



Safety management of electric arc flash hazards



Electric arc flash is a known hazard in the workplace. Each year, around 25 significant arc flash incidents occur in the Western Australian mining industry that cause or have the potential to cause injury.

This information sheet is designed to assist principal employers and registered managers in developing safety measures to control electric arc flash hazards at their mine.

Regulatory requirements

Electrical installations in Western Australia are governed by legislation and must meet the requirements of the *Electricity Act 1945*, Electricity Regulations 1947 and the Electricity (Licensing) Regulations 1991.

Mining operations must also comply with provisions of the *Mines Safety and Inspection Act 1994* (MSIA) and the Mines Safety and Inspection Regulations 1995 (MSIR).

The MSIA (s. 9) requires the principal employer of a mine to provide and maintain a work environment where workers are not exposed to hazards, as far as is practicable. Under the MSIR (r. 6.2.(1)), the principal employer must ensure that:

- a system is implemented to identify any hazards associated with the plant
- risks of workers being exposed to those hazards are assessed
- all practical measures are taken to reduce those risks.

In order to manage the risk of an electrical arc flash hazard, the principal employer must ensure that competent personnel identify the reasonably foreseeable electrical hazards that could potentially injure or harm workers.

The development and implementation of safety control measures that mitigate electrical arc flash hazards should involve input from electrical engineers and supervisors. These measures include hazard assessments, inspections, audits and electrical safety training for all personnel.

Risk assessment

The hierarchy of control (Figure 1) can be applied to address the defined risk of an arc flash event. Once the incident energy (the amount of energy that strikes a person during an arc flash) and the arc flash boundary for an arc flash event are known, hazard risk controls can be put in place to reduce the risk of harm to workers.

For arc flash hazards, the quantitative impact of the incident energy and the arc flash boundary distance can be calculated or estimated using various documented models and standards (e.g. IEEE 1584:2018, NFPA70E:2018, ENA NENS 09-2014). Each method has limitations depending on the system parameters and configuration.

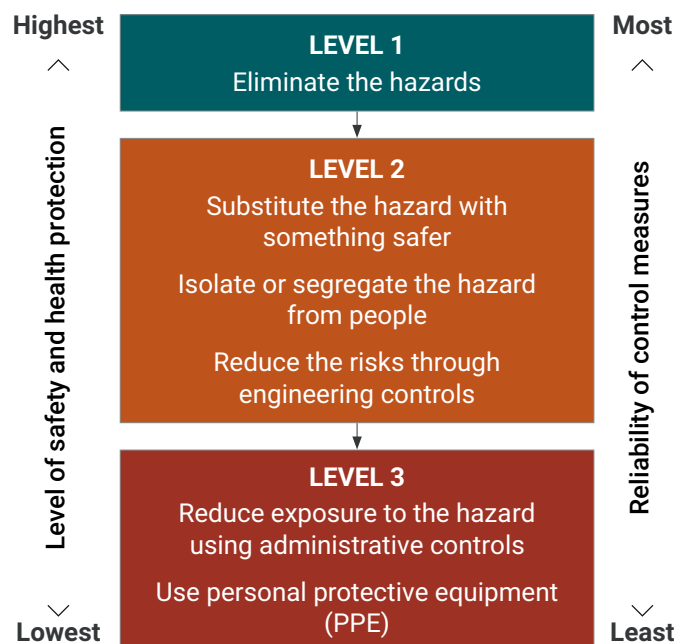


Figure 1 Hierarchy of control

Examples of controls

LEVEL 1	
Elimination	De-energise plant – no risk of arc flash if plant is de-energised
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LEVEL 2	
Substitution	If electrical energy is required, substitution is not possible
Isolation	Remote switching (out of line-of-fire) Isolation and earthing Testing for correct isolation
Engineering	<p>Protection settings</p> <p>Decreasing fault clearing times is an effective means of reducing arc flash incident energies, boundaries and subsequent risk. The reduction of fault clearing times requires a change management process to ensure no other hazards are introduced.</p> <p>Drawings</p> <p>Drawings should be up-to-date for the current installation.</p> <p>Switchboard design</p> <p>Typically, type-testing of switchboards occurs during design and equipment selection for a new installation. For existing switchboards, arc flash containment calculations and/or assessments can help determine the capability of the switchboard to contain a fault.</p> <p>The installation of light and current sensing devices to existing switchboards can provide an alternative approach to physical modifications for the early detection and isolation of an arc flash event.</p> <p>Maintenance</p> <p>A routine preventative maintenance program is required on protection devices, circuit breakers and electrical installations.</p> <p>Switchboard doors must be securely fixed and closed.</p> <p>Any changes to switchgear installations should have the required engineering change review.</p>
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LEVEL 3	
Administration	Clear and concise labelling on all electrical equipment
PPE	Selection and maintenance of arc-rated PPE



Further information

- IEEE 1584-2018 Guide for Performing Arc-Flash Hazard Calculations
- NFPA 70E Standard for Electrical Safety in the Workplace
- ENA NENS 09-2014 National Guideline for the Selection, Use and Maintenance of Personal Protection Equipment for Electrical Arc Hazards
- SIR No. 245 Worker injured by low-voltage switchboard arc flash
- MSB No. 138 Electrical arc flash hazards in mining
- Toolbox presentation Arc flash awareness
- Mines Safety Alerts
- Electrical arc flash hazard management guideline – Australian Energy Council
- NOPSEMA Safety Bulletin Electric Arc Flash Management