



# EERC

Energy & Environmental Research Center

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April 29, 2011

Ms. Karlene Fine  
Executive Director  
North Dakota Industrial Commission  
600 East Boulevard Avenue  
State Capitol, 14th Floor  
Bismarck, ND 58505-0840

Dear Ms. Fine:

Subject: EERC Plains CO<sub>2</sub> Reduction Partnership (PCOR) Phase III Quarterly Technical Progress Report for the Period January 1 – March 31, 2011  
Contract Nos. FY08-LXIII-162 and G-015-030; EERC Funds 16196 and 15631

Enclosed is a hard copy of the Quarterly Technical Progress Report for the PCOR Partnership Program for Phase III. Also enclosed is a CD-ROM containing the Quarterly Technical Progress Report. A PDF version will also be sent via e-mail.

If you have any questions, please contact me by phone at (701) 777-5279 or by e-mail at [esteadman@undeerc.org](mailto:esteadman@undeerc.org).

Sincerely,

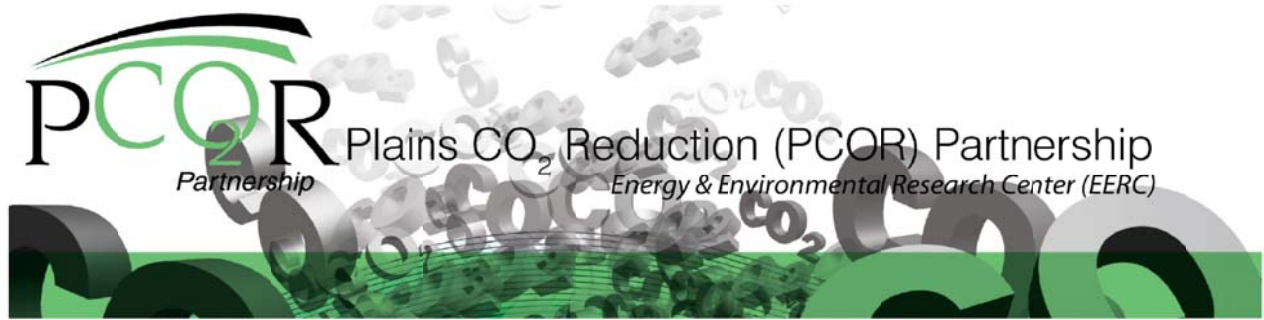
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## **PLAINS CO<sub>2</sub> REDUCTION PARTNERSHIP PHASE III**

### **Quarterly Technical Progress Report**

*(for the period January 1 –March 31, 2011)*

*Prepared for:*

Karlene Fine

North Dakota Industrial Commission  
600 East Boulevard Avenue  
State Capitol, 14th Floor  
Bismarck, ND 58505-0840

Contract Nos. FY08-LXIII-162 and G-015-030  
EERC Funds 16196 and 15631

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April 2011

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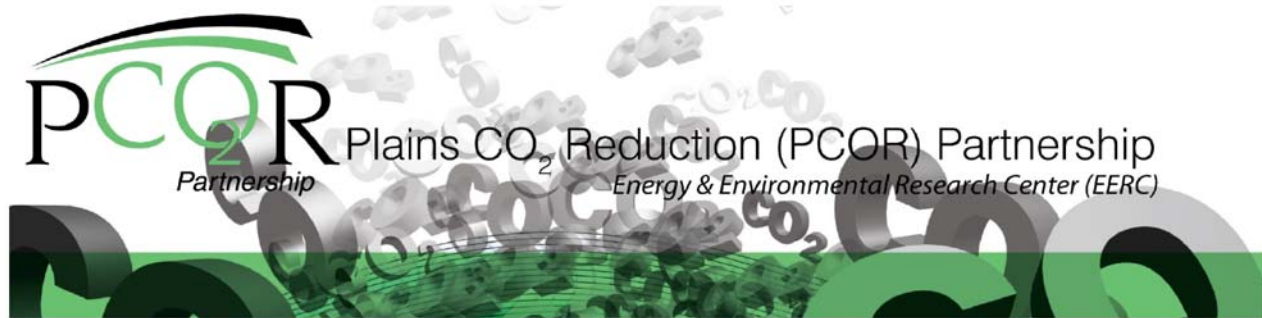
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**PLAINS CO<sub>2</sub> REDUCTION PARTNERSHIP PHASE III**  
**Quarterly Technical Progress Report**  
**January 1 – March 31, 2011**

**EXECUTIVE SUMMARY**

The Plains CO<sub>2</sub> 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 at the University of North Dakota and continues to include stakeholders from the public and private sector in Phase 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. The Phase III efforts of the PCOR Partnership include two large-volume demonstration tests—one in Canada and one in the United States—that focus on injecting carbon dioxide (CO<sub>2</sub>) into deep geologic formations for CO<sub>2</sub> storage. Budget Period 4 (Years 3–8 of Phase III) began October 1, 2009.

This progress report presents an update of Phase III PCOR Partnership activities from January 1, 2011, through March 31, 2011.

The PCOR Partnership welcomed a new partner in January. Husky Energy Inc. is one of Canada's largest integrated energy and energy-related companies, with upstream operations that include the exploration, development, and production of crude oil, bitumen, and natural gas in Western Canada and the northwest United States. Plans are also under way for the PCOR Partnership Annual Meeting and Workshop, scheduled for September 12–14 in Denver, Colorado.

Of particular note during this quarter, all of the RCSPs participated in a biennial expert review of Phase III activities. The IEA Greenhouse Gas R&D Programme (IEAGHG) undertook the Phase III technical review and appointed an independent international panel of experts. The PCOR Partnership presented an hour-long overview of its activities on March 15 before the expert panel in Arlington, Virginia. In approximately 2 to 3 months, preliminary results are anticipated, along with an opportunity to comment.

Activities leading to the initiation of CO<sub>2</sub> injection at both demonstration sites continued during this reporting period. Simulation history matching and the next-round risk assessment continued with Spectra Energy for the Fort Nelson demonstration project in British Columbia, Canada. Preliminary monitoring, verification, and accounting planning is well under way with Denbury Resources for the Bell Creek demonstration project in southeastern Montana. Petrological and geochemical analyses continued on cuttings and/or representative outcrops from both sites.



## **PLAINS CO<sub>2</sub> REDUCTION PARTNERSHIP PHASE III**

### **Quarterly Technical Progress Report**

**January 1 – March 31, 2011**

## **INTRODUCTION**

The Plains CO<sub>2</sub> 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 (UND) in Grand Forks, North Dakota, and includes stakeholders from the public and private sector. The membership as of March 31, 2011, 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 is part 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
- Phase II – Validation Phase (2005–2009): conducted small-scale field validation tests
- Phase III – Development Phase (2007–2017): involves large-volume carbon storage demonstration tests (Figure 1)

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

BP3: October 1, 2007 – September 30, 2009

BP4: October 1, 2009 – September 30, 2015

BP5: October 1, 2015 – September 30, 2017

Note: BP1 and BP2 were effective in Phase II.



**Table 1. PCOR Partnership Membership Phase III (October 1, 2007 – Present, inclusive)**

DOE NETL	Great Northern Project Development, LP	North Dakota Industrial Commission
UND EERC		Oil and Gas Research Council
Abengoa Bioenergy New Technologies	Great River Energy Hess Corporation	North Dakota Natural Resources Trust
Air Products and Chemicals	Halliburton	North Dakota Petroleum Council
Alberta Department of Energy	Huntsman Corporation	North Dakota Pipeline Authority
Alberta Department of Environment	Husky Energy Inc.	Otter Tail Power Company
Alberta Innovates – Technology Futures	Interstate Oil and Gas Compact Commission	Oxand Risk & Project Management Solutions
ALLETE		Petroleum Technology Research Centre
Ameren Corporation	Indian Land Tenure Foundation	Petroleum Technology Transfer Council
American Coalition for Clean Coal Electricity	Iowa Department of Natural Resources	Pinnacle, a Halliburton Service
American Lignite Energy	Lignite Energy Council	Prairie Public Broadcasting
Apache Canada Ltd.	Manitoba Geological Survey	Pratt & Whitney Rocketdyne, Inc.
Aquistore	Marathon Oil Company	Ramgen Power Systems, Inc.
Baker Hughes Incorporated	MEG Energy Corporation	RPS Energy Canada Ltd.
Basin Electric Power Cooperative	Melzer Consulting	Saskatchewan Ministry of Industry and Resources
Biorecro AB	Minnesota Power	SaskPower
Blue Source, LLC	Minnkota Power Cooperative, Inc.	Schlumberger
BNI Coal, Ltd.	Missouri Department of Natural Resources	Shell Canada Energy
British Columbia Ministry of Energy, Mines, and Petroleum Resources	Missouri River Energy Services	Spectra Energy
British Columbia Oil and Gas Commission	Montana–Dakota Utilities Co.	Suncor Energy Inc.
Computer Modelling Group, Inc.	Montana Department of Environmental Quality	TAQA North, Ltd.
Dakota Gasification Company	National Commission on Energy Policy	TGS Geological Products and Services
Denbury Resources Inc.	Natural Resources Canada	University of Alberta
Eagle Operating, Inc.	Nebraska Public Power District	University of Regina
Eastern Iowa Community College District	North American Coal Corporation	Weatherford Advanced Geotechnology
Enbridge Inc.	North Dakota Department of Commerce Division of Community Services	Western Governors' Association
Encore Acquisition Company	North Dakota Department of Health	Westmoreland Coal Company
Energy Resources Conservation Board/ Alberta Geological Survey	North Dakota Geological Survey	Williston Basin Interstate Pipeline Company
Environment Canada	North Dakota Industrial Commission	Wisconsin Department of Agriculture, Trade and Consumer Protection
Excelsior Energy Inc.	Department of Mineral Resources, Oil and Gas Division	Wyoming Office of State Lands and Investments
	North Dakota Industrial Commission Lignite Research, Development and Marketing Program	Xcel Energy

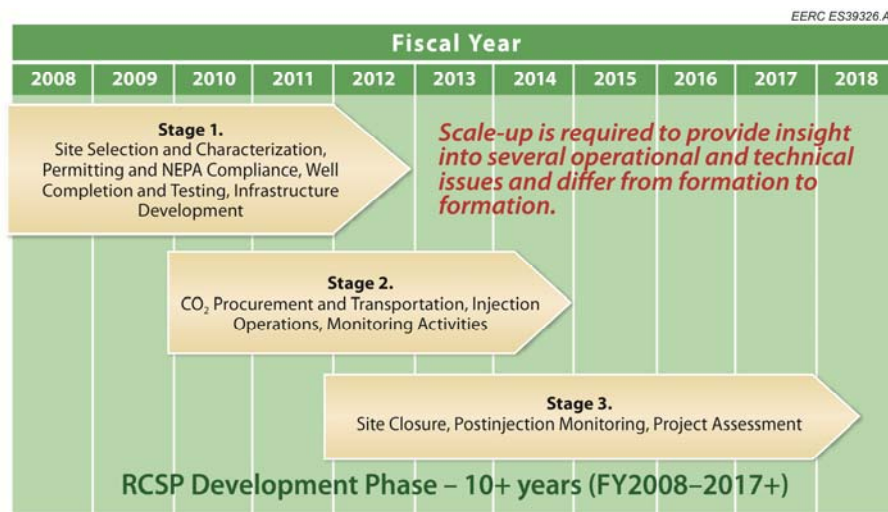


Figure 1. RCSP development phase: scaling up toward commercialization (figure taken from DOE NETL).



