Improving safety performance in the Australian mining industry through enhanced reporting

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August 2008

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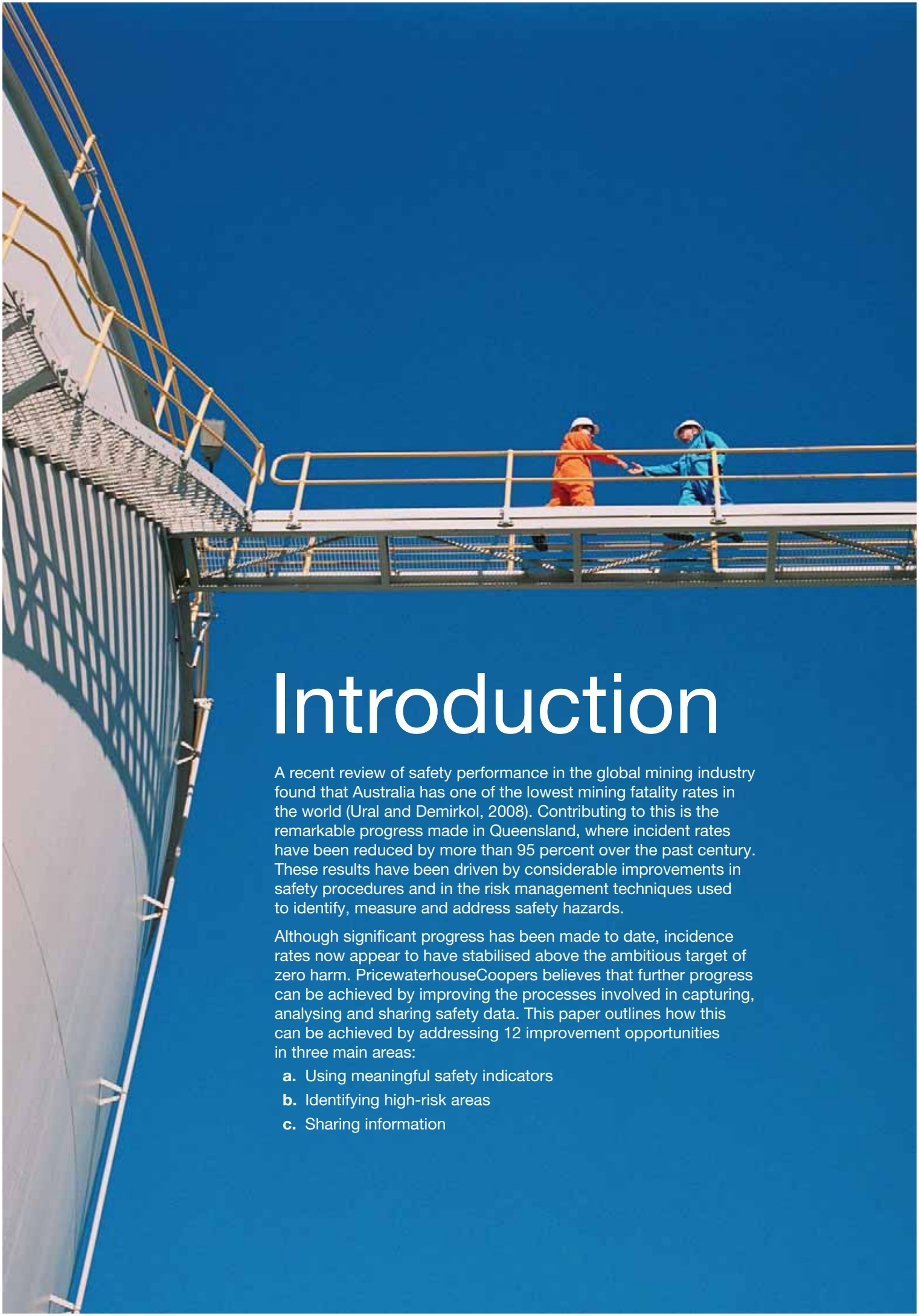


Introduction

A recent review of safety performance in the global mining industry found that Australia has one of the lowest mining fatality rates in the world (Ural and Demirkol, 2008). Contributing to this is the remarkable progress made in Queensland, where incident rates have been reduced by more than 95 percent over the past century. These results have been driven by considerable improvements in safety procedures and in the risk management techniques used to identify, measure and address safety hazards.

