Using Data to Identify Risk to Improve Safety and Health Performance

Paper

by

Rod Morrison
Assistant Director, Performance Improvement
Mine Safety
New South Wales Department of Mineral Resources

Ann Williamson
Director
NSW Injury Risk Management Research Centre
University of New South Wales

NSW Department of Mineral Resources
4th Floor
29-57 Christie Street
St Leonards NSW 2065
Email: morrisr@minerals.nsw.gov.au

NSW Injury Risk Management Research Centre
University of New South Wales
Sydney, NSW 2052
Email: a.williamson@unsw.edu.au

ABSTRACT

Using Data to Identify Risk to Improve Safety and Health Performance.

The New South Wales Department of Mineral Resources objective is to use data and information to undertake a detailed analysis of incidents and accidents to identify risks so that the predictable can be foreseen and avoided.

The Department of Mineral Resources has established a computerised data base called COMET (COmmon Mines EnvironmenT) to capture information on accidents incidents, inspections, audits and accreditation in improving safety and environment performance.

This data together with data from Coal Mines Insurance and WorkCover N.S.W is being used to provide trend and comparison information.

The NSW Injury Risk Management Research Centre at the University of NSW has been engaged by the Department to collate and prepare a detailed analysis of the data.

Through this process, five areas have been identified for further research. These being:-

- Electrical energy
- Mechanical equipment
- Work environment
- Hours of work
- Contractors involvement accident and incidents.

The paper covers:-

- The establishment of a mix of performance measures for the industry to indicate whether the safety performance is improving
- The provision of data to provide useful comparisons and benchmarks against which companies can compare performance
- The development of positive performance measures
- The findings and outcomes of the detailed analysis of electrical energy shocks.
- The provision of information to industry
- An outline how the data is being used to determine departmental operational priorities
- Future plans to undertake research into the other areas identified

INTRODUCTION

The development of performance measures in occupational and health and safety as a means of indicating whether the standard of performance is improving is not novel or innovative. The more recent debate has been about what are the most effective and relevant measures to show the true performance of occupational health and safety management.

The major review into Mine Safety in New South Wales conducted in 1997 by ACIL Economics and Policy Pty Ltd was extremely critical of the credibility of traditional measures such as Lost Time Injury Frequency Rate. It recommended that the appropriate measures should be a combination of those which measure the process in place to manage major risk and prevent serious injuries and death as well as measures safety outcomes. As a result, a recommendation was made to adopt a mix of measures that might include traditional measures as well as new measures such as disabling injury and the action taken to manage core risks together with a new set of measures to be defined to enable individual sites to determine their safety performance.

A great deal of progress has been made in this field with a wide suite of industry performance measures being adopted and steps being taken to adopt a consistent approach by the various jurisdictions across Australia through a National Mine Safety Framework.

Industry has been encouraged to adopt a range of positive performance measures to look at what proactive action is being taken to prevent accidents and incidents.

The development of a wider selection of performance measures and the adoption of positive performance measures has assisted in the understanding of occupational health and safety performance and has enabled trends to be identified and comparisons to be made. It has, however, been limited in undertaking a detailed analysis of the actual risks and causes of poor performance that arise out of accidents and incidents.

This is the task that the New South Wales Department of Mineral Resources (DMR) is endeavouring to undertake. The objective is to analyse incidents and accidents to identify the risks so that the predictable can be foreseen and avoided.

This paper traces through the establishment of a data base by DMR called COMET (Common Mines and EnvironmenT) which records mine accidents and incidents and looks at how reports from the database provide trend and comparison information which has been used to identify areas for more detailed research.

One of the areas of risk identified has been electrical energy. The first in-depth analysis of 110 electrical shock incidents has been undertaken and the methodology and the results are presented.

DMR DATA BASE

The Data Base COMET (COmmon Mines EnvironmenT) collects data/information on mines, events such as accidents and incidents, inspection audits, accreditations and environmental issues. The system commenced collecting data in April 1999.

The COMET information system captures and manages data to support:

- business objectives and strategy by providing data and information to improve health and safety performance in the NSW mining industry;
- corporate and business reporting requirements.

Industry reporting requirements are underpinned by the administration of the relevant mining legislation.

Events are the core component of COMET and reflect the essential business processes of the Division. They are the important link between mines and participants.

Events capture core data on event type, event subtype, date/time, organisation, event status, event priority and event participants. Documents (Excel & Word) can be attached to each event.

Data entered from incident and accident events includes location of the event, type of event (this relates the event to the relevant clause of the legislation), whether injuries occurred, property was damaged, equipment was involved, whether the mine manager's report was adequate, whether a more detailed report is required, whether a full investigation is required, circumstances surrounding the incident, apparent causes of the incident, actions taken and potential breaches.

The capacity of the COMET information system to capture the data detailed above, enables trend analysis and causal factors of incidents and accidents, to be identified, so that safety strategies can be developed, implemented and communicated to the mining industry, to influence systems, work practices, behaviour and culture.

A screen shot of one example of the COMET information system is highlighted in Figure 1.

