

# The Influence of Different Loading Scenarios on the Thermo - Mechanical Behavior of a Gas Storage Cavern

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## Abstract

New operation modes for gas storage caverns in rock salt mass require a more detailed rock mechanical consideration of thermal induced stresses in the vicinity of the caverns. This means that the change of gas temperatures during operation and the consequences of these temperature changes on the stressing of the salt rock mass cannot be neglected any more, i.e. thermo-mechanical coupled calculations are necessary.

As rock salt has a time dependent material behavior stress redistributions in the rock salt mass take place even under constant internal pressure conditions. Therefore not only the phases with different pressure change rates but also the duration of phases with nearly constant internal pressure have an influence on the resulting state variables.

Within the paper two different loading scenarios are taken into account. The first scenario is a cyclic pressure change with different withdrawal and injection rates, the second scenario includes an idle time period under maximum pressure. The main differences are demonstrated and discussed with respect to recommendations for the operator.

Because the thermodynamic response of a cavern depends on its shape, i.e. the ratio of volume to surface area, the influence of this factor also is considered within the calculations for this paper.

Keywords: *rock mechanics, gas cavern design, numerical analysis, cyclic loading*