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PIPE PERFORATION VS STRING CUTS FOR LEACHING MITIGATION

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Abstract

The U.S. Strategic Petroleum Reserve (SPR) is in the process of selling oil based on mandates from the U.S. Congress. SPR's configuration makes it necessary to remove oil from storage caverns using fresh to saline water instead of brine. As a result, oil sales change cavern shapes due to dissolution of the salt. The impact on shape depends on the volume of raw water, the original cavern shape, the depth to the brine string end of tubing, and the location of the oil-brine interface. The effects that some well configurations have had on the cavern shape, particularly near the cavern floor, will be presented.

Two methods have been identified in order to move the effective injection point and mitigate effects on cavern floor shape: string cuts and string perforation. String cuts reduce string length but impact the ability to run logs through the string. Effects due to string cuts are relatively straightforward to model and predict. On the other hand, string perforation adds another pathway for brine movement but depends heavily on fluid mechanics. Most perforation work described in the literature has dealt with fluid flowing into open air, rather than into a dense fluid such as brine. Other oil/gas-related research has focused on flow into a perforated pipe from oil reservoirs, which is a very different problem. Here, the fluid mechanics for water flowing down a vertical perforated pipe into brine were examined.

The model indicates that, for appropriate flow regimes, raw water would exit the perforations and not the end of tubing. A field scale test to validate the model was designed and implemented using cavern BM-102 during recent oil sales. Sonar surveys were taken before and after the oil removal to gather cavern geometry data for comparison. The results of the field test and the model validation analysis are presented.

Key words: Caverns for Liquid Storage, Fluid Mechanics, Computer Modeling, Cavern Dissolution Experiments, Cavern Hydraulics, Pipe Perforation, DOE, Strategic Petroleum Reserves

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