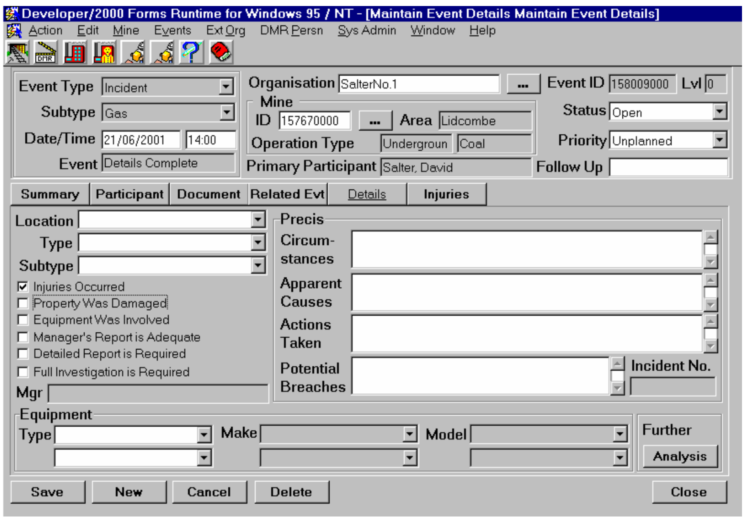


Figure 1 Example of a COMET Screen Shot

COMET is also used to help set priorities so that DMR can identify where its resources can be best focused to improve safety and environmental performance.

INDUSTRY PERFORMANCE MEASURES

From the Mine Safety Review referred to earlier, a comprehensive set of performance measures have been introduced.

These cover such traditional measures as:-

- fatality rates
- lost time injury rates
- serious injury
- severity and duration rates
- reportable occurrences
- workers compensation information as to claims and cost
- enforcement action directions and notices
- prosecutions

Some newer measures that are being used cover:-

- near miss
- permanent disability
- medical treatment
- total recordable injuries
- assessment of culture usually by survey.

LEAD OR POSITIVE PERFORMANCE MEASURES

Traditional outcome-based OHS performance measures have been criticised as being retrospective and backward looking. They do not provide any indication of how risks are being measured and what steps are being taken to address risk. On this basis, a deliberate move has been made to include a mix of lead or positive performance measures. These measures are used to gain an understanding of the actions being taken which are likely to reduce the risk of accidents and incidents.

The Minerals Council of Australia in their Practical guide to Positive Performance Measures (PPM) 1998 defined PPM as a measure of a proactive leading activity necessary to control loss and damage. It is an upstream process measure rather than a downstream outcome measure. Some of the positive performance measures put forward for site use by the Minerals Council of Australia include:-

Table 1: Positive Performance Measures

INTENT or TARGET	DEPLOYMENT – PPM
All operational hazards identified and managed	% risk assessment completed % control measures implemented
Standard work practices in place for critical activities	% ISA/SWPs completed for critical activities
Employees working safely	% safe behaviour observed, eg: PPE compliance

Provide safe & healthy place of work	% schedule inspections completed % actions arising complete
Safe and competent employees	Scheduled training completed. % incidents with training identified as major contributor
Implement lessons from hazard/incident reports	% incident investigation completed on time. % corrective actions implemented
Improve safety climate	Overall findings on criteria
Involve employees in regular tool box meetings (TBM)	% scheduled held % employees attending % actions arising completed

In addition to these measures the Department of Mineral Resources is looking at a range of positive performance in terms of measuring –

- the completeness of Mine Safety Management Plans
- an assessment by use of a test of the consultative process at the mine site.
- assessment of induction programmes
- review and follow up of findings of assessments and audits.

It is expected that feedback to industry on these measures will provide encouragement to understand and pursue these activities which will make a contribution to risk management and result in positive safety performance outcomes.

NATIONAL MINE SAFETY FRAMEWORK

One of the goals arising from the establishment of a National Mine Safety Framework is to develop consistent and reliable mining OHS performance data collection analysis and distribution.

The objective is to obtain consistency across the jurisdictions which will enable:

- comparison of data and performance
- identification of trends
- the effective and efficient targetting of resources
- development of proactive coordinated approaches to industry issues.

New South Wales is fully committed to participating in this process to share and exchange data and information.

PERFORMANCE REPORTS

Initially the COMET and Workers Compensation data was used to provide reports on trends and comparisons. However these reports were very limited in their capacity to provide the reasons for movements.

The data largely identified potential problems and improvements without a great deal of understanding as to the forces at work. The assessment of these changes was largely based on the experience of those working in the industry. It could be said that the data raised more questions than they answered.

These reports were provided to the Mine Safety Advisory Council being the principal advisory body to the Minister for Mineral Resources and while the content of the reports improved they were not providing the quality or content desired.

To provide more meaningful information, the NSW Injury Risk Management Research Centre (NSW IRMRC) was engaged by DMR to provide an analysis of safety performance data. The Centre brought a level of expertise and independence which added identifiable improved value to the reporting. They commenced the first analysis of information in June 2001 using data collected from COMET since April 1999.

