Monitoring a large-volume injection at Cranfield, Mississippi—Project design and recommendations

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Abstract

Injection and storage of 4 million metric tons of CO_2 have been monitored to observe multiphase fluid flow, to test technologies, to document permanence of storage, and to advance techniques for capacity estimation. The injection interval is the 3000-m-deep fluvial Tuscaloosa Formation at a structural closure that defines the Cranfield oilfield. Tests were conducted in the oil-producing area as well as in the downdip brine aquifer. These tests assessed the feasibility, operation, and sensitivity of monitoring using a selection of tools in the vadose zone, in the shallow groundwater, above the injection zone, and within the injection zone. Although each monitoring approach merits a separate, detailed analysis, this paper assesses the success of the overall strategy for monitoring and presents an overview of conclusions from multiple data sets.

Comparisons of modeled to observed reservoir response highlight the difficulties encountered in uniquely explaining measured pressure and fluid saturation measurements at interwell and field scales. Results of this study provide a cautionary note to regulatory and accreditation end users about the feasibility of obtaining unique and quantitative matches between fluid flow models and field measurements.