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A pilot CO_2 injection test was conducted at the South Liberty Field near Houston, Texas, as part of the U.S. Department of Energy's program to explore the feasibility and operational issues associated with geologic sequestration of CO_2 in brine formations. The target geologic unit is a 23-meter thick sand located at a depth of 1,500 m in the upper Frio formation, a Miocene-age fluvial-deltaic formation that underlies much of the upper Texas Gulf Coast. Two wells were completed: an injection well and a monitoring well located approximately 30 m up-dip from the injection well, both perforated through the top 6 m of the Frio sand. Prior to the CO_2 injection, formation hydrologic parameters were investigated by performing a single-well pump test followed by a two-well recirculating tracer test. Based on a Theis analysis of the interference data, the formation has a permeability of 2.3 Darcies. The arrival of the fluorescent tracer in 9 days with a laboratory-measured formation porosity of 35% suggests an effective thickness for the aquifer of 8 m. This coincides well with the geological model based on the presence of a thin-shale interbed.

Following the hydrologic testing, 1,600 tons of food grade CO_2 was injected over a 10 day interval. At the pressure and temperature of the Frio formation (63°C and 143 bars) the CO_2 is a supercritical fluid. The CO_2 plume had an initial arrival at the monitoring well of 51 hours. To properly compare the transport of the single-phase tracer results with the two-phase CO_2 we must correct for the differences in flow geometries and fluid properties. The arrival time for the CO_2 is still quicker than what is predicted based purely on phase interference. Inspection of buoyant to viscous forces suggests that gravity drive can be a significant mechanism and must be taken into account.

A multi-phase multi-component integral-finite-difference model, based on available borehole logs and laboratory data, was used to predict Frio test results. The geometry of the model was further calibrated using the results of the two-well tracer test. The numerical simulation of the CO_2 injection initially predicted arrival in 3-5 days. The two-day range in predicted arrival times arises from different assumptions about relative permeability, which is not well-established for supercritical CO_2/brine mixtures. Further refinement of the numerical model by adjusting relative permeability and capillary-

pressure-saturation parameters results in a better fit to the Frio data. The data collected at the Frio site provides an excellent opportunity to test the soundness of our conceptual and numerical models to represent the two-phase flow processes encountered during CO_2 sequestration.