Across-Fault Pressure Perturbation Induced by CO2 Injection

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Geological carbon sequestration aims at long-term storage of carbon dioxide in deep geological formations. To minimize the risk of leakage, the integrity of the geological seal has to be characterized carefully. The focus of this study is to simulate CO2 injection and observe the interaction of the CO2 and pressure evolution with a modeled fault intersecting the injection interval. Such features may be fairly common at a variety of scales in many sequestration reservoir targets, but their hydrologic and mechanical response to rapid pressure changes induced by CO2 injections requires investigation. We present numerical simulations from a commercial simulator (GEM from CMG). Preliminary numerical studies will determine the dependence of the CO2 and pressure evolution along and across the fault as a function of geological parameters. Additionally, the study is designed to complement and understand the field data being collected from the DOE-funded SECARB Phase 3 of the Cranfield CO2 injection project in the fall of 2009. A 12-level 3-component microseismic array has been deployed in a well approximately 1200 feet from a continuous CO2 injection well. A reservoir-scale fault intersects the reservoir between the injection and observation well. Available field data will be integrated with the flow model and analyzed to estimate the hydrologic properties of the adjacent fault. Pressure evolution predictions from the flow simulation will be critical for understanding the temporal distributions of any observed microseismic events detected. This project was funded thought the National Energy Technology Laboratory Regional Carbon Sequestration Partnership Program as part of the Southeast Regional Carbon Sequestration Partnership