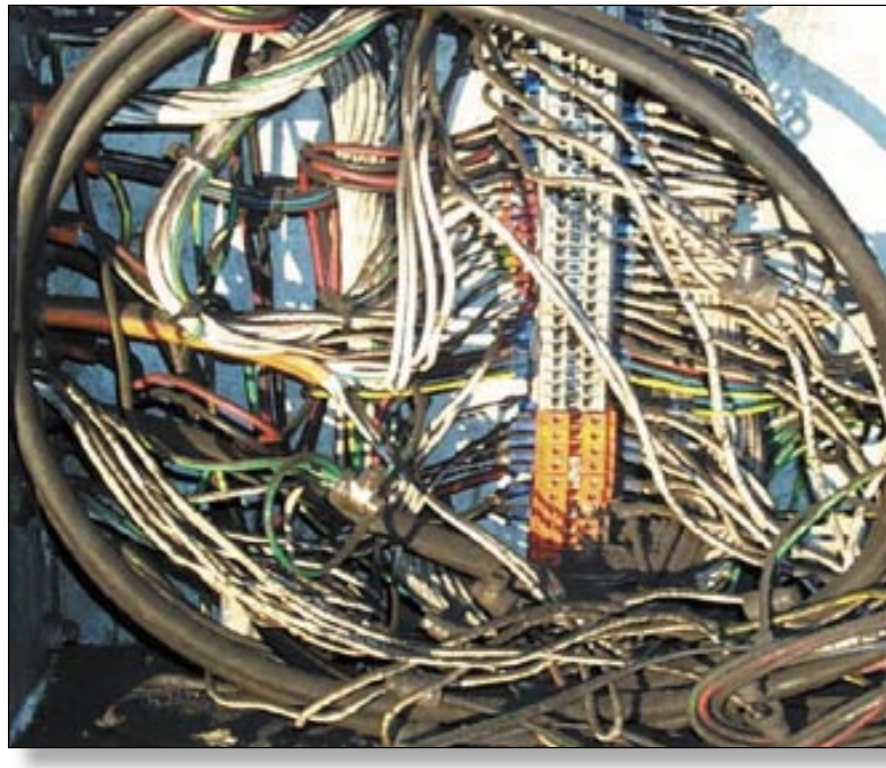
Electric Shock Incidents in the NSW Mining Industry 1999 - 2002

Introduction

In 2002 the New South Wales Mine Safety Advisory Council recommended the commissioning of an analysis of the underlying causes of electric shocks. The New South Wales Department of Mineral Resources (DMR) contracted the University of New South Wales (NSW), NSW Injury Risk Management Research Centre to conduct an in-depth analysis of the causes of all electric shock incidents recorded in the DMR's COMET database. The study commenced in 2002 and involved an analysis of 110 electric shock incidents. Most of the cases were reported as notifiable incidents and did not result in serious injury or lost time. Most occurred in surface locations, a small majority occurred at underground mines and around two-thirds related to the coal sector. The method of analysis and detailed results can be found in the full report[1].



Poor standards of installation and maintenance have contributed to the electrical injury risk

Following concerns about the number of electric shock incidents, in late 2001, the DMR independently analysed the electric shock incidents held in the COMET database. The DMR identified specific locations and types of equipment involved in the electric shock incidents, and the main causal factor. (The main causal factor was categorised as either; not fit for purpose equipment, procedural or competency - consistent with the four Nertney wheel components of work, namely, equipment, people, processes and working environment)[2].

It was found that in the vast majority of cases the electrical equipment was not "fit for purpose". This indicated that electrical equipment at mine sites was not being properly managed. To establish the reasons for this the DMR employed two electrical engineering mine safety officers to visit all coal mine sites and selected metalliferous mine sites to conduct an assessment of how mines were managing the risk of electric shock. This assessment was done to set criteria (the set criteria is included in the final report which was finalised in March 2003[3]). All information was entered into a database. Initial assessments were completed during August 2002 (follow up assessments were carried out at some sites demonstrating less than adequate standards).

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Results

The analyses by the NSW Injury Risk Management Research Centre and DMR were in very close agreement and are best described on page 2 of the report by the NSW Injury Risk Management Research Centre which states:

"The most common patterns of occurrence of the electric shock incidents involved the following:

* Almost all cases involved equipment factors mainly in the form of inadequate design or breakage.

* In almost all cases, the equipment failure was a pre-existing condition. Breakage of equipment just before the electric shock was very uncommon.

* The behaviour of mine workers played a minor role in these incidents. In most cases, the person inadvertently made contact with equipment which was already unsafe electrically. In this way, the person's role was an indication that a problem existed, rather than the person making a contribution to the problem occurring.

* Where an error occurred, it was mainly a rule-based error involving failure to isolate or check for dead. In all these cases, there was a pre-existing fault with the equipment which a check would have detected.

* Water was also a factor in a significant number of cases, especially in the metalliferous sector. Where water played a role, however, it always occurred in combination with pre-existing equipment design problems or breakage."

