



May 2, 2013

Ms. Karlene Fine  
Executive Director  
North Dakota Industrial Commission  
600 East Boulevard Avenue, Department 405  
State Capitol, 14th Floor  
Bismarck, ND 58505-0840

Dear Ms. Fine:

Subject: Plains CO<sub>2</sub> Reduction Partnership (PCOR) Phase III Revised Quarterly Technical Progress Report for the Period January 1 – March 31, 2013  
Contract Nos. FY08-LXIII-162 and G-015-030; EERC Funds 16196 and 15631

Attached please find the Energy & Environmental Research Center (EERC) Quarterly Technical Progress Report for the PCOR Partnership Program for Phase III. An error was found in Table 4 on page 29, which has been corrected.

If you have any questions, please contact me by phone at (701) 777-5355 or by e-mail at [cgorecki@undeerc.org](mailto:cgorecki@undeerc.org).

Sincerely,

*for*

Charles D. Gorecki  
Senior Research Manager

CDG/hmv

Attachment

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Lynn Helms, NDIC Department of Mineral Resources, Oil and Gas Division  
Joe Murphy, North Dakota Department of Commerce

c: Corey Irion, EERC



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

### **Quarterly Technical Progress Report**

*(for the period January 1 – March 31, 2013)*

*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 2013

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Plains CO<sub>2</sub> Reduction (PCOR) Partnership  
Energy & Environmental Research Center (EERC)

## PLAINS CO<sub>2</sub> REDUCTION PARTNERSHIP PHASE III Quarterly Technical Progress Report January 1 – March 31, 2013

### 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 (NETL) in 2003 as part of a national plan to mitigate greenhouse gas emissions. The PCOR Partnership is led by the Energy & Environmental Research Center (EERC) at the University of North Dakota 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, 2013, through March 31, 2013.

Activities at the Denbury Resources Inc. (Denbury)-owned Bell Creek Test Site continued at a vigorous pace this reporting period. Operations at the site provided new opportunities for the collection of additional sidewall and full-diameter core samples at previously unavailable wells. In addition, two new groundwater-monitoring wells were installed and the initial baseline pulsed-neutron-logging campaign was completed. In March 2013, Denbury began filling its Greencore Pipeline to transport CO<sub>2</sub> to the Bell Creek oil field. CO<sub>2</sub> injection is planned during the second calendar quarter of 2013. Core analysis efforts and modeling and simulation activities also continued.

The EERC-led RCSP Water Working Group released a new fact sheet entitled “Carbon Capture and Storage: Protecting Freshwater Resources,” now available online at [www.undeerc.org/pcor](http://www.undeerc.org/pcor). *Energy & Fuels* published a PCOR Partnership-authored journal article entitled “Methodology for Phased Development of a Hypothetical Pipeline Network for CO<sub>2</sub> Transport during Carbon Capture, Utilization, and Storage” at <http://pubs.acs.org/doi/ipdf/10.1021/ef302042p>.

In March, the 2nd Annual Technical Advisory Board meeting was held, and planning is now under way for the 5th Annual Regulatory Roundup Meeting (July 2013). Online registration has opened for the PCOR Partnership Annual Membership Meeting scheduled for September 2013 in Minneapolis, Minnesota ([www.undeerc.org/pcor13](http://www.undeerc.org/pcor13)).





**PLAINS CO<sub>2</sub> REDUCTION PARTNERSHIP PHASE III**  
**Quarterly Technical Progress Report**  
**January 1 – March 31, 2013**

## **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 sectors. The membership, as of December 31, 2012, 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 PCOR Partnership Program 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	Great River Energy	Oil and Gas Research Council
Abengoa Bioenergy New Technologies	Halliburton	North Dakota Natural Resources Trust
Air Products and Chemicals, Inc.	Hess Corporation	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	Indian Land Tenure Foundation	Oxand Risk & Project Management Solutions
ALLETE	Interstate Oil and Gas Compact Commission	Petroleum Technology Research Centre
Ameren Corporation	Iowa Department of Natural Resources	Petroleum Technology Transfer Council
American Coalition for Clean Coal Electricity	Lignite Energy Council	Pinnacle, a Halliburton Service
American Lignite Energy	Manitoba Geological Survey	Prairie Public Broadcasting
Apache Canada Ltd.	Marathon Oil Company	Pratt & Whitney Rocketdyne, Inc.
Aquistore	MEG Energy Corporation	Praxair, Inc.
Baker Hughes Incorporated	Melzer Consulting	Ramgen Power Systems, Inc.
Basin Electric Power Cooperative	Minnesota Power	RPS Energy Canada Ltd.
BillyJack Consulting Inc.	Minnkota Power Cooperative, Inc.	Saskatchewan Ministry of Industry and Resources
Biorecro AB	Missouri Department of Natural Resources	SaskPower
Blue Source, LLC	Missouri River Energy Services	Schlumberger
BNI Coal, Ltd.	Montana–Dakota Utilities Co.	Shell Canada Energy
British Columbia Ministry of Energy, Mines, and Petroleum Resources	Montana Department of Environmental Quality	Spectra Energy
British Columbia Oil and Gas Commission	National Commission on Energy Policy	Suncor Energy Inc.
C12 Energy, Inc.	Natural Resources Canada	TAQA North, Ltd.
Computer Modelling Group Ltd.	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	WBI Energy, Inc.
Eastern Iowa Community College District	North Dakota Department of Health	Weatherford Advanced Geotechnology
Enbridge Inc.	North Dakota Geological Survey	Western Governors' Association
Encore Acquisition Company	North Dakota Industrial Commission	Westmoreland Coal 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

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 sensible 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) facilitate establishment of 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 development phase (Phase III) goal is implementation of large-scale field testing involving at least 1 million tons (Mt) of CO<sub>2</sub> a project. Each of the RCSP's large-volume injection tests is

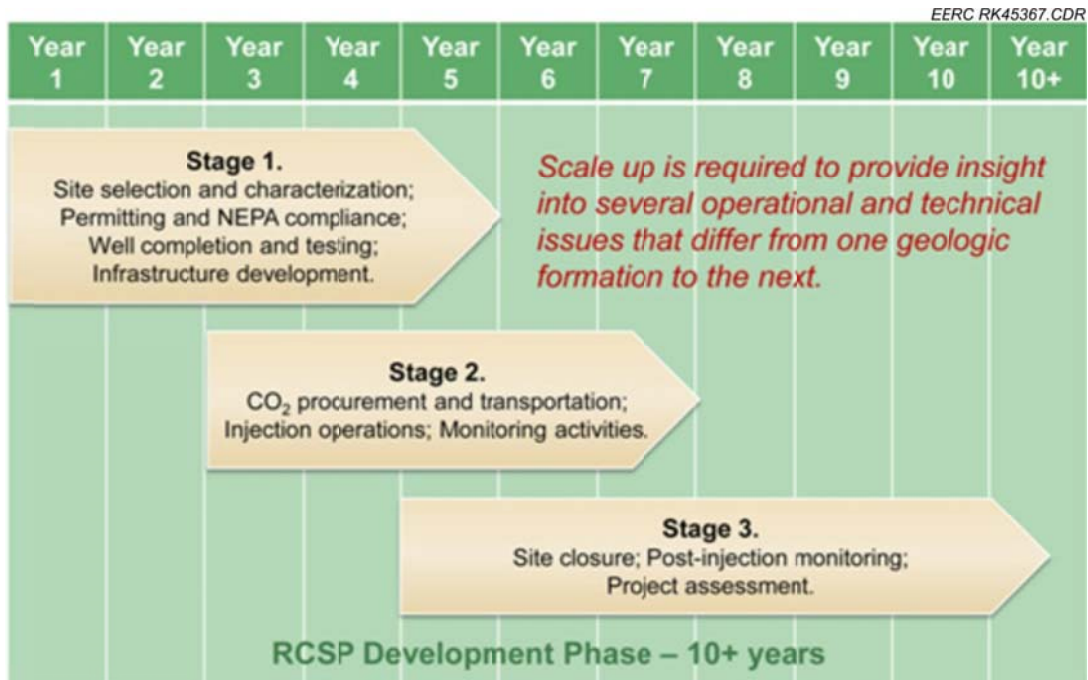


Figure 1. RCSP development phase: scaling up toward commercialization (source: [www.netl.doe.gov/technologies/carbon\\_seq/infrastructure/rcspiii.html](http://www.netl.doe.gov/technologies/carbon_seq/infrastructure/rcspiii.html) [accessed April 2013]).

designed to demonstrate that the 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 Denbury Resources Inc. (Denbury)-owned Bell Creek oil field in Powder River County in southeastern Montana and 2) near Spectra Energy Transmission’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 has 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;

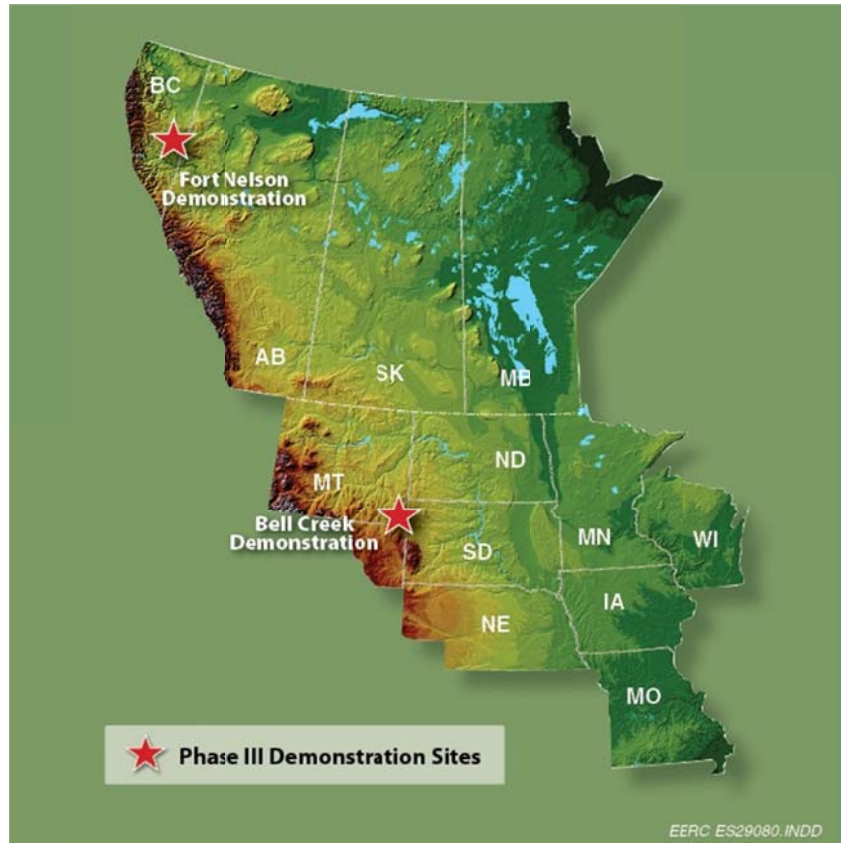


Figure 2. PCOR Partnership Phase III large-scale sites.

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.

## PROGRESS OF WORK

### Task 1 – Regional Characterization

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

- Participated in the 2013 Energy, Utility & Environment Conference (EUEC) in Phoenix, Arizona.
- Continued review of updates and corrections to the latest edition of the PCOR Partnership Atlas (Deliverable 81 [D81], update due August 2013).

**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	Dayanand Saini
Task 16 – Characterization of the Basal Cambrian System	Wesley D. Peck

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

- Current plans for the atlas update are to secure approval and then proceed with a reprinting around May 2013. Plans are to call this version of the atlas the *PCOR Partnership Atlas, Fourth Edition Revised*.
- Continued efforts to characterize the third target area (D7, due September 2013), including the following:
  - Continued to move historical water injection and oil production data for the Pine and Pennel oil fields from files collected at the Montana Board of Oil and Gas offices to spreadsheets for incorporation into a new database.
  - Worked on capturing monthly cumulative injection data by well (initially for the first 12 years of the Pine oil field) to create time-lapse bubble maps showing the progression of wells and volumes of injection water.
  - Reviewed production data scans of the first 30+ years.
  - Identified approximately 52 wells with cement bond logs.
  - Calculated cement tops for several wells and disseminated associated methodology.
  - Transferred historic production and injection data into the Petra database.
  - Created maps and cross sections illustrating the vertical and aerial distribution of production information.
  - Collected well ownership information as well as structural information throughout the target area.
  - Reviewed oil field information along the Greencore Pipeline in Nebraska and Wyoming.
  - Downloaded and analyzed field production history graphs from the Wyoming Oil and Gas Conservation Commission.
- Worked on acquiring new data sets for wells in Saskatchewan and North Dakota.

