Integration of Geophysical and Geomechanical Modeling to Monitor Integrity of Carbon Storage

Award Number: DE-FE0026825

Project Summary:

The goals of this project were to: (1) model and identify effective and low-cost monitoring techniques for carbon capture and storage; (2) derive geophysical techniques (seismic) and attributes for an accurate and robust carbon dioxide (CO₂) monitoring system; and (3) evaluate geophysical monitoring ideas for safe CO₂ storage, and identify any geohazard risks. To achieve the objectives, the project scope consisted of fluid flow and geomechanical simulation, rock physics and 4D seismic modeling, and validation of rock physics models with field data. The study was conducted using datasets from the Farnsworth Unit (FWU) oilfield.

Project Outcomes:

The project outcomes can be broken down into three major products. First, a coupled, multiphase flow-geomechanical model and simulation of FWU was constructed, which may predict changes in pressure, stress, CO₂ saturation, stress-dependent permeability and elastic moduli. Second, a new reverse time migration (RTM) imaging technique was derived to visualize the effect of CO₂ injection, using a rock physics model to account for the effect of fluid substitution on elastic properties. Finally, geomechanical experiments performed on FWU cores provided a characterization of dynamic elastic moduli due to changes in the CO₂ core pressure. This may determine constitutive model parameters in the rock-physics model and the coupled simulation model.

Presentations, Papers, and Publications