The overall mission of the Phase III program is to 1) gather characterization data to verify the ability of the target formations to store carbon dioxide (CO<sub>2</sub>), 2) facilitate the development of the infrastructure required to transport CO<sub>2</sub> from sources to the injection sites, 3) facilitate development of the rapidly evolving North American regulatory and permitting framework, 4) develop opportunities for PCOR Partnership partners to capture and store CO<sub>2</sub>, 5) establish a technical framework by which carbon credits can be monetized for CO<sub>2</sub> stored in geologic formations, 6) continue collaboration with other RCSPs, and 7) provide outreach and education for CO<sub>2</sub> capture and storage 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 CO<sub>2</sub> injection volumes. A programmatic RCSP Phase III goal is the injection of approximately 1 million tons of CO<sub>2</sub> a year into at least one regionally significant geologic formation. Each of the RCSP's large-volume injection tests is designed to demonstrate that CO<sub>2</sub> storage sites have the potential to store regional CO<sub>2</sub> 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 1) in the Bell Creek oil field in Powder River County in southeastern Montana and 2) near Spectra Energy's (Spectra's) Fort Nelson gas-processing facility, situated near Fort Nelson, British Columbia, Canada (Figure 2).

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

The PCOR Partnership plans to achieve its Phase III mission through a series of 14 tasks: 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) CO<sub>2</sub> 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, 14) RCSP Water Working Group (WWG) Coordination, 15) Further Characterization of the Zama Acid Gas Enhanced Oil Recovery (EOR), CO<sub>2</sub> Storage, and Monitoring Project, and 16) Characterization of the Basal Cambrian System. Table 2 lists the responsibility matrix for these 16 tasks.

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

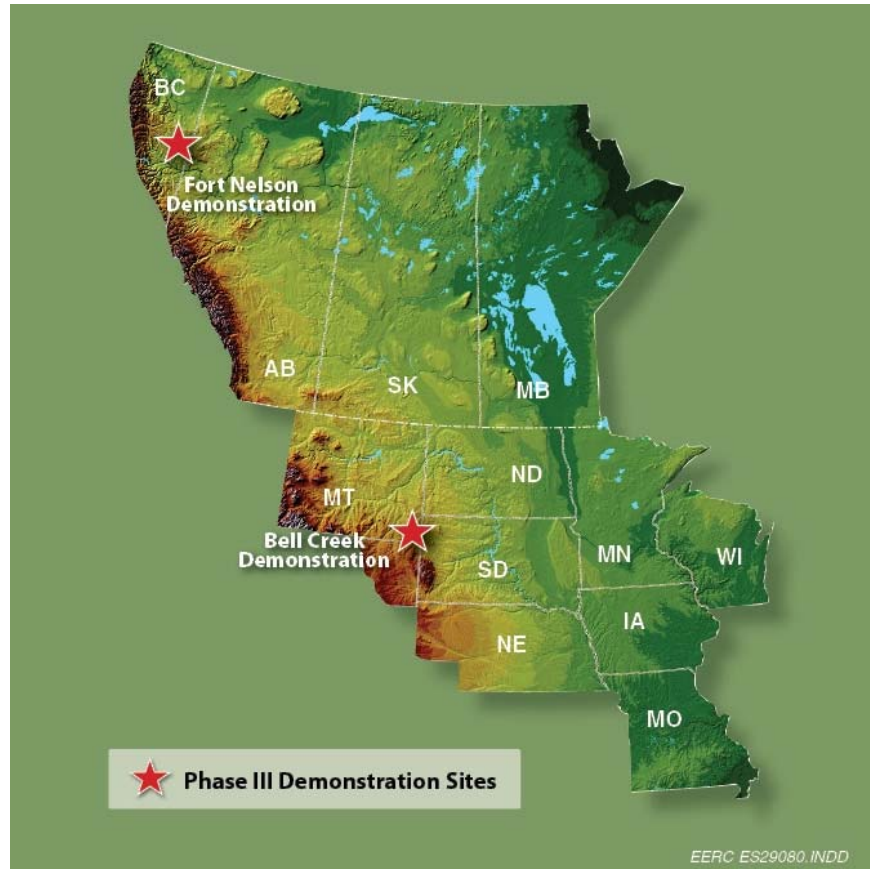


Figure 2. PCOR Partnership Phase III demonstration sites.

## PROGRESS OF WORK

### Task 1 – Regional Characterization

Note: Information on the Further Characterization of the Zama Acid Gas EOR, CO<sub>2</sub> Storage, and Monitoring Project is located in Task 15, and Information on the Basal Cambrian Deadwood Formation is located in Task 16.

Significant accomplishments for Task 1 for the reporting period included the following:

- Continued efforts on the next version of the PCOR Partnership Atlas – planned for distribution at the upcoming PCOR Partnership Annual Meeting (September 12–14, 2011 in Denver, Colorado).
- Presented information on the PCOR Partnership at EUEC 2011 (Energy, Utility & Environment Conference, [www.euec.com](http://www.euec.com).) in Phoenix, Arizona. An EERC booth displayed PCOR Partnership outreach materials, e.g., DVDs, atlases, etc., at the event.
- Continued drafting a report on the CO<sub>2</sub> storage potential in the state of Iowa.

**Table 2. Phase III Responsibility Matrix**

<b>Phase III Task Description</b>	<b>Task Leader</b>
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 <sub>2</sub> Procurement	John A. Harju
Task 8 – Transportation and Injection Operations	Melanie D. Jensen
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
Task 15 – Further Characterization of the Zama Acid Gas EOR, CO <sub>2</sub> Storage, and Monitoring Project	Steven A. Smith
Task 16 – Characterization of the Basal Cambrian System	Steven A. Smith

- Prepared numerous maps, including base maps for the Bell Creek project, a documentary broadcast area map, and several maps for inclusion in the PowerPoint presentation given before the IEA Greenhouse Gas R&D Programme's expert panel review of the RCSPs.
- Created maps for use in planning the soil carbon-monitoring efforts at the Bell Creek site.
- Continued maintenance of the information stored on the partners-only Web site.
- Completed the Demonstration Project Reporting System update (Deliverable [D]10) that will be included on the partners-only Web site.
- Geographic information system (GIS) programming staff attended the Esri Developer Summit held March 7–10 in order to better apply GIS programming advancements to the partners-only Web applications.
- Initiated development of a new Flex-based GIS for the Decision Support System (DSS, © 2007–2011 EERC Foundation).
- Prepared questions for consideration by the RCSP GIS Working Group regarding proposed database design and functionality.
- Secured updated licenses for NeuraLog.
- Renewed the PennWell MAPSearch (pipeline) Premium Data License Agreement.
- Progress continues on the detailed assessment of the Rival oil field in north-central North Dakota, including the following:
  - Added newly created digitized logs or logs located from missing intervals.
  - Imported 3-D seismic information received from TAQA North Ltd. (TAQA).
  - Uploaded existing 3-D seismic data into the Petrel model.

- Continued digitization of 50+ Black Slough logs that will further extend the study area.
- Added an additional 40 wells into Petrel, expanding the study area to include most of the Black Slough oil field.
- Validated the Black Slough logs that were digitized with Neuralog.
- Continued core-to-log calibration, annotation of core photos including horizons, and the adjustment of horizons in Petrel according to core microfacies and sequences, where the top of the sequences is denoted by a thin shale layer and fractures are associated with chicken-wire anhydrite.
- Continued creation of structural surfaces with trends for input into the model and for trend analysis normalization.
- Participated in conference calls with TAQA, where it was determined that TAQA would provide well files for the Rival Field horizontals and several vertical wells in the Lignite Field as well as convert vintage 1960s neutron log data into the neutron porosity hydrogen index and research the revitalization of vintage cores.
- Project meetings with TAQA were held on March 24 and 25 in Grand Forks regarding the development of detailed CO<sub>2</sub> storage calculations for the field.
- Submitted an abstract for the Rocky Mountain Section of the American Association of Petroleum Geologists (AAPG) 60th Annual Meeting scheduled for June 2011 in Cheyenne, Wyoming ([www.rms-aapg.org/2011\\_meeting](http://www.rms-aapg.org/2011_meeting)).
- Received pressure data from the most recent injection well.
- Continued locating mud logs for the horizontals.
- Continued use of MudLog software to log core data from core photos.
- Visited the core and sample library at UND, examined three cores from the Rival Field, and collected samples to make thin sections for the characterization of the field.
- Conducted a literature review on the conversion of vintage gamma ray neutron logs to neutron porosity logs.
- Prepared various maps of the Williston Basin oil fields.
- Continued to develop the Rival Field geologic model.

## **Task 2 – Public Outreach and Education**

Significant accomplishments for Task 2 for the reporting period included the following:

- Eleven EERC employees attended six conferences, resulting in approximately 3084 external participants that were exposed to the PCOR Partnership name, messaging, and informational materials. Specifically, the PCOR Partnership outreach activities included 11 oral presentations. The following quantities of outreach materials were distributed:
  - PCOR Partnership documentary entitled “Nature in the Balance: CO<sub>2</sub> Sequestration” – 56
  - PCOR Partnership documentary entitled “Reducing Our Carbon Footprint: The Role of Markets” – 51
  - PCOR Partnership documentary entitled “Out of the Air: Into the Soil” – 55

- PCOR Partnership documentary entitled “Managing Carbon Dioxide: The Geologic Solution” – 78
- PCOR Partnership documentary entitled “Global Energy and Carbon: Tracking Our Footprint” – 114
- PCOR Partnership Atlas 3rd Edition, Revised – 72
- PCOR Partnership product list – 20
- Met with partner Indian Land Tenure Foundation at the EERC on February 9.
- Continued preparation of a fact sheet intended for landowner outreach discussing the status of carbon markets and carbon management.
- Participated in the Weyburn–Midale Outreach Panel discussions regarding actions to respond to the news of the alleged release of sequestered CO<sub>2</sub> at the site.
- Participated in the Regional Carbon Sequestration Partnership Outreach Working Group (OWG) conference calls on January 20, February 17, and March 10.
- In coordination with the OWG, submitted an abstract to the 10th Annual Carbon Capture & Sequestration Conference scheduled for May in Pittsburgh, Pennsylvania ([www.carbonsq.com](http://www.carbonsq.com)).
- As a result of efforts by Prairie Public Broadcasting (PPB), an electronic broadcast-quality copy of the documentary Global Energy and Carbon: Tracking Our Footprint was made available to the National Educational Television Association, which, on January 21, made the documentary available by satellite feed to the 350 public television stations across the continent.
- On January 14, an e-mail was sent to all the PCOR Partnership members residing outside of the PPB region, first inquiring whether they would be interested in contacting their local public television station to request the broadcast of Global Energy and Carbon and then providing the contact information if they were interested. Twenty members agreed to contact their local public television station.
- Met with PPB’s education group to initiate planning for a multiyear effort to provide teachers in North Dakota and the region with classroom activities built around the documentary clips, various PCOR Partnership outreach materials, and other DOE-approved materials.
- Met with PPB’s education group to learn about its Teacher Training Institutes and the potential application to the PCOR Partnership’s outreach activities for educators in the region.
- Continued assessment of the geographic distribution of teachers exposed to PCOR Partnership materials and information.
- In cooperation with PPB’s education group, prepared outreach materials for 30+ teachers and initiated planning a fall workshop.
- Summarized documentary broadcast data on public television for the period May 2005 – February 2011.
- Continued efforts to create a database to more efficiently track the outreach products.
- Prepared a Bell Creek fact sheet (D15) that can be viewed at [www.undeerc.org/PCOR/newsandpubs/pdf/FactSheet17.pdf](http://www.undeerc.org/PCOR/newsandpubs/pdf/FactSheet17.pdf).
- Prepared a Bell Creek PowerPoint presentation (D18) that is currently under review.
- Prepared a Fort Nelson public outreach poster (D26) that is currently under review.

