Public Abstract
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Title:Numerical modeling of CO2-water-rock interactions in the Farnsworth, Texas Hydrocarbon Unit, USA

Numerical speciation, reaction path, and reactive transport modeling were used to evaluate potential for long-term CO2 sequestration in Farnsworth Hydrocarbon Unit in northern Texas. Speciation modeling showed the present Morrow B formation water to be supersaturated with respect to an assemblage of zeolite, clay, carbonate, mica, aluminum hydroxide minerals, and quartz. Feldspars and chlorite were predicted to dissolve. A reaction path model showed pH value decreased initially from 7 to 4.1 and 4.2 during titration of CO2. As the resultant CO2-charged fluid reacted with Morrow B mineral matrix, the pH rose to 5.1 to 5.2 with precipitation of diaspore, quartz, nontronite, siderite, witherite, dolomite, and calcite. CO2 sequestration by mineral trapping was predicted to maximum of 2% of the titrated CO2 with porosity increase of about 1.4 to 1.5%.
Reactive transport modeling was executed injecting CO2 at nine wells at field rate for 10 years. During injection, fluid pressures near the wells rose from about 15 MPa to about 19.2 MPa, but quickly dissipated after injection ceased. A plume of immiscible CO2 gas built up around the wells, reaching pore saturations of about 50%. Over the 30 years time of the simulations thus far, ankerite was the only carbonate mineral predicted to precipitate, and only mineral sink for CO2. Injected CO2 after 30 years simulation was predicted to be sequestered by hydrodynamic trapping, followed by solubility and mineral trapping, respectively. The amounts of mineral precipitation and dissolution were too small to affect the porosity and permeability significantly.