Integrated Wellbore Integrity Analysis Program for CO_2 Storage Applications

Award Number: DE-FE0026585

Project Summary:

The objective of this project was to develop and validate a program for identifying and characterizing wellbore leakage potential for carbon dioxide (CO_2) storage applications based on analytics of well records validated with sustained casing pressure field monitoring. The approach focused on determining the nature of well defects, location within the borehole, and severity of potential gas leakage rate. Results were validated with field testing of sustained casing pressure buildup in existing boreholes exposed to CO_2. The project used study areas in Michigan, West Virginia, and Wyoming.

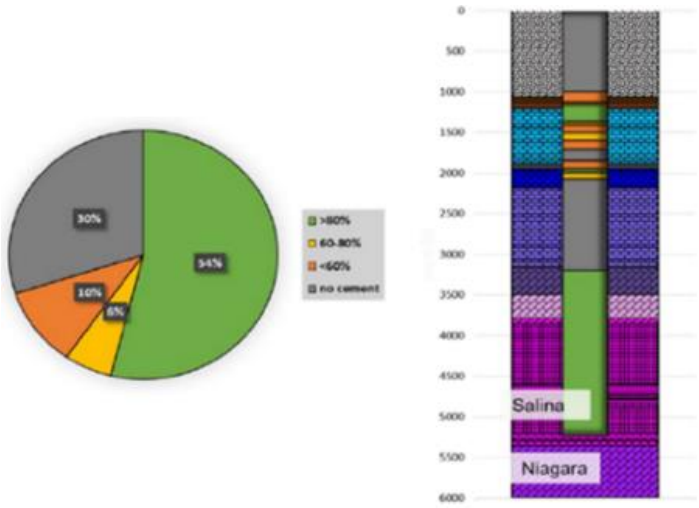

Figure 1: Cement bond log analysis of a Niagaran reef well in Ostego County, Michigan

Prime Performer:
Battelle Memorial Institute

Principal Investigator:
Mark Moody

Project Duration:
10/1/2015 – 9/30/2018

Performer Location:
Columbus, Ohio

Field Sites:
Michigan Basin site, Michigan
Appalachian Basin site, West Virginia
Williston Basin site, Wyoming

Program:
Carbon Storage

Project Outcomes:

This project compiled a wellbore database and evaluated it for wellbore leakage potential. The wellbore integrity registry developed in this project provided a catalog of the well component, integrity issues, causes, timing, and leakage pathways that may occur in wells. More than 1,500 well records were reviewed in terms of well construction, history of exposure to CO_2, geochemistry, mineralogy, and well materials at the three field sites. Eighty-three wells that had been exposed to CO_2 either naturally or through enhanced oil recovery operations for 5 to 50 years were surveyed for well defects. Twenty-three wells showed signs that may indicate well defects; however, additional testing showed that no wells had significant well defects. Additional geochemical modeling and meta-modeling for the study areas indicated that mineralogy, hydrologic conditions, cement blends, and brine geochemistry were not critical factors to the cement carbonation process. Well construction and/or cement carbonation sealing appears to have contributed to well integrity. Results support effective management of CO_2 storage applications in areas with many legacy oil and gas wells. Results also demonstrate that well construction procedures, well design, and well logging/testing for defects are important considerations for wellbore integrity in CO_2 environments in the subsurface.

Presentations, Papers, and Publications

Final Report: Integrated Wellbore Integrity Analysis Program for CO_2 Storage Applications
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