

SALT CAVERN ABANDONMENT STUDY

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Abstract

A geomechanical study was performed to evaluate two abandonment alternatives for a Gulf Coast salt cavern. The two abandonment alternatives considered were: (1) sealing the cavern by filling the entire wellbore above the cavern with cement and (2) perforating the well casing in the caprock and plugging the well above the perforation.

In the case of sealed abandonment, the cavern was evaluated in terms of the potential for tensile fractures to develop at the cavern surface. The brine pressure in the cavern was predicted to slightly exceed the lithostatic stress in some of the simulations conducted. The total stresses around the cavern were predicted to remain highly compressive for all cases examined. The effective stresses predicted around the cavern were tensile for simulations with low permeability values and approached zero with high permeability values.

In the case of perforated-casing abandonment, the potential for the development of tensile fractures is minimal since brine will flow from the cavern to the caprock, keeping the brine pressure below the lithostatic stress.

Based on the results of this study, either abandonment option is viable. While both abandonment options are unlikely to develop tensile fractures at the cavern surface, the perforated-casing option is inherently safer in this regard since the cavern pressure will remain constant and well below lithostatic pressure. With sealed abandonment, cavern closure will be negligible because of cavern pressurization. Under perforated-casing abandonment, the cavern will continue to close and a small amount of surface subsidence will have to be tolerated.

Key words: Storage Cavern Abandonment, Tensile Stresses, Brine Thermal Expansion, Creep Closure, Salt Permeability