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PCO2R Partnership

Plains $CO_2$ Reduction (PCOR) Partnership

# Fact Sheet

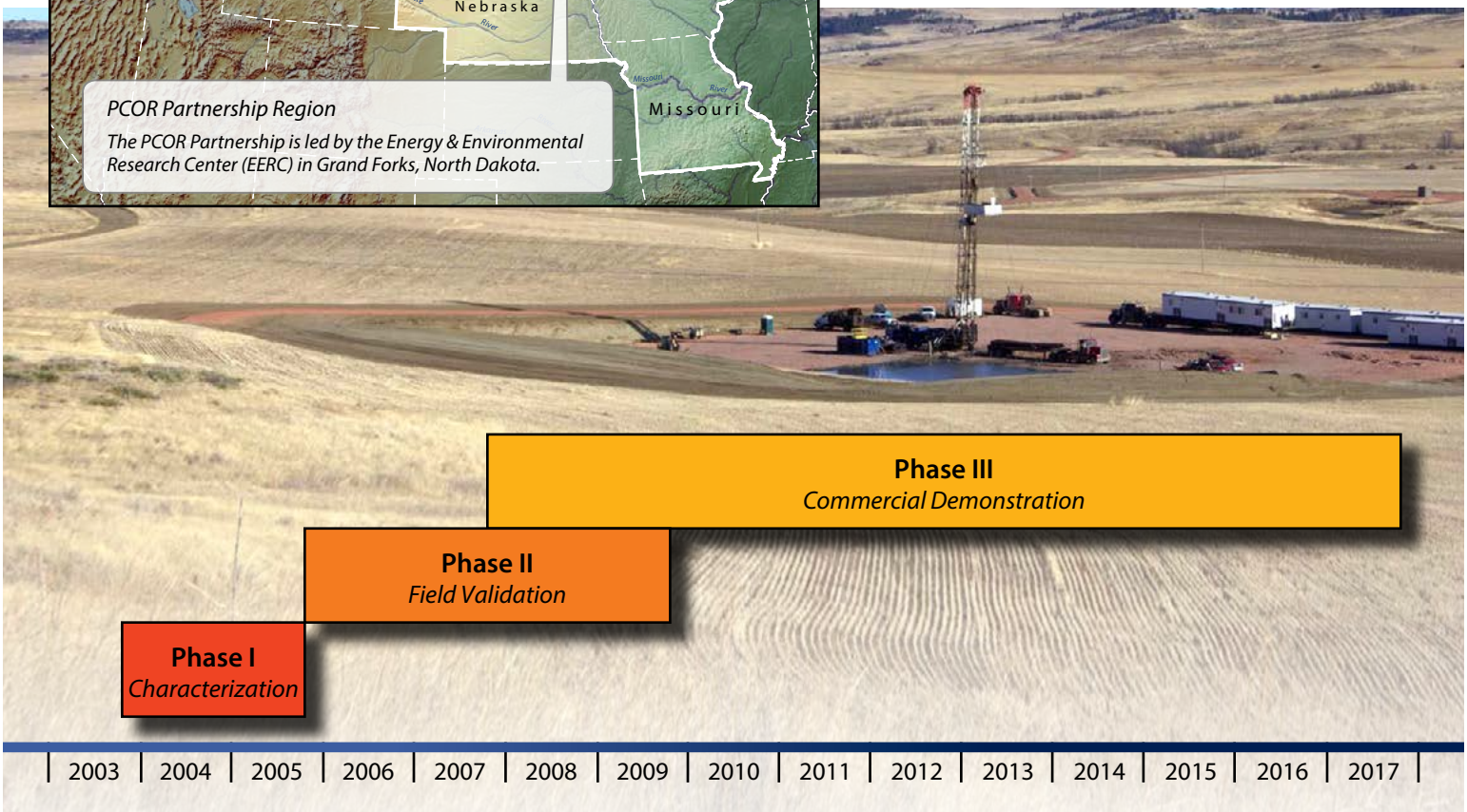
*Practical, Environmentally Sound $CO_2$ Sequestration*


*PCOR Partnership Region*

*The PCOR Partnership is led by the Energy & Environmental Research Center (EERC) in Grand Forks, North Dakota.*

## PCOR Partnership – Demonstrating $CO_2$ Storage in the Northern Great Plains

The Plains $CO_2$ Reduction (PCOR) Partnership Program is now in the third phase of its multiyear collaboration with public and private sector partners to demonstrate the permanent, safe, and practical underground storage of carbon dioxide ($CO_2$) from industrial facilities. In Phase I of the program (fall 2003 to fall 2005), work focused on characterizing the more than 900 major stationary sources of $CO_2$ as well as the geologic storage layers suitable for $CO_2$ storage in the PCOR Partnership region. In Phase II (fall 2005 to fall 2009), the PCOR Partnership completed four small-scale field validation tests. The multifaceted Phase III program, planned through fall 2017, is built around commercial-scale demonstrations and unprecedented collaboration at the local, regional, and cross-border levels.

