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METHOD FOR DESIGN OF SALT CAVERNS WITH RESPECT TO HIGH FREQUENCY CYCLING OF STORAGE GAS

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Abstract

A general method for designing salt caverns for high frequency cycling of storage gas is introduced and exemplified by a gas storage cavern which has been operated for several years in seasonal mode.

The material parameters and the general behavior of rock salt deformation have been validated by cavern convergence data from historical sonar control surveys and referring to special, multi-cyclic laboratory tests of location-specific rock salt cores.
Using the novel *Lux/Wolters* constitutive material law, in which rock salt is treated as *a material with memory* combined with a modified *Lubby2* approach, the real behavior of rock salt deformation can be reliably described over several years of storage operations.
In general, multi-cyclic storage operations make greater demands on the numerical simulation of cavern integrity as additional thermal stresses have to be taken into account. These stresses are created by rapid temperature changes. For characteristic multi-cyclic operational scenarios, such temperature changes have been predicted by a numerical thermodynamic simulation model which has been history matched to seasonal operation data. Afterwards, the resulting behavior of cavern temperature was input into the coupled thermo-mechanical simulation for rock mechanics to analyze the load bearing behavior of the cavern.

This approach provided the limiting parameters of the salt cavern for multi-cyclic storage operations specifically referring to loading below the dilatancy limit and for existing installations, however, this does not prevent the approach from more general applications.

Key words: cyclic loading, gas cavern design, caverns for gas storage, rock mechanics