NETL

the ENERGY lab

PROJECT FACTS

Carbon Sequestration

The Potential Risks of Freshwater Aquifer Contamination with Geosequestration Simulation and Risk Assessment of Carbon Capture and Storage

Background

Increased attention is being placed on research into technologies that capture and store carbon dioxide (CO_2). Carbon capture and storage (CCS) technologies offer great potential for reducing CO_2 emissions and, in turn, mitigating global climate change without adversely influencing energy use or hindering economic growth.

Deploying these technologies in commercial-scale applications requires a significantly expanded workforce trained in various CCS specialties that are currently under-represented in the United States. Education and training activities are needed to develop a future generation of geologists, scientists, and engineers who possess the skills required for implementing and deploying CCS technologies.

The U.S. Department of Energy's (DOE) National Energy Technology Laboratory (NETL) has selected 43 projects to receive more than $12.7 million in funding, the majority of which is provided by the American Recovery and Reinvestment Act (ARRA) of 2009, to conduct geologic sequestration training and support fundamental research projects for graduate and undergraduate students throughout the United States. These projects will include such critical topics as simulation and risk assessment; monitoring, verification, and accounting (MVA); geological related analytical tools; methods to interpret geophysical models; well completion and integrity for long-term CO_2 storage; and CO_2 capture.

Project Description

DOE is partnering with Duke University (Duke) to conduct research and training to advance CCS in the area of simulation and risk assessment. Simulation and risk assessment for CCS are used to forecast CO_2 behavior and transport; optimize site operational practices and ensure site safety; and refine site monitoring, verification, and accounting efforts. This project will include collecting lithologic (rock/sediment) samples from shallow freshwater aquifers, situated above proposed CO_2 storage

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PROJECT DURATION

Start Date
12/01/2009

End Date
11/30/2012

COST

Total Project Value
$299,918

DOE/Non-DOE Share
$299,918 / $0

Government funding for this project is provided in whole or in part through the American Recovery and Reinvestment Act.

reservoirs, that produce water with high heavy metal content (defined as having greater than 10 percent of the Environmental Protection Agency (EPA) maximum recommended contaminant levels (MCLs)). Site-specific field data for the targeted aquifers will also be collected. This data could include hydraulic conductivity; storativity; hydraulic head of surrounding wells, lakes, and rivers; transmissivity; saturated thickness; aquitard properties; local precipitation; location, construction, and yield of any pumping and monitoring wells; and groundwater samples. Duke will simulate the impact of introducing CO_2 into a shallow freshwater aquifer and evaluate its effect on the heavy metal content of the aquifer. Bench tests will bubble CO_2 laden water through the lithologic samples and analyze the percolated water for heavy metals after different contact periods. This data will be used with industry-standard software and the field readings, to predict the extent of the impacted area if a CO_2 reservoir might leak.

Goals/Objectives

The goal of the project is to understand how a potential CO_2 leak will affect water-rock interactions in freshwater aquifers. Project objectives include:

- Estimating the subset of locations where relatively high levels of heavy metals may be most prevalent
- Identifying geochemical signatures in affected water which can be used as detection criteria.
- Determining the potential impact of CO_2 which might not be contained in the target reservoir on water-rock interactions.
- Understanding the geographic, petrologic, and exposure-time dependence on these interactions.

Benefits

Overall, the project will make a vital contribution to the scientific, technical, and institutional knowledge necessary to establish frameworks for the development of commercial-scale CCS. This research will result in a better understanding of how potential CO_2 leaks will influence water/rock interactions and groundwater chemistry outside of the CO_2 target reservoir.

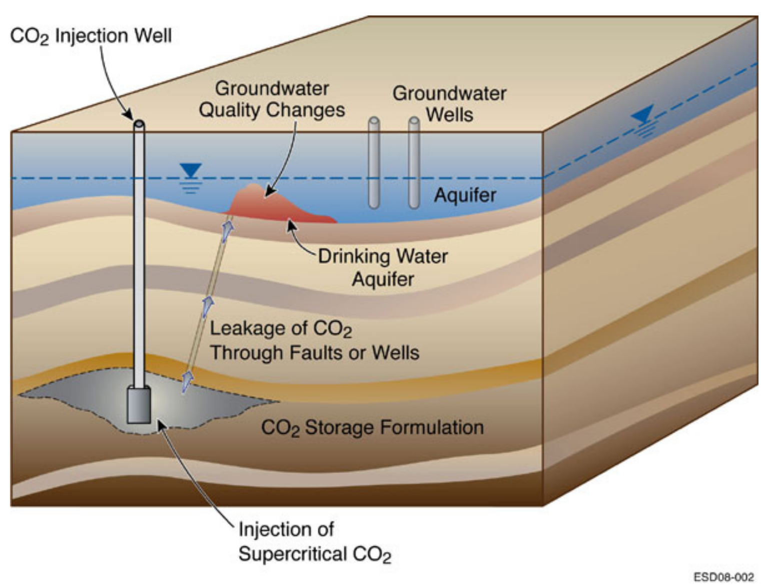

Figure 1. Schematic of the potential impact of leakage of injected CO2 on groundwater quality. (Source: http://esd.lbl.gov/co2geostorage/research/CO2/co2_taska.html.)