- Investigated Wikipedia authorship guidelines as part of the ongoing assessment of Web and social media.
- Accepted an invitation from the Lignite Energy Council to give a presentation at its annual teacher workshop scheduled for June in Bismarck, North Dakota. The 3-day workshop is typically attended by more than 100 teachers.

### **Task 3 – Permitting and NEPA Compliance**

Significant accomplishments for Task 3 for the reporting period included the following:

- Continued to review and analyze all of the U.S. Environmental Protection Agency's (EPA's) recently promulgated rules, including *Mandatory Reporting of Greenhouse Gases* and *Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide Geologic Sequestration Wells*.
- Reviewed EPA's extension of the deadline for its Greenhouse Gas Mandatory Reporting Rule (MRR).
- Completed review of an Interstate Oil and Gas Compact Commission (IOGCC) PowerPoint presentation providing an overview of the Pipeline Transportation Task Force (PTTF) final report.
- Completed review of an IOGCC Executive Summary of the PTTF final report.
- Plans for the next PCOR Partnership Regulatory Meeting (June 29–30) are under way. The meeting will follow the IOGCC Midyear Issues Meeting in Bismarck.
- Continued efforts on updating the Regulatory Roundup document. (The current version is available on the partners-only Web site at [www2.undeerc.org/website/pcorp/pdfs/RegulatoryRoundup.pdf](http://www2.undeerc.org/website/pcorp/pdfs/RegulatoryRoundup.pdf)).
- On January 20, sent an e-mail to the partnership regarding recent EPA activities.
- Attended the 2011 Groundwater Protection Council's UIC Conference held January 24–26 in Austin, Texas ([www.gwpc.org/meetings/uic/uic.htm](http://www.gwpc.org/meetings/uic/uic.htm)) and visited with state and federal regulators in attendance.
- Attended the Texas Carbon Capture and Storage Association's 4th Annual Preconference Workshop on CCS in Austin, Texas.
- Attended a project meeting in February with Denbury Resources Inc. (Denbury) in Plano, Texas, where regulatory issues such as permitting, greenhouse gas reporting, and NEPA analysis were discussed.
- Participated in the Fort Nelson monthly conference calls and discussed the status of permitting activities, British Columbia government participation, and plans for a risk assessment meeting in Grand Forks.
- Prepared and submitted the NEPA questionnaire for the Bell Creek project.
- Reviewed Montana drilling permit guidelines for potential monitoring wells at the Bell Creek project site.

### **Task 4 – Site Characterization and Modeling**

Significant accomplishments for Task 4 for the reporting period included the following:

- Several individuals began developing protocols and training on calibrating and using the gamma ray spectroscope in the EERC's Applied Geology Lab (AGL).
- Bell Creek test site activities included the following:
  - Continued the cataloging, evaluation, and integration of reservoir characterization data from Denbury for the Bell Creek oil field.
  - Continued the petrophysical testing on Muddy Formation outcrop samples.
  - Continued the creation of key baseline characterization maps based on data provided by Denbury.
  - Continued testing representative outcrop samples of Bell Creek reservoir rock for porosity, permeability, mineralogy, composition, and relative permeability.
  - Submitted Milestone [M] 8: Bell Creek test site wellbore leakage data collection initiated.
  - Submitted D31/M28: Bell Creek test site – geological characterization experimental design package.
  - Continued work on a report of the petrophysical properties and relative permeability results determined from testing representative Bell Creek outcrop samples.
  - Developed a plan for the resaturation of old cores (vintage ~1960s) in order to perform geochemical and geomechanical testing.
  - Submitted an abstract to the 25th International Symposium of the Society of Core Analysts scheduled for September 2011 in Austin, Texas ([www.scaweb.org/symposium\\_2011\\_callforabstracts.shtml](http://www.scaweb.org/symposium_2011_callforabstracts.shtml)).
  - Contacted the Bureau of Economic Geology (BEG) Houston Research Center and confirmed the existence and location of 71 cores from the field.
  - Met with Denbury on February 16 in Plano, Texas.
  - Continued compilation of approaches and techniques to be outlined in D34: Baseline Hydrogeological Experimental Design Package.
  - Calculated cost estimates for the baseline sampling efforts.
  - Continued development of a near-surface (surface waters, groundwater, and soil gas) testing plan.
  - Reviewed existing groundwater well logs in the Bell Creek Field to determine suitability for sampling.
  - EERC staff and Denbury staff met at BEG to examine, photograph, and visually characterize Bell Creek Field core samples on March 9 and 10. Activities included the following:
    - ◆ Viewed eight cores taken from the Phase 1 area (18 boxes of core).
    - ◆ Created a WellSight Systems MudLog program to record the core descriptions.
    - ◆ Documented locations to take future core plug samples from U.S. Geological Survey (USGS) core stored in Denver, Colorado.
  - EERC staff traveled to Denbury headquarters in Plano, Texas, on March 7–18 to search and review well files, including the following:
    - ◆ Located, scanned, and labeled nearly 600 well files maintained on the Bell Creek Field.
    - ◆ Worked with Denbury staff to analyze the well files.
  - Continued working on improved petrophysics for the Bell Creek Field, including better correlations and ancient and modern analogs.
  - Completed a report on lab work performed on representative outcrop samples.



- Fort Nelson test site activities included the following:
  - Held the monthly conference calls on January 20, February 24, and March 22 between the EERC and the Spectra team, and updated the activity list.
  - Prepared a 2011 master schedule for key activities and deliverables for the Fort Nelson project and provided it to Spectra for its review.
  - Continued petrological and geochemical analysis work using cuttings and chips from Fort Nelson reservoir and seal formations.
  - Initiated draft outline for near-surface and surficial monitoring, verification, and accounting (MVA) plan for the Fort Nelson project. This outline will provide the framework for a long-term approach to monitoring the potable groundwater sources, vadose zone, soils, and local rivers and streams within a predefined area for the project.
  - Continued geochemical evaluations on cuttings from Spectra's C-61-E well batch reactor series, including the following:
    - ◆ Sample set No. 3 (cuttings): near-wellbore conditions (high-pressure, low-temperature regime):
      - Conducted optical profiler to analyze degree of surface degradation.
      - Conducted x-ray diffraction (XRD).
      - Prepared scanning electron microscope (SEM) mounts.
    - ◆ Sample set No. 4 (cuttings): deep reservoir conditions (lower-pressure, high-temperature regime):
      - Removed from high-pressure batch reactor.
      - Photographed and transferred fluids to the AGL for analysis.
  - Performed clipping of static Petrel geologic model for future thermal, geochemical, and geomechanical modeling.
  - Began drafting a report based on all laboratory analyses of cuttings.
  - Continued progress on the analytical activities of the core collected from the exploratory well, including the following:
    - ◆ Completed white light photography.
    - ◆ Completed preparation of 10 thin sections.
    - ◆ Optical examination, description, and interpretation of thin sections are under way.
    - ◆ Completed five mercury injection capillary pressure tests.
    - ◆ Completed three full-diameter routine core analyses.
    - ◆ Completed cap rock integrity test, i.e., exposure to brine and gas intrusion.
    - ◆ Completed two batches of acid gas synthesis.
    - ◆ Reservoir condition relative permeability (drainage and imbibition) is under way, including the following:
      - Completed preexposure computerized tomography (CT) scan.
      - Completed routine analyses.
      - Actual relative permeability testing is in progress.
    - ◆ Hydrogen sulfide (H<sub>2</sub>S) and CO<sub>2</sub> solubility experimentation is in progress.
  - Continued petrological and geochemical analysis work using cuttings and chips from Fort Nelson reservoir and seal formations.

- Met with RPS Energy to discuss the status of laboratory work being performed by Weatherford Labs.
- Confirmed the injected gas stream chemistry for the start of cap rock integrity studies.
- Forwarded documents related to the experimental conditions of the ongoing EERC lab work, planned activities for core analyses, and subcontracted lab work time lines to Spectra.
- Removed samples from the batch reactor on January 4. Fourteen vials of cuttings in synthetic brine analogous to in situ formation water from the C-61-E test well were exposed to a mixture of CO<sub>2</sub> and H<sub>2</sub>S for a period of 28 days. Analysis is under way.

## **Task 5 – Well Drilling and Completion**

Significant accomplishments for Task 5 for the reporting period included the following:

- Initiated draft outline for near-surface and surficial MVA plan. This outline will provide the framework for a long-term approach to monitoring the potable groundwater sources, vadose zone, soils, and local rivers and streams within a predefined area for the project.
- Participated in Bell Creek project discussions with Denbury in February, including well drilling and utilization of wellbores for MVA activities.
- On March 24, M30 was met with notice to NETL that the baseline MVA was initiated.
- Continued working on the MVA work plan for surface, near-surface, existing wellbores, and deep monitoring activities.
- Created several maps of the Bell Creek Field for use in MVA plan development.
- Began drafting a memo setting forth the PCOR Partnership's approach to MVA at the Bell Creek site.
- Compiled appendices for inclusion in the MVA plan, specifically:
  - Detailed maps with sample locations (by phase).
  - Creating landowner maps (plats into GIS).
  - Cost estimates.
  - Health and Safety Plan.
  - Detailed existing deep well map.
  - Tables outlining sample analytes.
- Discussed options for drilling a monitoring well in the Bell Creek Field, including drilling mud, logging tools, coring options, core testing, casing options, and seismic options.

## **Task 6 – Infrastructure Development**

Significant accomplishments for Task 6 for the reporting period included the following:

- Prepared D85, "Opportunities and Challenges Associated with CO<sub>2</sub> Compression and Transportation During CCS Activities," which is currently under review.
- Submitted the final approved value-added report entitled "Current Status of CO<sub>2</sub> Capture Technology Development and Application."

- Responded to an e-mail request for information about the use of CO<sub>2</sub> captured from a flue gas stream in soda pop. Information about plants that capture their CO<sub>2</sub> and sell it for use in the food-processing industry was prepared and sent.
- Addressed a question from a partner regarding estimated acid gas concentrations in coal-fired power plant flue gas.

### **Task 7 – CO<sub>2</sub> Procurement**

Significant accomplishments for Task 7 for the reporting period included the following:

- The following activity occurred in the quarter:
  - A meeting at Denbury headquarters in Plano, Texas, was held on February 16.
  - The transfer of data continued.
  - Dates for a follow-on meeting, likely in Grand Forks in May, are being discussed.

### **Task 8 – Transportation and Injection Operations**

Significant accomplishments for Task 8 for the reporting period included the following:

- Attended several in-house Bell Creek project status meetings.
- Continued preparation with respect to surface facilities design at an EOR injection site.

