Wildfire Mitigation: Products & Solutions

Kevin Corcoran, Director, Product Management – Grid Monitoring, Aclara
Haley Engel, Marketing Manager – Cable Accessories, Hubbell Power Systems, Inc.
Ryan Freeman, Product Manager – Arresters, Hubbell Power Systems, Inc.

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EXECUTIVE SUMMARY

KEY TAKEAWAYS

• Wildfires pose significant danger to the general public and utilities.

• High voltage surge arresters and fire protection disconnectors minimize fire-producing sparks from utility equipment.

• Passive fire protection solutions like coatings can protect the utility infrastructure.

• Contact prevention products are an effective way to mitigate the risk of power line fires caused by animals.

• Grid monitoring tools provide visibility before, during, and after wildfires.
Wildfire Mitigation: Products & Solutions

A panel of experts from Hubbell Power Systems, Inc. and Aclara discussed products and solutions designed to address wildfire mitigation.

OVERVIEW
Severe destruction in the wake of wildfires has received national and international attention over the last few years. Today, utilities face intense scrutiny and criticism over steps they are taking to prevent future events. New products such as high voltage surge arresters, fire protection disconnectors, fire protection coatings, and contact prevention devices can lower the risk of wildfires around the power infrastructure. Grid monitoring solutions can also play a critical role before, during, and after emergency operations.

KEY TAKEAWAYS
Wildfires pose significant danger to the general public and utilities.
Over the past decade, the impact of wildfires worldwide has been dramatic:

- The average annual number of wildfires worldwide has been 67,000 and the average acreage burned has been 7 million acres per year.
- In California alone each year over the past five years, on average there have been 144 wildfires and 1,400 acres burned.
- In February 2009, 400 bushfires in Victoria, Australia caused 173 fatalities.

In response, governments worldwide are demanding solutions. At a recent conference, California utilities reported that the top cause of wildfires near power lines is vegetation touching the lines. Other major contributors include dropped conductors and pole or equipment failure. Given their experience with wildfires, Australian utilities have developed effective risk-mitigation programs that represent global best practice.

Figure 1: Wildfire Ignition Data from California Reporting Utilities

High voltage surge arresters and fire protection disconnectors minimize fire-producing sparks from utility equipment.
High voltage A.C. surge arresters protect vital utility equipment that is costly to replace and often has long lead times to acquire, such as pole top transformers, breakers, or other devices.

Under normal operating circumstance, arresters act as high impedance devices which allow a small amount of current to pass through the devices. When an arrester is exposed to an increase in electrical voltage, due to lightning or a switching surge, the MOV blocks in the core of the arrester switch into an electrically conductive low impedance state. The surge current is diverted to ground. By limiting the voltage across the arrester and the protected device, the MOV blocks prevent damage from occurring. Following the surge, the arrester returns to a normal high impedance state.

If a sustained voltage exceeds the capability of the surge arrester, the current that the device is conducting increases significantly. If the arrester short circuits, the system fault current flows through the arrester uncontrolled. When this occurs, hot particles may be expelled which can cause a fire.
Usually surge arresters are equipped with a ground lead disconnector (GLD) which reacts to sudden current increases. A blank 22 cartridge actuates and breaks the line to ground connection. This removes the shorted product from the system and allows the system to be re-energized. At the same time, arcing and stray particles may be emitted. These must be contained to mitigate the potential fire risk.

Countries and regions have taken different approaches to certifying high voltage surge arresters:

- **Australia has developed high voltage surge arrester standards.** These are based on IEC standards. Australian standards include a subsection with specific criteria to qualify the spark production class. One commonly used calibration test method to quantify the fire risk is called the “ground paper method.” Australian utilities often require products that meet Class A spark production (zero sparks) based on ground paper testing.

- **California relies on the California Power Line Fire Prevention Field Guide.** This document outlines procedures to minimize the risk of catastrophic wildfires caused by electrical power lines and equipment. The guide details testing processes and qualified test equipment that meets requirements for CalFire exempt status for electrical equipment. The current edition of the guide was released in 2008, but an updated draft is expected later in 2020.

**Hubbell has developed a surge arrester specifically to meet Australian test requirements for Class A.** If incandescent particles are emitted from this arrester, they don’t have enough energy to ignite a fuel bed. This product includes insulated line and ground ceiling caps which limit the available energized surface area.

