



PLAINS CO₂ REDUCTION (PCOR) PARTNERSHIP PHASE III – ANNUAL ASSESSMENT REPORT

Task 12 – Deliverable D57

(for the period October 1, 2008, through September 30, 2009)

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EXECUTIVE SUMMARY

The Plains CO₂ Reduction (PCOR) Partnership is one of seven Regional Carbon Sequestration Partnerships (RCSPs) competitively awarded by the U.S. Department of Energy National Energy Technology Laboratory in 2003 as part of a national plan to mitigate greenhouse gas emissions. The PCOR Partnership is led by the Energy & Environmental Research Center (EERC) at the University of North Dakota in Grand Forks, North Dakota, and includes more than 80 stakeholders from the public and private sector in Phases II and III. The PCOR Partnership region includes all or part of nine U.S. states and four Canadian provinces.

Phase III, the development phase, a 10-year effort (2007–2017), is an extension of the characterization (Phase I) and validation (Phase II) phases and is intended to demonstrate that carbon dioxide (CO₂) capture, storage, and transportation can be achieved safely, permanently, and economically at a large scale in the PCOR Partnership region.

The Phase III efforts of the PCOR Partnership include two large-volume demonstration tests that focus on injecting CO₂ into deep saline geologic formations for CO₂ storage. The first demonstration activity (the Fort Nelson demonstration) involves monitoring, verification, and accounting (MVA) support for the injection of CO₂ captured from one of the largest gas-processing plants in North America into a saline formation in British Columbia, Canada. The second demonstration will inject CO₂ into formations in the Powder River Basin in the northern

Great Plains region of North America for the dual purpose of CO₂ storage and enhanced oil recovery (EOR). Other activities in Phase III include the following: 1) continue regional characterization to verify the ability of the target formations to store CO₂, 2) facilitate the planning and development of the infrastructure required to transport CO₂ from the source to the injection site, 3) facilitate development of the rapidly evolving North American regulatory and permitting framework, 4) establish means by which carbon credits can be monetized for CO₂ stored in geologic formations, 5) collaborate with other RCSP Program partnerships, and 6) provide outreach and education for CO₂ storage stakeholders and the general public.

Budget Period 3 (first 2 years of Phase III) was initiated October 1, 2007. Significant effort was focused on facilitating the development of a CO₂ procurement plan and agreement for the U.S. field demonstration. Negotiations for a site within the Williston Basin reached a stalemate in mid-April 2009. Several alternative options were explored for a demonstration site in the United States. The EERC and its partners worked diligently to explore a set of options that would meet overall goals and objectives, including potential alternative arrangements and/or projects that could be considered as contingencies. Potential alternative arrangements include a CO₂ capture facility at a regional coal-fired utility and integration of that CO₂ with that of a collocated ethanol production facility. Other potential alternative sources were also pursued and resulted in a shift in focus from the Williston Basin to the Powder River Basin. Although a site has now been selected, negotiations are ongoing and have not yet resulted in an agreement with the commercial partners. This has resulted in the delay of several deliverables.

Activities for the Fort Nelson demonstration project are progressing on schedule. Data gathered by the research team for this site were derived from a historical seismic survey, an exploratory well, a geophysical well log, a drill stem test, and the regional hydrogeologic regime. The EERC staff met regularly with representatives of Spectra Energy, the provincial government of British Columbia, and the Canadian federal government to discuss the direction and progress of baseline characterization, modeling, and MVA plan development for this project.

Regional characterization continues, and the Decision Support System (DSS, © 2007–2009 EERC Foundation) continues to evolve and improve. All other tasks also continue to effectively support program goals.

Budget Period 4 (Years 3–8 of Phase III) will begin October 1, 2009. Activities that will lead to the initiation of CO₂ injection in both demonstration sites during Year 4 will continue. Operational monitoring and modeling activities will be initiated to verify that injection operations do not adversely impact human health or the environment and that the CO₂ injected has been safely stored, with minimal risk of natural release. All other support tasks will also continue to be implemented.

This report presents an update of Phase III PCOR Partnership activities from October 1, 2008, through September 30, 2009, and planned activities for the following year.



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December 2009

INTRODUCTION

The Plains CO₂ Reduction (PCOR) Partnership is one of seven regional partnerships operating under the U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL) Regional Carbon Sequestration Partnership (RCSP) Program. The PCOR Partnership is led by the Energy & Environmental Research Center (EERC) at the University of North Dakota in Grand Forks, North Dakota, and includes 86 stakeholders from the public and private sector in Phases II and III. The Phase II and III membership as of September 30, 2009, is listed in Table 1. The PCOR Partnership region includes all or part of nine states (Iowa, Minnesota, Missouri, Montana, Nebraska, North Dakota, South Dakota, Wisconsin, and Wyoming) and four Canadian provinces (Alberta, British Columbia, Manitoba, and Saskatchewan).

The RCSP Program comprises a large portion of NETL's Carbon Sequestration Program and is a government–industry effort tasked with determining the most suitable technologies, regulations, and infrastructure needs for carbon capture and storage (CCS) on the North American continent.

The RCSP Program initiative is being implemented in three phases:

- Phase I – Characterization Phase (2003–2005): characterized opportunities for carbon sequestration.

Table 1. PCOR Partnership Phase II and III Partners*

-
- 1) U.S. Department of Energy National Energy Technology Laboratory
 - 2) University of North Dakota Energy & Environmental Research Center
 - 3) Abengoa Bioenergy New Technologies
 - 4) Air Products and Chemicals
 - 5) Alberta Department of Energy
 - 6) Alberta Research Council
 - 7) ALLETE
 - 8) Ameren Corporation
 - 9) American Coalition for Clean Coal Electricity
 - 10) American Lignite Energy (ALE)
 - 11) Apache Canada Ltd.
 - 12) Baker Hughes Oilfield Operations, Inc.
 - 13) Basin Electric Power Cooperative
 - 14) Biorecro AB
 - 15) Blue Source, LLC
 - 16) BNI Coal, Ltd.
 - 17) British Columbia Ministry of Energy, Mines and Petroleum Resources
 - 18) Carbozyme, Inc.
 - 19) Computer Modelling Group, Inc.
 - 20) Dakota Gasification Company
 - 21) Ducks Unlimited Canada
 - 22) Ducks Unlimited, Inc.
 - 23) Eagle Operating, Inc.
 - 24) Eastern Iowa Community College District
 - 25) Enbridge Inc.
 - 26) Encore Acquisition Company
 - 27) Energy Resources Conservation Board/Alberta Geological Survey
 - 28) Environment Canada
 - 29) Excelsior Energy Inc.
 - 30) Fischer Oil and Gas, Inc.
 - 31) Great Northern Project Development, LP
 - 32) Great River Energy
 - 33) Hess Corporation
 - 34) Huntsman Corporation
 - 35) Interstate Oil and Gas Compact Commission
 - 36) Iowa Department of Natural Resources – Geological Survey
 - 37) Lignite Energy Council
 - 38) Manitoba Geological Survey
 - 39) Marathon Oil Company
 - 40) MEG Energy Corporation
 - 41) Melzer Consulting
 - 42) Minnesota Power
 - 43) Minnkota Power Cooperative, Inc.
 - 44) Missouri Department of Natural Resources
 - 45) Missouri River Energy Services
 - 46) Montana–Dakota Utilities Co.
-

* Phase II members in good standing were automatically enrolled in Phase III for overlapping years (October 1, 2007 – September 30, 2009).

Continued . . .

Table 1. PCOR Partnership Phase II and III Partners* (continued)

- 47) Montana Department of Environmental Quality
- 48) National Commission on Energy Policy
- 49) Natural Resources Canada
- 50) Nebraska Public Power District
- 51) Nexant, Inc.
- 52) North American Coal Corporation
- 53) North Dakota Department of Commerce Division of Community Services
- 54) North Dakota Department of Health
- 55) North Dakota Geological Survey
- 56) North Dakota Industrial Commission Department of Mineral Resources, Oil and Gas Division
- 57) North Dakota Industrial Commission Lignite Research, Development and Marketing Program
- 58) North Dakota Industrial Commission Oil and Gas Research Council
- 59) North Dakota Natural Resources Trust
- 60) North Dakota Petroleum Council
- 61) North Dakota Pipeline Authority
- 62) North Dakota State University
- 63) Otter Tail Power Company
- 64) Oxand Risk & Project Management Solutions
- 65) Petroleum Technology Research Centre
- 66) Petroleum Technology Transfer Council
- 67) Prairie Public Broadcasting
- 68) Pratt & Whitney Rocketdyne, Inc.
- 69) Ramgen Power Systems, Inc.
- 70) RPS Energy Canada Ltd.
- 71) Saskatchewan Industry and Resources
- 72) SaskPower
- 73) Schlumberger
- 74) Shell Canada Energy
- 75) Spectra Energy
- 76) Strategic West Energy Ltd.
- 77) Suncor Energy Inc.
- 78) TAQA NORTH, Ltd.
- 79) TGS Geological Products and Services
- 80) University of Alberta
- 81) U.S. Geological Survey Northern Prairie Wildlife Research Center
- 82) Weatherford Advanced Geotechnology
- 83) Western Governors' Association
- 84) Westmoreland Coal Company
- 85) Wisconsin Department of Agriculture, Trade and Consumer Protection
- 86) Xcel Energy

* Phase II members in good standing were automatically enrolled in Phase III for overlapping years (October 1, 2007 – September 30, 2009).

- Phase II – Validation Phase (2005–2009): small-scale field validation tests.
- Phase III – Development Phase (2007–2017): large-volume carbon storage demonstration tests.

The PCOR Partnership’s efforts are in support of the following NETL Carbon Sequestration Program goal (Figure 1):

“By 2012, develop fossil fuel conversion systems that offer 90% CO₂ capture with 99% storage permanence at less than a 10% increase in the cost of energy services.”

Attainment of this program goal will be aided by the PCOR Partnership’s integrated approach to address identified challenges. The PCOR Partnership’s efforts will help enable technologies to overcome a multitude of economic, social, and technical challenges, including cost-effective carbon dioxide (CO₂) capture through successful integration with fossil fuel conversion systems, effective CO₂ monitoring and verification, permanence of underground CO₂ storage, and public acceptance.

The PCOR Partnership was established in the fall of 2003. Phase I was focused on characterizing sequestration opportunities in the region. In the fall of 2005, the PCOR Partnership launched its 4-year, Phase II program focused on carbon storage field validation projects designed to build core local technical expertise and experience needed to facilitate future large-scale CO₂ sequestration efforts in the region’s subsurface and terrestrial settings. In the fall of 2007, the PCOR Partnership initiated its 10-year Phase III program focused on implementing two commercial-scale geologic carbon sequestration demonstration projects in the region.

Phase III is divided into three budget periods (BPs), running from October 1, 2007, to September 30, 2017:

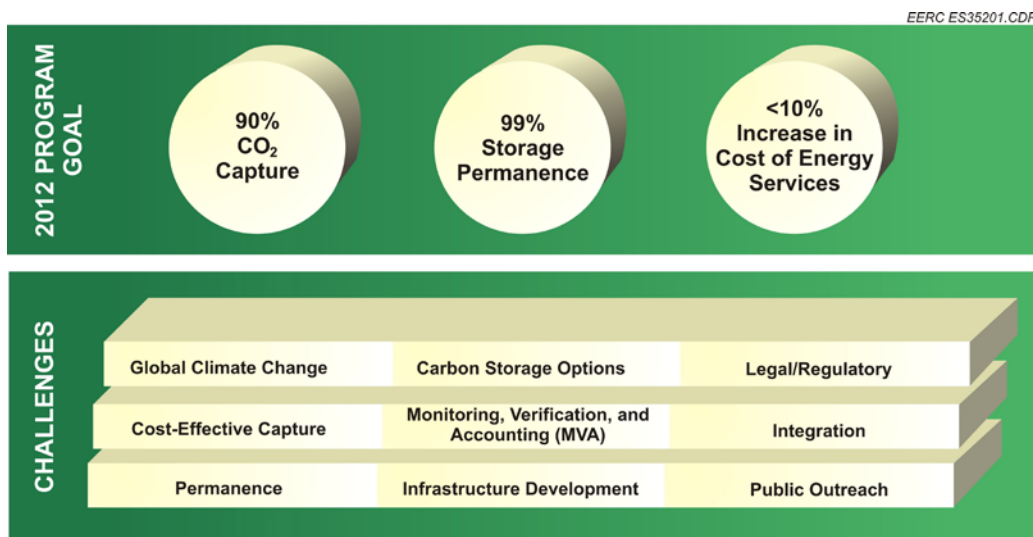


Figure 1. NETL Carbon Sequestration Program goals (1).

Budget Period 3 (BP3): October 1, 2007 – September 30, 2009

Budget Period 4 (BP4): October 1, 2009 – September 30, 2015

Budget Period 5 (BP5): October 1, 2015 – September 30, 2017

Note: BP1 and BP2 were effective in Phase II.

The overall mission of the Phase III program is to 1) build upon Phase I and II assessments of regional sequestration data to verify the ability of target formations to store CO₂, 2) facilitate the development of the infrastructure required to transport CO₂ from the source to the injection site, 3) facilitate development of the rapidly evolving North American regulatory and permitting framework for CO₂ storage, 4) develop opportunities for PCOR Partnership partners to capture and store CO₂, 5) establish a means by which carbon markets can facilitate CCS/EOR (enhanced oil recovery) project development in the region, 6) develop a mechanism by which carbon credits can be monetized for CO₂ sequestered in geologic formations, 7) continue collaboration with the other RCSP Program partnerships, and 8) provide outreach and education for CO₂ sequestration stakeholders and the general public.

In Phase III, the PCOR Partnership is building on the information generated in its characterization (Phase I) and validation (Phase II) phases. The PCOR Partnership plans to fully utilize the infrastructure of its region to maximize CO₂ injection volumes. A programmatic RCSP Phase III goal is the injection of approximately 1 million tons of CO₂ a year into at least one regionally significant geologic formation. Each of the RCSP's large-volume injection tests is designed to demonstrate that the CO₂ storage sites have the potential to store regional CO₂ emissions safely, permanently, and economically for hundreds of years.

The PCOR Partnership is working toward the establishment of two demonstration sites. The sites are located in 1) the Bell Creek oil field in Powder River County, southeastern Montana and 2) near Spectra Energy's Fort Nelson gas-processing facility, situated near Fort Nelson, British Columbia, Canada (Figure 2).

Original plans were for a demonstration site project located in the Williston Basin, a large sedimentary basin lying within the PCOR Partnership region, located in eastern Montana, western North and South Dakota, and southern Saskatchewan and Manitoba. In total, the basin covers roughly 300,000 square miles. Transected by the Missouri River, this large tectonically stable sedimentary basin is known for its rich deposits of petroleum. The results of Phase I and II activities indicated that the basin has the potential for hosting world-class CO₂ sequestration projects. These projects will likely feature CO₂ captured at major stationary emission sources that is transported to proximal oil fields for use in concurrent storage/EOR projects.

