

Nalco Water clay dispersant—NALFLOTE™ 600.05—boosts molybdenum concentrate grade, adding \$2M in annual revenue

CASE STUDY

▶ BACKGROUND

The growing global demand for copper has driven mining operations to exploit mineralogically complex deposits. These deposits typically have low grades and are characterized by the presence of clay gangue minerals, which are ubiquitous porphyry copper ores. Given that approximately 50% of the world's copper produced via flotation originates from porphyry deposits, the challenge posed by clays is significant and requires innovative solutions.

A major copper mining operation in the Southwestern United States encountered difficulties in achieving the required molybdenum grade in its final concentrate. To meet Grade C molybdenum specifications, the concentrate must contain less than 4% insoluble matter. The inability to meet this specification is attributed to clay-based insoluble minerals reporting to the final concentrate, rendering the cleaning stage ineffective.

▶ SOLUTION

To gain a comprehensive understanding of the operational challenge, the Nalco Water technical team conducted a full system survey and engaged in on-site consultations with the plant's metallurgical team. A review of the plant's flotation circuit philosophy, which prioritizes meeting Grade C molybdenum in the molybdenum cleaning stage, highlighted the need to evaluate novel polymer-based solutions in both the rougher flotation bank and the cleaner circuit of the molybdenum plant.

Nalco Water experts selected a NALFLOTE polymer chemistry designed to perform under the circuit's operating conditions.

In an attempt to address this issue, the customer applied sodium silicate as a dispersant. However, this approach failed to deliver any improvement in metallurgical performance. On the contrary, sodium silicate caused operational challenges, including silicate scaling in-process equipment and inadvertent solids settling in various process units. Consequently, the customer discontinued the use of sodium silicate in the flotation circuit.

Recognizing Nalco Water's success at applying alternative dispersants at another site within the same corporate group, the customer engaged Nalco Water to develop a solution. The objective was to identify a chemical program that would enhance flotation performance in the molybdenum circuit. The key performance indicators included improving molybdenum grade without incurring significant molybdenum losses.

Polymers from the new range of NALFLOTE clay dispersants were tested in hot float bench-scale tests using the bulk copper molybdenum concentrate. A dosage profile between 100–200 g/t was evaluated, with the dispersant prepared as a 5% solution to ensure efficient reagent dispersion. All other reagents were maintained at standard dosages to isolate the effect of the dispersant. Laboratory tests confirmed that Nalco Water's proprietary clay dispersant, NALFLOTE 600.05, significantly improved molybdenum grade.

To validate these findings, Nalco Water and the customer initiated a full-scale plant trial.



ANNUAL SAVINGS



QUALITY

1% grade
reduction of insoluble gangue



PRODUCT OPTIMIZATION

\$500,000
savings on silica
scale hydroblasting



TOTAL VALUE DELIVERED

\$2,500,000

The dosing strategy targeted points of high turbulence to maximize reagent dispersion.

Two dosing locations were selected:

1. Upstream entry point of the raceways, prior to tailings on the feed line to the molybdenum rougher section bank, dosing reagent on the concentrate from the bulk flotation circuit
2. Third conventional cleaner cell, just before final concentrate upgrading in column cells

The trial aimed to determine whether dosing in both rougher and cleaner circuits yielded superior results or if cleaner-only dosing was more efficient in terms of performance and reagent consumption. The trial was executed in an on/off format to confirm that observed effects were attributable to the dispersant rather than normal process variability.

Performance was monitored through composite sampling of feed, concentrate and tails during each shift. Grade and recovery data were statistically analyzed to assess significance. Results demonstrated a clear correlation: whenever dosing was stopped, performance deteriorated; when dosing resumed, the issues were resolved.



FIGURE 1: Nalco Water dosage point setup for the dispersant solution

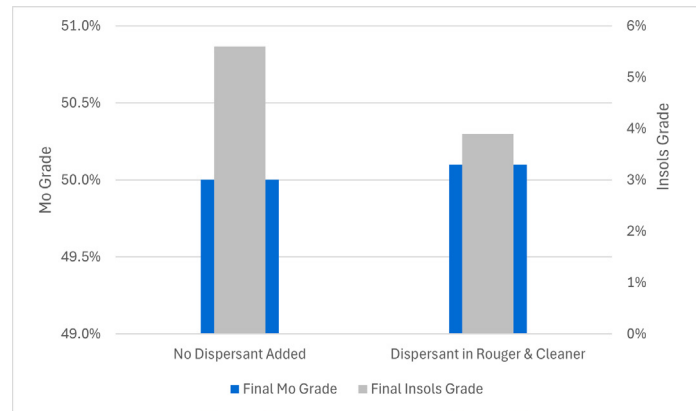


FIGURE 2: A comparison of the metallurgical grade after molybdenum flotation product in the presence and absence of dispersant

Operational Cost Efficiency: With Nalco Water's NALFLOTE clay dispersant chemistry, the plant was able to meet the 4% permissible insoluble grade in the Grade C molybdenum concentrate. Incentives for dispatching Grade C molybdenum concentrate result in a \$2M increase in revenue. Silica scale hydroblasting cost savings amounted to \$500K annually. These results show the strength of Nalco Water's proprietary dispersant chemistry over sodium silicate.

▶ RESULTS

The plant trial flotation results and economic benefits from the Nalco Water solution were apparent to the customer.

Productivity: The application of Nalco Water's NALFLOTE™ dispersant to the molybdenum flotation circuit yielded significant improvement in molybdenum grade at no loss in molybdenum recovery. As illustrated in Figure 2, the grade of insoluble gangue decreased by 1.5 percentage points, meeting the 4% permissible grade. This resulted in reduced penalties for the grade of insoluble gangue in the final molybdenum concentrate for shipment.

▶ CONCLUSION

The deployment of Nalco Water's advanced NALFLOTE dispersant technology delivered quantifiable improvements in flotation performance, evidenced by enhanced molybdenum concentrate grade and a significant reduction in scaling typically associated with sodium silicate-based dispersants. Leveraging the integrated capabilities of Nalco Water's Flotation 360™ flotation program of digitally-enabled insights, specialized chemistry, rigorous onsite service and deep industry expertise, the solution effectively mitigated operational challenges and contributed to increased revenue generation. Building on these results, Nalco Water continues to implement dispersant solutions across molybdenum processing facilities where water quality variability poses a critical risk to flotation efficiency.