

UNDERSTANDING MINING INDUSTRY

Loss Trends and Predictive Analytics

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Executive Summary

The global mining industry is a cornerstone of the world economy, with top companies generating approximately US\$845 billion in total revenue and holding more than \$1.2 trillion worth of assets.

Mining makes a significant contribution to GDP in many nations and plays an important role in the transition to clean energy, making operational efficiency critical. Losses in mining don't just hurt growth potential and cause long production delays, they also pose a significant risk to the wider economy.

While you can't eliminate all incidents, the good news is that most of them can be avoided using a data-driven risk mitigation strategy. As a property insurance business with more than 50 years of risk engineering loss history data, FM has deep insight into the drivers of losses within the mining industry. Our comprehensive risk management approach – which involves sending engineers to sites to identify issues, rather than using actuaries – makes this possible.

We insure more than 300 mine sites worldwide and have analysed loss history across the industry. Our global data shows mining organisations recorded more than 400 losses at sites over a 20-year period, mostly due to inherent risks and those related to environment or location.

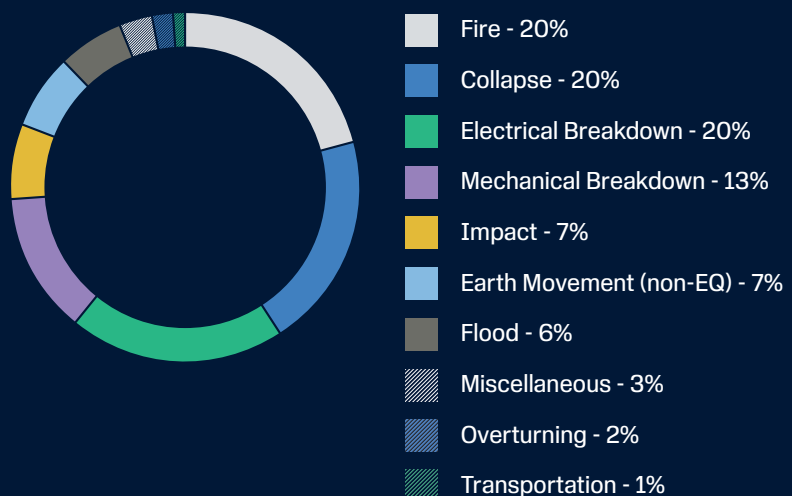
SOME KEY FINDINGS INCLUDE

- Fire is the single-biggest driver of losses at 21 per cent, as incidents continue to rise.
- Significant, unexpected losses related to very large pieces of equipment feature prominently in our loss history data.
- Natural hazards (such as flood and earth movement) account for 13 per cent of losses.

Mining Loss History

USD\$2
Billion

Recent 20 Year Period Total



Identifying Causes

Equipment breakdown and fire incidents are the two primary loss drivers at mine sites.

Fire-related incidents are on the rise and account for 27 per cent of all losses over the last five years, compared to 21 per cent normalised over the last 20 years. An increase in plastic use for the construction of buildings and equipment – due to its cost-effective and versatile nature – is contributing to this.

As with any industrial sector, fires caused by electrical issues are the leading cause of loss, with electrical ignition sources responsible for about 30 per cent of loss across the sector.

Hot work (meaning any process that generates flames, sparks or heat) and hot surfaces contribute to about 15 per cent of losses

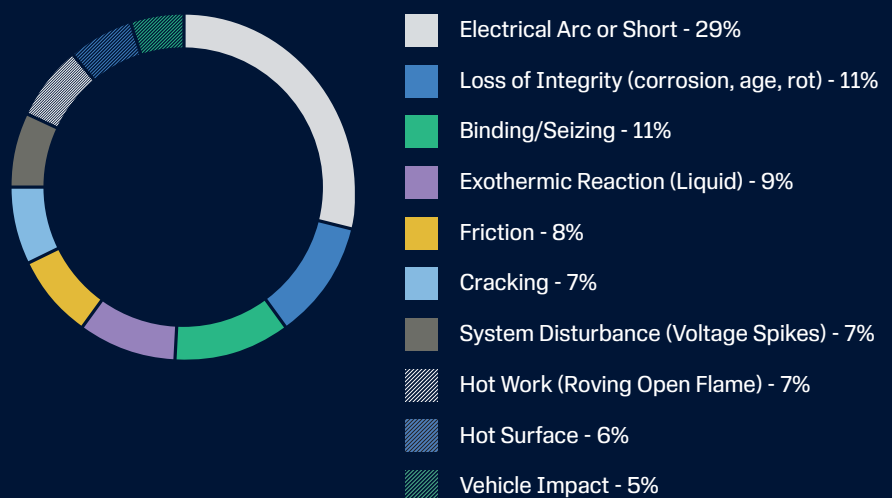
You can minimise risk by addressing a range of key issues, preventing a minor incident from becoming a major event. The main factors contributing towards loss, in order of importance, include:

1. Adequacy of protective or safety devices
2. Lack of automatic fire sprinkler protection
3. Business interruption bottleneck
4. Equipment design/manufacturing flaw
5. Weather
6. Lack of contingency planning
7. Lack of or inadequate operating procedures

Our data shows that many losses can be prevented by addressing equipment failures, including issues like malfunctioning safety devices, poor equipment design and inadequate operating procedures.

