ADDRESSING wear and abrasion OF METALS IN THE MINING INDUSTRY

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A.W. Chesterton Company

CHESTERTON EQUIPMENT PROTECTION EXPERT

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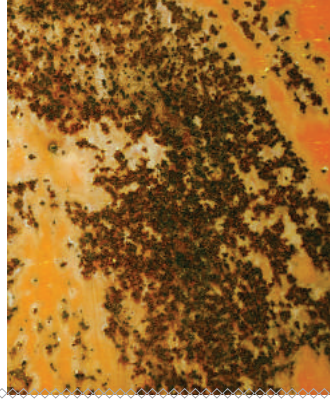


Introduction

This e-book highlights specific best practices to help protect metal equipment and structures from the harsh conditions and 24/7/365 demands of the mining and ore processing environment.

Learn how to extend the reliability of metal equipment and structures exposed to specific kinds of abrasion, corrosion, erosion, and other wear attack.

THE HIGH COSTS OF CORROSION

Across all industries, the global cost of corrosion is estimated at $2.5 trillion (US) according to a report released by NACE International, the Worldwide Corrosion Authority. The same study found that implementing corrosion prevention best practices can save between 15-35 percent of the cost of damage.

In the Mining and Ore Processing industry a primary cause of downtime is related to abrasive wear and its effect on process equipment. Put simply, things rarely get the chance to corrode as they abrade faster.

THE BENEFITS OF PROTECTED METAL EQUIPMENT/STRUCTURES

- Fewer corrosion-related failures
- Increased production efficiency
- Extended life of worn equipment
- Lower wastage and erosive product losses
- Avoid unsafe and potentially hazardous leaks
- Lower scrap equipment costs
- Reduced need for redundant equipment

EQUIPMENT EXAMPLE

In our experience, slurry pumps that were rebuilt and refurbished with a reinforced epoxy coating can see significant improvements in operational efficiencies, with sustained performance over time.

THE IMPACT OF ABRASION ON MINING OPERATIONS

The processes at most mines involve a wide spectrum of abrasion, impact, and corrosion. The equipment being affected ranges from large earth excavators to pumps and valves.

Plant maintenance personal are constantly working to resolve issues with equipment that no longer works as efficiently as it should, or has broken down and must be replaced.

With the increased economic pressures impacting the mining industry in recent years, mining operations must plan a more sustainable approach to more efficient operations with an eye towards reduced maintenance expenditures whenever possible.

ADVANCES IN WEAR AND CORROSION PROTECTIVE TECHNOLOGIES

New technologies allow you to address variations in the size of the abrasive media, velocity, impact, and more. Technologies such as **thermal spray metal systems, ceramics, reinforced epoxies and urethanes** provide valuable service in highly abrasive and corrosive applications, and are becoming more economical.

A few things to consider when selecting from the various qualified options include:

- Cost and ease of application
- Mean time between failure performance
- Characterization of potential of failure to significantly impact equipment or overall plant performance
- Dry service conditions may involve higher grinding and gouging wear while wet service (slurry) applications involve scratching abrasion and corrosion

THE BUSINESS CASE FOR IMPROVED CORROSION MANAGEMENT

- Lower maintenance costs
- Decreased inspection/monitor costs
- Improved ability to meet production goals
- Reduced product loss
- Shorter equipment life cycles and expensive replacement
- Asset preservation goes direct to bottom line
- Increased mean time between maintenance (MTBM) = Lower labor costs
- Fewer environmental releases/fines = Improved public relations
- Decreased employee injuries

Protection from gouging impact

EQUIPMENT EXAMPLE:

A worn crusher allows oversized material to pass downstream, where it will be rejected. The material is sent back for secondary crushing, causing additional time and expense.

equipment affected
DRAG LINE BUCKETS, EXCAVATORS, *AND* ***CRUSHERS***

ABOUT GOUGING IMPACT ABRASION

This type of abrasion is similar to machining with a cutting tool – it cuts a deep furrow or groove into softer metal. Gouging impact abrasion effects the excavation, hauling, and primary crushing phases of mining and ore processing.

HOW IT IMPACTS PRODUCTION

Over time, the surface becomes plastically deformed and work-hardened by the abrasive forces. The deteriorated equipment will fail to work as efficiently, resulting in additional expense and labor

PROTECTION

For new equipment, spend more upfront and purchase equipment made of wear-resistant material (such as Martensitic steel) or purchase lower-grade Austinetic alloy and accept a higher wear rate.

