

## Natural Gas Storage Operations Using Downhole Instrumentation An Update

Terry Rittenhour and Ron Benefield  
Spectra Energy Corp, Houston, Texas

### Abstract

Spectra Energy Corp (Spectra Energy), a U.S. Gulf Coast natural gas storage operator, has installed downhole pressure-temperature gauges in six storage caverns at two salt dome storage facilities. The pressure and temperature data collected at the center of each cavern is continuously transmitted into surface data acquisition, distribution and archiving systems, and provides operations and engineering personnel with real-time and historical information to help operate the caverns safely and efficiently.

The benefits derived from the downhole instrumentation project are to the areas of gas inventory verification, cavern-wellbore system mechanical integrity testing, salt creep-closure rate analysis, and flow rate calculation. This information also provides the key elements of cavern integrity monitoring programs that are required under state and federal laws.

The instruments have provided very valuable information to Spectra Energy but the instruments have not all worked continuously and reliably. In some installations the data collection has been interrupted due to instrument instability or loss within the cavern. This paper will discuss our understanding of the failure mode(s) and how the installation procedure and the equipment used have been modified to improve the reliability of the installed instruments. Possible future installation methods to further improve reliability will also be introduced.

Spectra Energy has worked with the instrument supplier, the installation contractor and consultants to research the cause of the failure and design a new instrumentation and installation technologies to ensure reliability.

The most recent downhole instruments installed include accelerometers. Also included is a discussion of how data collected by these tools could be utilized in a study of possible flow-induced tubular vibration.

Spectra Energy believes a thorough understanding of the failure mechanism will lead to improved installation techniques and advances in downhole instrumentation technology for better monitoring and safer operations of gas storage caverns.

Spectra Energy would like to share these experiences with the industry and believe downhole instrumentation will bring invaluable data and knowledge to the gas cavern storage industry and will become widely used as an inventory, integrity, and gas management tool.

**Key words:** Downhole Instrumentation, Downhole Gauges, Tubing Stop, Mechanical Integrity, Inventory Tracking, Salt Creep Closure, Real Time Pressure Temperature Data, Tubing Enclosed Cable (TEC), Tubing Vibration, High Frequency Cycling