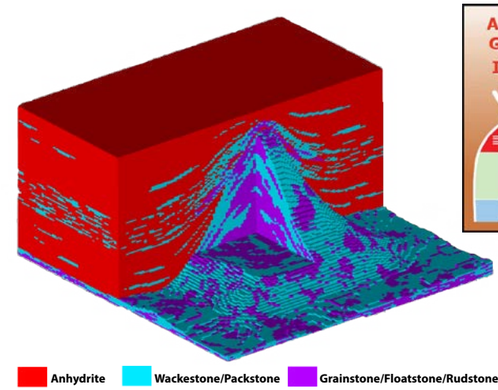


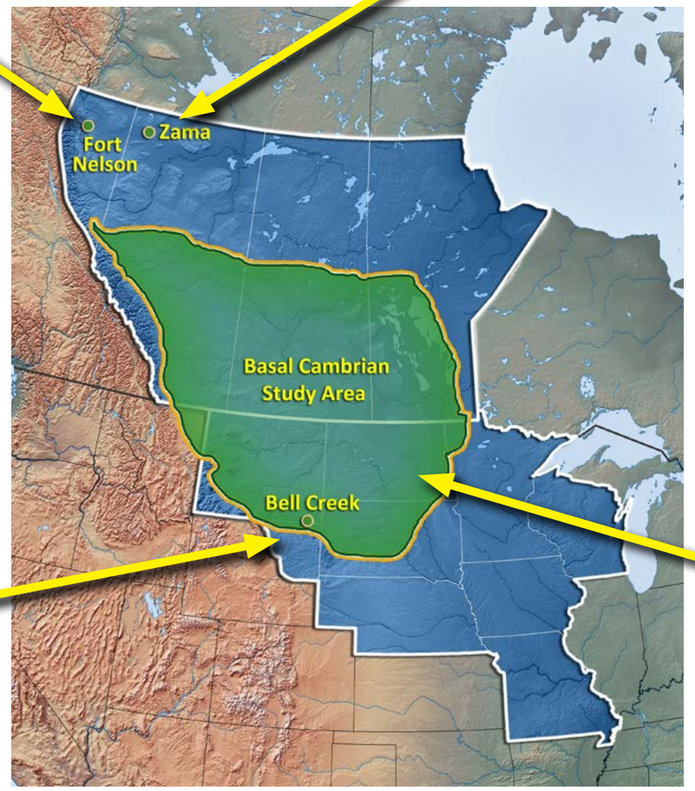
## Fort Nelson Demonstration

The Fort Nelson Carbon Capture and Storage Feasibility Project may become one of the largest demonstrations of deep saline geologic storage in North America. Led by Spectra Energy Transmission (Spectra), the project is an international collaboration that includes industry, government, and researchers. As part of this effort, the PCOR Partnership is collaborating with Spectra to develop cost-effective, risk-based monitoring techniques for large-scale storage of $CO_2$ in deep saline formations. The approach integrates site characterization; modeling and simulation; risk assessment; and monitoring, verification, and accounting (MVA).

## Zama Project

Prior to the initiation of the Zama Acid Gas EOR, $CO_2$ Storage, and Monitoring Project in 2006, Apache Canada's natural gas production and processing operations in the Zama oil and gas field released thousands of tons of $CO_2$ to the atmosphere each year. Since 2006, the project has injected and/or recycled all $CO_2$ produced from the oil and gas field into six reservoirs, with over 80,000 tons of $CO_2$ injected into the Zama F pool. As part of Phase III, the PCOR Partnership is collaborating with Apache Canada on characterization and modeling of all six active Zama EOR reservoirs to enable Apache Canada to better understand the EOR potential and the ultimate $CO_2$ storage capacity of its field.




*PCOR Partnership Phase III Activities*

## Basal Cambrian Project

Researchers in the United States and Canada are collaborating to evaluate the storage resource potential in the deep, thick, regional sandstone layer known as the Cambro-Ordovician saline system. This potential $CO_2$ storage layer underlies much of the Canadian and American northern Great Plains. It reaches a depth of 14,000 feet (4400 meters), is far below sources of drinking water or oil and gas resources, and appears to have ample pore space for $CO_2$. This effort is led by the PCOR Partnership Program on the U.S. side of the border and by Alberta Innovates – Technology Futures on the Canadian side. Partners in this effort include the U.S. Department of Energy; Lawrence Berkeley National Laboratory; Princeton University; Saskatchewan Industry and Resources; the North Dakota Industrial Commission; the North Dakota Geological Survey; the Montana Board of Oil and Gas; the South Dakota Geological Survey; Manitoba Water Stewardship; Manitoba Innovation, Energy and Mines; CanmetENERGY; Natural Resources Canada; TOTAL E&P Ltd.; and the University of Regina Petroleum Technology Research Centre. The product will be a unified, detailed 3-D geologic model encompassing the entire 1.4-million-square-mile transborder study area.

