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[PS]Characterization of Springfield Coal Member of the Carbondale Formation (Pennsylvanian) in a CO_2 Sequestration Pilot - Illinois Basin - Tanquary Site*

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Abstract

The potential for sequestering CO_2 in the largest bituminous coal reserve in the United States (Illinois Basin) is being assessed in southeastern Illinois as part of the U.S. Dept of Energy's Regional Sequestration Partnership program. To accomplish the main objectives of this test, which are to determine CO_2 injection rates and storage capacity, a detailed coal characterization program was developed in order to provide the best input into the COMET 3 Reservoir Simulator. At the Tanquary site, the targeted Springfield Coal is high volatile bituminous rank (Ro average of 0.62%), 7 ft thick and occurs at 900 ft depth. The seam was examined in core from one injection and three observation wells spaced approximately 50 to 100 ft apart and oriented relative to the cleat directions.

Desorbed coal gas content from one foot core intervals varies from 150 to 210 scf/ton (dmmf) and consists generally of >92% CH_4 with lesser amounts of N_2 and then CO_2. Coal maceral composition averaged 70.2% vitrinite, 3.6% liptinite, 13.9% inertinite and 7.3% mineral matter with considerable variation, particularly in inertinite content, from the top to the bottom of the seam. As the adsorption of CO_2 varies with maceral type, the abundance of different macerals significantly affects the sequestration potential, being greatest in the vitrinite-rich (bright) coal and decreasing significantly in the inertinite-rich (dull) coals. Coal cleats are well developed with 1 to 2 cm spacing and, may be partially mineralized with calcite and/or kaolinite fillings that decrease coal permeability. CH_4, CO_2 and N_2 adsorption isotherms indicate at least 3 molecules of CO_2 can replace each displaced CH_4 molecule. High resolution open-hole logs through the coal reveal variation in the potential coal permeability with the shallow resistivity curve in the basal 2 feet showing much higher resistivity than the medium or deep curves, due to increased fresh water drilling fluid invasion into the near well bore compared

to the deeper more saline indigenous fluid. Gamma Ray and bulk density vary somewhat, reflecting differences in maceral, ash and pyrite content. Density porosity is fairly uniform, whereas neutron porosity, which is sensitive to hydrogen atoms, shows high variability. Because all the coal characteristics highlighted above will vary across the basin, it is critical to determine them around any injection site in order to best predict the potential for CO_2 injection.

References

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