In some regions of Australia, surge arresters aren’t installed with a GLD. In response, **Hubbell has also developed a fire protection disconnector (FPD) solution.** This retrofit option for existing surge arresters is designed to reduce fire-producing sparks. Upon activation, the FPD disconnects the arrester from the line and provides a visual indicator. Additional protection against interference is provided through an optional wildlife guard.

**Looking ahead, both utilities and manufacturers are interested in developing standardized test methods for high voltage surge arresters. This work will leverage the Australian standards and CalFire expertise.**

Ryan Freeman

**Passive fire protection solutions like coatings can protect the utility infrastructure.** Utilities recognize that wooden poles are vulnerable to fire. However, replacing millions of wooden poles with metal or composite ones isn’t realistic from a cost and labor perspective. Reinforcing wooden poles with passive fire protection options is a promising alternative.

To make a difference, it makes sense to deploy passive fire protection solutions in high risk fire areas, controlled burn zones, and active fire paths. This can reduce the duration and cost associated with power outages. Coatings and wraps are two options that mitigate fire risks for wooden poles. These solutions offer different benefits in terms of serviceability, ease of installation and removal, and breathability.
Hubbell Power Systems, Inc. recently introduced a new product called Fire Protection Coating (FPC). This intumescent coating is formulated to preserve the structural integrity of wooden utility poles in the event of a fire. When poles are coated with FPC, intumescent char forms as a reaction to heat or fire. FPC can be sprayed, brushed, or rolled on poles.

In addition to standard flame spread tests and screening using ASTM E119, FPC has also been tested using the proposed ASTM testing method for wooden utility poles. The official standard is expected to include mechanical loading, weathering evaluation, and a performance baseline for comparing methods.

Contact prevention products are an effective way to mitigate the risk of power line fires caused by animals.

Ed LeRouzic reviewed five ways that wildlife can cause fires near power lines:

1. **Animals are a potential fire risk.** Animals conduct electricity and are flammable. Dry fur and feathers can be highly flammable in the right situation. If an animal contacts energized equipment, it can ignite and fall onto dry vegetation.

2. **Nesting creates dangerous ignition potential.** This is a significant problem for North American utilities. Nests are composed of organic matter like twigs and grasses. Birds often build nests near energized components. There is a high risk of nests catching fire and dropping to the ground. Effective mitigation strategies depend on the type of nests, the species involved, and the structures the nests are built on. In some cases, wildlife mitigation products can prevent nesting material from contacting energized components. However, this isn’t always an acceptable substitute for removing the nest.

3. **Electrical equipment can explode when contacted by animals.** Close-in faults can cause electrical equipment failures which may result in catastrophic fires. After an explosion, molten metal or flammable insulating oil is often sprayed onto vegetation below, which can cause a wildfire.

4. **Over-voltage can lead to ignition.** If animals contact a distribution transformer, there may be a fuse expulsion on the disconnect protecting the equipment. Damaged insulation or windings may increase the voltage on the secondary side of the transformer. Secondary system equipment damage can also create fault conditions that cause arcing and conductor damage.
5. **Non-fire rated covers may be a source of ignition, since they support combustion.** Even with covers in place, animal contact can occur. If products don’t fit well or aren’t properly applied, equipment is exposed and at risk for contact. If a fault is caused by animal contact, non-fire rated products can ignite themselves and drip flaming material onto vegetation below.

In 2010, the IEEE released a guideline for evaluating electrical and mechanical performance of wildlife mitigation products. The guideline calls for sequenced tests. Flammability testing is optional and specified for when nonflammable materials are needed by end users. Two methods are specified for testing flammability: vertical flame tests and horizontal burn tests.

Hubbell Power Systems, Inc. offers two products for wildlife contact prevention that are V-0 rated and tested in compliance with IEEE 1656:

- **Reliaguard.** These products are preformed and intended for distribution power lines. Reliaguard is designed for retention, ease of installation and removal, and adaptability.

- **Greenjacket.** These site-specific solutions intended for substations focus on a precise fit. Overlapping covers eliminate gaps and contact risk. With Greenjacket, there are “no gaps and no zaps.” Greenjacket solutions come with comprehensive installation instructions to ensure they are applied properly.

