Power Surge Damage

Protecting, Preventing and Predicting

Applications Paper

TLECC
Timber Line Electric & Control Corporation
Automation Control / SCADA / Telemetry

OVERVIEW

Power surges are generally considered to be the most destructive type of electrical power disturbances. Over 65% of all equipment damages, premature failures and burn-outs in electronic/ electrical equipment like PLCs, MCC panels, Drives, Controllers, Switch Mode Power Supply (SMPS) units, UPS systems, IT equipment, etc., is due to surge over-voltages.

There are a variety of causes for power surges, but typically for our customers they occur from two sources; power grid switching and equipment failures by the electric utility company, and the most powerful ones from lighting strikes.

Here we discuss both and describe two actual protection and prevention projects. We will review the installation of a multi-level Transient Voltage Surge Suppression (TVSS) system at Breckenridge's Gary H. Roberts Drinking Water Plant and the implementation of an imminent lightning detection and automatic shut down system for pumps and equipment for Donala Water and Sanitation District.

Facts about lightning strikes

- **Each bolt can contain up to one billion volts of electricity.**
- **The temperature of a typical lightning bolt can reach 50,000 F degrees – that is 5 times greater than the temperature of the surface of the Sun.**
- **There are over 20 million cloud-to-ground lightning strikes in the continental US each year.**
- **65% of equipment failures and losses at storage and process facilities are due to lightning.**

BRECKENRIDGE TVSS SYSTEM

When a snowplow hit a utility pole that provided power and phone service to Breckenridge's Roberts Drinking Water Plant, the plant experience multiple disruptive voltage system failures. The accident, which happened in the middle of the night, created several electrical surges which destroyed numerous electrical components and took the SCADA system off-line. To add to these problems, the local area phone system was also disabled in the incident, so critical alarm notifications could not be received by the plant operators. The next morning, around 5 AM when the phone service was restored the SCADA system began sending multiple alarms as the computer was operating on UPS power.

This unfortunate and costly accident prompted the Breckenridge management team to ask for a complete audit of their power distribution and TVSS equipment. This investigation discovered that there was TVSS protection at the plant, but as the plant had been expanded (twice) the surge protection coverage was no longer sufficient to protect the added systems and equipment. Timber Line resolved the protection problem by adding supplementary TVSS coverage for 3 Motor Control Centers, one 120VAC power panel and one 120VAC circuit that transmits power to a near-by reservoir.

Although no surge arrestor can compensate for the lack of phone service, a phone-line TVSS was added to the system to help shield the computer and alarm modem. Additionally, each 4-20mA control loop that leaves the water plant is now protected with a low-voltage TVSS device. Since the implementation of these additional surge suppression devices, the Breckenridge Gary H. Roberts Drinking Water Plant has not experienced any surge-related failures.

The possibility of delay in alarms, delays in response by plant operators and the unforeseen costs associated with the absence of proper surge suppression should be reviewed by every Water and Wastewater Utility service provider. Complete electrical distribution audits are available through Timber Line Electric & Control Corporation.

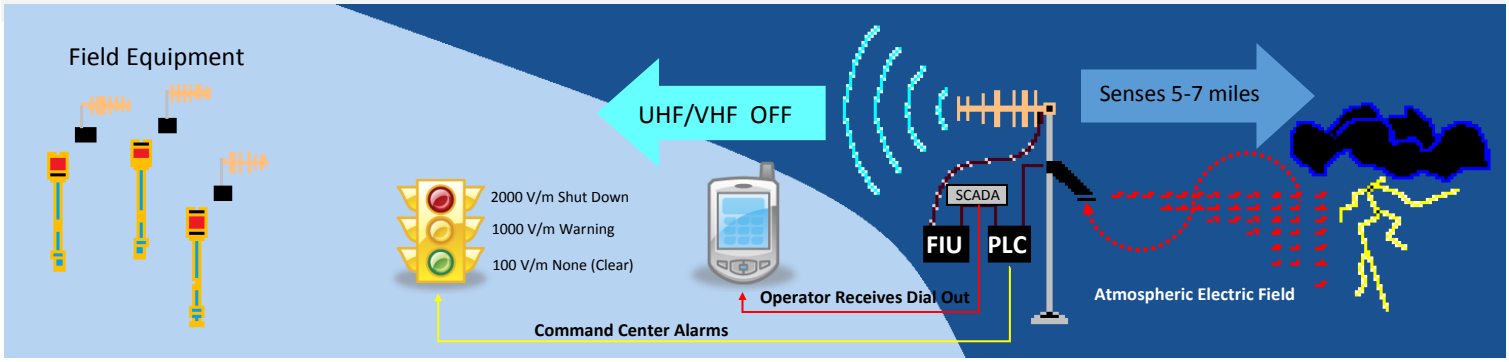
DONALA LIGHTNING DETECTION & SCADA

Located just east of the U.S. Air Force Academy north of Colorado Springs, Colorado, the Donala Water and Sanitation District is situated in one of the nations heaviest lightning strike regions. Over the years operators and management observed that if aquifer wells are running during an area lightning event, they are very likely to sustain damage to pumps and many of the well's ancillary electrical devices. However, human resources are not always at the right places at the right times to insure that manual shut down procedures take place during an event. No matter efforts to monitor the weather, in a single season, the District could typically experience damages exceeding $30,000 due to lightning strikes. In order to remedy this, Donala's management team contacted Timber Line Electric & Control Corporation for a ON/OFF/Auto SCADA solution.

Finding the right solution for their existing SCADA design required many brain-storming sessions to think through the "What-if" scenarios. Finally, a Standard Operating Procedure (SOP) was written, equipment hardware selected, customized telemetry ladder logic was programmed, panels were fabricated and the completed system was installed. Currently, Donala has completed one lightning season with no equipment losses. Mark Parker, Donala's Chief Water Operator, is pleased with the results of the technology that has dramatically reduced equipment damage.

SOLUTION

The lightning detector technology used for Donala is similar to the technology used on golf courses and ball fields to warn participants and fans that there is an imminent danger of lightning strikes. The equipment deployed can begin sensing atmospheric electric field changes from about 5 to 7 miles from the field detector. When lightning is probable, the detector sends a digital input to the SCADA system. The telemetry unit then issues the "off" command to the remote well sites via a customized code running in the Field Interface Unit (FIU). The message is sent to the selected remote well sites via VHF licensed radio frequency. Operators can override the "off" command if water is needed in an emergency such as a wild or residential fires. Additionally, operators can activate the "all off" command for other reasons such as electrical brown-outs or requests from the power company to reduce usage. To complement this system, warning alarms and indicator lights can be added to show current conditions, such as; no, moderate and imminent danger.



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