### **Task 9 – Operational Monitoring and Modeling**

Significant accomplishments for Task 9 for the reporting period included the following:

- Participated in the RCSP Sim/Risk Working Group conference call on January 18.
- Evaluated Paradigm's GOCAD and SKUA to determine whether to pursue licenses for geologic modeling.
- Continued optimizing the high-performance computer cluster software, and discussed how it is used to run Computer Modelling Group software, with representatives from Kansas Geological Survey.
- Modeling staff attended Schlumberger's Petrel Seismic Visualization and Interpretation training course in Houston.
- Attended a 3-day simulation software training session, entitled "CO<sub>2</sub>-Based EOR Miscible Flood" with Computer Modelling Group on January 24–26 in Calgary, Alberta, Canada.
- Continued Bell Creek site activities, including the following:
  - Completed the pressure–volume–temperature (PVT) regression on the Bell Creek crude oil and CO<sub>2</sub> to determine minimum miscible pressure, and initiated preparation of a report on the results.
  - Finished tuning the equation of state (EOS) for the Bell Creek Field from the PVT data.
  - Continued testing analogous outcrop samples of Bell Creek reservoir rocks for porosity, permeability, mechanical properties, relative permeability, and mineralogy.

- Began setting up a project management meeting with individuals from Denbury for February 16 in Plano, Texas, to prioritize project goals and efforts.
- Continued work on the report on the “Minimum Miscibility Pressure of the Bell Creek Oil with CO<sub>2</sub>.”
- Prepared for and presented at the meeting on February 16 in Plano with Denbury.
- Prepared and submitted an abstract to the 10th Annual Conference on CCS in Pittsburgh, Pennsylvania.
- Continued preparation of the report entitled “Site Characterization, Modeling, and Monitoring Plan” (D50).
- Created a Techlog Bell Creek project.
- Loaded LAS files for 98 wells into the Bell Creek Petrel model.
- Created a premade file for each core, including LAS logs and pertinent columns for geologic data.
- Continued review of digital well logs and correlating tops in Petrel for the Phase 1 region of the Bell Creek Field.
- Continued identification of coastal plain channel sand.
- Continued Fort Nelson site activities, including the following:
  - Continued working on history-matching the historic production and injection in the neighboring gas field to validate the model properties and to better understand the regional pressure profile and connectivity.
  - Reviewed the schedule and preliminary table of contents for the 2010 risk assessment update.
  - Held a risk assessment meeting with Spectra personnel and Nakles Consulting on January 11–12, 2011.
  - Initiated efforts on a PowerPoint presentation for the IEA Greenhouse Gas R&D Programme, Modeling Network Meeting scheduled for April 27–29, 2011, in Perth, Australia, based on work at Fort Nelson.
  - Received and began incorporating final comments from Spectra on D52 entitled “Site Characterization, Modeling, and Monitoring Plan.”
  - Submitted an abstract based on D52 to the Trondheim CCS Conference scheduled for June in Norway (<http://www.sintef.no/Projectweb/TCCS-6/>).
  - Spectra reviewed an abstract for submittal to the 10th Annual Conference on CCS.
  - Held a history match and risk assessment meeting in Grand Forks on March 1 and 2.
  - Continued preparation of a report on the 2010 risk assessment activities.
  - Adjusted the geologic model (June 2010 version) to run several “worst-case” scenarios for inclusion in the next risk assessment update.
  - Selected a few alternative well locations.
  - Worked on validation of the Slave Point tops.
  - Performed various calculations on Gas Pool A.
  - Scheduled risk management software training.

## **Task 10 – Site Closure**

This task is anticipated to be initiated in Quarter 1 – BP5, Year 9 (October 2015).

### **Task 11 – Postinjection Monitoring and Modeling**

This task is anticipated to be initiated in Quarter 1 – BP5, Year 9 (October 2015).

### **Task 12 – Project Assessment**

- The project assessment report (D57) for the period October 1, 2009 – September 30, 2010, was submitted in December 2010 and is available on the partners-only Web site at [www2.undeerc.org/website/pcorp/ProductsDB/pdfs/ENS\\_D57\\_Task12\\_Dec10.pdf](http://www2.undeerc.org/website/pcorp/ProductsDB/pdfs/ENS_D57_Task12_Dec10.pdf).

### **Task 13 – Project Management**

Significant accomplishments for Task 13 for the reporting period included the following:

- Welcomed a new partner, **Husky Energy Inc.**, of Calgary, Alberta, Canada (joined January 4, 2011).
- Continued planning for the upcoming PCOR Partnership Annual Meeting (September 12–14, 2011) to be held at the Sheraton Denver Downtown Hotel ([www.sheratondenverdowntown.com](http://www.sheratondenverdowntown.com)), including sending a “Mark Your Calendar” e-mail blast to the partnership on March 29.
- Activities associated with the IEA Greenhouse Gas R&D Programme Expert Review of the RCSPs included the following:
  - Compiled information and drafted text for inclusion in the two (Bell Creek and Fort Nelson) project information forms (PIFs). Draft PIFs were submitted drafts on January 14, and final PIFs were submitted on February 2.
  - Prepared the PowerPoint presentation. A draft was submitted on February 4, and the final presentation was submitted on February 28.
  - The hour-long presentation was given on March 15, followed by a one-and-one-half-hour question-and-answer session.
- Provided upon request updated information on the PCOR Partnership Phase II and III projects for a Carbon Sequestration Leadership Forum (CSLF) fact sheet on the NETL Sequestration Program.
- Submitted the quarterly progress updates on January 14 to CSLF on both recognized projects, i.e., Fort Nelson CCS Project and Zama Acid Gas EOR, CO<sub>2</sub> Sequestration, and Monitoring project.
- Continued work on the programmatic risk management plan (D88).
- On March 8, submitted the updated project management plan for review and approval.
- On January 19, February 23, and March 21, participated in a teleconference with Spectra’s project lead in preparation for the team’s monthly conference calls held January 20, February 24, and March 22, respectively.
- Held a task leader meeting on January 21. Topics discussed included new partners, upcoming conferences and travel, deliverables, and task leader updates.
- Held a task leader meeting on March 17. Topics discussed included an overview of the presentation to the expert review panel; the upcoming EERC research reorganization; upcoming conferences, meetings, and travel; deliverables; and task leader updates.

- On January 28, submitted an abstract to the New Horizons in Oil and Gas Conference that will be held at the South Dakota School of Mines on October 6–7. It was accepted.
- Submitted two abstracts for the upcoming 10th Annual Conference on CCS in Pittsburgh ([www.carbonsq.com](http://www.carbonsq.com)) for the following “hot topics”: The U.S.–Canadian CCS Collaboration and Regional Carbon Sequestration Partnerships – Large-Scale Field Testing. Both were accepted.
- Attended the Canadian Institute’s 5th Annual CCS Conference in Calgary.
- Attended the Basal Cambrian kickoff meeting with Alberta Innovates – Technology Futures (AITF) in Calgary.
- Received an invitation to attend the next NACAP (North American Carbon Atlas Partnership) meeting scheduled for April 5 and 6 in Morgantown, West Virginia.
- Presented at the European CCS Demonstration Project Network meeting in Brindisi, Italy, on February 16.
- Prepared updates on both the Fort Nelson and Zama projects for the CSLF Storage and Monitoring Projects Interactive Workshop scheduled for February 28 – March 3, 2010, in Saudi Arabia.
- Participated in the 4-Kingdoms CCS Initiative Technical Workshop held February 28, and presented on both the Fort Nelson and Zama projects at the CSLF Storage and Monitoring Projects Interactive Workshop held March 1 and 2, in Al Khobar, Saudi Arabia.
- Deliverables and milestones completed in January include the following:
  - December monthly update
  - Task 4: M8 – Bell Creek Test Site Wellbore Leakage Data Collection Initiated
  - Task 4: D31 – Bell Creek Site Geological Characterization Experimental Design Package
  - Task 4: M28 – Bell Creek Geological Experimental Design Package Completed
  - Task 13: D58/59 – Quarterly Progress Report/Milestone Quarterly Report
- Deliverables completed in February include the following:
  - January monthly update
  - Task 2: D15 – Bell Creek Fact Sheet
- Deliverables completed in March include the following:
  - February monthly update
  - Task 1: D10 – Demonstration Project Reporting System Update
  - Task 2: D18 – Bell Creek Test Site PowerPoint Presentation
  - Task 2: D26 – Fort Nelson Test Site Poster
  - Task 3: D28 – Environmental Questionnaire – Bell Creek Test Site
  - Task 5: M30 – Bell Creek Test Site Baseline MVA will be initiated
  - Task 6: D85 – Report – Opportunities and Challenges Associated with CO<sub>2</sub> Compression and Transportation During CCS Activities
  - Task 14: M23 – Monthly WWG Conference Call Held
- Deliverables and milestones due in April include the following:
  - March monthly update
  - Task 13: D58/D59 – Quarterly Progress Report/Milestone Quarterly Report
  - Task 13: D88 – Programmatic Risk Management Plan
  - Task 14: M23 – Monthly WWG Conference Call Held

## **Task 14 – RCSP Water Working Group Coordination**

Significant accomplishments for Task 14 for the reporting period included the following:

- Participated in the RCSP WWG conference calls on January 19 and March 22. The February conference call was canceled.
- Continued preparations for a presentation at the 2011 American Water Resources Association Spring Specialty Conference in April.
- Continued work on the Nexus of Water and CCS – Technology Gaps document.
- Continued planning the WWG annual meeting, including selection of date and location, as well as preparation of an agenda. The annual meeting will be held on May 5, 2011, 1:00–5:00 p.m., in conjunction with the 10th Annual Conference on Carbon Capture & Sequestration in Pittsburgh.

Actual or anticipated problems or delays during the reporting period included the following:

- On December 15, 2009, DOE waived the water resource estimation methodology documents due February 2010 and May 2011. The fact sheet submitted April 30, 2010, replaced the former. An alternative report to replace the latter is still under consideration.

## **Task 15 – Further Characterization of the Zama Acid Gas EOR, CO<sub>2</sub> Storage, and Monitoring Project**

Significant accomplishments for Task 15 for the reporting period included the following:

- On February 24, received Modification No. 19 to DOE Award No. DE-FC26-05NT42592, approving relocation of Subtask 1.4 – Further Characterization of the Zama Acid Gas EOR, CO<sub>2</sub> Storage, and Monitoring Project to a new task (Task 15) under the same title. No overall budget modifications were required. The time line remains the same; i.e., work was initiated in July 2010 and would continue through April 2012.
- Used the current version of the static geological model to estimate storage capacity for the Zama F Pool.
- Continued a search for cement, rock, and steel samples representative of those found at Zama for use in laboratory experiments.
- Continued discussions with Natural Resources Canada to establish laboratory experiments dedicated to effects of impurities (flue gas) on reservoir materials.
- Spoke with RPS Energy regarding the wellbore integrity work and the availability of obtaining core representative of the cap rock in the system.
- Applied DOE methodology for EOR to the pore volume generated from the modeling exercise, and obtained a recovery factor using historical production data.
- Also generated an estimate for the entire Zama Field using the F pool as an analogue for the rest of the pinnacles. This evaluation will be ongoing and updated in subsequent reports.



- Presented on the Zama project to the Second France/European Union–Canada Workshop on CCS held on March 30 and 31 in Paris.
- Acquired 20 steel coupons representative of oil field casing material, and initiated a 28-day batch reaction using CO<sub>2</sub> and H<sub>2</sub>S.
- Initiated preexposure optical profiling that will be compared to postexposure measurements in an effort to gauge whether degradation has occurred.

