

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

### **Quarterly Technical Progress Report Task 13 – Deliverable D58/D59**

*(for the period October 1 – December 31, 2011)*

*Prepared for:*

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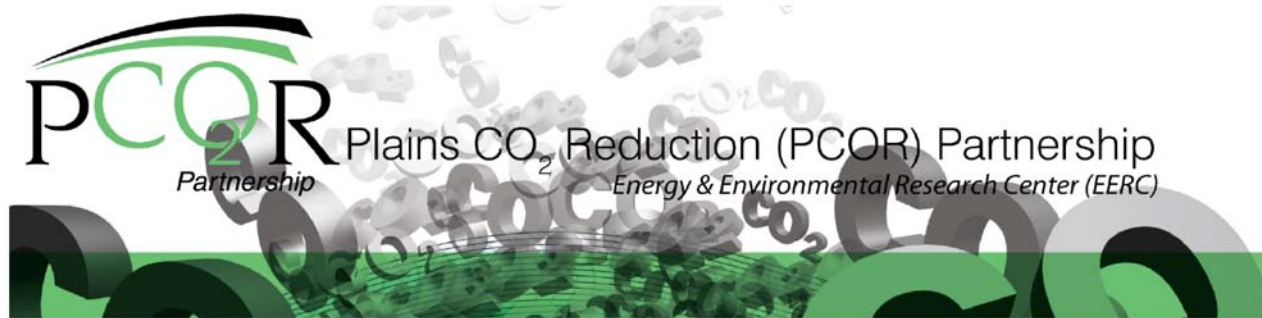
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**PLAINS CO<sub>2</sub> REDUCTION PARTNERSHIP PHASE III**  
**Quarterly Technical Progress Report**  
**October 1 – December 31, 2011**

**EXECUTIVE SUMMARY**

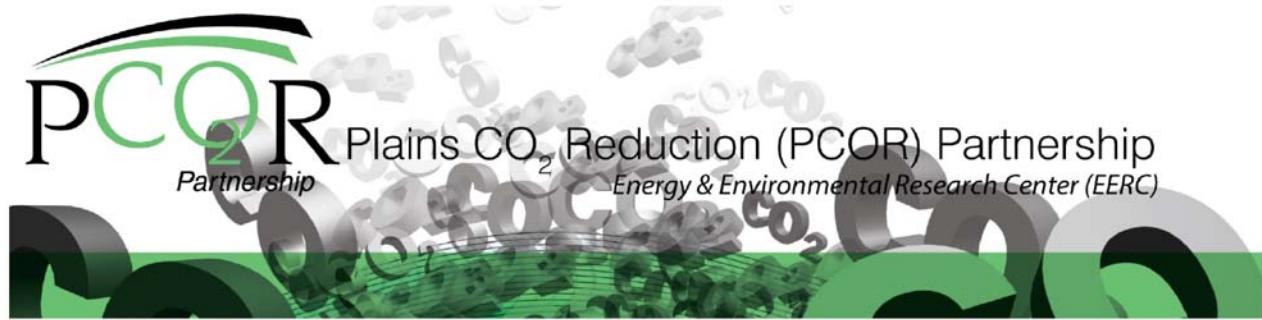
The Plains CO<sub>2</sub> Reduction (PCOR) Partnership is one of seven Regional Carbon Sequestration Partnerships (RCSPs) competitively awarded by the U.S. Department of Energy (DOE) National Energy Technology Laboratory in 2003 as part of a national plan to mitigate greenhouse gas emissions. The PCOR 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 October 1, 2011, through December 31, 2011.

Activities at the Bell Creek test site ramped up exponentially during this reporting period, particularly the baseline monitoring, verification, and accounting (MVA) activities. In November and December, the first-round of surface water, groundwater, and soil gas-monitoring was completed. Twenty-one water samples and 110 soil gas samples were collected, along with approximately 170 soil gas samples from around the 55 plugged and abandoned wells in the field. On December 15, the monitoring well (0506 OW) was spud, and coring operations began. In addition, a seven-run logging, pressure-testing, and sidewall-coring program was conducted. The EERC in collaboration with Prairie Public Broadcasting was on site to film the monitoring well activities.

Planning for the newly created PCOR Partnership Technical Advisory Board began with selection of the inaugural board, creation of draft guidelines, and establishment of a recurring milestone. PCOR Partnership staff participated in DOE's annual review meeting in November 2011 in Pittsburgh, Pennsylvania, along with attending 14 additional conferences. A quarterly Fort Nelson project meeting was held with Spectra Energy in December in Calgary, Alberta, Canada. Regulators from the PCOR Partnership region convened in Buffalo, New York, to participate in a breakfast meeting held in conjunction with the Interstate Oil and Gas Compact Commission's annual meeting. Detailed characterization activities continued in the Rival Field, located in the northwestern corner of North Dakota, and the basal Cambrian (Deadwood) Formation lying in both Canada and the United States. Geologic and geomechanical modeling activities continued, as did geochemical analyses in the EERC's Applied Geology Laboratory.



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

### **Quarterly Technical Progress Report**

**October 1 – December 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 December 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 River Energy	North Dakota Industrial Commission
UND EERC	Halliburton	Oil and Gas Research Council
Abengoa Bioenergy New Technologies	Hess Corporation	North Dakota Natural Resources Trust
Air Products and Chemicals	Huntsman Corporation	North Dakota Petroleum Council
Alberta Department of Energy	Husky Energy Inc.	North Dakota Pipeline Authority
Alberta Department of Environment	Interstate Oil and Gas Compact Commission	Otter Tail Power Company
Alberta Innovates – Technology Futures	Indian Land Tenure Foundation	Oxand Risk & Project Management Solutions
ALLETE	Iowa Department of Natural Resources	Petroleum Technology Research Centre
Ameren Corporation	Lignite Energy Council	Petroleum Technology Transfer Council
American Coalition for Clean Coal Electricity	Manitoba Geological Survey	Pinnacle, a Halliburton Service
American Lignite Energy	Marathon Oil Company	Prairie Public Broadcasting
Apache Canada Ltd.	MEG Energy Corporation	Pratt & Whitney Rocketdyne, Inc.
Aquistore	Melzer Consulting	Ramgen Power Systems, Inc.
Baker Hughes Incorporated	Minnesota Power	RPS Energy Canada Ltd.
Basin Electric Power Cooperative	Minnkota Power Cooperative, Inc.	Saskatchewan Ministry of Industry and Resources
BillyJack Consulting Inc.	Missouri Department of Natural Resources	SaskPower
Biorecro AB	Missouri River Energy Services	Schlumberger
Blue Source, LLC	Montana–Dakota Utilities Co.	Shell Canada Energy
BNI Coal, Ltd.	Montana Department of Environmental Quality	Spectra Energy
British Columbia Ministry of Energy, Mines, and Petroleum Resources	National Commission on Energy Policy	Suncor Energy Inc.
British Columbia Oil and Gas Commission	Natural Resources Canada	TAQA North, Ltd.
Computer Modelling Group, Inc.	Nebraska Public Power District	TGS Geological Products and Services
Dakota Gasification Company	North American Coal Corporation	University of Alberta
Denbury Onshore LLC	North Dakota Department of Commerce	University of Regina
Eagle Operating, Inc.	Division of Community Services	Weatherford Advanced Geotechnology
Eastern Iowa Community College District	North Dakota Department of Health	Western Governors' Association
Enbridge Inc.	North Dakota Geological Survey	Westmoreland Coal Company
Encore Acquisition Company	North Dakota Industrial Commission	Williston Basin Interstate Pipeline Company
Energy Resources Conservation Board/Alberta Geological Survey	Department of Mineral Resources, Oil and Gas Division	Wisconsin Department of Agriculture, Trade and Consumer Protection
Environment Canada	North Dakota Industrial Commission	Wyoming Office of State Lands and Investments
Excelsior Energy Inc.	Lignite Research, Development and Marketing Program	Xcel Energy
Great Northern Project Development, LP		

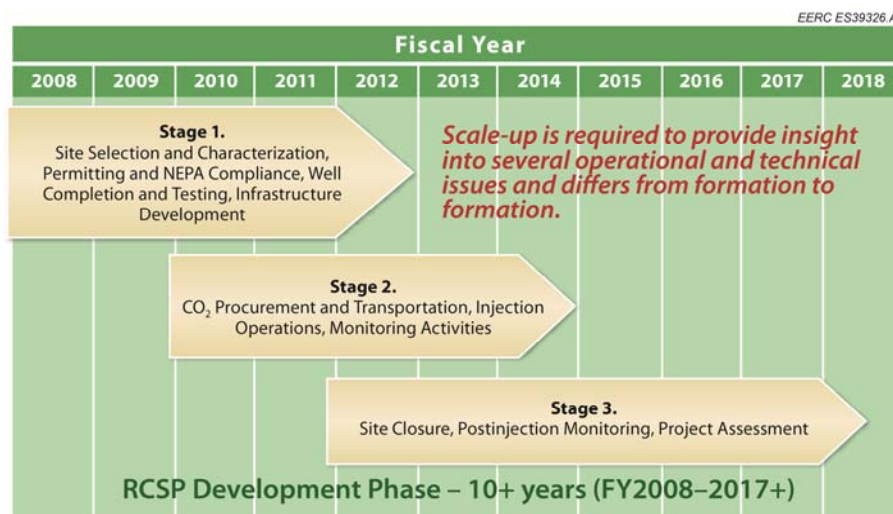


Figure 1. RCSP development phase: scaling up toward commercialization (figure taken from DOE NETL).

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 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 16 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.



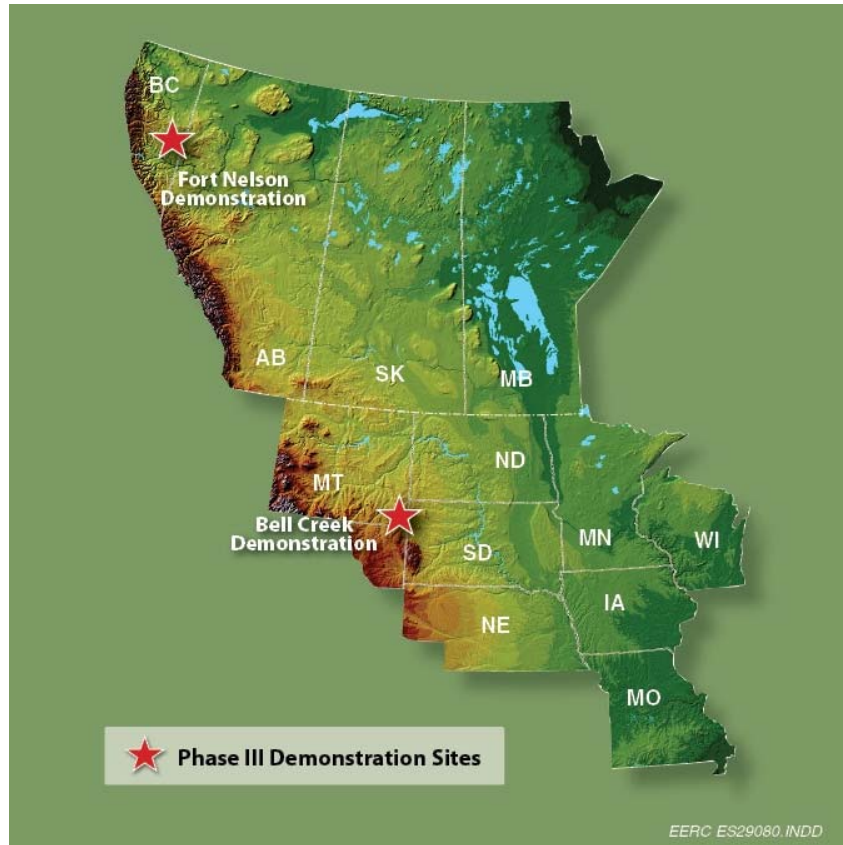


Figure 2. PCOR Partnership Phase III demonstration sites.