Although significant progress has been made to date, incidence rates now appear to have stabilised above the ambitious target of zero harm. PricewaterhouseCoopers believes that further progress can be achieved by improving the processes involved in capturing, analysing and sharing safety data. This paper outlines how this can be achieved by addressing 12 improvement opportunities in three main areas:

a. Using meaningful safety indicators

b. Identifying high-risk areas

c. Sharing information

A. Using meaningful safety indicators

Having a strong safety record can yield significant benefits

Recent years have brought a sharp increase in focus on safety performance in the mining industry worldwide, as demonstrated by the emergence of comprehensive global safety programs such as “Zero Harm” by BHP Billiton and “Target Zero” by Anglo. By introducing these programs, mining companies are acknowledging that improving safety performance is not just the right thing to do; it can also drive financial benefits. By way of example, companies with strong safety records may increase their access to external capital, as investors frequently consider past safety performance when making resource-allocation decisions. Top performers can also benefit from reduced costs in such areas as litigation, insurance, accident damages and production delays. While these costs can be considerable, the long-term financial implications of a tarnished reputation are often more severe, in terms of lost sales and reduced share prices. These impacts may be even more pronounced for mining contractors, as safety records are closely investigated before contracts are awarded. This effectively makes exceptional safety management a prerequisite for tendering.

Traditional safety indicators are of limited value in comparing performance across organisations

Mining companies have traditionally used safety indicators to identify internal trends and to compare performance across business units. The resulting reports have then been used to allocate safety resources to where they are most needed. The three most frequently reported lag indicators have been lost time injury frequency rates (LTIFR), fatal injury frequency rates (FIFR) and disabling injury severity rates (DISR). In recent years however, the increasing need to compare performance between organisations has seen these measures fall out of favour, as they suffer from two significant limitations:

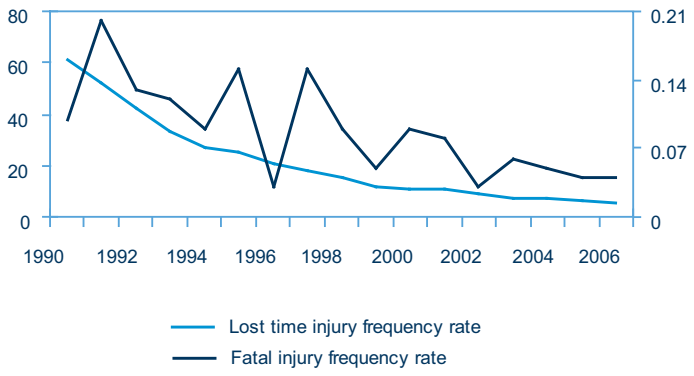
1. They are highly sensitive to differences in definitions and injury management processes
2. They focus entirely on past performance

The first limitation is universally recognised by safety managers, with most believing that traditional indicators are of little value when comparing performance between organisations, due to differences in processes, definitions and applications. For example, some organisations choose to exclude incidents from LTIFR metrics if the injured party returns to work the next day, regardless of whether normal duties are resumed. A portion of the improvement in industry LTIFR over the last decade may therefore be due to smarter management of injured people rather than better management of risks.

The second limitation is also recognised by most organisations, with three-quarters of surveyed safety managers believing that LTIFR is not an accurate representation of current or future risk profiles. This perception is supported by the fact that many sites with major incidents have historically performed very well in terms of traditional safety indicators. For example, historical LTIFR for the refinery in Texas City that suffered an explosion resulting in over 15 fatalities in 2005, was two-thirds lower than industry averages (CSB, 2007).

Exclusively focusing on the LTIFR indicator also excludes fatal incidents from consideration. While the popular iceberg hypothesis in safety management states that there is a clear relationship between non-fatal and fatal occupational incidents (Staley and Foster, 1996), this hypothesis is often rejected by safety managers who believe that non-fatal and fatal incidents follow different distributions and hence require separate reporting and indicators (figure 1).