Actual or anticipated problems or delays during the reporting period included the following:

- Apache Corporation is currently planning to divest certain conventional properties in Canada, including its EOR project in the Zama field located in Alberta. Because of Apache’s corporate planning strategies and personnel redistribution, efforts to initiate the seismic profiles, logging suites, and MVA activities have been delayed. Once the divestiture of the EOR project is finalized, the EERC is optimistic that the new site owner will authorize the PCOR Partnership’s continuing MVA efforts.

### **Task 16 – Characterization of the Basal Cambrian System**

Significant accomplishments for Task 16 for the reporting period included the following:

- On February 24, received Modification No. 19 to DOE Award No. DE-FC26-05NT42592, approving a new task (Task 16) for an expanded characterization of the Basal Cambrian System.
- Tested an outcrop sample of the Deadwood Formation (Fm) and acquired porosity, permeability, and mechanical properties; relative permeability (CO<sub>2</sub> and water); and mineralogy.
- Initiated preparation of a report and poster on the characterization study results of the CO<sub>2</sub> storage potential of the Deadwood Fm.
- Initiated a case study of the Deadwood Fm for inclusion in a peer-reviewed Society of Petroleum Engineers article about storage resource estimation.
- Traveled to Calgary to participate in a technical briefing/steering committee meeting.
- Traveled to Ottawa, Canada, on February 8–11 to visit with representatives from Natural Resources Canada, Canmet Energy, and the National Research Council of Canada. Specific topics discussed included overviews of each specific organization, storage of CO<sub>2</sub> streams containing impurities, development of laboratory programs researching this topic, high-temperature and -pressure XRD capabilities of the National Research Council, and capture technologies being investigated by Canmet. The trip also included facility tours of each organization.
- Assigned “themes” and “theme leaders” for the project, and scheduled ongoing in-house meetings to discuss scheduling, budgeting, and technical aspects of the project.
- Continued planning the next meeting of the technical and steering committees at NETL headquarters in Pittsburgh on May 25.

## PHASE III COST STATUS

The approved BP4 (Modification No. 19) budget along with actual costs incurred and in-kind cost share reported is shown in Table 3. A spending plan for BP4 and actual incurred cost by quarter of cash funds for BP4 are provided in Figure 3 and Table 4.

**Table 3. Phase III Budget – BP4**

Organization	Approved Budget, \$	Actual Costs Incurred, \$
DOE Share – Cash	55,670,206	8,104,703
Nonfederal Share – Cash	2,411,971	553,160
Nonfederal Share – In-Kind	17,400,865	16,539,019
Total	75,483,042	25,196,882

## PHASE III SCHEDULE STATUS

Table 5 lists all deliverables and milestones by quarter, with completion dates, through the end of the reporting period (see Table 6 for the Gantt chart for BP4, Years 3 and 4).

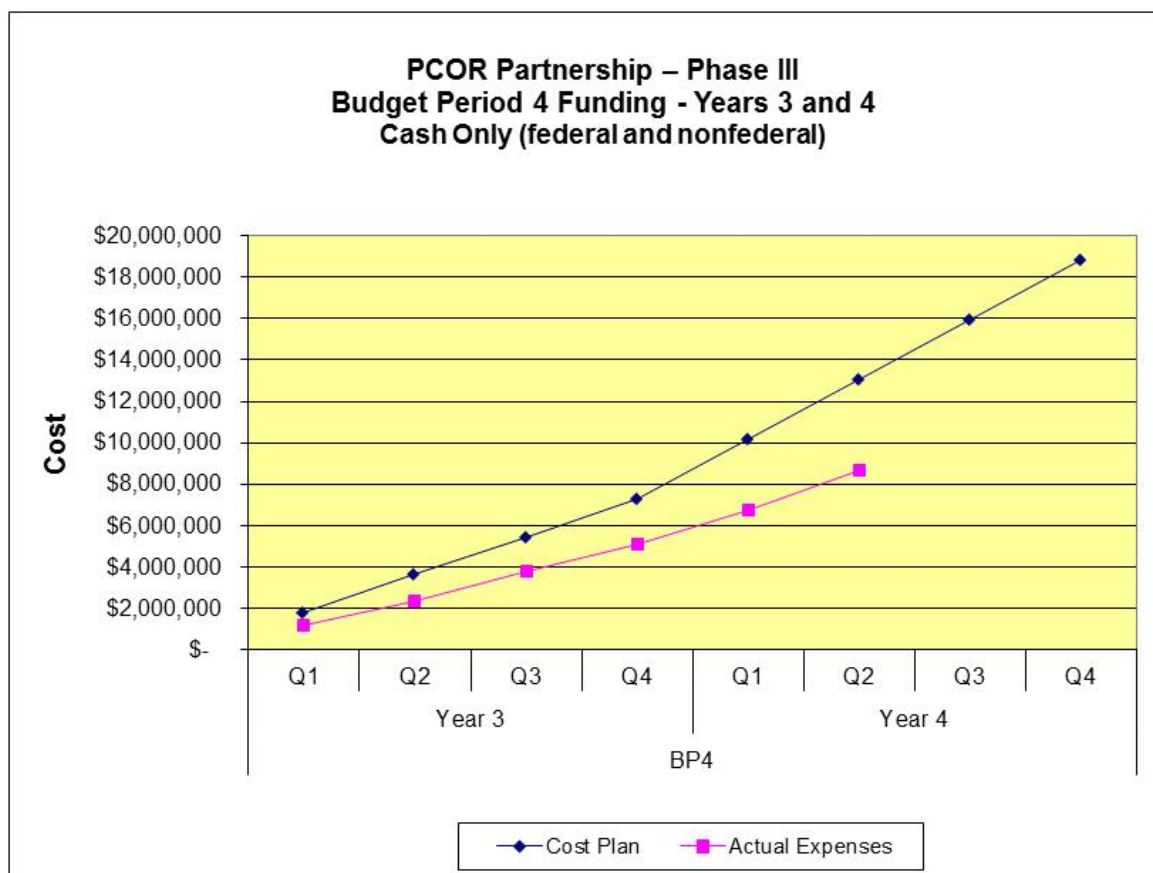


Figure 3. PCOR Partnership Phase III, BP4 – Years 3 and 4 funding (cash only).

**Table 4. BP4 – Years 3 and 4 Spending Plan**

Baseline Reporting Quarter	Year 3								Year 4							
	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
<b>Baseline Cost Plan</b>																
Federal Share	\$ 1,692,969	\$ 1,692,969	\$ 1,692,969	\$ 3,385,938	\$ 1,692,969	\$ 5,078,906	\$ 1,692,969	\$ 6,771,875	\$ 2,707,624	\$ 9,479,499	\$ 2,707,624	\$ 12,187,123	\$ 2,707,624	\$ 14,894,747	\$ 2,707,624	\$ 17,602,371
NonFederal Share	\$ 127,735	\$ 127,735	\$ 127,735	\$ 255,470	\$ 127,735	\$ 383,204	\$ 127,735	\$ 510,939	\$ 177,644	\$ 688,583	\$ 177,644	\$ 866,227	\$ 177,644	\$ 1,043,871	\$ 177,644	\$ 1,221,515
Total Planned	\$ 1,820,704	\$ 1,820,704	\$ 1,820,704	\$ 3,641,407	\$ 1,820,704	\$ 5,462,111	\$ 1,820,704	\$ 7,282,814	\$ 2,885,268	\$ 10,168,082	\$ 2,885,268	\$ 13,053,350	\$ 2,885,268	\$ 15,938,618	\$ 2,885,268	\$ 18,823,886
<b>Actual Incurred Cost</b>																
Federal Share	\$ 1,025,953	\$ 1,025,953	\$ 983,104	\$ 2,009,057	\$ 1,352,281	\$ 3,361,338	\$ 1,347,660	\$ 4,708,998	\$ 1,531,401	\$ 6,240,399	\$ 1,864,304	\$ 8,104,703				
NonFederal Share	\$ 171,873	\$ 171,873	\$ 164,935	\$ 336,808	\$ 74,929	\$ 411,737	\$ 4,563	\$ 416,300	\$ 80,246	\$ 496,546	\$ 56,614	\$ 553,160				
Total Incurred Cost	\$ 1,197,826	\$ 1,197,826	\$ 1,148,039	\$ 2,345,865	\$ 1,427,210	\$ 3,773,075	\$ 1,352,223	\$ 5,125,298	\$ 1,611,647	\$ 6,736,945	\$ 1,920,918	\$ 8,657,863				
<b>Variance</b>																
Federal Share	\$ 667,016	\$ 667,016	\$ 709,865	\$ 1,376,881	\$ 340,688	\$ 1,717,568	\$ 345,309	\$ 2,062,877	\$ 1,176,223	\$ 3,239,100	\$ 843,320	\$ 4,082,420				
NonFederal Share	\$ (44,138)	\$ (44,138)	\$ (37,200)	\$ (81,339)	\$ 52,806	\$ (28,533)	\$ 123,172	\$ 94,639	\$ 97,398	\$ 192,037	\$ 121,030	\$ 313,067				
Total Variance	\$ 622,878	\$ 622,878	\$ 672,665	\$ 1,295,542	\$ 393,494	\$ 1,689,036	\$ 468,481	\$ 2,157,516	\$ 1,273,621	\$ 3,431,137	\$ 964,350	\$ 4,395,487				

**Table 5. Phase III Milestones and Deliverables**

<b>Title/Description</b>	<b>Due Date</b>	<b>Actual Completion Date</b>
<b>Year 1 – Quarter 1 (October–December 2007)</b>		
D37: Task 4 – Fort Nelson Test Site – Geological Characterization Experimental Design Package	12/31/07	12/28/07
D63: Task 13 – Project Management Plan	12/31/07	12/28/07
M17: Task 4 – Fort Nelson Test Site Selected	12/31/07	12/28/07
<b>Year 1 – Quarter 2 (January–March 2008)</b>		
D38: Task 4 – Fort Nelson Test Site – Geomechanical Experimental Design Package	1/31/08	1/31/08
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	1/31/08	1/31/08
D11: Task 2 – Outreach Plan	3/31/08	3/31/08
D27: Task 3 – Environmental Questionnaire – Fort Nelson Test Site	3/31/08	4/02/08
D30: Task 4 – Williston Basin Test Site – Geomechanical Experimental Design Package	3/31/08	3/31/08
M1: Task 1 – Three Target Areas Selected for Detailed Characterization	3/31/08	3/20/08
M18: Task 4 – Fort Nelson Test Site Geochemical Work Initiated	3/31/08	3/19/08
<b>Year 1 – Quarter 3 (April–June 2008)</b>		
D14: Task 2 – General Phase III Fact Sheet	4/30/08	4/30/08
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	4/30/08	4/30/08
D17: Task 2 – General Phase III Information PowerPoint Presentation	5/30/08	5/30/08
M3: Task 3 – Start Environmental Questionnaire for Williston Basin Test Site	6/30/08	6/27/08
M6: Task 4 – Williston Basin Test Site Geochemical Work Initiated	6/30/08	6/30/08
M7: Task 4 – Williston Basin Test Site Geological Characterization Data Collection Initiated	6/30/08	6/30/08
<b>Year 1 – Quarter 4 (July–September 2008)</b>		
D12: Task 2 – Demonstration Web Pages on the Public Site	7/31/08	7/31/08
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	7/31/08	7/31/08
D1: Task 1 – Review of Source Attributes	9/30/08	9/26/08
M2: Task 1 – Demonstration Project Reporting System (DPRS) Prototype Completed	9/30/08	9/26/08
<b>Year 2 – Quarter 1 (October–December 2008)</b>		
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

Continued . . .

