

STRESS ANALYSIS OF SALT CAVERN WELL CONNECTIONS

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ABSTRACT

Research was performed to identify if gas injection and withdrawal temperatures of typical natural gas storage cavern well completions could potentially result in failure of the casing through low frequency cyclic fatigue. Finite element analyses of two salt cavern wells were used to estimate the state of stress in the casings resulting from: (1) casing weight; (2) product pressures; (3) thermally induced stresses; and (4) external ground pressures, including salt creep. The range of stress and temperature conditions determined during simulations of a gas service cycle at the lowest casing joint were used as input to another set of finite element models to predict the casing connection response when subjected to cyclic loads caused by pressure and temperature changes. The stress and strain history at critical points in the connections were then used in cyclic fatigue analyses to determine the expected number of cycles the couplings can withstand before failure.

Keywords: Gas storage caverns, rock mechanics, well casing, threaded connections, thermal analysis, cyclic fatigue