Exploring the potential for CCS hubs – Part 1

An IMII Minerals Innovation Series

Introduction

In October 2023, the IMII announced that a collaborative project was underway exploring the potential for carbon capture and storage (CCS) hubs anchored by minerals and power production. A CCS hub is a deep geological reservoir where carbon dioxide (CO_2) emissions captured from one or more industrial facilities may be permanently stored underground. They are served by pipelines that transport captured carbon to the hub, and strategically built hubs could provide a pathway for reduced greenhouse gas (GHG) emissions from both potash and power production.

The project involved three areas of study – a preliminary investigation into the geological potential for carbon storage in the southern half of the province, a review of transportation opportunities for moving captured carbon from industrial facilities to storage hubs, and consideration of legislative and financial elements that may influence the potential for hub development and investment.

In addition to the IMII, project participants included two of its minerals company members – BHP and the Mosaic Company, SaskPower and Innovation Saskatchewan. The geological study was undertaken by the Petroleum Technology Research Centre (PTRC). IMII partnered with Enbridge on the transportation study. The International CCS Knowledge Centre was contracted by the IMII on the developmental considerations study.

The IMII is publishing a series of three summaries of the studies and their findings as building blocks for future discussions on the potential advancement of CCS hubs to decarbonize industrial processes and products while supporting the sustainable development of low carbon industries.

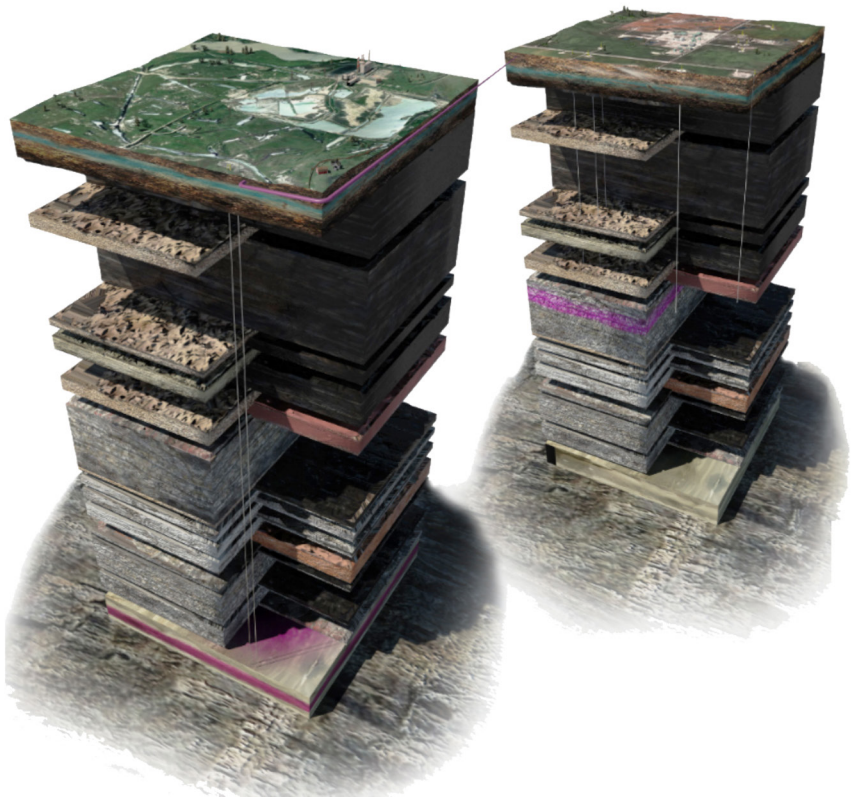
Geological Potential

The PTRC conducted a high-level screening for the purpose of evaluating the geological potential for CO_2 storage in the southern half of the province, with a focus on what is known as the Deadwood formation. The southern half of the province was studied as it is home to Saskatchewan's potash operations and planned SaskPower natural gas-fired power plants. Such operations and plants may be amenable to the adoption of carbon capture technologies as an option to reduce carbon emissions in the future. The Deadwood formation was chosen given several features making it potentially suitable for storage, including experience gained through the internationally recognized Aquistore project near Weyburn.

The screening used the most up-to-date provincial and federal geological survey information to determine the potential viability of the Deadwood formation in the regions where potash and power production exist or is planned. It did not identify specific locations as a high-level screening contains several uncertainties. Assuming potentially participating companies continue to advance consideration of carbon capture and storage as an option for achieving GHG emissions reductions, several other phases of work would be required before site selection could occur and would require the collection of new and proprietary data and further detailed evaluation of both subsurface and surface information. A potential next phase would be site characterization and assessment.

The screening concluded that the Deadwood formation, which is the deepest saline aquifer in the study area, far removed and separated from more shallow aquifers used for agricultural or municipal purposes, has the potential for suitable geological conditions for storing CO2 in a safe and long-term manner. These conditions include but are not limited to:

- The shape and size of the aquifer and the volume of CO2 it could hold.
- The ability of the aquifer to both receive CO2 and store it in place for the long-term.
- The porosity and permeability of the aquifer.
- The maximum pressure that can be applied to the aquifer without affecting the amount of CO2 that can be injected.
- The hydrogeological and geomechanical properties of the cap rock layer that is required to prevent CO2 from escaping above to other formations.
- The pressure, temperature and salinity of the aquifer.
- Regional water flow in the aquifer where CO2 is stored.
- The interface between CO2 and brine and how they displace each other in pore spaces.
- The mineral composition of the formation rocks and brine chemistry and how it may affect how much CO2 can be dissolved or mineralized.



Porosity and permeability are critical hydrogeological properties to determining the injectivity and capacity of a potential CO2 storage zone, and injectivity, the ability of the formation to accept injected CO2, is one of the most important parameters. The study's geological findings suggests that there are several regions which could be further screened for CO2 storage hubs in southern Saskatchewan.

Next in the Series – Transportation Potential