Figure 1: There has been no strong correlation between non-fatal and fatal incidents in the Queensland mining industry in recent years



A final concern raised by many safety managers is the timeliness of industry reports. Since these reports are published up to 18 months after the relevant reporting period, the figures are often considered out of date before the report is even published.

Five improvement opportunities have been identified in relation to safety indicators

The following five opportunities have been developed to address the identified limitations:

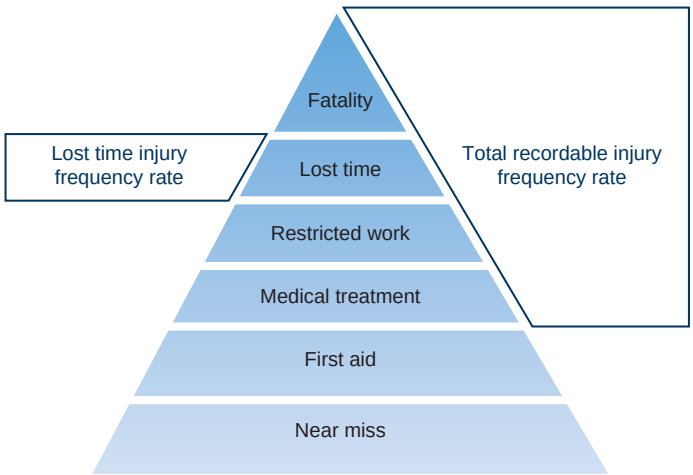
1. Increase indicator spans
2. Improve consistency of definitions
3. Include lead indicators in scorecard reporting
4. Align performance incentives with safety objectives
5. Produce more timely reports

Addressing these opportunities, detailed over the next five sections, will make safety indicators more valuable in comparing performance between organisations.

Opportunity 1: Increase indicator spans

In response to increasing criticism of narrow safety indicators, most mining organisations are introducing broader indicators into their internal reporting frameworks. Examples of such indicators include total recordable injury frequency rates (TRIFR), all injury frequency rates (AIFR) and classified injury frequency rates (CIFR). These indicators include all injuries where the affected party did not return to their normal duties for the next shift, thereby reducing the ability of users to influence statistics through injury management. These indicators also include fatalities (figure 2), but unfortunately fail to distinguish appropriately between such grave incidents and minor medical treatments.

Figure 2: Differences in coverage between two frequently used lag indicators (BHP, 2005)



On balance, broader indicators offer clear advantages over traditional lag indicators and many mining organisations have started using them in internal reports. As a result, the Queensland Resources Council believes TRIFR should become the standard for industry reporting. This would allow many organisations to align internal and external reporting practices, as recommended by the Institution of Occupational Safety and Health in Europe (IOSH, 2002).

Opportunity 2: Improve consistency of definitions

There is limited value in comparing safety indicators between organisations unless the underlying data has been collected using consistent definitions. For instance, while many organisations currently choose to include contractor information in external safety reports, others choose to exclude it. This decision impacts considerably on individual company statistics, as contractors are often responsible for more than 50 percent of the workforce of modern mining organisations. Until there is absolute agreement around the relevant definitions and inclusions, potentially valuable discussions around safety performance will frequently be reduced to debates around terminology. This is one reason why the Global Reporting Initiative (GRI) recommends that organisations use external agencies to verify internally generated data before it is released to the market.

Opportunity 3: Include lead indicators in scorecard reporting

As safety reporting processes become more mature, focus is gradually shifting towards lead indicators of performance. Lead indicators are forward-looking and are designed to help organisations introduce preventative measures before harm occurs. These indicators often relate to hazard reporting, audit results, risk assessment completion rates and use of personal protective equipment.

Recognising the benefits of using lead indicators, pioneering companies are now including them in balanced safety scorecards. At Newcrest Mining, lead indicators determine up to 75 percent of total business unit safety scores. Since these measures describe activities that can be directly influenced by employees, they are also suitable for inclusion in performance incentive programs at all levels.

Increasingly, researchers are also recommending that a third element, process indicators, be included in balanced safety scorecards (Hopkins, 2007). Examples of such indicators include the number of uncontrolled releases of hazardous substances and the number of processes operating outside of safety margins. These measures differ from behavioural safety indicators and have proven effective at reducing the occurrence of low-probability high-impact events. As such, process measures should be considered valuable contributions to any well-balanced safety scorecard.