- Continued efforts to characterize additional saline formations for CO<sub>2</sub> storage, including the following:
  - Continued to digitize structure and isopach maps for formations in the Power River and Williston Basins.
  - Reviewed existing Broom Creek Petrel models and associated documentation.
  - Began creating 2013 Broom Creek Petrel model.
  - Began a Web-based literature review of the Broom Creek Formation (North Dakota) and the Minnelusa Formation (South Dakota and Montana).
  - Began compiling data for the Mission Canyon Formation using LAS (Log ASCII Standard) files to fill the gaps.
  - Built structural models for Minnelusa, Mission Canyon, and Inyan Kara Formations.
  - Continued work on Petrel structural models for Broom Creek, Keg River – Zama, and Stuttgart Formations.
- Continued updates and maintenance of the Decision Support System (DSS, © 2007–2013 EERC Foundation<sup>®</sup>) including the following:
  - Updated the databases that ultimately feed the DSS with new oil fields, wells, and gas plants.
  - Updated the oil field information, especially North Dakota wells.
  - Continued to explore opportunities to augment the demonstration project reporting system housed on the partners-only DSS.
  - Compiled images from the *PCOR Partnership Atlas* for inclusion in the online image gallery.
  - Continued efforts to update the current GIS (geographic information system) well files with new and corrected well information where discrepancies were identified.
  - Continued development of a new monitoring, verification, and accounting (MVA) section for the Bell Creek portion of the demonstration project reporting system.
  - Reviewed the partners-only site Bell Creek Web pages and prepared draft updates.
- Continued efforts to prepare a value-added report on the methodology used for updating the oil fields in the PCOR Partnership region.
- Conducted a preliminary investigation of CO<sub>2</sub> EOR potential of the area along the Miles City Arch in southeastern Montana.
- Continued updating the Petra database with Montana well data and formation tops.
- Participated in a conference call with the Petroleum Technology Research Centre (PTRC) on February 28, 2013, to discuss the Aquistore collaboration.
- Provided NATCARB (National Carbon Sequestration Database and Geographic Information System) personnel with documentation on the PCOR Partnership latest CO<sub>2</sub> source inventory.

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

- C12 Energy has not yet provided the characterization report on the Halliday Dome (originally due June 2012) or the accompanying cost-share report.

## Task 2 – Public Outreach and Education

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

- EERC employees attended 16 conferences/meetings, exposing external participants to the PCOR Partnership name, messaging, and informational materials. Specifically, the PCOR Partnership outreach activities included 14 oral presentations and one poster presentation. The following quantities of outreach materials were distributed:
  - PCOR Partnership documentary entitled “Nature in the Balance: CO<sub>2</sub> Sequestration” – 16
  - PCOR Partnership documentary entitled “Reducing Our Carbon Footprint: The Role of Carbon Markets” – 16
  - PCOR Partnership documentary entitled “Out of the Air – Into the Soil” – 15
  - PCOR Partnership documentary entitled “Managing Carbon Dioxide: The Geologic Solution” – 49
  - PCOR Partnership documentary entitled “Global Energy and Carbon: Tracking Our Footprint” – 35
  - *PCOR Partnership Atlas*, 4th Edition – 56
- During this reporting period, there were 1209<sup>a</sup> visits to the public Web site ([www.undeerc.org/pcor](http://www.undeerc.org/pcor)) from 1005 external visitors from 67 countries. New visitors comprised 78% of the overall traffic to the Web site. Of the 1209 visits, 62% of the Web traffic was domestic, while 35% was international. As depicted in Figure 3, the countries with the highest number of visits included the United States (747), Canada (96), India (41), United Kingdom (37), Australia (24), South Korea (21), France (18), Malaysia (15), and China (14).
- During this reporting period, a breakdown of how visitors came to the PCOR Partnership Web site, also referred to as traffic sources (Figure 4), is provided below.
  - Direct traffic consists of those visitors who type in or enter the URL ([www.undeerc.org/pcor](http://www.undeerc.org/pcor)). We presume that most of the direct traffic (14%) was from persons familiar with the PCOR Partnership.
  - Search engine traffic refers to the use of keywords and accounted for nearly three-quarters of the traffic. Google Analytics provides the keywords visitors used. About half of the keywords are specific to the EERC and the PCOR Partnership, and the other half are general terms such as “CO<sub>2</sub> sequestration.”
  - Referral site traffic (14%) is traffic directed to the PCOR Partnership Web page from other sites via links. The top referring sites were the DOE site, the Massachusetts Institute of Technology (MIT) site, and the EERC home page.

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<sup>a</sup> Google Analytics is utilized to track activity for the PCOR Partnership public Web site. This Web analysis tool has played an integral part in understanding the online behavior of Web site visitors. Through the use of Advanced Segments in Google Analytics, most internal traffic was excluded, thus providing a more accurate representation of external traffic behavior. All data provided in this section is from external traffic only.



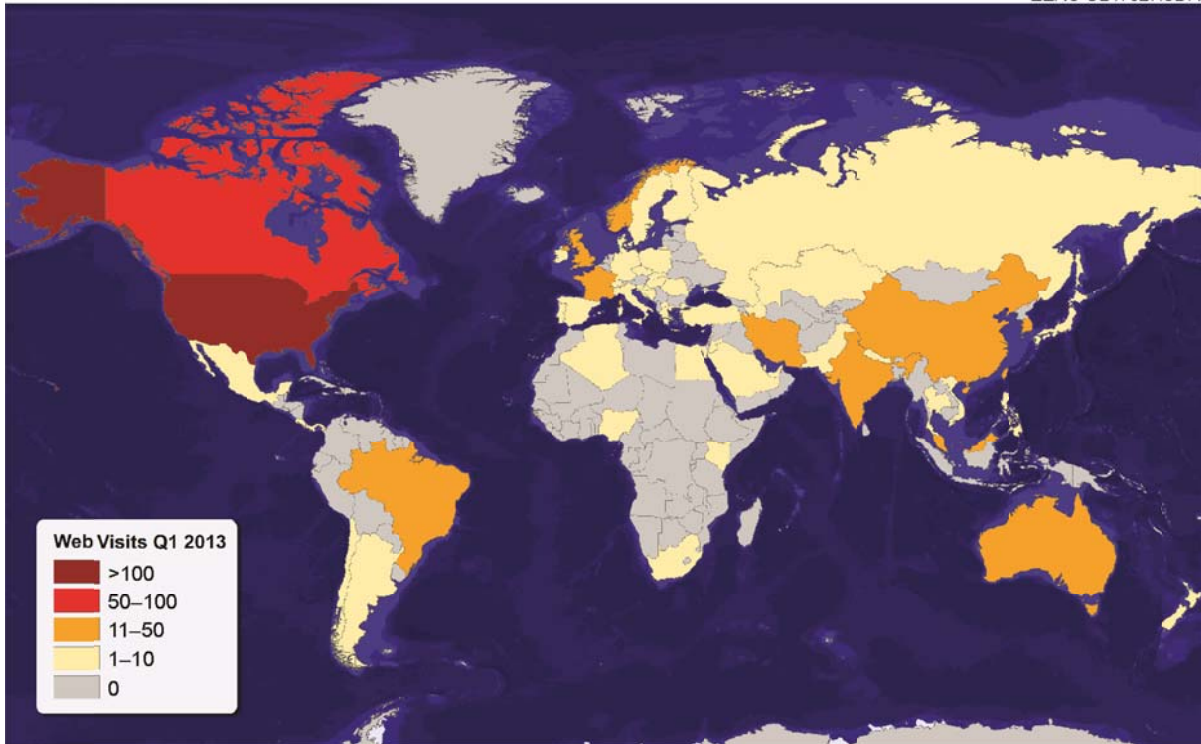


Figure 3. Map of PCOR Partnership global Web traffic (source: Google Analytics).

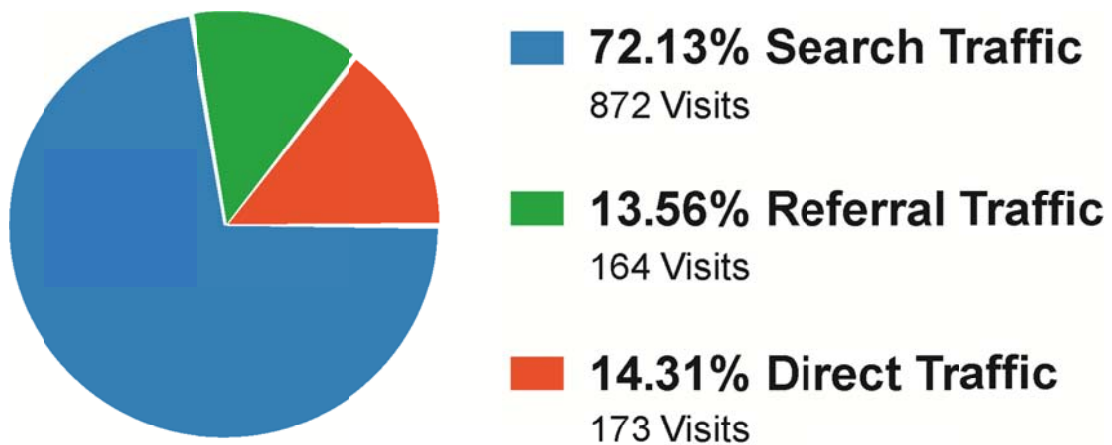


Figure 4. PCOR Partnership public Web site traffic (source: Google Analytics).



- During this reporting period, the nature of the visits to the PCOR Partnership public Web site included nearly 2750 page views and the top three pages viewed included:
  - The PCOR Partnership home page (<http://undeerc.org/pcor/>), with 667 page views or 24%.
  - The *What is CO<sub>2</sub> Sequestration?* Web page ([www.undeerc.org/PCOR/sequestration/whatissequestration.aspx](http://www.undeerc.org/PCOR/sequestration/whatissequestration.aspx)), with 422 page views or 15%.
  - The *CO<sub>2</sub> Sequestration Projects in Our Region* Web page ([www.undeerc.org/PCOR/co2seqprojects/default.aspx](http://www.undeerc.org/PCOR/co2seqprojects/default.aspx)), with 169 page views or 6%.
- During this reporting period, there were five (5) telecasts on public television airing in North Dakota, northwestern Minnesota, and Manitoba, as follows:
  - “Reducing Our Carbon Footprint: The Role of Markets”: two (2) telecasts.
  - “Out of the Air into the Soil”: two (2) telecasts.
  - “Global Energy and Carbon: Tracking our Footprint”: one (1) telecast.
- Participated in monthly RCSP Outreach Working Group (OWG) conference calls on January 17, February 21, and March 21, 2013. Topics discussed included:
  - Participation in an outreach session at the upcoming 12th Annual Conference on Carbon Capture, Utilization, and Sequestration (CCUS-12) scheduled for May 13–16, in Pittsburgh, Pennsylvania.
  - A side meeting to be held in conjunction with the DOE project review meeting in August.
  - Time line displayed at the 2012 PCOR Partnership Annual Meeting and the potential use of a time line to showcase the 10-year anniversary of the RCSP program at the meeting in August.
- Participated in the monthly Aquistore Outreach Advisory Panel conference call on February 25, 2015, where marketing literature, recent press coverage, and upcoming events were discussed.
- The monthly Aquistore outreach advisory panel call was canceled for March 2013, but as requested, the draft final of the Aquistore Project marketing booklet was reviewed, and brief comments were provided.
- On March 19, 2013, finalized the updated Fort Nelson PowerPoint presentation (D19, originally due June 2012) after EERC review of Spectra’s comments.
- Continued collaborative efforts with Prairie Public Broadcasting (PPB), including the following:
  - Held a meeting at the EERC on February 8, 2013, to review the planned scope of work for Program Year (PY) 6.
  - Made plans to film geophone installation in the Bell Creek Field and maintained communication with regard to scheduling filming.
  - Reviewed PowerPoint presentations given at past teacher seminars as a basis for preparing a filmed version to be used for future education activities.
  - Practiced the educator PowerPoint presentation at PPB studios on February 27, 2013, in preparation for upcoming filming; the presentation will be used on the Web and in future partnership education activities.
  - Held a meeting at the EERC on March 12, 2013, to review schedules and budgets in relation to the subcontract.