Negotiations for a site within the Williston Basin reached a stalemate in the spring of 2009. Because there is substantial interest in the development of a commercial CO₂ storage/EOR project, the PCOR Partnership worked diligently to pursue other alternatives. One alternative was to develop a Williston Basin demonstration project that included the capture of CO₂ from a coal-fired generation plant. The project would also have included CO₂ from a collocated ethanol production facility. Captured CO₂ was to be transported via pipeline to a commercial EOR flood. Other potential sources were also pursued.

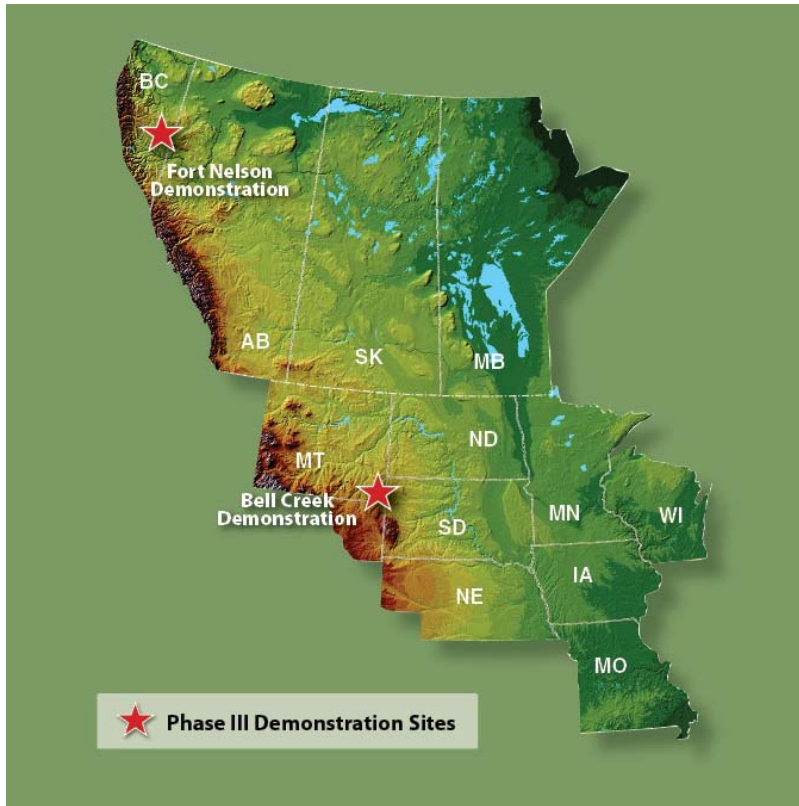


Figure 2. PCOR Partnership Phase III demonstration sites.

Another alternative was proposed by a PCOR Partnership partner, namely Encore Acquisition Company. Encore proposed to carry out the injection process, while the EERC would conduct CO₂ MVA activities at the site. The project, to be conducted in the Bell Creek oil field in Powder River County, southeastern Montana, will provide insight regarding the impact of miscible CO₂ flood tertiary recovery on oil production and successful CO₂ storage within a sandstone reservoir in the Powder River Basin (PRB) Cretaceous Muddy Formation. The Bell Creek project will be a unique opportunity to develop a set of cost-effective MVA protocols for large-scale CO₂ storage associated with an EOR operation. Although this site is not in the originally planned Williston Basin, the Bell Creek project is located in the PRB, which is geologically similar to the Williston Basin, both tectonically and lithologically, and is located immediately to the southwest of the Williston Basin. The CO₂ source pipeline will run through the PRB of Wyoming and Montana and to within 120 miles of the Cedar Creek Anticline in the Williston Basin. The Cedar Creek Anticline has over 3 billion barrels of original oil in place, with a tertiary target of over 300 million barrels, and is located in Montana, North Dakota, and South Dakota. The selection of the Bell Creek demonstration site was proposed to and approved by DOE NETL. Negotiations are under way to formalize an agreement with Encore.

In collaboration with Spectra Energy, the PCOR Partnership is pursuing a large-scale integrated CCS project near Spectra Energy's existing Fort Nelson natural gas-processing facility in northeast British Columbia, Canada. The Fort Nelson facility is one of the largest sour gas-processing plants in North America. This plant processes gas from an extensive network of

approximately 620 miles of gathering pipelines servicing the Horn River producing basin. The sour CO₂ (approximately 90% CO₂ and 10% H₂S) developed by this process will be pipelined a short distance to a storage site (see Figure 3). The PCOR Partnership's monitoring, verification, and accounting (MVA) efforts will help Spectra Energy determine whether deep underground saline reservoirs and associated infrastructure in the Fort Nelson area are appropriate for CCS.

During BP3, Year 2, which evaluated geological, technical, and economic feasibility, Spectra Energy drilled an exploratory well to determine whether surrounding geology is suitable for the permanent storage of CO₂ and hydrogen sulfide. These compounds are present in the raw natural gas produced in the area and are removed during processing at the company's Fort Nelson gas plant.

The PCOR Partnership's objectives for the demonstration projects are as follows: 1) conduct a successful U.S. field demonstration to verify that the region's large number of oil fields have the potential to store significant quantities of CO₂ in a safe, economical, and environmentally responsible manner and 2) conduct a successful Fort Nelson demonstration to verify the economic feasibility of using the region's carbonate saline formations for safe, long-term CO₂ storage. During Phase III, the PCOR Partnership will continue to refine storage resource estimates and evaluate other factors relevant to regional storage goals.

APPROACH

The PCOR Partnership is identifying practical CO₂ sequestration options for the PCOR Partnership region, characterizing the technical issues, enhancing the public's understanding of CO₂ sequestration, identifying the most promising opportunities for sequestration in the region, and detailing an action plan for the demonstration of regional CO₂ sequestration opportunities.

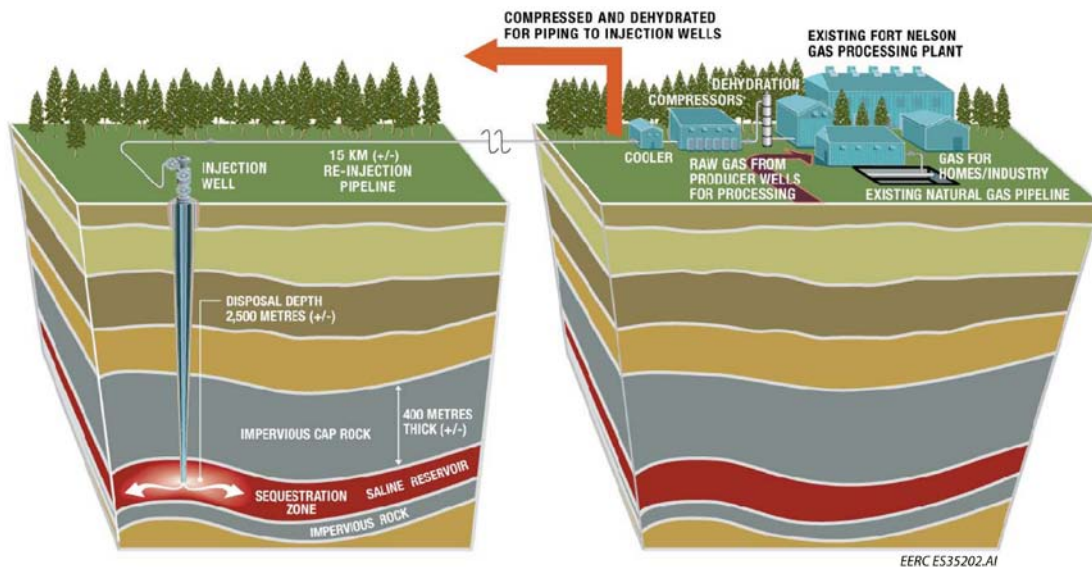


Figure 3. CCS schematic of Spectra Energy's Fort Nelson facility (2).

The EERC entered into a cooperative agreement with DOE NETL for Phase III activities in late September 2007. Phase III is a 10-year project, in three BPs, running from October 1, 2007, to September 30, 2017. This project Annual Assessment Report summarizes the activities for the reporting period (October 1, 2008 – September 30, 2009) for Phase III.

The PCOR Partnership plans to achieve its Phase III mission through a series of 14 tasks, as shown in Figure 4. These tasks include 1) Regional Characterization, 2) Public Outreach and Education, 3) Permitting and National Environmental Policy Act (NEPA) Compliance, 4) Site Characterization and Modeling, 5) Well Drilling and Completion, 6) Infrastructure Development, 7) CO₂ Procurement, 8) Transportation and Injection Operations, 9) Operational Monitoring and Modeling, 10) Site Closure, 11) Postinjection Monitoring and Modeling, 12) Project Assessment, 13) Project Management, and 14) RCSP Water Working Group Coordination. See Table 2 for the responsibility matrix of these fourteen tasks.

This project Annual Assessment Report includes the following information:

- Progress update and budget status of the nine tasks (Tasks 1–4, 6–7, and 12–14) that were active in BP3, Y2 (October 1, 2008 – September 30, 2009)
- Accomplishments achieved during BP3, Y2 (October 1, 2008 – September 30, 2009)
- Description of planned BP4, Y1 (October 1, 2009 – September 30, 2010) activities

It should be noted that Tasks 10 and 11 will not be initiated until BP5.

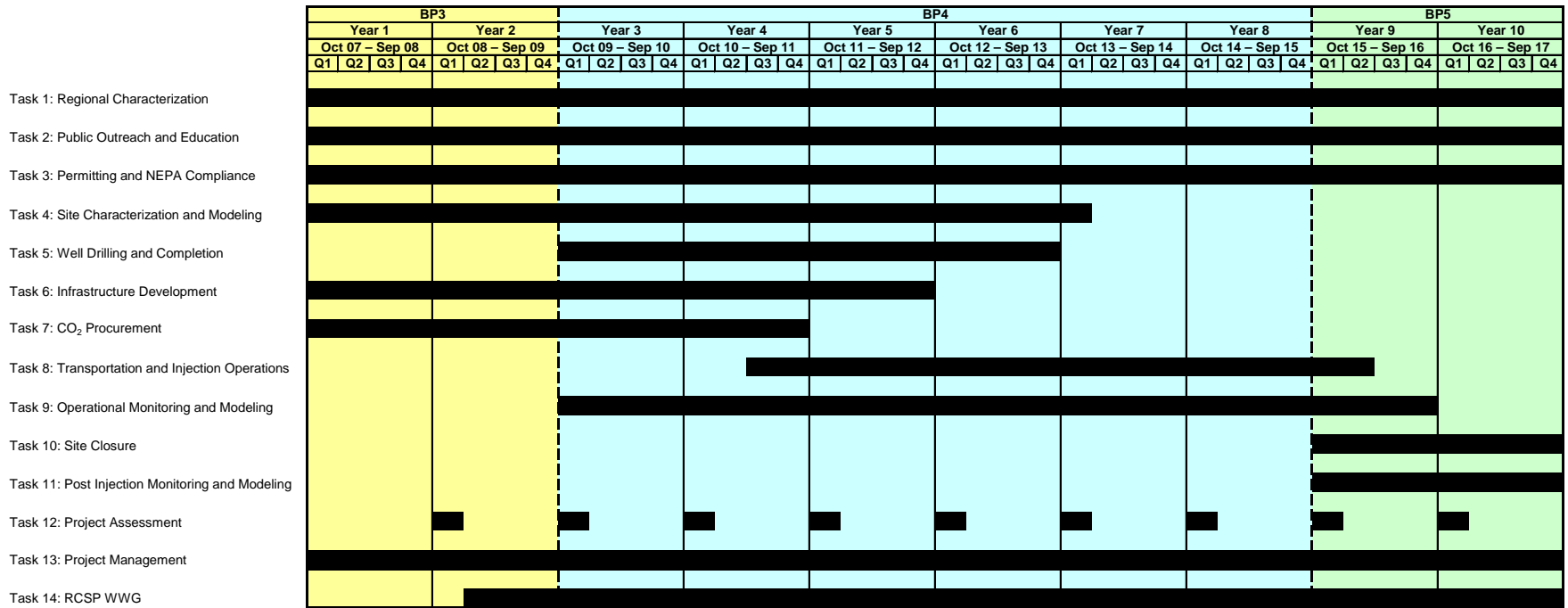


Figure 4. Phase III tasks.

Table 2. Phase III Responsibility Matrix

Phase III Task Title	Task Leader
Task 1 – Regional Characterization	Wesley D. Peck
Task 2 – Public Outreach and Education	Daniel J. Daly
Task 3 – Permitting and NEPA Compliance	Lisa S. Botnen
Task 4 – Site Characterization and Modeling	James A. Sorensen
Task 5 – Well Drilling and Completion	Steven A. Smith
Task 6 – Infrastructure Development	Melanie D. Jensen
Task 7 – CO ₂ Procurement	John A. Harju
Task 8 – Transportation and Injection Operations	Steven A. Smith
Task 9 – Operational Monitoring and Modeling	Charles D. Gorecki
Task 10 – Site Closure	TBA
Task 11 – Postinjection Monitoring and Modeling	TBA
Task 12 – Project Assessment	Katherine K. Anagnost
Task 13 – Project Management	Edward N. Steadman
Task 14 – RCSP Water Working Group Coordination	Charles D. Gorecki

BUDGET PERIOD 3, YEAR 2 ACTIVITIES (2008–2009)**Progress Report**

BP3 entails the first 2 years of Phase III, with activities initiated October 1, 2007. Thirteen tasks were originally scheduled for Phase III. A new task, Task 14, was added during Year 2 of BP3. Out of the 14 tasks, nine tasks were active during BP3, as shown in Figure 4. The progress update for those tasks is presented within this section. This project Assessment Annual Report (Deliverable [D57]) reports activities beginning October 1, 2008, through the end of BP3, September 30, 2009. Edward N. Steadman is the overall program manager (PM) and provides leadership in fully coordinating and integrating the activities of the PCOR Partnership. To facilitate the management of this project, task leaders were designated, as shown in Table 2.

Task 1 – Regional Characterization

The PCOR Partnership continues to refine the characterization of sources, geologic and terrestrial sinks, infrastructure, and the regulatory framework within its region. The goal is to further refine the assessment of the region’s CO₂ production and storage potential in an effort to optimize source–sink opportunities within the region. This continued regional characterization will be used to refine capacity estimates for DOE NETL’s national atlas and to provide context for extrapolating the results of the large-scale demonstrations.

Activities and Results

Phase III regional characterization efforts for BP3, Year 2 (Y2, October 1, 2008 – September 30, 2009) are addressed below.

First Target Area Completed

The PCOR Partnership completed a detailed site characterization for its first target area, the Dickinson Lodgepole Mounds (DLMs) (including the Eland oil field) near Dickinson, North Dakota (see Figure 5).

The DLMs in southwestern North Dakota have been identified as possible targets for CO₂ storage and CO₂ EOR activities because of the high recovery factor and very successful waterflooding operations as well as their proven ability to trap oil and gas for millions of years. Site characterization has indicated the DLMs have a high potential for CO₂ EOR, with estimated incremental recovery in the 21-million to 34-million-barrel range, and associated storage of 6 to 15 million tons of CO₂.