**Table 5. Phase III Milestones and Deliverables (continued)**

<b>Title/Description</b>	<b>Due Date</b>	<b>Actual Completion Date</b>
<b>Year 2 – Quarter 2 (January–March 2009)</b>		
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 <sub>2</sub> Capture and Sequestration (CCS) and Water, Part Subtask 14.2 – White Paper on Nexus of CCS and Water	2/28/09	2/27/09
D24: Task 2 – PCOR Partnership Region Sequestration General Poster	3/31/09	3/31/09
<b>Year 2 – Quarter 3 (April–June 2009)</b>		
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	4/15/09
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
D16: Task 2 – Fort Nelson Test Site Fact Sheet	5/29/09	5/29/09
M24: Task 14 – WWG Annual Meeting Held	5/31/09	5/07/09
M23: Task 14 – Monthly WWG Conference Call Held	6/30/09	6/25/09
<b>Year 2 – Quarter 4 (July–September 2009)</b>		
M23: Task 14 – Monthly WWG Conference Call Held	N/A	Not required
D19: Task 2 – Fort Nelson Test Site PowerPoint Presentation	7/31/09	7/31/09
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	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
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 – 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
M4: Task 4 – Bell Creek Test Site Selected	9/30/09	9/30/09
M5: Task 4 – Bell Creek Test Site – Data Collection Initiated	9/30/09	9/30/09
M23: Task 14 – Monthly WWG Conference Call Held	9/30/09	9/22/09

Continued . . .

**Table 5. Phase III Milestones and Deliverables (continued)**

<b>Title/Description</b>	<b>Due Date</b>	<b>Actual Completion Date</b>
<b>Year 3 – Quarter 1 (October–December 2009)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	10/30/09	11/02/09
D78: Task 14 – Final White Paper on the Nexus of CCS and Water	10/30/09	10/28/09
M23: Task 14 – Monthly WWG Conference Call Held	10/31/09	10/26/09
M23: Task 14 – Monthly WWG Conference Call Held	11/30/09	11/16/09
D57: Task 12 – Project Assessment Annual Report	12/31/09	12/31/09
M23: Task 14 – Monthly WWG Conference Call Held	12/31/09	Waived by DOE
<b>Year 3 – Quarter 2 (January–March 2010)</b>		
D13: Task 2 – Public Site Updates	1/15/10	1/15/10
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	1/31/10	1/29/10
M23: Task 14 – Monthly WWG Conference Call Held	1/31/10	1/6/10
D79: Task 14 – Water Resource Estimation Methodology Document	2/28/10	Waived by DOE
M23: Task 14 – Monthly WWG Conference Call Held	2/28/10	2/25/10
D11: Task 2 – Outreach Plan	3/31/10	3/31/10
M23: Task 14 – Monthly WWG Conference Call Held	3/31/10	3/23/10
<b>Year 3 – Quarter 3 (April–June 2010)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	4/30/10	4/30/10
M23: Task 14 – Monthly WWG Conference Call Held	4/30/10	4/28/10
M23: Task 14 – Monthly WWG Conference Call Held	5/31/10	5/13/10
D17: Task 2 – General Phase III Information PowerPoint Presentation (update)	6/30/10	6/30/10
D19: Task 2 – Fort Nelson Test Site PowerPoint Presentation (update)	6/30/10	6/29/10
M23: Task 14 – Monthly WWG Conference Call Held	6/30/10	6/23/10
M24: Task 14 – WWG Annual Meeting Held	6/30/10	5/13/10
<b>Year 3 – Quarter 4 (July–September 2010)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	7/31/10	7/29/10
M23: Task 14 – Monthly WWG Conference Call Held	7/31/10	7/28/10
M23: Task 14 – Monthly WWG Conference Call Held	8/31/10	8/31/10
D1: Task 1 – Review of Source Attributes	9/30/10	9/20/10
D52: Task 9 – Fort Nelson Test Site – Site Characterization, Modeling, and Monitoring Plan	9/30/10	9/30/10
M9: Task 4 – Bell Creek Test Site Geological Model Development Initiated	9/30/10	9/30/10
M23: Task 14 – Monthly WWG Conference Call Held	9/30/10	Waived by DOE

Continued . . .

**Table 5. Phase III Milestones and Deliverables (continued)**

<b>Title/Description</b>	<b>Due Date</b>	<b>Actual Completion Date</b>
<b>Year 4 – Quarter 1 (October–December 2010)</b>		
D87: Task 4 – Bell Creek Test Site – Geomechanical Experimental Design Package	10/30/10	10/29/10
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	10/31/10	10/29/10
M23: Task 14 – Monthly WWG Conference Call Held	10/31/10	10/26/10
M23: Task 14 – Monthly WWG Conference Call Held	11/30/10	Waived by DOE
D57: Task 12 – Project Assessment Annual Report	12/31/10	12/23/10
M23: Task 14 – Monthly WWG Conference Call Held	12/31/10	12/13/10
<b>Year 4 – Quarter 2 (January–March 2011)</b>		
M8: Task 4 – Bell Creek Test Site Wellbore Leakage Data Collection Initiated	1/15/11	1/14/11
D31: Task 4 – Bell Creek Test Site – Geological Characterization Experimental Design Package	1/31/11	1/27/11
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	1/31/11	1/31/11
M23: Task 14 – Monthly WWG Conference Call Held	1/31/11	1/19/11
M28: Task 4 – Bell Creek Geological Experimental Design Package Completed	1/31/11	1/27/11
D15: Task 2 – Bell Creek Test Site Fact Sheet	2/28/11	2/28/11
M23: Task 14 – Monthly WWG Conference Call Held	2/28/11	Waived by DOE
D10: Task 1 – Demonstration Project Reporting System Update	3/31/11	3/25/11
D18: Task 2 – Bell Creek Test Site PowerPoint Presentation (Update)	3/31/11	3/31/11
D26: Task 2 – Fort Nelson Test Site Poster	3/31/11	3/31/11
D28: Task 3 – Environmental Questionnaire – Bell Creek Test Site	3/31/11	3/30/11
D85: Task 6 – Report – Opportunities and Challenges Associated with CO <sub>2</sub> Compression and Transportation During CCS Activities	3/31/11	3/31/11
M23: Task 14 – Monthly WWG Conference Call Held	3/31/11	3/22/11

Continued . . .



**Table 5. Phase III Milestones and Deliverables (continued)**

<b>Title/Description</b>	<b>Due Date</b>	<b>Actual Completion Date</b>
<b>Year 4 – Quarter 3 (April–June 2011)</b>		
M30: Task 5 – Bell Creek Test Site Baseline MVA Initiated	4/01/11	3/24/11
M23: Task 14 – Monthly WWG Conference Call Held	4/30/11	
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	4/30/11	
D88: Task 13 – Programmatic Risk Management Plan	4/30/11	
D17: Task 2 – General Phase III Information PowerPoint Presentation (Update)	5/31/11	
D34: Task 4 – Bell Creek Test Site – Baseline Hydrogeological Final Report	5/31/11	
M23: Task 14 – Monthly WWG Conference Call Held	5/31/11	
D19: Task 2 – Fort Nelson Test Site PowerPoint Presentation (Update)	6/30/11	
M23: Task 14 – Monthly WWG Conference Call Held	6/30/11	
M24: Task 14 – WWG Annual Meeting Held	6/30/11	
<b>Year 4 – Quarter 4 (July–September 2011)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	7/31/11	
D67: Task 9 – Fort Nelson Test Site – Simulation Report	7/31/11	
M23: Task 14 – Monthly WWG Conference Call Held	7/31/11	
D29: Task 3 – Permitting Action Plan	8/31/11	
D81: Task 1 – Regional Carbon Sequestration Atlas (Update)	8/31/11	
M23: Task 14 – Monthly WWG Conference Call Held	8/31/11	
D66: Task 9 – Bell Creek Test Site – Simulation Report	8/31/11	
D1: Task 1 – Review of Source Attributes	9/30/11	
D4: Task 1 – Permitting Review – Two Additional States	9/30/11	
D9: Task 1 – Updated DSS	9/30/11	
D25: Task 2 – Bell Creek Test Site Poster	9/30/11	
D50: Task 9 – Bell Creek Test Site – Site Characterization, Modeling, and Monitoring Plan	9/30/11	
M23: Task 14 – Monthly WWG Conference Call Held	9/30/11	
M31: Task 9 – Bell Creek Test Site – Site Characterization, Modeling, and Monitoring Plan Completed	9/30/11	
M33: Task 16 – Basal Cambrian Baseline Geological Characterization Completed	9/30/11	

**Table 6. PCOR Partnership Phase III BP4, Years 3–4 Gantt Chart**



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Table 6. PCOR Partnership Phase III BP4, Years 3–4 Gantt Chart (continued)



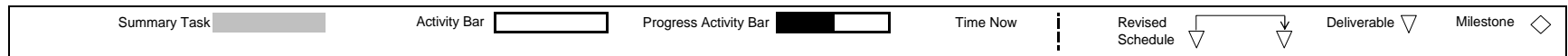
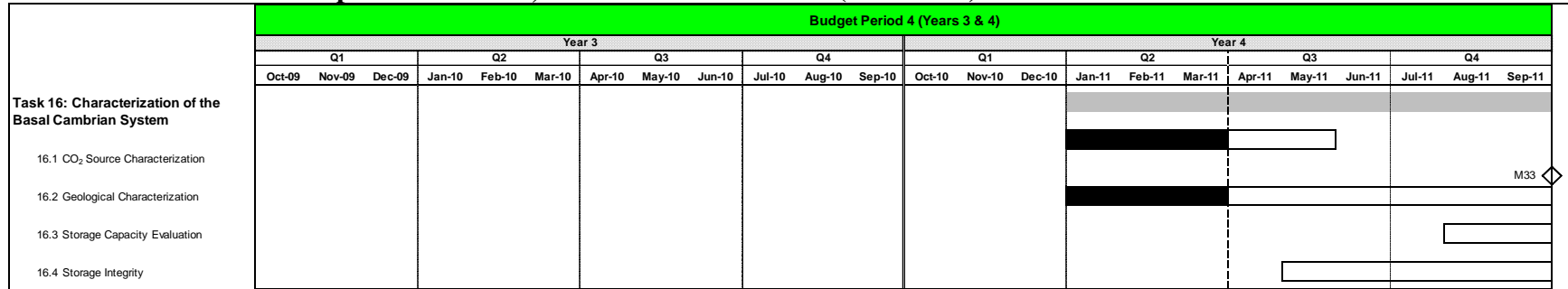
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Table 6. PCOR Partnership Phase III BP4, Years 3–4 Gantt Chart (continued)



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**Table 6. PCOR Partnership Phase III BP4, Years 3–4 Gantt Chart (continued)**