Opportunity 4: Align performance incentives with safety objectives

Safety performance typically accounts for between 5 and 15 percent of total remuneration in most mining organisations. This provides employees with strong incentives to improve the relevant safety statistics. Consequently, it is important to ensure that these statistics are closely aligned with safety objectives.

In recent years, this has been achieved by focusing on lead indicators. This is important because focusing excessively on lag indicators can skew attention towards activities that impact only on short-term metrics. Rio Tinto Bauxite and Alumina is currently achieving this by splitting its employee safety scorecards into three distinct components. They are:

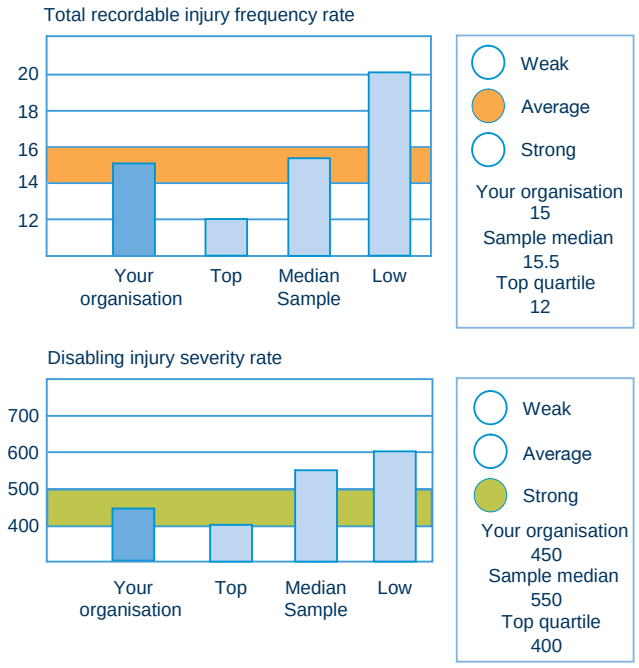
1. All incidents frequency rate
2. Positive performance activities
3. High-potential incidents

Mining organisations are also advised to complement employee performance metrics with qualitative assessments. Under these arrangements, supervisors can make use of scales when evaluating adherence to safety procedures, such as: (1) meets few, (2) meets most, (3) meets all, (4) exceeds most and (5) exceeds all requirements. This will help mitigate the impact of potential inaccuracies in the reported data.

Opportunity 5: Produce more timely reports

It can currently take up to 18 months before industry indicator reports reach corporate users. As a result, the figures in these reports are often considered out of date before they are even received. To address this concern, industry working groups should consider introducing a centralised, electronic repository for safety indicators, where companies can upload data and receive timely reports comparing their indicators to industry averages. In their recent review for the Queensland Resources Council, Parker and Cliff (2007) concluded that the Queensland Department of Mines and Energy should introduce an electronic database for purposes similar to this.

Figure 3: Potential outputs from the proposed reporting system



Following the introduction of such a system, the next step should involve integrating it with corporate reporting dashboards. This will allow organisations to evaluate their performance in near real-time and allow them to take action in a timely manner.

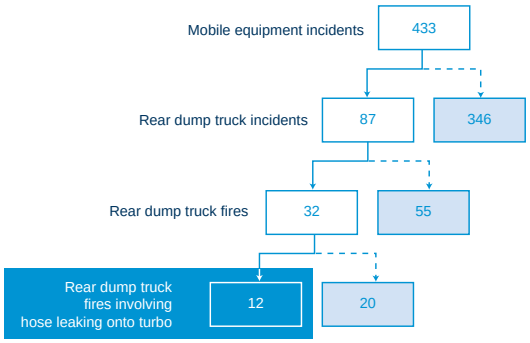
B. Identifying high-risk areas

Incident data can be utilised to identify areas of high risk

While safety indicators can be used to compare performance and allocate resources accordingly, they are of limited use in determining where incidents are most likely to occur in the future. To assist in identifying these high-risk areas, organisations are increasingly using detailed incident reports.