**Table 2. Phase III Responsibility Matrix**

Phase III Task Description	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	John A. Hamling
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 <sup>1</sup>
Task 11 – Postinjection Monitoring and Modeling	TBA
Task 12 – Project Assessment	Katherine K. Anagnost
Task 13 – Project Management	Charles D. Gorecki
Task 14 – RCSP WWG Coordination	Ryan J. Klapperich
Task 15 – Further Characterization of the Zama Acid Gas EOR, CO <sub>2</sub> Storage, and Monitoring Project	James A. Sorensen
Task 16 – Characterization of the Basal Cambrian System	Wesley D. Peck

<sup>1</sup> To be announced.

## **PROGRESS OF WORK**

### **Task 1 – Regional Characterization**

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

- Continued efforts on the revised atlas (4th edition).
- The updated geographic information system (GIS) application went “live” on the partners-only Web site ([www2.undeerc.org/website/PCORP/DSS/](http://www2.undeerc.org/website/PCORP/DSS/)).
- Attended the North Dakota GIS Users Conference 2011 in Grand Forks on October 11–13, 2011 ([www.nd.gov/gis/news/20100203.html](http://www.nd.gov/gis/news/20100203.html)).
- Organized and uploaded the geospatial data used in various PCOR Partnership activities to a central geodatabase location to allow for more efficient sharing of the data among the EERC staff.
- Presented an overview of the PCOR Partnership Program to the “Introduction to GIS” class at North Dakota State University on December 7, 2011, in Fargo, North Dakota.
- Attended and presented at the Nebraska Public Power District’s (NPPD’s) Power Summit on November 16, 2011, in Lincoln, Nebraska ([www.nppd.com/our\\_community/environment/additional\\_files/power\\_summit.asp](http://www.nppd.com/our_community/environment/additional_files/power_summit.asp)).
- Continued efforts on the Rival Field characterization, including the following:
  - Continued work on the petrophysical report.
  - Hosted a meeting on October 20 and 21, 2011, to review characterization findings with visitors from TAQA North Ltd. (TAQA).
  - Held a conference call in November with TAQA to discuss ongoing work.
  - Worked on Rival Field activity posters for the American Association of Petroleum Geologists (AAPG) 2012 Annual Convention and Exhibition scheduled for April 2012 in Long Beach, California.
  - Continued drafting Deliverable D5, second target area completed, due March 2012.

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

- All activities are on schedule, and there were no problems or delays during the reporting period.

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

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

- EERC employees attended 20 conferences/meetings, resulting in approximately 1480 external participants that were exposed to the PCOR Partnership name, messaging, and informational materials. Specifically, the PCOR Partnership outreach activities included 24 oral presentations. The following quantities of outreach materials were distributed:
  - PCOR Partnership documentary entitled “Nature in the Balance: CO<sub>2</sub> Sequestration” – 33

- PCOR Partnership documentary entitled “Reducing Our Carbon Footprint: The Role of Markets” – 33
- PCOR Partnership documentary entitled “Out of the Air – Into the Soil” – 33
- PCOR Partnership documentary entitled “Managing Carbon Dioxide: The Geologic Solution” – 77
- PCOR Partnership documentary entitled “Global Energy and Carbon: Tracking Our Footprint” – 55
- PCOR Partnership Atlas 3rd Edition, Revised – 126
- Continued efforts to implement use of the outreach tracking database.
- Attended Prairie Public Broadcasting’s (PPB’s) “master” teacher training session to discuss lesson plans to incorporate the PCOR Partnership video materials.
- Attended and presented at the Society of Petroleum Engineers (SPE) Forum Series entitled “CO<sub>2</sub> Geological Storage: Will We Be Ready in Time?” October 9–14, 2011, in Vilamoura, Algarve, Portugal ([www.spe.org/events/11fse3/pages/about/index.php](http://www.spe.org/events/11fse3/pages/about/index.php)). Presented on the RCSP outreach best practices manual and PCOR Partnership outreach experiences.
- Provided feedback on draft “needs” and “path forward” documents for outreach developed at the SPE Europe/North Africa/Middle East CCS forum held October 9–14, 2011, in Vilamoura, Portugal.
- Attended a presentation on October 14 entitled “Social Change, Culture, and Human Development: The Role of Technology” sponsored by the UND College of Education and Human Development.
- Attended the Education Minnesota Professional Conference in Minneapolis, Minnesota, October 20 and 21, 2011, as a basis for assessing future involvement in that venue, and prepared a trip report following attendance at the conference ([www.educationminnesota.org/en/events/conference.aspx](http://www.educationminnesota.org/en/events/conference.aspx)).
- Reviewed a survey under development by the WWG and provided comments.
- On November 1, sent a set of comments to the Outreach Working Group (OWG) regarding materials developed for the Message Mapping Workshop held November 17, 2011, at the Carbon Storage Infrastructure Annual Review Meeting held in Pittsburgh, Pennsylvania.
- Attended and presented at the PPB Prairie Energy & Carbon Teacher Training Institute on November 18 and 19, 2011, in Grand Forks, North Dakota.
- Drafted a filming schedule for the drilling and installation of the monitoring well at Bell Creek and coordinated scheduling for filming with PPB.
- Traveled with PPB filming crew to the Bell Creek site. Highlights include video of drilling operations (time-lapse and real-time) as well as video of geologic analysis of cuttings, analysis of drilling mud, and coring operations (Figure 3).
- Continued efforts to finalize the Fort Nelson poster (D26).
- Continued efforts to update the public Web site (D13, due July 2012).
- Prepared a Bell Creek documentary (D21) plan, including concept, shot list, schedule, and FAQs (frequency asked questions), as part of seeking Denbury Onshore LLC’s (Denbury’s) permission to initiate documentary activities.



Figure 3. Dan Daly (EERC; right) and Dave Geck (PPB; left) at the Bell Creek site filming monitoring well activities. Photo courtesy of Frode Tilden.

- Continued preparation of a Fort Nelson documentary (D22) plan, including concept, shot list, schedule, and FAQs, to begin the process of seeking Spectra Energy's permission to initiate filming.
- Continued to develop outreach materials to address natural storage of CO<sub>2</sub>, gas field chemical composition, unconventional oil and gas resources, and related topics.

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

- Provided D26 – Fort Nelson Test Site Poster to Spectra Energy in March 2011 and provided D19 – Fort Nelson Test Site PowerPoint presentation (based on the draft poster) to Spectra Energy for review and comment in June 2011. Discussed the poster with Spectra Energy again at the December 13–14, 2011, meeting in Calgary, Alberta, Canada. Began incorporating the latest round of changes.

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

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

- Attended the Interstate Oil and Gas Compact Commission (IOGCC) annual meeting October 15–17, 2011, in Buffalo, New York.

- Hosted a breakfast meeting for PCOR Partnership regulatory members, including representatives from Alberta, Canada; South Dakota; North Dakota; Montana; and the IOGCC, on October 17, 2011.
- Presented a PCOR Partnership overview to the IOGCC Public Lands Committee.
- Attended the EERC's Air Quality VIII Conference in Arlington, Virginia, and coordinated a session on carbon management and policy.
- Completed review of the proposed rule changes to North Dakota Administrative Code §43-05-01, Geologic Storage of Carbon Dioxide, and provided comments to the North Dakota Industrial Commission (NDIC).
- Continued review of the Canadian Standards Association (CSA) draft proposal for geologic storage.
- Participated in the Fort Nelson quarterly meeting in Calgary, Alberta. Provided Spectra Energy with a perspective on the CSA draft proposal for geologic storage and also provided an update on North Dakota's CCS revised rulemaking process.
- Continued development of the revised/updated Regulatory Roundup document.
- Continued efforts on the Lignite Phase II site closure and reclamation, including the following:
  - All subcontracted site work is complete, including plugging and reclamation.
  - Submitted the North Dakota Department of Mineral Resources Form 7 for plugging and abandoning.
  - Spraying to control Canadian thistle will be considered next spring.
  - Traveled to the Lignite field validation site near Kenmare, North Dakota.
  - Seeding originally planned for October was performed in November.
  - Reclamation was completed, and development of a value-added report is under way.

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

- Under the Statement of Project Objectives, Subtask 3.2 (Assistance in the Development of the Environmental Assessment), a categorical exclusion was received (July 2011); therefore, activities under Subtask 3.2 will be significantly reduced or eliminated entirely. Efforts are continuing to redefine the efforts of this subtask.

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

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

- Attended the Storage in Saline Formations R&D Workshop October 18 and 19, 2011, in Pittsburgh, Pennsylvania.
- Continued preparation of a technology assessment on the geomechanical modeling options available.
- **Bell Creek** test site activities included the following:
  - Held an in-house Bell Creek update meeting on October 3, 2011, to discuss the monitoring well; surface and deep monitoring, verification, and accounting (MVA) plans; status of modeling; lidar corrections; and upcoming deliverables.

- Held an in-house Bell Creek update meeting on October 17, 2011, to discuss additional work for Bell Creek samples. Potential scope includes permeability, relative permeability, x-ray diffraction, x-ray fluorescence, and scanning electron microscopy (SEM).
- Continued development of the core analysis plan.
- Participated in a conference call on November 2 with Denbury to discuss core analysis.
- Submitted the draft Bell Creek production and injection report (M16) on December 29, 2011.
- Began correlating geomechanical data with reservoir properties to construct the geomechanical static model with Petrel.
- Traveled to Bell Creek Field December 4–6, 2011, to participate in seismic check shot survey and source testing.
- Held an in-house meeting to discuss Bell Creek operations on December 8, 2011.
- Initiated drilling of the Bell Creek monitoring well 0506 OW on December 15, 2011.
- Collected drill cutting samples
- Collected full-diameter core from well 0506 OW starting on December 21, 2011. Standard core analysis and special core analysis will be performed and utilized to supplement and update modeling efforts. Sidewall core was also retrieved for additional high-priority core work.
- Collected a suite of well logs from well 0506 OW beginning December 27, 2011, in order to supplement and correct historic well log data, and provide a suite of modern high-resolution data for modeling efforts.
- **Fort Nelson** test site activities included the following:
  - Hosted the monthly Fort Nelson management conference call on October 11, 2011. Topics discussed included the 2010 risk assessment report, status of winter drilling and characterization activities, and a review of the action item list.
  - Sent a draft of the “MVA Plan – Surface and Shallow Subsurface” report to Spectra Energy for review on October 14, 2011.
  - Held conference call with Spectra Energy to discuss an integrated project schedule, and continued development of MVA plans and revisions.
  - Distributed minutes from the October 11, 2011, conference call on October 26, 2011.
  - Continued work on the geomechanical model.
  - Continued work on updating the 2011 static geological model, and held an in-house meeting on November 2, 2011.
  - Continued drafting a report on the results of geochemical experiments conducted over the course of 2009–2011.
  - Continued the process of reconciling the various data packages that are associated with the 2009 Fort Nelson wellbore characterization and core analyses to ensure the quality and accuracy of data relative to the specific rock formation intervals being evaluated.
  - Continued preparation of the site characterization report (D65).

