Carbon Dioxide Storage Potential of the Broom Creek Formation in North Dakota: A Case Study in Site Characterization for Large-Scale Sequestration

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ABSTRACT

Future fossil-fuel based energy production facilities may include carbon management strategies as part of their overall operational plans. Geological formations, such as saline aquifers, oil fields, and coal seams, appear to have significant capacity to store carbon dioxide (CO_2) provided that they have adequate porosity, permeability, temperature and pressure conditions, and competent seals. As part of the conceptual design phase of a proposed future coal-fired power plant in southwestern North Dakota, the Broom Creek Formation was identified as being a potential sink for large-scale CO_2 sequestration. The Pennsylvanian/Permian Broom Creek Formation is a laterally extensive sandstone at the top of the Minnelusa Aquifer System which is capped by the Opeche shale. A wide variety of previously generated data, including well logs, core analyses, water analyses, and other published data were used to conduct a detailed characterization of an area of the Broom Creek Formation in the immediate vicinity of the proposed power plant location. These data were used to estimate injection rates and predict plume size and migration tendencies. The results of the exercise suggest that a minimum of 50 million metric tons of CO_2 could be stored in an area no larger than 15 square miles over an injection period of 30 years. This case study describes an approach that can be applied to conducting site-specific characterization of geologic formations for the purpose of large-scale CO_2 sequestration.