For incident data, the real test of value is whether it allows the user to make inferences, initiate further investigations and take appropriate actions. This was the objective of the Queensland Resources Council when it recently asked PricewaterhouseCoopers to review industry safety performance based on data supplied by the Queensland Department of Mines and Energy. While the review was successful in identifying several high-risk areas, the certainty of the findings was somewhat reduced as the available data lacked accuracy, consistency and granularity. As demonstrated in figure 4, even slight improvements in granularity can significantly increase the value of the resulting findings.

Figure 4: Slight improvements in granularity may allow organisations to apply more effective controls



Three improvement opportunities have been identified in relation to incident reporting

While the quality of internal incident-reporting processes has increased significantly in the last decade, three clear improvement opportunities remain:

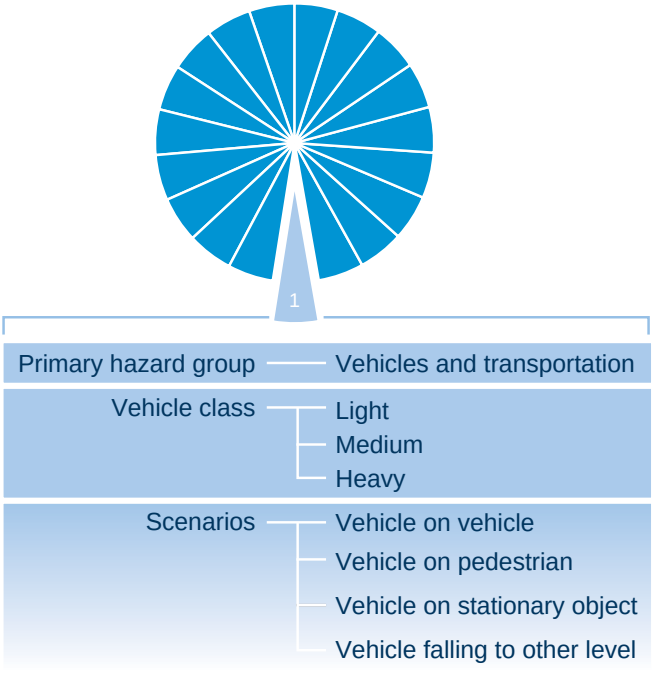
1. Improve data quality through consistent application of classification taxonomies
2. Increase reporting volume by building a reporting culture
3. Apply innovative analysis methods

Opportunity 1: Improve data quality through consistent application of classification taxonomies

It is generally difficult to identify high-risk areas using incident information unless the underlying data is of sufficient quality and granularity. This in turn requires data that has been collected using a contemporary classification taxonomy. This requirement is currently being addressed by most operators in Australia, as technological advances and human factor insights have rendered many existing frameworks obsolete.

The first step in this complex process is to reach agreement around fundamental incident dimensions, such as how to group incidents, how to identify actual and potential impacts and how to define incident types (e.g. near-hit, hazard, personal, mechanical). At Rio Tinto Coal, this process has resulted in a list of 19 primary hazard groups that break down into several levels of sub-classification (figure 5). Supported by simple yet specific definitions, this system will allow users to specify the precise nature of an incident and assist decision makers in identifying potential risk areas.

Figure 5: One element of the hazard-grouping system being developed by Rio Tinto Coal



Consistent application of definitions is also needed to improve overall data quality. This can be achieved by providing better training and user guidance or by introducing more user-friendly capturing mechanisms. In better practice organisations, this involves using interactive, simple and flexible online reporting systems, supported by integrated guidance material where needed. Many companies are also using data cleansing tools and dedicated personnel to address any inconsistencies that have slipped through the cracks.

Opportunity 2: Increase reporting volume by building a reporting culture

As the safety performance of the Australian mining industry continues to improve, the volume of incident reports is naturally decreasing and operators are finding it harder to identify remaining high-risk areas. This is particularly true for smaller organisations that may no longer have the reporting volumes needed to produce statistically significant findings.

