



Practical, Environmentally Sound CO₂ Sequestration

PCOR Partnership Role in the Aqstore Project

Deep saline storage of carbon dioxide (CO₂) is widely regarded as one of the most promising techniques to mitigate greenhouse gas emissions and is the focus of the Petroleum Technology Research Centre's (PTRC's) Aqstore Project. The Plains CO₂ Reduction (PCOR) Partnership is providing technical expertise and outreach to the Aqstore Project.

The Aqstore Project has targeted the basal Cambrian system, which has the potential to be a major regional resource for storage of CO₂ from human actions. This system occurs in the subsurface of central North America corresponding to the Deadwood and Black Island Formations (see figure). The Aqstore Project will inject CO₂ into a 90- to 230-meter (300- to 700-foot)-thick section of this system that is predominantly sandstone interbedded with shales and siltstone.

Understanding the behavior of CO₂ in the basal Cambrian system at the Aqstore site requires knowledge of its physical character, the fluids in the storage rock, the hydrology and chemistry of the system, and the nature and competence of the storage zone's seals (overlying rock that isolates the flows to the storage zone). To help meet these needs, the PCOR Partnership is developing a geologic (geocellular) model of the injection zone and the seals above it.

Rock Core Analysis

The PCOR Partnership is performing mineralogical characterization of representative core samples of the storage zone and the seal formations. These samples were taken from newly acquired core from the Aqstore Project site itself. The characterization includes the determination of relative permeability for CO₂ and brine as well as a routine suite of physical and mineral analyses. The results of these analyses will be integrated into the regional database being developed through the multipartner international project focused on evaluating the entire basal Cambrian system, entitled the "Geologic Characterization of the Basal Cambrian System," funded, in part, by the U.S. Department of Energy (DOE).



Rock cores from the initial well drilling prior to sectioning and analysis.

Aqstore – A Landmark Project

Located west of Estevan, Saskatchewan, the Aqstore Project injects CO₂ from human activity into a sandstone layer 3400 meters (11,000 feet) below the surface. The project is managed by PTRC. The source for the CO₂ is the SaskPower Boundary Dam Integrated Carbon Capture and Storage Demonstration Project—the first-ever commercial-scale capture of CO₂ from a coal-fired power plant. Together, these projects are the first in Canada to demonstrate a complete system for the capture, transportation, injection, and storage of human-derived CO₂ into a formation not associated with oil and gas recovery.



The Aqstore Project is injecting CO₂ from the Boundary Dam Carbon Capture and Storage Project into the basal Cambrian system in southern Saskatchewan.

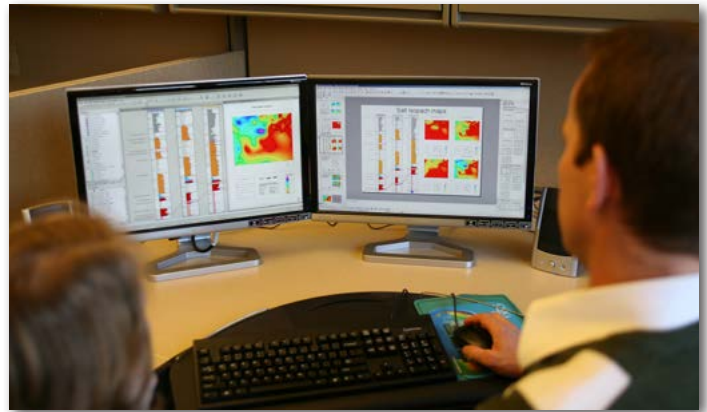
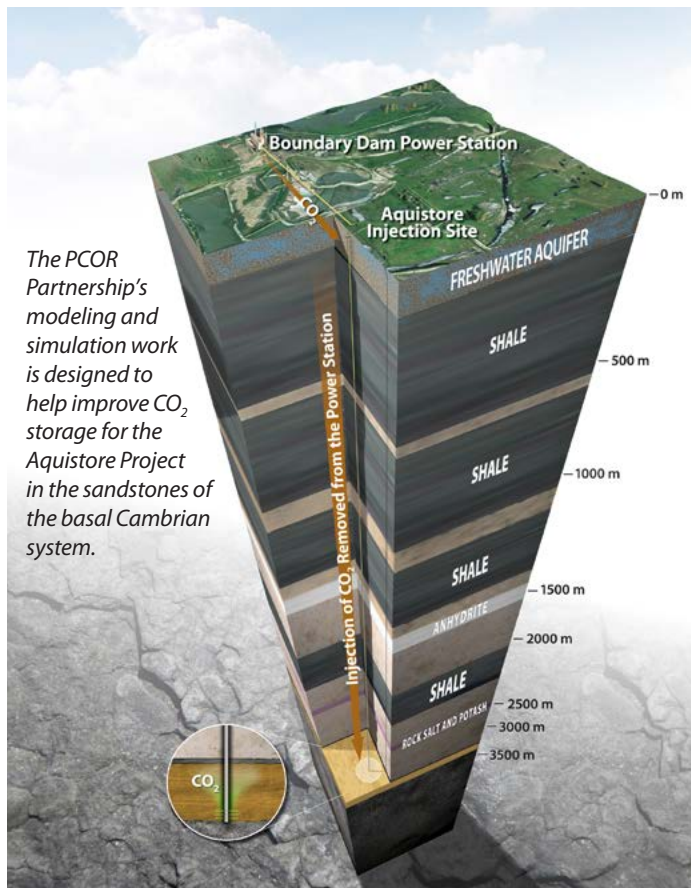


