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# APPLICATION OF A LIQUID-LIQUID INTERFACE MECHANICAL INTEGRITY TEST TO BEDDED SALT SOLUTION-MINED HYDROCARBON STORAGE CAVERN WELLS

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**Abstract**

The geometry and/or casing installation of solution-mined hydrocarbon storage caverns in bedded salt deposits often does not allow for practical application of contemporary Mechanical Integrity Test (MIT) methods, such as the nitrogen/brine interface test. Practical application of the nitrogen/brine interface test requires a relatively small diameter open hole interval below the cemented production casing which is not always present in many bedded salt caverns. Additionally, wellheads and/or casing in deep cavern wells often do not have the pressure rating required for a nitrogen/brine interface test.

PB Energy Storage Services, Inc. (PB ESS) has devised a liquid-liquid interface test protocol and analysis algorithm that allows an alternative method for accurate MITs. The test is executed with a liquid hydrocarbon placed in the well annulus below the cemented production casing with brine in the storage cavern. In conjunction with an initial logging pass, the wellhead pressure differences between the hydrocarbon and the brine are monitored over time. Using the PB ESS algorithm, the Calculated Leak Rate (CLR) is determined, along with an associated confidence interval. If a temperature log is run at the end of the test period, this method also has the provision to account for temperature stabilization effects (fluid density changes) caused by injection of cold brine or hydrocarbon.

The liquid-liquid interface test and the analysis algorithm are presented along with several case history applications. Special considerations required for deep caverns, such as those in the Lotsberg Salt in Alberta, are presented.

**Key words:** Caverns for Liquid Storage, Alberta, Canada, Kansas, Bedded Salt Deposits, Cavern Testing, Mechanical Integrity, Regulations, Storage Cavern, Well Casing, Well Design, Liquid-Liquid Pressure Differential MIT, Ft. Saskatchewan