To maintain the volume of valuable incident data, Reason (1997) advocates the recording of near-hit and high-potential incidents and this recommendation is increasingly being accepted by better practice organisations. Many operators are however finding it difficult to achieve this in practice, as it requires a workforce that is collectively aware and willing to report any slips, lapses and mistakes that occur (Nixon, 2005). BHP Billiton is a particularly strong supporter of this approach, demonstrated by its assertion that increasing volumes of near-hit reports correlates with declining injuries and fatalities. As such, this paper argues that increasing reporting of high-potential incidents is a key step on the journey towards zero harm.

Opportunity 3: Apply innovative analysis methods

Organisations that are able to increase the quality and volume of incident data may find themselves able to apply innovative analysis methods. For instance, it is possible that mining companies can adapt systems from the aviation industry, where groundbreaking analysis tools have been developed as part of the Aviation Safety Information Analysis and Sharing program. This system pulls terabytes of anonymous data from a wide number of sources and applies recent advances in text-mining tools to analyse far greater numbers of incidents than ever before possible (Rosenkrans, 2008). In a recent case study, this breakthrough allowed a Federal Aviation Administration (FAA) project team to examine 5.3 million text records across three databases in as little as 10 days.

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C. Sharing information

Additional value can be realised from existing information-sharing mechanisms

Most major mining organisations believe that sharing information between organisations is fundamental to improving safety performance. Hence most Australian operators frequently use one or more of the information-sharing mechanisms in table 1.

Table 1: Frequently used information-sharing mechanisms

Mechanism	Comments
Research institutes	These institutes often send out information based on research and industry surveys. The MIRMgate program at the University of Queensland is a prominent local example.
Government authorities	They often send out regular safety bulletins based on incidents reported under state legislation. Information is often received from multiple states. The Queensland Department of Mines and Energy also operates a high-potential incidents database for recording and reporting purposes.
Manufacturers	Operators often inform manufacturers when an incident appears to be equipment-specific. The manufacturer may then forward this information to owners of the equipment in question.
Industry working groups	Identified as one of the most important mechanisms. Both the Queensland Resources Council and the Minerals Council of Australia have dedicated safety working groups that publish formalised reports based on regular surveys.
Informal networks	Also identified as one of the most important mechanisms, but informal networks are highly dependent on personal relationships. Networks are also becoming increasingly important internally, as organisations continue to grow in size and complexity.

While these mechanisms are growing in popularity, many organisations believe the resulting information is of limited value. This is mainly because incident information can seldom be directly compared between organisations that use different incident classification frameworks. Furthermore, many organisations are somewhat resistant to sharing detailed information, as they fear it may be used against them or their employees by regulators and other stakeholders.

Four opportunities to improve information sharing have been identified

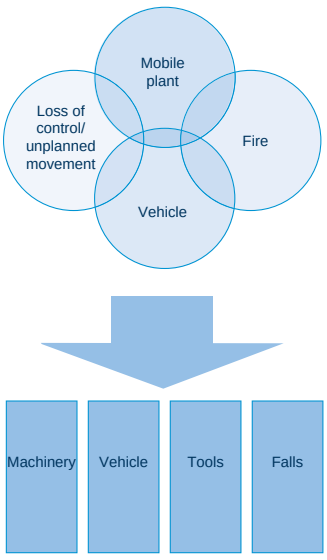
The following four improvement opportunities have been developed to address the identified limitations:

1. Develop a shared classification taxonomy
2. Address concerns about sharing information
3. Refine the high-potential incidents database maintained by the Queensland Department of Mines and Energy
4. Share incident findings and controls

Opportunity 1: Develop a shared classification taxonomy

Addressing the issue of inconsistent classification taxonomies will be fundamental to increasing information sharing in the mining industry. This can be achieved by either bringing operators together to agree on a standardised framework, or by passing this responsibility to a regulatory body. Regardless of the chosen approach, a high level of consultation and change management will be needed, since such a project would involve significant changes to internal reporting systems. This is particularly true for larger organisations, as they tend to have highly customised systems in place across their global operations. This process may be complicated further by the fact that researchers continue to argue the merits of various design principles, such as whether to group primarily by energy types, mechanisms of injury, equipment types or control types.

