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PRESSURE TRENDING ANALYSIS TO SUPPORT CAVERN INTEGRITY MONITORING AT THE U.S. STRATEGIC PETROLEUM RESERVE

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Abstract

Sixty three oil storage caverns at the United States Strategic Petroleum Reserve (SPR) are monitored daily in order to verify cavern integrity. Daily cavern pressure by itself; however, is not entirely sufficient to determine the health of a cavern. A new approach of comparing static cavern pressurization cycles to historic static cavern pressurization cycles has proven to be an effective way to assess the integrity of the cavern system. The components of the closed boundary storage cavern system include the cavern, wellbore, and wellhead. Since the system is closed and the cavern is continuously losing storage volume due to creep while the internal fluid volume is increasing due to geothermal heating, pressure in the cavern gradually increases over time. Digital pressure transmitters measure wellhead pressures and these data are stored in a database for further analysis. Since the SPR facilities are non-commercial oil filled caverns intended for long-term storage, months to years pass between drawdown cycles and significant fluid movements. Hence, static cavern conditions provide unique datasets for analysis to fully understand site salt dome creep and cavern behavior. When adjacent caverns are de-pressured during workovers, neighboring caverns demonstrate increased pressurization rates. For caverns that were affected by water injection (either by leaching or oil movements), there are negative cavern pressurization rates, followed by a return to “normal” increasing pressurization rates. The technical analysis group at the SPR analyzes daily cavern pressure data to identify and understand changes to normal cavern pressure behaviors. The caverns behave in predictable ways, so when incoming data veer from the expected normal trend, the cause is investigated. Corrective action may be taken to maintain cavern integrity. This paper summarizes the utility of the cavern monitoring technology being used to analyze cavern pressurization data at the SPR.

Key words: Static cavern pressurization cycles, salt dome creep, oil storage caverns.