

# Mining-metallurgical **waste management**

## Tailings Management

Managing our mining and metallurgical waste responsibly and effectively is essential to maintaining stakeholder trust and executing our business strategy. Peñoles manages Tailings Storage Facilities (TSFs) responsibly, adopting best engineering and governance practices with the goal of zero harm to people and the environment.

## Governance

Our governance structure defines and documents the roles, competencies, responsibilities, and accountabilities of the teams involved in the safe and effective management of TSFs throughout their life cycle—design, construction, operation, maintenance, and oversight. It incorporates the recommendations of leading practice guides from the International Council on Mining and Metals (ICMM) and the Mining Association of Canada (MAC).

The Board of Directors is committed to protecting public health, safety, and the environment. Our Tailings Policy, endorsed by the Board, instructs senior management to ensure that every member of the Operating Group continues to:

- Implement all reasonable measures to safely manage tailings and minimize potential harm
- Allocate appropriate resources to support tailings management, including facility closure
- Implement and uphold an effective Tailings Management System (TMS), ensuring that all employees, contractors, and consultants adhere to it.

The CEOs of Peñoles and Fresnillo are designated as the Accountable Executives (AEs) by the Board, responsible for ensuring the responsible management of TSFs through sound governance and engineering practices.

*Peñoles manages Tailings Storage Facilities (TSFs) responsibly, adopting best engineering and governance practices.*



Water stewardship

Biodiversity

Mining-metallurgical waste management

Waste management

Air quality

Mine closure



**I. Site Management:** The General Manager (GM) of each mine is the risk owner and is accountable for operating the TSF in accordance with our TMS. The Responsible Tailings Facility Engineer (RTFE) and a qualified Engineer of Record (EoR) provide technical expertise to ensure safe facility management. The tailings management and operations teams work together to implement the TMS and operate safely.

**II. Corporate Tailings Team (CTT):** This team oversees the TMS and advises the AEs on the designation of EoRs and external reviewers for Dam Safety Reviews (DSRs), as well as coordination with the Independent Tailings Review Panel (ITRP).

**III. External Reviewers:** Independent experts, inspectors, reviewers, and auditors support our governance framework by confirming compliance with best engineering and governance practices. The review process includes evaluations by the ITRP, dam safety inspections by the EoR, and third-party safety reviews.

**IV. Tailings Review Committee (TRC):** This committee—composed of senior management and led by the AEs—provides internal oversight of TSF governance and operations. It engages independent experts to review operations, inspections, audits, and governance processes.



*Our governance structure defines and documents the roles, competencies, responsibilities, and accountabilities of the teams involved in the safe and effective management of TSFs throughout their life cycle—design, construction, operation, maintenance, and oversight.*

## Policies and guidelines

Peñoles' Tailings Policy and TMS guidelines offer a consistent, company-wide approach to managing TSFs throughout their life cycle. These documents establish clear expectations for roles and responsibilities.

Talings Policy

Guidelines for the Tailings Management System

## Context and strategic considerations

### Tailings

Tailings are a byproduct of mineral processing. Mineral is crushed and milled using water to liberate the ore, creating a slurry from which valuable minerals are separated. The residual material, or tailings, is transported to TSFs or repurposed for backfilling underground workings or as construction material.

### Stakeholder trust

Although most of the mining industry has responsibly managed TSFs, catastrophic failures—such as those in Fundão (Mariana) and Feijão (Brumadinho), Brazil—have severely impacted public trust. These events, while rare, have had unacceptable consequences for people and the environment. As a result, stakeholders now expect zero harm. Therefore, responsible management is essential for maintaining trust from communities, workers, governments, investors, and insurers.



### Effective tailings management

Ensuring sufficient storage capacity is critical to mining and metallurgical operational continuity and growth. Effective tailings management is a complex, multidisciplinary process involving best engineering practices and strong governance at every stage—from planning, design, and construction to operation, maintenance, monitoring, and post-closure. It also requires social best practices, including community engagement throughout the TSF life cycle.