- Continued development of the scopes of work for each of the key activities to be undertaken by the EERC over the next 12 months.
- Continued work on the development of the next iteration of the petrophysical model for the Fort Nelson area.
- Continued the multimineral analysis of the Fort Nelson wells using Techlog.
- Held in-house Fort Nelson project update meetings on November 4 and 21, 2011.
- Held in-house meetings to discuss the upcoming quarterly meeting on November 22 and 29, 2011.
- Held a conference call on December 1, 2011, with Spectra Energy and Nakles Consulting to discuss updates to MVA plan.
- Held the quarterly Fort Nelson project meeting on December 13 and 14, 2011, in Calgary, Alberta, Canada. Topics discussed included the following:
  - ◆ Status of winter drilling and seismic survey activities
  - ◆ Risk assessment-driven MVA: the Bayesian approach
  - ◆ Restatement of project goals and the project master schedule
  - ◆ Potential meeting with DOE in early 2012
  - ◆ Modeling update
  - ◆ Well integrity report
  - ◆ Regulatory update
  - ◆ Next quarterly meeting tentatively scheduled for March or April 2012

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

- Received an extension for submittal of D65, Fort Nelson Site Characterization Report, from October 31, 2011, to December 31, 2011, and then to January 31, 2012.
- Received an extension for the Fort Nelson Geochemical Report (D41/M32) from December 15, 2011, to April 30, 2012. Also added annual geochemical update reports for the Fort Nelson test site.

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

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

- The gas chromatograph for soil gas sampling arrived on October 7, 2011, and setup is complete.
- Participated in in-house training on the gas chromatograph.
- Continued in-house personnel training for MVA field sampling.
- Completed the first surface water, groundwater, and soil gas-monitoring baseline sampling trip held November 1–10, 2011; 21 water samples and 110 soil gas samples were collected, which included soil gas samples at all injection and production well sites in the Phase 1 area, 10 interspaced samples, and six samples per development phase in Phases 2–7.
- Completed the second soil gas-sampling trip targeting plugged and abandoned (P&A) wells within and surrounding the Bell Creek oil field on November 28 – December 1,

2011; approximately 170 gas samples from ~55 P&A wells were collected utilizing a three-spot pattern in addition to field blanks and repeat samples.

- Attended the National Ground Water Association Ground Water Expo on November 28 – December 1, 2011, in Las Vegas, Nevada.
- Participated in Bell Creek in-house update meetings on November 2 and 28, 2011, to discuss the monitoring well; surface and deep MVA plans; status of modeling; lidar data; and upcoming deliverables.
- Continued to analyze and archive MVA baseline results in anticipation of a preinjection baseline report.
- Held weekly conference calls with Denbury to discuss well-drilling and completion operations.
- Selected a casing-conveyed perforating service company, and continued coordinating activities.
- Continued work in material procurement and design of permanent downhole monitoring equipment for the monitoring well in conjunction with Sandia Technologies and Denbury.
- Continued planning core analysis activities; selected core analysis provider.
- Held a predrilling and weekly operations conference call with Denbury and third-party service providers to discuss logistical issues and concerns.
- Traveled to the Bell Creek Field on December 5, 2011, to observe seismic source testing and meet with Denbury geophysical staff.
- Supervised drilling activities at the Bell Creek site from December 9, 2011, through January 3, 2012 (Figure 4). Activities included the following:
  - Mobilized Capstar Rig 314 beginning on December 9, 2011, to the Bell Creek site.
  - Participated in a predrill meeting at the Bell Creek site on December 12, 2011, with Denbury, the EERC, and third-party service providers to discuss operational drilling logistics and safety.
  - Initiated drilling of the observation well (0506 OW) on December 15, 2011.
  - Targeted total depth of the surface hole was reached at 1010.0 ft on December 16, 2011.
  - Completed cementing the surface casing.
  - Drilled to 1400.0 ft and ran a gamma ray resistivity log to correlate core point depth.
  - Drilled to 1446.0 ft and initiated coring operations.
  - Recovered approximately 113 ft of drill stem core from the Bell Creek sands, Mowry shale, and Skull Creek shale.
  - Drilled to 4855 ft.
  - Completed a seven-run logging, pressure-testing, and sidewall-coring program (recovered forty-seven 1.5-inch-diameter sidewall cores) on January 1, 2012.





Figure 4. EERC Director Gerald Groenewold and project staff at the Bell Creek site during monitoring well installation activities.

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

- Equipment failure issues prevented soil gas sampling at P&A wells within the study area on the first trip. Equipment has been repaired, and a second trip to collect soil gas samples at P&A well locations has been completed.
- The spud date for the monitoring well was delayed until December 15, 2011, because of rig availability.

### **Task 6 – Infrastructure Development**

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

- Continued adapting information from the capture technologies table (included as an appendix in the value-added capture technologies overview report) as an interactive technology tree on the PCOR Partnership Decision Support System (DSS, © 2007–2011 EERC Foundation<sup>®</sup>), and began testing the same.
- Began work on an interactive compression technology tree for the DSS.
- Attended and presented at NPPD's Power Summit on November 16, 2011, in Lincoln, Nebraska.
- Performed various runs of the Integrated Environmental Control Model as part of information gathering to answer a PCOR Partnership partner's question.

- Reviewed the “CO<sub>2</sub> Capture” section of the upcoming edition of the PCOR Partnership Atlas.
- Answered questions for a partner regarding flare gas in western North Dakota.

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

- All activities are currently on schedule, and there were no problems or delays during the reporting period.

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

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

- Attended a business dinner on December 4, 2011, and the 9th Annual Enhanced Oil Recovery Carbon Management Workshop on December 5–7, 2011, in Houston, Texas.
- Participated in ongoing project discussions with Denbury.

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

- All activities are on schedule, and there were no problems or delays during the reporting period.

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

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

- Staff attended the PetroSkills “CO<sub>2</sub> Surface Facilities” training course ([www.petroskills.com/courseDetails.aspx?courseID=532](http://www.petroskills.com/courseDetails.aspx?courseID=532)) held October 3–6, 2011, in Midland, Texas.
- Labeled approximately 120 photographs taken during the PetroSkills field trip to the Whiting CO<sub>2</sub> Recovery Plant near Wickett, Texas. The photos will be made available to the PCOR Partnership for use in presentations and reports.
- Prepared a preliminary list of questions for Denbury facility engineers for the Bell Creek site. Efforts were made to set up a conference call with Denbury site engineers to discuss the task activities in more detail.

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

- All activities are on schedule, and there were no problems or delays during the reporting period.

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

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

- Reviewed course materials from “Practical Reservoir Simulation” to help connect the geologic side of modeling with simulation and history matching.
- Held in-house discussions on building experimental capabilities for PVT (pressure–volume–temperature) and MMP (minimum miscibility pressure) measurements.
- Reviewed recent advances in geomechanical modeling for CO<sub>2</sub> sequestration.
- Modeling staff attended an “Introduction to CMOST” training course October 6 and 7, 2011, in Houston, Texas.
- Modeling staff attended a “CO<sub>2</sub> Sequestration with GEM” training course October 12 and 13, 2011, in Houston, Texas.
- Modeling staff attended a “Petrel Fracture Modeling” training course October 17 and 18, 2011, in Houston, Texas.
- Participated in the RCSP Sim/Risk monthly conference call on October 25, 2011.
- Held an in-house modeling group update meeting on December 1, 2011.
- Prepared a summary report on the recently attended Midwest Carbon Sequestration Science Conference November 7–9, 2011, in Champaign, Illinois.
- Continued **Bell Creek** site activities, including the following:
  - Updated project graphics using the geologic model.
  - Worked on revisions to the report on subnormal pressure mechanism in Bell Creek Field.
  - Worked on finding relevant references and published literature related to mercury pressure data for one of the Bell Creek wells discussed in SPE Paper Number 17366.
  - Continued work on history matching.
  - Continued efforts on the simulation report.
  - Participated in in-house update meetings on November 2 and 28 and December 15, 2011.
  - Created cross sections through the well site with raster logs, and prepared for coring and pressure sensor placement.
  - Updated PETRA database with lidar data, and began drafting an outline of the fieldwide modeling plan.
  - Began drafting an outline of the fieldwide modeling plan.
- Continued **Fort Nelson** site activities, including the following:
  - Held conference call with Spectra Energy to discuss Monte Carlo analysis conducted for the risk assessment report.
  - Finalized the confidential “2010 Subsurface Technical Risk Assessment” and transmitted the same on October 14, 2011, to Spectra Energy.

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

- Continued addressing Spectra’s comments on the deliverable submitted for its review, namely the Fort Nelson Test Site – Site Characterization, Modeling, and Monitoring Plan (D52).

### **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**

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

- Submitted D57 “Project Assessment Annual Report” for the period October 1, 2010 – September 30, 2011, on December 30, 2011, for review and approval. The report for the previous program year is available on the partners-only Web site ([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:

- Staff attended and presented at the New Horizons Oil and Gas Conference at the South Dakota School of Mines, including the following:
  - Participated in a panel discussion on CO<sub>2</sub>.
  - Gave a presentation entitled “PCOR Partnership: Investigating Carbon Management Options in North America's Interior Plains.”
- Hosted Bill Jackson, BillyJack Consulting, at the EERC on October 7.
- Coordinated and presented at the EERC’s Air Quality VIII preconference workshop on carbon management on October 23, 2011.
- Attended, presented, and coordinated two sessions at the EERC’s Air Quality VIII Conference in Arlington, Virginia, October 24–27, 2011 (<http://undeerc.org/aq8/eventschedule.aspx>).
- Held a monthly task leader meeting on October 17, 2011. Topics discussed included feedback from the annual meeting and plans for the 2012 meeting, the creation of an advisory board, upcoming visitors, budgets, proposals, deliverables, and updates from each task leader.
- Attended and presented at the “Storage in Saline Formations R&D Workshop” October 19–20, 2011, in Pittsburgh, Pennsylvania.
- Reviewed and submitted comments on a manuscript entitled “Impacts of Fluvial Sedimentary Heterogeneity on the Connectivity: Implications for Capacity Estimate of CO<sub>2</sub> Geological Storage” for the International Journal of Greenhouse Gas Control.
- Began discussions regarding the newly created PCOR Partnership Technical Advisory Board (TAB), including the following:
  - Created a new annual milestone (M36) for the scheduling of the TAB by the end of March each year.