- Worked on the four segments of the education presentation, including *Energy, Energy and Carbon, Finding Solutions, and CO<sub>2</sub> Storage – One Action Among Many*.
- Traveled to PPB studios in Fargo, North Dakota, and filmed the four segments of the education presentation on March 20, 2013, that, when finalized and approved, will be used in teacher activities and made available on the Web site.
- Provided the PPB editor with updated slide materials for use in the education presentation.
- On March 28, 2013, PPB signed an agreement with SaskPower granting permission for PPB to film at the Boundary Dam site and conduct interviews as part of Aquistore outreach activities.
- Continued preparation of a value-added video short, including a script revision and film edit, focused on smart casing installation or permanent downhole monitoring for CCS reservoir monitoring.
- Submitted the Phase III general fact sheet (D14) on February 28, 2013.
- Continued development of a new Lignite Field validation site fact sheet (value-added).
- In response to a request from Spectra, provided a PDF file of the Fort Nelson poster (D26) for personnel to print for distribution as part of presentations to select groups in London and Oslo.
- Mailed 25 copies of D26 to Spectra for distribution at conferences.
- Finalized the input and most output modules of the outreach tracking database and continued efforts to refine and finalize the modules.
- Continued efforts to review and improve the public Web site, including identification and prioritization of areas for update, actions to increase Web traffic, planned updates to the education section, and actions to improve tracking and reporting.
- PowerPoint presentations given by the project team regarding demonstration activities included the following:
  - “The Plains CO<sub>2</sub> Reduction (PCOR) Partnership: CO<sub>2</sub> Sequestration Demonstration Projects Adding Value to the Oil and Gas Industry” e-Poster presented at the International Petroleum Technology Conference on March 26, 2013, in Beijing, China.
  - “Overview of the PCOR Partnership Program and other EERC-Led CO<sub>2</sub> Storage-Related Projects” presented to the Division of Engineering Geology and Water Resources Institute of Geology and Geophysics on March 26, 2013, in Beijing, China.
  - “PCOR Partnership Technical Advisory Board Meeting” presented to the PCOR Partnership Technical Advisory Board on March 5–6, 2013, in Orlando, Florida.
  - “Plains CO<sub>2</sub> Reduction (PCOR) Partnership Overview” presented to the CCP Team on March 8, 2013, in Grand Forks, North Dakota.
  - “Baseline Monitoring, Verification, and Accounting (MVA) Activities” Presented to the PCOR Partnership Technical Advisory Board on January 3, 2013, via WebEx in Grand Forks, North Dakota.
  - “The Plains CO<sub>2</sub> Reduction (PCOR) Partnership” presented to the U.S. Department of Energy National Energy Technology Laboratory on February 20, 2013, in Morgantown, West Virginia.

- “The Plains CO<sub>2</sub> Reduction (PCOR) Partnership” presented to Konkuk University on March 14, 2013, in Grand Forks, North Dakota.
- “The Plains CO<sub>2</sub> Reduction (PCOR) Partnership” presented to Statoil on March 7, 2013, in Houston, Texas.
- “The Plains CO<sub>2</sub> Reduction (PCOR) Partnership” presented to the 8th Annual SECARB Stakeholder’s Briefing on March 12, 2013, in Atlanta, Georgia.
- “Integrated Reservoir Modeling and Simulation Optimization Workflow Based on a High-Performance Parallel Computing Cluster” presented at the 2013 Rice Oil & Gas HPC Workshop on February 28, 2013, in Houston, Texas.
- “The Plains CO<sub>2</sub> Reduction (PCOR) Partnership: A Regional Carbon Sequestration Partnership in the Interior Plains of North America” presented to the Energy, Utility & Environment Conference on January 30, 2013, in Phoenix, Arizona.

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

- On March 25, 2013, DOE NETL waived the requirement for an updated Fort Nelson Test Site Fact Sheet (D16) due in April 2013.
- Also on March 25, 2013, DOE NETL approved changes in subject matter and/or due dates for the Phase III documentaries, as follows:
  - Extend the due date for D21 – Bell Creek Test Site 30-minute Documentary to April 29, 2016.
  - Rename “D22 – Fort Nelson Test Site 30-minute Documentary” to “Domestic Energy and Carbon 30-minute Documentary” and extend the due date to May 31, 2015.
  - Extend the due date for D23 – Storage in Carbon Management 30-minute Documentary to April 30, 2017.

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

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

- EERC staff attended the 2013 UIC (underground injection control) Conference, sponsored by the Ground Water Protection Council ([www.gwpc.org/events/2013-uic-conference](http://www.gwpc.org/events/2013-uic-conference)), held January 22–24, 2013, in Sarasota, Florida, and met with representatives about potential risk-based data management system work.
- Continued activities regarding Class VI rules, including the following:
  - Provided information upon request regarding a cost comparison between Class II and Class VI wells.
  - Provided an overview upon request of North Dakota’s proposed Class VI rules and primacy application to an interested party.
  - Held a conference call to discuss Class VI well permit cost factors.
- Provided a brief overview of GS3, a geologic sequestration software suite under development by Pacific Northwest National Laboratory, to the NETL project manager.

- Continued activities associated with the Interstate Oil and Gas Compact Commission (IOGCC) Carbon Geologic Storage (CGS) Task Force, including the following:
  - Continued to discuss the outline for the final report, comprising the subgroup findings and recommendations, and the writing assignments.
  - Held discussions with Bliss Consulting regarding upcoming conference calls and meetings of the operational and postoperational liability groups.
  - Participated in subgroup conference call(s).
  - Reviewed the final report outline and began writing the CGS Task Force report.
  - Participated in a subgroup call to discuss various insurance options for carbon capture and storage (CCS) projects.
  - Participated in the IOGCC CGS Task Force Subgroup meeting on February 27 and 28, 2013, in Minneapolis, Minnesota.
  - Participated in a conference call with a subset of task force and subgroup members to discuss Class II to Class VI transition liabilities.
  - Began planning for the next subgroup and full task force meetings.
- Continued planning for the 5th Annual Regulatory Roundup, including the following:
  - Drafted and sent an e-mail to regulatory participants soliciting input on date and location preferences.
  - Decided upon a venue in Deadwood, South Dakota.
- Began review of new U.S. Environmental Protection Agency (EPA) geologic sequestration draft and final guidance documents, including the following:
  - Geologic Sequestration of Carbon Dioxide: Draft Underground Injection Control (UIC) Program Class VI Well Recordkeeping, Reporting and Data Management Guidance for Owners and Operators (comments due May 11, 2013).
  - Geologic Sequestration of Carbon Dioxide: Draft Underground Injection Control (UIC) Program Class VI Well Recordkeeping, Reporting and Data Management Guidance for Permitting Authorities (comments due May 11, 2013).
  - Geologic Sequestration of Carbon Dioxide: Underground Injection Control (UIC) Program Class VI Well Testing and Monitoring Guidance (issued March 2013).
- With regard to the Lignite Field Validation Test site (Phase II) closure:
  - Continued efforts to monitor the site during the reclamation phase, including site visits on January 10 and 24; February 7 and 21; and March 7 and 21, 2013 (Figure 5).
  - Continued to modify a draft value-added report on closure activities.

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

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



Figure 5. Results of reclamation efforts at the Lignite Field Validation Test site (top: September 2011, bottom: March 2013).

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

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

- Modeling staff attended Schlumberger Network of Excellence in Training (NExT) software training entitled “Petrel Property Modeling” on February 10–18, 2013, in Houston, Texas.
- Modeling staff attended Schlumberger NExT software training entitled “Techlog Formation Evaluations” on February 24 – March 1, 2013, in Houston, Texas.
- **Bell Creek** test site activities included the following:
  - Submitted EERC Proposal No. 2013-0123 on February 22, 2013, requesting additional funding in the amount of \$999,565 for additional core collection (36-14R and 56-14R), analysis, and logging activities on previously unavailable wells.
  - Worked on a poster entitled “Subsurface Core and Analogous Outcrop Characterization for the Muddy/Newcastle Formation of the Bell Creek Oil Field, Power River County, Montana” for the American Association of Petroleum

Geologists (AAPG) Annual Convention & Exhibition 2013 (<https://www.aapg.org/pittsburgh2013/>).

- Participated in a conference call on January 8, 2013, with Denbury personnel to discuss vertical seismic profile (VSP) installation.
- Continued pulsed-neutron-logging (PNL) activities, including the following:
  - ◆ Completed baseline PNL activities on 27 of 27 wells during the initial campaign.
  - ◆ Schlumberger completed processing the 27 baseline PNLs.
  - ◆ Participated in a PNL review meeting with Schlumberger Carbon Services (Schlumberger), Denbury, and the EERC on March 12, 2013, in Denver, Colorado.
- Visited a Muddy Formation outcrop near Hulett, Wyoming.
- Continued revising the fieldwide static model, including creating a 3-D grid.
- Continued building a depofacies object model using historic and recently acquired core data.
- Continued work on the geomechanical modeling activities, including the following:
  - ◆ Submitted the geomechanical modeling report (D32) on January 31, 2013.
  - ◆ Held a conference call with Denbury personnel to discuss their comments on D32.
  - ◆ Continued analysis of pressure gauge response from the 05-06 OW well, including construction of a leakage model (including pressure and temperature models) and a simplified geomechanical model.
  - ◆ Worked on improving the 1-D mechanical earth model (MEM) with additional analysis of Poisson's ratio and stresses.
  - ◆ Continued work on the 3-D MEM of the Phase 1 area.
- Continued work on the SCAL (special core analysis) plan with Core Labs, including the following:
  - ◆ Authorized the scope of work and budget.
  - ◆ Discussed basic property testing results and plug selection for planned flow tests.
  - ◆ Discussed drilling additional core plugs in bioturbated zones.
  - ◆ Reviewed the Petrel model and associated Phase 1 logs.
  - ◆ Reviewed the Weatherford cost proposal for planned SCAL work for additional wells.
  - ◆ Finalized electrical property test plan with Core Labs.
- Continued 05-06 OW sidewall core activities in the Applied Geology Laboratory (AGL), including the following:
  - ◆ Continued efforts to modify the value-added mineralogy report on 12 sidewall core samples.
  - ◆ Completed data sheets and porosity point counting for the remaining 35 samples.
- Continued fieldwide core analysis activities on the U.S. Geological Survey (USGS) Denver Core Research Center 81 intervals of core in the AGL, including the following:
  - ◆ Scanned thin sections for point counting.

- ◆ Continued work on photographs as well as x-ray diffraction, x-ray fluorescence, and scanning electron microscopy analyses.
- Began 56-14R horizontal sidewall core activities, including the following:
  - ◆ Created a plan for the core testing.
  - ◆ Provided on-site technical advice during collection (Figure 6).
  - ◆ Began cutting samples (for thin-section preparation) from the 23 sidewall cores collected.
    - Denbury received 8 cores.
    - The EERC retained 15 cores.
  - ◆ Photographed, weighed, and measured the core plugs and provided the information to Denbury.
- Began 33-14R full-diameter core collection and provided on-site technical advice during the collection (Figure 7).
- **Fort Nelson** test site activities included the following:
  - Continued efforts to compile a report summarizing the activities and lessons learned at the Fort Nelson test site.
  - Reviewed and answered various questions from Spectra personnel regarding the static model scope of work.
  - Participated in a call with Spectra personnel on February 13, 2013.
  - Packaged the June 2010 and July 2011 Petrel static models and transferred them to Spectra at its request.



Figure 6. Denbury and EERC personnel examine cut core barrels from 56-14R (March 2013).



Figure 7. Cut core barrel sections from 33-14R prior to transport to Weatherford Core Labs (March 2013).

- Responded to Spectra’s questions regarding well tops and structure interpretations in the transferred static models.
- Sent the Fort Nelson Test Site – Site Characterization Report to Spectra for review and approval in May 2012. Spectra comments were received on February 1, 2013, and EERC review is under way.
- Sent the Fort Nelson Test Site – Geochemical Report to Spectra for review and approval in September 2012. Spectra comments were received on February 7, 2013, and EERC review is under way.

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

- Original plans to complete PNL activities on a total of 54 wells were scaled back because of operational and access reasons.
- Acquisition of the two VSP surveys was delayed until May 2013 because of weather and ground-cover reasons.
- On March 25, 2013, DOE NETL approved an extension request for D33 – Bell Creek Test Site – Preinjection Geochemical Report from March 31, 2013, to July 31, 2013.

