

Pressure Transient Testing and Analyses

Although historically underused on geologic CO₂ storage projects, INTERA uses pressure

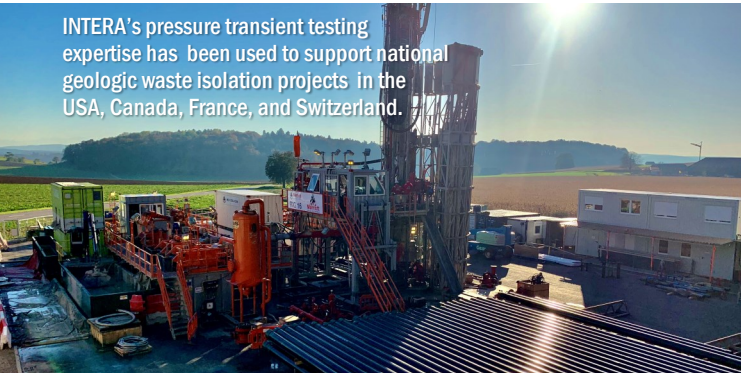
transient tests to gain a thorough understanding of the hydrogeological, hydrochemical, hydromechanical, petrophysical, and mineralogical conditions within a subsurface zone of interest. These range from initial tests where small volumes of fluid are extracted under open-hole conditions to single-well tests where fluids are pumping from a well, or injecting into a well, while observing the pressure response in the same well. We also perform multi-well tests, where injection or extraction

occurs in one well while the pressure response is observed in nearby wells. INTERA brings over 35 years of experience in the design and implementation of pressure transient testing programs in support of waste isolation projects. On several of these programs, special technical challenges have been encountered during testing (e.g., non-isothermal effects on pressure pulse tests, borehole pressure history, equipment compliance, 2-phase flow effects, etc.). Our expertise enables us to rapidly identify the issues, take appropriate steps to modify test equipment and procedures, and incorporate any necessary effects in the data interpretation.

We also bring experience with a wide variety of analytical and numerical methods for analyzing pressure transient

tests. This includes the state-of-the-science numerical simulator nSIGHTS (n-dimensional Statistical Inverse Graphical Hydraulic Test Simulator), which several of our staff members helped develop. Consisting of a numeric simulator and analytic routines, nSIGHTS employs standard well-test interpretation methodologies, as well as statistical sampling/optimization and post-processing capabilities, enabling the quantification of uncertainty in parameter estimates.

INTERA's pressure transient testing expertise has been used to support national geologic waste isolation projects in the USA, Canada, France, and Switzerland.



■ Pressure Transient Testing for the Swiss National Program for the Disposal of Radioactive Wastes, Switzerland

Challenge: To collect detailed data needed to support characterization and decision-making on site suitability.

Solution: As part of Nagra's deep borehole investigation program, INTERA is performing, analyzing, and documenting pressure transient tests in vertical and inclined boreholes at depths ranging from 100 to over 4,500 feet in the sedimentary geological formations of the candidate siting regions. INTERA is employing complete packer-test (downhole and surface) and data acquisition systems. Tests are performed using both straddle-packer and single-packer configurations. The pressure transient tests are analyzed using nSIGHTS, which provides advanced well-test interpretation methodologies that include a full suite of tools for uncertainty-related analyses. To maximize cost effectiveness, test analyses occur in real time with perturbation analysis to determine when test objectives have been met. INTERA is also supporting the design, performance, and analysis of fluid logging campaigns. Based on available borehole section information, we provide recommended procedures and schedules for fluid logging operations as well as quantitative analysis of the measurements to derive zone transmissivities.

Results: Test results are being used to develop a comprehensive description of the site and inform the final site selection decision.