- Held discussions regarding potential board member invites, meeting venues, and the TAB’s role and responsibility.
- Began preparations for the inaugural TAB meeting scheduled for February 2012.
- Submitted three papers by November 21 for the 2012 Carbon Management Technology Conference (CMTC), including the following:
  - (CMTC-151349-PP) “A Risk-Based Monitoring Plan for the Fort Nelson Feasibility Project”
  - (CMTC-151476-PP) “Integrating CO<sub>2</sub> EOR (enhanced oil recovery) and CO<sub>2</sub> Storage in the Bell Creek Oil Field”
  - (CMTC-151566-PP) “PCOR Partnership”
- Began work on two presentations and a poster for 2012 CMTC.
- Provided updates to the NETL PCOR Partnership Phase III fact sheet.
- Attended and presented at the Carbon Storage Program Infrastructure Annual Review Meeting November 14–17, 2011, in Pittsburgh, Pennsylvania.
- Held a task leader meeting on November 21, 2011. Topics discussed included upcoming conferences and abstract deadlines (11th Annual Conference on Carbon Capture, Utilization, and Storage; and GHGT-11) and updates from each task leader.
- Participated in a conference call with Big Sky Carbon Sequestration Partnership on December 6, 2011.
- Upon request from DOE, provided information on December 7, 2011, regarding tracers used at the Phase II geologic sites.
- Key EERC staff and UND President Robert Kelley traveled to the Bell Creek site to watch drilling efforts on December 21–22, 2011.
- EERC events staff traveled on December 6 and 7, 2011, to Milwaukee, Wisconsin, for planning purposes for the upcoming annual meeting.
- Selected Milwaukee, Wisconsin, as the site and September 11–13, 2012, for the dates for the 2012 annual meeting.
- Deliverables and milestones completed in October:
  - September monthly update
  - Task 13: D58/D59 – Quarterly Progress Report/Milestone Quarterly Report
  - Task 14: M23 – Monthly WWG Conference Call Held
- Deliverables and milestones completed in November:
  - October monthly update
  - Task 14: M23 – Monthly WWG Conference Call Held
- Deliverables and milestones completed in December:
  - November monthly update
  - Task 16: M34 – Basal Cambrian Static Geological Model Completed
  - Task 12: D57 – Project Assessment Annual Report
  - Task 4: M16 – Bell Creek Test Site – Initiation of Production and Injection Simulation

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

- All activities for Task 13 – Project Management are on schedule, and there were no problems or delays during the reporting period.

#### **Task 14 – RCSP WWG Coordination**

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

- Held the monthly conference calls on October 26 and November 30, 2011, and subsequently distributed the associated minutes. The requirement for a December conference call was waived by DOE.
- Discussed progress of NatCarb activities with staff from West Virginia University.
- Announced change in WWG administrative support from Heather Altepeter to Nola Pithey to the WWG members.
- Held conference call to discuss the needs and goals of the NatCarb brine database project.
- Continued internal review of Stakeholder Group Outreach Survey, and distributed the draft interest survey on December 12, 2011.
- Scheduled the January conference call for January 19, 2011.

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

- On December 15, 2009, DOE waived the requirement for the water resource estimation methodology documents due February 2010 and May 2011. The fact sheet submitted April 30, 2010, replaced the former. To replace the latter, the report entitled “Challenges and Opportunities in the Carbon Capture and Storage and Water Nexus: A Technology Gap Assessment” was submitted on September 23, 2011, and approved by DOE on November 21, 2011.

#### **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:

- Continued work on the modification of the dynamic model, and ran several simulations for obtaining an initial history match.
- Held an in-house discussion on the Zama simulation on November 2, 2011.
- Consultant (and former Apache employee) met with Apache personnel on November 24, 2011, in Calgary to discuss Zama project next steps. An update from that meeting is anticipated soon.
- Program management staff met with Apache Canada on December 13, 2011, in Calgary, Alberta, Canada.

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

- The EERC continues to be optimistic that efforts to initiate the seismic profiles, logging suites, and MVA activities will begin soon. They were originally slated to

begin in January 2011. Discussions with Apache Canada staff are ongoing with face-to-face meetings scheduled for January 2012. An extension to the task time line is one option under consideration.

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

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

- Obtained six plug samples and two additional chunks of the Deadwood Formation on October 13, 2011.
- Hosted visitors from Alberta Innovates – Technology Futures October 18 and 19, 2011, to discuss data integration concepts and work flow logistics. Visited the Wilson M. Laird Core Library on the UND campus.
- Presented a poster entitled “CO<sub>2</sub> Storage Characterization of the Basal Aquifer System in the Northern Plains – Prairie Region of North American” at the DOE Carbon Storage Program Infrastructure Annual Review Meeting on November 16 in Pittsburgh, Pennsylvania.
- Initial 2-D models have been developed. Project is progressing according to schedule and budget. Next step is to create 3-D models.
- Examined Deadwood Formation core from three wells. Resulting discussion focused on the similarities and differences between the basal sedimentary units in the central portion of the Williston Basin to those in the Alberta Basin and northern portions of the Williston Basin.
- Continued work on processing the information gathered from the visit to the Montana Board of Oil and Gas Conservation offices in Billings, Montana. The wireline logs that were scanned are now being digitized into LAS format.
- Work began on SEM and baseline permeability measurements for the characterization activities occurring on the formation.
- Held in-house project meetings on October 5 and 31 and November 10 and 28, 2011.
- Examination of previously unexamined boxes of core has revealed new rock that is suitable for taking samples for relative permeability tests. This effort will add nicely to the limited set of information available for the rocks of the Basal Cambrian system in North Dakota. Project is progressing according to schedule and budget.
- Continued work on SEM and baseline permeability measurements for the characterization activities occurring on the formation.
- Submitted M34: “Basal Cambrian Static Geological Model Completed” on December 21, 2011, for review and approval.

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

- Collection and analysis of the core plugs took longer than originally anticipated; however, the overall development of the 3-D model should not be delayed.

## PHASE III COST STATUS

The approved BP4 (Modification No. 21) budget along with actual costs incurred and in-kind cost share reported are shown in Table 3. A spending plan for BP4 and actual incurred cost by quarter of cash funds for BP4 are provided in Figure 5 and Table 4.

## 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 5 and 6).

**Table 3. Phase III Budget – BP4**

Organization	Approved Budget, \$	Actual Costs Incurred, \$
DOE Share – Cash*	55,979,431	14,506,115
Nonfederal Share – Cash	2,411,971	1,222,584
Nonfederal Share – In-Kind	17,400,865	17,025,586
Total	75,792,267	32,754,285

\*Does not include \$1.5M for environmental impact statement.

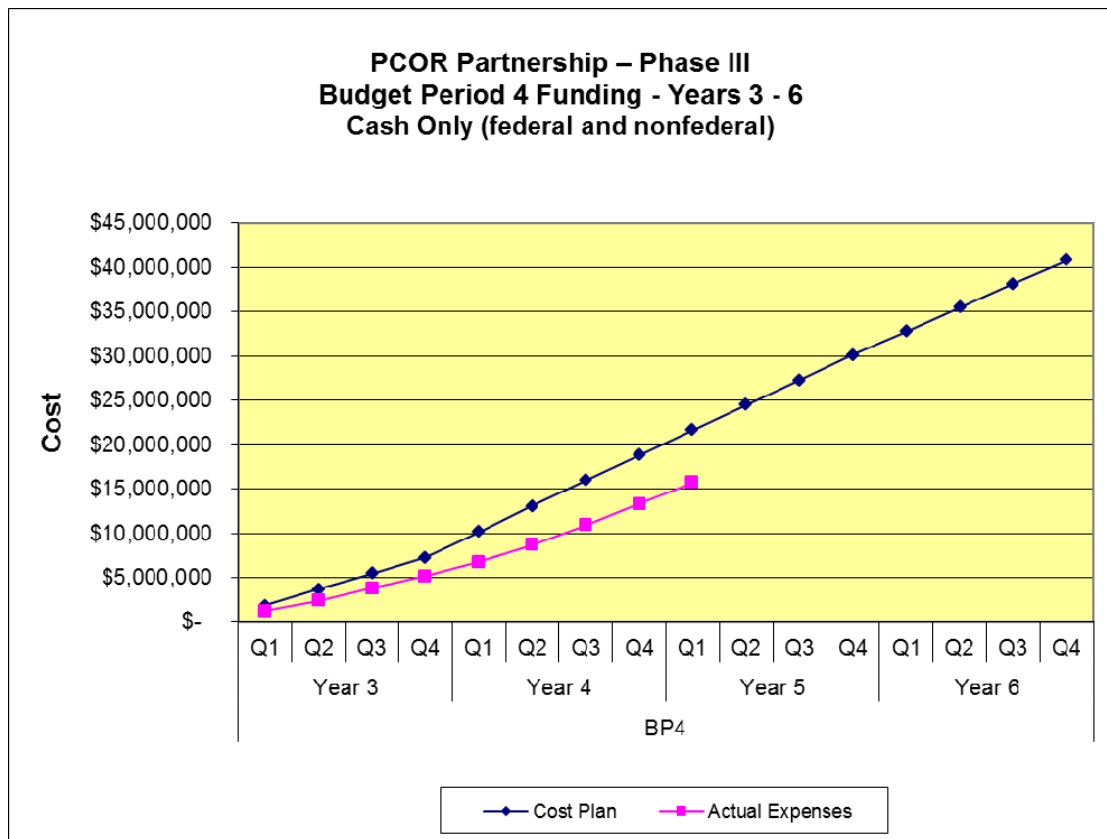


Figure 5. PCOR Partnership Phase III, BP4 – Years 3–6 funding (cash only).



**Table 4. BP4 – Years 3–6 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	\$ 1,982,465	\$ 10,087,168	\$ 2,163,678	\$ 12,250,846
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	\$ 257,142	\$ 810,302	\$ 251,531	\$ 1,061,833
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	\$ 2,239,607	\$ 10,897,470	\$ 2,415,209	\$ 13,312,679
<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	\$ 725,159	\$ 4,807,579	\$ 543,946	\$ 5,351,525
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	\$ (79,498)	\$ 233,569	\$ (73,887)	\$ 159,682
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	\$ 645,661	\$ 5,041,148	\$ 470,059	\$ 5,511,207

Baseline Reporting Quarter	Year 5								Year 6							
	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	\$ 2,671,493	\$ 20,273,864	\$ 2,671,493	\$ 22,945,356	\$ 2,671,493	\$ 25,616,849	\$ 2,671,493	\$ 28,288,341	\$ 2,532,430	\$ 30,820,771	\$ 2,532,430	\$ 33,353,201	\$ 2,532,430	\$ 35,885,630	\$ 2,532,430	\$ 38,418,060
NonFederal Share	\$ 152,429	\$ 1,373,944	\$ 152,429	\$ 1,526,373	\$ 152,429	\$ 1,678,802	\$ 152,429	\$ 1,831,231	\$ 145,185	\$ 1,976,416	\$ 145,185	\$ 2,121,601	\$ 145,185	\$ 2,266,786	\$ 145,185	\$ 2,411,971
Total Planned	\$ 2,823,922	\$ 21,647,808	\$ 2,823,922	\$ 24,471,729	\$ 2,823,922	\$ 27,295,651	\$ 2,823,922	\$ 30,119,572	\$ 2,677,615	\$ 32,797,187	\$ 2,677,615	\$ 35,474,802	\$ 2,677,615	\$ 38,152,416	\$ 2,677,615	\$ 40,830,031
<b>Actual Incurred Cost</b>																
Federal Share	\$ 2,255,269	\$ 14,506,115														
NonFederal Share	\$ 160,751	\$ 1,222,584														
Total Incurred Cost	\$ 2,416,020	\$ 15,728,699														
<b>Variance</b>																
Federal Share	\$ 416,224	\$ 5,767,749														
NonFederal Share	\$ (8,322)	\$ 151,360														
Total Variance	\$ 407,902	\$ 5,919,109														

