

The Application of Polythermic Solution Mining Techniques and Curved Flow Design to the Solution Mining of Potash

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Abstract

Polythermic solution mining is described by Ozsahin and Husband in "An Investigation of Solution Mining of Potash in Saskatchewan, Aug 1965". Polythermic mining uses hot brine to dissolve potash while leaving salt in the mined deposit. Hot brine is brought to the plant, cooled to produce potash, then reheated and returned to the mine. This early paper identifies the difficulty dissolving the potash out of the static salt matrix. "the solvent would have to honeycomb the deposit by dissolving the potash and leaving the rock salt in the form of a framework or fallen debris".

This paper describes the use horizontal drilling equipment, commonly used in the oil and gas industry to form curved flow patterns on a typically horizontal plain in a selected layer of high grade potash deposit. The curved flow causes helicoidal flow to dissolve the potash from the cavern wall, with the liberated salt deposited inside the curve in a manner similar to that occurring in a meandering stream. The high flow rate against the ore surface, and elevated temperature, results in high dissolution rates. The high production rate allows heating of the small area of active ore, to produce high temperature saturated brines, (a single horizontal hole, 1000 meters long, should produce as much as 100,000 tonnes per year).

The processing plant consists of cooling crystallizers, centrifuge and dryer, plus brine heaters. Product sizing, storage and loadout are similar to existing mines. A typical mine has a small footprint, as little as 10 to 40 acres. Capital costs are reduced as much as 80%, energy by about 80%, and water consumption about 80 to 90%, as compared to existing solution mines. The simplicity of the operation also reduces operator numbers and maintenance cost. There is no tailings area. Most of the salt remains in the mine in a horizontally oriented mine sequence, resulting in minimal subsidence.

Key words: Polythermic mine, curved flow, solution mining, potash, horizontal drilling, equilibrium saturation, Beechy, Saskatchewan, Canada.