The Solution – Dissipation Array® System

The utility chose LEC's Dissipation Array® System (DAS®) for its new substation construction and for ongoing substation renovations. Each DAS is mounted to a pole adjacent to a

The DAS solution proved to be a significant benefit to the utility, virtually eliminating lightning related incidents at protected substations. This reliability helped provide customers with a continuous supply of quality power. Even one lightning strike to a substation could have a devastating effect.

When utilities experience a lightning strike to an electrical substation, they are exposed to a multitude



of risks. The loss of electrical power to even a small portion of the company's service network would result in lost revenues and customer reliability concerns. Hardware failures can include lost electronics, lost site communication and, in a catastrophic failure, the loss of high voltage power transformers.

## About LEC and Charge Transfer Technology

LEC helps utilities and other critical infrastructure industries avoid lightning damage and service disruptions by providing integrated, industrial lightning protection and prevention solutions, products and services. 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.

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 controlled, low amplitude discharge 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 50 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.



---

## Contact

### **Lighting Eliminators and Consultants, Inc.**

6687 Arapahoe Road

Boulder, CO 80303

720-927-6004

info@lecglobal.com

www.LightningProtection.com

---