**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	4/21/11
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	4/30/11	4/29/11
D88: Task 13 – Programmatic Risk Management Plan	4/30/11	4/29/11
D17: Task 2 – General Phase III Information PowerPoint Presentation (Update)	5/31/11	5/31/11
D34: Task 4 – Bell Creek Test Site – Baseline Hydrogeological Final Report	5/31/11	5/31/11
M23: Task 14 – Monthly WWG Conference Call Held	5/31/11	5/5/11
D19: Task 2 – Fort Nelson Test Site PowerPoint Presentation (Update)	6/30/11	6/30/11
M23: Task 14 – Monthly WWG Conference Call Held	6/30/11	6/23/11
M24: Task 14 – WWG Annual Meeting Held	6/30/11	5/5/11
<b>Year 4 – Quarter 4 (July–September 2011)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	7/31/11	7/28/11
M23: Task 14 – Monthly WWG Conference Call Held	7/31/11	7/26/11
D29: Task 3 – Permitting Action Plan	8/31/11	8/31/11
D66: Task 9 – Bell Creek Test Site – Simulation Report	8/31/11	8/31/11
D67: Task 9 – Fort Nelson Test Site – Simulation Report	7/31/11	8/31/11
M23: Task 14 – Monthly WWG Conference Call Held	8/31/11	8/24/11
D1: Task 1 – Review of Source Attributes	9/30/11	9/21/11
D4: Task 1 – Permitting Review – Basic EPA Requirements <sup>+</sup>	9/30/11	9/30/11
D9: Task 1 – Updated DSS	9/30/11	9/23/11
D25: Task 2 – Bell Creek Test Site Poster	9/30/11	9/30/11
D50: Task 9 – Bell Creek Test Site – Site Characterization, Modeling, and Monitoring Plan	9/30/11	9/30/11
M23: Task 14 – Monthly WWG Conference Call Held	9/30/11	Waived by DOE
M31: Task 9 – Bell Creek Test Site – Site Characterization, Modeling, and Monitoring Plan Completed	9/30/11	9/30/11
M33: Task 16 – Basal Cambrian Baseline Geological Characterization Completed	9/30/11	9/29/11

<sup>+</sup> Name change requested September 28, 2011, and approved October 3, 2011.

Continued . . .

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

<b>Title/Description</b>	<b>Due Date</b>	<b>Actual Completion Date</b>
<b>Year 5 – Quarter 1 (October–December 2011)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	10/31/11	10/31/11
M23: Task 14 – Monthly WWG Conference Call Held	10/31/11	10/26/11
M23: Task 14 – Monthly WWG Conference Call Held	11/30/11	11/30/11
D57: Task 12 – Project Assessment Annual Report	12/31/11	12/30/11
M23: Task 14 – Monthly WWG Conference Call Held	12/31/11	Waived by DOE
M34: Task 16 – Basal Cambrian Static Geological Model Completed	12/31/11	12/21/11
<b>Year 5 – Quarter 2 (January–March 2012)</b>		
M16: Task 4 – Bell Creek Test Site – Initiation of Production and Injection Simulation	1/13/12	12/29/11
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	1/31/12	
D65: Task 4 – Fort Nelson Test Site – Site Characterization Report	1/31/12	
D81: Task 1 – Regional Carbon Sequestration Atlas (Update)	1/31/12	
M23: Task 14 – Monthly WWG Conference Call Held	1/31/12	
M29: Task 4 – Fort Nelson Site Characterization Report Completed	1/31/12	
D91: Task 16 – Report – Geological Characterization of the Basal Cambrian System in the Williston Basin	2/29/12	
M23: Task 14 – Monthly WWG Conference Call Held	2/29/12	
D5: Task 1 – Second Target Area Completed	3/31/12	
D18: Task 2 – Bell Creek Test Site PowerPoint Presentation (Update)	3/31/12	
M10: Task 4 – Bell Creek Test Site Wellbore Leakage Data Collection Completed	3/31/12	
M23: Task 14 – Monthly WWG Conference Call Held	3/31/12	
<b>Year 5 – Quarter 3 (April–June 2012)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	4/30/12	
D41: Task 4 – Fort Nelson Test Site – Geochemical Final Report	4/30/12	
M32: Task 4 – Fort Nelson Geochemical Final Report Completed	4/30/12	
D86: Task 15 – Updated Regional Implementation Plan for Zama	4/30/12	
M23: Task 14 – Monthly WWG Conference Call Held	4/30/12	
D17: Task 2 – General Phase III Information PowerPoint Presentation (Update)	5/31/12	
M23: Task 14 – Monthly WWG Conference Call Held	5/31/12	

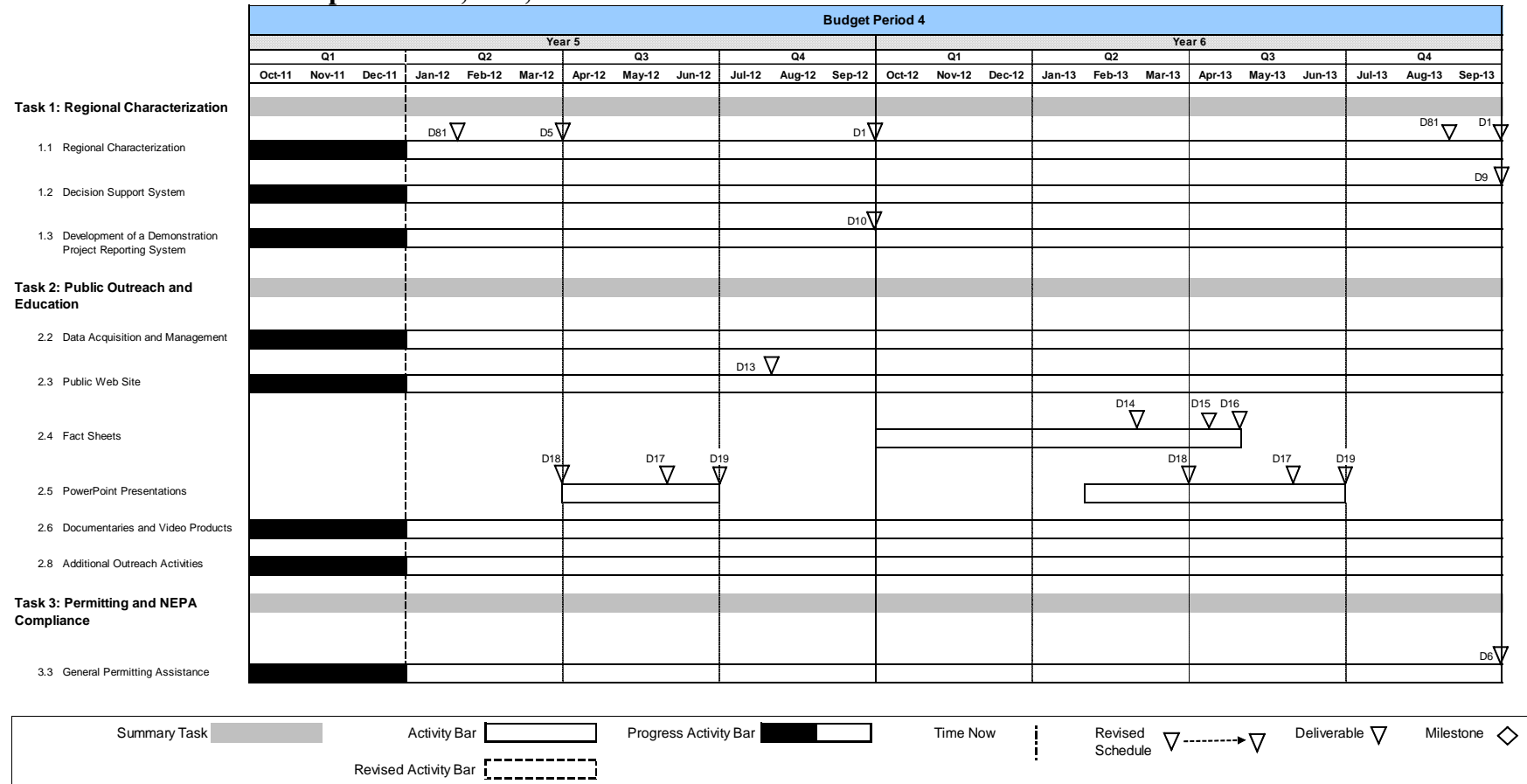
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**Table 5. Phase III Milestones and Deliverables (continued)**

<b>Title/Description</b>	<b>Due Date</b>	<b>Actual Completion Date</b>
<b>Year 5 – Quarter 3 (April–June 2012) (continued)</b>		
D19: Task 2 – Fort Nelson Test Site PowerPoint Presentation (Update)	6/30/12	
D84: Task 6 – Report – A Phased Approach to Building Pipeline Network for CO <sub>2</sub> Transportation During CCS	6/30/12	
M23: Task 14 – Monthly WWG Conference Call Held	6/30/12	
M24: Task 14 – WWG Annual Meeting Held	6/30/12	
<b>Year 5 – Quarter 4 (July–September 2012)</b>		
D13: Task 2 – Public Site Updates	7/31/12	
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	7/31/12	
D67: Task 9 – Fort Nelson Test Site – Simulation Report	7/31/12	
M23: Task 14 – Monthly WWG Conference Call Held	7/31/12	
D66: Task 9 – Bell Creek Test Site – Simulation Report	8/31/12	
M23: Task 14 – Monthly WWG Conference Call Held	8/31/12	
D1: Task 1 – Review of Source Attributes	9/30/12	
D10: Task 1 – DPRS Update	9/30/12	
D42: Task 5 – Bell Creek Test Site – Injection Experimental Design Package	9/30/12	
D64: Task 4 – Bell Creek Test Site – Site Characterization Report	9/30/12	
D82: Task 6 –Report – Issues Associated with Integration of Advanced Compression Technology into a CO <sub>2</sub> Storage Project	9/30/12	
M23: Task 14 – Monthly WWG Conference Call Held	9/30/12	
<b>Year 6 – Quarter 1 (October–December 2012)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	10/31/12	
M23: Task 14 – Monthly WWG Conference Call Held	10/31/12	
D79: Task 14 – Water Resource Estimation Methodology Document	11/30/12	
M23: Task 14 – Monthly WWG Conference Call Held	11/30/12	
D57: Task 12 – Project Assessment Annual Report	12/31/12	
M23: Task 14 – Monthly WWG Conference Call Held	12/31/12	