### Global Industry Standard on Tailings Management (GISTM)

We recognize the relevance and value of GISTM to the industry. Peñoles is currently developing and implementing a TMS based on the state-of-the-art guidance from the Mining Association of Canada (MAC) and the International Council of Mining and Metals (ICMM), as well as documents from the Canadian Dam Association (CDA).

These technical resources will enable us to align with many GISTM principles. Although we do not currently plan to adopt GISTM formally, we are actively monitoring our progress and industry developments and remain open to evaluating future adoption.

### Impact, risk, and opportunity management

Our goal is zero harm to people and the environment. We manage impacts, risks, and opportunities by applying best governance and engineering practices to design, construction, operation, closure, and post closure of TSF, guided by a comprehensive Tailings Management System (TMS).

Maintaining the highest safety and environmental protection standards for TSF is an ongoing process that requires constant evaluation throughout the facility's life cycle. Standards for design, construction, monitoring, maintenance, and external review specify the protection of human health and the environment and establish parameters for closure of mining operations.

We apply the following basic principles to achieve a culture of safe tailings management throughout our facilities' life cycle:

- i. **Accountability, Responsibility, and Competence:** Defined responsibilities and competencies to identify and manage facility risks
- ii. **Planning and resourcing:** Ensuring necessary financial and human resources for the continuous management and governance throughout the facility's life cycle
- iii. **Risk management:** Identifying risks, establishing control systems, and verifying performance targets. We apply a "critical controls" approach (see Safety section)
- iv. **Change management:** Evaluating, controlling, and communicating risks related to changes that could impact facilities' safety
- v. **Emergency preparedness and response:** Recognizing and responding to imminent failures and mitigating the impacts of a catastrophic failure
- vi. **Review and assurance:** Internal and external reviews to evaluate and continuously improve risk controls
- vii. **Meaningful community involvement:** Engaging communities to address questions and concerns, and plan visits to the facilities to learn about these infrastructures and responsible operating practices.