Figure 6: A shared classification taxonomy should have no overlap between categories



Opportunity 2: Address concerns about sharing information

To increase the detail and volume of information available at the industry level, it will be important to address stakeholder apprehensions about supplying information that may be used against them in some way. Although litigation in certain circumstances is unavoidable, the key to good reporting is transparency and openness of data, which requires guarantees about the use and audience of such data.

Openness of data will be particularly important for mechanisms that depend entirely on self-reported information, such as the high-potential incidents database maintained by the Queensland Department of Mines and Energy. Recognising the importance of this, the Department asserts that information in this database has never been used for litigative purposes and that it would view resorting to prosecutions as a failure on its part to address issues in a collaborative manner. While this approach has been very successful in Queensland, there is a general concern that this would change if other regulators were to seize responsibility for safety management in the mining industry, as occurred with the introduction of WorkSafe in Victoria.

Opportunity 3: Refine the high-potential incidents database maintained by the Queensland Department of Mines and Energy

The Queensland Department of Mines and Energy uses a high-potential incidents database to collect information about incidents that have had the potential to cause significant bodily harm. Since its use is mandatory, it contains information from all mining companies operating in Queensland. While this resource is one of the most complete reporting databases in Australia, there is wide agreement that major improvements need to be made, including:

- Increasing awareness of the information available in the database
- Making the data-entry interface simpler and more user-friendly
- Giving users the opportunity to query the database directly
- Presenting annual findings at major industry conferences
- Reviewing the database annually to identify improvement opportunities
- Ensuring that submitted data is validated for completeness and accuracy (table 2)

Table 2: Examples of lacking detail in incident descriptions in the high-potential incidents database

Full incident description	How incident occurred	Sequence of events	Description of incident
"Dozer and light vehicle collided"	✘	✘	✔
"Haul truck contacted supporting leg of conveyor structure"	✘	✘	✔
"Collision between Ostwald Bros Cat 815F compactor and stationary freightliner water cart"	✘	✘	✔
"Incident occurred due to bearing failure on flat return roller"	✔	✘	✘
"Shuttle car cable snapped causing flash"	✘	✘	✔
"Spontaneous combustion"	✘	✘	✘

Many of these recommendations were also raised in an independent review by Parker and David in 2007, and the majority will be addressed in a phased manner over the next three years. If skilfully implemented, these changes will significantly increase the value of this database to the Queensland mining industry going forward.

Opportunity 4: Share incident findings and controls

The final improvement opportunity relates to the sharing of more value-added information than basic incident data. This may include sharing experiences with certain types of equipment or sharing highly successful controls and preventative measures. Such efforts can be catered for by existing working groups or informal networks, and should be recognised as best practice by the industry.

Conclusion

Having made considerable progress in recent years, safety performance in the Australian mining industry has now stabilised above the target of zero harm. Further progress will require tools that are adapted to contemporary decision-making needs. This paper has sought to demonstrate that greater excellence in safety reporting is the first step on this journey, and that this can be achieved by addressing the following 12 improvement opportunities:

Area	Improvement opportunities
A. Using meaningful safety indicators	1. Increase indicator spans 2. Improve consistency of definitions 3. Include lead indicators in scorecard reporting 4. Align performance incentives with safety objectives 5. Produce more timely reports
B. Identifying high-risk areas	1. Improve data quality through consistent application of classification taxonomies 2. Increase reporting volume by building a reporting culture 3. Apply innovative analysis methods
C. Sharing information	1. Develop a shared classification taxonomy 2. Address concerns about sharing information 3. Refine the high-potential incidents database maintained by the Queensland Department of Mines and Energy 4. Share incident findings and controls

Acknowledgements

This paper has been developed following insights gained by PricewaterhouseCoopers while working on safety projects with the BHP Billiton Mitsubishi Alliance and the Queensland Resources Council and operational improvement projects with Rio Tinto, Dalrymple Bay Coal Terminal, MacArthur Coal and Anglo Coal Australia. In our research for this paper, we also undertook interviews with senior management and industry stakeholders from the following organisations: BHP Billiton Mitsubishi Alliance, Department of Mines and Energy, Downer EDI, MacArthur Coal, Newcrest Mining, PanAust, Peabody, Queensland Resources Council, Lihir Gold, Rio Tinto Alcan and Rio Tinto Coal.

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