

KGS has been active in major projects related to carbon storage and use of CO₂ for enhanced oil and gas recovery.

Western Kentucky Deep Storage Test

Drilling of the Marvin Blan No. 1 well in Hancock County, Ky., to test the potential for permanent storage of carbon dioxide in deep western Kentucky formations, began on April 24 and was completed on June 15, reaching a total depth of 8,126 feet. Three primary carbon storage reservoirs of the Knox Group were identified. St. Peter and Mount Simon Sandstones, potential carbon storage reservoirs being tested elsewhere in the Illinois Basin, were not present in this well. **Rick Bowersox** of the Energy and Minerals Section and Henderson office manager **Dave Williams** served as principal investigators on the Hancock County effort. Injection of carbon dioxide and brine was scheduled for the summer of 2009.

ConocoPhillips, E.ON US, Peabody Energy, and the Tennessee Valley Authority formed the Western Kentucky Carbon Storage Foundation to provide additional funding and technical services to the project. The Illinois Department of Commerce and Economic Opportunity also provided funding.

Cores were taken in the New Albany, Maquoketa, Black River, and Knox formations; 30 feet of core was also taken in the Precambrian Middle Run Sandstone at the bottom of the well. The U.S. Department of Energy provided funding for the Precambrian core.

Other project partners include the Kentucky Energy and Environment Cabinet; Schlumberger Carbon Services; Geo Consultants LLC; Smith Management Group; Wyatt,

Tarrant, and Combs, LLC; and Kentucky Syngas LLC. ⌘

Enhanced Oil Recovery—Sequestration

Carbon dioxide injection began on May 11 at the Sugar Creek enhanced oil recovery and sequestration project in Hopkins County. The project is jointly administered by the state geological surveys of Kentucky and Illinois and the operator of the oil field, Gallagher Drilling Inc. In addition to Kentucky House Bill 1 funding, the project also receives support from the U.S. Department of Energy through the Midwest Geological Sequestration Consortium, which includes the Kentucky, Indiana, and Illinois surveys. Though a mature technology elsewhere in the United States, CO₂-EOR has not been used extensively in the

Aerial view of the completed Marvin Blan No. 1 well in Hancock County.



◀ The rig used for drilling the western Kentucky deep carbon storage test well is set up at the Hancock County site.

Glynn Beck, Brack Wimmer of the Illinois Survey and Kathy Takacs take brine samples for the Sugar Creek project in Hopkins County. ▶



Illinois Basin, largely because of the cost of CO₂.

Marty Parris is principal investigator for the KGS portion of the Sugar Creek project. By late June, about 1,500 tons of CO₂ was injected about 1,850 feet deep into the Mississippian Jackson Sandstone through a single injection. The project goal is to inject 8,000 tons of CO₂ during a period of about a year.

Water and gas chemistry data are being collected by KGS researchers **Glynn Beck** and **Kathy Takacs** to determine how long the reservoir fluid stays reactive once CO₂ injection ends, and whether the reactions produce any discernible changes in the properties of the reservoir or seal rocks. ⌘

Devonian Shale Sequestration

Low-permeability, organic-rich, fractured Devonian black shales underlie about two-thirds of the state and account for nearly 75 percent of Kentucky's natural gas production. Evidence suggests that CO₂ is preferentially adsorbed in the shale, making possible both

long-term CO₂ storage and enhanced natural gas recovery. Two ongoing projects are investigating this possibility.

The Pike County Fiscal Court nominated a natural gas well along Burke Branch as a potential CO₂ injection test site. The nominated well is a cased-hole completion, preventing acquisition of additional data for shale characterization and injection project design. But data from similar wells were provided by Rosewood Resources, the Midwest Regional Carbon Sequestration Partnership, and Chesapeake Appalachian. These data have been compiled into a reservoir model for simulating

CO₂ injection and enhanced gas recovery at the Pike County site.

Two injection scenarios were investigated: continuous injection (a CO₂ "flood") and a CO₂ "huff and puff," in which CO₂ is injected and allowed to dissipate and dissolve before more natural gas is recovered. Preliminary analysis of the simulation suggests continuous injection of CO₂ results in the higher natural gas recovery. An injection test project will be designed based on these results.

In western Kentucky, the Devonian New Albany Shale is an emerging natural gas play with potential for long-term storage of CO₂. Thirty feet of full core was acquired from the Marvin Blain No. 1 deep storage test well to better characterize Illinois Basin shale for CO₂ storage and as a seal for deeper storage zones. This core is being sampled and analyzed to determine its properties. ⌘

Rough Creek Graben Consortium

A 2-year study on the Cambrian geology and petroleum potential of the Rough Creek Graben region of the southern Illinois Basin approached completion. This study was funded by a consortium of 12 petroleum exploration companies, the Kentucky Energy and Environment Cabinet, and KGS. It included analysis and geologic interpretation of 69 two-dimensional seismic lines (totaling nearly 1,000 miles of data), 10 regional cross sections constructed from well data, and laboratory analyses of 25 sets of