CO₂ Source Locations Within the Region

The PCOR Partnership maintains a database of significant regional point sources of CO₂. The database is key in the development of CO₂ capture–transportation–sequestration scenarios that have the potential to reduce greenhouse gas (GHG) emissions in the PCOR Partnership region. To maintain a reasonably current status, the data set undergoes an annual review during which new or missing sources are identified and added, CO₂ emission rates are updated, and facility locations are verified. The review that took place between October 1, 2008, and September 30, 2009, addressed all of these areas.

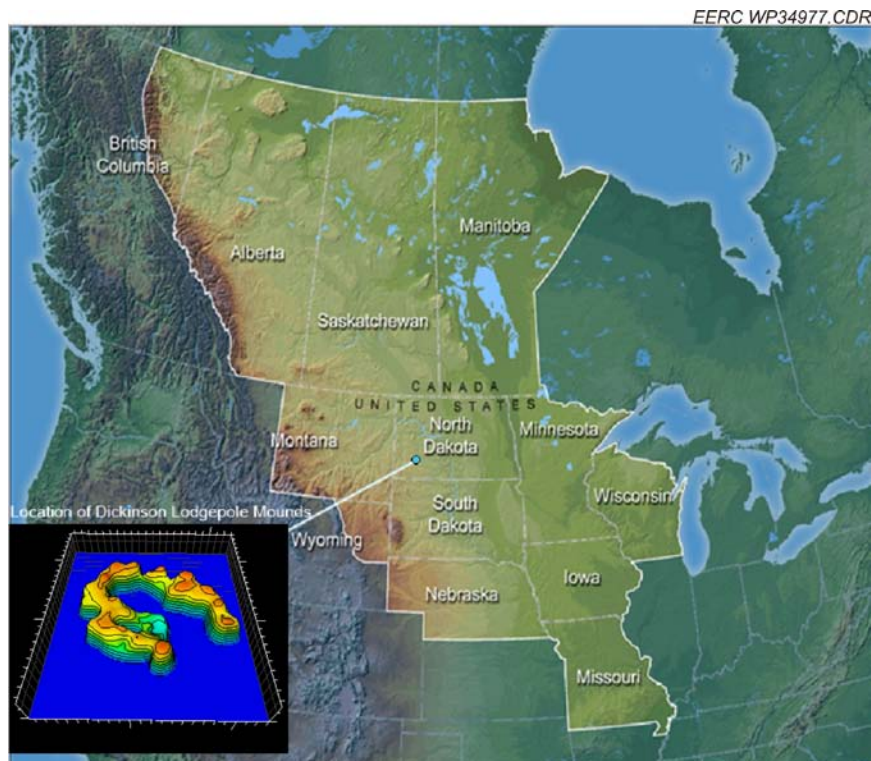


Figure 5. Location of the DLM.

A significant change to the PCOR Partnership CO₂ emission database was to define “large stationary sources” as emitting at least 15,000 short tons CO₂/yr. All sites emitting less than 15,000 tons CO₂/yr were eliminated from the searchable database that appears in the PCOR Partnership DSS. Currently, there are 927 sources that emit 561.89 million short tons CO₂ annually.

Rebuilding the DSS

The implementation of the site redesign began in September 2008, and changes to the new site were reported to DOE NETL in September 2009. The redesign of the DSS site was conducted in five phases as set forth below.

Phase 1 – Evaluate Original DSS Site

Web tracking software was used to determine how often the original DSS site was being used by DOE and PCOR Partnership Partners (EERC users were not considered in the evaluation).

Phase 2 – Develop a New DSS Site Prototype

The redesign team reviewed other well-organized and award-winning Web sites and took various components from other sites to create a unique prototype for the new DSS site. The home page was completely redesigned, as illustrated in Figure 6. The functionality of the site was improved by making each secondary page accessible through navigation that remains consistent on every page.

Phase 3 – Perform an Internal Review of the Prototype

Once a working prototype of the new DSS site was created, it was sent out for review by PCOR Partnership technical researchers and the management team.

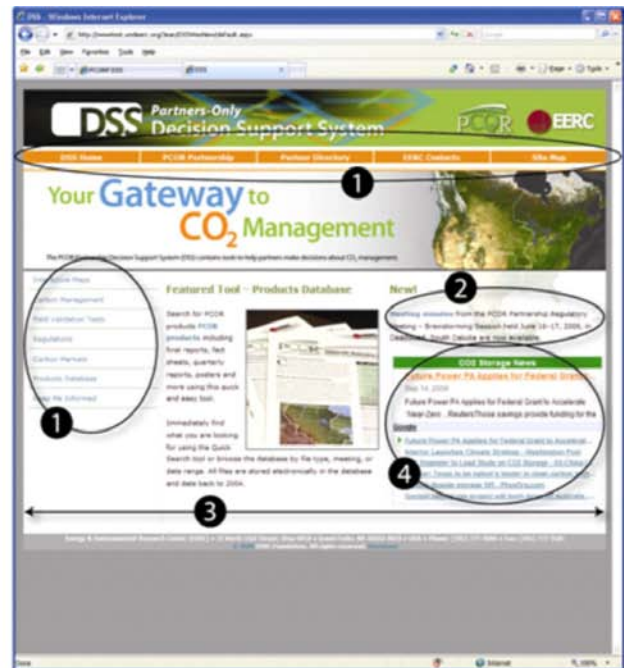
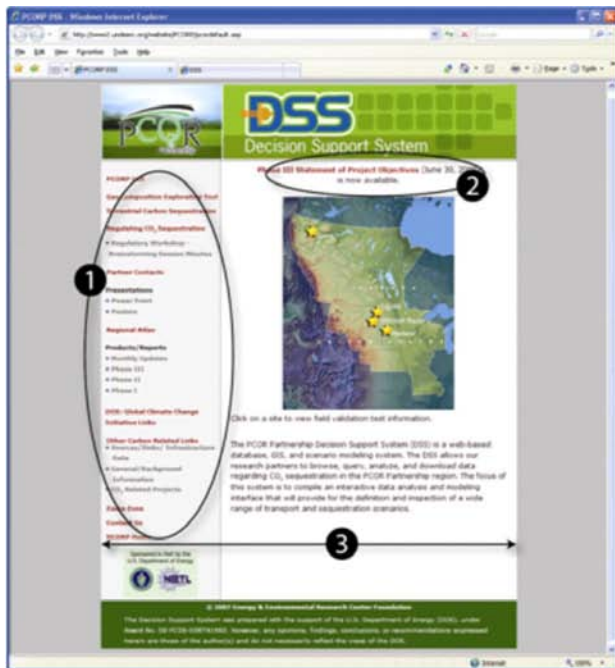
Phase 4 – Revise Prototype Based on Internal Review

The only major revision to the prototype was the addition of a new section called Keep Me Informed.

Phase 5 – Launch and Maintain Site

All pages will be continuously updated to ensure content remains up to date. Revisions to the site’s databases will be performed by the DSS Site Manager, as new content is acquired.

The new server arrived in April 2009 and is in operation. The purchase of this new device ensures that the management efforts of the past several years will not be lost. Diagnoses of recent server problems had been identified. A secure socket layer (SSL) certificate from Verisign has been purchased and installed on the www2.undeerc.org (Hydrogen) server. This software will ensure that our partners will log-in through a secure mechanism. Without this setup, it would have been possible to intercept passwords and hack into the DSS.



EERC ES36293.CDR

Figure 6. Screen captures comparing the original and new DSS home pages: 1) revised navigation; 2) new site has dedicated feature to highlight announcements, 3) wider format, and 4) ticker to provided current CO₂ sequestration news).

Great progress is being made on the new GIS interface for the DSS. Several new functions will make the site more versatile. Results of the six Washburn area formation sequestration capacities have transferred from the Petrel model into a GIS format that can be integrated into the DSS.

EERC staff attended the Latitude Geographics annual meeting in April in Victoria, British Columbia. Latitude Geographics developed the software currently used to assist in the development of the new GIS interface on the DSS.

Permitting Review – One State, One Province

This permitting review provided a synopsis of the types of permitting activities that are necessary to conduct a CCS project in the province of Alberta or the state of North Dakota. The information provided gave a broad overview of the regulatory requirements and the authorities involved. It also provided links to the various forms and regulations needed to conduct CCS projects in each jurisdiction.

Missouri Division of Geology and Land Survey

The Missouri Department of Natural Resources, Division of Geology and Land Survey (MO DGLS), was added as a PCOR Partnership member and subcontractor on March 13, 2008, to provide baseline data and characterization regarding the potential geologic sequestration of

CO₂ in Missouri. Information about Missouri-specific data gathered from October 1, 2008, to September 30, 2009, includes:

- A summary of the 14 principal coal seams to include the creation or update of several coal resource maps and the extraction of coal data from the National Coal Resources Data System (NCRDS). To date, NCRDS information for the Mulky, Summit, Lexington, and Mulberry coal seams has been added to previously completed coal seams. A combination of MO DGLS and NCRDS data have produced raster files depicting depth-to-coal and thickness-of-coal for the Rowe, Drywood, Weir, Tebo, Mineral, Robinson Branch, Fleming, Croweburg, and Bevier coals.
- Modeling on assembled U.S. Geological Survey (USGS) and U.S. Environmental Protection Agency (EPA) water quality data for Paleozoic saline formations in the northwestern half of the state. The results of these models pointed out several outlier points that are being reviewed. In addition to these basic operations, the data have been plotted on Piper plots, with some distinct grouping and dilution curves present. These Piper plots will be used to determine groundwater movement routes and where isolated groundwater facies are located.
- Compilation of structural information from geologic and outcrop maps for the Missouri portions of the Dyersburg, Poplar Bluff, Harrison, Tulsa, Joplin, Springfield, Lawrence, Kansas City, Moberly, Quincy, Nebraska, Centerville, Burlington, and the western half of the Jefferson City 1° × 2° quadrangles. In addition, work has begun on the eastern half of the Jefferson City and St. Louis 1° × 2° quadrangles. A total of 1039 maps have been examined for structures. These maps contain 452 named structural features that comprise 1203 separate lines.
- Presentations on potential Missouri CO₂ sequestration:
 - American Association of State Geologists (AASG) Central States Cluster meeting, Cedar City, Iowa, October 2008.
 - Annual conference of Missouri's Division of Environmental Quality, Osage Beach, Missouri, November 2008.

Nebraska Geological Survey

Efforts are under way to enter into a subcontract with the Nebraska Geological Survey and/or the Nebraska Oil and Gas Commission to aid in the assessment of carbon storage opportunities in that state. Efforts continue to gather well data on the Cedar Hills Sandstone in western Nebraska.

PCOR Partnership Atlas

Work is progressing on modifications to the current PCOR Atlas. The upcoming 3rd edition will contain individual page spreads for Phase III demonstration projects. This product serves as a valuable resource as well as outreach tool, and efforts will continue throughout Phase III to update it every 2 years.

GIS Working Group

Attended the NACAP IT/GIS Working Subgroup meeting in Morgantown, West Virginia, on July 20–21, 2009.

U.S. Field Demonstration Site Reference Support

A new reference map is under development for the Powder River Basin/Williston Basin area. This map will include the proposed Lost Cabin Gas Plant to Bell Creek oil field pipeline proposed by Encore Acquisition Company.

Task 2 – Public Outreach and Education

This task provides outreach and education mechanisms to raise awareness regarding CO₂ storage opportunities in the region as well as outreach to select target audiences concerned with the demonstration activities.

Activities and Results

Accomplishments during BP3, Y2 (October 1, 2008 – September 30, 2009) are described below.

Fact Sheets

Fact Sheet No. 16, regarding the Fort Nelson site, entitled “Geologic Storage of Sour CO₂ from a Natural Gas-Processing Plant – A Commercial Demonstration,” was completed on May 29, 2009 (D16).

PowerPoint Presentations

A PowerPoint presentation (D19) focused on the Fort Nelson demonstration was prepared and completed by July 31, 2009.

Posters

A general outreach poster (D24) featuring the PCOR Partnership sequestration sites in the region as well as general information on sequestration options was completed on March 31, 2009.

Video and Web-Based Outreach

A set of over 50 video clips was created from the PCOR Partnership television documentaries and submitted for DOE's review on December 31, 2008 (D20). B-roll footage, e.g., landscapes and facilities, along with in-house interviews were shot using the prosumer-grade video camera. The footage is intended for Web applications. The set of video clips was created from the documentary products and other materials held by PPB. The clips range from 30 seconds to 3 minutes in length and are intended to supplement the PowerPoint presentations and public-accessible Web site. The package also contained six clips, including introductions and credits that are intended to be used for Web or YouTube (© 2009 YouTube, LLC) applications.

Outreach Information System (OIS)

A GIS capable database, termed the OIS, was initiated to enable efficient planning and assessment for outreach activities. The database contains fields on population, media outreach, media contacts, and other information to aid planning and assessment. The OIS will contain not only a record of outreach activities, but also establish a baseline for the assessment of audience exposure to the outreach activities. A number of first-generation products were developed for population, households, school districts, native populations, newspaper coverage, and public television coverage regions.

Classroom Materials

Development of a set of materials for classroom use was initiated. A volunteer team of educators reviewed the proposed classroom materials. Packets of regional sequestration efforts were prepared and made available to teachers in the PCOR Partnership region in the spring of 2009.

In addition, invitations to present at three regional teacher seminars were received and accepted by the PCOR Partnership task leaders, including:

- “North Dakota Petroleum Council Teacher Education Seminar” (June 8–11, 2009), Bismarck, North Dakota.
- Lignite Energy Council’s “2009 Lignite Education Seminar: Energy, Economics and Environment” (June 15–18, 2009), also in Bismarck, North Dakota.
- Keystone Center’s Teacher Training Opportunity “CSI: Climate Status Investigations” (July 29–30, 2009) in Omaha, Nebraska.

Outreach Working Group

Participation in the RCSP’s Outreach Working Group continued during Year 2 of Phase III. The group has shared materials and lessons learned with other regions. Monthly conference calls and other related activities are ongoing.

The PCOR Partnership was represented on July 14–15, at the RCSP program’s Outreach Working Group (OWG) Outreach Best Practices Manual Development Workshop in Washington, D.C. Activities included a review of the first draft Best Practices Manual (based on contributions by the outreach leads of the seven regional partnerships), determining next steps, and laying out a time line for the completion of the document.

On July 24, 2009, the PCOR Partnership’s draft “Best Practices Manual: Outreach” was sent for distribution to the other six RCSP OWG leads for use in developing the RCSP OWG’s Best Practices Document. A draft of the RCSP manual is scheduled for DOE review in mid-September.

In addition, the OWG is preparing review comments for the World Resources Institute’s draft document entitled “Guidelines for Community Engagement Regarding Carbon Dioxide Capture and Storage Projects.”

Documentaries

Although the completed four documentaries were developed under Phase II, these DVDs serve as a valuable outreach tool for Phase III (Figure 7). They are featured on the public Web site, and requests can be made to receive a copy at no charge. In addition, these DVDs are often displayed at conferences attended by the PCOR Partnership and distributed at teacher seminars. A final internal review of the fourth documentary entitled “Managing Carbon Dioxide: The Geologic Solution” was held September 22, 2009, and it is expected to be broadcast on Prairie Public Television on November 10, 2009.

