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MINE SAFETY | TARGETED INTERVENTION PROGRAM

Summary report: Electrical safety at dimension stone quarries

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Background

In February 2016, the NSW Resources Regulator published the Mine safety regulatory reform: Incident prevention strategy (IPS). The strategy proposed significant changes to the way that the Resources Regulator operates as a regulator. It also suggested ways to support and enforce compliance of mine operators' obligations under the *Work Health and Safety (Mines and Petroleum Sites) Act 2013, Work Health and Safety Act 2011* and their associated regulations.

A key component of the strategy was the development and implementation of a risk-based intervention framework. The framework identifies and confirms risk profiles, verifies risk control measures and allocates resources based on risk priority.

The implementation of the strategy has led to the development of two key targeted programs. These are:

- **targeted assessment program** (TAP): a planned, proactive program that assesses the overall effectiveness of an operator's attempt to control critical risk
- **targeted intervention program** (TIP): an intervention in response to a specific incident that assesses how effectively relevant risks are being controlled (see below for further detail).

This report summarises the findings of TIPs undertaken on the management of electrical risk at dimension stone quarries.

Targeted interventions

Targeted interventions provide a systematic response to a critical risk. They can be applied across all sectors of the mining industry. The need to undertake an intervention will be identified through:

- a series of events
- a single significant event, such as a catastrophic failure or fatality
- a change in the operation's risk profile
- data that suggests an emerging issue.

Targeted interventions are typically undertaken by a team of inspectors from various disciplines. The interventions provide an assessment of the:

- operational and management plans and supporting documentation
- implementation of plans and procedures
- effectiveness of control measures, and
- operator's compliance with relevant legislative provisions.

Selection and process

Selection

The target area—dimension stone quarries—was determined after an inspection at a dimension stone quarry following an investigation into an alleged electrical fire on electrical equipment. The electrical equipment at the quarry was found to be in poor condition, with exposed electrical wiring presenting a significant risk of electric shock to workers.

The mine safety unit's analysis concluded that 13 other dimension stone quarries were using electricity on site. Electrical improvement audits had been completed at seven of the dimension stone quarries during the past seven years. Of note, an electrical improvement audit was completed in 2011 at the dimension stone quarry where the alleged electrical fire had taken place. There had been no reported electrical incidents at any of the dimension stone quarries in the past seven years.

All 14 of the dimension stone quarries were selected for targeted interventions, including the operation where the alleged fire had taken place. These operations varied in size from 2 to approximately 40 workers.

The selected dimension stone quarries each had different electricity profiles. Eleven of the operations had mains power connected from the supply authority at either 415 or 240 volts. Three operations had electrical power supplied to the operation by generator only.

Six of the operations had dimension stone processing on site, with a combination of electric block saws and splitters.

All 14 operations had fewer than 1000 kilowatts of connected power and did not use high voltage on site. Therefore, the operations did not require an electrical engineer with statutory responsibilities.

Note: the word "mine" is used throughout the balance of this report rather than the term 'quarry' for consistency with the *Work Health and Safety (Mines and Petroleum Sites) Act 2013*.

Process

In July 2016, the Resources Regulator's mine safety unit began a series of targeted intervention assessments on the management of electrical risk at dimension stone quarries.

Electrical management at dimension stone quarries is a highly specialised activity. Targeted interventions respond to specific incidences of critical risks so in this instance an electrical inspector was assigned to complete the entire program.

The targeted interventions at dimension stone quarries were completed in several stages. These were:

1. preliminary meetings and the preparation of documents
2. discussions on information and assessment requirements, which were later supplied to the relevant mines
3. execution of a one day on-site assessment involving:
    a. a site desk-top assessment of all electrical plans and processes
    b. a discussion with the mine operator, production manager and electrical representative (if available) on the legislative compliance of the relevant plans
    c. an inspection of site operations
4. discussion and feedback to the mine operator, production manager and electrical representative (if available) on the findings and actions that need to be taken by the mine operator in response.