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

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



- Field staff completed an 8-hr Occupational Safety and Health Administration (OSHA) (HAZWOPER [hazardous waste operations and emergency response]) refresher training course.
- Field staff participated in a UND Environmental Training Institute OSHA 10-hour Construction Outreach Training on March 4 and 5, 2013, in Grand Forks, North Dakota.
- Held Bell Creek Project Update Meetings on January 15 and March 25, 2013. Topics included upcoming activities, core analysis update, surface and near-surface MVA activities, status of reports, PNL, seismic activities, modeling updates, and upcoming deliverables.
- Continued efforts on the Fox Hills groundwater-monitoring wells, including the following:
  - Completed installation of surface casing for both groundwater-monitoring wells.
  - Collected cutting samples during the surface casing installation.
  - Completed full installation of one well (05-04) in January 2013.
  - Attempted installation of second well (33-12) in February 2013
  - Installed a larger pump on 05-04 and redrilled 33-12 in March 2013 (Figure 8).
  - Began planning for sampling (anticipated to occur in April 2013).
  - Evaluated permanent pump and solar-powered continuous flow options.
  - Worked on compiling data needs for modeling Fox Hills Formation CO<sub>2</sub> rock exposure using PHREEQC.
  - Continued work on a sampling and analysis plan.
- Continued operations planning for the permanent VSP geophone array.
- Traveled to the Bell Creek Field (along with PPB film crew) to observe planned (but unsuccessful) geophone array installation in February 2013.
- Continued analysis of pressure gauge response from the 05-06 OW well, along with an associated literature review.
- Completed a working outline entitled “Evaluation of Continuous Downhole Pressure and Temperature Response in the Muddy and Niobrara Formations in Bell Creek Oil Field 05-06 OW Well from April 2012 through January 2013 During Water Injection” for discussion purposes.
- Continued work on a value-added preinjection surface water, groundwater, and soil gas baseline MVA sampling and analysis report, including results. The report consists of three sections: 1) site descriptions, 2) sampling protocol, and 3) field and lab analyses.
- Prepared water chemistry landowner packages based on August and November 2012 sampling trips.
- Completed reviewing and verifying the finalized Baseline Sampling Events 4 and 5 (August and November 2012, respectively) landowner packages for distribution:
  - Collected a total of 24 water samples, including seven (7) surface water, eight (8) stock well, and nine (9) drinking water (residential) well samples during Event 4.
  - Collected a total of 24 water samples, including eight (8) surface water, eight (8) stock well, and eight (8) drinking water (residential) well samples during Event 5.



Figure 8. Groundwater-monitoring well drilling 33-12, Bell Creek, Montana (February 2013).

- Compiled the most recently collected active well and fixed-station soil gas data from the January 2013 sampling event:
  - Sampled a total of ten (10) soil gas profile stations, eight (8) active wells, and ten (10) interspaced locations.
  - Compared field and analytical soil gas measurements between all sampling events (October and November 2012 and January 2013).
- Completed an outline for and began work on the Bell Creek Test Site – Monitoring Experimental Design Package (D43, due May 2013).
- Prepared abstracts for the upcoming Carbon Management Technology Conference (CMTC) due for upload by April 15, 2013.

- Began consideration of an additional suite of baseline soil gas and water monitoring based on timing of CO<sub>2</sub> injection.

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

- Installation of downhole geophone array was delayed until April 2013 because of well issues in the 08-12A well. After review, Well 04-03 OW was selected.
- Because of a lodged screen in Fox Hills Formation Groundwater-Monitoring Well 33-12, it was necessary to re-drill at no additional cost.

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

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

- Continued studying information about surface facilities, as they play a large role in the site infrastructure development at the Bell Creek site.
- Revised and submitted the final version of D84, Report – A Phased Approach to Building Pipeline Network for CO<sub>2</sub> Transportation During CCS, based on recommendations from NETL project manager.
- Collected information for the report entitled “Opportunities and Challenges Associated with CO<sub>2</sub> Compression and Transport During CCUS Activities.” This is an update of D85, which the Statement of Project Objectives requires to occur biennially.
- Began preparation of a journal article focusing on CO<sub>2</sub> capture and associated infrastructure requirements, especially pipeline sizing, for sources that produce variable amounts of CO<sub>2</sub>, such as power plants. Activities included the following:
  - Continued investigating potential peer-reviewed journals for submittal of the article.
  - Began revisions to an initial draft manuscript.
- Reviewed an *Energy & Fuels* manuscript entitled “Initial Results from a New CO<sub>2</sub> Storage Cost Model: FE/NETL CTS-Saline Cost Model.”
- Continued activities regarding the journal article entitled “A Methodology for Phased Development of a Hypothetical Pipeline Network for CO<sub>2</sub> Transport During Carbon Capture, Utilization, and Storage” for publication in *Energy & Fuels*, including the following:
  - Addressed all peer-review comments and submitted the final manuscript for publication.
  - Received notification that the manuscript was accepted for publication.
  - Received an electronic version of the proof pages for careful proofreading.
  - Proofread manuscript galley proofs and uploaded corrections to the *Energy & Fuels* Web site. The paper is available online at <http://pubs.acs.org/doi/ipdf/10.1021/ef302042p>.

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

- On March 25, 2013, DOE NETL waived the requirement for an update to D85 due March 31, 2013. A journal article (see above) is under preparation in lieu of the report.

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

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

- Participated in ongoing project discussions with Denbury.
- Began planning for the Bell Creek Test Site – Procurement Plan and Agreement Report (D48, due September 2013).

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:

- Participated in the Bell Creek project update meetings held on January 15 and March 25, 2013.
- Potential methods of measurement or estimation of fugitive CO<sub>2</sub> emissions during MVA activities at injection sites are being investigated. The accuracy and application of the techniques as they apply to surface facilities as well as well bores and the subsurface will be studied. The results of the study will be discussed in a value-added report. During the January–March 2013 quarter, fugitive CO<sub>2</sub> emission pathways from surface facility unit operations were examined and EPA regulations that apply to those emissions were documented.

Actual or anticipated problems, delays, or changes 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:

- Staff attended the Society of Petroleum Engineers (SPE) 2013 Reservoir Simulation Symposium and premeeting training courses entitled “Fundamentals of Reservoir Simulation” and “Reservoir Simulation for Practical Decision Making” in The Woodlands, Texas.

- Staff presented at the Rice 2013 Oil & Gas High-Performance Computing (HPC) Workshop in Houston, Texas.
- Worked with Computer Modelling Group Ltd. (CMG) on licensing renewals.
- Continued **Bell Creek** site activities, including the following:
  - Denbury began filling the Greencore Pipeline with CO<sub>2</sub> in March 2013.
  - Participated in a conference call with The CETER Group, Inc., to discuss Bell Creek MVA and risk management.
  - Continued efforts to integrate the risk assessment activities and the MVA plan.
  - Configured CMOST for the numerical tuning process.
  - Reviewed and discussed ongoing dynamic modeling work.
  - Worked on history-matching the simulation model.
  - Continued PVT (pressure–volume–temperature) modeling work, including the following:
    - ◆ Digitized the new PVT data and began modeling.
    - ◆ Performed a literature review on PVT modeling.
    - ◆ Performed a literature review on the relative permeability interface between experimental and simulation data.
    - ◆ Discussed the recently received Core Labs PVT report.
    - ◆ Ran PVT simulations.
    - ◆ Continued work on PVT in regression to match the experimental data.
    - ◆ Conducted a literature search and review on a PVT modeling and tuning method for compositional simulation to minimize the convergence problem.
    - ◆ Worked on PVT in minimum miscibility pressure.
  - Participated in biweekly project update meetings.
- Continued **Fort Nelson** site activities, including the following:
  - Continued working with Spectra on a scope of work for the next stage of dynamic modeling.
  - Sent D66, Fort Nelson Test Site – Simulation Report, to Spectra for review and approval in September 2011. Spectra comments were received February 4–7, 2013, and EERC review is under way.

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

- CO<sub>2</sub> injection was anticipated in the first quarter of 2013. Because of the time needed to fill the 232-mile pipeline, injection is delayed until the second quarter of 2013.

#### **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, the annual assessment report, on December 28, 2012.

## Task 13 – Project Management

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

- Continued preparations for the 2013 PCOR Partnership Annual Membership Meeting scheduled for September 25 and 26, 2013, in Minneapolis, Minnesota, including the following:
  - Tested the annual meeting Web site, which went “live” (<http://undeerc.org/pcor13/>) on March 28, 2013.
  - Continued preparing a postcard for mailing and an e-mail blast announcing that registration is open.
  - Began planning the meeting agenda and associated side meetings.
- Prepared and presented an e-poster presentation entitled “The Plains CO<sub>2</sub> Reduction Partnership: CO<sub>2</sub> Sequestration Demonstration Projects Adding Value to the Oil and Gas Industry” for the 2013 International Petroleum and Technology Conference (IPTC) held March 26–28, 2013, in Beijing, China.
- Met with and gave a presentation entitled “Overview of the PCOR Partnership Program and other EERC-Led CO<sub>2</sub> Storage-Related Projects” at the National Academy of Sciences on March 26, 2013, in Beijing, China (Figure 9).

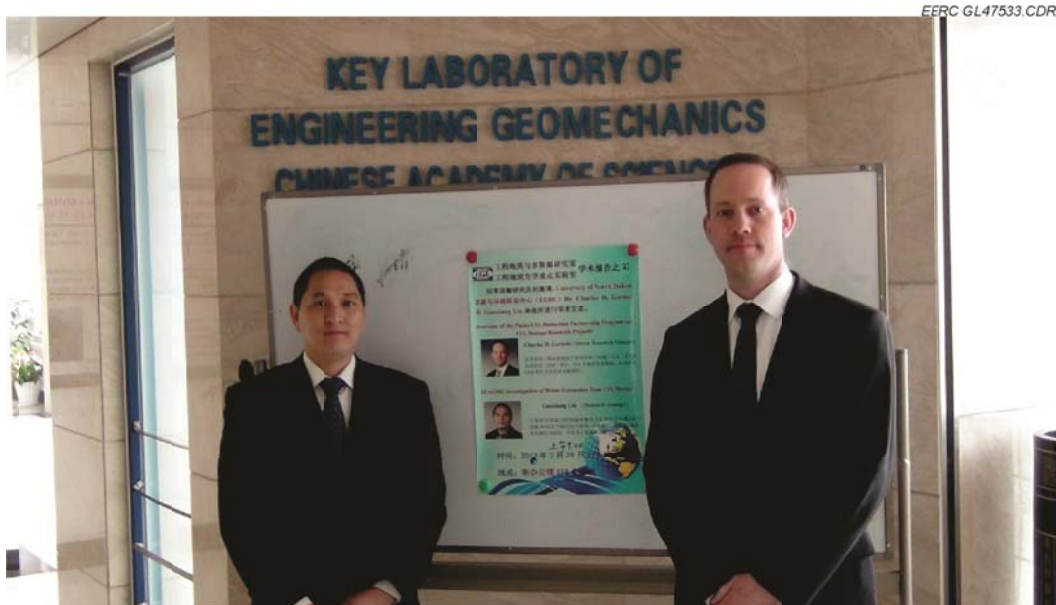


Figure 9. EERC staff Guoxiang Liu (left) and Charles Gorecki (right) pose in front of a poster announcing their presentations in Beijing, China (March 2013).

