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A review of CCUS caprock across Saskatchewan

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Summary

Investment into Carbon Capture and Underground Storage (CCUS) has amplified in recent years in response to a global initiative to achieve net-zero emissions by 2050. Research into characterizing target reservoirs and the overlying caprock is ongoing and is a crucial step towards effectively regulating CCUS and mitigating future risk. An important part to this workflow is investigating caprock integrity and understanding the controls that could influence their effectiveness in ensuring the stored CO2 remains underground.

A storage complex for CCUS contains a storage unit (reservoir) and primary and secondary seals (caprock). In Saskatchewan, the storage unit/injection interval for CCUS is the regionally extensive Cambrian Basal Sandstone Unit (BSU). Localized sandstone deposits within the overlying Deadwood formation are utilized as secondary injection targets. The BSU unconformably overlies the Precambrian basement and consists of highly permeable sandstones with localized deposits of conglomerate (Kreis et al., 2004; Dixon, 2008; Ichazo Demianiuk, 2024). The primary caprock that immediately overlies the BSU is the heterolithic sandstone and mudstone-rich lithofacies of the Earlie Formation. Possible secondary caprock units within the province are the Deadwood Formation (interbedded shale, siltstone, sandstones), the lower Ordovician Icebox Member shale (Winnipeg Formation), and the Ashern (calcareous shale to dolomitic shale) and Prairie Evaporite formations of the Middle Devonian Elk Point Group (Kreis et al., 2004; Luo et al., 2017).

The Saskatchewan Geological Survey (SGS) supports the Saskatchewan Ministry of Energy and Resources Resource Management regulatory group by providing consultation on all Carbon Capture and Storage projects in the province with respect to geology. This includes conducting detailed investigations on CCUS caprock viability by integrating sedimentological and structural data into a province-wide stratigraphic framework. This workflow helps identify where variable depositional conditions, presence of fracture networks, and proximity to faults occur and potentially influence local permeability and porosity. Results from these investigations provides valuable insight into Lower Paleozoic sedimentary strata and an opportunity to use sound geological knowledge to support the regulation of the waste material disposal into the Cambrian in Saskatchewan.

References

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