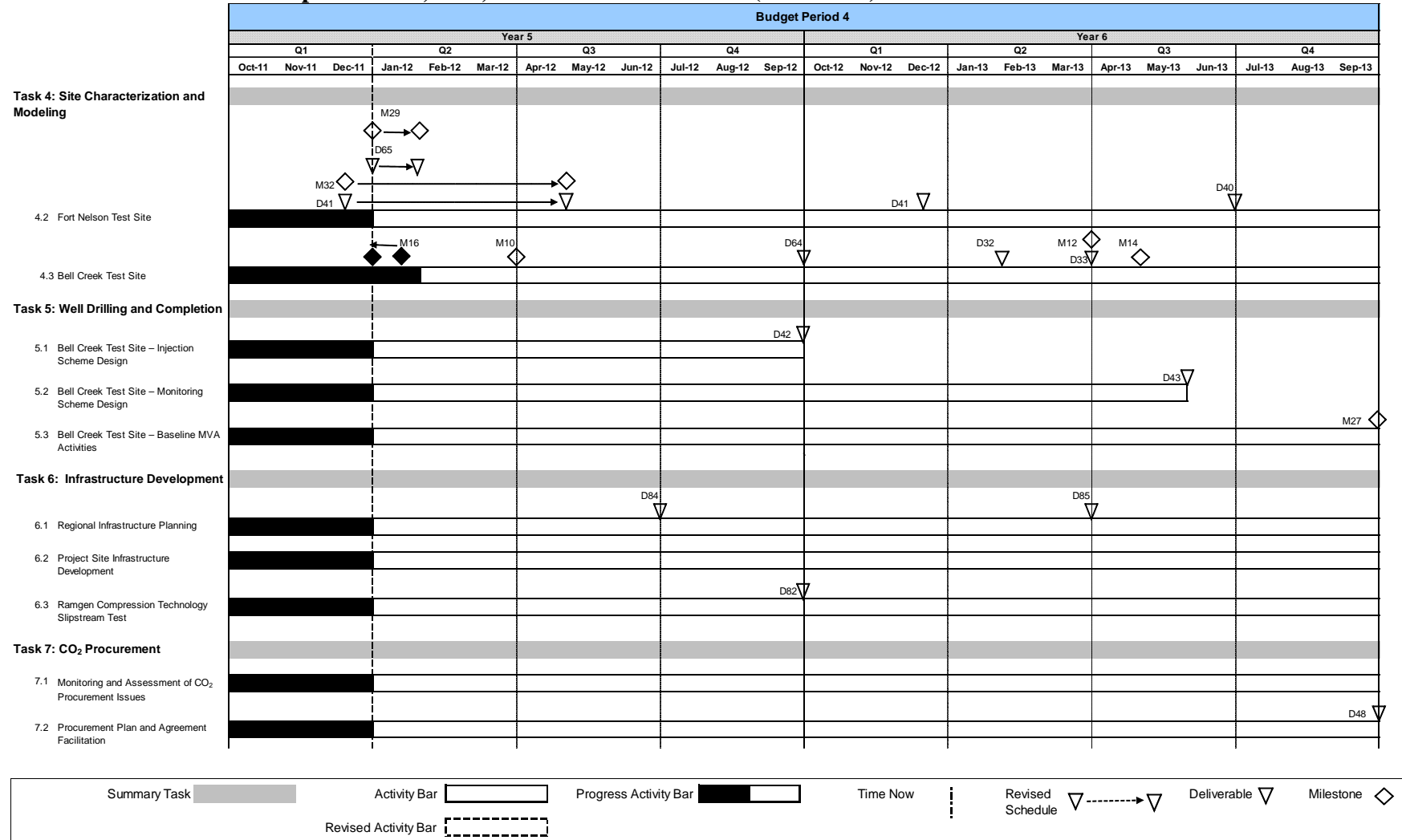


**Table 6. PCOR Partnership Phase III, BP4, Years 3–4 Gantt Chart**



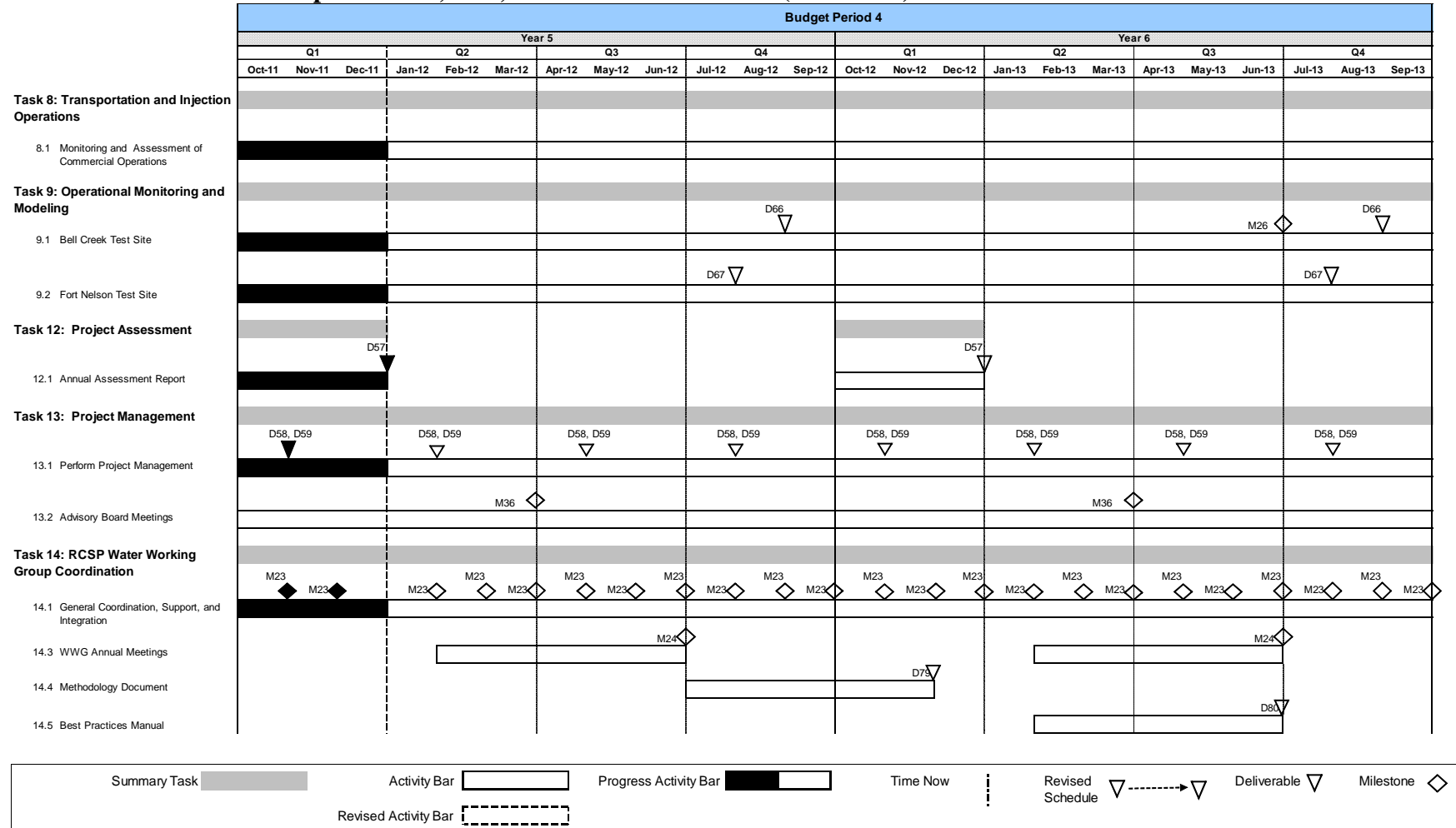
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Table 6. PCOR Partnership Phase III, BP4, Years 3–4 Gantt Chart (continued)



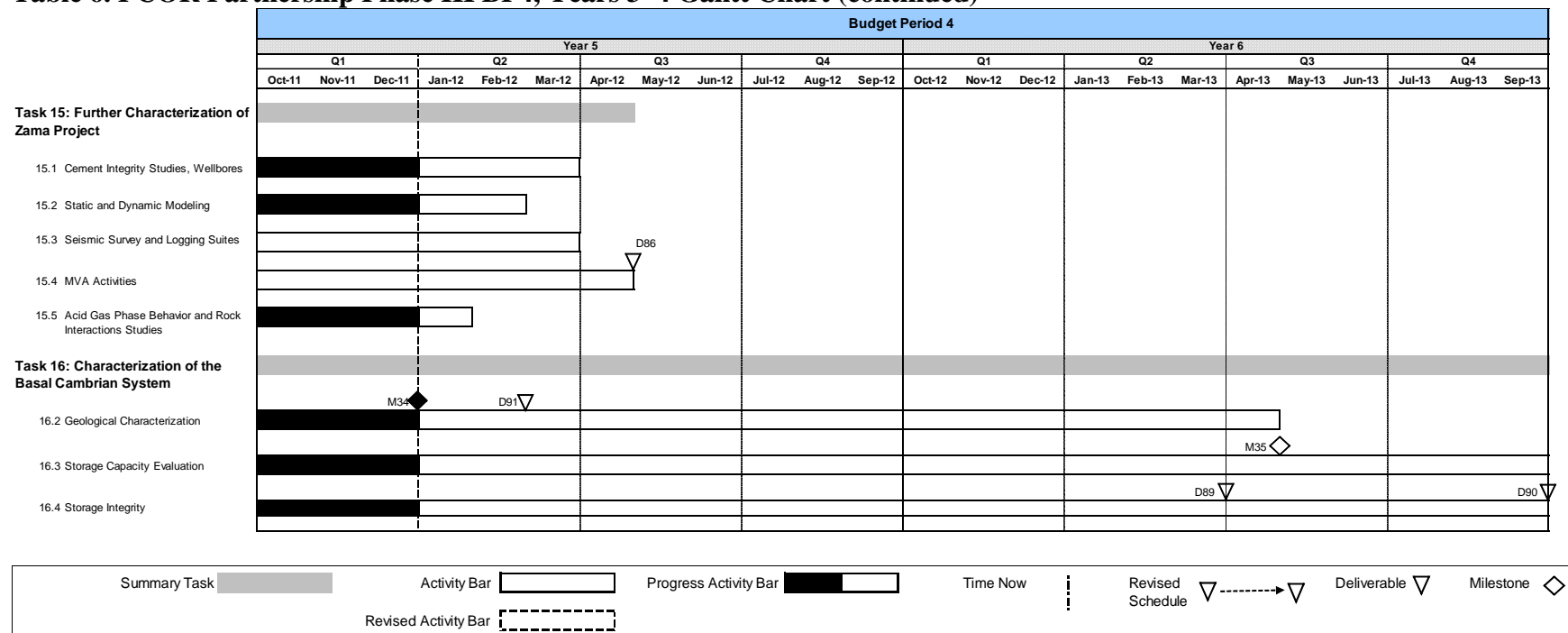
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Table 6. PCOR Partnership Phase III, BP4, Years 3–4 Gantt Chart (continued)