- Submitted an updated project management plan on January 22, 2013.
- Hosted a Webinar and presented on the Bell Creek surface and near-surface soil gas- and water-monitoring program to the PCOR Partnership Technical Advisory Board (TAB) on January 3, 2013.
- Hosted visitor Bill Jackson of BillyJack Consulting, Inc., TAB Chair, at the EERC on January 3, 2013.
- Participated in a task leader meeting on January 8, 2013. Topics discussed included drilling of Bell Creek groundwater-monitoring wells, planned installation of geophones for the 3-D VSP surveys, filling of the Greencore Pipeline (anticipated to begin in February), TAB Webinar held January 3, upcoming conferences and deliverables, and updates from each task leader present.
- Participated in the RCSP EOR working group conference calls.
- Participated in a task leader meeting on February 5, 2013. Topics discussed included upcoming in-house training opportunities, conferences, deliverables, and updates from each task leader present.
- Numerous staff members participated in an all-day training session entitled “The CO<sub>2</sub> EOR Overview Course for the PCOR Partnership” on February 26, 2013.
- Sent a revised letter and scope of work on February 7, 2013, to PTRC regarding ongoing EERC participation in Aquistore activities.
- Accepted a second review request on a paper for the *International Journal of Greenhouse Gas Control*.
- Submitted the updated project management plan in January 2013.
- Continued preparations for the 2nd Annual Technical Advisory Board (TAB) meeting scheduled for March 5 and 6, 2013, in Orlando, Florida, including the following:
  - Participated in several conference calls with the TAB chair and the meeting facilitator.
  - Prepared an overview presentation on Phase III activities and objectives.
  - Finalized meeting arrangements.
- Participated in a task leader meeting on March 12, 2013. Topics discussed included upcoming in-house training opportunities, conferences, deliverables, and updates from each task leader present.
- Participated in a conference call hosted by DOE NETL with all of the RCSPs on March 15, 2013, to discuss upcoming meetings.
- Attended the Southeast Regional Carbon Sequestration Partnership (SECARB) 8th Annual Stakeholders’ Briefing on March 12 and 13, 2013, in Atlanta, Georgia.
- Deliverables and milestones completed in January:
  - December monthly update
  - Task 4: D32 – Bell Creek Test Site – Geomechanical Report
  - Task 13: D58/D59 – Quarterly Progress Report/Milestone Quarterly Progress Report
  - Task 14: M23 – Monthly WWG conference call held
- Deliverables and milestones completed in February:
  - January monthly update
  - Task 2: D14 – General Phase III fact sheet (update)
  - Task 14: M23 – Monthly WWG conference call held

- Deliverables and milestones completed in March:
  - February monthly update
  - Task 16: D89 – Geochemical Evaluation of the Basal Cambrian System
  - Task 14: D99 – Water/CCS nexus-related fact sheet
  - Task 14: M23 – Monthly WWG conference call held
  - Task 13: M36 – Annual Advisory Board meeting scheduled

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

- Continued discussions with Spectra regarding a path forward for the Fort Nelson project now that CO<sub>2</sub> injection will be significantly delayed.

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

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

- Continued efforts on the WWG review of the water–CCS nexus-related fact sheet (D99-1) and distributed a draft to the WWG for review and comment.
- Held the monthly conference call on January 16, 2013. Ten members participated and the topics included the following:
  - Announced that the joint IEA Greenhouse Gas R&D Programme and DOE extracted water report is available for public use.
  - Discussed the EPA progress report on hydraulic fracturing.
  - Reviewed deliverables required for 2013, namely two fact sheets due in March and October.
  - Announced the annual meeting will be held in August 2013, in conjunction with the DOE Carbon Storage R&D Project Review Meeting.
- Distributed the February meeting agenda on February 6, 2013.
- Distributed the January conference call notes via e-mail on February 22, 2013.
- Continued reviewing the WWG white paper in preparation for journal article submission.
- Held the monthly conference call on February 26, 2013. Eight members participated, and the topics included the following:
  - Discussed revisions to the water resource protection fact sheet (due March 2013).
  - Discussed development of an MVA-centric fact sheet (due October 2013).
  - Reviewed upcoming meetings and scheduling plans for the annual meeting.
  - Heard WWG participant updates from the PCOR Partnership and the Midwest Regional Carbon Sequestration Partnership (MRCSP).
- Distributed the March meeting agenda on March 5, 2013.
- Continued review of upcoming conferences for possible distribution of the fact sheets.
- Distributed the February conference call notes via e-mail on March 22, 2013.
- Submitted the fact sheet entitled “Carbon Capture and Storage: Protecting Freshwater Resources” (D99) on March 22, 2013.
- Held the monthly conference call on March 28, 2013. Nine members participated and the topics included the following:



- Discussed completion of the new fact sheet entitled “Carbon Capture and Storage: Protecting Freshwater Resources.” The fact sheet is available for public use on the PCOR Partnership public Web site at [www.undeerc.org/PCOR/newsandpubs/pdf/RCSPWWGFactSheet2.pdf](http://www.undeerc.org/PCOR/newsandpubs/pdf/RCSPWWGFactSheet2.pdf).
- Continued planning for the MVA-centric fact sheet due in October 2013.
- Announced that the annual meeting is tentatively planned for August 20, 21, or 22, 2013, in conjunction with the DOE Carbon Storage R&D Project Review Meeting in Pittsburgh, Pennsylvania.
- Received WWG participant updates from the PCOR Partnership, SECARB, MRCSP, SWP (Southwest Regional Partnership on Carbon Sequestration), and DOE NETL.
- Continued review of upcoming water-related conferences for potential distribution of the fact sheets.
- Began work on the next WWG fact sheet (D99, due October 31, 2013) focused on MVA technologies applicable to water.

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

- Received approval from DOE NETL on March 25, 2013, to change the requirement for the annual meeting to be held by June each year to be held by December each year (for 2013–2016). This will allow flexibility in scheduling the meeting in coordination with other DOE meetings.

### **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:

- Participated in discussions with Apache Canada’s Zama team and presented Task 15 progress to date during Apache’s visit to the EERC on January 24–25, 2013.
- Built porosity and permeability logs and performed calibration using the core data.
- Analyzed routine core analysis data for identification of rock types and generated porosity, permeability, and saturation logs in Techlog for the wells with core data.
- Held biweekly in-house Zama project update meetings.
- Continued work on the G2G Pool, including the following:
  - Worked on production data analysis.
  - Continued building static geologic models.
  - Generated rock type, porosity, permeability, and saturation logs along existing G2G Pool wellbores and then upscaled into a static model.
  - Began facies, property, and petrophysical modeling.
  - Exported the preliminary G2G Pool static model to dynamic simulation software (CMG–GEM) and started working on a test run.
- Continued work on the Muskeg L Pool, including the following:
  - Started preparing dynamic data.
  - Started preparing fluid property data for PVT model development.

- Continued to review relevant literature.
- Discussed G2G and Muskeg L Pools static and dynamic modeling work, including the following:
  - Reviewed the structure model and worked to resolve a few occurrences of wedge grid cells around the well.
  - Discussed the dynamic simulation model issues (trace component and CO<sub>2</sub> solubility in aqueous phase).
- Modified dynamic simulation workflow and ran the test model again.
- Continued work on the PVT model for the RRR Pool.
- Conducted a literature review for geostatistical modeling.
- Discussed grid thickness, training image, porosity–permeability relationship, water saturation modeling, Zama area geology, and other static modeling issues.
- Received additional PVT, well, and pool pressure data on February 13 and 20, 2013, from Apache.
- Smoothed dynamic workflow and ran the test dynamic model again.
- Began compiling relevant data and documentation for inclusion into the Updated Regional Implementation Plan for Zama (D86, due in September 2013). Discussed project at in-house meeting on March 12, 2013.
- Discussed in-house subtask requirements and wrap-up plans.

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

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

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

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

- Successfully integrated the 3-D geomodel into the simulation software and began injection simulation efforts.
- Conducted a literature review for the geochemical report (D89, due March 2013) to ensure that data generated are valid.
- Continued work on the report describing the wellbore integrity issues (D90, due September 2013) for wells in the Cambro–Ordovician Saline System in the United States.
- Attended and presented at the Joint Technical and Steering Committee Meeting for the Basal Aquifer Project on February 21, 2013, in Berkeley, California. Meeting details include the following:
  - Attended by representatives from Alberta Innovates – Technology Futures, Natural Resources Canada (NRCan), Lawrence Berkeley National Laboratory, and Princeton University (by phone).
  - Focused on review of modifications to the EERC-prepared 3-D geomodel and discussion held on preliminary dynamic simulation modeling.

- Recognized insufficient injectivity at the local extent to accommodate the CO<sub>2</sub> (at the current annual rate) for some of the large stationary sources even though there is a large storage resource available in the system.
- Began modification of dynamic simulation parameters used to maximize the injectivity at the various large-scale CO<sub>2</sub> sources across the study region.
- Continued simulation efforts.
- Began compilation of updated information regarding the emission rates for some of the Canadian CO<sub>2</sub> sources.
- Completed a preliminary draft report of the 3-D modeling effort.
- Submitted the D89 report entitled “Geochemical Evaluation of the Basal Cambrian System” on March 28, 2013.
- Contacted PTRC regarding core plug extraction and implementation of the core testing program for the Aquistore Project in Saskatchewan, Canada. PTRC agreed to provide the 3-D geomodel in April 2013, and the EERC will add in the core analysis results.

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

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

### PHASE III COST STATUS

The approved BP4 (Modification No. 24) 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 10 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	58,400,697	31,094,031
Nonfederal Share – Cash	2,411,971	2,319,073
Nonfederal Share – In-Kind	27,034,759	23,783,635
<b>Total</b>	<b>87,847,427</b>	<b>57,196,739</b>

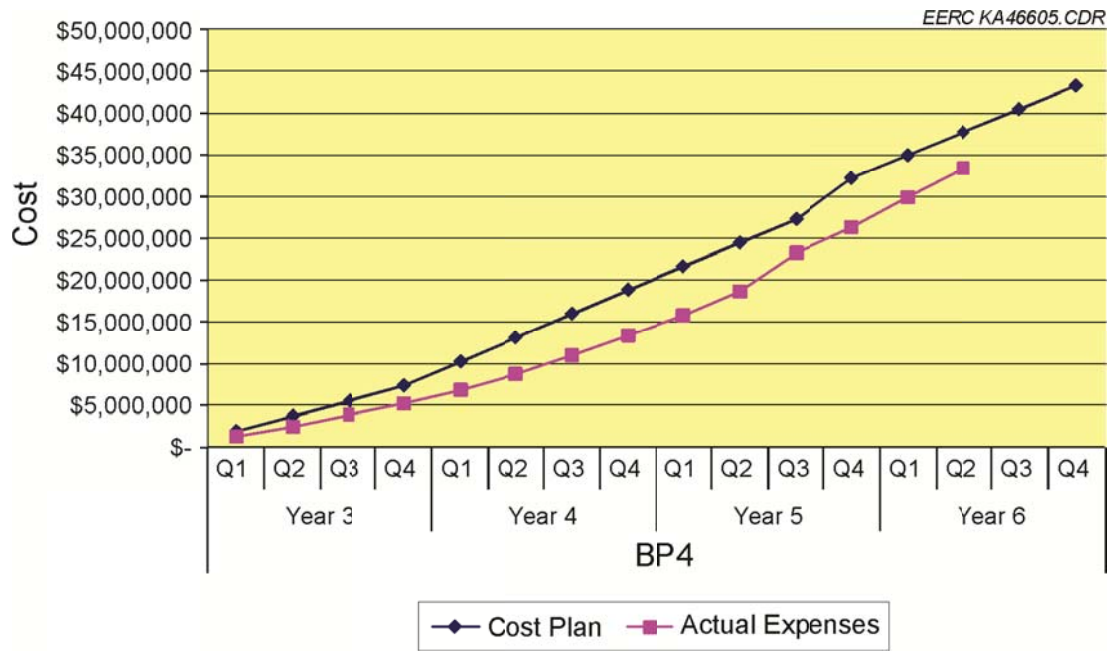


Figure 10. PCOR Partnership Phase III, BP4, Years 3–6 funding (cash only).

