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ANALYSIS OF POTASH SOLUTION MINING HORIZONTAL CAVITY STABILITY WITH A NON-AQUEOUS CAP

Gary Walter, Goodluck Ofoegbu, Kevin Smart
Southwest Research Institute, San Antonio, Texas, USA

Abstract

The stability of solution mine cavities produced in thick evaporite deposits from an initial horizontal borehole was investigated. Potash deposits, such as those in Saskatchewan, Canada, occur in relatively thin beds (6 to 25 m) within non-economic evaporite beds of halite and mixed halite, carnallite, and sylvite, in various proportions. Solution mining of the potash deposits using a horizontal borehole could permit economic development of deep potash deposits, but requires control of the development of the solution cavity to prevent it intruding into adjacent non-economic evaporite beds or causing overburden evaporites to collapse into the solution cavity. Upward vertical development of the solution cavity can be controlled by introducing a light, non-aqueous fluid (petroleum, air) into the evolving solution cavity to restrict its vertical development. The required thickness of the non-aqueous layer will depend, among other factors, on the amount of cavity roof sag that occurs due to overburdened stresses, associated creep within the strata, and the resistance of the cavity roof to collapse. Results of the limited cavity geometries simulated indicated the cavity roof displacement as large as 0.55 m, which would be the minimum non-aqueous fluid cap required to prevent penetration of the cavity into overlying barren evaporites. The results of the analyses can provide guidance for evaluating the potential for using horizontal solution mining wells to exploit deep potash deposits.

Key words: Potash, solution mining, cavern dissolution modeling, rock mechanics