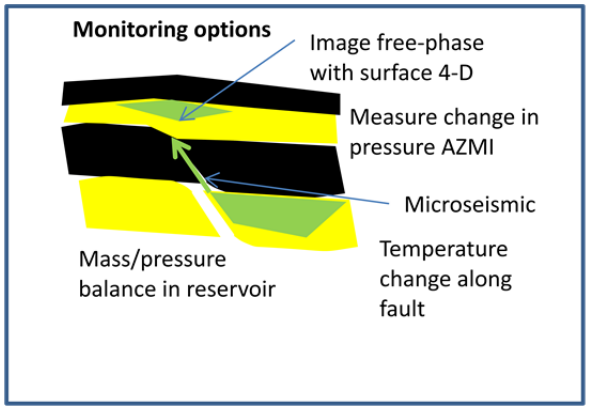
Theme Overview: Monitoring Methods Optimization

2011–2014 Goal

Monitoring optimization of geological carbon sequestration at GCCC focuses on four monitoring zones: in zone, above zone, shallow groundwater, and vadose zone. Our work includes field demonstration, laboratory studies, and assessments.



A variety of monitoring options are possible at geological sequestration sites.

Accomplishments

- Developed new monitoring tools and approaches: for example, a process-based method of using gas ratios to attribute sources of anomalies and time-lapse compressibility to assess change/no change in fluid in a zone.
- Analyzed dense monitoring data from 2008 to the present from the research-oriented program at Cranfield, Mississippi.
- Designed a monitoring plan for two commercial enhanced oil recovery (EOR) projects sourced from anthropogenic (captured) CO_2 (Hastings and West Ranch, Texas).
- Produced assessments of methods for optimization of monitoring approaches including site-specific sensitivity of tools (Hovorka et al., 2014), sites with storage via EOR (Wolaver et al., 2013), and statistical methods for optimization of well placement.
- Transmitted information to industry and regulatory participants (see Outreach, Training, Policy and Regulation Theme for more information).

Impacts

- Pioneered pressure surveillance of above-zone monitoring intervals (AZMI) as a robust, commercial method of assessing storage permanence.
- Provided fit-to-purpose monitoring tools for response to changes (time-lapse compressibility and process-based method) (see Natural Analog Studies Theme for more on process-based method).
- Improved conceptualization of fluid flow using multiple methods in a cross-well array.
- Developed a pragmatic approach to monitoring large-scale injection with full industrial participation.
- Enabled the private sector to develop an economically viable CO_2 sequestration industry.
- Assessed and demonstrated limits, as well as strengths, of monitoring methods that support parsimonious commercial plans.
- Generated valuable experience using monitoring data for input into a fluid-flow model.

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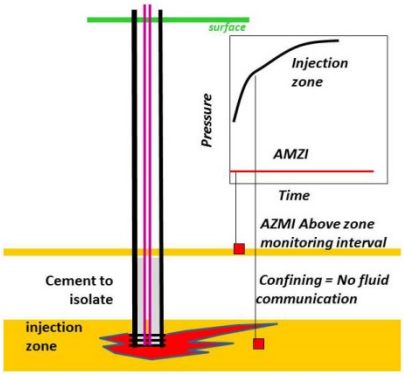
Major Projects

- **SECARB Cranfield 2008–17.** Multiyear, multimillion-ton injection with a focus on the water leg of an EOR project.
- **Monitoring design and implementation for commercial capture to EOR projects.** Working with industry partners on commercial projects has sharpened the understanding of optimization of monitoring, including thermal and time-lapse pressure methods.
- **Pressure-based inversion and data assimilation system (PIDAS)**. This system is developing a harmonic pulse testing technique for detecting leakage from CO_2 storage formations and data assimilation and inversion algorithms for incorporating this technique into operational monitoring programs.



At some sites, the above zone (AZMI) is a key monitoring target.

- **EPA-CCP site-specific monitoring study**. This study undertook a novel assessment of how site-specific properties impact deveopment of monitoring strategies at geological sequestration sites.

(See Natural Analog Studies Theme for information on additional monitoring associated with industrial and natural analog sites.)

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