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FLOW-INDUCED BUCKLING OF BRINE INJECTION STRINGS IN SOLUTION-MINED STORAGE CAVERNS

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Abstract

For decades, operators and engineers have been perplexed by flow-induced deformation of the long, slender hanging strings in wells that access solution-mined storage caverns. The storage industry knows that deformation (and sometimes damage) occurs, but no proven mathematical tools exist for predicting and characterizing the deformation.

Mathematical models for flow-induced deformation of many different geometrical configurations with long slender structures exist in the literature (e.g., Païdoussis [2014]). However, a validated (using physical data from a storage cavern) comprehensive mathematical model of brine-string deformation during injection into (and withdrawal from) a solution-mined storage well cavern has yet to appear in the literature. This paper provides several case histories and mathematical models of one of the modes of flow-induced deformation that can occur during brine injection—specifically flow-induced buckling.

Key words: Cavern hydraulics, casing design, flow-induced buckling, brine injection tubing