# FARNSWORTH UNIT PROJECT

*Pennsylvanian Upper Morrow Formation, Ochiltree County, Texas*

Southwest Regional Partnership on Carbon Sequestration


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NATIONAL ENERGY TECHNOLOGY LABORATORY

## BACKGROUND

The Southwest Regional Partnership on Carbon Sequestration (SWP), working with Chaparral Energy of Oklahoma City, Oklahoma, is conducting a carbon capture and storage (CCS) project in northern Texas using anthropogenic carbon dioxide ($CO_2$) for enhanced oil recovery (EOR) within the Farnsworth Unit (FWU) in Ochiltree County, Texas. The SWP Region is in a unique position, geologically and technically, to take advantage of CCS opportunities. EOR and gas recovery operations in Texas, Oklahoma, Colorado, New Mexico, and Utah currently use a pipeline network to deliver predominantly naturally sourced $CO_2$. The existing pipeline network is located near some of the region's largest stationary $CO_2$ sources and about 20 percent of the region's existing oil fields are within 12 miles.

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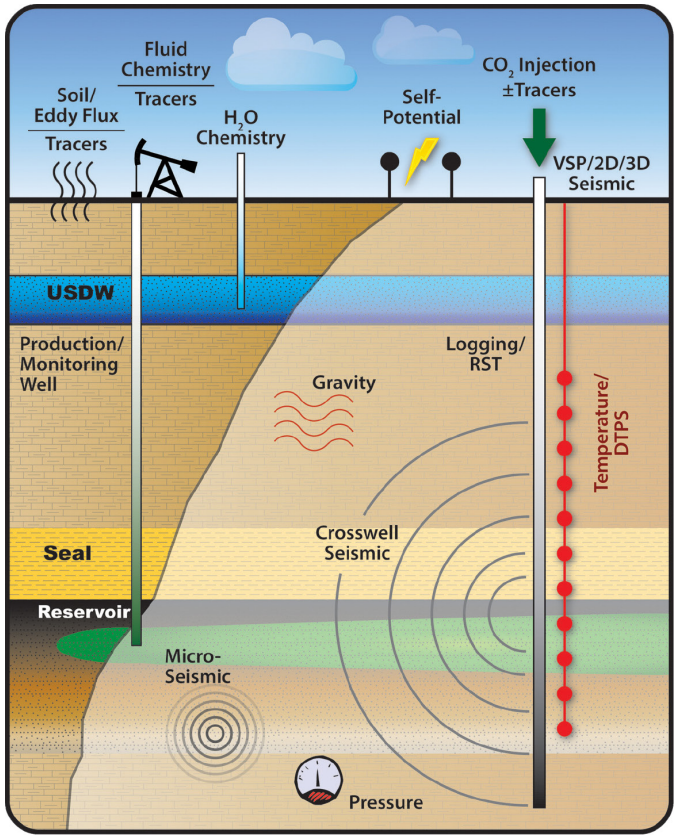
## PROJECT OVERVIEW

The project targets an incised valley-fill coarse sandstone in the Anadarko Basin that produced more than 19 million barrels of oil and 44 billion cubic feet of gas. Preliminary estimates of $CO_2$ storage capacity of the Farnsworth Unit exceed 25 million metric tons. The Farnsworth Unit has 13 active $CO_2$ injection wells. Three wells were drilled by the SWP that are dedicated to characterization and monitoring injected $CO_2$. The Farnsworth Unit project serves as a blueprint for future commercial-scale CCS projects.

The $CO_2$ injected is 100 percent anthropogenic. It is captured, compressed, and transported via pipelines from a fertilizer plant in Texas and an ethanol plant in Kansas. The SWP maintains a detailed inventory of the $CO_2$ delivered to and stored at the Farnsworth Unit for use as carbon offsets. Approximately 461,000 metric tons of anthropogenic $CO_2$ has been permanently stored in the subsurface—more than 1,000,000 metric tons will be injected by 2018.

Stakeholders are private industry, non-government organizations, the general public and government entities. Stakeholders are kept informed of the technical benefits of CCS, which include: increased resolution of reservoir characterization; direct and frequent sampling and fluid analyses; collection of core and detailed logging suites; petrophysical, geochemical and geomechanical core testing; and optimization of CCS methods through monitoring and simulation.

The project also provides educational excellent experience for students, including college level courses, internships with national laboratories, and hands-on fieldwork. SWP members participate at regional, national and international meetings and provide expertise and information to industry, trade associations, and other interested organizations.




## PROJECT SUCCESSES

The site characterization activities associated with the project have provided a wealth of surface and subsurface data to serve as a baseline for the simulation and monitoring, verification, and accounting activities. In addition to the logging and coring of the three characterization wells, new data sets include a baseline 3-D survey at Farnsworth for basin-scale petroleum systems modeling, a suite of surface and subsurface fluid and gas samples collected on a regular basis, continuous microseismic monitoring data, and aqueous and vapor phase tracer testing. Interpretation of the 3-D seismic survey has provided previously unknown information about reservoir structure, while detailed geological characterization gives increased insight into heterogeneity. Geologic models have been used to evaluate reservoir properties, $CO_2$ storage capacity/injectivity, $CO_2$ tapping mechanisms, and potential injection/production-induced reservoir/seal damage. Models are updated on an annual basis and incorporate new findings from the characterization team as well as refinements for fine-scale models. A continuous risk assessment process has been developed and integrated into the project.

The frequent repeat of seismic monitoring techniques in a challenging setting has been deemed a successful approach. In addition, predictive capabilities have been improved through extensive reservoir fluid relative permeability studies. Simulation studies have outlined new ways of looking at the project to optimize both carbon storage and recovery efficiency in this mature field. Numerous publications have resulted from SWP's work at Farnsworth Unit.

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