Rock Mechanical Dimensioning of
Gas Storage Caverns in the Salt Dome Edge Region

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Abstract

In recent years, the number of new and planned gas storage caverns has increased, so that optimization of the existing salt deposits and especially the question of the minimum allowable distance between the cavern and the salt dome boundaries became important. Although caverns were built in the salt dome boundaries in recent years, however, no dimensioning concept was previously published worldwide.

This paper deals with creating a concept for rock mechanical dimensioning of gas storage caverns in the salt dome edge area. Within this dimensioning concept it has to be demonstrated that caverns can be operated gas tight and stable in this location. The analysis of the formation of salt deposits and possibilities of exploration of a salt dome represents an important basis for the model buildup and evaluation of a cavern in the salt dome edge region.

A numerical model was created that takes into account the essential and non-negligible influences in the salt dome edge area. Furthermore time-dependent, thermo-mechanical coupled numerical calculations were carried out. The influences of different model variations were analyzed regarding the cavern surrounding stress state.

Based on the calculation results, the effects of varying the parameters on the cavern surrounding stress state were discussed and assessed. Here, the dimensioning parameters maximum and minimum internal pressures as well as the pressure change rates of the cavern were analyzed for a cavern in salt dome edge region. An important role for the evaluation of the stress state of the cavern in the salt dome edge region plays the stress intensity index of the rock salt.

Within this paper a dimensioning concept is shown which includes beneath the recommendation for the selection of a suitable calculation model of a cavern in the border region of a salt dome a dimensioning parameter as a recommendation for the minimum distance between the cavern wall and the salt dome boundary.

Keywords: rock mechanics, gas cavern, salt dome edge, dimensioning concept