NALCO Water
An Ecolab Company

Nalco Water's Tailings Management Technology and Rheology Modifier Help Copper Mill Increase Throughput, Reduce Annual Reagent Costs by $14M

CASE STUDY

BACKGROUND

With the surging global demand for copper, driven by the expansion of renewable energy infrastructure, artificial intelligence technologies, and hyperscale data centres, mining operations are under increasing pressure to increase the production of copper. This inherently leads to an increased need to process higher volumes of run-of-mine (ROM) ore. This escalation in processing volume often exposes critical bottlenecks within the concentrator circuit, particularly in the tailings thickening stage. The tailings thickener plays a pivotal role in water recovery and recirculation to the grinding and flotation circuits. However, elevated throughput rates can compromise tailings rheology, leading to reduced flowability and suboptimal settling performance.

A major copper mining operation in the Southwestern US faced persistent operational inefficiencies due to poor tailings flowability within its gravity-fed tailings launder system. Unlike conventional closed slurry pipelines driven by centrifugal pumps, this site utilised open-air troughs to transport tailings from the flotation circuit to the thickening units. The system relied solely on gravitational force, making it highly sensitive to changes in slurry characteristics.

To meet aggressive throughput targets, the plant routinely processed coarse ore fractions. However, the coarse particles exhibited poor fluid transport behaviour, leading to premature settling within the launders. This accumulation formed sediment beds that restricted flow, ultimately causing water to overflow from the launder system. The resulting spillage not only drove the customer to reduced operational throughput but also required frequent manual clean-up and introduced safety hazards across the plant.

To address the issue, the site increased lime addition to 80–100 g/t to improve slurry dispersion and maintain flowability. While this approach temporarily alleviated the problem, it incurred reagent costs exceeding $1.2 - $1.5 million per month. The lime also added carbonate scale in the vessels, increasing the need for cleaning and maintenance.

Recognising the need for a more cost-effective and scalable solution, the customer engaged the local Nalco Water sales team. The objective was to identify a chemistry or process optimisation strategy that could maintain high solids transport efficiency without excessive reagent consumption.

By resolving the tailings transport bottleneck, the customer aimed to sustain elevated throughput levels, minimise unplanned downtime, and maximise annual copper recovery. The engagement underscored the critical role of Nalco Water in ensuring continuous plant-wide process optimisation, making us a highly reliable partner in mineral processing operations.

eROI℠ by Ecolab

ANNUAL SAVINGS

PRODUCTIVITY

20% recovery
in throughput capacity

PRODUCT OPTIMIZATION

$14 Million
saving on reagent costs

TOTAL VALUE DELIVERED

$20 million

SOLUTION

To gain a comprehensive understanding of the operational challenge, the Nalco Water technical team initiated a full-system survey and conducted on-site consultations with the plant's tailings engineer. This collaborative diagnostic approach revealed that the core issue stemmed from unfavorable slurry rheology, which impaired flowability in the gravity-fed launder system.

Leveraging Nalco Water's portfolio of rheology control technologies, the team identified the need for a chemistry that would counteract the natural settling behaviour of coarse particles—essentially performing the inverse function of a flocculant. Laboratory-scale reagent screening was conducted using settling rate tests. A dosage range of 10–50 ppm (30-150g/t) was evaluated, and slurry bed height measurements were taken post-agitation using a standardized plunger method, to quantify settling behaviour and dispersion of sand in the settled slurry. The laboratory jar tests confirmed that Nalco Water's proprietary rheology modifier, 106RM, delivered superior performance in maintaining particle suspension and minimizing bed formation.

To validate the laboratory settling rate tests, Nalco Water and the customer implemented a full plant trial. The dosing strategy was engineered to introduce the reagent at the upstream entry point of the raceways, prior to the tailings entering the launder system. This ensured optimal mixing and dispersion, effectively preventing solids deposition in both the raceways and the launders. The approach enabled consistent flow, reduced overflow incidents, and eliminated the need for excessive lime addition.

Performance was monitored using a laser-based slurry level measurement system, which tracked the vertical distance between the slurry surface and a fixed reference point. The trial was performed with an on-and-off-again format to verify if the effects were truly due to the product addition, or due to normal fluctuations in the process. Each time the product was turned off, the symptoms returned, and each time dosing was resumed, the symptoms were eliminated.

