Case Study

Brazil Zinc Mine Tailings Optimisation

At a Glance

A leading zinc mining and refining operation in Brazil faced an urgent tailings storage crisis, with both of its tailings storage facilities (TSFs) nearing full capacity.

Regulatory constraints and the high costs of conventional dewatering solutions, such as filtration and thickening, made expansion unfeasible, threatening early closure of the site.

By implementing Accelerated Mechanical Consolidation (AMC®), the mine was able to rapidly increase storage capacity, recover entrained water, and improve the geotechnical stability of the TSFs.

Key Metrics

By leveraging AMC, the mine optimised tailings management, deferred costly expansions, and ensured continued production while meeting environmental and regulatory standards.

- **Total storage recovery:** 196,585 m^3 in 9 months (4,095 m^3/ha)
- **Annual recovered capacity:** 235,902 m^3
- **Storage requirement reduction:** From 1,100,000 to 470,000 m^3/year (57% decrease)
- **Operational life extension:** +3.5 years without new TSF construction

Challenge

WithTSF B already at its limit and TSF A projected to reach capacity within two years—faster than expected. Regulatory hurdles prevent the timely approval of new storage solutions, and conventional dewatering technologies, such as filtration and thickening, are unviable due to high costs and land-use restrictions. Without a viable solution, the entire zinc complex is at risk of early closure.

Traditional tailings management methods, including natural consolidation and drainage, have proven insufficient due to site-specific challenges like excessive deposition depth, low beach angles, and poor water recovery. A more effective and rapid consolidation method is required to extend the operational life of the TSFs and avoid production shutdown.

Solution

Phibion deployed its MudMaster® fleet to conduct AMC, utilising a two-stage dewatering and consolidation process. During the recovery phase, the first layer of tailings was consolidated, establishing a high-strength working surface. This process enhanced traction and mobility for the equipment, significantly increasing operational efficiency. Initial material strength was low, so careful water drainage was required before achieving consolidation.

In the production phase, the MudMaster applied cyclic loading, which increased pore pressure and forced excess water out of the tailings. This step led to a significant improvement in both the dry density and shear strength of the material. The process also prevented surface crust formation, which can trap water and hinder consolidation.

Operational & Financial Benefits

1. **EXTENDED TSF LIFESPAN BY 3.5 YEARS**
   without raising dams or building new facilities
2. **ENABLED REGULATORY COMPLIANCE**
   by maintaining safe geotechnical conditions
3. **DEFERRED MULTI-MILLION-DOLLAR CAPITAL COSTS**
   associated with new tailings infrastructure

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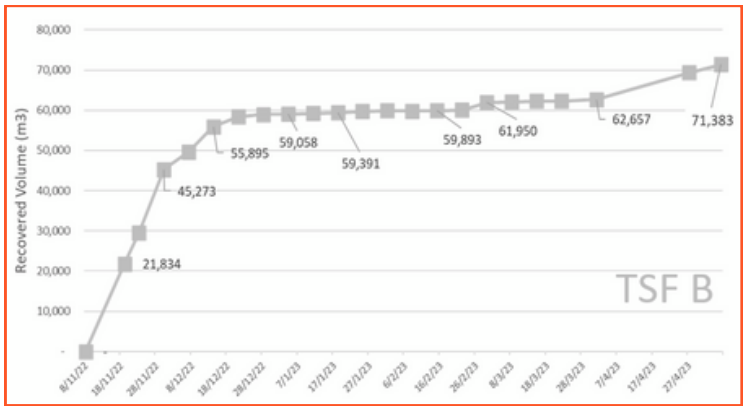
Recovering TSF Storage Capacity

TSF A - 21 hectares

Application of in-situ mechanical consolidation on TSF A successfully recovered a total storage capacity of 125,202m^3 or equivalent to **5,962m^3/Ha**.
At the end of the application the average tailings undrained shear strength >40kPa at 0.5m deep.

TSF B - 27 hectares



At TSF B an additional storage of 71,383 m^3 which is equivalent to **2,643m^3/Ha.**
The additional volume was generated with tailings developing a minimum shear strength of >50kPa (@ 0.2m) and >70kPa (@ 0.5m).

TSF A material strength improvement through AMC cycle.

(a) MudMaster working tailings surface providing dewatering

(b) In-situ inspection and testing on foot after shear strength is found to be over 40 kPa.

(c) and (d) Pictures with material strength >50 kPa

By leveraging AMC and in-situ mechanical dewatering, the zinc mine transformed its tailings management strategy, improving storage efficiency, geotechnical stability, and cost-effectiveness. This approach ensured continued operations, deferred costly TSF expansions, and minimised environmental risks, **setting a new benchmark for sustainable tailings solutions.**

Contact Phibion:

info@phibion.com
+61 1300 683 627
www.phibion.com

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Intelligent tailings management

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