**Advanced Seiche Hazard Modeling for In-Pit Tailings Storage Facilities Using FLOW-3D**

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# ABSTRACT

This Seiche Hazard Assessment evaluates the potential hazards posed by seiche waves in in-pit tailings storage facilities (IPTSFs). The primary focus is on using numerical simulations and empirical correlations to model seiche wave propagation and overtopping risks.

The study identified 18 failure scenarios based on pit wall stability and tailings deposition. Simulations accounted for various physical phenomena, including wave propagation, run-up, and overtopping, considering tailings as both solid and liquid to represent extreme behaviours.

Key findings indicate that overtopping risks are linked to maximum tailings deposition and extreme rainfall events. Numerical simulations provided detailed insights into wave characteristics, such as wave crest amplitude, wave trough amplitude, and maximum wave height. The most critical scenarios for overtopping were those considering tailings as liquid, revealing significant wave heights and potential inundation extents.

Comparing numerical and empirical approaches showed that both produced results of the same order of magnitude. Numerical simulations offered higher accuracy by considering complex topographic and wave propagation phenomena, while empirical methods provided a quick validation tool, particularly useful for intermediate wave conditions.

The study underscores the importance of using advanced modelling techniques like FLOW-3D to accurately predict seiche hazards and inform risk mitigation strategies. The results are crucial for developing effective emergency response plans and ensuring the safety of operations at IPTSFs. By incorporating these findings into forward planning, operators can better prepare for and mitigate the risks associated with seiche events, ultimately enhancing the resilience and safety of their facilities.

This comprehensive analysis provides valuable insights for mitigating risks associated with IPTSF operations. Continuous monitoring and updating of models to reflect changing conditions are essential for improving predictive accuracy. Leveraging the capabilities of FLOW-3D, the assessment offers a robust framework for understanding and managing seiche hazards, contributing to safer and more efficient tailings storage facility management.