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Assessment of water quality evolution in filtered tailings storage facilities

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Neutral mine drainage (NMD) and contaminants leaching are common problems at mine effluents. They occur as metal(oids) become soluble in water system of mine tailings at near-neutral pH. Filtered tailings storage facilities (TSF) are particularly prone to contaminants released because of their unsaturated state and continuous interactions with atmosphere. Metal leaching can be made even more challenging in TSF where salinity is high. A potential approach to improve water quality in TSF consists in using waste rock inclusions (WRI) to control contaminants flow and reduce water contamination.

This investigation focused on the hydrogeochemical behaviour of a filtered TSF located in Quebec (Canada) and studied the influence of seasonal fluctuations of temperature and rainfall on contaminant transport and NMD generation. The objective of this research was to predict the flow of contaminants into mine drainage water treatment systems, and estimate the time needed for contaminants to be observed in the effluent after deposition. Laboratory leaching experiments were conducted using medium-scale columns (10 cm radius, 30 cm height) submitted to water flow with constant gradient. The effect of porosity, tailings thickness and degree of saturation, together with temperature were investigated. Reactive transport with contaminants movement simulations were calibrated based on laboratory results.

The outcomes of this study provide new insights on salinity evolution, contaminants interactions and flowrate under the influence of seasonal climatic fluctuations.

Keywords : Filtered tailings, neutral mine drainage, contaminants leaching, mine effluent, salinity, waste rock inclusions, contaminants flow, seasonal fluctuations, reactive transport.