Key for Deliverables (D) ▼				Key for Milestones (M) ◆	
D1	Review of Source Attributes	D29	Permitting Action Plan	M8	BC Test Site – Wellbore Leakage Data Collection Initiated
D4	Permitting Review – Two Additional States	D31	BC Test Site – Geological Characterization Experimental Design Package	M9	BC Test Site – Geological Model Development Initiated
D9	Updated DSS	D34	BC Test Site – Baseline Hydrogeological Experimental Design Package	M23	Monthly WWG Conference Call Held
D10	DPRS Update	D50	BC Test Site – Site Characterization, Modeling, and Monitoring Plan	M24	WWG Annual Meeting Held
D11	Outreach Plan	D52	FN Test Site – Site Characterization, Modeling, and Monitoring Plan	M28	BC Test Site – Geological Characterization Experimental Design Package Completed
D13	Public Site Updates	D57	Project Assessment Annual Report	M30	BC Test Site – Baseline MVA Activities Initiated
D15	Bell Creek (BC) Test Site Fact Sheet	D58	Quarterly Progress Report	M31	BC Test Site – Site Characterization, Modeling, and Monitoring Plan Completed
D16	Fort Nelson (FN) Test Site Fact Sheet	D59	Milestone Quarterly Report	M33	Basal Cambrian Baseline Geological Characterization Completed
D17	General Phase III Information PowerPoint Presentation	D66	BC Test Site – Simulation Report		
D18	BC Test Site PowerPoint Presentation	D67	FN Test Site – Simulation Report		
D19	FN Test Site PowerPoint Presentation	D78	White Paper – Nexus of CCS and Water		
D20	Video Support to PowerPoint and Web Site	D81	Regional Carbon Sequestration Atlas (update)		
D24	PCOR Partnership Region CO <sub>2</sub> Storage General Poster	D85	Report – Opportunities and Challenges Associated with CO <sub>2</sub> Compression and Transportation During CCS Activities		
D25	BC Test Site Poster	D87	BC Test Site – Geomechanical Experimental Design Package		
D26	FN Test Site Poster	D88	Programmatic Risk Management Plan		
D28	BC Test Site – Environmental Questionnaire				

## **PHASE III PRODUCTS OR TECHNOLOGY TRANSFER ACTIVITIES**

During the reporting period, there were 15 abstracts accepted for presentation and 11 presentations given at 17 different meetings/conferences. In addition, seven deliverables, five milestones, and a quarterly progress report were completed.

### **Abstracts – Submitted**

Gorecki, C.D., Sorensen, J.A., Klapperich, R.J., Smith, S.A., Botnen, L.S., Steadman, E.N., and Harju, J.A., 2011, An integrated characterization, modeling, risk assessment, and monitoring plan for the Fort Nelson CCS project [abs.]: TCCS-6, the Trondheim CCS Conference for CO<sub>2</sub> Capture, Transport and Storage, Trondheim, Norway, June 14–16, 2011.

### **Abstracts – Submitted and Accepted for Presentation**

Braunberger, J.R., Bremer, J.M., Liu, G., Gorecki, C.D., Peck, W.D., Steadman, E.N., and Harju, J.A., 2011, Characterization and modeling using macrofacies and microfacies intervals of the Midale and Rival “Nesson” beds in the Mississippian Madison Group, Burke County, North Dakota [abs.]: Abstract for the American Association of Petroleum Geologists – Rocky Mountain Section (AAPG–RMS) 2011 Annual Conference, Cheyenne, Wyoming, June 25–29, 2011.

Bremer, J.M., Lindeman, C.D., Mibeck, B.A.F., Huffman, B.W., Gorecki, C.D., Smith, S.A., Steadman, E.N., and Harju, J.A., 2011, Laboratory analysis of Newcastle/Muddy outcrop samples as analogs to Bell Creek Field, Powder River County, Montana [abs.]: American Association of Petroleum Geologists – Rocky Mountain Section (AAPG–RMS) 2011 Annual Conference, Cheyenne, Wyoming, June 25–29, 2011.

Gorecki, C.D., Sorensen, J.A., Klapperich, R.J., Smith, S.A., Botnen, L.S., Steadman, E.N., and Harju, J.A., 2011, An integrated characterization, modeling, risk assessment, and monitoring plan for the Fort Nelson CCS project [abs.]: 10th Annual Carbon Capture & Sequestration Conference, Pittsburgh, Pennsylvania, May 2–5, 2011.

Gorecki, C.D., Sorensen, J.A., Steadman, E.N., and Harju, J.A., 2011, The Plains CO<sub>2</sub> Reduction Partnership’s Phase III Bell Creek integrated CO<sub>2</sub> EOR and storage project [abs.]: 10th Annual Carbon Capture & Sequestration Conference, Pittsburgh, Pennsylvania, May 2–5, 2011.

Holubnyak, Y.I., Mibeck, B.A., Bremer, J.M., Smith, S.A., Sorensen, J.A., Steadman, E.N., and Harju, J.A., 2011, 3-D geochemical modeling of CO<sub>2</sub>-based huff ‘n’ puff oil recovery at the Northwest McGregor oil field [abs.]: Abstract for the American Association of Petroleum Geologists – Rocky Mountain Section (AAPG–RMS) 2011 Annual Conference, Cheyenne, Wyoming, June 25–29, 2011.

Holubnyak, Y.I., Smith, S.A., Sorensen, J.A., Steadman, E.N., and Harju, J.A., 2011, Geochemical modeling of acid gas (H<sub>2</sub>S and CO<sub>2</sub>) EOR/storage at Zama, Alberta, Canada

[abs.]: American Association of Petroleum Geologists – Rocky Mountain Section (AAPG – RMS) 2011 Annual Conference, Cheyenne, Wyoming, June 25–29, 2011.

Holubnyak, Y.I., Smith, S.A., Sorensen, J.A., Steadman, E.N., and Harju, J.A., 2011, Geochemical modeling of acid gas (H<sub>2</sub>S and CO<sub>2</sub>) EOR/storage at Zama, Alberta, Canada [abs.]: ATCE 2011—Society of Petroleum Engineers Annual Technical Conference and Exhibition, Denver, Colorado, October 30 – November 2, 2011.

Knudsen, D.J., Smith, S.A., Sorensen, J.A., Gorecki, C.D., Steadman, E.N., and Harju, J.A., 2011, Characterization and modeling of an EOR, H<sub>2</sub>S disposal, and CO<sub>2</sub> storage project in the Zama Subbasin, Northern Alberta, Canada [abs.]: American Association of Petroleum Geologists – Rocky Mountain Section (AAPG–RMS) 2011 Annual Conference, Cheyenne, Wyoming, June 25–29, 2011.

Peck, W.D., Gorecki, C.D., Knudsen, D.J., Bremer, J.M., Steadman, E.N., and Harju, J.A., 2011, Application of the U.S. Department of Energy CO<sub>2</sub> storage resource estimation methodology on the Deadwood Formation, Williston Basin [abs.]: 10th Annual Carbon Capture & Sequestration Conference, Pittsburgh, Pennsylvania, May 2–5, 2011.

Wade, S., Greenberg, S., Cumming, L., Tollefson, L., Garrett, G., Myhre, R., Daly, D.J., and Peterson, T., 2011, An approach for tailoring public outreach programs [abs.]: 10th Annual Carbon Capture & Sequestration Conference, Pittsburgh, Pennsylvania, May 2–5, 2011.

Steadman, E.N., Harju, J.A., Anagnost, K.K., Botnen, L.S., Daly, D.J., Gorecki, C.D., Jensen, M.D., Peck, W.D., Smith, S.A., and Sorensen, J.A., 2011, The Plains CO<sub>2</sub> Reduction (PCOR) Partnership—a regional carbon sequestration partnership conducting large-scale field tests [abs.]: 10th Annual Carbon Capture & Sequestration Conference, Pittsburgh, Pennsylvania, May 2–5, 2011.

Steadman, E.N., Harju, J.A., Botnen, L.S., Daly, D.J., Gorecki, C.D., Jensen, M.D., Peck, W.D., Smith, S.A., Sorensen, J.A., and Anagnost, K.K., 2011, The Plains CO<sub>2</sub> Reduction (PCOR) Partnership—investigating carbon management options in North America’s interior plains [abs.]: 2011 New Horizons in Oil and Gas Conference, Rapid City, South Dakota, October 5–8, 2011.

Steadman, E.N., Harju, J.A., Sorensen, J.A., Smith, S.A., Gorecki, C.D., Daly, D.J., Jensen, M.D., Botnen, L.S., Peck, W.D., and Anagnost, K.K., 2011, The Plains CO<sub>2</sub> Reduction (PCOR) Partnership—collaborative U.S.–Canada carbon capture and storage demonstration activities [abs.]: 10th Annual Carbon Capture & Sequestration Conference, Pittsburgh, Pennsylvania, May 2–5, 2011.

### **Abstracts – Submitted and Rejected**

Bremer, J.M., Lindeman, C.D., Mibeck, B.A.F., Huffman, B.W., Gorecki, C.D., Smith, S.A., Steadman, E.N., Harju, J.A., and Miller, D.J., 2011, Laboratory analysis of Newcastle/Muddy outcrop samples as analogs to Bell Creek Field, Powder River County, Montana [abs.]: 25th



International Symposium of the Society of Core Analysts, Austin, Texas, September 18–21, 2011.

### **Abstracts – Accepted for Presentation**

Bachu, S., Steadman, E.N., and Smith, S.A., 2011, The potential for, and possible effects of CO<sub>2</sub> storage in the Basal Aquifer of the Northern Plains – Prairie Region of North America—a joint US–Canada project [abs.]: 10th Annual Carbon Capture & Sequestration Conference, Pittsburgh, Pennsylvania, May 2–5, 2011.

Steadman, E.N., Harju, J.A., Botnen, L.S., Daly, D.J., Gorecki, C.D., Jensen, M.D., Peck, W.D., Smith, S.A., Sorensen, J.A., and Anagnost, K.K., 2010, The Plains CO<sub>2</sub> Reduction (PCOR) Partnership—demonstrating carbon management options for the central interior of North America [abs.]: 2011 American Association of Petroleum Geologists – Rocky Mountain Section (AAPG–RMS) Meeting, Cheyenne, Wyoming, June 25–29, 2011.

### **Presentations, Conference Papers, Posters, and Other Media**

Braunberger, J.R., 2011, Rival model update: Presented at the Rival Project Update Meeting with TAQA North, Ltd., Grand Forks, North Dakota, March 24–25, 2011.

Daly, D.J., and Crocker, C.R., 2011, Plains CO<sub>2</sub> Reduction Partnership Prairie Public Broadcasting education activities planning: Presented to Prairie Public Broadcasting personnel and area teachers, Grand Forks, North Dakota, January 26, 2011.

Gorecki, C.D., Liu, G., and Bailey, T.P., 2011, History matching efforts on Fort Nelson project: Presented at the History Matching Update Meeting with Spectra Energy, Grand Forks, North Dakota, March 1, 2011.

Peck, W.D., and Steadman, E.N., 2011, Plains CO<sub>2</sub> Reduction (PCOR) Partnership update: Presented at EUEC 2011 Energy, Utility & Environment Conference, Phoenix, Arizona, January 31 – February 2, 2011.

Smith, S.A., 2011, Zama acid gas EOR, CO<sub>2</sub> storage, and monitoring project: Presented at the 2nd France–Canada Workshop on Carbon Capture and Storage, Paris, France, March 30, 2011.

Steadman, E.N., 2011, Plains CO<sub>2</sub> Reduction (PCOR) Partnership CCS demonstrations: Presented at the European CCS Project Network Knowledge-Sharing Meeting, Brindisi, Italy, February 16, 2011.

Daly, D.J., Gorecki, C.D., Peck, W.D., Buckley, T.D., Steadman, E.N., and Harju, J.A., 2011, Bell Creek integrated CO<sub>2</sub> EOR and storage project: Plains CO<sub>2</sub> Reduction (PCOR) Phase III Task 2 Deliverable D15 fact sheet, Grand Forks, North Dakota, Energy & Environmental Research Center, March.