Water stewardship

Biodiversity

Mining-metallurgical waste management

Waste management

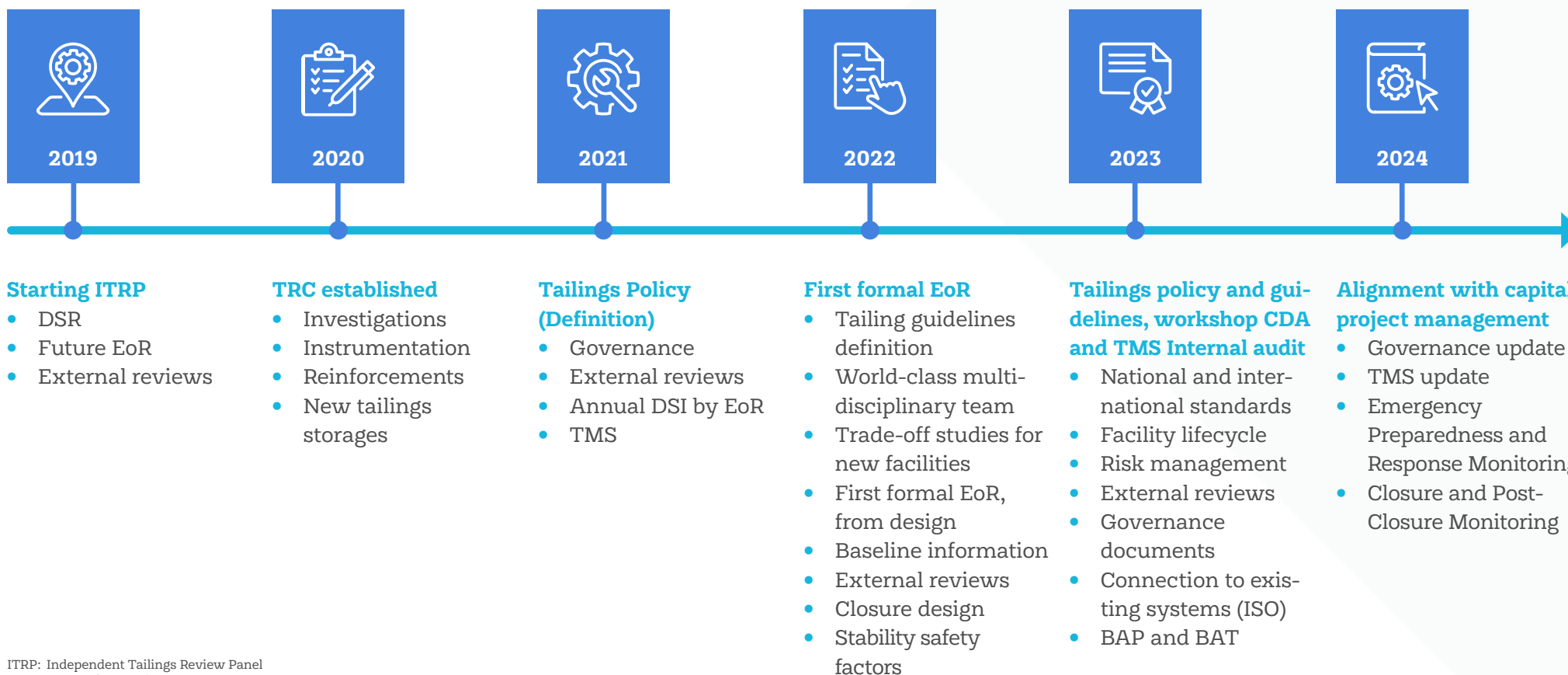
Air quality

Mine closure

### Tailings Management System

Our TMS provides a robust framework for the governance and application of engineering best practices. The TMS plays a key role in effective com-

munication to address risks and to ensure sound decision-making. This system is aligned with our Tailings Policy and is applied throughout the life cycle of a Tailings Storage Facility.



ITRP: Independent Tailings Review Panel  
 DSR: Dam Safety Review  
 EoR: Engineer of Record  
 TRC: Tailings Review Committee  
 DSI: Dam Safety Inspection  
 CDA: Canadian Dam Association  
 TMS: Tailings Management System  
 BAP: Best applicable practices  
 BAT: Best available technology



We continue to develop the risk management elements of the TMS. The Fresnillo, Saucito, Juanicipio, and Velardeña facilities completed their risk assessments using the Potential Failure Mode Analysis (PFMA) methodology. Herradura, Sabinas, and San Julián developed their Dam Breach Analyses (DBA), including simulations to confirm classification based on consequences. Ciénega and Sabinas issued their Operation, Maintenance, and Surveillance (OMS) Manuals, along with the definition of their Triggered Action Response Plans (TARPs), which correspond to the critical controls implemented when the facility's normal operating parameters are exceeded.

In new projects, we use multi-criteria analysis, also known as multi-account analysis, to assess social, environmental, technical, technological, and economic aspects when evaluating potential sites for the construction of mining and metallurgical waste storage infrastructure.

#### **Surveillance, inspections, and geotechnical investigations**

We continuously monitor our sites using complementary systems such as piezometers, inclinometers, topographic controls, drones, InSAR, and other technologies to monitor water and the embankment integrity. The RTFE performs regular

inspections to the facilities, and the EoR conduct periodic Dam Safety Inspections (DSI). Furthermore, we conduct site investigations that include the use of CPT tests to characterize tailings.

#### **Reviews**

The Independent Tailings Review Panel (ITRP) regularly reviews the design, operation, maintenance, surveillance, and governance of our Tailings Storage Facilities and provides input on the EoR performance. In addition, independent experts conduct periodically Dam Safety Reviews (DSR). All findings are submitted to the TRC.

#### **Emergency preparation and response**

TMS require our sites to regularly update the OMS with the definition of their TARPs and Emergency Response Plans. We consider the Potential Failure Mode Analysis (PFMA) and DBA methodologies to plan for the emergency response of extremely unlikely events. We conduct emergency response drills and engage with communities and authorities to communicate our approach to safe management of tailings and foster collaborate on emergency response.