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



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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	D58	Quarterly Progress Report
D5	Second Target Area Completed	D59	Milestone Quarterly Report
D6	Permitting Review – Update	D64	BC Test Site – Site Characterization Report
D9	Updated DSS	D65	FN Test Site – Site Characterization Report
D10	DPRS Update	D66	BC Test Site – Simulation Report
D13	Public Site Updates	D67	FN Test Site – Simulation Report
D14	General Phase III Fact Sheet	D79	Report – Water Resource Estimation Methodology
D15	BC Test Site Fact Sheet	D80	Best Practices Manual – Nexus of Water and Carbon Storage Activities
D16	Fort Nelson Test Site Fact Sheet	D81	Regional Carbon Sequestration Atlas
D17	General Phase III Information PowerPoint Presentation	D82	Report – Issues Associated with Integration of Advanced Compression Technology into a CO <sub>2</sub> Storage Project
D18	BC Test Site PowerPoint Presentation	D84	Report – A Phased Approach to Building Pipeline Network for CO <sub>2</sub> Transportation During CCS
D19	FN Test Site PowerPoint Presentation	D85	Report – Opportunities and Challenges Associated with CO <sub>2</sub> Compression and Transportation During CCS Activities
D32	BC Test Site – Geomechanical Final Report	D86	Updated Regional Technology Implementation Plan for Zama
D33	BC Test Site – Geochemical Final Report	D89	Report – Geochemical Evaluation of the Basal Cambrian System
D40	FN Test Site – Geomechanical Report	D90	Report – Wellbore Evaluation of the Basal Cambrian System
D41	FN Test Site – Geochemical Report	D91	Report – Geological Characterization of the Basal Cambrian System in the Williston Basin
D42	BC Test Site – Injection Experimental Design Package		
D43	BC Test Site – Monitoring Experimental Design Package		
D48	BC Test Site – Procurement Plan and Agreement Report		
D57	Project Assessment Annual Report		
		M10	BC Test Site – Wellbore Leakage Data Collection Completed
		M12	BC Test Site – Geochemical Work Completed
		M14	BC Test Site – Geological Characterization Data Collection Completed
		M16	BC Test Site – Initiation of Production and Injection Simulations
		M23	Monthly WWG Conference Call Held
		M24	WWG Annual Meeting Held
		M26	BC Test Site – CO <sub>2</sub> Injection Initiated
		M27	BC Test Site – MVA Equipment Installation and Baseline MVA Activities Completed
		M29	FN Test Site – Site Characterization Report Completed
		M32	Fort Nelson – Geochemical Report Completed
		M34	Basal Cambrian Static Geological Model Completed
		M35	Basal Cambrian Dynamic Capacity Estimation Completed
		M36	Annual Advisory Board Meeting Scheduled

## PHASE III PRODUCTS OR TECHNOLOGY TRANSFER ACTIVITIES

During the reporting period, there were four abstracts accepted for presentation and 23 presentations given at 12 different meetings/conferences. In addition, a quarterly progress report, one deliverable, nine milestones were completed, and 10 deliverables/milestones were finalized.

### Abstracts

#### *Submitted and Accepted for Presentation*

Steadman, E.N., Harju, J.A., Gorecki, C.D., and Anagnost, K.K., 2011, The Plains CO<sub>2</sub> Reduction (PCOR) Partnership—progressing geologic storage through applied research [abs.]: 2012 Carbon Management Technology Conference, Orlando, Florida, February 7–9, 2012.

#### *Accepted for Presentation*

Gorecki, C.D., Hamling, J.A., Steadman, E.N., and Harju, J.A., 2011, Integrating CO<sub>2</sub> EOR and CO<sub>2</sub> storage in the Bell Creek oil field [abs.]: 2012 Carbon Management Technology Conference, Orlando, Florida, February 7–9, 2012.

Gorecki, C.D., Sorensen, J.A., Klapperich, R.J., Botnen, L.S., Steadman, E.N., and Harju, J.A., 2011, A risk-based monitoring plan for the Fort Nelson CCS project [abs.]: 2012 Carbon Management Technology Conference, Orlando, Florida, February 7–9, 2012.

Knudsen, D.J., Peck, W.D., and Bachu, S., 2011, CO<sub>2</sub> storage characterization of the basal aquifer system in the northern Great Plains prairie region of North America [abs.]: American Association of Petroleum Geologists (AAPG) 2012 Annual Convention & Exhibition, Long Beach, California, April 22–25, 2012.

Knudsen, D.J., Saini, D., Gorecki, C.D., Peck, W.D., Sorensen, J.A., Steadman, E.N., and Harju, J.A., 2011, Using multiple-point statistics for conditioning a Zama pinnacle reef facies model to production history [abs.]: American Association of Petroleum Geologists (AAPG) 2012 Annual Convention & Exhibition, Long Beach, California, April 22–25, 2012.

### Presentations

Botnen, L.S., Gorecki, C.D., Steadman, E.N., and Harju, J.A., 2011, Plains CO<sub>2</sub> Reduction (PCOR) Partnership: Presented to the Public Lands Committee at the 2011 Interstate Oil and Gas Compact Commission Annual Meeting, Buffalo, New York, October 17–18, 2011.

Braunberger, J.R., 2011, Geographic information systems in the PCOR Partnership: Lecture presented at North Dakota State University, Fargo, North Dakota, December 7, 2011.

- Braunberger, J.R., 2011, Overview of geologic CO<sub>2</sub> storage—focus on PCOR: Presented at the Nebraska Public Power District/Nebraska Department of Environmental Quality (NPPD/NDEQ) Power Summit, Lincoln, Nebraska, November 16, 2011.
- Braunberger, J.R., 2011, Rival geologic model update: Presented to TAQA North Ltd. personnel, Grand Forks, North Dakota, October 21, 2011.
- Braunberger, J.R., 2011, Rival modeling and simulation – proposed path forward: Presented to TAQA North Ltd. personnel, Grand Forks, North Dakota, October 21, 2011.
- Bremer, J.M., 2011, Grenora Field geomechanics: Presented to TAQA North Ltd. personnel, Grand Forks, North Dakota, October 20, 2011.
- Bremer, J.M., 2011, Rival Field laboratory analysis: Presented to TAQA North Ltd. personnel, Grand Forks, North Dakota, October 21, 2011.
- Gorecki, C.D., 2011, An overview of CO<sub>2</sub> storage capacity estimation, *in* Proceedings of Air Quality VIII: An International Conference on Carbon Management, Mercury, Trace Substances, SO<sub>x</sub>, NO<sub>x</sub>, and Particulate Matter: Arlington, Virginia, October 24–27, 2011.
- Gorecki, C.D., 2011, Plains CO<sub>2</sub> Reduction (PCOR) Partnership update: Presented at the 2011 Carbon Storage Program Infrastructure Annual Review Meeting, Pittsburgh, Pennsylvania, November 15–17, 2011.
- Gorecki, C.D., 2011, Plains CO<sub>2</sub> Reduction (PCOR) Partnership—large-scale demonstration projects in the central interior of North America, *in* Proceedings of Air Quality VIII: An International Conference on Carbon Management, Mercury, Trace Substances, SO<sub>x</sub>, NO<sub>x</sub>, and Particulate Matter: Arlington, Virginia, October 24–27, 2011.
- Gorecki, C.D., 2011, Quantifying and enhancing CO<sub>2</sub> storage capacity: Presented at the Storage in Saline Formations R&D Workshop, Pittsburgh, Pennsylvania, October 19–20, 2011.
- Jensen, M.D., 2011, Overview of CO<sub>2</sub> capture research by the Plains CO<sub>2</sub> Reduction Partnership and the Partnership for CO<sub>2</sub> Capture: Presented at the Nebraska Public Power District/Nebraska Department of Environmental Quality (NPPD/NDEQ) Power Summit, Lincoln, Nebraska, November 16, 2011.
- Melzer, S., 2011, CO<sub>2</sub> enhanced oil recovery, *in* Proceedings of Air Quality VIII: An International Conference on Carbon Management, Mercury, Trace Substances, SO<sub>x</sub>, NO<sub>x</sub>, and Particulate Matter Preconference Workshops: Arlington, Virginia, October 23, 2011.
- Melzer, S., Harju, J.A., Steadman, E.N., and Pavlish, B.M., 2011, CO<sub>2</sub> separation and capture—status, challenges, and opportunities, *in* Proceedings of Air Quality VIII: An International Conference on Carbon Management, Mercury, Trace Substances, SO<sub>x</sub>, NO<sub>x</sub>, and Particulate Matter Preconference Workshops: Arlington, Virginia, October 23, 2011.

Saini, D., 2011, Energy & Environmental Research Center modeling overview: Presented at the Energy & Environmental Research Center Internal Modeling Group Meeting, Grand Forks, North Dakota, October 7, 2011.

Schmidt, D.D., 2011, Carbon capture and storage (CCS) research at the EERC: Presented at the 2011 New Horizons in Oil and Gas Conference, Rapid City, South Dakota, October 5–8, 2011.

Schmidt, D.D., 2011, Plains CO<sub>2</sub> Reduction (PCOR) Partnership update: Presented at the 2011 New Horizons Oil and Gas Conference, Rapid City, South Dakota, October 5–8, 2011.

Steadman, E.N., 2011, Carbon capture and storage research at the EERC: Presented at the Lions Service Club Breakfast Meeting, Grand Forks, North Dakota, October 4, 2011.

Steadman, E.N., 2011, Carbon management, *in* Proceedings of Air Quality VIII: An International Conference on Carbon Management, Mercury, Trace Substances, SO<sub>x</sub>, NO<sub>x</sub>, and Particulate Matter Preconference Workshops: Arlington, Virginia, October 23, 2011.

Steadman, E.N., 2011, The impact of carbon management on future utilities: Presented at the CoBPA Mellem Business Symposium, Grand Forks, North Dakota, October 18, 2011.

Steadman, E.N., 2011, Plains CO<sub>2</sub> Reduction (PCOR) Partnership update: Presented to SaskPower personnel, Regina, Saskatchewan, October 13, 2011.

Steadman, E.N., and Botnen, L.S., 2011, Regulatory environment, *in* Proceedings of Air Quality VIII: An International Conference on Carbon Management, Mercury, Trace Substances, SO<sub>x</sub>, NO<sub>x</sub>, and Particulate Matter Preconference Workshops: Arlington, Virginia, October 23, 2011.

Steadman, E.N., and Harju, J.A., 2011, Carbon management strategies, *in* Proceedings of Air Quality VIII: An International Conference on Carbon Management, Mercury, Trace Substances, SO<sub>x</sub>, NO<sub>x</sub>, and Particulate Matter Preconference Workshops: Arlington, Virginia, October 23, 2011.

### **Posters Presentations**

Daly, D.J., Bradbury, J., Garrett, G., Greenberg, S., Myhre, R., Peterson, T., Tollefson, L., Wade, S., and Sacuta, N., 2011, Outreach best practices—a practical foundation for the future: Poster presented at the SPE International Forum: CO<sub>2</sub> Geological Storage: Will We Be Ready in Time?, Faro, Portugal, October 7–14, 2011.

Peck, W.D., Knudsen, D.J., Bachu, S., and Hauck, T., 2011, CO<sub>2</sub> storage characterization of the basal aquifer system in the northern Great Plains – prairie region of North America: Poster presented at the Carbon Storage Program Infrastructure Annual Review Meeting, Pittsburgh, Pennsylvania, November 15–17, 2011.



## **Deliverables/Milestones**

### ***Draft***

Pu, H., Hamling, J.A., Gorecki, C.D., and Steadman, E.N., 2012, Bell Creek test site initiation of production and injection simulation: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III draft Milestone M16 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.

