CARBON DIOXIDE STORAGE POTENTIAL OF THE BASAL SALINE SYSTEM IN THE ALBERTA AND WILLISTON BASINS OF NORTH AMERICA

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ABSTRACT

The Plains CO_2 Reduction (PCOR) Partnership led by the Energy & Environmental Research Center (EERC) and partnered with Alberta Innovates – Technology Futures (AITF) conducted a 3-year study to determine the potential for geologic storage of CO_2 in the basal saline system of central North America. This system extends from northern South Dakota in the United States to central Alberta and Saskatchewan in Canada, covering an area of approximately 1.5 million km^2.

The basal saline system lies directly on top of igneous and metamorphic basement rocks and, except for outcrop areas, is confined by sealing formations that include shales, tight carbonates, and evaporites. The thickness of the system is up to 300 m, with permeability ranging from 0.0001 to 1250 mD and porosity ranging from 0.01% to 25%. A 3-D geocellular model encompassing the entire system was constructed using available data. The model incorporates the internal architecture of numerous facies changes and petrophysical properties of this heterogeneous system. Based on the model, the static volumetric CO_2 storage resource potential of this saline system is 480 billion tonnes.

To better validate this storage potential, two scenarios, comprising a total of 16 injection simulation cases, were investigated to better understand the site-specific characteristics which may affect the CO_2 storage capacity of this system. Simulation cases investigated several options to increase injectivity and maximize the storage efficiency of the system, including injection well location and spacing, injection rate optimization, and water extraction. Additionally, the effect of different geologic properties on the dynamic storage capacity, including boundary conditions, and relative permeability were tested. Simulation results indicate that the dynamic storage capacity of the system is 3112 Mt.

This examination of CO_2 storage in the basal saline system of central North America helps to answer questions regarding reservoir pressure buildup over the injection and postinjection periods and CO_2 movement tracking. Additionally, this study underscores the potential difference in CO_2 storage potential between estimates made with volumetric approaches and those made with dynamic methodologies.

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