Water stewardship

Biodiversity

Mining-metallurgical waste management

Waste management

Air quality

Mine closure

## Training

Training is key to safe tailing facilities management. We focused our efforts on increasing awareness of our tailings policy and management system guidelines, as well as other related topics, including engineering, governance, and environmental protection. In 2025, we'll concentrate our training efforts in circular economy strategies and technological innovation.

## MIT Global Summit on Mine Tailings Innovation

The summit showcased innovative approaches to tailings management, including reuse and repurposing of tailings for alternative applications, strategies to reduce the volume of tailings generated, and the potential for their complete elimination.

Staff from Corporate Tailings Management, along with the Engineers Responsible for the Ciénega and San Julián tailings deposits, attended the event virtually on September 19–20, 2024. Key takeaways from the summit were shared with other areas of the organization.

## Filtered Tailings and Mine Backfill Workshop

Paterson & Cooke conducted a workshop on filtered tailings and mine backfilling on September 9–10, 2024, in Torreón, Coahuila. The event brought together 25 participants from Peñoles and Fresnillo mining operations, as well as representatives from Projects and Construction, the Center for Research and Technological Development, and the Health, Safety, and Environment departments.

On September 12, Paterson & Cooke also held an executive session on the same topics for members of the Tailings Review Committee.



## Technology and innovation

Our approach to technology and innovation is guided by the strategic priorities and maturity level of each technology. We focus on three key strategic lines:

- i. Enhancing Safety:** Implementing surveillance, monitoring, and alert systems (e.g., InSAR, drones, data analytics)
- ii. Improving Operational Efficiency:** Advancing downstream processing technologies, such as paste and filtered tailings
- iii. Reducing Environmental Risks and Footprint:** Developing upstream processing technologies aimed at selective processing, and reducing water and energy consumption.

Water stewardship

Biodiversity

Mining-metallurgical waste management

Waste management

Air quality

Mine closure

### Case Study – Natural tailings drying in Velardeña

A new tailings storage facility (TSF) is planned to support the remaining life of mine (LOM) at Velardeña. Tailings will be stored with low moisture content—just enough to achieve optimal compaction—enabling the development of a dry stack TSF. This approach enhances safety and stability, results in a more compact structure, and reduces the facility’s overall footprint compared to conventional tailings storage methods.

Although the evaluation of tailings filtration indicated it was not economically viable, Velardeña’s favorable climate supports natural tailings drying. The current TSF is divided into multiple cells, allowing tailings to be deposited as pulp in the first cell, dried in the second, and excavated from the third for transport and placement in the dry stack.

Permitting for the new facility is currently underway, with construction expected to begin before the end of 2025. The projected capacity of the facility is 27 million tons of tailings.



### Case Study – Extended capacity and reuse tailings in Sabinas

In recent years, Sabinas has made significant investments to enhance the safety factor of Tailings Dam 4. With this objective achieved, the site proceeded with the construction of a new embankment raise to extend storage capacity and support two additional years of operation.

The current raise is being constructed using tailings generated by the processing plant. Through hydrocyclone separation, coarser particles are selected for embankment construction, with strict control over layer thickness and compaction. A total of 180,000 m<sup>3</sup> of tailings will be reused in this process, promoting circularity, reducing the need for additional tailings storage, and eliminating the use of borrow materials.

### Case Study – Fresnillo and Saucito storage tailings extended

Both units have faced significant challenges in developing new tailings storage facilities, primarily due to land acquisition and permitting constraints. Despite this complex context, cost-effective short- and medium-term solutions have been identified.

Drawing on the robust data and insights gathered from studies and research conducted over the past three years, the design of the existing facilities has been optimized. These expansions align with the stability and safety standards established in our Tailings Management System.

As a result, the San Carlos Tailings Facility in Fresnillo has extended its capacity through the second half of 2026, while the Saucito Facility will now support operations through the second half of 2028.

## Performance and metrics

### Investment

In 2024, investment efforts shifted toward the development of new tailings storage capacity. This contrasts with the previous three years, during which investments primarily focused on geotechnical investigations, technical studies, and construction projects aimed at reinforcing existing facilities.

