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THERMO-MECHANICAL EFFECTS IN A CAES

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SUMMARY

Various thermo-mechanical phenomena generated by high-frequency pressure cycles in a salt cavern are discussed. A simple analytical model proves that the depth of penetration of temperature changes is a small fraction of the radius of the cavern. However, temperature changes generate large thermal stresses. These phenomena are compared to several failure criteria (Ratigan et al.'s (1991) dilation criterion, DeVries et al.'s (2005) dilation criterion, no-tension and no-effective-tension criteria). In several cases, spalling at the cavern wall resulting from thermal stresses must be expected. A simplified solution has been developed to predict the long-term cavern-creep closure rate in an idealized spherical cavern when cavern pressure is cycled daily between an upper and lower bound.

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