

CASE STUDY

Arc-Flash Detection in the Mining Industry

North American Mine Discovers Arc-Flash Detection Isn't Just Academic—It Saves Lives and Equipment

Mining is an energy-intensive process, which requires a sophisticated, well-coordinated power system. It is subject to potential arc-flash hazards, which can produce dangerously large amounts of heat, ultraviolet radiation, blast pressure, flying shrapnel, and deafening sound waves. To protect against these risks, mines are increasing their use of arc-flash mitigation solutions as part of their electrical equipment configurations.

Background

The use of cemented paste backfill is an important component of underground mining operations. When used to fill in exposed areas, it provides ground support and increases mine safety.

One North American mining company was in the commissioning stages of a cemented paste backfill project when an arc-flash event occurred. This event was safely mitigated and provided a timely reminder of the benefits of arc-flash mitigation. A potentially devastating event was avoided by having arc-flash mitigation technology in place. In an effort to raise awareness about arc-flash safety, the customer contacted SEL to share their story.



Figure 1—Typical Mine Interior

This particular mining operation first began using SEL-501 Dual Overcurrent Relays in their substations in 1994, at the recommendation of an electrical engineering consultant, and began adding arc-flash mitigation capability in 2000. They have installed SEL-751 Feeder Protection Relays and SEL-710 Motor Protection Relays configured with arc-flash detection. Figure 2 shows a representative arc-flash detection scheme.

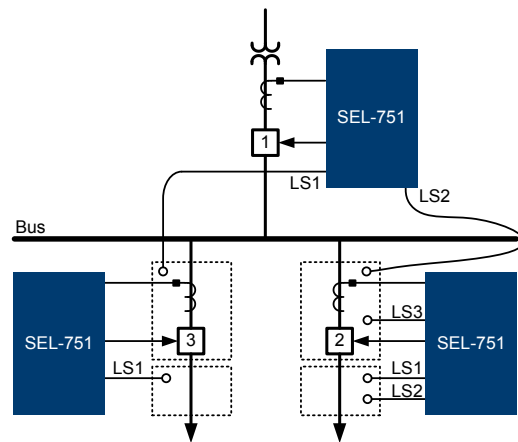


Figure 2—Arc-Flash Detection Scheme Using Overcurrent and Light Sensors (LS) for Fast and Secure Arc-Flash Protection

How It Happened

The arc-flash event occurred while the mining firm was in the process of sinking a shaft to install four 3,000 horsepower fans for ventilation. The electrical facilities had been energized, and the mine site had been experiencing inclement weather. When the contractors showed up to work that weekend, the lights were off and there was a trip condition on the incoming feeder.

A rodent had triggered an arc-flash event while making its nest between two phases of the newly installed switchgear. The rodent was killed, but the switchgear was protected and showed no visible damage.

The arc-flash event reports are shown below in Figure 3 and Figure 4.

An overcurrent condition was detected (see the square cursor at the point the overcurrent condition is measured on Phases A and B in Figure 3).

Four milliseconds later (see the square cursor at the trip indicator in Figure 4), the overcurrent and arc-flash time-overlight[®] conditions were met and the trip was asserted.

“What was humbling was that this installation and event were real... The (SEL) equipment was installed to protect personnel, but the SEL relays also protected our equipment from potentially devastating damage.”

Electrical Engineer,
North American Mining Firm

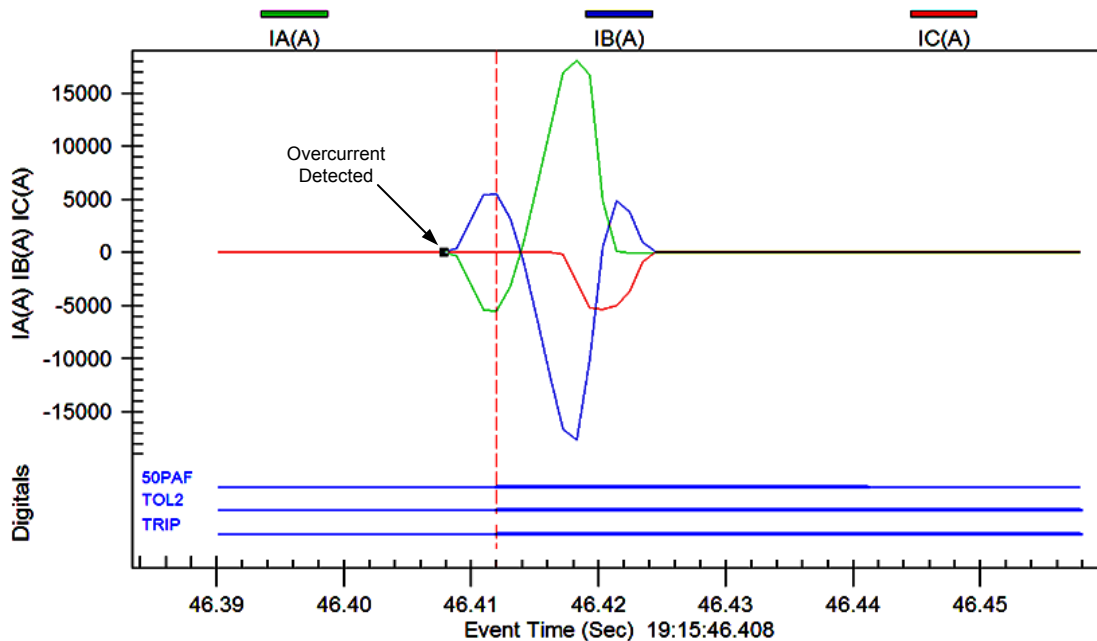


Figure 3—SEL-751 Captured Arc-Flash Event Showing Overcurrent and Digital Logic Signals

