Analysis of CO_2 Sequestration in the Southwestern U.S.

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Long-term sequestration of anthropogenic "greenhouse gases" such as CO_2 is a proposed approach to managing climate change. Deep brine reservoirs in sedimentary basins are possible sites for sequestration, given their ubiquitous nature. The Southwest Regional Partnership on Carbon Sequestration, a consortium of academic, industry, government and non-government organizations, is evaluating technological options for sequestration in deep brine reservoirs, coal seams and oil/gas fields throughout the southwestern U.S. The program includes four individual geological sequestration tests. Each test site will be subjected to a minimum of ~75,000 tons/year CO_2 and minimum injection duration of one year. These pilots represent medium-scale sinks that may host capacity for possible larger-scale sequestration operations later.

We are using many tools to design and engineer the pilot tests, to elucidate possible impacts of CO_2 injection, and to determine how to control those impacts. For example, one important set of tools are mathematical sedimentary basin models, including coupling of multiphase CO_2-groundwater flow and rock deformation, to evaluate residence times, migration patterns and rates, and effects of CO_2 injection on fluid pressures and rock strain. In addition to CO_2 migration from target sequestration reservoirs into other reservoirs, simulations suggest that another issue to consider is displacement of brines into freshwater aquifers. Model simulations also suggest that as injection-induced overpressures migrate, effective stresses may follow this migration under some conditions, as will associated rock strain.

Such "strain migration" may lead to induced or reactivated fractures or faults, but should be controllable through reservoir engineering.