

Simplified Water Chemistry Model for Oil Sands Facilities

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Excessive levels of sodium in oil sands process water may negatively impact both bitumen extraction operations and the mine closure landscape. This paper describes development of a mathematical water quality model that is general and adaptable and can be adopted for use at oil sands extraction and upgrading facilities. The model is coded in a high-level language (Matlab) It can be used to predict the evolution of sodium and chloride concentrations in process water in response to varying ore feed rate and grade, water input, and fluid tailings recycling. This paper outlines the modeling approach and reports on preliminary sensitivity studies for the evolution of sodium concentration in the various model reservoirs. The sensitivity studies indicate that key factors influencing sodium concentration include sodium concentration in the ore, degree of liberation of clays from the ore, addition rate of process aids that contain sodium (caustic) and the volume of water permanently retained in extraction tailings.

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John Swenson is a Senior Environmental consultant with Barr Engineering and an Associate Professor in the Department of Earth and Environmental Sciences at the University of Minnesota Duluth. John's background is in mathematical modeling of fluid flow and heat transfer in a wide range of systems. At Barr, he works on a variety of oil sands topics, including numerical modeling of tailings flows. John's academic research focuses on the dynamics of sediment transport and landscape evolution in river systems, deltas, and coastal environments