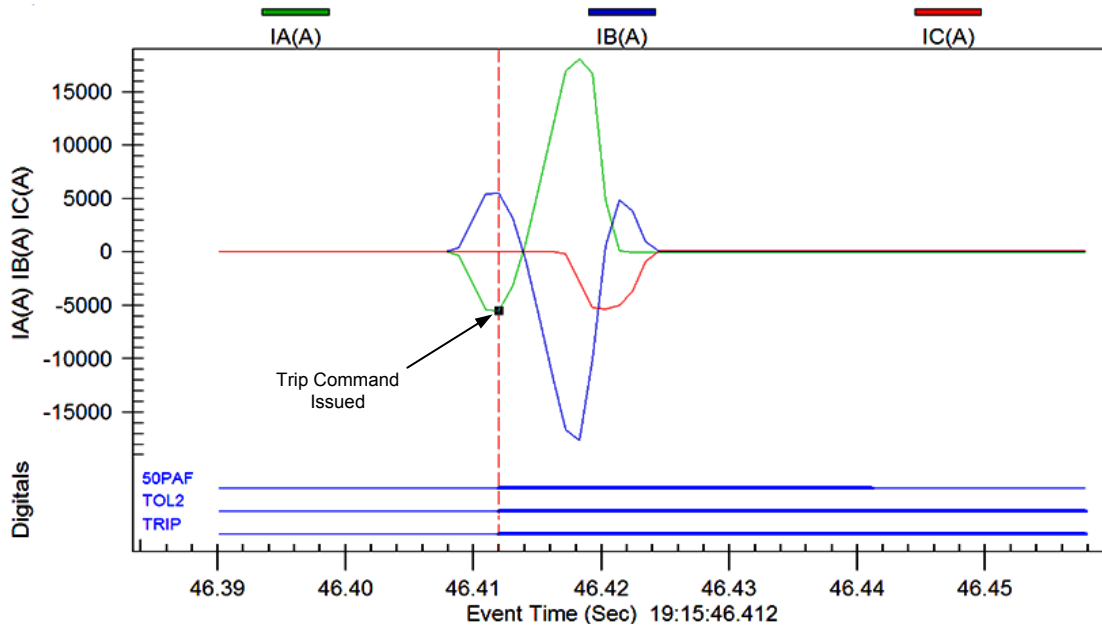


Figure 4—Vertical Line Showing When the Overcurrent and Light Conditions Were Met and a Trip Command Was Issued

Key Benefits of Arc-Flash Detection

The key benefits of arc-flash detection, as experienced by this customer, included the following:

- Improved personnel safety.
- Significantly reduced incident energy.
- No reported damage to switchgear.

Heightened Arc-Flash Awareness

After using arc-flash mitigation technology for several years and never having had an event, the lead engineer and his associates had sometimes wondered if their investment in arc-flash detection was truly necessary.

When the arc-flash event actually occurred, it changed their minds and piqued their interest in how arc-flash mitigation works. “The total [incident] energy was significantly minimized by having the arc-flash technology,” said the engineer. “It was clear [to the 30 electrical contractors] that this technology was good to have—it’s not just academic.”

“Originally we implemented technology because it was the right thing to do for personnel safety. Investing in arc-flash safety is more work, and people don’t always see the benefit. But after we saw how the SEL equipment protected our switchgear, the reaction was: ‘Wow, this is cool stuff!’ Arc-flash equipment is good—and the right thing to do in this day and age.”

Retrofit Application

The engineer was convinced that arc-flash mitigation was well worth the effort. He went on to say, “Now we are actively looking at adding arc-flash detection to existing motor controls via SEL protective relays. Older gear doesn’t have any venting, so it’s even more important to have arc-flash protection.”

Next Steps for the Mine

The mining operation plans to add arc-flash detection to its remaining switchgear equipment. They are also expanding beyond SEL protective relays to begin using SEL solutions for industrial automation and communications.

About SEL

Schweitzer Engineering Laboratories, Inc. (SEL) has been making electric power safer, more reliable, and more economical since 1984. This ISO 9001:2000-certified company serves the electric power industry worldwide through the design, manufacture, supply, and support of products and services for power system protection, control, and monitoring. For more information, please contact SEL at 2350 NE Hopkins Court, Pullman, WA 99163-5603; phone: +1.509.332.1890; fax: +1.509.332.7990; email: info@selinc.com; website: www.selinc.com.

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