The analysis undertaken by the NSW IRMC covered both trends in a number of specific indicators and an indepth examination of relationship between events in each sector.

The analysis considered trends in the number of events and persons recorded in the COMET data base and looked at trends in injury and non injury for the Coal and Non-Coal sector as to the types of events, mine operator region, types of injury, characteristics of persons injured, the agent, mechanism nature of injury and part of body injured.

The analysis was undertaken of the following range of performance measures for the coal and metalliferous sectors and mine operation types:

- Lost time injury frequency – numbers, rates and trends
- Severity level – numbers, rates and trends
- Body part injured
- Nature of injury
- Mechanism of injury
- Agent of injury
- Types of incidents and events
- Characteristics of persons injured including occupation, employment type, age
- Relationships between type of injury, event subtype and mine operation
- Relationships between type of incident, event subtype and incident subtype
- Enforcement notices including the number and the relationships between the application of the DMR's enforcement mechanisms and changes in mine safety performance indicators.
- Where possible benchmarking information will be provided which will allow comparisons with other states in the mining sector and with other industries.

A further analysis has looked at frequency and incidence rates, compensation claims and distribution of incident and mine type. The area which was of particular importance as to possible links to causation related to the characteristics of injuries, reviewing the data from 1 July 99 to June 2002. Changes over the period showed:-

- Fractures have increasingly been the most common type of injury, followed by other and unspecified injuries which also increased over the period, whereas the percentage of acute sprains and strains of joints and muscles, showed a clear decrease over the three year period.

- The percentage of cases with injuries to the hip, back, spine or pelvis decreased markedly with more injuries reported as general/unspecified. As the percentage not recorded also increased over the time, these changes may be due to coding problems.

- Analysis of the mechanism of injury showed an increase in the percentage of reports of contact with electricity and a slight decrease in the reporting of being hit by moving objects and multiple/unspecified mechanisms (see Figure 2).

- General machinery and fixed plant, mobile plant and underground work environment have been the most common agency of injury over the three years, with the percentage of cases involving general machinery and fixed plant increasing and the percentage of mobile plant decreasing over the period.

- The main types of events over all years have involved electrical energy, work environment, mechanical mobile equipment and strata control (see Figure 3). Most notably, the percentage of electrical energy events has trebled and the percentage of strata control events has doubled over the three years. On the other hand, percentages of work environment and mobile mechanical equipment have decreased.

- Analysis of the types of persons involved in events reported to COMET shows an increasing percentage of 20 to 29 year olds but little change in the distribution of occupations or contractors over the period. Contractors made up a significant minority of around 20% of injury cases for both sectors and all mine types (see Figures 4 and 5).

