



CHALLENGE TITLE

Total Recovery of Minerals in Metallurgical Processes

CHALLENGE DESCRIPTION

In Chilean large-scale copper mining, flotation and leaching processes still present losses of valuable minerals that end up in tailings or residual solutions, affecting metallurgical efficiency, profitability, and process sustainability. This challenge seeks to promote technologies that increase the total recovery of valuable minerals before tailings deposition, minimizing losses and optimizing the utilization of treated ore. Solutions that integrate advanced separation, intelligent monitoring, and online metallurgical control will be prioritized, enabling a more efficient, cleaner, and competitive operation.

GENERAL OBJECTIVE

Contribute to increasing metallurgical recovery in large-scale copper mining through the development and validation of technologies that reduce losses in tailings and residual solutions, optimizing ore utilization before final disposal.

SPECIFIC OBJECTIVES

1. Co-develop advanced separation technologies applicable to flotation and leaching that allow recovery of residual minerals before deposition.
2. Implement intelligent monitoring systems to detect and correct losses in real time.
3. Execute pilots in semi-industrial and operational environments to measure metallurgical, energy, and environmental efficiency.



4. Generate technical guidelines and operating protocols for industrial adoption of total recovery solutions.

EXPECTED RESULTS

- Technical reports with validation results of advanced recovery technologies.
- Substantial improvement in metallurgical recovery and reduction of losses in tailings and solutions.
- Demonstrative pilots of technologies in semi-industrial and operational environments.
- Technical guideline document for industrial adoption.

SCOPE

Includes:

- Technologies with $TRL \geq 4$ applicable to mineral recovery prior to tailings.
- Demonstrations in relevant controlled environments, semi-industrial and operational piloting and validation.
- Evaluation of technical, metallurgical, energy, and environmental performance.
- Studies on integration with process control systems and metallurgical monitoring.

Does not include:

- Proofs of concept and/or laboratory-scale tests $TRL < 4$.
- Solutions focused on revalorization of deposited tailings.



- Solutions that imply additional risks for worker, equipment, or environmental safety.
- Technologies that increase consumption of strategic resources such as water or energy.
- Interventions that negatively interfere with continuity of the production process.

KEY PERFORMANCE INDICATORS (KPIs)

1. Increase in overall recovery of valuable elements such as copper, molybdenum, cobalt, rare earths, or other strategic minerals (%).
2. Specific consumption of strategic resources (water and energy) per ton processed.
3. Accuracy of the intelligent monitoring system (% of loss detection).

DESIRABLE CONTRIBUTION TO ITL CAPACITY BUILDING

- Infrastructure for pilot testing of advanced recovery technologies.
- Generation of validation and technological certification protocols in metallurgical efficiency.
- Training and operating protocols associated with technology use.
- Development of capacities in intelligent monitoring, advanced separation, and metallurgical control.