Ineffective human element controls and a lack of automatic sprinkler protection impact most fire-related losses, with the latter being particularly relevant to critical conveyor systems. Missing safety devices, special protection systems and passive protection failures also loom large in fire losses, while combustible construction and equipment present key risks.

Top 10 Loss Causes





Focus on equipment

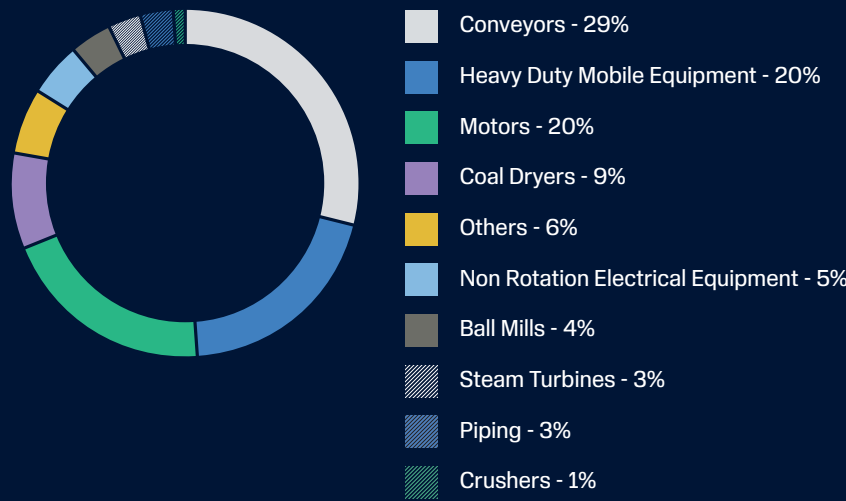
It takes a wide range of powerful and complex pieces of equipment to run a successful mining operation, making it critical that you understand and actively reduce the risk of equipment loss. Large equipment poses many risks, mostly related to impact (physical collisions), collapse, overturning, or ore transportation disruptions, which can all significantly impact business operations.

We collected data from more than 50,000 pieces of equipment across numerous mining and other heavy industry operations to build a complete picture of equipment loss impact.

It's no surprise that conveyors, motors, and heavy-duty mobile equipment (HDME) – which are found at most mining sites – make up almost 70 per cent of losses across the industry. A considerable proportion of fire losses involve equipment breakdowns, such as when bearings overheat and ignite rubber belt conveyors.

Our loss history data shows that 34 per cent of mining industry losses directly stem from mechanical or electrical equipment breakdowns, but when collapse, impact and overturning are included (all related to large equipment/structure failures), this climbs to 63 per cent.

Top 10 Losses by Equipment Breakdown Factors



We recommend focusing on the following equipment factors to lower the risk of failure

Maintenance

Improve your asset integrity programs and maintenance strategies to routinely verify the integrity and reliability of equipment

Operating conditions

Analyse actual operating conditions of equipment compared to design conditions, including overloading, cyclic use and/or process upsets outside of design limits.

Environment

Survey the operating environments and physical conditions, including the surroundings in which the equipment is operating, to determine the suitability of the equipment for the service environment.

Operators

Assess the effectiveness and adequacy of operator training processes to ensure equipment is operating within design limits during both normal and upset conditions.

Age and history

Evaluate operating history, taking note of inspections, testing and maintenance work, condition and performance monitoring, persistent environmental conditions, failures, and breakdowns to determine the age and remaining useful life of equipment.

Safety devices

Verify that equipment protection devices (safety or control) are adequately designed, installed, and maintained, ensuring they're functional and reliable during normal and upset conditions.

Contingency planning

Evaluate your contingency planning procedures to ensure you're prepared to respond to – and recover from – unplanned breakdowns of equipment that would interrupt key operations. Look for opportunities to employ recovery options and mitigation strategies that minimise downtime and speed up restoration. This helps you mitigate the overall size of losses.