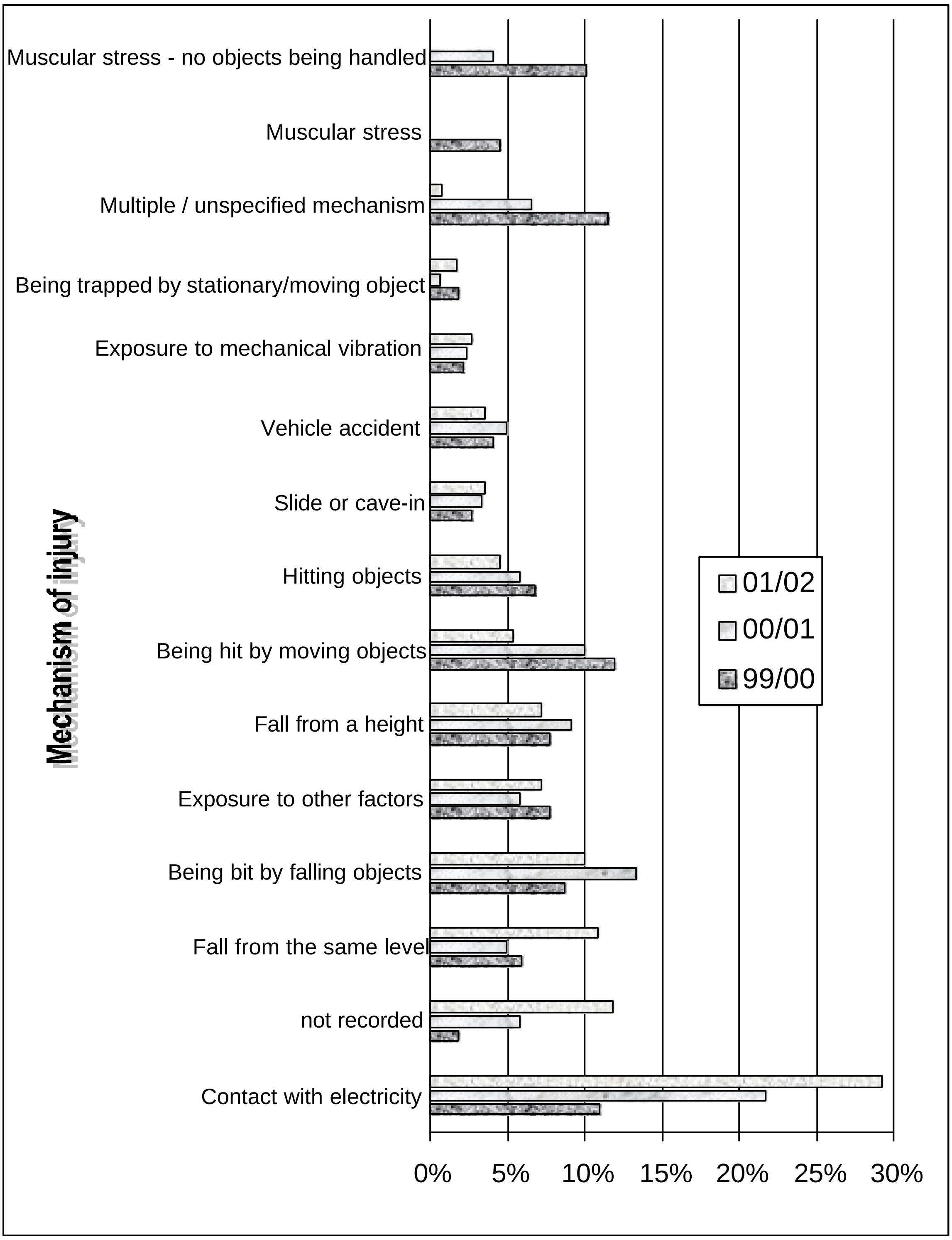


Figure 2 Trends in mechanisms of injury

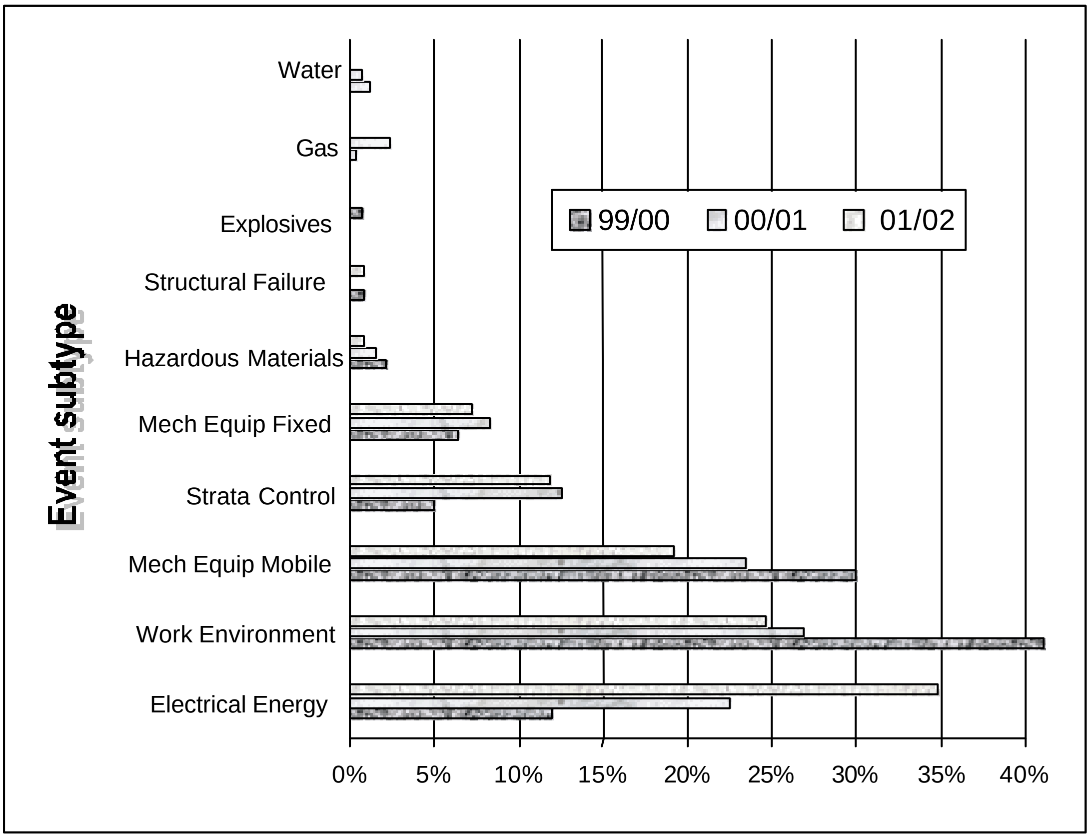


Figure 3 Event Subtype

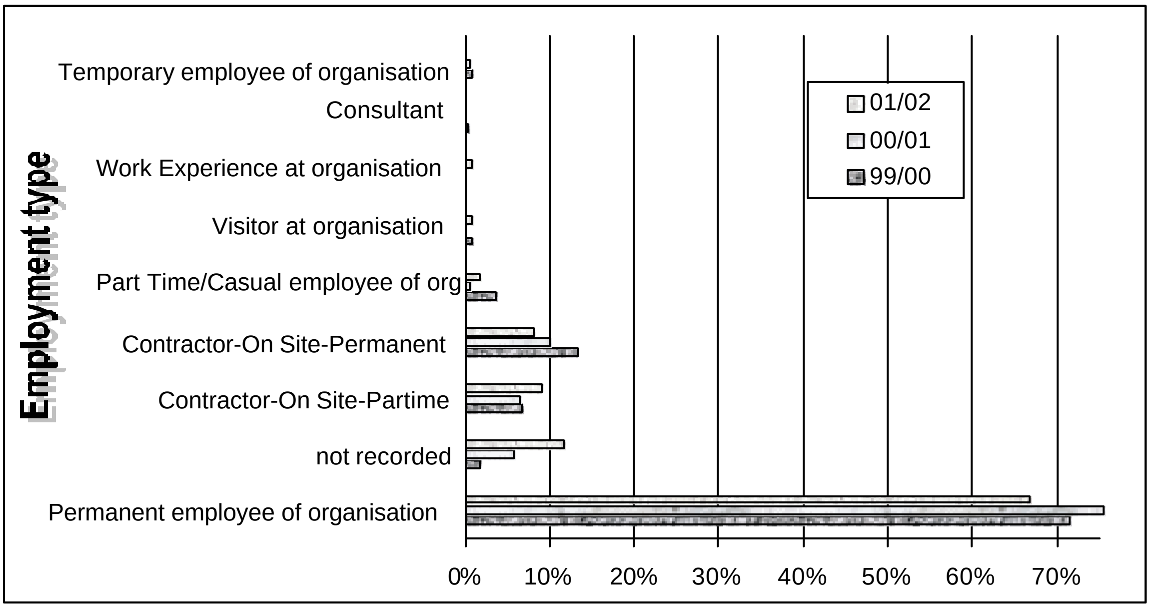


Figure 4 Trends in type of employment

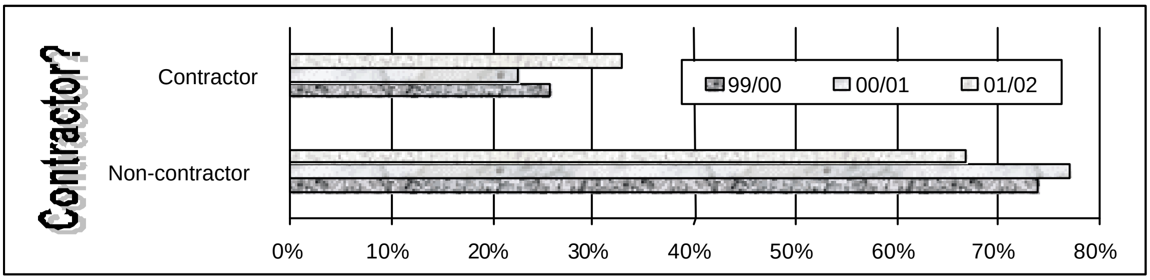


Figure 5 Trends in numbers of contractors injured

DETAILED ANALYSIS OF EVENTS/INCIDENTS

The analysis of the COMET database provided background information that helped to identify the most important high risk areas for further in-depth examination.

In addition, the Mine Safety Council then established a Performance Measures Task Group to review the available information on trends in mine safety performance and to identify areas for further analysis and research.

Based on the analysis of the mechanism of injury event and trend data the Task Group identified a number of areas for further in-depth analysis and research. These were:-

- electrical energy incidents
- mechanical equipment incidents
- work environment incidents
- accidents/incidents involving contractors
- the issue of hours worked

No data was available to identify hours of work as an issue but anecdotal evidence and the experience input from the tripartite safety advisory committees for the various mining sectors supported the five areas nominated and these were endorsed by the Mine Safety Advisory Council.