Assessment findings

General findings

The general findings are a summary of the common issues identified during the interventions and are specific to electrical management at dimension stone quarries. The general findings cover electrical staffing and competence, risk assessments, electrical engineering control plans, previous electrical improvement audits, electrical maintenance, wiring rules and electrical staffing. A response has been included for each issue, with suggestions on how operators can better control risks associated with electricity usage.

Electrical staffing and competence

Issues

None of the mines employed permanent electrical tradespeople. Generally electrical tradespeople were only called to the mines for electrical production problems and did not provide electrical advice or carry out any regular electrical preventative or safety inspections on the electrical equipment. This contributed to a number of issues identified including:

- electrical hazards and risks were not identified
- risk assessments and the identification of controls did not involve competent people as required by clause 9 of the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 (WHS (M&PS) Regulation)
- electrical engineering control plans were not adequately developed and implemented
- recommendations of previous audits were not addressed
- information about the mine's electrical systems including buried services, cable schedules, equipment history and other factors were, in general, retained by the electrical contractor. The information was not adequately documented within the mine's safety management system.
- some mines did not have a process to verify that people completing electrical works on site had the necessary qualifications.

Response

If the mine does not have staff with sufficient knowledge of electrical matters, it may need to involve electrical contractors or electrical engineers to provide advice.

Operators should review the qualifications of electrical tradespeople to ensure compliance with schedule 10, clause 34 of the WHS (M&PS) Regulation, prior to letting work take place. Records of the tradesperson's qualifications should be kept onsite.

It is important to ensure electrical information is retained within the mine's safety management system. Equipment safety files should be updated to reflect equipment history for all completed electrical works.

Risk assessments

Issue — Operators did not provide evidence of risk assessments that considered the risks associated with the use of electricity. Where risk assessments were undertaken and documented, no electrical risks were identified.

Response — Operators must identify electrical risks as part of the mine's risk management process. The risk assessment must include the participation of people with sufficient knowledge and experience of electrical risks and risk assessments. The selected controls for the electrical risks identified in the risk assessments must be incorporated into the mine's electrical engineering control plan.

Electrical engineering control plan

Issues — Operators are required to have implemented an electrical engineering control plan prior to the end of the transitional arrangements on 1 February 2017. This is a requirement under clause 26(5) of the WHS (M&PS) Regulation. The targeted intervention found that none of the mines had completed the electrical engineering control plan. Response Mine operators must ensure that an electrical engineering control plan is prepared and implemented as part of the mine's safety management system.

Previous electrical improvement audits

Issue — Mine Safety has made recommendations to some of the mines in previous electrical improvement audits. Issues identified in the electrical improvement audits were not fixed and were still present at some sites. Examples of issues identified and not satisfactorily addressed included:

- little or no electrical signage
- poor sealing of enclosures or holes present in electrical enclosures, allowing dirt and moisture to enter
- portable tools not being inspected and tested regularly
- residual current devices (RCDs) not being regularly tested, and
- electrical equipment not being regularly maintained.

Response — When reviewing technical electrical reports or audits, operators must ensure that they understand their contents. It is particularly important that mines have people who are competent in electrical safety management. If the mine does not have staff with sufficient knowledge of electrical matters, it may need to involve electrical contractors or electrical engineers to provide advice. These people can assist by reviewing electrical reports and providing guidance on prioritising and completing electrical work.

Electrical maintenance

Issue — Operators failed to ensure that electrical equipment was maintained in accordance to the original equipment manufacturers' (OEM) recommendations and considering relevant Australian Standards and site conditions. This included fixed electrical equipment, portable tools, RCDs and critical safety devices such as emergency stops, access gate interlocks, and other electrical equipment. Many mines did not maintain a list of electrical equipment in use at the mine (an equipment register). Such a list can assist in identifying electrical hazards and support control measures such as maintenance arrangements.