Total investment in 2024 reached \$83.0 million, with \$66.5 million allocated to 11 construction projects and \$16.5 million directed toward six projects in the pre-feasibility or feasibility stages. Notable projects include the construction of Cell 2 of the Juanicipio Tailings Deposit, second and third raises of the San Carlos at Minera Fresnillo, Phase II of the Saucito Deposit, and the expansion of the Velardeña Tailings Deposit.

### Production and reuse of tailings (circularity)

We continue to rigorously monitor the volume of tailings deposited across our facilities to assess storage capacity and forecast remaining operational life. In 2024, 20.92 million tonnes of tailings were generated. Of this total, 0.65 million tonnes were reused as paste backfill; 1.28 million tonnes were employed for construction and backfill of inactive mine workings; and 1.4 million tonnes were reprocessed to recover metallic content.

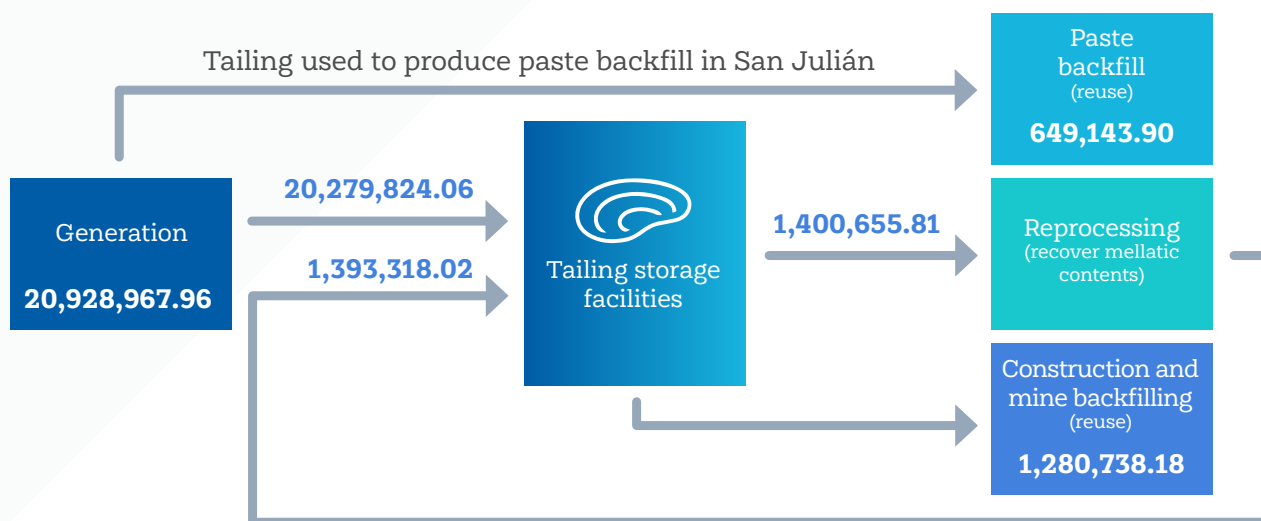
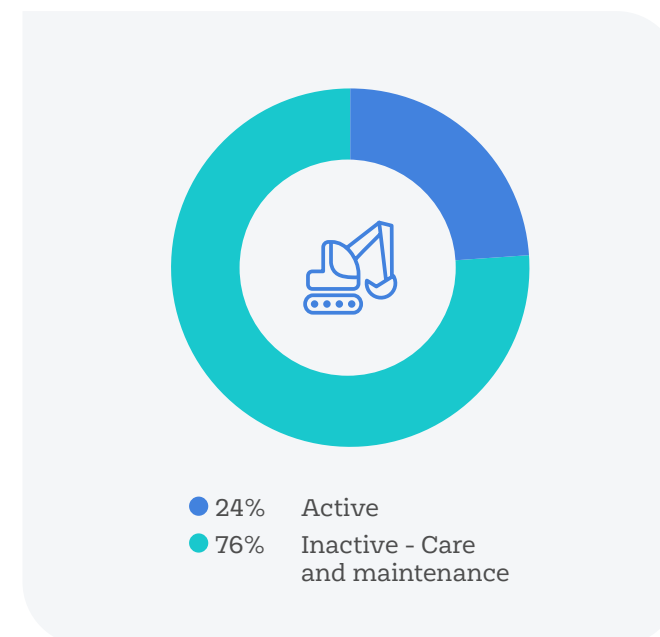
*We reuse the equivalent of 9.22% of the tailings generated, representing savings in storage requirements and increasing the life of the tailings storage facilities.*

