Rock Mechanical Optimization for Non Seasonal Operation of Gas Storage Caverns

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Abstract

Since several years, the requirements for the storage of gas in salt caverns have been changed, that the stored gas to be withdrawn from or refilled into the cavern at any time during the year with a maximum rate.

This new usage of the caverns instead of the seasonally influenced usage of the last years is from an engineering point of view a particular challenge with regard to the rock mechanical dimensioning. It has to be determined the withdrawal and refilling rate between the maximum and minimum internal pressure in the cavern which is quickly enough to allow an economic storage operation on the one hand and to guarantee a secure storage operation from rock mechanical point of view over many years on the other hand.

For this reason, it is necessary to take into account temperature changes occurring in the cavern during operation in the numerical calculations. As part of the geomechanical dimensioning may at no time and at any point in the calculation model tensile stresses due to excessive temperature changes occur, as these can lead to macroscopic fractures at the cavern wall due to the low tensile strength of rock salt.

A special aspect in this context is the withdrawn and refilled gas quantity. Within this paper it is going to be discussed in which way a constant pressure rate differs from a constant volume change rate and their influence on the temperature changes in the cavern and the stress state in the surrounding rock salt mass. Furthermore, it is going to be elaborated the effect of phases during a design load case where no gas is withdrawn from or filled into the cavern and within the scope what specific impact the geometry of the cavern has.

Keywords: *rock mechanics, gas cavern design, cyclic loading, operation optimization*