Geomechanical Framework for Secure Carbon Dioxide (CO_2) Storage in Fractured Reservoirs and Caprocks for Sedimentary Basins in the Midwest United States

Award Number: DE-FE00023330

Project Summary:

The project was designed to leverage tools and technologies to improve methods for defining geomechanical risk factors (such as geomechanical stress) at carbon dioxide (CO_2) storage sites. Project research is utilizing regional geologic data collected from previous and ongoing projects. Site-specific geomechanical constraints on storage were evaluated at three sites: Arches site in Boone County, Kentucky; Northern Appalachian Basin site in Chautauqua County, New York; and East-Central Appalachian Basin site in Tuscarawas County, Ohio. The methodologies developed under the project may have the potential to enable CO_2 storage in many fractured reservoirs through risk reduction, therefore increasing overall CO_2 storage capacity by enabling more storage options. In addition, the project has the potential to cut costs by reducing the need for additional expensive testing and logging. The research will benefit both enhanced oil recovery and CO_2 storage applications.

Prime Performer:
Battelle Memorial Institute

Principal Investigator:
Joel Sminchak

Project Duration:
10/1/2014 – 9/30/2017

Performer Location:
Columbus, Ohio

Field Sites:
Arches, Kentucky
Northern Appalachian Basin, New York
East-Central Appalachian Basin, Ohio

Program:
Carbon Transport & Storage

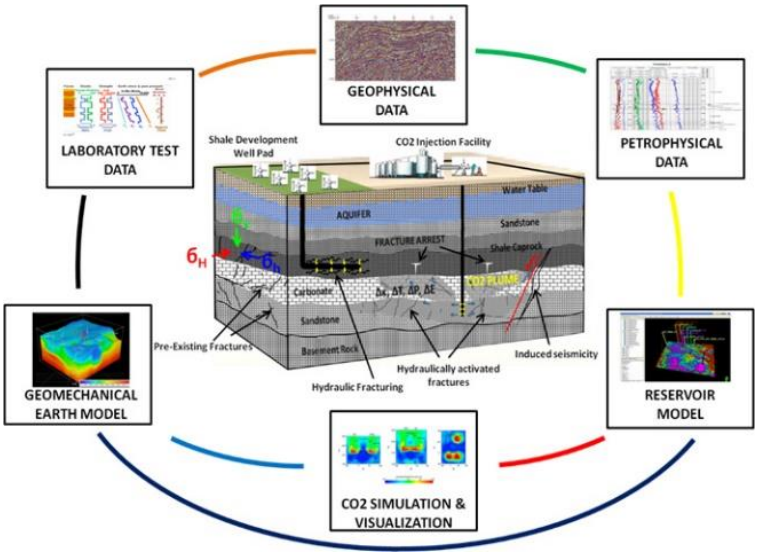

Figure 1: The methodology used for this project gathered laboratory test, geophysical, and petrophysical data and used that to generate a reservoir model, perform simulations, and develop/refine a geomechanical Earth model for the Illinois and Michigan basins.

Project Outcomes:

This project evaluated the stress-strain setting of the midwestern United States using regional geologic and laboratory data. The natural fracture system and spatial variation of in-situ stress was estimated regionally for caprock and saline formations suitable for CO_2 storage. No tensile or shear failure was observed in any of the layers in the caprock during simulations. At the Arches study site, simulations suggested the capacity to inject 24 to 51 million metric tons (MMT) of CO_2 into the Mt. Simon Sandstone over 30 years in a single well. At the East-Central Appalachian Basin site, results suggested a storage capacity of at least 10 MMT of CO_2 injected into multiple layers over 30 years in a single well. At the Northern Appalachian Basin site, the low-permeability rock layers did not appear capable of maintaining industrial-scale injection.

Presentations, Papers, and Publications

Final Report: Geomechanical Framework for Secure CO_2 Storage in Fractured Reservoirs and Caprocks for Sedimentary Basins in the Midwest United States (September 2017) J.R. Sminchak