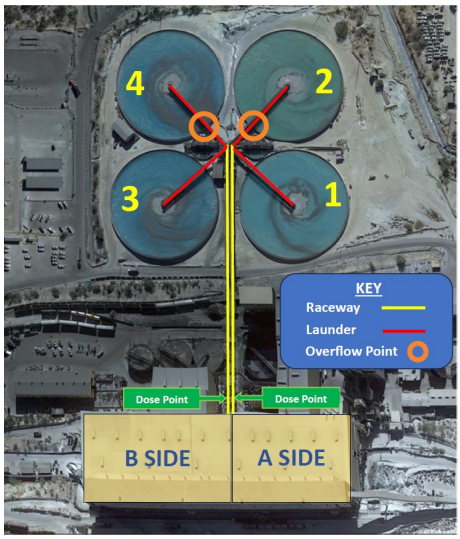

FIGURE 1: Site setup and Nalco Water dosage points for the tailings launder solution.

RESULTS

The process performance results and economic benefits from the Nalco Water solution were apparent to the customer.

Process Efficiency: The application of Nalco Water's tailings launder solution resulted in a decrease in slurry height in the troughs. The impact of the launder solution was immediate. Within a single shift, overflow was eliminated, slurry levels normalised, and the trial was deemed successful. The customer managed to increase throughput capacity by 20%, allowing the plant to operate at the targeted 4500t/h. This translates to a $6 million increase in revenue gained through increased copper production. No negative downstream impacts were observed in the thickeners at a 106RM dosage of 10g/t. The settling rate of materials in the thickener was unchanged, and there was no additional flocculant demand.

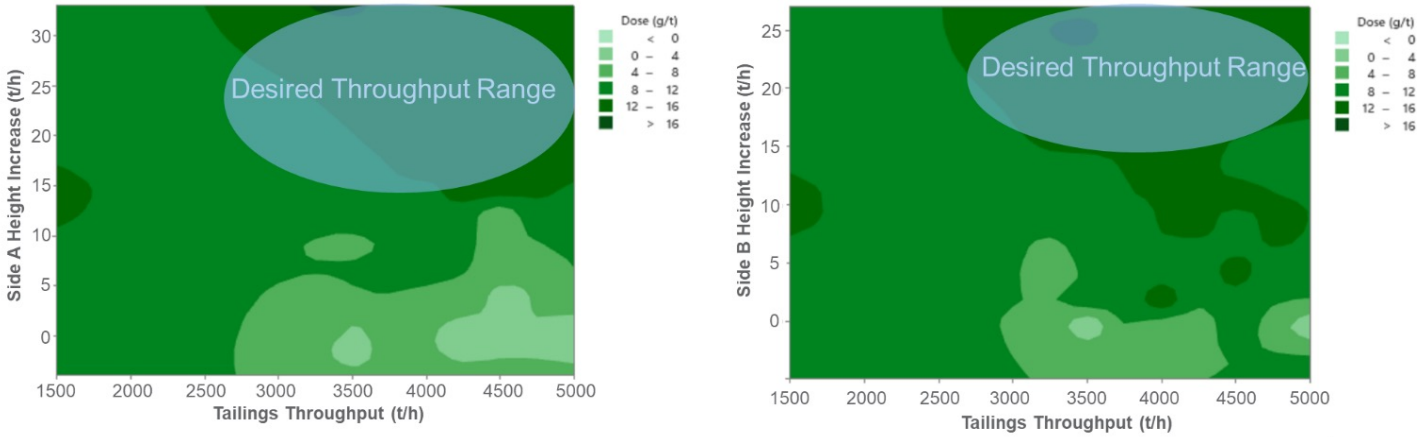

FIGURE 2: Mapping of throughput capacity vs the change in height between the slurry surface and a fixed point above the slurry surface. This distance was measured using a laser distance measuring device.

Operational Cost Efficiency: With Nalco Water's rheology modifier for the launder system, the customer realised annual reagent costs savings of $14 million. This value was delivered because of the significant reduction in dosage requirements by 80-90% from 80-100 g/t to 10g/t whilst realizing the desired technical benefit.

Test No.	106RM Dose	Settling Rate
1	0g/tonne	15.3 ft/hr
2	150g/tonne	9.4 ft/hr
3	90g/tonne	10.2 ft/hr
4	30g/tonne	14.2 ft/hr
5	0g/tonne	19.1 ft/hr
6	600g/tonne	5.6 ft/hr

CONCLUSION

The implementation of the tailings launder solution to enhance the transportation of tailings through open troughs to the thickener section yielded measurable operational benefits. Specifically, the intervention resulted in increased tailings throughput and a reduction in reagent consumption per tonne of ore processed, thereby contributing to lower reagent-related operating costs. Following the successful deployment at one of the customer's mining operations in the southwestern United States, the solution has been replicated at two other sites with consistent performance outcomes.

Nalco Water's post-implementation service model continues to support ongoing optimisation through sustained on-site presence, enabling the service team to conduct regular discovery engagements, proactively identify operational challenges, and collaborate with the customer on tailored solutions.