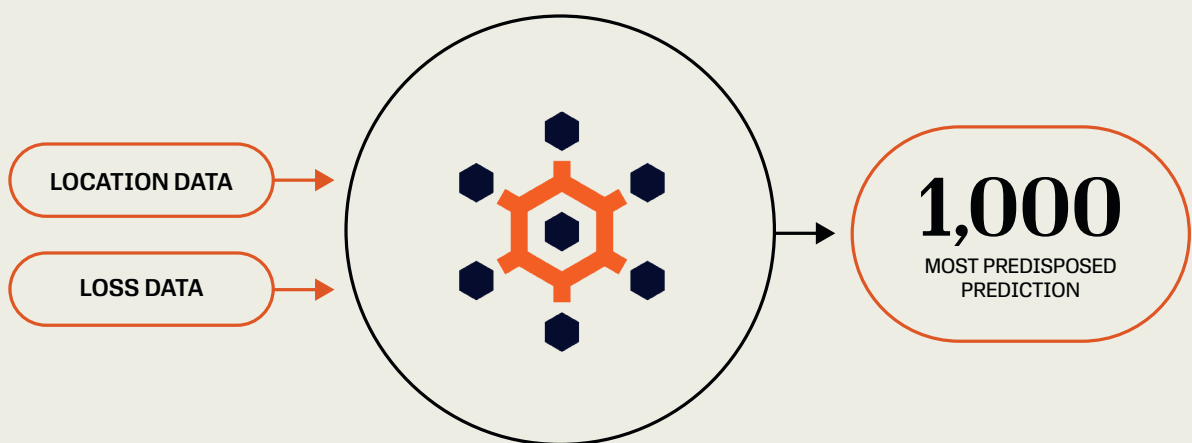
If organisations don't properly manage these seven equipment factors, loss becomes far more likely. Equipment breakdown is more severe and more frequent as the number of unsatisfactory factors increases.



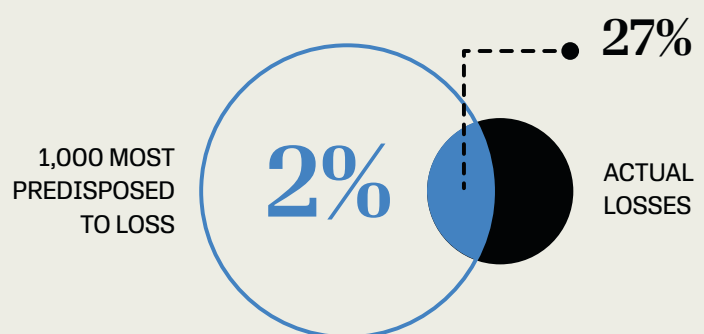
Identifying high-risk locations

Our data shows that over a quarter (27 per cent) of losses come from just two per cent of locations. By overlaying our loss and location-specific data and feeding it through a rigorous mathematical process (called a multinomial ordinal regression model), we can identify the 1,000 locations most predisposed to losses of more than US\$3 million.

Multinomial ordinal Regression model



This predictive model's accuracy is evident in the consistent overlap between anticipated high-risk locations and actual losses. It effectively pinpoints areas around the world that require focused risk management strategies.



60,000
Visited Locations

Harnessing predictive analytics



While historical loss data offers valuable insights to mining organisations, it only tells part of the story. FM's team of global engineers and scientists visit over 600 mine sites and production facilities every year to build a comprehensive dataset that helps us improve our customers' business continuity.

Our engineers collect at least 700 data points from each location and even more from mining sites. This gives us a comprehensive understanding of mining operations, allowing us to assess and mitigate risk factors and uncover opportunities, both now and in the future.

Predictive analytics in action

In the mid-2010s, a fire broke out at a large mine that used a thick screen with a hard polyurethane lining that was used to size ore. During maintenance work in the area, hot work sparks set the screen on fire, quickly impacting the screen and its surrounding structure.

The emergency response team controlled the fire with hose streams and prevented it from spreading into the key conveyor that connected several other screens. There was approximately \$5 million in damage, but things could have been much worse. Only one of several screens was affected, meaning production was not significantly interrupted.

This location was identified as being predisposed to loss the prior year, providing a compelling real-life example of predictive analytics in action. Other similar instances have occurred in the years since, and the number of fires involving plastic materials continues to rise, underscoring the urgency of ongoing vigilance and action.

FM's loss history data, coupled with predictive analytics, forms a comprehensive framework for understanding, preventing and mitigating losses within the mining industry. We use our deep knowledge and rich data to help you make more informed decisions and better use existing resources to improve risk management and secure your future.

Enabling a change in approach

Our loss prevention data demonstrates why it's important to consider practical approaches to improving production outcomes and risk management strategies. A risk management partner that helps you build regular maintenance items into business schedules makes the process much easier. While every mine operator is different, FM recommends you consider the following:

Equipment maintenance is key

More than a quarter of loss incidents are caused by equipment failures. You must ensure equipment isn't running for long periods without being assessed for faults, as the result is often much more expensive than equipment downtime. Predictive analytics technology can identify potential failures before they occur.

Consider the human element

When updating equipment, you must ensure consideration is given to updating safety-related processes and ensuring employees are aware of the changes. Well-trained firefighting staff and equipment are also critical.

Limit the concentration of plastic materials

The risk of fire spreading can be significantly reduced based on how combustible equipment is laid out. Consider the layout, and if it can't be changed, look at fire protection as an alternative solution.

Manage change

Ensure a robust change management process is in place and process hazard analysis is conducted appropriately.

Focus on hot work

Ensure hot work is managed carefully and includes a proper hazard analysis before the work is done. Consider flanging off pipes so that fires in one vessel will not easily spread and think about the best time of day for hot work to be carried out.

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