TELLUS
Mining Productivity

Canada-Kazakhstan

Mining Working Group

Industry Best practices in Health & Safety

Mobile equipment

January 2024

Tellus Mining - About Us

TELLUS Mining Productivity

We have developed projects in different countries, such as:

Chile, Peru, Canada, Australia, Kazakhstan, and South Africa.

+ 120
Projects awarded

We are a global **mining consultancy**, leader in automation, productivity and mining technologies.

- Mine Automation (AHS/ADS)
- Mine Electrification (Trolley assist & BEV´s)
- Mine Performance Optimization
- Mining & Safety technologies
- Strategic/Tactic Mine Planning
- Fleet Management Systems (FMS)
- Collision Awareness Systems (CAS)

Main cause of fatalities in mining – ICMM statistics

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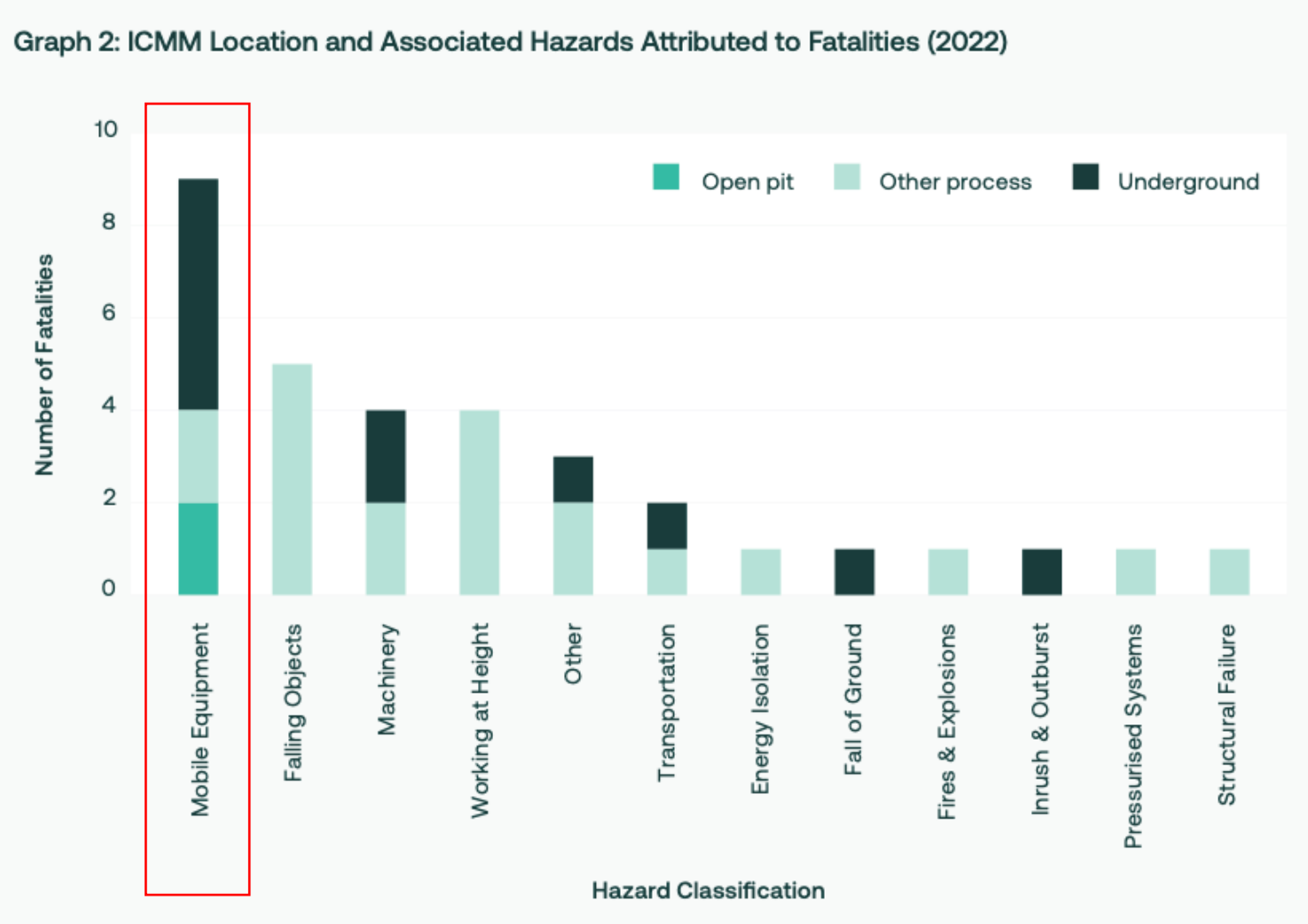
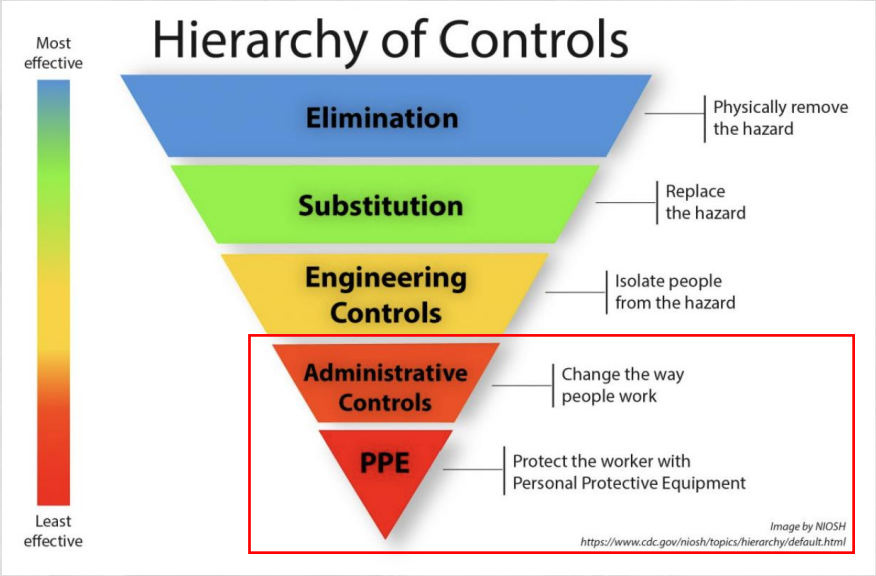


