California Energy Commission
Public Interest Energy Research (PIER) Program

Geologic Carbon Storage and Potential Impacts on Groundwater Resources in California's Central Valley

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Fact Sheet

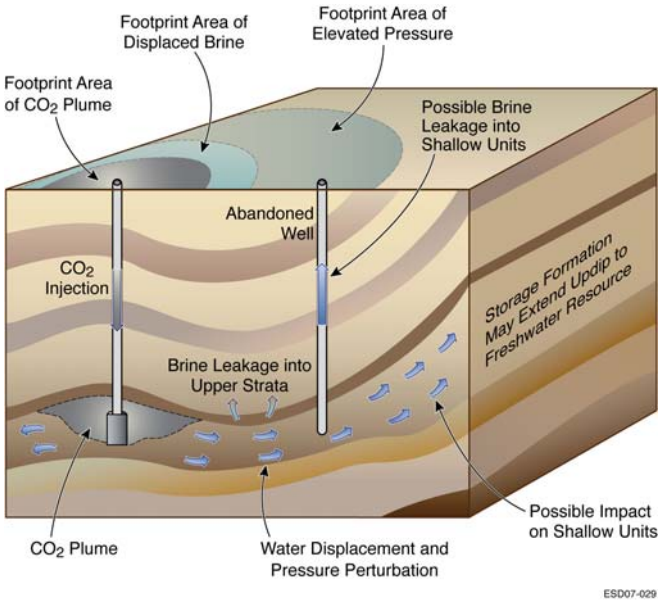
The Issue

A potential measure for mitigating greenhouse gas emissions from the combustion of natural gas is to capture large volumes of carbon dioxide for storage in deep, underground saline aquifers. Carbon dioxide storage at depth may potentially impact shallow freshwater underground aquifers. The consequences of large-scale pressure buildup and the fate of the brines or brackish waters displaced by injected carbon dioxide are not well understood. Other possible effects include water table rise, changes in underground aquifer recharge and discharge zones, alteration of subsurface flow patterns and changes in surface water flow patterns and water quality.

In California, the thick marine sediments of the San Joaquin Valley have been identified as a prime target for future carbon dioxide storage.

Project Description

This project involves two main tasks: 1) analysis of basin-pressure changes due to historic hydrocarbon production; and 2) simulation and analysis of the consequences of deep basin pressure changes for surface and subsurface water resources.



Schematic showing different regions of influence related to carbon dioxide storage
Image Credit: Lawrence Berkeley National Laboratory

The researchers will analyze data on historic hydrocarbon production and fluid pressures in the San Joaquin basin for pressure responses to help evaluate possible pressure changes in the future due to large volumes of carbon dioxide storage. Specific goals include:

- Define pressure phenomena that could be investigated and prioritized for further analysis; and

- Identify and analyze suitable case histories for studying pressure-change phenomena, and evaluate implications for carbon dioxide storage.

The research will also look at pressure effects on water and simulate consequences of deep basin pressure changes on water resources. Results from a simulation study funded by the U.S. Department of Energy on carbon dioxide storage in the deep sediments of the San Joaquin Valley will be linked to existing groundwater management models for the area. This project will investigate whether potential basin pressure changes and brine displacement caused by future carbon dioxide storage will have an impact on underground and surface water resources. Specific goals include:

- Simulate reasonable carbon sequestration scenarios for the San Joaquin basin;
- Use the large-scale carbon dioxide storage simulation model to predict impacts of carbon dioxide injection on pressure buildup and brine displacement;
- Apply prediction results from the deep-sediment model to the selected groundwater-surface water models;
- Utilize groundwater-surface water models and predict possible changes in future (+100 years) groundwater and surface water regimes;
- Evaluate the impacts of carbon dioxide storage in the context of water resource utilization, population, land use, and climate; and
- Consider implications of the water resource simulation results for other parts of the Central Valley.

PIER Program Objectives and Anticipated Benefits for California

The geological storage of large volumes of carbon dioxide and its possible impacts on groundwater hydrology are being addressed in this research effort. This knowledge is crucial, particularly in this groundwater-dependent agricultural region, because underground freshwater supplies may be impacted. This should be considered, along with the economic, social, and environmental implications associated with water usage. Because energy production is a large source of greenhouse gas emissions, identifying solutions to mitigate climate change is a priority for the Energy Commission in an effort to ensure that Californians continue to have a good quality of life along with stable, secure, and reliable sources of energy.

Project Specifics

Agreement Number: 500-09-034
Contractor: Lawrence Berkeley National Lab
Agreement Amount: $500,000
Agreement Term: June 2010 to May 2013

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