Audit of Outreach Materials

The PCOR Partnership determined that a thorough audit and assessment of its communication materials would be beneficial to guide the development of a more consistent and effective set of core materials. Lipman Hearne Inc., a marketing and communications firm and an associate of The Goodman Group (a public relations group), has been retained to prepare an inventory of all communication materials, develop a set of criteria for effective communication products, and assess the existing materials according to the criteria. Utilizing the criteria and communication needs identified through their assessment, they will then develop recommendations to improve the outreach materials.

Weyburn–Midale Outreach Advisory Panel

The Outreach Advisory Panel of the Weyburn–Midale project held a daylong session on June 25, 2009, in Regina, Saskatchewan, and included a tour of the Weyburn CO₂ sequestration project site in Weyburn, Saskatchewan. EERC staff participated in numerous conference calls regarding communications and outreach for the Weyburn–Midale project.

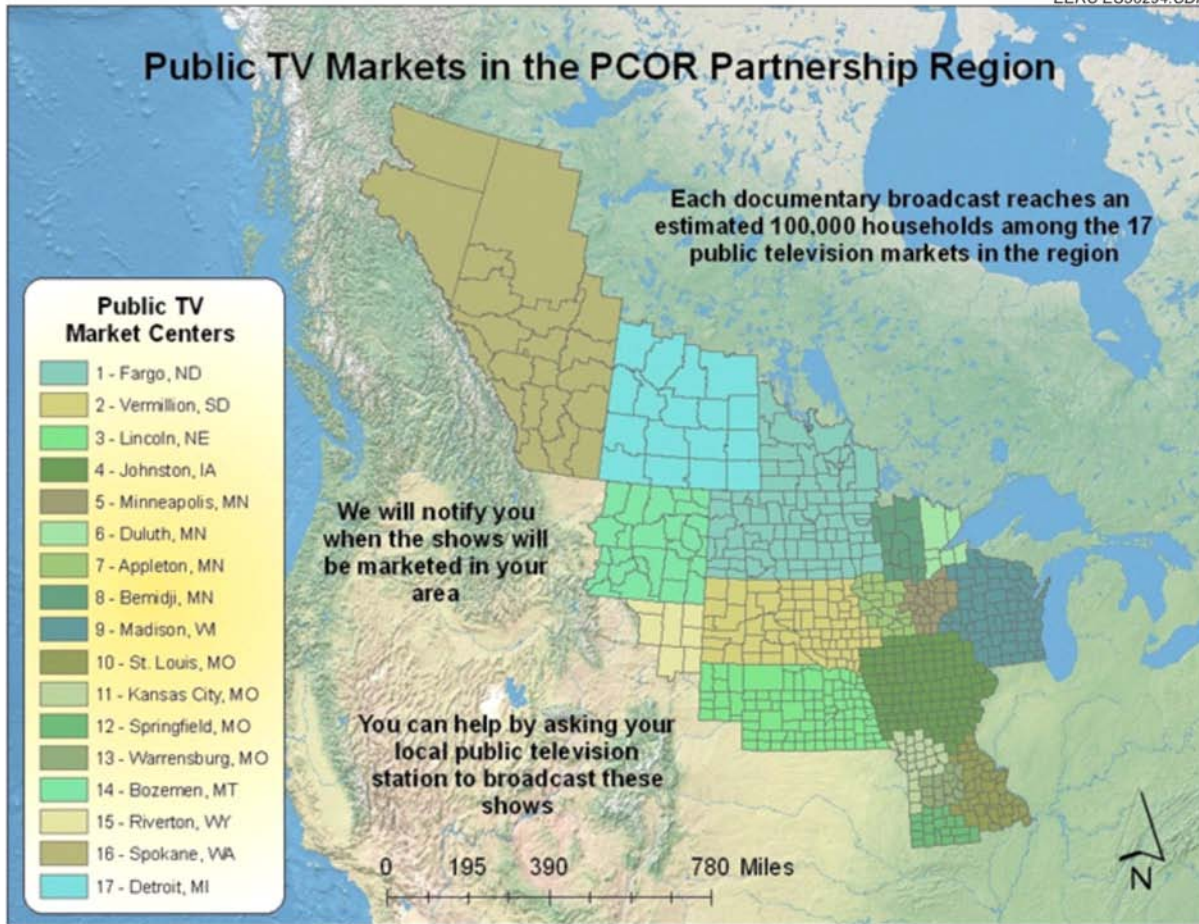


Figure 7. Public TV markets in the PCOR Partnership region.

Public Web Site (www.undeerc.org/pcor)

The most recent updates of the PCOR Partnership Web site included the following: a revised home page; new pages, e.g., a request information link, information on carbon capture and storage, information on the carbon footprint documentary, a video clip library; and updated pages, e.g., regarding educators, the PCOR Partnership team, the site map, etc.

Task 3 – Permitting and NEPA Compliance

The overall goal of Task 3 is to advance the regulatory and permitting framework for CO₂ storage projects in North America as well as to assist the demonstration site owners as necessary in obtaining the permits and approvals needed for the projects to comply with state, provincial, and federal requirements.

Activities and Results

The PCOR Partnership continues to stay abreast of legislative actions occurring in the U.S. Congress and follows the developments of various state and regional initiatives. Internal documents that outline the activities of these groups are updated on a regular basis. Reviews continue of publications relating to the regulation of CO₂ sequestration, MVA issues, and carbon market developments. Frequent updates are provided to task leaders with regard to federal, state, and provincial actions. In addition, an update to the regulatory section of the DSS is currently under development.

Accomplishments during BP3, Y2 (October 1, 2008 – September 30, 2009) also include the following.

NEPA Environmental Questionnaires

The NEPA for non-site-specific and non-field-based work for the PCOR Partnership project for BP4 and BP5 was completed in September 2009.

Interstate Oil and Gas Compact Commission (IOGCC)

The IOGCC is a multistate government agency that promotes the conservation and efficient recovery of domestic oil and natural gas resources while protecting health, safety, and the environment. EERC staff participated in numerous conference calls of the IOGCC Pipeline Transportation Task Force and attended the IOGCC Midyear Issues Summit in Anchorage, Alaska. In addition, the IOGCC Washington Representative attended the Regulatory Workshop – Brainstorming Session (see below) in June 2009.

EPA Proposed Rules

A complete and thorough review of EPA's "Proposed Rule for Federal Requirements under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO₂) Geologic Sequestration (GS) Wells" was conducted. Draft comments were developed and submitted to a PCOR Partnership ad hoc committee for comment. The committee's comments were incorporated into a proposed response document which was, in turn, distributed to the entire PCOR Partnership membership for its comment.

A review was then completed of the EPA's recent release of additional data as they relate to the geologic sequestration of carbon dioxide under the "Federal Requirements under the UIC Program for CO₂ GS Wells; Notice of Data Availability (NODA) and Request for Comment" as announced August 24, 2009, and issued August 30, 2009. The comment period is 45 days or until October 15, 2009. The impact of the NODA on the PCOR Partnership members and region is under assessment.

Additionally, an evaluation was conducted of EPA's "Proposed Mandatory Greenhouse Gas (GHG) Reporting Rule." The proposed rule would collect accurate and comprehensive emission data from large sources in the United States to inform future policy decisions. In

general, EPA proposes that many of the PCOR Partnership's partners, including suppliers of fossil fuels or industrial GHGs, manufacturers of vehicles and engines, and facilities that emit 25,000 metric tons or more per year of GHG emissions, submit annual reports to EPA. One of the gases covered by the proposed rule is CO₂.

International Energy Agency (IEA)

The PCOR Partnership provided comments to IEA on the regulatory and economics section of the "Draft Aquifer Storage – Development Issues" document.

North Dakota Legislative Task Force

The PCOR Partnership participated on a task force that is working on geologic sequestration rules for the state of North Dakota. Previously, staff testified at North Dakota Senate and House hearings regarding the merits of the now-enacted carbon sequestration bill.

Fort Nelson Demonstration Site

The PCOR Partnership has been supporting Spectra Energy's permitting efforts for the Fort Nelson demonstration. EERC staff met with representatives from Spectra Energy and the British Columbia government to discuss regulatory issues in British Columbia, Canada, and in the United States. Additionally, legislative and regulatory actions by the province of British Columbia are continually followed for the effect they may have on the Fort Nelson demonstration project.

U.S. Field Demonstration Site

Because of delays in finalizing the selection of a second demonstration site, i.e., a U.S. field demonstration site, the permitting and NEPA compliance task for the second demonstration has focused on collecting general background material. In addition, continual contact is maintained with state and federal regulatory and permitting staff to help ensure a smooth process once a site is selected.

PCOR Partnership Regulatory Workshop – Brainstorming Session

This workshop was held June 16–17, 2009, in Deadwood, South Dakota, and was designed to facilitate interactions among oil and gas regulatory officials from states and provinces in the PCOR Partnership region toward planning a broader workshop. The oil and gas regulatory officials are seen as key regional leads in these regards, given their relevant experience in the management of the deep subsurface mineral estate. There was representation from the majority of the states and provinces within the PCOR Partnership region (Alberta, British Columbia, Saskatchewan, Missouri, Montana, Nebraska, North Dakota, South Dakota and Missouri) as well as the IOGCC and an independent EOR consultant.

The consensus was to focus on public utility commissioners for the next workshop. The purpose would be to educate commissioners on the issues related to CCS and to provide a forum for the exchange of ideas and experiences. The next workshop will be held in early-to-mid 2010.

One State, One Province Permitting Overview

A permitting overview update on Alberta (Canada) and North Dakota was completed for inclusion on the DSS partners-only Web site (see Task 1 above).

Conferences and Education

- Carbon Market Insights Americas 2008 Conference, November 12–13, 2008, in Washington, D.C.
- Platt's 2nd Annual Carbon Capture and Sequestration Policy, Economics, Regulation, and Risk Conference 2009, September 14–15, 2009, in Washington, D.C., to discuss current policy, economic, regulation, and risk issues as they relate to CCS today.
- Climate Change and Emissions Management Corporation (CCEMC): "Climate Change and Emissions Management Act and Alberta's Response to Reduce Emissions" Webinar on September 3, 2009, to learn about the Act and the CCEMC. The CCEMC is the innovative initiative of Alberta to address climate change issues through funding new emission-reducing technology.

Task 4 – Site Characterization and Modeling

This task selects the sites for the two field-based large-scale demonstrations as well as develops baseline site characterization data and petrophysical models for the selected sites.

Activities and Results

Accomplishments during BP3, Y2 (October 1, 2008 – September 30, 2009) are described below

Fort Nelson Demonstration Site

PCOR Partnership staff met regularly with representatives of Spectra Energy, the provincial government of British Columbia, and the Canadian federal government to discuss the direction and progress of baseline characterization, modeling, and MVA plan development for the Fort Nelson project.

It should be noted that the originally specified well location for the Fort Nelson demonstration, which was located approximately 3 km south of the gas-processing plant, had to be moved to a location approximately 15 km west of the plant. The reason for the move was the fact that the potential target injection zone at the original well location is overlain by a producing natural gas reservoir. While this decision did postpone the drilling of the exploration well from

fall 2008 to spring 2009, the drilling and baseline characterization plan had enough flexibility built into it so that subsequent key milestones such as installation of compression systems, pipeline construction, and initiation of injection in the fall of 2011 will not be delayed.

An exploratory well was drilled and completed at the Fort Nelson CCS project site location during April and May of 2009. A number of detailed geophysical logging techniques were used to characterize the geologic, geomechanical, and geochemical properties of the potential sink and seal formations at the site. Characterization activities associated with the drilling of the well included the collection of core and cuttings samples from potential seal and sink formations, the application of formation microimaging logs, and drill stem tests to evaluate injectivity of potential injection zones. Initial results indicate that there are thick, competent shale formations that can serve as seals and that there are multiple horizons which appear to have adequate porosity and permeability to allow for large-scale injection of CO₂. Additional analyses and interpretation of results will be conducted over the course of 2009 and 2010 to confirm these initial observations and support the development of detailed injection and monitoring schemes. The development of a detailed petrophysical model was initiated on June 9, 2009. The model is based on historical seismic survey data, geophysical logging and core data from numerous existing wells in the Fort Nelson area, hydrogeologic studies, and recently acquired data generated during the drilling of the Fort Nelson CCS exploratory well in the spring of 2009. The petrophysical model will be the basis for dynamic simulations of potential injection schemes.

Fort Nelson CCS Project Risk Management Plan (RMP)

In spring 2009, efforts were initiated for a Fort Nelson project RMP. A kickoff meeting was held on June 11, 2009, in Calgary. Throughout the summer, various interviews with Spectra Energy key stakeholders were held to begin defining the risk management process and policy within the context of the project. These interviews helped determine how technical risks could impact various Spectra Energy administrative operations, including potential legal, environmental, and financial concerns. Collaboration was undertaken with the EERC, Spectra Energy, and Oxand Risk & Project Management Solutions.

On July 27, another meeting was held with Spectra Energy. The objectives were to determine whether the currently identified risks associated with injection of sour CO₂ at the Fort Nelson project warranted further discussion and ultimately quantification for future MVA plans. The meeting was attended by members of the technical team evaluating subsurface processes which may present risks to the project (wellbores, pressure maintenance, faults, cap rock, reservoir, fluids, etc.). The meeting goals were accomplished with plans for a new workshop to be organized by the EERC and Oxand to quantify identified risks.

Several phone meetings were held with Oxand and Spectra Energy to finish up the first-round risk assessment for the Fort Nelson CCS project, including a risk evaluation workshop on September 11, 2009. This workshop included an evaluation of the risk estimation results, i.e., determining which risks needed to be treated and which were acceptable. A draft Risk Management Framework and First-Round Risk Assessment Results was delivered to Spectra Energy on September 21, 2009, and currently remains under review.

U.S. Field Demonstration Site

Williston Basin Demonstration Site

The final selection of a site was repeatedly delayed while negotiations continued for the sale and transportation of the CO₂ between prospective owner/operators of CO₂ sources and prospective owner/ operators of oil reservoirs. A Geological Characterization Experimental Design Package (D31) is under development, and although a formal agreement with the site operator has not been finalized, the collection of baseline geological data at the regional and subregional scale has been initiated (M7).

A series of experiments to examine the geochemical interactions between candidate reservoir and seal rocks, formation fluids, and CO₂ under relevant reservoir conditions (M6) were completed in June 2008, with preliminary results summarized and presented as a poster at the 9th International Conference on Greenhouse Gas Control Technologies (GHGT-9) in November 2008.

Petrophysical models were completed for 1) saline formation systems in the Washburn study area and 2) hydrocarbon systems in the Dickinson study area within the Williston Basin. Several other activities conducted as part of the baseline characterization resulted in the presentation of papers at GHGT-9.

Regular meetings were held with representatives from potential CO₂ suppliers, the North Dakota Oil and Gas Research Council, the North Dakota Department of Mineral Resources, and key oil companies to discuss the direction and progress of baseline characterization, modeling, and MVA plan development for the Williston Basin demonstration.

Unfortunately, in spring 2009, negotiations reached a stalemate and alternative locations were diligently pursued. This, in turn, resulted in the postponement of several activities and deliverables that are site-specific.

