Introduction to CO_2 Storage

Carbon dioxide storage in subsurface geologic formations is one option to reduce significant levels of CO_2 emitted to the atmosphere. Fundamental science and engineering principles indicate that such systems should be feasible and safe: the energy cost of preparing CO_2 for injection can be as low as a few percent of the heating value of the original fuel; and the very existence of oil and gas reservoirs is proof that buoyant fluids can be contained in the subsurface for millions of years. Carbon dioxide has been injected safely into subsurface reservoirs for many years for enhanced oil recovery or coalbed methane. However, long-term CO_2 storage does carry a risk of possible leaks to the atmosphere. The costs and risks are not insurmountable, but research is required to make these concepts economically and technologically feasible.

GCEP-funded scientists are investigating a range of research concepts in CO_2 storage, from rock characterization in the presence of CO_2 to simulations, models and theory that predict and monitor fluid flow. The largest GCEP program in CO_2 storage focuses on coalbeds, and the progress to date has advanced the understanding of CO_2 and coal interactions for what is otherwise a poorly understood area. Another area of ongoing research area is on CO_2 storage in saline aquifers. The following ongoing GCEP research activities are taking place in the area of CO_2 Storage.

Professor Hamdi Tchelepi and his colleagues are developing a set of numerical methods that efficiently simulate the flow of fluids in large-scale subsurface formations. Assuring long-term sequestration of CO_2 requires simulations on a set of length and time scales that go well beyond those investigated in the design of oil recovery processes, and hence they involve new computational challenges. Over the last year the investigators have made significant progress in the analysis and development of models, methods and algorithms for an advanced numerical simulation framework.

A team led by Professor Jerry Harris, with members from both Geophysics and Energy Resources Engineering, is investigating carbon sequestration in coal seams that are too deep to be mined. The interdisciplinary team creates experiments, models, and theory to understand the interactions between CO_2 and coal which is useful for the predicting and monitoring flow in the subsurface.

GCEP Executive Director, Sally Benson also has an appointment as a Professor (Research) in the Department of Energy Resources Engineering. Her team develops experimental investigations and numerical simulations to research the fundamental science of CO_2 storage in saline aquifers. Their report on multiphase flow and trapping in saline aquifers is divided into four sections 1) laboratory set-up and data sets, 2) sub-core scale experiments 3) simulation work and 4) a web-based database application to collect and present relative permeability curves.