

# Development of Geomechanical Screening Tools to Identify Risk: An Experimental and Modeling Approach

Award Number: DE-FE0023314

## Project Summary:

The goal of this project was to develop screening tools for improved understanding of reservoir geomechanical processes and conditions related to carbon dioxide (CO<sub>2</sub>) storage including faults, fractures, and caprock flaws. Specifically, this project was conducting laboratory experiments to study petrophysical and hydro-mechanical properties of rocks under CO<sub>2</sub> storage conditions and using the findings from this effort to develop a simulator that can model two CO<sub>2</sub> storage field studies; the Frio pilot injection study in Texas and the Southeast Regional Carbon Sequestration Partnership (SECARB) Cranfield large-scale injection project in Mississippi. The results of these experimental and computational methods can be integrated to generate geomechanical screening tools that can be used for assessment of future CO<sub>2</sub> storage operations.

**Prime Performer:**  
*University of Texas at Austin*

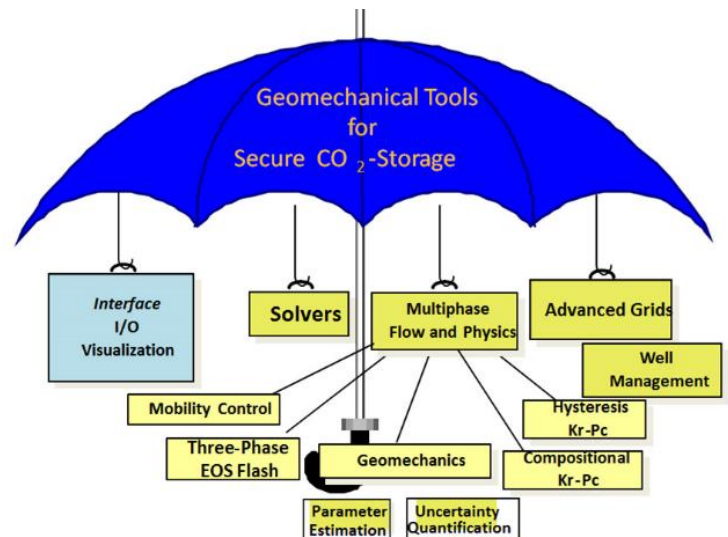
**Principal Investigator:**  
*Mary Wheeler*

**Project Duration:**  
*9/1/2014 – 8/31/2017*

**Performer Location:**  
*Austin, Texas*

**Program:**  
*Carbon Transport & Storage*

Figure 1. Depiction of the geomechanical tools that are part of the computational framework developed as part of this project.



## Project Outcomes:

This project developed a coupled mathematical modeling and experimental framework that considered the effect of rock heterogeneity on effective mechanical properties of the rock in contact with CO<sub>2</sub> (Figure 1). Accurate laboratory experiments were performed to determine the changes in rock mechanical properties due to mineral dissolution in the presence of carbonic acid generated by CO<sub>2</sub> injection. A two-scale adaptive homogenization framework was then developed to consistently upscale petrophysical and geomechanical properties to the field scale. The numerical model was then used to study field scale CO<sub>2</sub> sequestration problems for the two selected field sites: (1) the Frio formation and (2) the Cranfield site. Robust schemes were developed for field data assimilation and model calibration such that the residual uncertainty at the end of the data assimilation procedures can be faithfully represented while taking into account the coupled geochemical and geomechanical processes.

## Presentations, Papers, and Publications

**Final Report:** [Development of Geomechanical Screening Tools to Identify Risk: An Experimental and Modeling Approach for Secure CO<sub>2</sub> Storage Final Technical Report](#) (December 2017) Mary Wheeler, Sanjay Srinivasan, David Espinoza