

PLUGGING AND ABANDONMENT OF WEST TEXAS SALT CAVERN WELLS

Brandon Schulte, WSP, Houston, TX, USA

David Stilson, Energy Transfer, Houston, TX, USA

Abstract

Research of the permanent abandonment of solution-mined salt caverns is active and ongoing. Responsible abandonment of a solution-mined salt cavern ensures there can be no leaks which would lead to cavern collapse or fluid release from the cavern system. In addition, the long-term, post-closure development of the cavern pressure must not exceed the lithostatic pressure or fall to a critically low pressure. Pressure changes in a sealed or shut-in cavern that has been brine filled may be attributed to five primary phenomena: (1) pressure gain due to cavern convergence or salt creep; (2) pressure gain due to cavern brine warming; (3) pressure loss due to brine loss casing or casing shoe leaks; (4) salt dissolution to the cavern brine; and (5) brine permeation into salt or non-salt members.

The Solution Mining Research Institute (SMRI) has supported research programs conducting both field measurements and modeling. Cavern abandonment research is broadly categorized into shallow and deep caverns. Various research has concluded shallow caverns can be responsibly abandoned given the right conditions. Research into the feasibility of responsibly abandoning very deep caverns is ongoing.

A case study on the abandonment process of four solution-mined storage caverns developed in the Salado Formation of West Texas will be presented. At 2100 ft (640 m) original total depth, the caverns are considered shallow under SMRI classification. The post-operation monitoring data collected prior to plugging is summarized. Multiple wellbore wireline logs were run in each well to measure changes in wellbore and cavern temperature with depth, and these data were used to verify a model of the transient cavern brine temperature.

A review of the governing Texas regulations and their recent implementation is provided. True to many bedded salt caverns in West Texas, Kansas, and other regions, these caverns were drilled and developed in the 1950s, and thus not constructed or developed according to modern North American industry practices. The unique challenges encountered and de facto methods available to properly plug the caverns are presented. Finally, a detailed account of the plugging process from planning through completion is given.

Key words: Abandonment, Bedded Salt Deposits, Computer Software, Texas, Cavern Plugging and Abandonment, P&A (Plug and Abandonment of Wells), Permian Basin, Regulations, Texas