Steadman, E.N., and Harju, J.A., 2011, Fort Nelson Carbon Capture and Storage Project: Presented at the Carbon Sequestration Leadership Forum (CSLF) Storage and Monitoring Projects Interactive Workshop, Al Khobar, Saudi Arabia, March 1, 2011.

Steadman, E.N., and Harju, J.A., 2011, Plains CO<sub>2</sub> Reduction (PCOR) Partnership: Presented to Indian Land Tenure Foundation personnel, Grand Forks, North Dakota, February 9, 2011.

Steadman, E.N., and Harju, J.A., 2011, Zama acid gas EOR, CO<sub>2</sub> storage, and monitoring project: Presented at the Carbon Sequestration Leadership Forum (CSLF) Storage and Monitoring Projects Interactive Workshop, Al Khobar, Saudi Arabia, March 1, 2011.

Steadman, E.N., Gorecki, C.D., Harju, J.A., and Nakles, D.V., 2011, The Plains CO<sub>2</sub> Reduction (PCOR) Partnership Program: Presented at the IEA Greenhouse Gas R&D Programme 2011 Expert Review of Regional Carbon Sequestration Partnerships (RCSPs) – Phase III, Arlington, Virginia, March 15, 2011.

Steadman, E.N., Harju, J.A., Jensen, M.D., and Peck, W.A., 2011, Plains CO<sub>2</sub> Reduction (PCOR) Partnership: Presented to Cargill Corn Milling North America personnel, Grand Forks, North Dakota, January 28, 2011.

### **Technical Reports**

Cowan, R.M., Jensen, M.D., Pei, P., Steadman, E.N., and Harju, J.A., 2011, Current status of CO<sub>2</sub> capture technology development and application: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III value-added report for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, EERC Publication 2011-EERC-03-08, Grand Forks, North Dakota, Energy & Environmental Research Center, January.

Jensen, M.D., Steadman, E.N., Harju, J.A., and Belshaw, K.L., 2009, Preliminary design of advanced compression technology: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III Task 6 Deliverable D47 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, EERC Publication 2011-EERC-03-05, Grand Forks, North Dakota, Energy & Environmental Research Center, September.

Sorensen, J.A., Steadman, E.N., and Harju, J.A., 2011, Bell Creek test site wellbore leakage data collection initiated: Plains CO<sub>2</sub> Reduction Partnership Phase III Task 4 Milestone M8 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, EERC Publication 2010-EERC-02-06, Grand Forks, North Dakota, Energy & Environmental Research Center, January.

## **Progress Reports, Meeting Minutes, and Project Management Documents**

- Daly, D.J., Hanson, S.K., Crocker, C.R., Steadman, E.N., and Harju, J.A., 2010, Outreach action plan: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III Task 2 Deliverable D11 Update 1 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, EERC Publication 2011-EERC-03-06, Grand Forks, North Dakota, Energy & Environmental Research Center, March.
- Gorecki, C.D., 2011, Minutes—Regional Carbon Sequestration Partnership Water Working Group conference call: January 19.
- Gorecki, C.D., 2011, Minutes—Regional Carbon Sequestration Partnership Water Working Group conference call: March 22.
- Steadman, E.N., Peck, W.D., Daly, D.J., Botnen, L.S., Sorensen, J.A., Smith, S.A., Jensen, M.D., Harju, J.A., Gorecki, C.D., and Anagnost, K.K., 2010, Plains CO<sub>2</sub> Reduction (PCOR) Partnership: Phase III monthly report (December 1–31, 2010) for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, Grand Forks, North Dakota, Energy & Environmental Research Center, December.
- Steadman, E.N., Peck, W.D., Daly, D.J., Botnen, L.S., Sorensen, J.A., Smith, S.A., Jensen, M.D., Harju, J.A., Gorecki, C.D., and Anagnost, K.K., Plains CO<sub>2</sub> Reduction (PCOR) Partnership: Phase III monthly report (February 1–28, 2011) for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, Grand Forks, North Dakota, Energy & Environmental Research Center, February.
- Steadman, E.N., Peck, W.D., Daly, D.J., Botnen, L.S., Sorensen, J.A., Smith, S.A., Jensen, M.D., Harju, J.A., Gorecki, C.D., and Anagnost, K.K., 2011, Plains CO<sub>2</sub> Reduction (PCOR) Partnership: Phase III monthly report (January 1–31, 2011) for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, Grand Forks, North Dakota, Energy & Environmental Research Center, January.
- Steadman, E.N., 2011, Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III Bell Creek test site: Task 3 Deliverable D28 Environmental Questionnaire for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, Grand Forks, North Dakota, Energy & Environmental Research Center, March.
- Steadman, E.N., Harju, J.A., Romuld, L., Sorensen, J.A., Daly, D.J., Gorecki, C.D., Smith, S.A., Jensen, M.D., Botnen, L.S., Peck, W.D., Anagnost, K.K., and Votava, T.J., 2010, Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III annual assessment report: Task 12 Deliverable D57 (October 1, 2009 – September 30, 2010) for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, EERC Publication 2011-EERC-02-02, Grand Forks, North Dakota, Energy & Environmental Research Center, December.

Steadman, E.N., Harju, J.A., Romuld, L., Sorensen, J.A., Daly, D.J., Jensen, M.D., Botnen, L.S., Peck, W.D., Smith, S.A., Gorecki, C.D., Votava, T.J., and Anagnost, K.K., 2011, Plains CO<sub>2</sub> Reduction Partnership Phase III: Quarterly technical progress report (October 1 – December 31, 2010) for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592 and North Dakota Industrial Commission Contract Nos. FY08-LX111-162 and G-015-030, Grand Forks, North Dakota, Energy & Environmental Research Center, January.

### **Draft Documents**

Daly, D.J., 2011, Bell Creek integrated CO<sub>2</sub> EOR and storage project: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III draft Task 2 Deliverable D18 General Public Presentation for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, Grand Forks, North Dakota, Energy & Environmental Research Center, March.

Daly, D.J., Sorensen, J.A., Gorecki, C.D., Peck, W.D., Steadman, E.N., and Harju, J.A., 2011, Fort Nelson CO<sub>2</sub> sequestration—growing the economy...shrinking the footprint: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III draft Deliverable D26 poster presentation for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, Grand Forks, North Dakota, Energy & Environmental Research Center, March.

Gorecki, C.D., Steadman, E.N., and Harju, J.A., 2011, Bell Creek test site baseline MVA initiated: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III draft Task 5 Milestone M30 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, Grand Forks, North Dakota, Energy & Environmental Research Center, March.

Jensen, M.D., Cowan, R.M., Pei, P., Steadman, E.N., and Harju, J.A., 2011, Opportunities and challenges associated with CO<sub>2</sub> compression and transportation during CCS activities: Plains CO<sub>2</sub> Reduction Partnership Phase III draft Task 6 Deliverable D85 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, Grand Forks, North Dakota, Energy & Environmental Research Center, March.

Peck, W.D., Buckley, T.D., Steadman, E.N., and Harju, J.A., 2011, Demonstration project reporting system update: Plains CO<sub>2</sub> Reduction Partnership Phase III Draft Task 1 Deliverable D10 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, Grand Forks, North Dakota, Energy & Environmental Research Center, March.

Sorensen, J.A., Gorecki, D., Smith, S.A., Steadman, E.N., and Harju, J.A., 2011, Bell Creek test site – geological characterization experimental design package: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III Task 4 Deliverable D31 and Milestone M28 confidential draft report for U.S. Department of Energy National Energy Technology Laboratory Cooperative

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## MEETINGS/TRAVEL

Representatives from the PCOR Partnership participated in and/or presented at the following 17 meetings/conferences and seven training opportunities in this reporting period:

- January 15–20, 2011: Attended a 2-day CMOST simulation software training course with Computer Modelling Group in Houston, Texas.
- January 24–27, 2011: Attended the 2011 Groundwater Protection Council's UIC Conference in Austin, Texas.
- January 24–27, 2011: Attended a 3-day simulation software training session, entitled "CO<sub>2</sub>-based EOR Miscible Flood," with Computer Modelling Group in Calgary, Alberta, Canada.
- January 28 – February 6, 2011: Attended a Petrel Seismic Visualization and Interpretation software training course with Schlumberger in Houston, Texas.
- January 29 – February 5, 2011: Presented at the 14th Annual Energy, Utility, and Environment Conference in Phoenix, Arizona.
- January 30 – February 3, 2011: Attended The Canadian Institute's 5th Annual Carbon Capture and Storage Conference in Calgary, Alberta, Canada.
- January 30 – February 3, 2011: Participated in the steering committee meeting for the Basal Cambrian System project in Calgary, Alberta, Canada.
- February 8–10, 2011: Attended the Carbon Capture and Storage Association's 4th Annual Preconference Workshop on CCS in Austin, Texas.
- February 8–11, 2011: Attended meetings with Natural Resources Canada, National Research Council, and others to discuss potential areas of collaboration in Ottawa, Ontario, Canada.
- February 11, 2011: Traveled to PPB's offices to discuss education outreach activities in Fargo, North Dakota.
- February 12–21, 2011: Attended a 3-day simulation software training session, entitled "CO<sub>2</sub>-Based EOR Miscible Flood," with the Computer Modeling Group in Houston, Texas.
- February 13–18, 2011: Attended a 2-day CMOST and 1-day Wellbore Modeling in STARS simulation training sessions in Calgary, Alberta, Canada.
- February 14–20, 2011: Presented at the European CCS Demonstration Project 2011 Network Sharing Event held in Brindisi, Italy.
- February 15–17, 2011: Met with Denbury Resources at its headquarters in Plano, Texas.
- February 16 and 17, 2011: Traveled to locate a hotel and meeting space for the 2011 PCOR Partnership Annual Meeting in Denver, Colorado.
- February 19–24, 2011: Attended a Society of Petroleum Engineers Reservoir Simulation Symposium, as well as a training course on history matching, in The Woodlands, Texas.

- February 25 – March 4, 2011: Presented at the CSLF Storage Projects Interactive Workshop in Al Khobar, Saudi Arabia.
- February 28 – March 2, 2011: Attended Schlumberger's Petrel Reservoir Engineering simulation software training in Houston, Texas.
- March 6–18, 2011: Traveled to Denbury's headquarters to search, retrieve, and scan Bell Creek-related documents in Plano, Texas.
- March 7–8, 2011: Participated in an advisor's meeting and abstract review for the 10th Annual Conference on Carbon Capture and Sequestration in Pittsburgh, Pennsylvania.
- March 7–11, 2011: Attended the 2011 Esri Developer Summit in Palm Springs, California.
- March 8–11, 2011: Reviewed core samples from the Bell Creek Field at the Bureau of Economic Geology in Houston, Texas.
- March 14–16, 2011: Participated in the IEA Greenhouse Gas R&D Programme 2011 Expert Review of Regional Carbon Sequestration Partnerships in Arlington, Virginia.
- March 16, 2011: Participated in an education activities meeting at PPB offices in Fargo, North Dakota.
- March 28 – April 3, 2011: Presented at the 2nd France–Canada Workshop on Carbon Capture and Storage in Paris, France.

Materials presented at these meetings are available to partners on the PCOR Partnership DSS Web site ([www2.undeerc.org/website/pcorp/](http://www2.undeerc.org/website/pcorp/)).

## REFERENCES

None.