

**The hydrogeology of a tailings impoundment formed by central discharge of thickened tailings: implications for tailings management**

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The Kidd Creek Cu-Zn sulphide mine is located near Timmins, Ontario. Mill tailings are thickened and deposited as a slurry in a circular impoundment with an area of approximately 1200 ha. Deposition of tailings as a thickened slurry from a central discharge ramp results in a conical-shaped tailings deposit with low perimeter dykes, a relatively uniform grain-size distribution, uniform and low hydraulic conductivity, and a tension-saturated zone above the water table up to 6 to 7 m thick. These characteristics provide benefits over conventionally disposed tailings with respect to tailings management. The thick tension-saturated zone within the tailings limits the thickness of unsaturated tailings susceptible to rapid sulphide oxidation. The conical shape of the deposit results in the formation of a recharge

area near the centre of the impoundment and discharge in the peripheral areas. In contrast, the elevated nature of many conventional, unthickened tailings impoundments commonly results in recharge over most of the surface of the impoundment, with discharge occurring outside the impoundment through large containment dykes. Three-dimensional pore-water flow modelling suggests that approximately 90% of the total discharge from the thickened tailings occurs within the tailings impoundment. When discharge is confined within the impoundment, there is improved control over low-quality effluent, and an opportunity to design passive control measures to reduce treatment costs and environmental impact.