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The improved IfG Gas Storage Cavern Design Concept

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Abstract

Progress has been made concerning the rock mechanical approaches describing the stress–strain behavior as well as the long term deformation behavior of salt rocks as a coupling of thermo-mechanical / hydraulic process. Especially new challenges in the gas storages operation creates a demand on an improved constitutive law answering the more specified questions resulting from changed cavern load conditions. In the case of cyclic operated caverns additional thermo-dynamical induced load at the cavern contour has to be considered. Therefore, in terms of long term stability and integrity assessment tension as well as shear load conditions are a matter of particular interest. Amongst others new assessment criteria as derived from the developed approach considering the theory of continuum and discontinuum mechanics leads to a proof of stability by the means of the long-term strength limit which is much more significant to in-situ conditions. Some examples are presented showing the practical realization of this method.

Nevertheless, new or modified laboratory tests are necessary to understand and reproduce in-situ loading conditions for qualifying the numerical approach by back-calculations. The paper presents a summary of some tests and test results which could be back-calculated by the advanced constitutive approach. For better understanding the rock salt material behavior under cyclic load conditions laboratory tests has been performed to reproduce in-situ conditions and to qualify the numerical approach by back-calculations.

Key words: Caverns for Gas Storage, Computer Modeling, Rock Mechanics; Salt Properties