

## Pressure Trend Analyses for Geophysical and Integrity Investigations

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### Abstract

Cavern pressure histories (in static caverns) provide insight into geophysical behavior and well and cavern integrity. Events such as salt falls, neighboring cavern depressurization, well-bore to annulus flow paths can all be seen in some form in pressure histories. A tool was developed to help in the analysis of both long and short term pressure trends, and several behaviors of note were studied. These behaviors and the potential impacts and research directions are discussed in this study. For example, during the life cycle of a cavern, depressurization, many times to a zero wellhead pressure, is done routinely to assure safety and minimize risks during workover operations or for diagnostic, if necessary. Cavern depressurization has been found to directly impact pressures within neighboring caverns. Two different, and opposite behaviors have been observed in these nearby caverns. Analysis seems to show behaviors change based on the position of the caverns with respect to a shear zone.

Another study that has benefited from these types of analysis is the investigation of cemented annulus pressures. Both depressurization and high pressurization during mechanical integrity tests have shown interactions between pressures within the cemented annulus and the wellbore pressure. Several different behaviors that can be seen only by looking at pressure trends, along with suspected causes and proposed or in-progress research into the mechanisms, are discussed.

While the first two studies look at long-term pressure trends, a third study is presented that looks at short-term pressure trends. Salt falls can cause pressure waves within a cavern as the fall travels through the fluid. Brine-string pressures fluctuate at the wellhead as the salt passes through the interface. These waves may be identifiable from the pressure data provided other possible sources are accounted for.

**Key words:** cavern operation, salt domes, geophysics, instrumentation and monitoring, Strategic Petroleum Reserve, storage cavern