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**According to California utilities, about one in ten of all ignition causes are traced back to animals. A pretty significant number of wildfires are caused directly by animal contact.**

*Ed LeRouzic*

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**Grid monitoring tools provide visibility before, during, and after wildfires.**

Grid monitoring tools are valuable for predicting and responding to utility-related fire hazards. Kevin Corcoran discussed four scenarios where grid monitoring is helpful:

1. **Avoiding wildfires by identifying potential risks.** Best practices include using multiple grid monitoring tools, as well as tools that support multiple use cases. No single tool can identify every type of wildfire hazard. Tools that support multiple use cases are cost effective. Grid monitoring solutions like Aclara’s are particularly good at identifying transient fault current events. Patterns in these events provide early indications about potential causes of faults such as vegetation, lines down, failing equipment, wildlife, or slapping conductors.

2. **Taking action when wildfire conditions are imminent.** Network visibility is crucial, especially around areas of risk. In advance of wildfires, many utilities turn off power. To minimize the number of customer power outages, utilities can switch and reconfigure their networks. During switching operations, utilities must understand the capacity on adjacent circuits and estimate the potential new load that will be introduced. Displaced load is also a consideration as customers temporarily move to nearby areas.
3. **Gaining visibility during emergency operating conditions.** During emergencies, weather and fire conditions are fluid and utilities engage in emergency switching. Grid visibility in and around targeted areas is essential. Priority visibility must be provided to first responders, on-site command centers, shelters, and critical infrastructure.

4. **Restoring power after the emergency has passed.** Following an emergency, the best-case scenario is standard power restoration. The worst case is fixing damaged circuits and substations. Grid monitoring can be a great tool for temporary SCADA monitoring for mobile generators or temporary substations.

Aclara’s grid monitoring solutions offer enhanced visibility, flexibility and mobility. Sensors are inductively powered and include integrated wireless communications. A set of three sensors can be installed in 15 to 30 minutes. Sensors may be deployed permanently or temporarily for troubleshooting. Once installed, the sensors inductively self-power, automatically connect to the wireless network, and immediately report interval data and their GPS location. Fault events are reported as they occur on the network. Aclara’s grid monitoring and analytics software can be provided as a cloud-based service or run on utility data center servers. It can also run standalone or integrate into a SCADA or ADMS system. A wildfire application guide is available on Aclara’s website.

Grid monitoring sensors and software can prevent wildfires by providing early indications of potential hazards. During and after emergency operations, they aid with switching by offering visibility into load and voltage conditions.

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**BIOGRAPHIES**

**Kevin Corcoran**
Director, Product Management – Grid Monitoring, Aclara

Kevin has been a Director of Product Management with Aclara since 2016 with P&L responsibility for Aclara’s award-winning Grid Monitoring product line. Prior to Aclara, he has had over 17 years’ experience in the smart grid industry with roles as the Product Line Management Director for Tollgrade’s LightHouse smart grid business and as a Principle Engineer and Product Manager for CURRENT Group. Kevin has been awarded 6 patents in powerline communications and networking and has held positions in software and firmware development and engineering management for communications and networking firms. Kevin is a 1987 BSEE graduate from the University of Virginia.

**Haley Engel**
Marketing Manager – Cable Accessories, Hubbell Power Systems, Inc.

Haley Engel received her Bachelor of Science in Mechanical Engineering from Texas Tech University. She began her career as a Mechanical Engineer and Drone Pilot for Kratos in Huntsville, Alabama. In 2017, Haley joined Hubbell Power Systems, Inc. where she held various roles in application engineering and marketing for the surge arrester business. Ms. Engel is currently a Marketing Manager with responsibility for Cable Accessories and Fire Protection Coating.
Ryan Freeman
Product Manager – Arresters, Hubbell Power Systems, Inc.

Ryan Freeman received his Bachelor of Science in Mechanical Engineering from the University of South Carolina. He joined Hubbell Power Systems, Inc. in 2011 as a Design Engineer with a focus on the development of high voltage surge arresters. Mr. Freeman transitioned to the role of Application Engineer in 2016. He is an active member of the IEEE SPDC WG, IEC TC37, IEEE 693 Seismic Design for Substation WG and CIGRE WG C4.39. In his current role, Mr. Freeman is the Product Manager responsible for the design and application of surge arresters.

Ed LeRouzic

For nearly a decade Ed has been a part of the Greenjacket team developing innovative products and unique solutions to improve power system reliability. This included playing a key role in the creation of the Reliaguard line of products and acting as the technical lead for the Design and Site Services teams. Ed has a background in product development and holds a degree in Industrial Design from the University of Alberta.