

Practical Risk-Based Assessment: Safety Integrity Levels for Mining Systems

The coal mining industry is actively embracing concepts of Safety Integrity Level (SIL) in all aspects of control and safety shutdown systems. Safety Integrity Level is an internationally adopted concept for describing and managing risk reduction, aimed at improving standards for safety.

The Issue

The use of Safety Integrity Level is a natural consequence of technological evolution, where outdated relay-based electrical control systems are being replaced by modern programmable electronic devices. Of course, programmable systems have been in use for many years for basic control systems, but until recently hard-wired electrical controls were preferred for safety-critical systems. Nowadays the considerable power of programmable devices to self-diagnose and monitor safe operations has made them attractive for safety functions as well. However, the applicable standards and degree of rigour required can pose problems for new users.

The trend is for regulators to move away from prescribing minimum standards (such as defining required Safety Integrity Levels for mining systems) and instead require each mine operator to determine an appropriate Safety Integrity Level on a case by case basis.

For example, a current NSW Department of Primary Industries guideline¹ specifies the Safety Integrity Levels required for functions in powered winders. However the move towards non-prescriptive regulation requires users to determine Safety Integrity Levels for themselves, on the basis of hazard identification and risk assessment. This is in line with the current NSW OHS regulations which are not prescriptive, but rather require organisations to take responsibility for risk assessment and management. It is expected that in the future, operators will indeed be required to make their own assessment of control and safety systems, something that may prove daunting for some. Further, operators may be required to prepare safety cases for these system changes.

The Solution

Advitech has developed a practical methodology to:

- Help operators determine Safety Integrity Levels from first principles.
- Assess the reliability of systems where there is little published reliability data.
- Use hazard guidewords against required safety functions to identify as many risk scenarios as possible.
- Combine these steps to assist operators in preparing a thorough safety case, for submission to the regulator.

The process involves a series of facilitated risk assessment workshops which bring together key personnel, such as equipment designers, component suppliers and the mine operator. Advitech's process is simple and understandable, "de-mystifying" the jargon and complications of the applicable standards and guidelines.

The process is based on overall principles, rather than technical product sales data for individual components. Coal mining safety performance data from Australian, UK and US operations can be used to help companies meet corporate standards. Being facilitated by an external third party, this process ensures a neutral and independent perspective is taken in the assessment of safety.

Potential Benefits

The use of a structured methodology to determine Safety Integrity Levels helps mine operators design their systems secure in the knowledge that they have applied the principles of risk management described in NSW Department of Primary Industries guidelines, and in accordance with the Coal Mine Health and Safety Regulation 2006.

Operators can benefit from preliminary reliability assessments at early stages of a project, before locking in a final design. This allows adjustments to the design to be made at an early stage, where costs are lowest.

In addition, the output from the risk assessment and failure modes and effects analysis provides the basis for the safety case (or "safety file" in the regulator's terminology). The safety file documents the design, installation, operation and decommissioning of equipment. It includes reliability assessments for probabilities of dangerous failure, so that operators can assure themselves that acceptable levels of safety will be achieved.

Advitech's methodology has already successfully been applied to:

- Mine winder upgrades.
- Underground power trip circuits in the event of mine ventilation fan failure.
- Long wall systems.
- Shuttle car tram controls.

Significance to the Mining Industry

Advitech's structured approach facilitates the process of determining Safety Integrity Levels in a simple and efficient manner, helping operators achieve high levels of safety for their personnel. The innovation achieves significant outcomes for the mining industry including:

- Improving the ability of operators to achieve and demonstrate compliance.
- Providing a cost effective approach to safety.
- Guiding the design of systems to achieve appropriate levels of safety.

Advitech's practical implementation of a risk management system aligned with Safety Integrity Level concepts raises the bar on safety standards in the mining industry.

References:

1. MDG 2005 – *Electrical Technical Reference for the Approval of Powered Winding Systems*, NSW Department of Primary Industries, Feb 2003.

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