Bell Creek EOR Demonstration Site

The PCOR Partnership is now working with Encore Acquisition Company to evaluate the efficacy of developing a robust and practical MVA, risk management, and simulation project associated with a commercial-scale injection of CO₂ for the purpose of simultaneous EOR and storage of CO₂. A technical team that includes Encore, the EERC, and others will conduct a variety of activities to determine the baseline geological characteristics of the injection site and surrounding areas. Encore will carry out the injection process, while the EERC will conduct CO₂ MVA activities at the site. The project, which will be conducted in the Bell Creek oil field in Powder River County, southeastern Montana, will provide insight regarding the impact of miscible CO₂ flood tertiary recovery on oil production and successful CO₂ storage within a sandstone reservoir in the PRB's Cretaceous Muddy Formation. The PRB is geologically similar to the Williston Basin, both lithologically and technically. The Bell Creek project will be a unique opportunity to develop a set of cost-effective MVA protocols for large-scale CO₂ storage associated with an EOR operation.

The Bell Creek oil field is an ideal candidate for a CO₂ tertiary recovery project for numerous reasons. The primary reason is its depth of 4500 feet, which results in temperature and pressure conditions that will maintain the injected CO₂ in a supercritical state and allow for miscibility of the CO₂ in the oil. Further, the Bell Creek's permeability at 900 millidarcies and its porosity, which averages 24%, allow for high CO₂ injection rates and a fairly rapid production response.

The Lost Cabin Gas Plant, located in Fremont County, Wyoming, is owned and operated by ConocoPhillips and currently generates approximately 50 million cubic feet a day of CO₂. Encore and ConocoPhillips have entered into a 15-year CO₂ purchase-and-sale agreement. This CO₂ will be transported to the Bell Creek oil field in a new pipeline to be constructed by Encore Acquisition Company (see Figure 8).

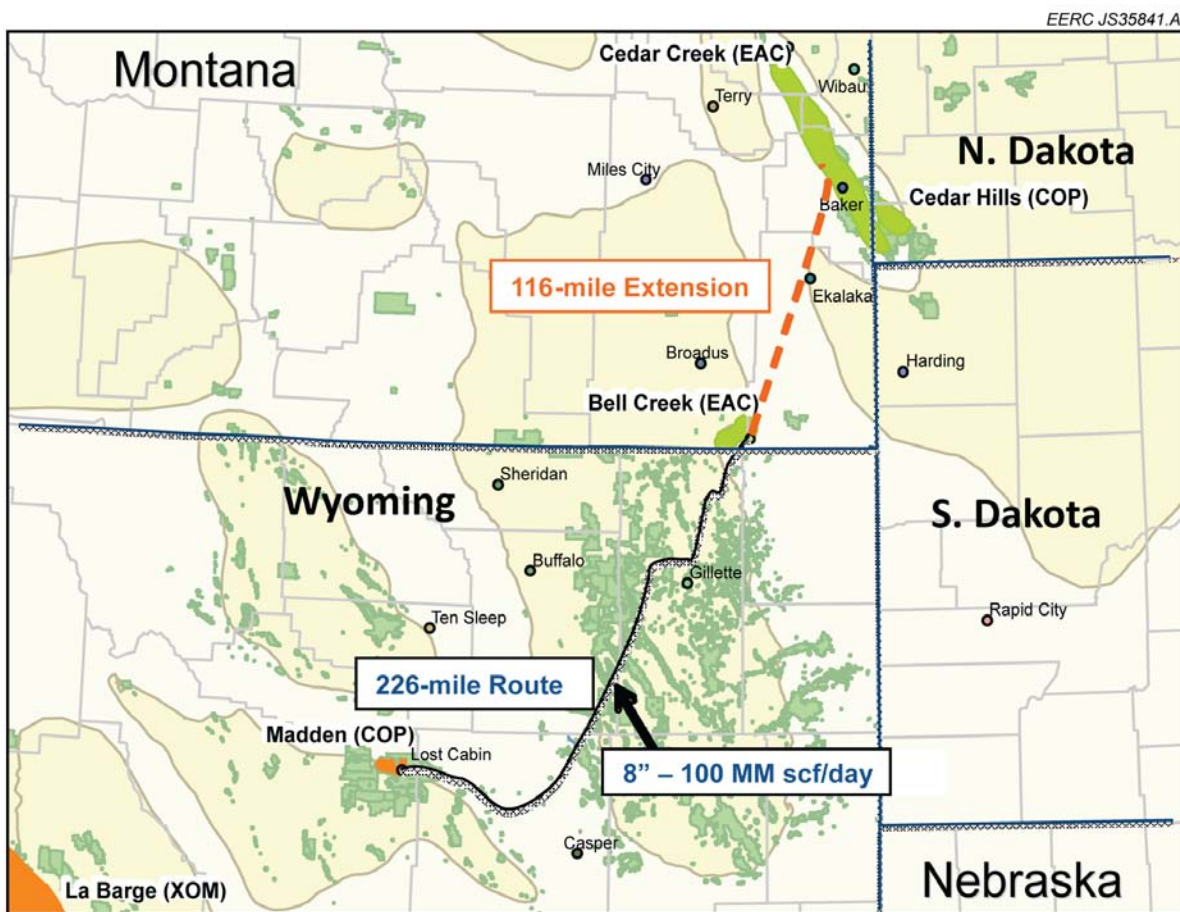


Figure 8. CO₂ pipeline running from the Lost Cabin Gas Plant to the Bell Creek project site in the PRB and anticipated future expansion to the Cedar Creek Anticline in the Williston Basin (1).

Task 5 – Well Drilling and Completion

This task was not active during BP3, Y2.

Task 6 – Infrastructure Development

This task facilitates the infrastructure planning required for CCS to be implemented on a wide-scale regional basis, as well as the development of the specific infrastructure associated with the capture, dehydration, compression, and pipeline transportation of CO₂ from its source to the oil field for EOR. The infrastructure development for the U.S. test site will be performed by the industrial partners, with EERC personnel documenting the activities, interfacing with source facility engineers and vendors, and providing assistance as needed.

Activities and Results

Accomplishments during BP3, Y2 (October 1, 2008 – September 30, 2009) include the following.

CO₂ Capture Technology

- PCOR Partnership staff prepared a list containing short descriptions of capture and storage demonstrations that were announced during FY08.
- A review of the World Resources Institute's Carbon Capture and Sequestration guidelines document was performed.
- A PowerPoint presentation was prepared on the topic of carbon capture during hydrogen production. The PCOR Partnership PM presented the information at a hydrogen production conference.
- Preliminary calculations of a thermodynamic balance of the Powerspan ECO2™ process were initiated. ECO2 is a postcombustion, regenerative process that uses an ammonia-based solution to capture CO₂ from the flue gas of a power plant and releases it in a form that is ready for further compression, safe transportation, and geological storage.

PCOR Partnership Member Requests for Information

- CO₂ pipeline specification information was developed and reported.
- The oxygen requirement of a particular unit, assuming retrofit for oxygen combustion, was calculated.
- Information regarding the calculation of CO₂ emissions from the compression, pipeline transportation, and injection activities associated with CO₂ sequestration in various geological settings was prepared.

- Skyonic's SkyMine and Clean Energy Systems' power generation/CO₂ capture technology processes were evaluated, the role of potassium carbonate in CO₂ capture was summarized, and the additives used in the Econamine FG process were researched.
- The cost, infrastructure, and permitting requirement for truck-loading CO₂ were summarized in a short document. A second document was prepared that specifically dealt with truck-loading CO₂ captured from an ethanol plant.
- Determination of the potential pipeline infrastructure needed to move CO₂ from a planned integrated gasification combined-cycle (IGCC) plant to various geological sequestration opportunities in the PCOR Partnership region.

Ramgen Power Systems

A subcontract was entered into with Ramgen Power Systems in order to evaluate its novel shockwave-based CO₂ compression technology, the Rampressor, for potential use during one of the PCOR Partnership demonstration projects.

In preparation for potential installation of the Rampressor during a demonstration test, the following activities were undertaken:

- Ramgen has begun work on the detailed planning and demonstration unit design in preparation for a demonstration at a power plant. In November 2008, Ramgen entered into a partnership with Dresser-Rand Group, Inc., a U.S.-based compressor manufacturer. This collaboration has resulted in two significant enhancements to the CO₂ Rampressor development plan. The first is an increase in the planned size of the demonstration unit by roughly fourfold. This will reduce the time to commercial introduction by an estimated 2 years. The second enhancement is the ability to test the CO₂ Rampressor at Dresser-Rand's test facility in Olean, New York. One of the most flexible and sophisticated in the world, this facility will permit testing to be performed with greater control, reduced risk, and more quickly than would otherwise be possible.
- Ramgen has focused on the conceptual design of the demonstration unit and has been working to identify any facility and interface issues that may impact the demonstration as well as the facility requirements for the installation of the demonstration unit. Ramgen is preparing a draft document describing these interface issues and providing specifications for the facility requirements.
- A Topical Report on the Preliminary Design of Advanced Compression Technology (D47) was prepared and submitted to DOE on September 29, 2009. It summarized Ramgen Power Systems activities relative to integration of the Ramgen compression technology with a power plant.

Modeling Evaluations

- The ProTreat gas-scrubbing model was evaluated with respect to its applicability/ usefulness to the PCOR Partnership program and members. It appears that it will be a useful tool for determining applicability of gas scrubbing to the CO₂ streams emitted from the various point sources within the PCOR Partnership region and providing information that can be used when estimating the cost of this type of process.
- Argonne National Laboratory's GREET model was downloaded and an evaluation of the model begun. The model may be useful in determining the CO₂ footprint associated with the entire ethanol production process from field preparation and seeding to production at an ethanol plant and even its use as a transportation fuel.

Pipeline Network

In June, an evaluation was begun of the proposed preliminary regional pipeline network that was developed under Phase II activities (during July 2008); the preliminary network will be adapted to include the Phase III demonstration test activities.

Compressor Evaluation

In June, preliminary calculations were begun to investigate CO₂ compressors that could be utilized if CO₂ for the U.S. demonstration project site were to be captured at a coal-fired power generating plant. One estimate received indicated that the purchase and installation of compression and dehydration equipment would likely run \$13 million to \$16.25 million, although private sector partners' estimates tended to be much higher, on the order of \$25 million.

Task 7 – CO₂ Procurement

This task documents CO₂ procurement procedures for the EOR activities. This task provides for EERC personnel to interface with commercial partners with respect to CO₂ procurement for the U.S. demonstration as a means of documenting critical pathways for future projects.

Activities and Results

Accomplishments during BP3, Y2 (October 1, 2008 – September 30, 2009) include the following:

- Discussions are ongoing with potential CO₂ suppliers; however, certain specific details cannot be shared at the present time because of the business-sensitive nature of the negotiations.
- Significant effort was previously focused on facilitating negotiations between one particular CO₂ supplier and regional oil companies. At an April 15, 2009, meeting, a stalemate was declared, and the CO₂ supplier stated that it was unable to be a participant

at this time in the site selection process. An e-mail was sent to the PCOR Partnership's members seeking input on alternative site options.

- In an effort to resolve this issue, EERC staff explored a set of options to meet overall goals and objectives, including potential alternative arrangements and/or projects that could be considered as contingencies. Potential alternative arrangements include a CO₂ capture facility at another regional coal-fired utility and integration of that CO₂ with that of a collocated ethanol production facility. Conference calls with all interested parties were held on May 1, 11, and 20. A brief outline, including proposed pipeline routes and distances, was sent to the interested parties on May 22, for review. Additional conference calls were held on June 2 and 9, and a draft prospectus was disseminated for review and comment. Additional calls were held on July 8 and August 18.
- Other potential alternative sources were also pursued. A meeting was held on April 24, 2009, with an interested oil company that indicated it knew of potential CO₂ providers with a heightened focus on expediting site selection. A meeting was held on August 27, 2009, to present these additional site selection options to DOE NETL in Pittsburgh, Pennsylvania.

Task 8 – Transportation and Injection Operations

This task was not active in BP3, Y2.

Task 9 – Operational Monitoring and Modeling

Although this task is not due to begin until BP4, several conference calls were held with Spectra Energy, Oxand, and EERC staff to discuss the RMP for the Fort Nelson CCS project as well as the initial model development which will later feed directly into the Task 9 monitoring and modeling activity for the Fort Nelson CCS project.

Task 10 – Site Closure

This task was not active in BP3, Y2.

Task 11 – Postinjection Monitoring and Modeling

This task was not active in BP3, Y2.

Task 12 – Project Assessment

This task communicates and disseminates all Phase III activities detailed in annual progress reports. Reports summarize project progress, accomplishments, project recognition (travel), planned activities, and goals.

Activities and Results

Assessment was conducted for the tasks during the period October 1, 2007 – September 30, 2008. A Project Assessment Annual Report (D57) was submitted on December 31, 2008.

Task 13 – Project Management

This task focuses on ensuring the overall success of the entire program by providing experienced management and leadership to each of the individual tasks and to the program as a whole. The PM and task leaders meet regularly to report the progress of their tasks and discuss any issues and corrective actions necessary. Task leaders are also responsible to provide the PM with written weekly updates. These updates include highlights (including trip reports), issues (i.e., budget, staffing, technical issues, etc.), opportunities, and travel plans. The monthly, quarterly, and yearly updates can be found on the PCOR Partnership DSS.

Activities and Results

The PCOR Partnership has significant support and participation from its partners. As of September 30, 2009, there are 86 partners supporting Phase III activities. Phase II members in good standing were automatically considered members of Phase III for the overlapping project years (October 1, 2007 – September 30, 2009).

Accomplishments during BP3, Y2 (October 1, 2008 – September 30, 2009) include the following.

IOGCC Stewardship Award

The PCOR Partnership was selected by the IOGCC's Stewardship Award Subcommittee as the winner in the 2008 Environmental Partnership category. The award was presented to the PCOR Partnership by the Chairman of the IOGCC, Governor Brad Henry (D-OK), on November 17, 2008, during the general session of the IOGCC Annual Meeting in Santa Fe, New Mexico (Figure 9).

Quarterly Reports

Quarterly progress reports (D58), including a milestone report (D59) have been submitted to DOE and the PCOR Partnership partners 1 month after the end of each calendar quarter.

Continuation Application

The Phase III Continuation Applications was submitted on June 30, 2009. On July 14, the updated Project Management Plan (including an RMP) was submitted.



Figure 9. EERC Associate Director John Harju receives the award from Oklahoma Governor Brad Henry while Nebraska OGCC Director Bill Sydow and North Dakota Oil and Gas Director Lynn Helms look on.

Annual Meetings

Preparations have begun for the 2009 PCOR Partnership Annual Meeting. The meeting will be held in St. Louis, Missouri, on December 2–3, 2009, with workshops on Effective Outreach and Carbon Management Strategies to be held December 1. A “Save-the-Date” e-mail blast was sent to partners on May 29, 2009.

