

Feasibility Study to Evaluate Casing Deformation in Storage Caverns in a Salt Dome

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Abstract

Sandia National Laboratories has long used geomechanical models for the SPR to model the viscoplastic, or creep, behavior of the salt in which their oil storage caverns reside. The operation-driven imbalance between fluid pressure within the salt cavern and in-situ stress acting on the surrounding salt can cause the salt to creep, potentially leading to a loss of the cavern volume. The mechanical deformation of the cavern will perturb the stress state of the adjacent formation and around borehole casings. Therefore, a greater understanding of salt creep's behavior on borehole casing must be addressed to drive cavern operations decisions.

Large dome-scale geomechanical computational models are used at Sandia to evaluate oil storage sites in salt domes. Previous geomechanical studies focused on accurately capturing the physical processes, cavern geometry, and operating conditions; the simulation run times prohibited thorough sensitivity studies. To evaluate potential casing damage mechanisms, the authors have created a geomechanical model that includes nine caverns. The results show how various parameters impact casing deformation. Our findings from this generic study suggest that the stability of multiple caverns for underground storage needs to consider the geomechanical interaction.

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