**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	\$ 4,771,676	\$ 30,388,524	\$ 2,612,701	\$ 33,001,225	\$ 2,612,701	\$ 35,613,925	\$ 2,612,701	\$ 38,226,626	\$ 2,612,701	\$ 40,839,326
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	\$ 4,924,105	\$ 32,219,755	\$ 2,757,886	\$ 34,977,641	\$ 2,757,886	\$ 37,735,526	\$ 2,757,886	\$ 40,493,412	\$ 2,757,886	\$ 43,251,297
<b>Actual Incurred Cost</b>																
Federal Share	\$ 2,255,269	\$ 14,506,115	\$ 2,762,335	\$ 17,268,450	\$ 4,349,081	\$ 21,617,531	\$ 2,768,852	\$ 24,386,383	\$ 3,463,510	\$ 27,849,893	\$ 3,244,138	\$ 31,094,031				
Nonfederal Share	\$ 160,751	\$ 1,222,584	\$ 134,138	\$ 1,356,722	\$ 264,409	\$ 1,621,131	\$ 296,942	\$ 1,918,073	\$ 156,655	\$ 2,074,728	\$ 244,345	\$ 2,319,073				
Total Incurred Cost	\$ 2,416,020	\$ 15,728,699	\$ 2,896,473	\$ 18,625,172	\$ 4,613,490	\$ 23,238,662	\$ 3,065,794	\$ 26,304,456	\$ 3,620,165	\$ 29,924,621	\$ 3,488,483	\$ 33,413,104				
<b>Variance</b>																
Federal Share	\$ 416,224	\$ 5,767,749	\$ (90,843)	\$ 5,676,906	\$ (1,677,589)	\$ 3,999,318	\$ 2,002,824	\$ 6,002,141	\$ (850,810)	\$ 5,151,332	\$ (631,438)	\$ 4,519,894				
Nonfederal Share	\$ (8,322)	\$ 151,360	\$ 18,291	\$ 169,651	\$ (111,980)	\$ 57,671	\$ (144,513)	\$ (86,842)	\$ (11,470)	\$ (98,312)	\$ (99,160)	\$ (197,472)				
Total Variance	\$ 407,902	\$ 5,919,109	\$ (72,552)	\$ 5,846,557	\$ (1,789,569)	\$ 4,056,989	\$ 1,858,311	\$ 5,915,299	\$ (862,280)	\$ 5,053,020	\$ (730,598)	\$ 4,322,422				

**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> 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
<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

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) (continued)</b>		
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
<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

<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 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	1/31/12
D65: Task 4 – Fort Nelson Test Site – Site Characterization Report	1/31/12	1/31/12
D81: Task 1 – Regional Carbon Sequestration Atlas (update)	1/31/12	1/31/12
M23: Task 14 – Monthly WWG Conference Call Held	1/31/12	1/19/12
M29: Task 4 – Fort Nelson Site Characterization Report Completed	1/31/12	1/31/12
D91: Task 16 – Report – Geological Characterization of the Basal Cambrian System in the Williston Basin	2/29/12	2/29/12
M23: Task 14 – Monthly WWG Conference Call Held	2/29/12	2/28/12
D5: Task 1 – Second Target Area Completed	3/31/12	3/30/12
D18: Task 2 – Bell Creek Test Site PowerPoint Presentation (update)	3/31/12	3/30/12
M10: Task 4 – Bell Creek Test Site Wellbore Leakage Data Collection Completed	3/31/12	3/12/12
M36: Task 13 – Annual Advisory Board Scheduled	3/31/12	3/28/12
M23: Task 14 – Monthly WWG Conference Call Held	3/31/12	3/27/12
<b>Year 5 – Quarter 3 (April–June 2012)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	4/30/12	4/30/12
M23: Task 14 – Monthly WWG Conference Call Held	4/30/12	Waived by DOE
D17: Task 2 – General Phase III Information PowerPoint Presentation (update)	5/31/12	5/31/12
M23: Task 14 – Monthly WWG Conference Call Held	5/31/12	5/31/12
D19: Task 2 – Fort Nelson Test Site PowerPoint Presentation (update)	6/30/12	6/29/12
D41: Task 4 – Fort Nelson Test Site – Geochemical Report	6/30/12	6/29/12
D84: Task 6 – Report – A Phased Approach to Building Pipeline Network for CO <sub>2</sub> Transportation During CCS	6/30/12	6/29/12
M23: Task 14 – Monthly WWG Conference Call Held	6/30/12	6/28/12
M24: Task 14 – WWG Annual Meeting Held	6/30/12	5/3/12
M32: Task 4 – Fort Nelson Geochemical Report Completed	6/30/12	6/29/12

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 4 (July–September 2012)</b>		
D13: Task 2 – Public Site Updates	7/31/12	7/31/12
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	7/31/12	7/31/12
D67: Task 9 – Fort Nelson Test Site – Simulation Report	7/31/12	7/31/12
M23: Task 14 – Monthly WWG Conference Call Held	7/31/12	7/24/12
D66: Task 9 – Bell Creek Test Site – Simulation Report	8/31/12	8/31/12
M23: Task 14 – Monthly WWG Conference Call Held	8/31/12	8/30/12
D1: Task 1 – Review of Source Attributes	9/30/12	9/28/12
D10: Task 1 – DPRS Update	9/30/12	9/28/12
M23: Task 14 – Monthly WWG Conference Call Held	9/30/12	9/27/12
<b>Year 6 – Quarter 1 (October–December 2012)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	10/31/12	10/31/12
M23: Task 14 – Monthly WWG Conference Call Held	10/31/12	10/25/12
M23: Task 14 – Monthly WWG Conference Call Held	11/30/12	11/28/12
D57: Task 12 – Project Assessment Annual Report	12/31/12	12/28/12
M23: Task 14 – Monthly WWG Conference Call Held	12/31/12	Waived by DOE
M37: Task 3 – IOGCC Task Force Subgroup Meeting 1 Held	12/31/12	12/21/12
<b>Year 6 – Quarter 2 (January–March 2013)</b>		
D32: Task 4 – Bell Creek Test Site – Geomechanical Final Report	1/31/13	1/31/13
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	1/31/13	1/31/13
M23: Task 14 – Monthly WWG Conference Call Held	1/31/13	1/16/13
D14: Task 2 – General Phase III Fact Sheet (update)	2/28/13	2/28/13
M23: Task 14 – Monthly WWG Conference Call Held	2/28/13	2/28/13
D85: Task 6 – Report – Opportunities and Challenges Associated with CO <sub>2</sub> Compression and Transportation During CCS Activities	3/31/13	Waived by DOE (journal article)
D89: Task 16 – Report – Geochemical Evaluation of the Basal Cambrian System	3/31/13	3/28/13
D99: Task 14 – Water/CCS Nexus-Related Fact Sheet	3/31/13	3/22/13
M23: Task 14 – Monthly WWG Conference Call Held	3/31/13	3/28/13
M36: Task 13 – Annual Advisory Board Meeting Scheduled	3/31/13	3/27/13

Continued . . .

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

<b>Title/Description</b>	<b>Due Date</b>	<b>Actual Completion Date</b>
<b>Year 6 – Quarter 3 (April–June 2013)</b>		
D15: Task 2 – Bell Creek Test Site Fact Sheet (update)	4/15/13	3/25/13
D16: Task 2 – Fort Nelson Test Site Fact Sheet (update)	4/30/13	Waived by DOE
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	4/30/13	
M14: Task 4 – Bell Creek Test Site Geological Characterization Data Collection Completed	4/30/13	
M23: Task 14 – Monthly WWG Conference Call Held	4/30/13	
M35: Task 16 – Basal Cambrian Dynamic Capacity Estimation Completed	4/30/13	
D17: Task 2 – General Phase III Information PowerPoint Presentation (update)	5/31/13	
D43: Task 5 – Bell Creek Test Site – Monitoring Experimental Design Package	5/31/13	
M23: Task 14 – Monthly WWG Conference Call Held	5/31/13	
M27: Task 5 – Bell Creek Test Site – MVA Equipment Installation and Baseline MVA Activities Completed	5/31/13	
D40: Task 4 – Fort Nelson Test Site – Geomechanical Final Report	6/30/13	
D93: Task 1 – Geological Modeling and Simulation Report for the Aquistore Project	6/30/13	
D96: Task 4 – Bell Creek Test Site – 3-D Seismic and Characterization Report	6/30/13	
D97: Task 3 – Report – Findings and Recommendations of CGS Subgroups	6/30/13	
M23: Task 14 – Monthly WWG Conference Call Held	6/30/13	
M26: Task 8 – Bell Creek Test Site – CO <sub>2</sub> Injection Initiated	6/30/13	
M37: Task 3 – IOGCC Task Force Subgroup Meeting 2 Held	6/30/13	
<b>Year 6 – Quarter 4 (July–September 2013)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	7/31/13	
D33: Task 4 – Bell Creek Test Site – Geochemical Final Report	7/31/13	
D67: Task 9 – Fort Nelson Test Site – Simulation Report	7/31/13	
M12: Task 4 – Bell Creek Test Site Geochemical Work Completed	7/31/13	
M23: Task 14 – Monthly WWG Conference Call Held	7/31/13	
D64: Task 4 – Bell Creek Test Site – Site Characterization Report	8/31/13	
D66: Task 9 – Bell Creek Test Site – Simulation Report	8/31/13	
D81: Task 1 – Regional Carbon Sequestration Atlas (update)	8/31/13	
M23: Task 14 – Monthly WWG Conference Call Held	8/31/13	

Continued . . .

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

Title/Description	Due Date	Actual Completion Date
<b>Year 6 – Quarter 4 (July–September 2013) (continued)</b>		
D1: Task 1 – Review of Source Attributes	9/30/13	
D6: Task 3 – Permitting Review – Update 1	9/30/13	
D48: Task 7 – Bell Creek Test Site – Procurement Plan and Agreement Report	9/30/13	
D86: Task 15 – Updated Regional Implementation Plan for Zama (Ext. from 4/30/12)	9/30/13	
D90: Task 16 – Report – Wellbore Evaluation of the Basal Cambrian System	9/30/13	
D94: Task 2 – Aquistore Project Fact Sheet	9/30/13	
D95: Task 2 – Aquistore Project Poster	9/30/13	
D98: Task 3 – Report – Findings, Recommendations, and Guidance of CGS Task Force	9/30/13	
M23: Task 14 – Monthly WWG Conference Call Held	9/30/13	
M38: Task 3 – IOGCC Task Force Wrap-Up Meeting Held	9/30/13	
M39: Task 3 – IOGCC Task Force Editing Subgroup Meeting Held	9/30/13	
M40: Task 15 – Further Characterization of the Zama Acid Gas EOR, CO <sub>2</sub> Storage, and Monitoring Project Completed	9/30/13	
<b>Year 7 – Quarter 1 (October–December 2013)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	10/31/13	
D42: Task 5 – Bell Creek Test Site – Injection Experimental Design Package	10/31/13	
D99: Task 14 – Water/CCS Nexus-Related Fact Sheet	10/31/13	
M23: Task 14 – Monthly WWG Conference Call Held	10/31/13	
M23: Task 14 – Monthly WWG Conference Call Held	11/30/13	
D41: Fort Nelson Test Site – Geochemical Report (Update 1)	12/15/13	
D57: Task 12 – Project Assessment Annual Report	12/31/13	
M23: Task 14 – Monthly WWG Conference Call Held	12/31/13	
M24: Task 14 – WWG Annual Meeting Held	12/31/13	
<b>Year 7 – Quarter 2 (January–March 2014)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	1/31/14	
M23: Task 14 – Monthly WWG Conference Call Held	1/31/14	
M41: Task 6 – Decision to Incorporate Ramgen Compression Technology into Bell Creek Project	1/31/14	
M23: Task 14 – Monthly WWG Conference Call Held	2/28/14	

Continued . . .

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

<b>Title/Description</b>	<b>Due Date</b>	<b>Actual Completion Date</b>
<b>Year 6 – Quarter 4 (July–September 2013) (continued)</b>		
D24: Task 2 – PCOR Partnership Region Sequestration General Poster (update)	3/31/14	
D36: Task 4 – Bell Creek Test Site – Wellbore Leakage Final Report	3/31/14	
D92: Task 16 – Report – Storage Capacity and Regional Implications for Large-Scale Storage in the Basal Cambrian System	3/31/14	
M23: Task 14 – Monthly WWG Conference Call Held	3/31/14	
M36: Task 13 – Annual Advisory Board Meeting Scheduled	3/31/14	

