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At the Cranfield Field, Mississippi, USA, a monitored CO_2-EOR project provides a unique opportunity to understand geochemical interactions of injected CO2 within the reservoir. Cranfield field, discovered in 1943, is a simple anticlinal four-way closure and had a large gas cap surrounded by an oil ring (Mississippi Oil and Gas Board, 1966). The field was abandoned in 1966. The reservoir returned to original reservoir pressure (hydrostatic pressure) by a strong aquifer drive by 2008. The reservoir is in the lower Tuscaloosa Formation at depths of more than 3000 m. It is composed of stacked and incised channel fills and is highly heterogeneous vertically and horizontally. A variable thickness (5 to 15 m) of terrestrial mudstone directly overlies the basal sandstone providing the primary seal, isolating the injection interval from a series of fluvial sand bodies occurring in the overlying 30 m of section. Above these fluvial channels, the marine mudstone of the Middle Tuscaloosa forms a continuous secondary confining system of approximately 75 m.

The sandstones of the injection interval are rich in iron, containing abundant diagenetic chamosite (ferroan chlorite), hematite and pyrite. Geochemical modeling suggests that the iron-bearing minerals will be dissolved in the face of high CO2 and provide iron for siderite precipitation. CO2 injection by Denbury Resources Inc. begun in mid-July 2008 on the north side of the field with rates at ~500,000 tones per year. Water and gas samples were taken from seven production wells after eight months of CO2 injection. Gas analyses from three wells show high CO2 concentrations (up to 90 %) and heavy carbon isotopic signatures similar to injected CO2, whereas the other wells show original gas composition and isotope. The mixing ratio between original and injected CO2 is calculated based on its concentration and carbon isotope. However, there is little variation in fluid samples between the wells which have seen various levels of CO2. Comparison between preinjection and postinjection fluid analyses also shows little difference. It suggests that CO2 injection has not induced significant mineral-water reactions to change water chemistry. The lag of change of fluid chemistry is different from previous observation at Frio field test.

In October 2009, CO2 will be injected into the down-dip, non-productive Tuscaloosa Formation on the east side of the same field. In-situ fluid and gas samples will be collected using downhole U-tube. Fluid chemistry data through time will reveal mineral reactions during and after injection and confine timescales of the interactions.

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