

HYDROLOGY OF THE FOREST CITY BASIN, MID-CONTINENT, USA: IMPLICATIONS
FOR CO₂ SEQUESTRATION IN THE ST. PETER SANDSTONE

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ABSTRACT

The purpose of this research was to perform a preliminary assessment of the stratigraphy, storage capacity, hydrology and mineralogy of this basin to determine its suitability and structural trapping capacity for geologic sequestration of carbon dioxide. The basin is stratigraphically suited in that it contains the St. Peter Sandstone, a high permeability aquifer which is overlain by multiple low permeability units. These should act as a seal to prevent the upward migration of injected CO₂. Construction of a three dimensional stratigraphic model produces storage capacity estimates within the St. Peter ranging from 5.2 to 830 megatonnes CO₂. Groundwater modeling results highlight potential areas of flow stagnation and a predominately lateral flow regime within the St. Peter Sandstone. This, coupled with relatively low flow velocities in most model scenarios, indicates that CO₂ as a dissolved phase in groundwater is not likely to escape the basin through lateral migration in less than 1,000 years, the commonly accepted performance standard for sequestration (Hepple and Benson, 2005). Mineralogical analysis also indicates a grain matrix composed almost entirely of quartz which is non-reactive with CO₂; this indicates that dissolution of the grain matrix upon injection is not likely to occur and result in any loss of conductivity or porosity through grain collapse. The preliminary results presented in this study indicate that the Forest City Basin is indeed suitable for carbon sequestration and warrants further investigation.