For equipment already impacted by gouging, you can often repair or extend equipment life with protective coatings at a fraction of replacement cost using:

- Weld overlay of selected alloy rod
- Thermal spray coating

BENEFITS

Protection from high-stress grinding

EQUIPMENT EXAMPLE:

A SAG mill experiences wear of mill media and mill liner during grinding phase. Mill media wear reduces grinding effectiveness in the mill and increases the reject rate at the mill discharge/ hydrocyclone.

equipment affected
CRUSHERS** AND **GRINDING MILLS

ABOUT HIGH-STRESS GRINDING

High-stress grinding occurs when an abrasive surface is crushed between opposing faces. The fracturing stress is transferred to the metal surface which results in micro cutting and furrowing.

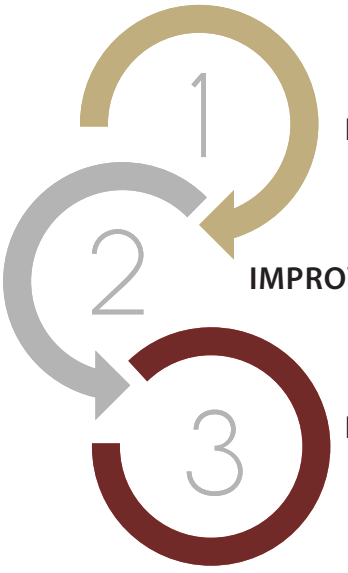
HOW IT IMPACTS PRODUCTION

High-stress grinding abrasion affects milling and grinding phases used to liberate the valuable ore body from the waste (gangue). Metal loss of these systems directly impacts yield and production output.

PROTECTION

- Purchase Martensitic mill liners and mill media
- For damaged equipment, replacement is the best option

BENEFITS



EXTEND asset life

IMPROVE production

IMPROVE worker safety

Protection from low-stress scratching

EQUIPMENT EXAMPLE:

A slurry pump transporting tailing experiences wear at the suction throat, backplate, impeller, and cutwater. Wear at these critical tolerance areas impacts pump performance and efficiency, requiring longer operational cycles to meet plant demand.

equipment affected

SLURRY PUMPS, CHUTES, AGITATORS,** AND **CYLONES

ABOUT LOW-STRESS SCRATCHING ABRASION

This type of wear affects the movement of slurry and other systems where particles move freely across a surface. Unless the metal is hard enough to resist, the particles cut micro furrows and grooves into the surface. Chutes, gravity classifiers, screens and pneumatic conveying systems experience this form of wear.

HOW IT IMPACTS PRODUCTION

Metal loss of this equipment directly impacts yield and production output.

PROTECTION

Ideally, purchase Martinistic steel equipment upfront for maximum resistance.

Equipment Repair with Coatings

Begin by tearing down the equipment and inspecting the pump/equipment for critical wear areas. There are typically three choices for repair:

- Alumina Ceramic tile inserts affixed by chemical adhesives
- Pre-molded Rubber Elastomers
- Ceramic-Reinforced Polymers: This option provides the wear resistance of ceramic tile and the ductility of a rubber elastomer

RESULTS

*Pump efficiency based on Chesterton case studies

Protection from chemical attack

EQUIPMENT EXAMPLE:

A clarifier thickener tank can become corroded, reducing mill water availability. Leaks can cause hazardous and costly environment spills that result in fines and employee safety issues.

equipment affected

GAS HANDLING FANS** AND **DUCTING, STRUCTURAL STEEL, SECONDARY CONTAINMENT** AS WELL AS **DRAINAGE SUMPS** AND **TRENCHES

ABOUT CHEMICAL ATTACK CORROSION

This is probably the lowest rated form of attack on metal equipment and structures based on severity and its impact on plant performance. Electrochemical corrosion is a reaction (oxidation or neutralization) between the surface (metallic or cementitious) and the chemical environment (fluid or gaseous). Heat will accelerate this reaction and hasten the rate of corrosion.

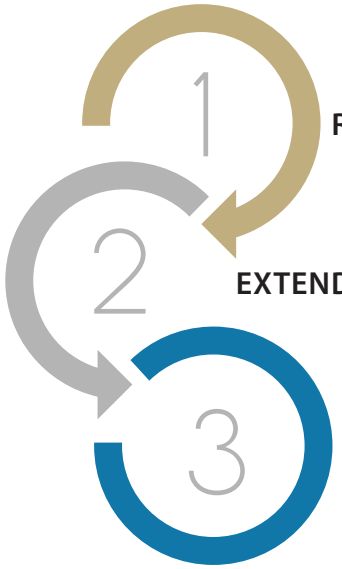
HOW IT IMPACTS PRODUCTION

Loss of integrity in the metal can result in leaks, resulting in environmental fines and costly product losses. New tanks can be prohibitively expensive.

PROTECTION

Protect your capital investment upfront by using a reinforced polymer coating.