Response — All electrical equipment in use at the mine should be identified and detailed in an equipment register. Electrical inspection and maintenance tasks should be developed for the electrical equipment to ensure safe and reliable operation. Operators must consider relevant

Australian Standards and site conditions when developing these inspection and maintenance tasks. Electrical equipment must be maintained in accordance with the manufacturer's recommendations, if any, or if there are no manufacturer's recommendations, in accordance with the recommendations of a competent person. As part of the electrical engineering control plan the electrical maintenance and inspection tasks should be completed and reviewed by an electrical engineer or a competent person. This could be a qualified electrical tradesperson who exercises the statutory function of qualified electrical tradesperson to supervise the installation, commissioning, maintenance and repair of electrical plant and installations at the mine.

When new equipment is introduced to the mine, maintenance tasks should be developed to ensure safe and reliable operation in accordance with OEM recommendations, relevant Australian Standards and site conditions. If the operating conditions for the electrical equipment changes, electrical inspection and maintenance tasks should be reviewed and updated, if necessary, to reflect any new risks resulting from these changes.

Wiring Rules (AS/NZS 3000) compliance

Issue — Operators could not provide evidence that demonstrated electrical installations were tested in accordance with the Wiring Rules (AS/NZS 3000) by a competent person prior to first being energised. Management personnel were not familiar with the minimum requirements for electrical installations and relied on the knowledge and competencies of electrical tradespeople. The outcomes of electrical installation work and testing were not retained with the equipment's safety file as required by the Wiring Rules. In most cases, the electrical documentation was either not supplied or it was supplied with the electrical tradesperson's invoice.

Response — Robust procedures should be developed and implemented for electrical work on site. The electrical installation works must be carried out in accordance with the Wiring Rules. Before placing the electrical installation in service for the first time or as part of recommissioning, there should be a process in place where the operator, or an individual nominated to exercise the statutory function of electrical engineering manager or electrical engineer at the mine, can be notified about that testing as soon as is reasonably practicable after the testing occurs. The procedure should include retaining documentation associated with the electrical work and testing.

Specific findings

The equipment issues listed below were common at most operations that were operating the equipment. A number of these equipment-specific issues have been causal factors in electrical incidents, including electric shocks, over the past 10 years. These issues include overhead power lines, welding procedures and equipment, portable tools, generators and ingress (entry) protection.

Numerous reference materials are published on the Resource Regulator's website, available at resourcesandenergy.nsw.gov.au/safety dealing with these issues. These publications include technical references, safety alerts, safety bulletins and electrical engineering decision sheets.

Overhead power lines

Issue

Operators were not aware of the high number of incidents related to contact with overhead power lines and did not have procedures for working in and around overhead power lines. There was uncertainty over the ownership and responsibility for the maintenance of overhead power lines.

Response

Operators must ensure that the electrical engineering control plan sets out the control measures for various risks to health and safety associated with electricity at the mine such as the risk of injury from direct or indirect contact with electricity. Schedule 2 clause 3 (3)(n)(iii) of the WHS (M&PS) Regulation requires that the procedures for work near overhead power lines and cables must be taken into account when developing those control measures Procedures, such as warning signs to indicate the location of overhead electric lines and defined work areas, will typically form part of the control measures for working in the vicinity of overhead power lines.

When developing maintenance tasks for electrical equipment onsite, the ownership of the overhead power lines should be identified by the operator. Relevant maintenance tasks should be incorporated into the electrical engineering control plan for any mine-owned power lines.

Welding procedures and equipment

Issue

There was a combination of contractor and site-owned welding machines at sites. The targeted intervention found that only one site had documented procedures for the use of welding machines. At the other 13 sites there were no documented procedures for managing the electrical risks associated with the welding activities or welding machines at the mines. Key staff at these 13 sites were not aware of the requirements to develop welding procedures or the high number of electric shocks reported at mine sites associated with welding over the past 15 years.

No sites had maintenance procedures in accordance with the OEM recommendations and considering relevant Australian Standards and site conditions.

Response

When developing control measures for risks to health and safety associated with electricity at the mine, the mine operator must take into account the procedures for the use of electrical welding plant (in accordance with Schedule 2 clause 3 (3)(n)(i) of the WHS (M&PS) Regulation). The control measures must be set out in the electrical engineering control plan. When developing the procedures for the use of electrical welding plant, the procedures must be in accordance with the OEM recommendations and consider relevant Australian Standards and site conditions.

