HEAP LEACH SOLUTION TRANSPORT MODELLING FOR IMPROVED PROCESS CONTROL AND PRODUCTION FORECASTING

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ABSTRACT

A dynamic bulk solution transport model has been developed by Element Process and coupled with a leaching model to predict, over time, solution flows and grades in heaps, ponds, solvent extraction and the neutralisation plant of an overseas copper heap leach project.

The model takes into account the ore stacking schedule, ore leach rates, irrigation rates, rainfall and evaporation, changes to on-flow solution and off-flow destination, and chemistry in solvent extraction and neutralisation to provide a comprehensive project-level process model tracking aqueous copper, iron, zinc and free acid.

The model is operated by project staff, and simulation results are used for medium- and long-term planning and process control.

Project mineralogy is primary and secondary copper sulphides hosted in massive pyrite and marcasite. Operators face challenging leach chemistry and extensive solution flow lag due to the topographically-constrained layout of leach pads. In medium-term planning, pregnant leach solution grade predictions by the model feed back into irrigation scheduling and give advanced warning of problems to enable remedial action.

In long-term planning, the model predicts the accumulation of iron, free acid and zinc in recirculating solutions. These results inform the implementation of engineering solutions to prevent problems and add value, and allows process change options to be explored in theory before pilot plants are built to prove the feasibility of any change.

The model's use in short-term planning continues to be explored.

Planning in heap leaching is always challenging due to its inherent semi-batch nature, significant process response lag, and exposure to weather and the environment. As such, potential exists for similar solution models to improve production and compliance outcomes at other sites by providing a practical, site-operated tool for forecasting solution volumes and grades across the operation.

This paper details the development of the bulk solution transport model and its application in a commercial setting.

Keywords: heap leaching, heap leach modelling, dynamic process modelling, residence time distribution, solution transport modelling