RCSP Support

- The PCOR Partnership was asked to coordinate the RCSP Water Working Group (WWG). In December 2008, a proposal to add this new task was submitted to DOE. This task began Quarter 2 – BP3, Year 2.
- The PCOR Partnership was represented at NETL’s 2009 RCSP Initiative Review Meeting held in October 2008.
- The PCOR Partnership’s PM serves as Chairman for the North American Energy Working Group’s (NAEWG’s) Subcommittee on CO₂ Storage Capacity Estimation. This subcommittee discusses geologic storage capacity coefficients and the methodology for estimations. The data sharing of this group will lead to a solid foundation in the area of CO₂ capture and sequestration mapping and estimations in North America. This subcommittee will coordinate its activities closely with the NAEWG–North American Carbon Atlas Partnership (NACAP). The Kickoff Session was March 27, 2009, and a conference call was

held May 4, 2009. A subsequent conference call was held July 15, 2009, and the subcommittee's recommendations were delivered to NAEWG–NACAP at a meeting July 22–23, 2009, in Pittsburgh, Pennsylvania. Plans are under way for the next meeting to be held in Mexico in March 2010. Prior to that meeting, the Methodology (Ed Steadman) and IT (Tim Carr) Subcommittees will work on the level of detail/granularity in a publicly accessible GIS system.

- Workshop on Potential Joint CCS Projects with Canada under the Clean Energy Dialogue on June 29–30, 2009, in Washington, D.C. CCS is one of the topics that both the United States and Canada have expressed interest in to continue discussions. This is occurring under the U.S.–Canada Clean Energy Dialogue. From the U.S. side, the effort is being led by the DOE Office of Policy and International Affairs.
- RCSP annual review meeting – Sent a notice out to the partnership that if any partners were interested in attending the annual review meeting in November, they were welcome. We received notices from 19 interested partners.

DOE Fossil Energy Techlines

- A DOE Fossil Energy Techline “DOE Regional Partnership Begins Core Sampling for Large-Volume Sequestration Test” was posted online May 22, 2009. This Techline outlined the core-sampling and well-logging activities at Spectra Energy's Fort Nelson, British Columbia, Canada, demonstration project site.
- On August 17, 2009, DOE NETL posted a news release on its Web site regarding the PCOR Partnership's use of its Decision Support System (DSS, © 2007 EERC Foundation) in the preparation of a carbon management plan for one of its partners, Excelsior Energy Inc.

Annual Carbon Capture & Sequestration Conference

The PCOR Partnership also took part in the 8th Annual Carbon Capture & Sequestration Conference held May 4–7, 2009, in Pittsburgh, Pennsylvania. The PCOR Partnership delivered four presentations, as well as two poster presentations. A booth was on exhibit and staffed during the conference.

GHGT-9

- Held on November 16–20, 2008, in Washington, D.C., this conference was organized by the Massachusetts Institute of Technology in collaboration with the IEA Greenhouse Gas R&D Programme, with major sponsorship from DOE. The PCOR Partnership was represented at this conference with several posters and presentations.
- Members of the PCOR Partnership took part in initial discussions and reviewed and provided input to the script and drafts of the NETL video on sequestration premiering at the booth at GHGT-9.

GHGT-10

Efforts are under way to submit approximately eight to ten abstracts by the December 22, 2009, deadline for the conference scheduled for September 19–23, 2010, Amsterdam, The Netherlands. The call for papers was announced on September 15, 2009.

Miscellaneous Activities

- The EERC's Partnership for CO₂ Capture, an 18-month project that examines the feasibility of different CO₂ capture technologies, was initiated on March 26, 2008. This project will complement various EERC PCOR Partnership activities.
- The Project Management Plan ([PMP], D63) has been revised to include updates on deliverable/milestone submissions and planned risk management activities.
- The draft outline for the RMP (D77) was submitted to DOE at the end of BP3 for review. The RMP is a living document, and more progress will be made as each Phase III demonstration project evolves. Work has begun on the risk management activities for the Fort Nelson field demonstration.
- The PCOR Partnership updated the North Dakota Oil and Gas Research Council on February 4, and August 6, 2009, in Bismarck, North Dakota, on the progress of the Phase III efforts.

PCOR Partnership Partners

- New Partners:
 - TAQA NORTH, Ltd. (October 2008)
 - Great Northern Power Development, LP, changed its name to Great Northern Project Development, LP (January 2009)
 - Nebraska Public Power District (February 2009)
 - Baker Hughes Oilfield Operations, Inc. (April 2009)
 - Petroleum Technology Research Centre (May 2009)
 - Williston Basin Interstate Pipeline (August 2009)
 - Oxand Risk & Project Management Solutions (September 2009)
- In addition, numerous inquiries were received about the PCOR Partnership throughout the course of this assessment period.
- Retention of Existing Partners:
 - Letter mailed to all regulatory and other supporting members on September 16, 2009
 - E-mail (with draft letter of agreement) sent to all commercial/industry members on September 30, 2009

Task Leader Meetings

Approximately once a month a meeting is held with all the task leaders, project manager, budget personnel, and support staff. These meetings are convened in order to share information, create time lines for the completion of products, and disseminate data.

Lignite Energy Council Award

In September 2009, the Lignite Energy Council's Awards Committee designated Ed Steadman and John Harju as recipients of the "Distinguished Service – Research and Development Award" because of their leadership and counsel on CO₂ storage projects involving the lignite industry. The awards will be presented on October 8, 2009, in Bismarck, North Dakota.

Task 14 – RCSP Water Working Group (WWG) Coordination

The PCOR Partnership leads an RCSP WWG comprising appropriate stakeholders. The RCSP WWG was initiated in January of 2009. The purpose of the WWG is to address the wide variety of concerns and opportunities at the nexus of carbon storage and water resources. Development of documents under this task is led by the EERC, with input from all WWG participants.

Activities and Results

Accomplishments during this assessment period (October 1, 2008 – September 30, 2009) include the following.

Monthly Conference Calls

The first five monthly conference calls (M23) have taken place: April 30, 2009; May 29, 2009; June 25, 2009; August 25, 2009 and September 22, 2009. DOE NETL waived the requirement for a July conference call. Minutes of the calls are submitted to the WWG within the first 15 days of each subsequent month following a call.

White Paper on Nexus of CCS and Water

An outline for the white paper on the nexus of CCS and water (M21) was completed and transmitted to DOE and the WWG participants on February 27, 2009, for comment. An updated version of this outline was submitted to DOE and WWG participants on May 29, 2009. The draft white paper (M22) was submitted for review and comment in August 2009.

Annual Meetings

The first annual WWG meeting (M24) was held on May 7, 2009, in Pittsburgh, Pennsylvania. The primary focus of this meeting was to discuss each partnership's unique challenges and opportunities with respect to the nexus of water and CCS and to review the outline of the white paper on the nexus of CCS and water.

Logo Banner

In August, a new banner showcasing the WWG name and the logos for all seven RCSP partners, in addition to DOE and NETL, was prepared and is now affixed to all WWG reports and deliverables.

COST STATUS

The approved BP3 budget along with actual costs incurred and in-kind cost share reported is shown in Table 3. An expected spending plan and actual expenditures by quarter of cash funds for BP3 is provided in Figure 10 and Table 4.

SCHEDULE STATUS

Table 5 contains all of the Phase III deliverables, milestones, and submission dates for the reporting period. Table 6 provides a Gantt chart for BP3.

Table 3. Phase III Budget – BP3

Organization	Approved Budget	Actual Costs Incurred
DOE Share – Cash	\$4,133,219	\$4,190,566
Nonfederal Share – Cash	\$908,847	\$887,694
Nonfederal Share – In-Kind*	\$4,850,385	\$2,585,256
Total	\$9,892,451	\$7,663,516

* Some of the actual in-kind reporting for BP3 is still pending.

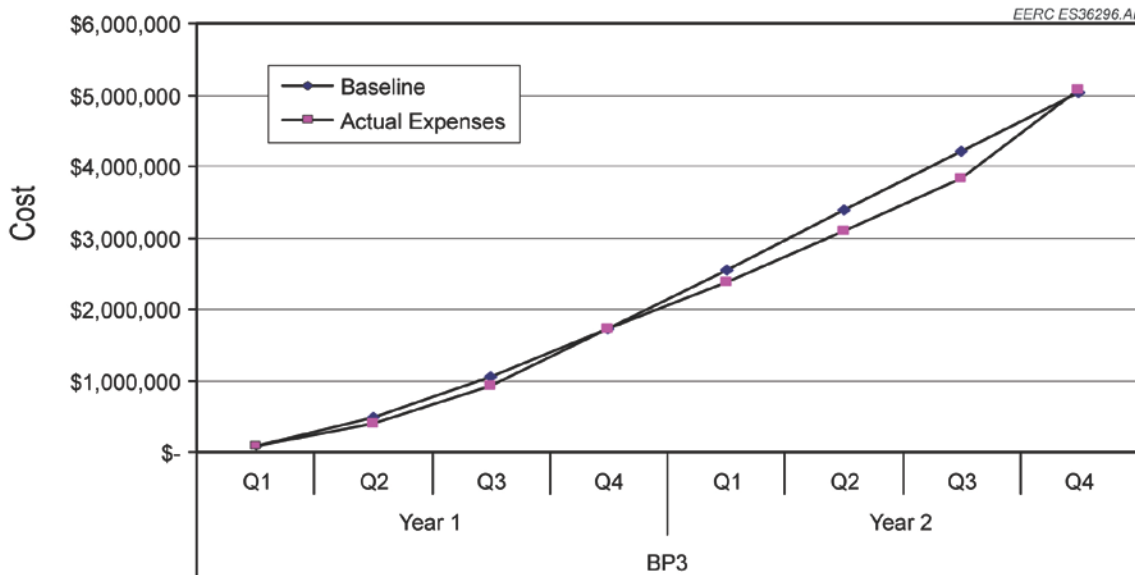


Figure 10. PCOR Partnership Phase III BP3 funding (cash only).

Table 4. BP3 Spending Plan (cash only)

EERC ES36295.CDR

Baseline Reporting Quarter	Q1		Q2		Q3		Q4		Q1		Q2		Q3		Q4	
	Q1	Cum. BP Total	Q2	Cum. BP Total	Q3	Cum. BP Total	Q4	Cum. BP Total	Q1	Cum. BP Total	Q2	Cum. BP Total	Q3	Cum. BP Total	Q4	Cum. BP Total
Baseline Cost Plan																
Federal Share	\$ 88,728	\$ 88,728	\$ 318,976	\$ 407,704	\$ 510,620	\$ 918,324	\$ 597,684	\$ 1,516,008	\$ 654,303	\$ 2,170,311	\$ 654,303	\$ 2,824,614	\$ 654,303	\$ 3,478,916	\$ 654,303	\$ 4,133,219
Nonfederal Share	\$ -	\$ -	\$ 68,000	\$ 68,000	\$ 67,999	\$ 135,999	\$ 67,999	\$ 203,998	\$ 176,212	\$ 380,210	\$ 176,212	\$ 556,422	\$ 176,212	\$ 732,634	\$ 176,213	\$ 908,847
Total Planned	\$ 88,728	\$ 88,728	\$ 386,976	\$ 475,704	\$ 578,619	\$ 1,054,323	\$ 665,683	\$ 1,720,006	\$ 830,515	\$ 2,550,521	\$ 830,515	\$ 3,381,036	\$ 830,515	\$ 4,211,550	\$ 830,516	\$ 5,042,066
Actual Incurred Cost																
Federal Share	\$ 88,728	\$ 88,728	\$ 318,976	\$ 407,704	\$ 510,620	\$ 918,324	\$ 597,684	\$ 1,516,008	\$ 390,254	\$ 1,906,262	\$ 365,077	\$ 2,271,339	\$ 743,537	\$ 3,014,876	\$ 1,175,690	\$ 4,190,566
Nonfederal Share	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 204,037	\$ 204,037	\$ 261,465	\$ 465,502	\$ 349,283	\$ 814,785	\$ 2,778	\$ 817,563	\$ 70,131	\$ 887,694
Total Incurred Cost	\$ 88,728	\$ 88,728	\$ 318,976	\$ 407,704	\$ 510,620	\$ 918,324	\$ 801,721	\$ 1,720,045	\$ 651,719	\$ 2,371,764	\$ 714,360	\$ 3,086,124	\$ 746,315	\$ 3,832,439	\$ 1,245,821	\$ 5,078,260
Variance																
Federal Share	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 264,049	\$ 264,049	\$ 289,226	\$ 553,275	\$ (89,234)	\$ 464,040	\$ (521,387)	\$ (57,347)
Nonfederal Share	\$ -	\$ -	\$ 68,000	\$ 68,000	\$ 67,999	\$ 135,999	\$ (136,038)	\$ (39)	\$ (85,253)	\$ (85,292)	\$ (173,071)	\$ (258,363)	\$ 173,434	\$ (84,929)	\$ 106,082	\$ 21,153
Total Variance	\$ -	\$ -	\$ 68,000	\$ 68,000	\$ 67,999	\$ 135,999	\$ (136,038)	\$ (39)	\$ 178,796	\$ 178,757	\$ 116,155	\$ 294,912	\$ 84,200	\$ 379,111	\$ (415,305)	\$ (36,194)

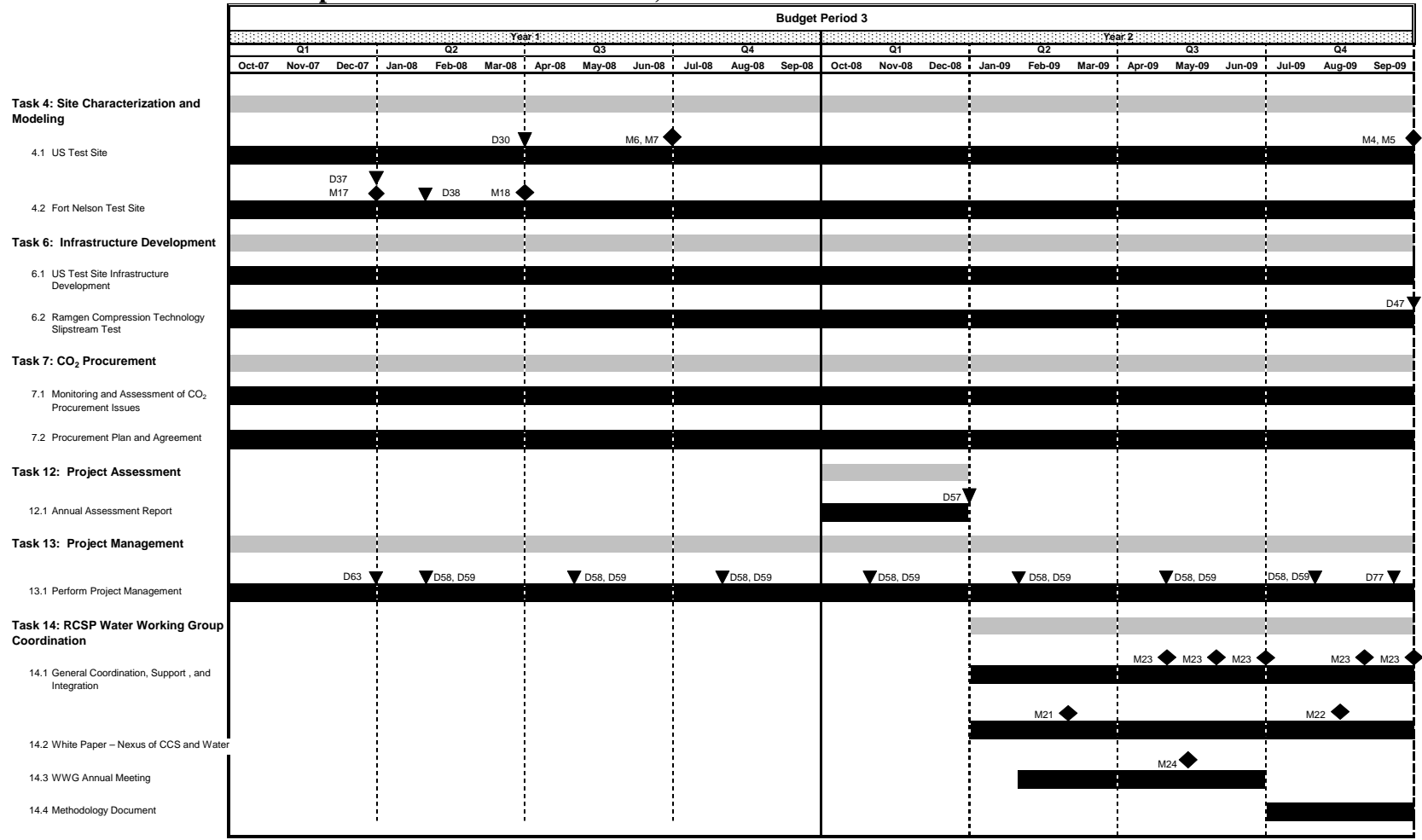
Table 5. Phase III – Year 2: Milestones and Deliverables

