



# Corrosion control best practices

By Zoe Coull

**M**any miners think of corrosion as something that happens gradually and that only becomes an issue towards the end of an asset's life cycle. While this can be true in some cases, the severity of corrosion risk for a processing asset or associated civil/structural infrastructure (including pipelines, ports and tailing dams) is a complex function of multiple factors: process chemistry and conditions, ore composition, water quality, age, climate, proximity to the coast, design and maintenance practices.

As well as corrosion that happens over longer time frames, there are corrosion types that result in rapid failure. For example, there can be deterioration due to microbially influenced corrosion within months of asset commissioning, or unexpected catastrophic failures due to chloride stress corrosion cracking.

These failures can impact a company's ability to achieve its sustainability goals.

Consider the environmental, economic and social impact of corrosion in mining:

**Environmental:** Pitting corrosion is a frequent failure mode for pipelines and tanks and can cause leaks of potential pollutants, ranging from diesel to process water to tailings. Even a small leak can have big impacts on permitting and community relations. In some jurisdictions, there could also be legal implications for company management. Solid technical consideration of corrosion helps meet the expectations of stakeholders, including regulatory authorities and non-governmental organizations.

**Economic:** The direct cost of corrosion globally is US\$2.5 trillion (NACE Impact Study 2016). These direct costs (including repairs, replacements, materials) are usually bundled into maintenance budgets, so often it is not clear what is being spent specifically on corrosion-related maintenance. In addition, corrosion causes indirect costs due to unexpected shutdowns and production losses. In mining, these indirect costs are usually significantly higher than direct costs of corrosion maintenance. There can also be environmental fines, insurance premium increases and reduced access to capital, which are harder to track.

**Social:** Unfortunately, there are multiple examples in the mining industry where corrosion failures have caused safety incidents, even fatalities. Stakeholders want critical physical assets on site to be safe for workers and communities. Proactive diligence on corrosion helps to reduce these incidents, helping to build a reputation for the mine as a safe place to work, supporting local recruitment and the mine's social licence to operate.

## Corrosion management: money and time well invested

Best practices that have been developed in other heavy industries, such as oil and gas and the military, provide models for policy setting, resourcing, communication and documentation. These best practices are disciplined, risk-based, data-

driven and follow established international risk standards, such as ISO 31000.

By adapting these proven frameworks for mining, companies can create proactive, structured plans to ensure due diligence around corrosion risk to gain a competitive advantage due to lower costs and greater reliability. These programs can be easily zippered into existing asset management/integrity programs.

## Corrosion management directly supports the mine in working towards its sustainable development goals.

Benefits can be significant. Consider one of the first corrosion management plans, mandated in 2002 by the U.S. Marines to reduce the time spent by troops on the maintenance of their mobile fleets. Within four years, they had reduced the maintenance budget by 15 per cent (US\$85M), the depot repair costs by 22 per cent and the field repair hours by 46 per cent, thereby improving overall equipment availability and team safety.

Owners of more recent programs report greater control over business risks through optimized designs, informed strategic decisions, better visibility on costs/budgets, reduced unexpected shutdown events, decreased maintenance costs, increased asset life and improved due diligence on health, safety and environmental risks.

## Corrosion management tips through the mine life cycle

Here are some steps that can have a big impact on managing corrosion in mines:

- Design your mine right from the start, with corrosion engineering integrated into specifications and risk-assessment processes. This helps avoid legacy problems that operation teams then have to deal with repeatedly.
- Understand that the importance of strong quality assurance/control in construction cannot be overstated.
- Build team resilience by creating internal training to build awareness and skills.
- Include fixed assets (structures, concrete, civil structures) in risk assessment.
- Remember that data is king. Visual inspection can be improved with quantitative technical and financial data and predictive models to inform decision-making.

Beyond practical operational issues, corrosion management directly supports the mine in working towards its sustainable development goals. Proactive corrosion management is not just about doing the right thing, it makes sense for the bottom line. **CIM**

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