Static Geologic Models

Using the results of the rock core analysis, the PCOR Partnership will work with PTRC and Schlumberger Carbon Services to develop a static geologic model of the injection zone (basal Cambrian system) and overlying seal. The model will divide the area into millions of small volumes—termed geocellular volumes. The petrophysical analysis will be performed in Schlumberger's Techlog™ petrophysics software package, and the geocellular model will be constructed using Schlumberger's Petrel™ software.

Dynamic Simulations

Using the static geologic model as a framework, the PCOR Partnership technical team is running a series of dynamic simulations for CO₂ and formation fluid behavior under different injection scenarios. The numerical modeling workflow will be performed using Computer Modelling Group Ltd.'s WinProp®, CMOST®, and GEM™. The simulations will include multiple predictive realizations of the proposed injection scheme at the Aquistore site that could then be used in the risk assessment and monitoring, verification, and accounting (MVA) planning activities.



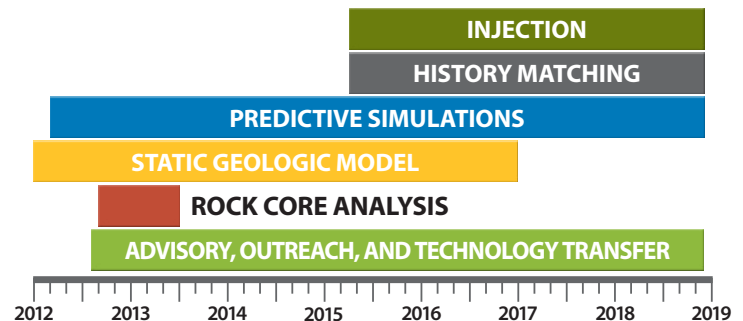
Advisory Role, Outreach, and Technology Transfer

As a member of the Aquistore Science and Engineering Research Council (SERC), the PCOR Partnership participates in advisory meetings, risk assessment, and monitoring. The Partnership is preparing public outreach materials (e.g., fact sheet and poster) as well as technical reports for the characterization, modeling, and simulation portions of the work.

Time Line

As illustrated below, the PCOR Partnership's participation in the Aquistore Project started in the spring of 2013 and will run through December 2018. The outcomes will include:

- Rock characterization data, including permeability, porosity, and mineralogy for the CO₂ storage zone and seal.
- Data to support the development of a static geologic model of the CO₂ storage zone and seal.
- Data from predictive simulations and history matching regarding the nature of the plume, its behavior, and its fate.
- Development of a fact sheet, poster, and technical reports.



The Plains CO₂ Reduction (PCOR) Partnership is a group of public and private sector stakeholders working together to better understand the technical and economic feasibility of storing CO₂ emissions from stationary sources in the central interior of North America. The PCOR Partnership is led by the Energy & Environmental Research Center (EERC) at the University of North Dakota and is one of seven regional partnerships under the U.S. Department of Energy's National Energy Technology Laboratory Regional Carbon Sequestration Partnership Initiative. To learn more, contact:

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Visit the PCOR Partnership Web site at www.undeerc.org/PCOR. New members are welcome.



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