Title/Description	Due Date	Actual Completion Date
Year 2 – Quarter 1 (October–December 2008)		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	10/31/08	10/31/08
D20: Task 2 – Documentary Support to PowerPoint and Web Site	12/31/08	12/31/08
D57: Task 12 – Project Assessment Annual Report	12/31/08	12/31/08
Year 2 – Quarter 2 (January–March 2009)		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	1/31/09	1/30/09
M21: Task 14 – Outline of White Paper on Nexus of CO ₂ Capture and Sequestration (CCS) and Water, Part Subtask 14.2 – White Paper on Nexus of CCS and Water	2/27/09	2/27/09
D24: Task 2 – PCOR Partnership Region Sequestration General Poster	3/31/09	3/31/09
M23: Task 14 – Monthly WWG Conference Call Held	3/31/09	3/31/09
Year 2 – Quarter 3 (April–June 2009)		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	4/30/09	4/30/09
M23: Task 14 – Monthly WWG Conference Call Held	4/30/09	4/30/09
D2: Task 1 – First Target Area Completed	5/29/09	5/29/09
M23: Task 14 – Monthly WWG Conference Call Held	5/29/09	5/29/09
M24: Task 14 – WWG Annual Meeting Held	5/29/09	5/07/09
D16: Task 2 – Fort Nelson Test Site Fact Sheet	5/29/09	5/29/09
M23: Task 14 – Monthly WWG Conference Call Held	6/30/09	6/25/09
Year 2 – Quarter 4 (July–September 2009)		
M23: Task 14 – Monthly WWG Conference Call Held	N/A	Not required by DOE (7/16/09)
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	7/31/09	7/31/09
D19: Task 2 – Fort Nelson Test Site PowerPoint Presentation	7/31/09	7/31/09
M22: Task 14 – Draft White Paper - Nexus of CCS and Water Available for Comments	8/17/09	8/18/09 (DOE); 8/21/09 (WWG)
M23: Task 14 – Monthly WWG Conference Call Held	8/31/09	8/25/09
M4: Task 4 – Site No. 2 Selected	9/30/09	9/30/09
M5: Task 4 – Data Collection Initiated for Site No. 2	9/30/09	9/30/09
M23: Task 14 – Monthly WWG Conference Call Held	9/30/09	9/22/09
D1: Task 1 – Review of Source Attributes	9/30/09	9/25/09
D3: Task 1 – Permitting Review – One State and One Province	9/30/09	9/30/09
D9: Task 1 – Updated DSS	9/30/09	9/29/09
D47: Task 6 – Topical Report on the Preliminary Design of Advanced Compression Technology	9/30/09	9/30/09
D77: Task 13 – Risk Management Plan Outline	9/30/09	9/18/09

Table 6. PCOR Partnership Phase III BP3 Gantt Chart



Table 6. PCOR Partnership Phase III BP3 Gantt Chart, continued



Summary Task Activity Bar Progress Activity Bar Time Now Revised Schedule

Key for Phase III Deliverables (D) ▼		Key for Phase III Milestones (M) ◆
D1 Review of Source Attributes	D27 FN Test Site – Environmental Questionnaire	M1 Three Target Areas Selected
D2 First Target Area Completed	D30 United States (US) Test Site – Geomechanical Experimental Design Package	M2 DPRS Prototype
D3 Permitting Review – One State and One Province	D37 FN Test Site – Site Geological Characterization Experimental Design Package	M3 Start Environmental Questionnaire for US Test Site
D9 Updated DSS	D38 FN Test Site – Geomechanical Experimental Design Package	M4 US Test Site Selected
D11 Outreach Plan	D47 Topical Report on the Preliminary Design of Advanced Compression Technology	M5 Data Collection Initiated for US Test Site
D12 Demonstration Web Pages on the Public Site	D57 Project Assessment Annual Report	M6 US Test Site Geochemical Work Initiated
D14 General Phase III Fact Sheet	D58 Quarterly Progress Report	M7 US Test Site Geological Characterization Data Collection Initiated
D16 Fort Nelson (FN) – Test Site Fact Sheet	D59 Milestone Quarterly Report	M17 FN Test Site Selected
D17 General Phase III Information PowerPoint Presentation	D63 Project Management Plan	M18 FN Test Site Geochemical Work Initiated
D19 FN Test Site – PowerPoint Presentation	D77 Risk Management Plan Outline	M21 Outline of White Paper on Nexus of CCS and Water Available for Comments
D20 Video Support to PowerPoint and Web Site	D78 Final White Paper on the Nexus of CCS and Water	M22 Draft White Paper on the Nexus of CCS and Water Available for Comments
D24 PCOR Partnership Region Sequestration General Poster		M23 Monthly WWG Conference Call Held
		M24 WWG Annual Meeting Held

PLANNED ACTIVITIES

Task 1 – Regional Characterization

During the next project year, the following activities will be undertaken:

- Review and update attribute data for existing sources. Add additional attributes as necessary for characterization. Incorporate new sources as they come online (D1).
- Refine storage analogs for specific geologic horizons within the regional basins.
- Work with the geological surveys/oil and gas divisions of the states and provinces to develop greater detail of the field and reservoir data.
- Develop and refine calculations to derive reservoir data, such as water saturation, porosity, permeability, and resistivity.
- Review current and emerging terrestrial carbon aggregator programs (i.e., Farmers Union, Ducks Unlimited, etc.) to compile regionwide net carbon storage benefits and assess impacts of expiring Conservation Reserve Program acres during the project period.
- Catalog existing pipeline routes.
- Continue to gather information on current and planned CO₂ storage-related regulations at the state, province, and federal levels and continue to participate in the IOGCC Regulatory Working Group.
- Development of a demonstration project reporting system (DPRS). Information specific to the demonstration tests will be maintained, utilized, and reported to DOE and partners through a DPRS. The DPRS will be a Web-based interface that will house data from each demonstration activity and facilitate communication and interpretation of these data. The DPRS will be designed to provide structured access to data by all demonstration participants and other partners and to allow for efficient replication of additional or related demonstration projects (D10).

Task 2 – Public Outreach and Education

During the next project year, the following activities will be undertaken:

- Update the outreach action plan (D11) for Phase III, with input from PCOR Partnership partners as well as outreach experts. This plan will address both general program and activities for specific demonstration projects.
- Update and expand the public PCOR Partnership Web site to include a section on the Phase III demonstration projects and the monetization of carbon credits. Other sections

may be developed or altered as needed. The Web site will be updated as appropriate, with major updates on a biannual basis (D13).

- Develop a fact sheet (D15) profiling the U.S. demonstration site.
- Update the PowerPoint presentations for Phase III general activities (D17) and the Fort Nelson demonstration (D19). In addition, develop a PowerPoint presentation for the U.S. demonstration project (D18). Other PowerPoint presentations may be developed as needed.
- Continue to develop video products to meet the needs of general and site-level outreach.
- Develop two posters (D25 and D26) profiling the two demonstration projects.
- Support the environmental impact statement (EIS) process, as appropriate, which may include disseminating site outreach materials, developing new materials, and giving presentations.
- Identify and act on opportunities to provide outreach both at the regional level and in the vicinity of the demonstrations and address needs with respect to general information on CO₂ storage as well as information on the specific demonstration projects. Activities may include public presentations, assembly of materials for the press and for specific audiences, including middle and high school students, conducting focus groups and undertaking other means of gaining audience feedback to gauge the knowledge of target audiences as well as the effectiveness of outreach materials, and working with outreach and education professionals in an effort to improve the effectiveness of outreach and education activities.

Task 3 – Permitting and NEPA Compliance

During the next project year, the following activities will be undertaken:

- Prepare the DOE's environmental questionnaire (D28) for the U.S. field demonstration site once commercial negotiations are completed.
- Develop a permitting action plan (D29) in conjunction with the site owner in accordance with relevant local, state, and federal regulatory requirements for the U.S. field demonstration project.
- Interface with relevant regulatory agencies within the PCOR Partnership region as well as with federal regulatory agencies (United States and Canada) to understand the regulatory framework for project implementation.

Task 4 – Site Characterization and Modeling

During the next project year, the following activities will be undertaken:

- U.S. field demonstration site
 - Evaluate baseline geology toward the development of a geological characterization experimental design package (D31) that describes the specific approaches and analytical techniques used to conduct the required activities.

- Fort Nelson demonstration site
 - Determine the geomechanical properties of the reservoir and cap rock and stress regime in the area to assess the mechanical integrity of the system and potential for rock fracturing. An in-depth review of available information on the stress regime and structural features in the area of the reservoir will be conducted to identify structures such as faults or dissolution areas. This information will help to elucidate the geological history of the reservoir and identify possible natural leakage paths. Activities may include, but are not necessarily limited to, in situ stress orientation and magnitude analysis, log-based analysis of rock mechanical properties, laboratory tests on geomechanical properties of key rocks, and geomechanical modeling. The results of these activities will be presented in a geomechanical final report for the Fort Nelson site (D40).

 - Conduct laboratory tests on samples of the target injection formation and key sealing formations under reservoir conditions to assess the geochemical reactions anticipated to occur between the injected gas and the rocks and fluids of the reservoir and seal. Mineral compositions will be obtained using x-ray diffraction, x-ray fluorescence, and scanning electron microscopy techniques. Samples of fluids from key formations in the selected oil field will be collected and analyzed for major and minor constituents. Laboratory results will be used to refine geochemical models which will be integrated with CO₂ fate predictive modeling efforts. The results of these activities will be presented in a geochemical final report for the Fort Nelson site (D41).

 - Model attributes such as injectivity, fluid production, and reservoir dynamics using relevant software packages. The ultimate capacity of the injection zone and the fate of the CO₂ over short-, intermediate-, long-, and extremely long-term time frames will be predicted. A report on the simulation modeling results (D67) will be prepared.

Task 5 – Well Drilling and Completion

This task will be initiated during the next project year, the following activities will be undertaken:

- Work with the operator of the selected U.S. demonstration site oil field to develop engineering designs for the installation of necessary injection, production, and monitoring wells. The development of operational plans for the injection and recycling of CO₂ over the duration of the project will also be conducted.

Task 6 – Infrastructure Development

During the next project year, the following activities will be undertaken:

- Regional infrastructure needs will continue to be investigated. Information will be made available for possible inclusion in the DSS.
- The PCOR Partnership will assist its commercial partners with the activities required to develop the infrastructure to deliver CO₂ to the EOR site for the U.S. large-scale storage demonstration.

Task 7 – CO₂ Procurement

During the next project year, the following activities will be undertaken:

- Continue to interface with commercial partners with respect to CO₂ procurement for the U.S. demonstration project.
- Continue to keep abreast of the various commercial issues associated with CO₂ procurement, such as contractual pricing mechanisms for CO₂, other potential customers, etc.

Task 8 – Transportation and Injection Operations

No activity is anticipated during the next project year.

Task 9 – Operational Monitoring and Modeling

This task will be initiated this next project year for the Fort Nelson project. The following activities will be undertaken:

- Develop a site characterization modeling and monitoring plan for the Fort Nelson test.

No activity is anticipated during the next project year in this task for the U.S. demonstration project.

Task 10 – Site Closure

No activity is anticipated during the next project year.

Task 11 – Postinjection Monitoring and Modeling

No activity is anticipated during the next project year.

Task 12 – Project Assessment

During the next project year, the following activities will be undertaken:

- Prepare the Annual Project Assessment Report (D57).

Task 13 – Project Management

During the next project year, the following activities will be undertaken:

- Continue to ensure timely production of deliverables and overall project management.
- Continue to expand the PCOR Partnership’s membership base.
- Plan the next annual meeting.
- Plan a regulatory workshop for February 2010 (tentatively).

Task 14 – RCSP Water Working Group Coordination

During the next project year, the following activities will be undertaken:

- Continue to conduct monthly WWG conference calls. Conference call minutes will be provided to DOE by the 15th day of the following month.
- Prepare a final white paper on the nexus of CCS and water.
- Plan and conduct the second annual meeting of the WWG.

PROJECT RECOGNITION/TRAVEL

Project Recognition

- The PCOR Partnership was selected by the IOGCC’s Stewardship Award Subcommittee as the winner in the 2008 Environmental Partnership category. Announced earlier, the award was presented to the PCOR Partnership on Monday, November 17, 2008, during the general session of the IOGCC Annual Meeting in Santa Fe, New Mexico.
- PPB and the PCOR Partnership documentary “Out of the Air: Into the Soil: Land Practices That Reduce Atmospheric Carbon Levels” won the 2007–2008 Gold Aurora Award in the category of entertainment documentary for nature/environment, as well as a 15th Annual Communicator Award of Excellence in the Environmental Documentary Category.

- PPB and the PCOR Partnership documentary “Reducing Our Carbon Footprint: The Role of Markets” also won a 15th Annual Communicator Award of Excellence. The Communicator Awards were announced on June 9, 2009.
- On September 23, 2009, the Lignite Energy Council’s Awards Committee designated Ed Steadman and John Harju as recipients of the “Distinguished Service – Research and Development Award” because of their leadership and counsel on CO₂ storage projects involving the lignite industry. The awards will be presented on October 8, 2009, in Bismarck, North Dakota.
- On June 22, 2009, an application was submitted to the Carbon Sequestration Leadership Forum (CSLF) for recognition of the Fort Nelson CCS Project, a partnership initiative of Spectra Energy Transmission (SET), the EERC PCOR Partnership, the Province of British Columbia, and the Government of Canada. If proven feasible, the project would be one of the first commercial-scale CCS projects to inject over 1 million tonnes per year of CO₂ into a brine-saturated formation in North America, making it one of the largest CCS projects in the world.