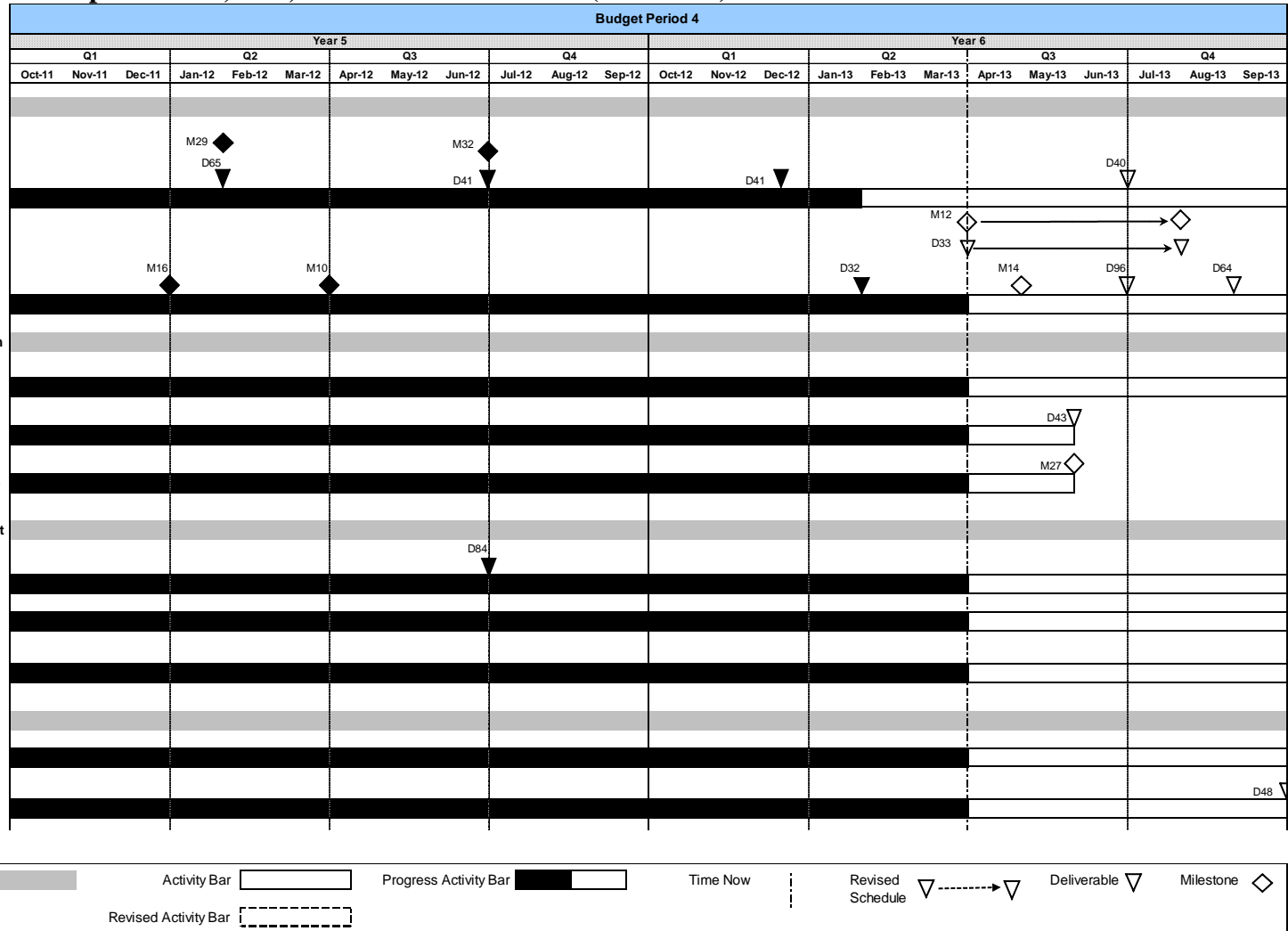
**Table 6. PCOR Partnership Phase III, BP4, Years 5–6 Gantt Chart**



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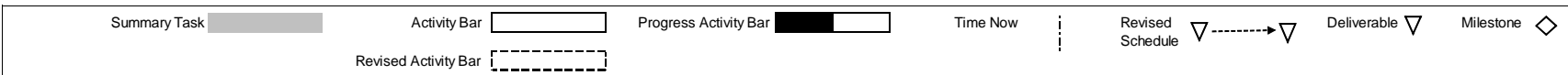


**Table 6. PCOR Partnership Phase III, BP4, Years 5–6 Gantt Chart (continued)**

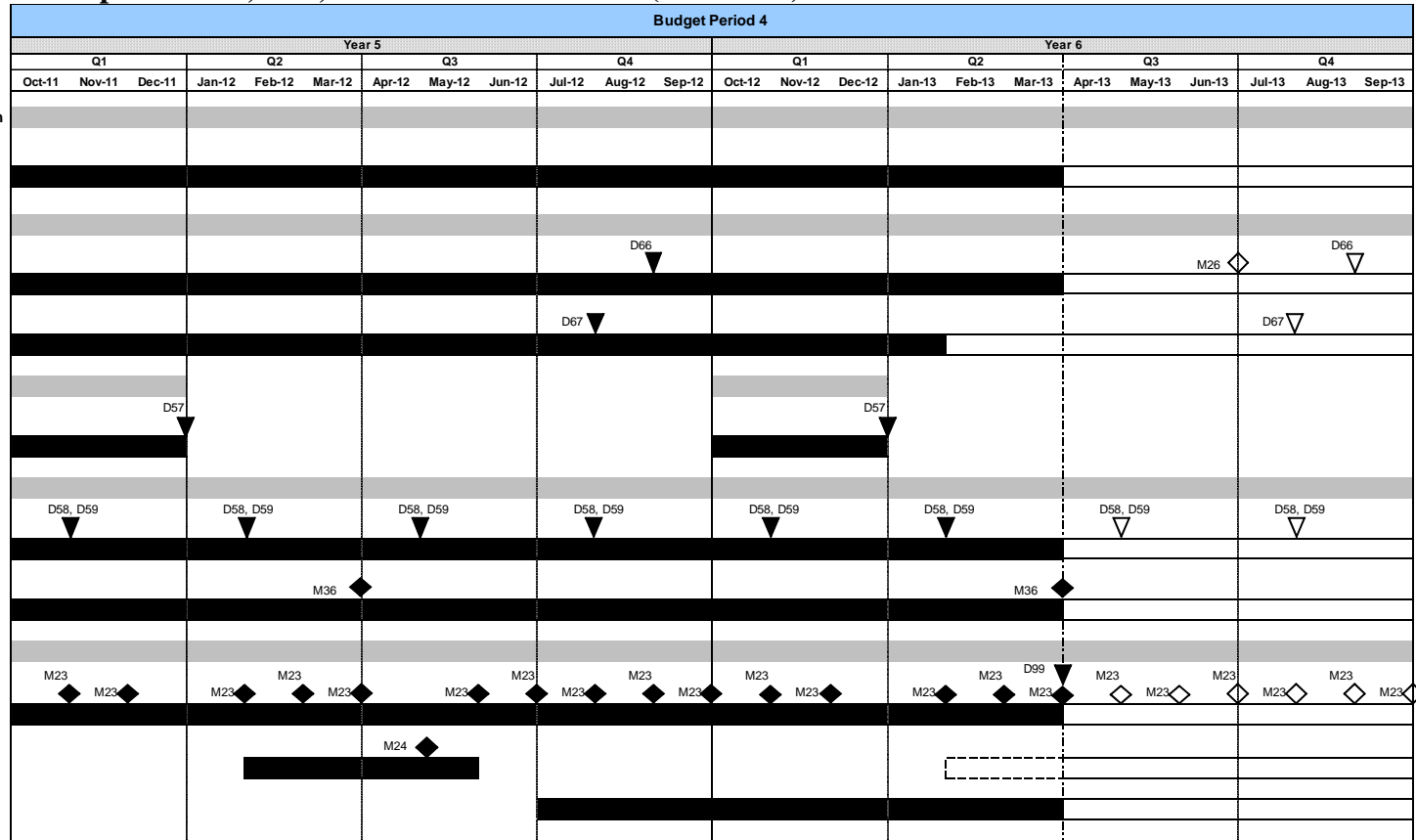


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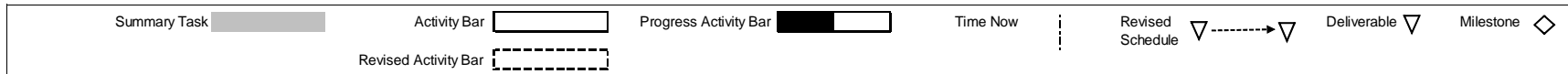
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**Table 6. PCOR Partnership Phase III, BP4, Years 5–6 Gantt Chart (continued)**

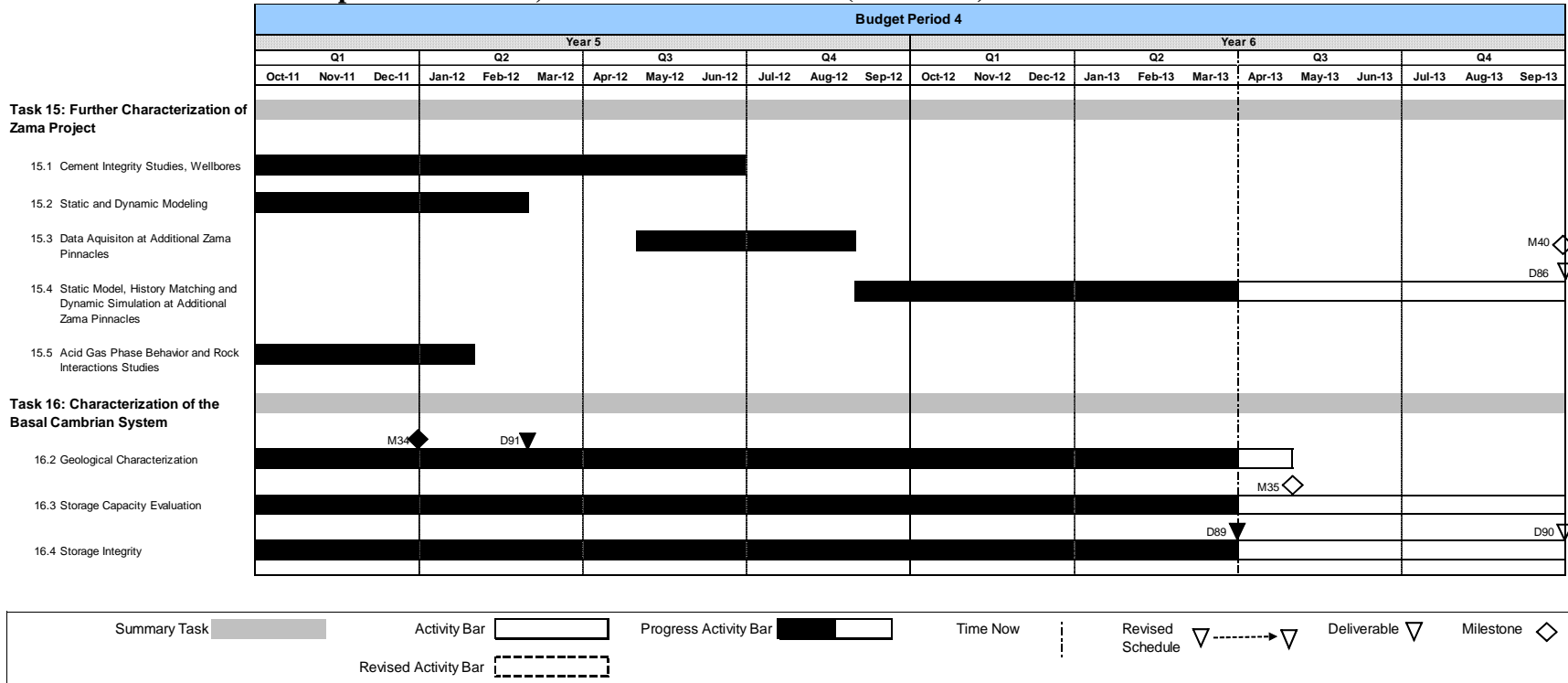


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**Table 6. PCOR Partnership Phase III BP4, Years 5–6 Gantt Chart (continued)**



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**Table 6. PCOR Partnership Phase III BP4, Years 5–6 Gantt Chart (continued)**

