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The Need for Multi-Formation Monitoring Schemes for Geologic CO₂ Sequestration

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Monitoring, Verification, and Accounting (MVA) of CO₂ stored in deep geologic formations will be an important factor for the success of CO₂ sequestration projects. Reliable monitoring technologies are paramount in gaining public and regulatory approval of sequestration sites. In addition, reliable data will be imperative for accurate site modeling and simulation.

Vertical migration and leakage of injected CO₂ will be a risk associated with all saline aquifer sequestration projects that inject CO₂ as a separate-phase. The density difference between the existing formation fluid and the CO₂ will cause the CO₂ to migrate upwards and formation heterogeneity will complicate the migration. This inherent tendency for vertical migration means that a monitoring scheme will be necessary both to clarify the understanding of CO₂ migration in the injection horizon and to identify any leakage into underground sources of drinking water or other sensitive formations that overlie the injection formation. Such a monitoring scheme requires multiple monitoring zones within the injection formation, as well as monitoring zones in adjacent formations. Currently, draft regulations for CO₂ storage projects recognize the importance of this kind of in-situ monitoring and accordingly will likely require monitoring wells in injection horizons as well as in overlying formations.

This paper discusses the value of multilevel monitoring for CO₂ storage projects and presents a monitoring platform for gathering multilevel data. These data include in-situ measurement of pressure and temperature, periodic in-situ collection of fluid samples, and unique hydraulic tests for characterization and monitoring made possible by the multilevel nature of the platform. Collection of this data from multiple zones in a borehole improves the understanding of vertical heterogeneities, leading to more robust predictive models for CO₂ storage projects. Moreover, a multilevel monitoring platform provides a cost-effective means of complying with the regulatory monitoring and sampling requirements that are likely to be mandatory at these sites.