RCSP Support

- Members of the GIS, Capture and Transportation, Geologic, Outreach, and Risk Assessment Working Groups took part in monthly conference calls.
- The PCOR Partnership was represented at DOE NETL’s 2008 RCSP Initiative Review Meeting in December 2007.
- The PCOR Partnership was represented at the GHGT-9 Conference in November 2008.

Travel for BP3, Y2

EERC staff travel extensively in its operation of the PCOR Partnership. The following trips briefly summarize the nature and extent of those travels.

- September 29 – October 2, 2008: Pittsburgh Coal Conference in Pittsburgh, Pennsylvania
- September 29 – October 3, 2008: EPA Public Hearings in Chicago, Illinois
- October 2, 2008: Lignite Energy Council Meeting in Bismarck, North Dakota
- October 6–8, 2008: Gasification Technologies Council Meeting in Washington, D.C.
- October 6–8, 2008: Regional Partnerships Annual Review Meeting in Pittsburgh, Pennsylvania
- October 20–22, 2008: Infocast Carbon Capture Status & Outlook and Carbon Capture Technology Showcase in Houston, Texas
- October 23–24, 2008: Carbon Sequestration Development and Finance Summit in Houston, Texas
- November 9–12, 2008: Attended SPE Applied Technology Workshop in Houston, Texas
- November 11–13, 2008: American Coalition for Clean Coal Electricity’s Annual Board of Directors Meeting in Naples, Florida

- November 11–13, 2008: Attended Carbon Markets Insights Americas 2008 Conference in Washington, D.C.
- November 15–19, 2008: IOGCC Annual Meeting in Santa Fe, New Mexico
- November 16–20, 2008: GHGT-9 in Washington, D.C.
- November 19, 2008: Incisive Analysis of Prices in the Global Carbon Emissions Market Webinar
- December 2–3, 2008: Workshop on CO₂ Geological Storage Capacity and Emission Sources Mapping in Houston, Texas
- December 3–5, 2008: PRISM meeting in Edmonton, Alberta
- December 3–5, 2008: PCOR Partnership Meeting with potential partner in Omaha, Nebraska
- December 7–12, 2008: Win Prop and CO₂ Sequestration Training Courses in Calgary, Alberta
- December 8–10, 2008: 6th Annual EOR Carbon Management Workshop in Houston, Texas
- December 11–12, 2008: 2008 CO₂ Flooding Conference in Midland, Texas
- December 16–18, 2008: RCSP Simulation & Risk Assessment Workshop in Berkeley, California
- December 29, 2008: Travel to PPB to review video clips in Fargo, North Dakota
- January 6–9, 2009: Meeting with Spectra Energy regarding the progress of the Fort Nelson project in Calgary, Alberta
- January 15–16, 2009: Gave testimony before North Dakota Senate Natural Resources Committee in Bismarck, North Dakota
- January 27–30, 2009: Attended Energy Generation Conference in Bismarck, North Dakota
- January 30, 2009: Traveled to PPB for meeting with animator in Fargo, North Dakota
- January 30 – February 5, 2009: SPE Reservoir Simulation Symposium in The Woodlands, Texas
- February 2–4, 2009: Carbon and Climate Change Conference in Austin, Texas
- February 3, 2009: North Dakota Petroleum Council Board Room Meeting & Legislative Reception in Bismarck, North Dakota
- February 4, 2009: Oil and Gas Research Council Meeting in Bismarck, North Dakota
- February 7–13, 2009: CO₂ Geological Storage Modeling Workshop in Orleans, France
- February 8–11, 2009: Intro to Win Prop Training Course in Calgary, Alberta
- February 19, 2009: Presented to faculty and students at the University of Minnesota in Crookston, Minnesota
- February 23–26, 2009: CO₂ & Capture Storage Conference in Calgary, Alberta
- February 23–27, 2009: Meeting with Spectra Energy in Calgary, Alberta
- February 25–26, 2009: Gave CO₂ storage testimony before North Dakota House Natural Resources Committee in Bismarck, North Dakota
- February 25–28, 2009: Rock Works Geological Modeling Conference in Denver, Colorado
- March 6–7, 2009: North Dakota Teacher Association in Bismarck, North Dakota
- March 16–18, 2009: EPRI CO₂ Transportation Workshop in Menlo Park, California
- March 22–26, 2009: 1st International Gas Symposium in San Francisco, California
- March 23–26, 2009: Annual NETL CO₂ Capture Technology for Existing Plants R&D Meeting in Pittsburgh, Pennsylvania
- April 6–10, 2009: Attended Introduction to ABAQUS training seminar in Woodbury, Minnesota

- April 6–9, 2009: Participated in meetings with Spectra Energy Transmission; the Province of British Columbia Ministry of Energy, Mines and Petroleum Resources; and the British Columbia Oil and Gas Commission regarding the progress of the Fort Nelson CCS demonstration project in Victoria, British Columbia, Canada.
- April 16–18, 2009: Attended the IEA Greenhouse Gas R&D Programme’s 4th Risk Assessment Network Meeting in Melbourne, New South Wales, Australia
- April 15, 2009: Attended a meeting at Basin Electric Power Cooperative’s headquarters regarding the Williston Basin demonstration project site selection in Bismarck, North Dakota
- April 20–21, 2009: Participated in meetings with Baker Hughes Incorporated and Baker Petrolite Corporation in Houston, Texas
- April 20–22, 2009: Attended the 2009 International Symposium on Oilfield Chemistry in The Woodlands, Texas
- April 22–23, 2009: Participated in meetings with Encore Acquisition Company in Fort Worth, Texas
- April 23, 2009: Attended a meeting with Devon Energy to view a demonstration of Aqua-Pure distillation unit technology in Decatur, Texas
- April 26–29, 2009: Attended the 17th Annual Williston Basin Petroleum Conference in Regina, Saskatchewan, Canada
- May 3–7, 2009: Attended the AAPG Hedberg Research Conference “Basin and Petroleum System Modeling: New Horizons in Research and Applications” in Napa, California
- May 4–7, 2009: Attended and participated in the 8th Annual Conference on Carbon Capture & Sequestration in Pittsburgh, Pennsylvania
- May 4, 2009: Organized and hosted the NAEWG Methodology Subcommittee Meeting/Conference Call in Pittsburgh, Pennsylvania
- May 6, 2009: Organized and participated in a Fort Nelson demonstration project meeting in Pittsburgh, Pennsylvania
- May 7, 2009: Organized and chaired the WWG annual meeting in Pittsburgh, Pennsylvania
- May 11–13, 2009: Attended the IOGCC 2009 Midyear Issues Summit in Anchorage, Alaska
- May 13–14, 2009: Attended the IEA Greenhouse Gas R&D Programme’s 5th Wellbore Integrity Network Meeting, Calgary, Alberta, Canada
- May 18–22, 2009: Attended the University of Alabama’s 2009 International Coalbed & Shale Gas Symposium and Short Course #2: Coalbed Methane and Shale Gas Well Completions and Production: Principles and Best Practice in Tuscaloosa, Alabama
- May 19, 2009: Attended the Wyoming CO₂ Pipeline Infrastructure Development Meeting in Casper, Wyoming
- May 27–29, 2009: Attended and presented at the Innovating for Energy (IFP) International Conference on Deep Saline Aquifers for Geological Storage of CO₂ and Energy in Rueil-Malmaison, France
- June 2–4, 2009: Attended the IEA Greenhouse Gas R&D Programme’s 5th Meeting of the Monitoring Network in Tokyo, Japan
- June 1–3, 2009: Attended QEMSCAN Training at Colorado School of Mines in Golden, Colorado
- June 7–10, 2009: Attended and presented at the AAPG Annual Convention and Expo in Denver, Colorado
- June 8–12, 2009: Met with Spectra Energy Transmission and presented modeling results in Calgary, Alberta, Canada

- June 10, 2009: Presented at the North Dakota Petroleum Council 2009 Teacher Seminar in Bismarck, North Dakota
- June 16–17, 2009: Hosted the PCOR Partnership Regulatory Workshop – Brainstorming Session in Deadwood, South Dakota
- June 16–18, 2009: Met with Spectra Energy Transmission on Fort Nelson demonstration project risk assessment in Calgary, Alberta, Canada
- June 17, 2009: Presented at the Lignite Energy Council’s 2009 Lignite Education Seminar: Energy, Economics and Environment in Bismarck, North Dakota
- June 18–20, 2009: Attended and presented at the Energy Council’s 2009 State and Provincial Trends in Energy and the Environment Conference in Saskatoon, Saskatchewan, Canada
- June 23–24, 2009: Attended the EORI 3rd Annual Wyoming CO₂ Conference in Casper, Wyoming
- June 26, 2009: Participated in session of the Outreach Advisory Panel of the Weyburn–Midale Project in Regina, Saskatchewan, Canada
- June 29 – July 1, 2009: Met with Spectra Energy Transmission on Fort Nelson demonstration project risk assessment in Calgary, Alberta, Canada
- June 29 – July 1, 2009: Participated in a Fort Nelson Risk Management meeting at Spectra Energy in Calgary, Alberta, Canada
- July 14–15, 2009: Attended the RCSP Public Outreach Working Group meeting in Washington, D.C.
- July 14–17, 2009: Participated in a Fort Nelson Risk Management meeting at Spectra Energy in Calgary, Alberta, Canada
- July 15–17, 2009: Presented at the Infocast 3rd Annual Carbon Capture Status & Outlook Conference, in Washington, D.C.
- July 20–21, 2009: Attended the North America Carbon Atlas Partnership Meetings in Morgantown, West Virginia
- July 22–23, 2009: Presented at the North America Energy Working Group – North American Carbon Atlas Partnership meeting in Pittsburgh, Pennsylvania
- July 27–30, 2009: Participated in a Fort Nelson Risk Management meeting at Spectra Energy in Calgary, Alberta, Canada
- July 28–29, 2009: Met with Nebraska Public Power District in Denver, Colorado
- July 29–30, 2009: Presented at the Keystone Center for Education: Climate Status Investigations Teacher Workshop in Omaha, Nebraska
- August 3–5, 2009: Attended the IOGCC Carbon Capture & Geologic Storage Task Force meeting in Oklahoma City, Oklahoma
- August 6, 2009: Presented at the North Dakota Industrial Commission Oil and Gas Council meeting in Bismarck, North Dakota
- August 16–19, 2009: Presented at the AAPG/Scientific Ecology Group, Inc./SPE Hedberg Research Conference “Geological Carbon Sequestration: Prediction and Verification” in Vancouver, British Columbia, Canada
- August 24–27, 2009: Traveled to Spectra Energy offices for meetings regarding the Fort Nelson risk management plan in Calgary, Alberta, Canada
- August 24–27, 2009: Attended meetings regarding CO₂ sourcing issues in Fort Worth, Texas, and Pittsburgh, Pennsylvania
- September 3, 2009: Participated in CCEMC’s Webinar entitled “Climate Change and Emissions Management Act: Alberta’s Response to Reduce Emissions”

- September 13–16, 2009: Attended the Platt’s 2nd Annual Carbon Capture & Sequestration Policy, Economics, Regulation and Risk Conference in Washington, D.C.
- September 13–16, 2009: Attended the ACI 3rd Annual Carbon Capture and Sequestration Summit and Post-Summit Workshop entitled “From the Smokestack to the Gas Tank: Transforming CO₂ into Fuel” in Washington, D.C.
- September 13–16, 2009: Attended the Water/Energy Sustainability Symposium at the 2009 Ground Water Protection Council Annual Forum in Salt Lake City, Utah
- September 15–17, 2009: Presented at the 2009 North Dakota Solid Waste and Recycling Symposium in Minot, North Dakota
- September 22, 2009: Participated in IEA CCS Webinar entitled “How Stable is Stable? – What is Required for CCS Site Handover?”
- September 22–25, 2009: Met with representatives of Spectra Energy in Calgary, Alberta, Canada

Materials presented at these meetings are available to partners on the PCOR Partnership DSS Web site (www2.undeerc.org/website/pcorp/ProductsDB/Default.aspx).

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1. Source: www.netl.doe.gov/technologies/carbon_seq/overview/program_goals.html (accessed December 2009).
2. Source: www.fortnelsonchamber.com/files/Presentations/March_24-09_Spectra_Presentation.pdf (accessed December 2009).
3. Figure provided courtesy of Encore Acquisition Company.

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- Botnen, L.S., Fischer, D.W., Dobroskok, A.A., Bratton, T.R., Greaves, K.H., McLendon, T.R., Steiner, G., Sorensen, J.A., Steadman, E.N., and Harju, J.A., 2009, Field test of CO₂ injection and storage in a lignite coal seam in North Dakota: *Energy Procedia*, v. 1, no. 1, p. 2013–2019.
- Gorecki, C., 2008, Plains CO₂ Reduction (PCOR) Partnership simulation and risk assessment activities: Presented at the Regional Carbon Sequestration Review Meeting, Pittsburgh, Pennsylvania, October 8, 2008.

- Gorecki, C.D., 2009, Regional Carbon Sequestration Partnership (RCSP) Water Working Group: Presented at the 1st Annual Meeting, Regional Carbon Sequestration Partnership (RCSP) Water Working Group, Pittsburgh, Pennsylvania, May 7, 2009.
- Gorecki, C.D., Sorensen, J.A., Steadman, E.N., and Harju, J.A., 2009, CO₂ storage risk minimization through systematic identification and assessment of faults—a Williston Basin case study: *Energy Procedia*, v. 1, no. 1, p. 2887–2894.
- Harju, J.A., 2009, Introduction to CO₂ sequestration and the Plains CO₂ Reduction (PCOR) Partnership: Presented at the North Dakota Energy Development and Transmission Committee Meeting, Grand Forks, North Dakota, September 16, 2009.
- Harju, J.A., and Sorensen, J.A., 2009, The PCOR Partnership and North Dakota's enhanced oil recovery opportunity: Presented at the North Dakota Solid Waste and Recycling Symposium, Minot, North Dakota, September 15–17, 2009.
- Harju, J.A., and Steadman, E.N., 2009, Plains CO₂ Reduction (PCOR) Partnership Phase III demonstration site selection: Presented at the U.S. Department of Energy National Energy Technology Laboratory, Pittsburgh, Pennsylvania, August 27, 2009.
- Litynski, J., Plasynski, S., Spangler, L., Finley, R., Steadman, E.N., Ball, D., Nemeth, K.J., McPherson, B., and Myer, L., 2009, U.S. Department of Energy's Regional Carbon Sequestration Partnership Program—overview: *Energy Procedia*, v. 1, no. 1, p. 3959–3967.
- Smith, S.A., 2008, Acid gas injection and monitoring at the Zama oil field in Alberta, Canada—a case study in demonstration-scale carbon dioxide sequestration: Presented at the 9th International Conference on Greenhouse Gas Technologies, Washington, D.C., November 16–20, 2008.
- Smith, S.A., McLellan, P., Hawkes, C., Steadman, E.N., and Harju, J.A., 2009, Geomechanical testing and modeling of reservoir and cap rock integrity in an acid gas EOR/sequestration project, Zama, Alberta, Canada: *Energy Procedia*, v. 1, no. 1, p. 2169–2176.
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