*We reprocess and reuse the equivalent of 15.37% of the tailings deposited, confirming our commitment to circular economy and seeking a second life for our waste.*

### Tailings generation (tonnes)

2024	
Company	Tailings
Peñoles Mines	5,186,498.23
Fresnillo plc Mines	15,742,469.73
<b>Industrias Peñoles</b>	<b>20,928,967.96</b>

### Status of Tailings Storage Facilities



All figures reported in tonnes. The difference between the input and output of the reprocessed material represents the mineral concentrate obtained.

Water stewardship

Biodiversity

Mining-metallurgical waste management

Waste management

Air quality

Mine closure



### Waste rock piles, heap leaching, and jarosite deposits

In 2024, a total of 24.22 million tonnes of ore were placed on heap leaching pads for processing. During the same period, 80.71 million tonnes of waste rock were generated, and 0.69 million tonnes of jarosite were disposed of in safe storage facilities. These facilities are managed under a system inspired by best practices learned for the safe handling of tailings.

We apply rigorous engineering standards—such as the use of impermeable barriers—and implement robust monitoring programs, including groundwater wells and regular water quality testing, to ensure full compliance with environmental regulations.

### Waste rock, heaps leaching and jarosite generation (tonnes)

2024			
Business division	Waster rock	Heap leaching	Jarosite
Peñoles Mines	4,104,284.50	2,226,336.18	-
Fresnillo plc Mines	76,608,132.70	21,989,426.89	-
Metals	-	-	689,151.00
<b>Industrias Peñoles</b>	<b>80,712,417.20</b>	<b>24,215,763.07</b>	<b>689,151.00</b>



### Waste rock

In mining operations, barren rock must be removed to access ore bodies. These rocks, which have no economic value, are transported and stored in designated piles for either permanent or temporary storage. When feasible, waste rock is reused—for example, as backfill material in underground cut-and-fill operations.

## Heaps leaching

Gold and copper oxides are processed using a hydrometallurgical method known as heap leaching. The ore is placed on leaching pads constructed with an impermeable barrier—typically high-density polyethylene (HDPE) geomembrane—at the base. A leaching solution percolates through the heap, dissolving the metals, and is then collected by the barrier and directed to a processing plant. There, the metals are recovered and refined into doré bars or copper cathodes.



## Jarosite deposits

Jarosite is a byproduct generated during the hydrometallurgical extraction of zinc. Once stabilized, it is stored in dedicated deposits similar to engineered landfills. These facilities are constructed with impermeable barriers at the base to prevent any potential environmental impact.

## Acid Mine Drainage (AMD) prevention

AMD represents a significant environmental challenge and a critical issue for the social license of the mining and metallurgical industry. Preventing and managing AMD is essential to minimize its potential impact on surface and groundwater resources during both mine operations and post-closure phases.

We fully comply with environmental regulations, including conducting geochemical testing to assess the AMD potential of ore minerals and waste rock, as well as evaluating the stability of jarosite. In operations identified with AMD risks, we implement site-specific management strategies designed to prevent, treat, and monitor AMD, ensuring long-term environmental protection.

## Reportable and significant incidents related to mining-metallurgical waste

In 2024, we reported no incidents of non-compliance with water quality permits, standards, or regulations concerning tailings, waste rock piles, heap leaching pads, jarosite deposits, or acid mine drainage.

Company	Reportable Incidents	Significant Incidents
Peñoles	0	0
Fresnillo plc	0	0