Comparison of Post-Drawdown Sonars with SANSMIC Model Predictions Following the Recent Unprecedented Oil Volume Movements at the SPR

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COMPARISON OF POST-DRAWDOWN SONARS WITH SANSMIC MODEL PREDICTIONS FOLLOWING THE RECENT UNPRECEDENTED OIL VOLUME MOVEMENTS AT THE SPR

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Abstract

The unprecedented oil volume movements at the Strategic Petroleum Reserve (SPR) in recent years, including contributions due to sales, exchanges for storage, and Congressional and Presidential drawdowns, were enabled by injecting a nearly equivalent volume of unsaturated surface water, referred to here as raw water. Drawdowns result in leaching of the salt cavern walls, developing additional cavern space and changing their shapes. Here we compare post-drawdown sonar measurements with leaching model results across caverns at the four SPR sites.

The SPR injected a total of about 225 MMB of raw water into 48 caverns as part of oil deliveries in calendar year 2022 (CY22), an increase over previous years. Here, we consider the cavern leaching occurring in the past few years by comparing sonar data to leaching modeling results. The leaching effects were modeled using the Sandia Solution Mining Code, SANSMIC. The impacts of large drawdowns are evidenced by radial cavern growth between the end-of-tubing (EOT) and oil-brine interface (OBI) depths, a depth range of over 1500 feet for some caverns.

In some cases, there was good agreement between the sonar data and SANSMIC modeling results, but in other cases the agreement was lacking. Some of the new sonars revealed deficiencies in the earlier sonars (up to 10 years prior) which provide the baseline cavern geometry for the SANSMIC calculations. Additionally, some caverns experienced salt falls resulting in missing lengths of brine string; uncertainty as to the timing of the string loss increased uncertainty in the injection volumes at each end-of-tubing depth. Changing cavern floor depths between sonars also lead to differences for the predicted results, as SANSMIC does not account for floor rise. Historically, SANSMIC has been able to satisfactorily capture the effects of leaching. We believe that SANSMIC continues to serve as a useful tool for monitoring changes in cavern shape due to leaching effects related to sales and exchanges.

Keywords: leaching, salt dissolution, model uncertainty, sonar