Electric Shocks Analysis

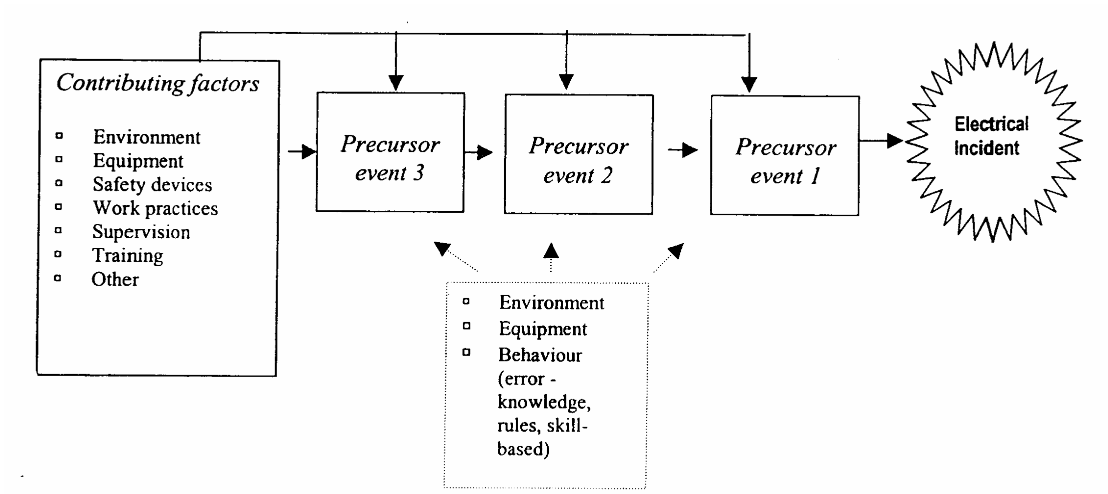
Identification of cases

For this analysis 122 cases involving electrical energy-related outcomes were located in the Department of Mineral Resources database. Most of these cases were in the database because they were Notifiable incidents under the Coal Mines Regulation Act (39.7%), Dangerous Incidents under the Mines Inspection Act (16.5%) Incidents (14.0%) or High Potential Incidents (12.4%). About half of the cases involved a degree of electric shock (55.74%), but only a few resulted in serious injury or lost time(3.2%). Most cases occurred at underground mines (51.6%), with the remainder occurring at open cut mines (33.6%) or at processing plants (13.9%). Most of the cases occurred in coal (62.3%) compared to minerals mining (35.9%).

Coding of cases

For each case in the sample of 122 cases the information available in the COMET database as well as Electrical Inspectors reports were coded and classified using a framework previously used to classify and code occupational fatalities (Williamson and Feyer, 1990; Feyer and Williamson, 1991; Williamson, Feyer and Cairns, 1996; Williamson and Feyer, 1998). This is illustrated in Figure 6 Classification framework for electrical incidents. In collaboration with a group of experts (DMR Electrical Inspectors), some modifications were made to the framework to make it more suitable for coding the information available on electrical energy events. Only 12 cases were unable to be coded as too little information was available on the causes. The reliability of coding was checked using a second coder for a sample of cases. The coding was found to be reliable, with 86.9% cases being coded in the same overall manner by both coders.

Figure 6 Classification framework for electrical incidents



Results of classification and coding

Contributing Factors:

Contributing factors are defined as factors that made a contribution to the incident occurring but were pre-existing, sometimes for very long periods, in the time before the incident occurred. Table 1 lists the Contributing factors which played a role in the circumstances of the electrical incidents for the subsample from the COMET database.

Ninety percent of cases involved equipment factors in some form. Approaching half of the cases involved equipment alone, mainly due to design features (eg: problems relating to equipment not being fit for purpose) or other aspects of poor design. Design or breakage of equipment were the main problems overall, both as single factors alone and in combination with other factors. In fact poor or inadequate design was a problem in more than half of cases (55.1 %) and equipment breakage was a problem in 46.2% of cases. The most common single patterns of contributing factors were equipment design which accounted for 14.5% of cases, followed by the combination of equipment design and breakage (11.8% of cases).

Equipment problems due to poor installation were less common, and occurred in only 13.6% cases and mostly in combination with other factors especially work practice factors, in particular unsafe or inadequate standard operating procedures. Poor installation of equipment was the sole factor in only three cases.

Work practices were a contributing factor in around one-third of cases overall (31.8%) and were mainly due to unsafe standard operating procedures (23.4%) and, to a lesser extent, problems with housekeeping (9.0%). Work practice problems hardly ever occurred as a sole factor (only 5.5% cases) and mainly involved continuing use of a piece of equipment that was poorly designed or broken, or not doing the housekeeping or maintenance to fix the equipment.

Environmental factors were also important contributing factors and in all of these cases this was due to the presence of water. Notably though, environmental factors only really played a role in combination with equipment factors and not work practice factors. Only two cases involved a combination of a wet environmental and inadequate or unsafe work practices.

Overall, therefore, the main types of Contributing Factors were due to equipment problems, with design factors and equipment breakage being the biggest single factors. Very few cases involved problems due to installation alone, although it was important in a significant proportion of cases in combination with other factors especially unsafe or inadequate work practices. Wet mine environments contributed to the incident almost always in combination with equipment design problems or breakage.

Table 2: Types of Contributing Factors involved in 110 cases resulting in exposure to electrical energy in mining

Type of Contributing Factors	*n*	*%*
Equipment factors only	**45**	**40.9**
Design only	16	14.5
Installation only	3	2.7
Breakage only	10	9.1
Design and breakage	13	11.8
Design and installation	1	0.9
Design, installation and breakage	2	1.8
Equipment and Environment factors	**19**	**17.3**
Design and Environ (water)	7	6.3
Breakage and Environ (water)	6	5.5
Design, Breakage and Environ (water)	4	3.6
Installation, breakage and Environ (water)	2	1.8
Equipment and Work practice factors	**27**	**24.5**
Design and standard operating procedures	6	5.4
Design and housekeeping	1	0.9
Design and supervision/coordination	1	0.9
Installation and standard operating procedures	4	3.6
Installation and housekeeping	1	0.9
Breakage and stand operating procedures	3	2.7
Breakage and housekeeping	4	3.6
Design, breakage and stand operating procedures	3	2.7
Design, breakage and housekeeping	2	1.8
Design, installation and supervision/coordination	2	1.8
Environmental factors only (water)	**1**	**0.9**
Environment and Work practice factors	**2**	**1.8**
Work practice factors only	**6**	**5.5**
Housekeeping	1	0.9
Standard operating procedures	5	4.5
Equipment, work practice and Environment factors	**6**	**5.5**
Design, standard procedures, water	3	2.7
Design, housekeeping, water	1	0.9
Breakage, standard procedures, water	2	1.8
No contributing factors	**4**	**3.6**
Total	**110**	**100**

