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Abstract

ABSTRACT BODY: Carbon capture, utilization, and storage (CCUS) is becoming an important bridge to commercial geologic sequestration (GS) to help reduce anthropogenic CO2 emissions. While CCUS at brownfield sites (i.e. mature oil and gas fields) has operational advantages over GS at greenfield sites (i.e. saline formations) such as the use of existing well infrastructure, previous site activities can add a layer of complexity that must be accounted for when developing groundwater monitoring protection networks.

Extensive work has been done on developing monitoring networks at GS sites for CO2 accounting and groundwater protection. However, the development of appropriate monitoring strategies at commercial brownfield sites continues to develop. The goals of this research are to address the added monitoring complexity by adapting simple analytical and numerical models to test these approaches using two common subsurface monitoring parameters, pressure and aqueous geochemistry. The analytical pressure model solves for diffusivity in radial coordinates and the leakage rate derived from Darcy's law. The aqueous geochemical calculation computer program PHREEQC solves the advection-reaction-dispersion equation for 1-D transport and mixing of fluids .The research was conducted at a CO2 enhanced oil recovery (EOR) field on the Gulf Coast of Texas. We modeled the performance over time of one monitoring well from the EOR field using physical and operational data including lithology and water chemistry samples, and formation pressure data. We explored through statistical analyses the probability of leakage detection using the analytical and numerical methods by varying the monitoring well location spatially and vertically with respect to a leaky fault. Preliminary results indicate that a pressure based subsurface monitoring system provides a better probability of leakage detection than geochemistry alone, but together these monitoring parameters can improve the chances of leakage detection. By assessing the probability of leakage detection, an initial finding on the use and implementation of each monitoring technique can be made at this field and realistically extrapolated to other CCUS fields.