

How mining companies can better protect workers from injury and death

October 29 2021



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New research from Edith Cowan University (ECU) has identified some key causes of workplace fatalities in the Western Australian mining and resources sector, which could assist companies to reduce the number of

workers injured on the job.

The study was comprised of two phases. First, researchers surveyed more than 2000 mining company employees from 2017-2019 to gain their perceptions of workplace [safety](#) and injury risk.

They used a questionnaire based on Professor Michael Quinlan's 2014 book 'Ten Pathways to Death and Disaster,' which outlines common risk factors for catastrophic work incidents.

Researchers then compared the questionnaire results to actual workplace fatalities to see if the way people perceived the injury risk at their workplace aligned with the results of the incidents.

The study identified four of Quinlan's pathways were regularly associated with WA mining deaths and are therefore a priority for action:

- Pathway 1: Design, engineering, technical and maintenance flaws
- Pathway 4: Failures in safety management systems
- Pathway 5: Failures in Auditing
- Pathway 9: Poor management—worker communication and trust

ECU Ph.D. candidate Tanya Jenke said the study could form as a blueprint for mining companies to ensure their worksites were as safe as possible.

"We aimed to assist the West Australian mining industry in learning from past fatalities and to provide direction for controlling fatality risks in the future," she said.

"The simplicity of the Ten Pathways makes them a valuable risk communication tool, and could readily be used to commence

discussions, for example at safety meetings, or implemented in a reporting tool to allow companies to learn about safety matters more effectively.

"It could also be used as a self-audit tool or an internal company assessment to benchmark against the findings published in this study."

Leadership is crucial

In most cases, [survey respondents](#) with leadership roles, such as superintendents and managers, scored their organization's performance higher than employees in frontline positions.

Ms Jenke said this suggested communication and cultural issues, which could have serious ramifications.

"It highlights potentially dangerous gaps between employee expectations of management—such as prioritizing worker safety—and reality," she said.

"Additionally, those in leadership roles perceived a better worker relationship compared to employees in the front line. Mining organizations need to ensure systems and processes are in place to foster a collaborative and transparent work environment."

The office vs. the site

The study also noted significant differences in responses from those based in Perth and workers in other regions of WA, with regional respondents attributing lower scores than their city-based counterparts.

"This possibly indicates a disconnect between operating site and head

office," Ms Jenke said.

"It may illustrate a difference between work as planned by the corporate office, versus work as done by the operations."

A rethink on reporting

Though the study recommends how mining companies should prioritize safety, Ms Jenke said organizations should address all 10 pathways, as they were developed from fatalities.

She said while some pathways did not appear in any WA mining fatality reports, it was likely due to how incidents were reported.

"We suggest that this may be a result of data on these pathways is not captured as part of the Fatality Register assessment and that they are contributing to fatalities," Ms Jenke said.

"Given that four pathways were most prominent in the DMIRS Fatalities Register and the remaining six were not, it is argued the type of information required for reporting does not require an organization to publicly address all ten pathways.

"It is recommended that reporting include a mechanism for addressing all ten pathways, so that other organizations can effectively learn from past fatal incidents."

The research was published in *Safety Science*.

Descriptions of the Ten Pathways

Pathway 1: Design, engineering, technical and maintenance flaws

The flaws in engineering, design and maintenance were mostly the result of poor decision making by management and were often known or should have been identified well before the fatal incident.

Pathway 2: Prior warnings or causes for alarm ignored

In many of the fatal incidents, Quinlan observed that clear warnings and causes for alarm were ignored. For example, prior to the Beaconsfield collapse the stress and seismicity of two previous rock falls were not properly managed or investigated to identify the root cause. In many cases, employees or supervisors had expressed their safety concerns prior to the fatal incident.

Pathway 3: Failures in risk assessment

Quinlan stated a causal factor of many of the fatal incidents was a failure to undertake risk assessments or undertake them accurately. Effective risk assessments are based on informed knowledge of the hazard, evaluation of the effectiveness of risk treatments and control measures, and monitoring and review of the situation to detect change in risk.

Pathway 4: Failures in management systems and hazard management plans

Quinlan reported that Work Health and Safety management systems which focus on behavioral change, Lost Time Injuries and poorly selected Key Performance Indicators can lead to complacency when it comes to major hazards. Furthermore, the catastrophic risk increases when well-documented procedures are not implemented and when there are major changes to work design, for example the increased use of contractors.

Pathway 5: Failures in auditing

Auditing ensures that Work Health and Safety Management Systems are designed and implemented effectively and identifies areas for improvement. Auditing needs to be rigorous across all parts of the Work Health and Safety Management System. Quinlan considered overly routinized audits that do not act on information may overlook catastrophic hazards.

Pathway 6: Economic pressures compromising safety

This [pathway](#) highlights the failure to control the influence of personal financial incentives and pressure on individuals to contribute to the production expectations. Quinlan stated that financial pressures such as the use of incentive- or bonus-based regimes are commonly found to undermine safety.

Pathway 7: Failures in regulatory oversight and inspection

The failure of the Regulator to provide feedback to an organization on their compliance with legislation and safety performance was found by Quinlan to be a common catastrophic incident pathway.

Pathway 8: Worker and others expressing concern prior to the incident

In most investigations it seemed to Quinlan to be remarkable how seldom workers were asked their views on safety at the mine, including evidence of concerns both prior to and pertaining to the incident. Quinlan found failure to heed well-founded concerns was a common pathway of mine fatalities.

Pathway 9: Poor management—worker communication and trust

This pathway concerns the flow of critical information to and from the workers as well as the willingness to act on that information. Quinlan

found ineffective communication and trust may result in a variety of poor outcomes including mixed messages, inconsistent messages and lack of engagement with the work force which undermines their participation.

Pathway 10: Emergency and rescue resources and procedures

Effective emergency management procedures play a critical role in mitigating the escalation of an incident. Failure to develop and implement effective emergency management systems endanger lives including safeguarding rescue personnel.

More information: Tanya Jenke et al, Fatality risk management: Applying Quinlan's Ten Pathways in Western Australia's mining industry, *Safety Science* (2021). [DOI: 10.1016/j.ssci.2021.105494](https://doi.org/10.1016/j.ssci.2021.105494)

Provided by Edith Cowan University

Citation: How mining companies can better protect workers from injury and death (2021, October 29) retrieved 21 June 2024 from <https://phys.org/news/2021-10-companies-workers-injury-death.html>

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