

Task 5 – Monitoring CO₂ and Pressure Plume

Award Number: FWP-2012.02.00

Project Summary:

This project focused on development of improved seismic technology to monitor carbon dioxide (CO₂) movement in the subsurface. Specifically, this project carried out studies to improve double difference tomography, develop seismic attributes for CO₂ and stress, and validate techniques. This project developed and demonstrated non-borehole-based methods for detecting the plume and pressure front in the storage formation. In addition, methods were explored to provide an early warning of deformation in overlying seals. These methods eliminate the need for drilling, reduce costs of locating, permitting, drilling, instrumenting, and abandoning monitoring wells, and reduce the possibility that plume fingering might bypass a monitoring well network without detection.

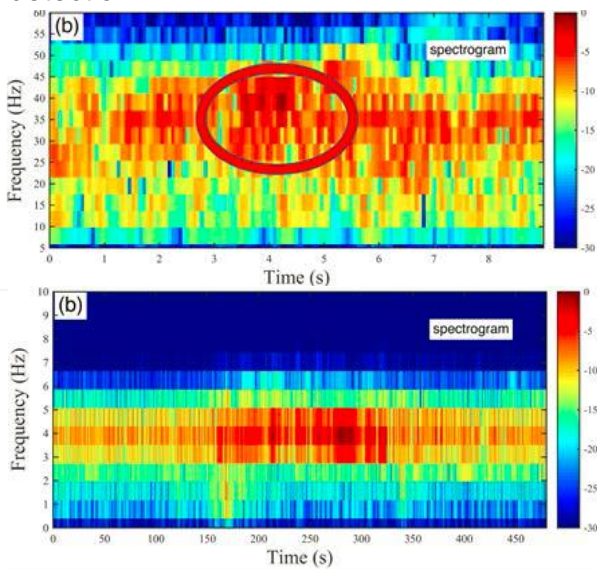


Figure 1: LPLD events in Texas (top) and Kansas (bottom).

Project Outcomes:

Researchers successfully installed a network of broadband seismometers on the surface above large CO₂ injection sites at the Farnsworth enhanced oil recovery (EOR) site in Texas and the Wellington EOR site in Kansas to monitor seismic activity, specifically long period long duration (LPLD) events. Researchers are also collecting and analyzing data from a downhole seismic array at the Pinnacle Reef EOR site in Michigan. A series of LPLD seismic events recorded at Farnsworth and Wellington are remarkably similar in appearance to tectonic tremor sequences first observed in subduction zones. About 190 and 112 LPLD seismic events were recorded during CO₂ injection in the Wellington and Farnsworth EOR field sites, respectively. Cross-correlation methods (developed by Northwestern University) have been used to locate the sources of LPLD at the Farnsworth EOR site in north Texas. This project is ongoing under FWP-1022403 Task 25.

- Prime Performer:**
National Energy Technology Laboratory (NETL)
- Principal Investigator:**
Rick Hammack
- Project Duration:**
10/1/2014 – 9/30/2016
- Performer Location:**
Pittsburgh, Pennsylvania
- Field Sites:**
Farnsworth EOR site, Texas
Wellington EOR site, Kansas
Pinnacle Reef EOR site, Michigan
- Program:**
Carbon Storage