## Bell Creek Demonstration

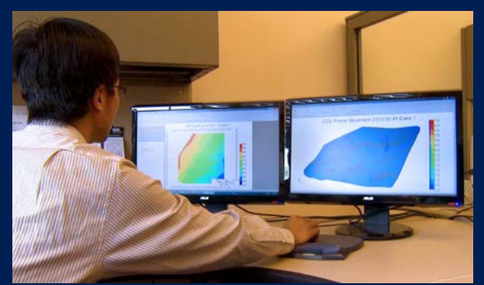
The PCOR partnership is collaborating with Denbury Resources Inc. to study incidental $CO_2$ storage associated with enhanced oil recovery (EOR) at the Bell Creek oil field while Denbury simultaneously and separately conducts a commercial EOR project. EOR operations at the field will inject approximately 1 million tons of $CO_2$ a year, most of which will be permanently stored at the end of the injection operations. Through this collaboration, the PCOR Partnership team is developing and testing advanced models of the behavior of $CO_2$, oil, and water in the subsurface. The knowledge gained from this project will be used to develop a comprehensive approach to monitor injected $CO_2$, including the ability to account for the $CO_2$ during the EOR operation and the ability to verify that the $CO_2$ remains in place in the injection zone after EOR operations have ended. These practical, state-of-the-art techniques can provide the data, knowledge, and experience needed to develop similar EOR and long-term $CO_2$ storage projects across the region.

*Geologic characterization begins with in-house laboratory analysis.*

## Geologic Characterization and Modeling

The location and development of large-scale $CO_2$ injection projects are built on an understanding of subsurface geology at the regional level as well as site-specific locations. Through the combination of laboratory testing, data acquisition, characterization, and assessment experience, the PCOR Partnership has developed extensive modeling expertise in geostatistical simulation models, facies deterministic models, and geomechanical models, both for carbonate- and silica-based storage formations. This capability can help project developers determine 1) the capacity of the target formation; 2) the mobility and fate of the $CO_2$ at near-, intermediate-, and long-term time frames; and 3) the potential for leakage of the injected $CO_2$ into overlying formations and/or the near-surface environment. In addition to supporting effective commercial operations, these capabilities are critical to developing and implementing effective environmental safeguards.

*The modeling-to-predictive simulation workflow includes geochemical, mechanical, and thermal inputs; characterization and laboratory data; and several optimization and validation steps.*



## Integrated Approach

The PCOR Partnership is taking an integrated approach to project design and assessment. Elements from site characterization, modeling and simulation, risk assessment, and MVA strategies are integrated from the initial design, through testing, and into the operation and closure phases. For example, new knowledge from site characterization work can help reduce uncertainty in assigning values to geologic reservoir properties. This reduced uncertainty, in turn, improves the ability to model behavior, assess risks, and improve the MVA design. Because of its growing knowledge and experience of carbon capture and storage (CCS) in the region, the PCOR Partnership can assist project developers with design and operations, provide insight to regulators crafting and implementing oversight of CCS, and help the public gain a realistic picture of the impact of living with CCS.

## Facilitating Sound, Consistent CCS Regulations

CCS projects in the PCOR Partnership region must satisfy some combination of two national regulatory regimes and over a dozen regional regulatory jurisdictions. The PCOR Partnership Program facilitates dialogue among regulators in its annual "regulatory roundup" meeting. In addition, the PCOR Partnership reviews and comments on provincial, state, and federal rule making and puts its technical expertise to work to develop model regulations through its membership on the Interstate Oil and Gas Compact Commission (IOGCC) Geological $CO_2$ Sequestration Task Force, on the IOGCC Pipeline Transportation Task Force, and in the North Dakota $CO_2$ Storage Workgroup. In addition, Partnership members receive assistance in developing and implementing carbon management strategies and developing custom permitting action plans for tests and demonstrations.


## Outreach and Education – Informing and Engaging Stakeholders

CCS is a new concept to the nearly 12 million households across the economically and politically diverse PCOR Partnership region. In Phase III, engaging the public, policymakers, and industry on CCS remains an essential component of PCOR Partnership activities. Public and partners-only Web sites provide information in formats tailored to meet the needs of these distinct demographics. Fact sheets, presentations, posters, and scientific reports inform technical audiences; the 122-page full-color regional atlas tells the story of CCS for a broader audience. The PCOR Partnership continues the collaboration with Prairie Public Broadcasting that has delivered award-winning programming and products that have brought information on CCS to the general public.

The Plains $CO_2$ Reduction (PCOR) Partnership is a group of public and private sector stakeholders working together to better understand the technical and economic feasibility of storing $CO_2$ 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:

**Charles D. Gorecki**, Senior Research Manager, (701) 777-5355; cgorecki@undeerc.org

**Edward N. Steadman**, Deputy Associate Director for Research, (701) 777-5279; esteadman@undeerc.org

**John A. Harju**, Associate Director for Research, (701) 777-5157; jharju@undeerc.org

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

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