Welding machines should be included in the electrical equipment register and, along with contractor welding machines, must be maintained, inspected and tested in accordance with OEM recommendations and considering relevant Australian Standards and site conditions.

Portable tools

Issue

Some operations were not maintaining portable electrical equipment and residual current devices (RCDs) in accordance with the recommendations of *AS/NZS 3760:2010: In-service safety inspection and testing of electrical equipment*. At some operations, only the portable electrical equipment was being maintained but with no regular testing of the RCDs. Clause 165 of the WHS Regulation requires an operator to take all reasonable steps to ensure that the RCDs used at the mine are tested regularly by a competent person to ensure that the devices are operating effectively.

Response Portable electrical equipment and RCDs must be maintained in accordance with OEM recommendations and consider relevant Australian Standards (particularly *AS/NZS 3760:2010: In-service safety inspection and testing of electrical equipment*) and site conditions.

Generators

Issue Operators did not provide evidence that generators were installed to Australian Standards or the Technical reference EES-014: *technical principles for the use of "stand alone" generators at NSW mines (coal and metals) and extractives operations*, available from the Resources Regulator website. Operators were not aware of the electrical considerations for the safe installation and operation of generators or of the risks associated with different earthing arrangements.

Response All generators at sites should be assessed against Technical reference EES-014. Regular maintenance of the generators should include checking the integrity of the earthing system and settings as well as testing protective devices, including any earth leakage devices.

Ingress protection

Issue The mines did not have procedures for preventing or detecting the ingress of moisture and dirt into electrical enclosures. Generally electrical tradespeople were only called to sites for electrical production problems and did not carry out any regular electrical preventative or safety inspections on the electrical equipment.

Response Operators should ensure that maintenance procedures for electrical equipment include checks to maintain the ingress protection (IP rating) in line with the original design. Implementation of regular electrical maintenance procedures will help to identify dirt or moisture in electrical enclosures that could affect equipment safety or cause reliability issues. Electrical inspections will also identify any potential electric shock issues.

Where to now

These targeted interventions give an indication of the electrical issues at dimension stone quarries at this time. Some of the findings from the interventions resulted in the issuing of notices, including notices of concern (under s 23 of the *Work Health and Safety (Mines and Petroleum Sites) Act 2013*) and improvement notices (under s 191 of the *Work Health and Safety Act 2011*).

The matters addressed by the notices reflect the findings of the individual assessments.

The interventions found, in summary, a lack of an effective electrical engineering control plan at those operations. Issues revealed by the intervention were in relation to:

- electrical hazard identification and electrical risk assessments
- maintenance of electrical equipment
- electrical equipment register
- welding machine procedures
- overhead power line procedures
- electrical protection settings
- AS/NZS 3000 (Wiring Rules) compliance
- ingress protection (IP) of electrical equipment
- qualifications and responsibilities of electrical tradespeople to complete works on a mine site

- electricity supply authority contacts
- electrical signs
- buried service plans
- testing of portable electric tools and residual current devices
- earth leakage on sub circuits
- isolation procedures
- removal and restoration of power.

The mine operators have indicated that they will respond to the issues identified through the inspections. Where significant issues were identified, the Resources Regulator will follow up with the relevant mines.

The assessment process has identified many common issues around the approach taken by the sites to manage electricity. The sites do not employ full-time electricians and rely on contract electricians for electrical engineering and electrical work on site and there are significant issues in the identification and control of electrical hazards.

This assessment also identified that regular maintenance of electrical equipment was not always undertaken or deemed necessary. This is a ‘false economy’ belief that eventually leads to unsafe and unreliable electrical equipment.

It has also highlighted broader issues associated with the process of developing, implementing and reviewing the risk assessments, electrical engineering control plan and procedures applicable across the sites.

The summary of issues contained in this document can assist other sites to consider their management of electrical risks and their future plans for compliance with the legislative requirements at those sites.

Issued by

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Further information

For more information on targeted assessment programs or targeted interventions, the findings outlined in this report, or other mine safety information, please contact the NSW Resources Regulator’s mine safety unit:

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