Precursor Events

Precursor Events are defined as the events leading most immediately to the incident's occurrence. They are linked with the incident in time, but they are distinguished by a much shorter time frame than for Contributing Factors.

The pattern of involvement of precursor events is shown in Table 2. Most cases involved an environmental event relating to the mine environment or location of the person at that point in time and relatively few resulted from a person's behaviour. Equipment breakage just before the incident was very rare. Specifically the results showed that:

- In most cases the most direct cause of the incident was due to a person coming into a situation where they could be exposed to electrical energy (90.7%) and in three-quarters of incidents there were no other immediate causes.
- A significant number of cases involved water getting into the person's location Just before the incident (13.7%).
- In the majority of cases behavioural failures were not involved at all (80% although for most cases the event sequence occurred when the person's behaviour placed them into the location where they made contact with electrical energy. In these cases, however, the behaviour was not an error.
- In a relatively small number of incidents the person made an error and this led to them making contact with electrical energy (19.1%). In most cases the error involved the person failing to apply a known rule, usually not isolating the equipment they were working on at the time and consequently making the situation safe.
- Very few incidents involved equipment breaking just before the incident (4.5 %).

Table 3: Types of precursor event involved in 110 cases resulting in exposure to electrical energy in mining.

Type of Precursor Event	n	%
Behaviour only	**7**	**6.4**
Skill-based error	2	1.8
Rule-based error	4	3.6
Violation	1	0.9
Environment only	**84**	**76.4**
Environment voltage	69	62.7
Environment water	8	7.3
Environment water→ Environment voltage	7	6.4
Environment and Equipment	**4**	**3.6**
Breakage → Environment	4	3.6
Environment and Behaviour	**14**	**12.7**
Skill-based error → Environment	3	2.7
Rule-based → Environment	9	8.2
Knowledge-base → Environment	1	0.9
Violation → Environment	1	0.9
Behaviour and Equipment	**1**	**0.9**
Breakage → Rule-based	1	0.9
Total	**110**	**100.0**

Patterns of occurrence of Contributing factors and Precursor Events

Table 3 shows a summary of the relationships between Contributing Factors and Precursor Events.

By far, the most common pattern involved pre-existing problems with equipment leading to a person inadvertently being exposed to electrical energy. Specifically the findings showed that:

- Unsafe work practices, including poor housekeeping played a much smaller role overall than equipment problems.
- Where work practice problems occurred they contributed to incidents that involved both a person's behaviour and characteristics of the environment at the time of the incident.
- Very few incidents occurred due to a person's behaviour just before the incident, although behaviour was important, as unlike the other types of events or factors, behaviour could be the sole cause of electrical incidents.
- Equipment and environmental events and factors were never the sole cause of the incident.
- Where an event was due to a person's behaviour. it mainly involved an error due to not applying a known rule (such as failing to isolate equipment before beginning work), and mainly in combination with pre-existing problems of equipment design and or breakage at an earlier time.

Differences between different types of mine operations

Electrical incidents occurred for similar reasons across all types of mines. Equipment factors both alone and in combination with other factors were the most common contributing factor and work practices were far less common in all types of mining operations. For all mine types the location of the person at the time making them come into contact with a source of electricity was the most common type of event leading directly to the electrical incident. The major differences were:

- For the non-coal sector, the second most common event involved the person's work environment being wet.
- For the coal sector, the second most common type of event leading to the electrical incident was due to a person's behaviour in the form of a failure to apply a known rule.

Table 4 Pattern of Contributing Factors and Precursor events showing the number of occurrences of each type of factors for each type of Precursor event.

Contributing factors	Precursor event
Equipment factors (45.1%) Design (19.8%) Installation (5.0%) Breakage (20.3%) **Environmental (water) (9.4%)** **Work practice (11.9%)** Housekeeping (4.5%) Standard operating Supervision/Coordination (0.9%)	**Environment (voltage)**
Equipment (4.5%) Design (2.5%) Breakage (0.9%) Standard operating procedures (0.9%)	**Environment (water)**
Equipment (5.4%) Design (2.0%) Breakage (2.0%) **Work practice (0.9%)** Housekeeping(0.9%)	**Environ (water)** **Environment (voltage)**
Equipment (3.0%) Design (2.0%) Installation (0.9%) **Work practice (0.5%)** Housekeeping (0.5%) **Environment (water)** (0.5%)	**Equipment (breakage)** **Environment (voltage)**
Equipment (3.5%) Design (2.5%) Breakage (0.9%) **Work practice (0.9%)** Standard operating procedures (0.9%) **Environmental (water) (0.5%)** **No contributing factors** (1.5%)	**Behaviour only**
Equipment (5.9%) Design (3.0%) Installation (0.5%) Breakage (2.5%) **Environmental (water)** (2.5%) **Work practice (3.0%)** Housekeeping (0.5%) Standard practices (2.5%)	**Behaviour** **Environment (voltage)**
Equipment design (0.5%)	**Behaviour** **Environment (water)**

