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Microseismics- Adding Value to Monitoring for CO2 Injection Compliance

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SUMMARY

From a compliance, environmental, and human impact standpoint, critical goals of any CO2 injection monitoring program are to identify the position of the CO2 plume, to verify containment of the injectant and cap rock integrity. These goals are common from pilot scale demonstrations through to commercial scale CO2 injection projects.

Activities within a reservoir, such as injection and production, lead to a change in the local stress-strain fields. When a critical change is achieved, microseismic activity in or around the reservoir can occur. This release of seismic energy may be related to the reactivation of pre-existing fault or fracture networks, or to the initiation of new fractures. Installation of downhole geophone arrays to listen for any significant changes within the reservoir is an application that has been adopted by the petroleum industry during steaming and hydraulic fracture operations. It is, therefore, a natural fit in the scenario of CO2 injection monitoring, where it is crucial to identify and locate any mechanism that may contribute to the creation of a potential CO2 leakage pathway. Conversely, a lack of observed microseismic activity in such a system is of equal importance in that it provides a level of confidence that containment has not been compromised through rock fracturing during the injection process.

To look at the potential value of microseismic monitoring for assessing its potential role in CO2 injection compliance, an integrated CO2 injection monitoring field test was carried out in Ostego County in February 2008 by the Midwest Regional Carbon Sequestration Partnership s (MRCSP). Based on these studies, we were able to identify that microseismic monitoring can play a significant role in assessing the stability of a CO2 injection program, particularly when it comes to cap rock integrity. This has the potential to impact public perception and acceptance of carbon sequestration and storage projects. To provide effective monitoring programs, current microseismic instrumentation will need to be adapted and developed to improve efficiencies in deployment and monitoring economics, and allow for more integrated monitoring solutions (e.g., inclusion of additional non-seismic sensors or acquisition parameters)