PUBLIC EXECUTIVE SUMMARY

Testing for the Dilation Strength of Salt

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A laboratory testing program on rock salt specimens is proposed using test conditions that are consistent with the stresses that are experienced near the cavern surface during storage operation. The proposed work effort focuses on improving the methodology for defining the onset of dilation for rock salt. Geomechanical studies use dilation criteria to assess the potential for salt damage that can lead to spalling in the cavern roof and/or walls and subsequent damage to the cavern or hanging string. This constraint is often the one that limits the minimum gas pressure in a natural gas storage cavern.

Currently, RESPEC uses the constant mean stress test to provide experimental data that are used to establish a dilation criterion for the host salt formation. The constant mean stress test, as currently performed, uses a single load path for assessing the propensity of salt to dilate. The test is performed by increasing/decreasing the axial stress and confining pressure simultaneously in a manner that maintains the mean stress constant. By maintaining a constant mean stress, elastic volumetric strain changes are suppressed in the test. The volumetric strain is monitored during the test and is used to determine the stress state that induces salt dilation (volume expansion caused by microfracturing). A typical testing program requires that several tests be performed to span the range in mean stress expected in the salt surrounding the cavern during gas storage operation. The tests are performed under triaxial compression and triaxial extension states of stress. Test conditions are often repeated to determine the response of different salt cores under identical conditions, further increasing the number of tests performed. Variability in the test results limits the confidence in establishing the dilation criterion, especially if only a limited number of tests are performed.

The objective of this project is to determine if substantially more information can be derived from a single specimen by subjecting the specimen to multiple load paths. Additionally, testing of specimens having different length-to-diameter (L:D) ratios are planned to assess the possible effect of L:D on the constant mean stress test results under triaxial extension states of stress. Results of this research will lead to an improved methodology for determining acceptable minimum operating pressures and increased confidence in geomechanical assessments of salt caverns used for natural gas storage.