In 2022, the main cause of fatalities in mining companies belonging to ICMM was that associated with "**Mobile equipment**".

The critical controls defined for this risk are mostly **low-level of hierarchy**.



Industry Best practices in Health & Safety

EMERST INITIATIVE – MOBILE EQUIPMENT INITITATIVE

Established in 2006, EMESRT is a **respected high-influence global organization** that delivers industry-level understanding of complex health and safety problems. Its effectiveness rests on trusted relationships with OEM's and third parties.

Throughout its 16-year history, the mining company membership-based entity has focused on **health and safety problems of real relevance to the mining industry**.

EMESRT
Earth Moving Equipment Safety Round Table

Alcoa	New Hope Group
Anglo American	Rio Tinto
AngloGold Ashanti	Teck Resources
BHP	Vale
Glencore	Whitehaven Coal
Kiewit	

Accelerate development and adoption of leading practice designs to minimize the risk of health and safety.

Industry Best practices in Health & Safety

EMERST METHODOLOGY – NINE LAYERS OF CONTROL EFECTIVENESS

The initial organisational assessment will stablish the maturity in terms of the Design and Operation categories to start defining which topic will require a further in-depth analysis.

DESIGN

Controls that minimize exposure

OPERATE

Controls that detect and defect potential threats

REACT

Last chance intervention

1. Site Requirements	• Equipment specifications, standards, mine design/plan	YEARS
2. Segregation Controls	• Berms, access control, traffic segregation, time schedule	MONTHS
3. Operating Procedures	•SOP´s, maintenance, road rules, quality control, lockout	WEEKS
4. Authority to Operate	•Training, licenses, induction, access control	DAYS
5. Fitness to Operate	•Fatigue state, drug & alcohol, medicals	SHIFTS
6. Operating Compliance	•Pre-start, safety tests, machine health, event recording	HOURS
7. Operator Awareness	•Cameras, live maps, mirrors, lights, visible delineators	MINUTES
8. Advisory Controls	•Alert: Proximity, Fatigue, Overspeed, Vehicle stability	SECS
9. Intervention Controls	•Interlocks: Prevent Start, Slow-Stop, Rollback, Retarder	MSECS

Industry Best practices in Health & Safety

EMERST METHODOLOGY – VEHICLE INTERACTION MATURITY FRAMEWORK

The initial organisational assessment will stablish the maturity in terms of the Design and Operation categories to start defining which topic will require a further in-depth analysis.

LEVEL 1 : Unaware	# Stars
Company is primarily focused on legislative compliance with regards vehicle standards and operation.	★
LEVEL 2 : Exploratory	
Company is actively investigating the elimination of vehicle interactions through mine design, operating procedures and engineering controls.	★ ★
LEVEL 3 : Defined	
Company is actively pursuing the elimination of vehicle interactions through mine design, operating procedures, monitoring operator behaviour and engineering controls.	★ ★ ★
LEVEL 4 : Adoptive	
Demonstrated success in the adoption of remote and or engineering controls to eliminate vehicle interactions. Coupled with the integrated use of digital data to optimise operational designs and monitoring of work practices.	★ ★ ★ ★
LEVEL 5 : Adaptive	
Implemented leading industry practice in the design of remote and or engineering controls to eliminate vehicle interactions. Coupled with the integrated use of digital data to optimise industry designs and monitoring of work practices.	★ ★ ★ ★ ★

Industry Best practices in Health & Safety

FINAL REMARKS

- Health and Safety remain paramount in the mining industry. Mining companies must implement robust safety protocols and ensure regulatory compliance to prevent accidents.
- There are different global collaborative initiatives between mining companies to better address the challenges facing the industry. It is an opportunity to **capture lessons learned, share experiences and accelerate the adoption** of high safety standards.
- The mining industry is undergoing transformation. New practices and technologies have improved industry's safety, efficiency, and sustainability. **Companies should embrace these innovations** and deploy them consistently to modernize their operations.
- Finally, the mining industry should continuously update its practices. For instance, they should regularly **evaluate their performance, identify areas for enhancement, and adopt better strategies**. By doing so, they will improve social and economic outcomes.

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