

AN OVERVIEW OF THE SOLUTION-MINING METHODOLOGIES FOR POTASH MINING

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Abstract

Solution mining of potash has become more attractive for new potash projects due to its lower up-front capital cost, worker safety, lower volumes of waste salt, and relatively less subsidence compared to conventional underground mining methods. Currently, there are six active potash solution-mining operations in Canada, the United States of America, and Germany, one of which is a flooded underground mine (PCS Patience Lake), but is presently operating as a solution mine, the other five are solution-mining projects. There are also several other solution-mining projects in planning or on hold.

There are two basic types of potash solution mining: nonselective and selective. Nonselective (also known as primary) potash solution mining utilizes fresh water to dissolve both halite (NaCl) and sylvite (KCl) from the potash bed and requires a gas or hydrocarbon blanket to control the vertical growth of the cavern during solution mining. Selective (also known as secondary) solution mining utilizes a saturated NaCl brine to dissolve just the KCl from the potash bed. There are multiple nonselective and selective solution-mining configurations that can be utilized to solution-mine potash. The two most common potash solution-mining configurations utilize vertical or horizontal caverns. Vertical cavern methods include single or dual vertical wells to develop vertical caverns, which utilize vertically or directionally drilled wells that perpendicularly intercept the potash beds. Horizontal cavern methods include single lateral cavern and multilateral horizontal caverns that utilize directionally drilled wells along the bottom of the potash bed. To improve solution-mining efficiency and enhance resource recovery, various specialized solution-mining techniques have been developed recently, including hydraulic fracturing, rubblized mining, hydraulic pressure dropdown of salt interbeds, batch mining, reservoir mining, and cavern backfilling.

The best solution-mining method is that which is technically feasible for the deposit geometry and ground conditions, while also being the lowest cost option. Each deposit is unique, with its own properties, and engineering judgement and/or pilot testing may impact the decision of which mining method to use. In this paper, an overview of the solution-mining methodologies used in potash mines is presented. Typical solution-mining processes for both the vertical cavern and horizontal cavern methods are described. The advantages and disadvantages of each solution-mining method are discussed. Solution-mining methodologies used in existing potash mines provide a practical reference for the design of all future potash solution-mining projects worldwide.

Key words: Solution Mining Methodology, Potash Mining, Vertical Cavern, Horizontal Cavern, Selective Mining, Enhanced Resource Recovery