Page 2 of the report also identified: "...directions for prevention of electric shocks in mining. Most obviously, they show that almost all of the incidents could have been prevented by audits, reviews and maintenance of mining equipment. The results show strongly that an on-going safety review system would be the single, most effective intervention to prevent electric shock incidents. The results also point to the need to reinforce among mine employees and contractors the importance of fundamental electrical safety procedures including isolating and checking electrical equipment. This is important because it is good safety practice, and because, as the results of this study show, mine employees and contractors cannot be sure that the equipment they are using is safe."

Discussion of recommendations made

The recommendations on pages 3, 4 and 5 of the Electric Shock Prevention Project Final Report[4] support very strongly those of the NSW Injury Risk Management Research Centre and by their nature are very specific.

The NSW Injury Risk Management Research Centre identified that:

"an ongoing safety review system would be the single, most effective intervention to prevent electric shock incidents."

Water was also a factor

Welding practices need improvement

Neglected signs are ineffective

The DMR findings recommended:

1. Mines should implement engineering risk controls using a management system approach consistent with AS/NZS 4801.[5]

2. A comprehensive audit against AS/NZS 3000[6] and AS 3007[7] should be done on surface installations.

Particular attention should be paid to:

* earthing requirements;

* risk of electric shock due to direct and indirect contact;

* ensuring that tests detailed in AS/NZS 3000 Section 6 are carried out and records of such tests are retained at the mine for future reference;

* signs and notices.

3. Review of the means for isolation with regard to the risk to the operator while carrying out isolation.

4. Review of procedures for the maintenance of portable tools and leads. The procedures should adopt the manufacturer safety directions, AS/NZS 3760[8] and AS/NZS 3012 and make particular reference to requirements for wet areas.

5. Reassessment by mines of their maintenance strategy to ensure that it covers standards compliance and pays particular attention to:

* identification of direct contact risk;

* regular testing of earth continuity;

* regular insulation resistance testing; and

* a testing program to ensure that electrical protection systems are set correctly and functional.

Power tools and leads are not for wet areas

The NSW Injury Risk Management Research Centre identified that:

"The results also point to the need to reinforce among mine employees and contractors the importance of fundamental electrical safety procedures including isolating and checking electrical equipment."

The DMR report made specific recommendations in this area:

1. Isolation procedures should contain detailed steps for testing for zero energy.

2. Review procedures for the safe use of portable tools and leads. The procedures should adopt manufacturers' safety directions, AS/NZS 3760 and AS/NZS 3012[9] and make particular reference to requirements for wet areas.

3. Mines should review welding practices to ensure they comply with the requirements of AS 1674.2.[10]

The NSW Injury Risk Management Research Centre report stated:

"... the results of this study show, mine employees and contractors cannot be sure that the equipment they are using is safe."

Mining can have unique service conditions

Basic wiring standards forgotten

The DMR made the following recommendations that would increase the likelihood of electrical equipment being in a safe state.

1. Electricity should be recognised as a serious hazard.

2. Competency of electricity workers on site should be identified and should contain elements that relate to all aspects of electrical engineering safety and standards compliance.

3. Implement a structured training program aimed to refresh the skills of electricity workers in the area of AS/NZS 3000 and AS 3007 compliance.

4. People who do electrical work should be sufficiently trained so that they are capable of determining the suitability of the instrument for the circuit under test.

The DMR also made recommendations for mitigation, should an electric shock occur, that is:

"Mines should develop and implement a procedure detailing the steps necessary to ensure that all victims of electric shock are provided with transport for professional medical assessment that includes a 12 lead ECG."

Summary

The DMR identified that the number of incidents of electric shock were unacceptable. A structured program was developed based on the analysis of electric shock incidents. The structured program consisted of assessing every coal mine site in NSW and selected metalliferous sites to determine how the risk of electric shock was being managed. After this program was commenced the NSW Injury Risk Management Research Centre was engaged to conduct an in depth analysis of electric shock incidents. Both projects concluded in late 2002. The findings of the NSW Injury Risk Management Research Centre and the DMR were in agreement. The recommendations from the NSW Injury Risk Management Research Centre are supported in specific detail by the recommendations contained in the DMR's Electric Shock Prevention Project Final Report.

A copy of the DMR Electrical Shock Prevention Project Final Report can be downloaded from the DMR website: www.minerals.nsw.gov.au/safety/safety.htm

1 "Williamson, A., Usha, G., "Analysis of the causes of electrical shock incidents in mining in NSW", NSW Injury Risk Management Research Centre, University of New South Wales, November 2002.

2 Waudby, J.F., "Electrical Engineering Safety in NSW mines - A regulators perspective." NSW Mining Industry - Terrigal Conference 2002.

3 "Electric Shock Prevention Project Final Report", NSW Department of Mineral Resources, Mine Safety and Environment Division, March 2003.

4 "Electric Shock Prevention Project Final Report", NSW Department of Mineral Resources, Mine Safety and Environment Division, March 2003.

5 AS/NZS4801:2001, Occupational health and safety management systems - Specification with guidance for use.

6 AS/NZS3000:2000, Electrical installations (known as the Australian/New Zealand wiring rules.

7 AS3007:1987, Electrical installations - Surface mines and associated processing plant.

8 AS/NZS3760:2001, In-service safety inspection and testing of electrical equipment.

9 AS/NZS3012:1995, Electrical installations - Construction and demolition sites.

10 AS1674.2, Safety in welding and allied processes - Part 2-1990, Electrical.

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