

Subsurface monitoring of anthropogenic CO₂ injected in sedimentary basins: results from the Frio-I brine test, Texas

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Abstract:

To investigate the potential for the long-term storage of CO₂ in deep saline aquifers, 1600 t of CO₂ were injected at 1500 m depth into a 24-m-thick "C" sandstone of the Frio Formation near Houston, Texas. Fluid samples obtained before CO₂ injection from the injection well and an observation well 30 m updip showed a Na-Ca-Cl type brine with 93,000 mg/L TDS at saturation with CH₄, but only 0.3% CO₂. Following CO₂ breakthrough, samples showed sharp drops in pH, pronounced increases in alkalinity and Fe, and significant shifts in the isotopic compositions of H₂O, and DIC. These parameters, together with perfluorocarbon tracer gases were used for monitoring migration of injected CO₂ into the overlying Frio "B", a 4-m-thick sandstone, separated from the "C" by ~15 m of shale and siltstone beds. Results from "B" 6 mo after injection show significant CO₂ (2.9 % vs. 0.3% CO₂) migration into the "B" sandstone. More important: These results are a first successful application of geochemical monitoring above-injection zone at depth.

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