

Mapping Saline Aquifers in Alberta in Support of Responsible Pore Space Management

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Alberta is world-renowned for its earth resources and a regulatory framework that focuses on their responsible development, while ensuring public safety, environmental protection, and resource conservation.

Over the past century, only a small portion of Alberta's geological pore space has been accessed to extract oil, natural gas, saline and non-saline groundwater and to inject substances for enhancing production, temporary storage (e.g., natural gas, air) or permanent disposal (e.g., oil field waste water, acid gas). Continued demand for fossil fuels, advances in technology combined with a need to curb anthropogenic emissions of CO₂ to the atmosphere are now setting the stage for accessing larger portions of the Alberta subsurface for resource extraction (e.g., shale gas, geothermal energy) and the management of industrial waste streams, particularly CO₂. This will necessarily increase the potential for interference between ongoing, planned and future uses. A forward-looking understanding of their potential cumulative effects is required for their responsible management.

The Alberta government has signed letters of intent with four projects as part of its \$2 billion commitment to carbon capture and storage (CCS). Each project aims to capture carbon dioxide (CO₂) from industrial plants and transport the gas via pipeline for injection into the subsurface for storage. Three projects intend to capture CO₂ at industrial sites in the Edmonton area. These sites include bitumen upgraders, coal-fired electricity generation plants, and a fertilizer production facility. A fourth project will capture CO₂ from an in-situ coal gasification (ISCG) project near Swan Hills.

Injection of CO₂ into deep saline aquifers and injection of CO₂ for enhanced oil recovery (EOR) within depleting oil reservoirs are among the options for a carbon storage project. The four selected projects propose varying aspects of carbon storage:

- Shell's Quest Project will inject CO₂ into a deep saline aquifer
- TransAlta's Pioneer Project will inject CO₂ into a deep saline aquifer and purify CO₂ for EOR.
- Enhance's Alberta Carbon Trunk Line pipeline will carry CO₂ to depleting oil reservoirs for EOR
- Swan Hills Synfuels' ISCG project will produce CO₂ for EOR

The Alberta Geological Survey (AGS) is undertaking regional mapping of saline aquifers in the deep subsurface below the Alberta Industrial Heartland, centred near Edmonton. The goal of this project is to map the major saline aquifers from the crystalline basement to the lowermost aquifer of the Colorado Group in order to assess their potential for future water production or storage, geothermal energy, and their intrinsic capacity to safely store liquid or gaseous wastes, like CO₂, over long periods of time.

This poster presentation will provide historical information on pore space usage in the Edmonton area and place the proposed CCS projects within the regional geologic context provided by AGS' saline aquifer mapping initiative.

Alberta Geological Survey maps and quantitatively inventories the nonsaline and saline groundwater resources in Alberta. Though there is really only a single groundwater resource in Alberta with gradations of salinity, the AGS program structures its activities based on relative groundwater salinity to ensure a strong linkage between AGS outcomes to Alberta's policy and regulatory framework for groundwater.