Gorecki, C.D., Harju, J.A., Steadman, E.N., Romuld, L., Sorensen, J.A., Botnen, L.S., Daly, D.J., Jensen, M.D., Peck, W.D., Smith, S.A., Hamling, J.A., Klapperich, R.J., Anagnost, K.K., and Votava, T.J., 2011, Annual assessment report: Plains CO<sub>2</sub> Reduction Partnership Phase III draft Task 12 Deliverable D57 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.

Peck, W.D., Knudsen, D.J., Gorecki, C.D., and Steadman, E.N., 2011, Basal Cambrian static geological model completed: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III draft Task 16 Milestone M34 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.

### ***Approved***

Botnen, B.W., Klapperich, R.J., Gorecki, C.D., and Steadman, E.N., 2011, Bell Creek test site – hydrogeological experimental design package: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III Task 4 Deliverable D34 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, EERC Publication 2011-EERC-10-03, Grand Forks, North Dakota, Energy & Environmental Research Center, May.

Botnen, L.S., Gorecki, C.D., and Steadman, E.N., 2011, Permitting action plan: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III Task 3 Deliverable D29 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, EERC Publication 2011-EERC-10-05, Grand Forks, North Dakota, Energy & Environmental Research Center, August.

Botnen, L.S., Gorecki, C.D., and Steadman, E.N., 2011, Permitting review – basic EPA requirements: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III Task 3 Deliverable D4 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, EERC Publication 2011-EERC-10-13, Grand Forks, North Dakota, Energy & Environmental Research Center, September.

Buckley, T.D., Peck, W.D., Gorecki, C.D., and Steadman, E.N., 2011, Decision Support System Web site update: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III Task 1 Deliverable D9

Update 2 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, EERC Publication 2011-EERC-10-09, Grand Forks, North Dakota, Energy & Environmental Research Center, September.

Daly, D.J., Gorecki, C.D., and Steadman, E.N., 2011, Bell Creek integrated CO<sub>2</sub> EOR and storage project: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III 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., Hamling, J.A., Gorecki, C.D., Crocker, C.R., and Steadman, E.N., 2011, CO<sub>2</sub> emissions go to work to produce more oil: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III Task 2 Deliverable D25 poster for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, Grand Forks, North Dakota, Energy & Environmental Research Center, September.

Hamling, J.A., Klapperich, R.J., Bremer, J.M., Gorecki, C.D., Steadman, E.N., and Harju, J.A., 2011, Bell Creek test site – characterization, modeling, and monitoring plan: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III Task 9 Deliverable D50 and Milestone M31 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, EERC Publication 2011-EERC-11-05, Grand Forks, North Dakota, Energy & Environmental Research Center, September.

Jensen, M.D., Pei, P., Peck, W.D., Gorecki, C.D., and Steadman, E.N., 2011, Review of source attributes: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III Task 1 Deliverable D1 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05BT42592, EERC Publication 2011-EERC-10-08, Grand Forks, North Dakota, Energy & Environmental Research Center, September.

Peck, W.D., Sorensen, J.A., Gorecki, C.D., and Steadman, E.N., 2011, Basal Cambrian geological characterization completed: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III Task 16 Milestone M33 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, EERC Publication 2011-EERC-10-10, Grand Forks, North Dakota, Energy & Environmental Research Center, September.

Sorensen, J.A., Smith, S.A., Gorecki, C.D., 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 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, EERC Publication 2011-EERC-10-04, Grand Forks, North Dakota, Energy & Environmental Research Center, January.

## **Progress Reports**

### ***Monthlies***

Gorecki, C.D., Steadman, E.N., Peck, W.D., Daly, D.J., Botnen, L.S., Sorensen, J.A., Hamling, J.A., Jensen, M.D., Harju, J.A., Anagnost, K.K., and Klapperich, R.J., 2011, Plains CO<sub>2</sub> Reduction (PCOR) Partnership: Phase III monthly report (November 1–30, 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, December.

Gorecki, C.D., Steadman, E.N., Peck, W.D., Daly, D.J., Botnen, L.S., Sorensen, J.A., Hamling, J.A., Jensen, M.D., Harju, J.A., Anagnost, K.K., and Klapperich, R.J., 2011, Plains CO<sub>2</sub> Reduction (PCOR) Partnership: Phase III monthly report (October 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, November.

Gorecki, C.D., Steadman, E.N., Peck, W.D., Daly, D.J., Botnen, L.S., Sorensen, J.A., Hamling, J.A., Jensen, M.D., Harju, J.A., Anagnost, K.K., and Klapperich, R.J., 2011, Plains CO<sub>2</sub> Reduction (PCOR) Partnership: Phase III monthly report (September 1–30, 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, September.

### ***Quarterlies***

Gorecki, C.D., Harju, J.A., Steadman, E.N., Romuld, L., Sorensen, J.A., Botnen, L.S., Daly, D.J., Hamling, J.A., Jensen, M.D., Peck, W.D., Klapperich, R.J., Anagnost, K.K., and Votava, T.J., 2011, Plains CO<sub>2</sub> Reduction Partnership Phase III: Task 13 Deliverable D58/59 quarterly technical progress report (July 1 – September 30, 2011) 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, October.

## **Other Technical Reports**

Bremer, J.M., Lindeman, C.D., LaBonte, J.L., Huffman, B.W., Mibeck, B.A.F., and Smith, S.A., 2011, Rival Field petrographic and physical analysis, October 2011: Plains CO<sub>2</sub> Reduction Partnership Phase III Technical report for TAQA North Ltd., Grand Forks, North Dakota, Energy & Environmental Research Center, November.

Botnen, L.S., Sorensen, J.A., Gorecki, C.D., Smith, S.A., Liu, G., Holubnyak, Y.I., LaBonte, J.L., Steadman, E.N., Harju, J.A., Nakles, D., and Azzolina, N., 2011, Fort Nelson carbon capture and storage project—2010 subsurface technical risk assessment: Confidential report

for Spectra Energy, EERC Publication 2011-EERC-10-02, Grand Forks, North Dakota, Energy & Environmental Research Center, October.

### **Meeting Minutes**

Klapperich, R.J., 2011, Minutes—Regional Carbon Sequestration Partnership Water Working Group conference call: November 30.

Klapperich, R.J., 2011, Minutes—Regional Carbon Sequestration Partnership Water Working Group conference call: October 26.

### **Other**

Gorecki, C.D., Hamling, J.A., Klapperich, R.J., Steadman, E.N., and Harju, J.A., 2012, Integrating CO<sub>2</sub> EOR and CO<sub>2</sub> storage in the Bell Creek oil field: Paper to be presented at the 2012 Carbon Management Technology Conference, Orlando, Florida, February 7–9, 2012.

Gorecki, C.D., Sorensen, J.A., Klapperich, R.J., Botnen, L.S., Steadman, E.N., and Harju, J.A., 2011, A risk-based monitoring plan for the Fort Nelson feasibility project: Paper to be presented at the 2012 Carbon Management Technology Conference, Orlando, Florida, February 7–9, 2012.

Steadman, E.N., Harju, J.A., Gorecki, C.D., and Anagnost, K.K., 2012, The Plains CO<sub>2</sub> Reduction (PCOR) Partnership—progressing geologic storage through applied research: Paper to be presented at the 2012 Carbon Management Technology Conference, Orlando, Florida, February 7–9, 2012.

## **MEETINGS/TRAVEL**

Representatives from the PCOR Partnership attended and/or participated in the following 15 meetings/conferences, six training opportunities, and nine project management site trips in this reporting period:

- October 2–7, 2011: Participated in a PetroSkills course entitled “CO<sub>2</sub> Surface Facilities” in Midland, Texas.
- October 5–13, 2011: Attended Computer Modelling Group training courses (2 days each) entitled “CMOST” and “CO<sub>2</sub> Sequestration with GEM” in Houston, Texas.
- October 7, 2011: Presented at the New Horizons Oil and Gas Conference at the South Dakota School of Mines in Rapid City, South Dakota.
- October 7–15, 2011: Presented at the SPE Forum “CO<sub>2</sub> Geological Storage: Will We Be Ready in Time?” held in The Algarve, Portugal.
- October 10, 2011: Participated in the PPB master teacher training group in Fargo, North Dakota.
- October 11–13, 2011: Attended the 2011 North Dakota GIS Users Conference in Grand Forks, North Dakota.

- October 15–18, 2011: Attended the IOGCC Annual Meeting and the PCOR Partnership Regulatory Group breakfast meeting in Buffalo, New York.
- October 16–19, 2011: Attended Schlumberger’s training course entitled “Petrel Fracture Modeling” in Houston, Texas.
- October 18–20, 2011: Presented at the Storage in Saline Formations R&D Workshop in Pittsburgh, Pennsylvania.
- October 20–21, 2011: Attended the Education Minnesota Professional Conference in Minneapolis, Minnesota.
- October 22–27, 2011: Participated in Air Quality VIII: An International Conference on Carbon Management, Mercury, Trace Substances, SO<sub>x</sub>, NO<sub>x</sub>, and Particulate Matter, and the preconference Carbon Management Workshop in Arlington, Virginia.
- October 28 – November 13, 2011: Traveled for soil gas and groundwater sampling to the Bell Creek oil field in Montana.
- November 7–10, 2011: Attended the Midwest Geological Sequestration Consortium Science Conference in Champaign, Illinois.
- November 14, 2011: Traveled to the Lignite field validation site near Kenmare, North Dakota.
- November 14–17, 2011: Attended Computer Modelling Group’s “Unconventional Gas Modelling with IMEX and GEM” in Houston, Texas.
- November 14–17, 2011: Participated in the Carbon Storage Program Infrastructure Annual Review Meeting held in Pittsburgh, Pennsylvania.
- November 14–20, 2011: Visited the Montana Board of Oil & Gas Conservation to scan well logs in Billings, Montana.
- November 15–17, 2011: Presented at NPPD Power Summit in Lincoln, Nebraska.
- November 27 – December 3, 2011: Traveled to the Bell Creek test site area for continued baseline sampling.
- November 28 – December 1, 2011: Attended the National Ground Water Association Ground Water Expo in Las Vegas, Nevada.
- December 2–8, 2011: Attended a business dinner on December 4 and the 9th Annual Enhanced Oil Recovery Carbon Management Workshop on December 5–7, 2011, in Houston, Texas.
- December 4–6, 2011: Viewed the seismic check-shot survey at the Bell Creek oil field near Broadus, Montana.
- December 5, 2011 – January 4, 2012: Traveled to oversee drilling efforts at the Bell Creek oil field in southeastern Montana.
- December 6–7, 2011: Event staff conducted site visits for the upcoming annual meeting in Milwaukee, Wisconsin.
- December 7, 2011: Presented before an “Introduction to GIS” class at North Dakota State University in Fargo, North Dakota.
- December 12–13, 2011: Traveled to attend the drilling kickoff meeting at the Bell Creek oil field in Montana.
- December 13–14, 2011: Held the Fort Nelson quarterly meeting at Spectra Energy’s offices in Calgary, Alberta, Canada.
- December 21–22, 2011: EERC Director, UND President and key program staff traveled to observe drilling efforts at the Bell Creek oil field in southeastern Montana.

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.