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A CO2 Sequestration Pilot Screening: Geologic and Simulation Modeling

This paper presents an investigation of CO2 sequestration potential in northern West Virginia geologic formations to determine potential sites for a carbon sequestration field research facility. Possible CO2 sequestration sites are assessed based on geological and engineering considerations, technical feasibility, process readiness, CO2 injection capability and other factors. The objective of the screening study is to evaluate and rank potential sites and geologic strata to select the most attractive site for a small-scale field research facility. Electric well logs from surrounding natural gas wells were analyzed to determine reservoir properties. All potential CO2 sequestration reservoirs were evaluated through the total log depth. Reservoirs included non-mined coal seams, producing and depleted oil and gas reservoirs, shallow and deep saline aquifers and organic-rich shale zones. Parameters determined for each reservoir included formation depth and total thickness, pay thickness, porosity, permeability and temperature. Computer simulation studies were performed to determine critical and optimum injection rates for CO2 injection. An inverted 5-spot well pattern was used as a pilot test model. Compositional simulations were run for cases with brine only and brine and gas saturated reservoirs. Both vertical and horizontal injector wells were considered. The pilot model was applied to run sensitivity simulations for well injectivity optimization, brine and gas production, mobility control and other scenarios that could be useful for maximizing sequestration capacity. The finding of this study will be useful in selecting a carbon sequestration field research facility site. Risks associated with the facility can be foreseen through highlighting potential CO2 injection problems, determining early CO2 breakthrough scenarios, reducing the potential of cap rock degradation, assisting in field facility design and instrumentation requirements, determining surface and subsurface monitoring requirements and evaluating potential enhanced gas production due to associated CO2 flooding.