Solution Mining Research Institute Fall 2021 Technical Conference

Galveston, Texas, USA 20-21 September 2021

CREEP-CLOSURE RATE AND INDUCED SUBSIDENCE IN A CLUSTER OF SALT CAVERNS

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Abstract

In a former paper, the behavior of the salt pillar between 4 or 9 neighboring caverns was discussed (Brouard et al., 2021). Several extraction ratios (i.e., several distances between the caverns) were considered (20%, 40% and 60%). It was shown that, opposite to the case of an elastic rock mass, in the case of a visco-plastic rock mass (a salt formation), a few years after the end of mining, the vertical stress in the pillar is smaller than the virgin stress. This effect is more pronounced still when the extraction ratio is larger. In this paper the creep closure in a cluster of 9 caverns with extraction ratios of 20% and 40% is analyzed more into details and the induced subsidence is discussed. The main results are as follows:

1. At the end of mining the central pillars are overloaded, but, a few years later, a large part of this overstress has been transferred outside the footprint of the cluster.

2. For elongated caverns, at cavern wall, vertical stress is less compressive than natural stress, this may induce tensile effective stresses and micro-cracks when cavern pressure is quickly increased, even at a cavern pressure significantly lower than geostatic pressure.

3. The average volume loss in a cluster is only slightly larger than the volume loss of a single cavern.

4. Rise of cavern bottom is faster than descent of cavern roof. The larger the extraction ratio, the larger the ratio between bottom rise and roof descent.

5. Computed maximum subsidence at ground level is sensitive to the selected boundary conditions (size of the meshed domain, etc.)

Key words: Cavern Design, Computer Modeling, 3D computations, Rock Mechanics