Fracture Predictions for Over-Pressurization of Sealed Wellbores

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ABSTRACT

The finite element method is used to evaluate the mechanical response of a wellbore that is internally pressurized above lithostatic pressure. The uncased wellbore is emplaced in salt, a rheologic media. Salt creep tends to relax the stress state in the salt around the wellbore making it possible to expand the size of the wellbore without fracturing the surrounding salt. This is a very desirable sealing feature as plugging and abandoning a cavern typically results in wellbore pressures that exceed lithostatic pressure. The analyses show that the rate of pressurization determines the hoop stress in the salt surrounding the wellbore. Pressurizing the wellbore above the surrounding lithostatic pressure reduces the hoop stress and, for very quick pressurization rates, the hoop stress can become tensile and fracture the salt. For most cavern fields, the pressurization rates after sealing and abandonment should be well below that required to mechanically fracture the salt surrounding a plugged wellbore. In the long-term, however, other mechanisms may contribute to fracture, or to increase the permeability in the salt.

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