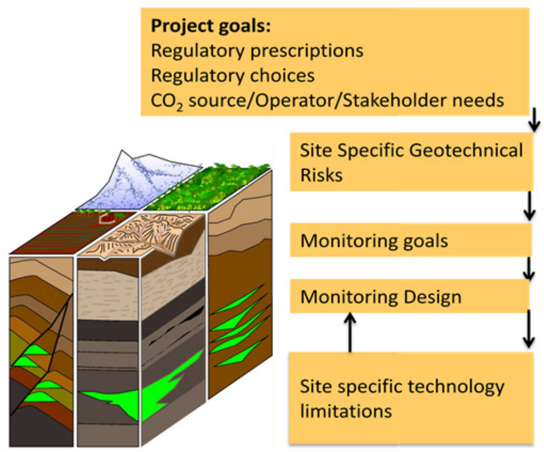
Monitoring Methods Optimization: Site-Specific Monitoring

Project Description

Most regulatory programs for geologic storage require that the monitoring design be site specific. However, little guidance is available to show how this can be accomplished. This four-year study, funded by the U.S. Environmental Protection Agency (EPA) and the Carbon Capture Project (CCP) considered two aspects of the unmet needs: (1) Not all sites have the same monitoring needs, and (2) Monitoring tools work differently at different sites.



Monitoring design and implementation is constrained by site-specific needs.

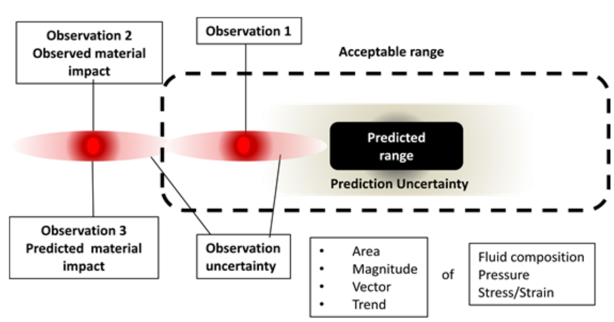
Accomplishments

To define monitoring needs, a process described as an assessment of low-probability material impacts (ALPMI) was developed. This process is similar to conventional risk assessment, in that experts and key stakeholders define the material impacts to the site. Material impacts are outcomes that would be unacceptable to the key stakeholders and may be different in different regulatory settings, for different stakeholders, in different operational settings, and in different geologic settings. The major difference between an ALPMI process and a risk assessment is that less effort is placed into probabilistic assessment and more effort is put into modeling the assessment.

The models developed during the ALPMI process can then be used to determine how to select, place, and operate the monitoring technologies so that an early warning of potential flaws in the assessment of an operation can reliably be identified at low cost and with high assurance. We illustrate the site-specific nature of tools with four case studies by forward modeling how a tool that can be quite sensitive to a signal in one setting can perform poorly in another setting.

Impacts

The combination of ALPMI with forward modeling of tool response provides a framework that can be followed at diverse settings to justify large differences in monitoring design. A standardized process is needed to create flexibility to avoid outcomes where the optimized monitoring design developed at one site is used inappropriately at a different site.



Schematic of ALPMI process used to evaluate monitoring technologies for a particular sequestration site.

Methods

The study drew upon examination of several dozen monitoring plans, from different types of sites having different perspectives in monitoring needs, from R&D–oriented sites, to fully commercial sites. The importance of the key stakeholder perspective was highlighted by this analysis. In addition, variable success with detection methods was noted, leading to a heightened awareness of the need for both formal assessment of the nature and magnitude of the ALPMI signal and forward modeling of tool response to that signal. The process is a traditional method of good experimental design applied to a regulatory and commercial setting.

Selected Citations

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