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CRYSTALLIZATION FROM BRINE PONDS: SIMULATION HELPS IMPROVE POND PERFORMANCE AND POTASH PRODUCTION

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Abstract

Cooling ponds are used in mining industry to provide relatively adaptable and low energy cost solutions. The performance of these ponds may be compromised due to improper design and control. To optimize pond design and management, a comprehensive three-dimensional computational fluid dynamic (CFD) model has been developed. The model accounts for all the heat transfer mechanisms as well as the heat release by crystallization.

A full-scale case study is presented. The results suggest that the existing pond has strong recirculation zones which reduce the effective surface area for cooling, resulting in reduced cooling performance. Several alternative pond configurations are investigated. Increasing channel outlet width can effectively reduce the recirculation zones and help evenly distribute the flow in the channels. Splitting the brine inflow and operating the ponds with parallel flows appear to reduce cooling performance due to the reduced flow velocities in the channels. Doubling the inflow rate can increase production by about 50%, but with a decrease in KCl yield (KCl production per unit flow) to 75 % of original. The study demonstrated the power of CFD for pond design, evaluation, and troubleshooting.

Key words: Cooling Ponds, Computational Fluid Dynamics, Crystallization, Potassium Chloride, Heat Transfer Mechanisms, Solution Mining, Hydrodynamics.