

Cavern Leaching at the SPR Associated with 2017 Oil Sales and Exchanges

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Abstract

In 2017 small-scale drawdowns at the Strategic Petroleum Reserve (SPR) supported oil sales for the Bipartisan Budget Act of 2015 and the 21st Century Cures Act of 2015 as well as exchanges supporting relief efforts for hurricane Harvey. These drawdowns may affect cavern stability and remaining available drawdowns, thus it is important to assess the leaching effects on the cavern shape. Some leaching effects may be documented using measurements of the oil brine interface depth and cavern geometry. However, these measurements can be expensive and may not be conducted following each sale. Alternatively, models may provide intermediate information on cavern conditions until post-sale measurements can be made. This report describes the use of the SANSMIC solution mining code to assess the magnitude of cavern leaching expected from the 2017 small-scale drawdowns at the SPR. These simulations used sonar-surveyed cavern shapes at the start of each leaching stage, measured hanging string depths, and the field reported water injection rates to estimate the new cavern shapes and leached volumes. SANSMIC results suggest that the shapes of 28 caverns were altered in 2017 to varying degrees depending on the total volume of water injected, the initial cavern shape and the distance between the hanging string depth and the oil-brine interface depth. A flaring of the cavern floor occurred in 13 caverns, a geomechanically unfavorable outcome that may require operational changes to preserve cavern integrity, such as changing the hanging string depth. Of the three caverns with post-sale sonars, SANSMIC predictions compared favorably to two but underpredicted the third.

Key words: Cavern Dissolution Modeling, Caverns for Liquid Storage, Computer Modeling, Domal Salt, Strategic Petroleum Reserves