

GEOCHEMICAL MODELING OF ENHANCED OIL RECOVERY AND CO₂ STORAGE AT THE NORTHWEST MCGREGOR OIL FIELD

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ABSTRACT

Injection of carbon dioxide (CO₂) for the purpose of enhanced oil recovery is widely regarded as one of the key commercial applications of geological storage and provides valuable insight into other large-scale projects aimed at reducing CO₂ emissions to the atmosphere. The Plains CO₂ Reduction (PCOR) Partnership, one of the seven U.S. Department of Energy National Energy Technology Laboratory Regional Carbon Sequestration Partnerships, is conducting a project in the Northwest McGregor oil field in North Dakota to determine the effects CO₂ has on the productivity of the reservoir, wellbore integrity, and the carbonate formation into which the CO₂ was injected. The method used in this project was huff 'n' puff whereby 440 tons of supercritical CO₂ was injected into a well over a 2-day period and allowed to "soak" for a 2-week period. The well was subsequently put back into production to recover incremental oil. This paper outlines the approach and current observations derived from numerical modeling and laboratory simulations of potential geochemical reactions to evaluate the short-term risks for operations (e.g., porosity and permeability decrease) and long-term implications for CO₂ storage via mineralization. The data obtained during mineralogical analyses and fluid sampling were used as input parameters for the numerical modeling. Results of the numerical modeling suggest that the already acidic and highly saline environment (pH <4.5 and total dissolved solids ~300,000 mg/kg) of the Northwest McGregor oil field should not experience any significant changes in mineralogy as a result of CO₂ injection, especially in the near term, which correlates with the postinjection field geochemical analyses.