Estimates of the Carbon Dioxide Sequestration Capacity for Lower Paleozoic Aquifer Systems in the Midcontinent Region of North America

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ABSTRACT

Saline aquifers within the midcontinent region of North America have the potential to store vast quantities of anthropogenic CO_2. The lower Paleozoic (Cambrian to Mississippian) aquifer systems extend from Oklahoma and Missouri in the south to Saskatchewan and Manitoba, Canada, in the north, comprising one of the largest regional-scale aquifer systems in North America. Understanding the regional continuity, hydrodynamic characteristics, and fluid properties of these regional-scale aquifer systems provides a basis to evaluate CO_2 sequestration potential. Large-scale relational databases and geographic information system tools are used to integrate temperature, pressure, and water geochemistry data from numerous wells to evaluate the potential for geologic CO_2 sequestration in the midcontinent lower Paleozoic aquifer systems. Specifically, a model was developed using a calculation that relates the pore volume in the formation as the product of area, thickness, and porosity, and the solubility of CO_2 in the formation water (which considered the effect of salinity) at spatially varying pressures and temperatures. Depth to the top of the formation was also considered, with a minimum depth of 2500 feet being set to protect potable aquifers. Additional tools provide the ability to query and analyze geochemical data within a geospatial context from numerous saline aquifers across North America. Specific stratigraphic units that were evaluated include the Madison Group (Mississippian) and Arbuckle Group (Cambrian–Ordovician). The reconnaissance-level potential storage capacity estimates generated by this approach suggest that over 100 billion tons of CO_2 could be stored in these aquifer systems.