SUMMARY OF ELECTRIC SHOCKS STUDY

This study involved an in-depth analysis of 110 electric shock incidents reported to the NSW Department of Mineral Resources COMET database. Most of the cases were reported as Notifiable incidents and did not result in serious injury or lost time. Most occurred at underground mines and around two-thirds came from the coal sector. All cases were coded using a classification and coding system developed to look at the causes of occupational fatalities. Evaluation of the reliability of the coding showed good reliability.

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 indicator 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 minority of cases, especially in the non-coal sector. Where water played a role, however, it always occurred in combination with equipment design problems or breakage.

These patterns highlighted 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 both because it is good safety practice, but also because, as the results of this study show, mine employees and contractors cannot be sure that the equipment they are using is safe.

Overall, this project has shown the value of in-depth analysis for identifying the causes of safety-related incidents and the strategies most likely to be successful in preventing them.

IMPLEMENTATION

To maximise the learning from the analysis and benefits flowing from the findings, from the electric shocks analysis, a meeting was held between the Electrical Inspectors, Senior DMR staff and the Director NSW IRMCC to develop a detailed implementation plan.

In summary the plan covers –

- A communications strategy was developed to communicate the recommendations of the electrical shock report to target industry groups including Electrical Consultants/Contractors, Local Supply Authorities, NECA, Regional Seminars, Workcover, Dept. Fair Trading, HEISN (Hunter Industrial Electrical Safety Network), NECA (National Electrical Communications Association), seminars, conferences and district check inspectors. A safety alert will also be issued.
- There will be a review of the data capture and recording processes to be more closely aligned with precursor events and contributing factors.
- Impact upon legislation to be considered as far as applying a “Industry Code of Practice”.
- Monitoring of the implementation of the recommendations from the electrical shock report by safety operations.
- The development of a “Factsheet” to highlight the learnings and recommendations of the report.

The implementation plan was endorsed by the Performance Measures Task Group and agreed to by the Mine Safety Advisory Council.

At the time of writing the plan is being implemented and the second project covering mechanical equipment is about to start.

CONCLUSION

A considerable effort has been directed to the development of a comprehensive set of performance measure to enable trends and comparisons to be made both within the industry and outside.

This information has enabled areas to be identified where further detailed research needs to be conducted with the objective of establishing what is known about risk factors in mining, or what can be predicted and then developing approaches for avoiding them or preventing them from occurring.

DMR has used the analysis of trend data to identify major areas of concern and has had conducted an indepth analysis as to factors leading to causation.

The learnings from the first analysis are being fed back to industry in a practical way to ensure that the industry is informed as to the appropriate action to be taken to address the findings.

The approach of the Department is that unless the data/information produced is used to change systems, procedures, equipment or behaviour, one has to question the benefit of the data.

The outcome of this methodology does raise the question as to whether specific performance measures should not exist in relation to specific hazards with high priority such as electrical energy.

The results of the analysis into the other areas identified namely, mechanical equipment, physical work environment, contractors involvement in accidents and incidents and hours of work are awaited with high expectations of providing valuable information to the industry to help manage risks.

References

Feyer, A-M. and Williamson, A.M. 1991. A classification system of the causes of occupational accidents for use in preventive strategies. Scandinavian Journal of Work Environment and Health, 17, 302-311.

Johnstone, S, 1997. Review of Mine Safety in New South Wales, Available from the Department of Mineral Resources, 29-57 Christie Street, St Leonards, NSW 2065.

Minerals Council of Australia 1998. Positive Performance Measures - A Practical Guide 1998, Available from the Minerals Council of Australia, 216 Northbourne Avenue, Braddon ACT 2602.

Williamson, A.M. and Feyer, A-M. 1990. Behavioural epidemiology as a tool for accident research. Journal of Occupational Accidents, 12, 207-222.

Williamson, A.M. Feyer, A-M. and Cairns, D. 1996. Industry differences in accident causation. Safety Science, 24 (1), 1-12.

Williamson, A.M. and Feyer, A-M., 1998. The causes of electrical fatalities at work. Journal of Safety Research, 29, 1-10.

Williamson, A and Garg, U, 2002. Analysis of COMET data from 1 July 1999 to June 2002, Available from the Department of Mineral Resources, 29-57 Christie Street, St Leonards, NSW 2065.

Williamson, A and Garg U, 2002. Analysis of the Causes of electrical shocks in Mining in NSW, Available from the Department of Mineral Resources, 29-57 Christie Street, St Leonards, NSW 2065.