Systematic Assessment of Wellbore Integrity for Geologic Carbon Storage Projects Using Regulatory and Industry Information

Award Number: DE-FE0009367

Project Summary:

The objective of this project was to assess depositional, structural, and diagenetic characteristics of caprock/ reservoir interfaces across the midwestern region, and how insight gained from observation linked to coupled modeling can contribute to best modeling practices. Specifically, this project developed a shortlist of oil/gas, gas storage, or injection wells in the Appalachian and Michigan basins for a detailed assessment of well history and collected sustained casing pressure and mechanical integrity test data through collection and analysis of well records. Technical items such as cement degradation, cracks and micro-annuli, acid-gas zones, channeling, casing corrosion, wellhead leaks, and sustained annulus pressures were evaluated with historical well records, field monitoring of selected gas storage wells, and review of regulatory information. The data review was linked to analysis of well casing annulus pressure data as they relate to well condition. Project results identified and developed methodologies that indicate future wellbore integrity risks from available public data with high confidence.

Prime Performer:
Battelle Memorial Institute

Key Performers:
BP

Principal Investigator:
Mark Moody

Project Duration:
10/01/2012 – 10/31/2015

Performer Location:
Columbus, Ohio

Program:
Carbon Transport & Storage

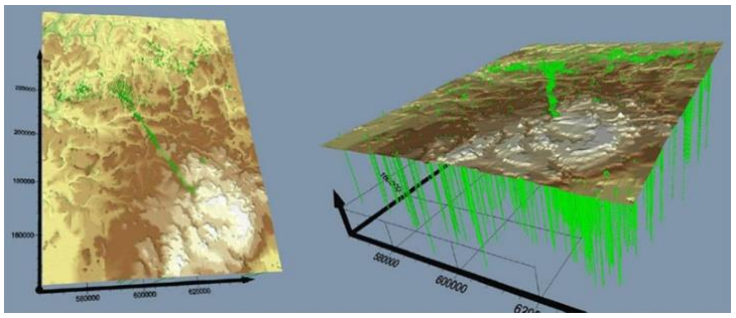

Figure 1: Digital 3D image of wells in the Michigan Albion-Scipio Trend.

Project Outcomes:

The condition of legacy oil and gas wells in the midwestern United States was evaluated through analysis of well records, well plugging information, cement bond log (CBL) evaluation, sustained casing pressure (SCP) field testing, and analysis of hypothetical carbon dioxide (CO_2) test areas to provide a realistic description of wellbore integrity factors. The research included a state-wide review of oil and gas well records for Ohio and Michigan along with more detailed testing of wells in Ohio. Many of the deep saline formations being considered for CO_2 storage have few wells that penetrate the storage zone or confining layers. Field monitoring of SCP also indicated that tested wells provided zonal isolation of the reservoirs they were designed to isolate. Most of these wells appeared to exhibit gas pressure originating from intermediate zones. Based on these results, more flexibility in terms of cementing wells to surface, allowing well testing, and monitoring wells may aid operators in completing CO_2 storage projects. Several useful products were developed under this project for examining wellbore integrity for CO_2 storage applications, including a database of over 4 million items on well integrity parameters in the study areas, a systematic CBL evaluation tool for rating cement in boreholes, SCP field testing procedures and analysis methodology, a process for summarizing well integrity at CO_2 storage fields, a statistical analysis of well integrity indicators, and an assessment of practical methods and costs necessary to repair/remediate typical wells in the region based on assessment of six test study areas.

Presentations, Papers, and Publications

Final Report: **Systematic Assessment of Wellbore Integrity for Geologic Carbon Storage Projects Using Regulatory and Industry Information** (November 2015) – Mark Moody, Joel Sminchak