RESULTS



REDUCE risk of environmental release

EXTEND asset life

REDUCE maintenance costs

Conclusion

Using some or all of these technologies can improve asset optimization and lower total cost of ownership, while improving reliability and availability of the required equipment. To gain the best possible outcome the process should:

- Begin with an assessment of current asset maintenance practices
- Create a prioritized list of critical equipment, and its performance and impact on overall plant productivity.

Once this is accomplished, a process to establish best practices by using subject matter expertise along with a well-planned technology rollout is ideal. This plan should be followed by periodic inspection and refinements. Together these efforts can yield dramatic improvements.

LEARN MORE

We hope this information helps you in your day-to-day operations. If you have any questions, feel free to contact the author or our Ask an Expert team of application engineers.

FOR MORE INFORMATION

ARC Efficiency & Protective Coatings

A.W. Chesterton Company

How to Select Protective Coatings for the Mining Environment

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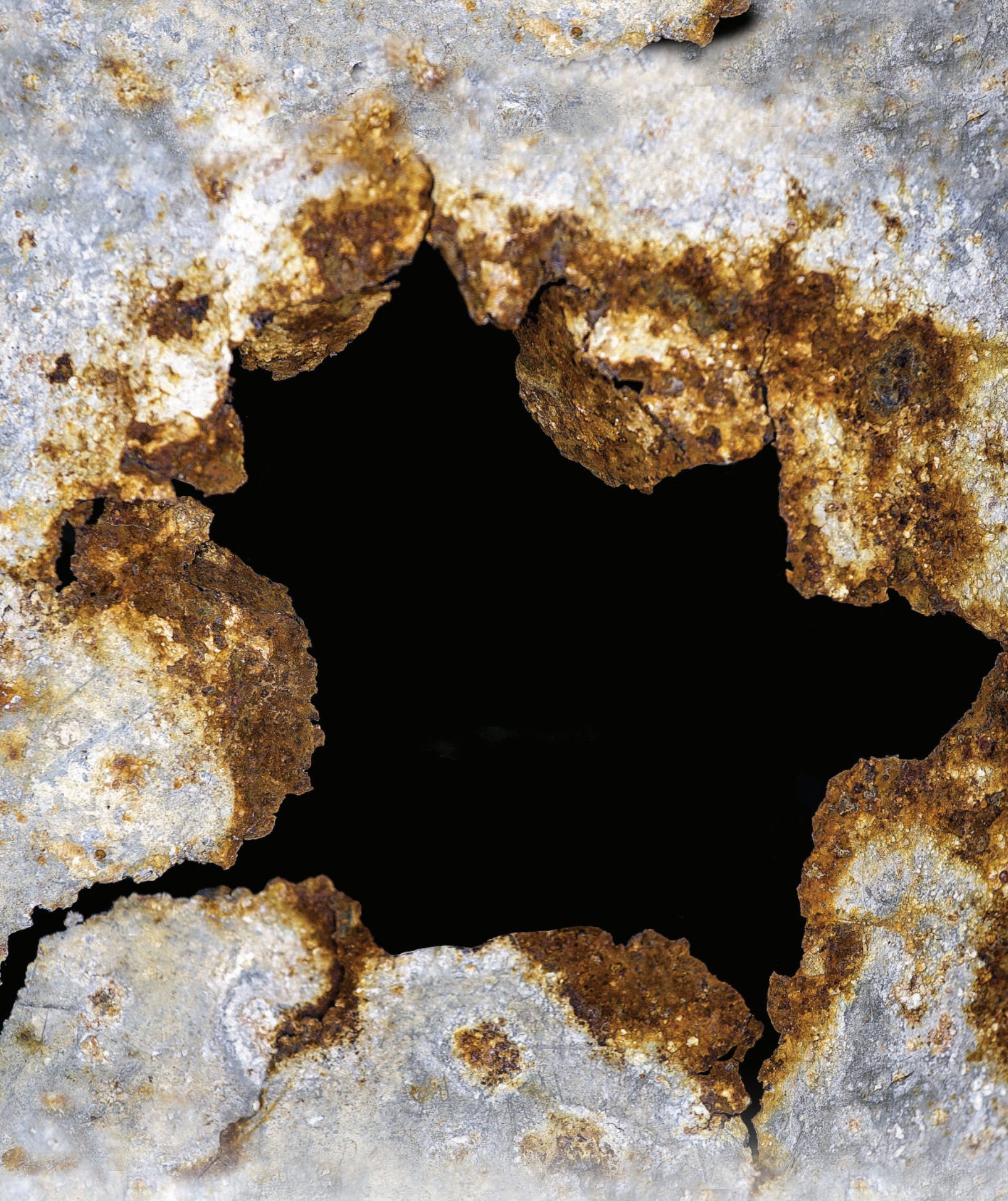

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