Electrical protection batteries discharging

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What happened?

A fault occurred on a high voltage dragline cable at an open cut coal mine. The electrical protection system in the substation supplying the dragline is designed to isolate such faults, however it did not operate. Upstream protection at the Ergon supply did operate to isolate the fault.

How did it happen?

Preliminary investigations found the electrical supply to the control and supervisory unit for the batteries that supply the electrical protection system had been isolated. This allowed the protection batteries to discharge over time and eventually become inoperable.
It was also found that while this unit had both battery monitoring trip and incoming control supply trip capability, which would have alerted to this problem, neither of these protection functions had been enabled in the software. Other units on the site were checked and these also had the same protection settings disabled.

Recommendations

Ensure the site's routine maintenance strategy addresses:

- electrical protection batteries monitoring and protection trip functionality that will operate before the electrical protection
- battery volts discharge below operational limits
- functional load testing of the protection tripping supply, including control, battery and capacitive trip supplies.

Using a single primary high voltage protection system with no back up protection is not recommended. Primary protection and back-up protection systems within a substation should be fully independent, so a single event will not affect both systems.

References and further information

Note the requirements of the Coal Mining Safety and Health Regulation 2001, including sections:

23 Design, installation and maintenance

The site senior executive must ensure the design, installation and maintenance of electrical equipment and installations at the mine provide for the following-

(a) reliable circuit interruption, under fault conditions, at all points in the mine's electrical distribution system;

25 Standard for electrical control systems

The electrical engineering manager must ensure-

(a) each electrical control system at the mine operates safely under all operating conditions, including electricity supply instability or failure; and

(b) if the system suffers a fault or fails, all emergency stopping systems and safety alarms at the mine remain effective.

Meanwhile, for metalliferous mines and quarries, note the requirements of the Mining and Quarrying Safety and Health Regulation 2001, including sections:

22 General

The operator or site senior executive must ensure-

(a) switchgear used at the mine allows for reliable circuit interruption, under fault conditions, at all points in the mine's electrical distribution system; and

(b) each electrical circuit at the mine is protected against overload, short circuit and earth fault under all operating conditions to effectively-

(i) interrupt the electricity supply; and

(ii) isolate faults.

24 Automatic control

The operator or site senior executive must ensure-

(a) each automatic, programmable or computerised electrical control system at the mine operates safely under all operating conditions, including power supply instability or failure; and

(b) the emergency stopping systems and safety alarms at the mine remain effective if there is a fault or failure in a system mentioned in paragraph (a).

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