Solution Mining Research Institute Spring 2021 Virtual Technical Conference

19-22 APRIL 2021

ASSESSMENT OF CAVERN STABILITY: CAVERN CLUSTERS VS SINGLE CAVERN

Benoit Brouard and Vassily Zakharov

Brouard Consulting, Paris, France

Pierre Bérest

Ecole Polytechnique, Palaiseau, France

Abstract

A lot of work has been dedicated to the mechanical behavior of a single salt cavern. Cavern clusters raise a more difficult problem, as 3-D numerical computations are required. The behavior of the salt pillar between neighboring caverns is an important issue in this context. The elastic theory predicts that the vertical load on the pillar is significantly larger than the virgin (geostatic) stress when the distance between neighboring caverns is smaller. In some cases, the pillars cannot bear the load excess generated by a high extraction ratio, as proved by several examples of mine collapses (Minkley et al., 1996). However, when the mechanical behavior of the rock mass is viscoplastic, a significant part of the load excess is transferred to the abutment; i.e., outside the footprint of the mine (Bérest et al., 2008). The state of stresses in the pillars is less critical than in the elastic case. Through numerical computations, the paper will discuss the mechanical stability of a cluster of caverns. Several features are considered as vertical-stress distribution, creep-closure rate, and possible onset of dilation.

Key words: Cavern Design, Computer Modeling, Rock Mechanics