



CHALLENGE TITLE

Integrated Management of Particulate Matter Emissions in Mining

CHALLENGE DESCRIPTION

Mining operations and tailings generate significant particulate matter emissions due to activities such as comminution, transport, loading, material transfer, and wind erosion. In critical events, these emissions exceed international guideline values, affecting the health of workers, nearby communities, and ecosystems. The challenge seeks to develop and implement an integrated emissions management platform that combines real-time monitoring, source traceability, forecasting, emission composition analysis, and intelligent control. The solution must be integrable with abatement and agglomeration systems, as well as with environmental and mining operation management platforms, contributing to cleaner and safer mining.

GENERAL OBJECTIVE

Contribute to the sustainable reduction of fine particulate matter emissions in mining through the development and validation of an integrated platform for monitoring, traceability, and intelligent control, enabling improvements in occupational health, community relations, and environmental protection.

SPECIFIC OBJECTIVES

1. Co-develop real-time monitoring systems and source traceability of particulate matter in mining environments.
2. Implement predictive and forecasting models to anticipate critical emission episodes.
3. Integrate emissions composition analysis tools with adaptive control systems.



4. Validate the interoperability of the platform with existing abatement, agglomeration, and environmental management systems.
5. Generate technical guidelines and operating protocols for the adoption of the platform in mining operations.

EXPECTED RESULTS

- Integrated platform for particulate matter emissions management validated in operational environments.
- Technical reports with monitoring, traceability, and forecasting results of emissions.
- Indicators of PM10 reduction in critical mining operation zones.
- Integration protocols with environmental and production management systems.

SCOPE

Includes:

- Development and validation of a technological platform for integrated management of particulate matter emissions.
- Validation of predictive models built from satellite data, in situ sensors, and mathematical equations.
- Demonstrations in relevant controlled environments, semi-industrial and operational piloting, and validation.
- Studies on integration with abatement, agglomeration, and environmental management systems.
- Evaluation of technical, economic, and environmental performance.

Does not include:



- Proofs of concept and/or laboratory-scale tests TRL < 4.
- Solutions focused only on particulate matter abatement in specific processes, without addressing mining operations systemically.
- Solutions that imply additional risks for workers, 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. Percentage reduction of PM10 concentrations in critical zones.
2. Number of critical emission episodes detected and mitigated.
3. Level of integration with environmental and production management systems (% interoperability).
4. Response time of the monitoring and control system.

DESIRABLE CONTRIBUTION TO ITL CAPACITY BUILDING

- Integrated technological platform (software + hardware) for emissions management.
- Installation of capacities for testing predictive modeling and intelligent control applied to advanced environmental monitoring.
- Training and operating protocols associated with platform use.
- Data repository and advanced analytics to consolidate historical emission series for environmental reporting and sectoral benchmarking.

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