Key for Deliverables (D) ▼		Key for Milestones (M) ◆
D1 Review of Source Attributes	D66 BC Test Site – Simulation Report	M10 BC Test Site – Wellbore Leakage Data Collection Completed
D5 Second Target Area Completed	D67 FN Test Site – Simulation Report	M12 BC Test Site – Preinjection Geochemical Work Completed
D6 Permitting Review – Update 1	D81 Regional Carbon Sequestration Atlas	M14 BC Test Site – Geological Characterization Data Collection Completed
D10 DPRS Update	D84 Report – A Phased Approach to Building Pipeline Network for CO <sub>2</sub> Transportation During CCS	M16 BC Test Site – Initiation of Production and Injection Simulations
D13 Public Site Updates	D86 Updated Regional Technology Implementation Plan for Zama	M23 Monthly WWG Conference Call Held
D14 General Phase III Fact Sheet	D89 Report – Geochemical Evaluation of the Basal Cambrian System	M24 WWG Annual Meeting Held
D15 BC Test Site Fact Sheet	D90 Report – Wellbore Evaluation of the Basal Cambrian System	M26 BC Test Site – CO <sub>2</sub> Injection Initiated
D17 General Phase III Information PowerPoint Presentation	D91 Report – Geological Characterization of the Basal Cambrian System in the Williston Basin	M27 BC Test Site – MVA Equipment Installation and Baseline MVA Activities Completed
D18 BC Test Site PowerPoint Presentation	D93 Report – Geological Modeling and Simulation for the Aquistore Project	M29 FN Test Site – Site Characterization Report Completed
D19 FN Test Site PowerPoint Presentation	D94 Aquistore Project Fact Sheet	M32 FN Test Site – Geochemical Report Completed
D32 BC Test Site – Geomechanical Report	D95 Aquistore Project Poster	M34 Basal Cambrian Static Geological Model Completed
D33 BC Test Site – Preinjection Geochemical Report	D96 BC Test Site – 3-D Seismic Acquisition and Characterization Report	M35 Basal Cambrian Dynamic Capacity Estimation Completed
D40 FN Test Site – Geomechanical Report	D97 Report – Findings and Recommendations – GCS Task Force's Operational and Postoperational Liability Subgroups	M36 Annual Advisory Board Meeting Scheduled
D41 FN Test Site – Geochemical Report	D98 Report – Findings, Recommendations and Guidance of the GCS Task Force on Operational and Postoperational Liability	M37 Subgroup Meetings Held
D43 BC Test Site – Monitoring Experimental Design Package	D99 Water/CCS Nexus Related Fact Sheet	M38 Task Force Wrap-Up Meeting Held
D48 BC Test Site – Procurement Plan and Agreement Report		M39 Editing Subgroup Meeting Held
D57 Project Assessment Annual Report		M40 Further Characterization of the Zama Acid Gas EOR, CO <sub>2</sub> Storage, and Monitoring Project Completed
D58 Quarterly Progress Report		
D59 Milestone Quarterly Report		
D64 BC Test Site – Site Characterization Report		
D65 FN Test Site – Site Characterization Report		

## PHASE III PRODUCTS OR TECHNOLOGY TRANSFER ACTIVITIES

During the reporting period, there were two abstracts (one poster and one oral) accepted for presentation and 15 presentations (14 oral and one poster) given at 16 different meetings/conferences. In addition, a quarterly progress report, 11 deliverables (eight finalized), and two milestones (one finalized) were completed.

### Abstracts

#### *Submitted*

Watson, K., Cumming, L., Daly, D.J., and Wade, S., 2013, Message mapping – field testing message to enhance CCS communications: Draft abstract for the 12th Annual Conference on Carbon Capture Utilization & Sequestration, Pittsburgh, Pennsylvania, May 13–16, 2013.

#### *Submitted, Accepted, and Declined by Author*

Ostadhassan, M., Braunberger, J.R., Hamling, J.A., and Gorecki, C.D., 2012, Post-stack processing and seismic inversion of 2-D line Bell Creek Field, Powder River Basin, Montana [abs.]: 2013 AAPG Annual Convention & Exhibition, Pittsburgh, Pennsylvania, May 19–22, 2013.

Saini, D., Gorecki, C.D., Hamling, J.A., Bailey, T.P., and Sorensen, J.A., 2012, Mechanism of subnormal pressure generation in the Bell Creek oil field and the implications to CO<sub>2</sub> storage [abs.]: International Petroleum Technology Conference, Beijing, China, March 26–28, 2013.

### Presentations

Botnen, L.S., Daly, D.J., Hamling, J.A., Sorensen, J.A., Peck, W.P., Saini, D., Kurz, B.A., Ayash, S.C., Steadman, E.N., Harju, J.A., Nakles, D., and Jackson, B., 2012, PCOR Partnership Technical Advisory Board meeting: Confidential presentation for the PCOR Partnership Technical Advisory Board meeting, Orlando, Florida, March 5–6, 2013.

Gorecki, C.D., 2013, Plains CO<sub>2</sub> Reduction (PCOR) Partnership overview: Presented at the Partnership for CO<sub>2</sub> Capture Phase II Project Update Meeting, Grand Forks, North Dakota, March 8, 2013.

Gorecki, C.D., and Liu, G., 2013, Overview of the PCOR Partnership Program and other EERC-led CO<sub>2</sub> storage-related projects: Presented at the Division of Engineering Geology and Water Resources, Institute of Geology and Geophysics, Beijing, China, March 27, 2013.

Harju, J.A., and Steadman, E.N., 2013, The Plains CO<sub>2</sub> Reduction (PCOR) Partnership: Presented to Statoil personnel, Houston, Texas, March 7, 2013.

Harju, J.A., and Steadman, E.N., 2013, The Plains CO<sub>2</sub> Reduction (PCOR) Partnership: Presented to U.S. Department of Energy National Energy Technology Laboratory personnel, Morgantown, West Virginia, February 20–21, 2013.

- Klenner, R.C.L., and Peck, W.D., 2013, North American CO<sub>2</sub> storage atlas—a comparable model: Presented at the CanGEA 2013 Geothermal Conference, Calgary, Alberta, March 20–22, 2013.
- Liu, G., Gorecki, C.D., Braunberger, J.R., Bailey, T.P., and Landsverk, K.R., 2013, Integrated reservoir modeling and simulation optimization workflow based on a high-performance parallel computing cluster: Presented at the 2013 Rice Oil & Gas HPC Workshop, Houston, Texas, February 28, 2013.
- Peck, W.D., 2013, The Plains CO<sub>2</sub> Reduction (PCOR) Partnership—a Regional Carbon Sequestration Partnership in the interior plains of North America: Presented at EUEC 2013: Energy, Utility & Environment Conference, Phoenix, Arizona, January 28–30, 2013.
- Peck, W.D., and Braunberger, J.R., 2013, Basal Cambrian project update meeting: Presented at the Basal Cambrian Project Meeting, Berkeley, California, February 21, 2013.
- Saini, D., 2013, An update on completed static and dynamic modeling work (F Pool) and further characterization of Zama CO<sub>2</sub> EOR and storage project: Presented to Apache Canada personnel, Grand Forks, North Dakota, January 24–25, 2013.
- Smith, S.A., 2013, The EERC and Zama past, present, and future: Presented to Apache Canada personnel, Grand Forks, North Dakota, January 24–25, 2013.
- Steadman, E.N., 2013, The Plains CO<sub>2</sub> Reduction (PCOR) Partnership: Presented at the 8th Annual Southeast Regional Carbon Sequestration Partnership (SECARB) Stakeholders' Briefing, Atlanta, Georgia, March 12, 2013.
- Steadman, E.N., 2013, The Plains CO<sub>2</sub> Reduction (PCOR) Partnership: Presented to Konkuk University (Seoul, Korea) personnel, Grand Forks, North Dakota, March 1, 2013.
- Stepan, D.J., and Klapperich, R.J., 2013, Baseline monitoring, verification, and accounting (MVA) activities: Presented via WebEx to the PCOR Partnership Technical Advisory Board, Grand Forks, ND, January 3, 2013.

### **Poster Presentations**

- Gorecki, C.D., 2013, The Plains CO<sub>2</sub> Reduction (PCOR) Partnership—CO<sub>2</sub> sequestration demonstration projects adding value to the oil and gas industry: ePoster presented at the International Petroleum Technology Conference, Beijing, China, March 26–28, 2013, No. IPTC-17089-MS.

### **Conference Papers**

- Gorecki, C.D., Steadman, E.N., Harju, J.A., Sorensen, J.A., Hamling, J.A., Botnen, L.S., Ayash, S.C., and Anagnost, K.K., 2013, The Plains CO<sub>2</sub> Reduction (PCOR) Partnership—CO<sub>2</sub> sequestration demonstration projects adding value to the oil and gas industry: Paper presented at the International Petroleum Technology Conference, Beijing, China, March 26–28, 2013, No. IPTC-17089-MS.

## **Deliverables/Milestones**

### ***Draft***

Ayash, S.C., Gorecki, C.D., Sorensen, J.A., Steadman, E.N., and Harju, J.A., 2013, Technical Advisory Board meeting scheduled: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III draft Task 13 Milestone M36 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., Crocker, C.R., Gorecki, C.D., Steadman, E.N., and Harju, J.A., 2013, PCOR Partnership – demonstrating CO<sub>2</sub> storage in the northern Great Plains: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III draft Task 2 Deliverable D14 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.

Galbreath, K.C., Laumb, J.D., McCollor, D.P., Peck, W.D., Thompson, J.S., Kurz, B.A., Klenner, R.C.L., Smith, S.A., Gorecki, C.D., Steadman, E.N., and Harju, J.A., 2013, Geochemical evaluation of the basal Cambrian system: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III draft Task 16 Deliverable D89 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, Grand Forks, North Dakota, March.

Ge, J., Klenner, R.C.L., Liu, G., Braunberger, J.R., Ayash, S.C., Pu, H., Gao, T., Bailey, T.P., Saini, D., Hamling, J.A., Sorensen, J.A., Gorecki, C.D., Steadman, E.N., and Harju, J.A., 2013, Bell Creek Field test site – geomechanical modeling report: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III draft Task 9 Deliverable D32 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.

### ***Approved***

Botnen, L.S., Gorecki, C.D., Steadman, E.N., and Harju, J.A., 2012, IOGCC Task Force subgroup Meeting 1 held: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III Task 3 Milestone M37 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, EERC Publication 2013-EERC-01-17, Grand Forks, North Dakota, Energy & Environmental Research Center, December.

Crocker, C.R., Daly, D.J., Anagnost, K.K., Gorecki, C.D., Steadman, E.N., and Harju, J.A., 2012, Public site updates: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III Task 2 Deliverable D13 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, EERC Publication No. 2013-EERC-01-05, Grand Forks, North Dakota, Energy & Environmental Research Center, July.

Gorecki, C.D., Harju, J.A., Steadman, E.N., Romuld, L., Hamling, J.A., Sorensen, J.A., Botnen, L.S., Daly, D.J., Jensen, M.D., Peck, W.D., Smith, S.A., Klapperich, R.J., Anagnost, K.K.,

- and Votava, T.J., 2012, Annual assessment report: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III Task 12 Deliverable D57 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, EERC Publication 2013-EERC-01-16, Grand Forks, North Dakota, Energy & Environmental Research Center, December.
- Jensen, M.D., Pei, P., Letvin, P.A., Peck, W.D., Gorecki, C.D., Steadman, E.N., and Harju, J.A., 2012, 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 2013-EERC-01-03, Grand Forks, North Dakota, Energy & Environmental Research Center, September.
- Jensen, M.D., Pei, P., Snyder, A.C., Heebink, L.V., Botnen, L.S., Gorecki, C.D., Steadman, E.N., and Harju, J.A., 2012, A phased approach to designing a hypothetical pipeline network for CO<sub>2</sub> transport during carbon capture, utilization, and storage: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III Task 6 Deliverable D84 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, EERC Publication 2013-EERC-03-11, Grand Forks, North Dakota, Energy & Environmental Research Center, June.
- Klapperich, R.J., Nakles, D., Peck, W.D., Gorecki, C.D., Steadman, E.N., Harju, J.A., and McNemar, A.T., 2013, Carbon capture and storage—protecting freshwater resources: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III Task 14 Deliverable D99 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., Botnen, L.S., Gorecki, C.D., Steadman, E.N., and Harju, J.A., 2012, Fort Nelson test site – geochemical observations: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III Task 4 Deliverable D41 Update 1 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, EERC Publication 2013-EERC-01-10, Grand Forks, North Dakota, Energy & Environmental Research Center, December.
- Sorensen, J.A., Anagnost, K.K., Gorecki, C.D., and Steadman, E.N., 2012, Fort Nelson test site – simulation report: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III Task 9 Deliverable D67 Update 1 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, EERC Publication 2013-EERC-01-02, Grand Forks, North Dakota, Energy & Environmental Research Center, July.
- Stevens, B.G., Peck, W.D., Gorecki, C.D., Steadman, E.N., and Harju, J.A., 2012, Demonstration project reporting system (DPRS) update: Plains CO<sub>2</sub> Reduction Partnership Phase III Task 1 Deliverable D10 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, EERC Publication 2013-EERC-01-06, Grand Forks, North Dakota, Energy & Environmental Research Center, September.



## **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., Klapperich, R.J., and Saini, D., 2013, Plains CO<sub>2</sub> Reduction (PCOR) Partnership: Phase III monthly report (December 1–31, 2012) 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., 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., Klapperich, R.J., and Saini, D., 2013, Plains CO<sub>2</sub> Reduction (PCOR) Partnership: Phase III monthly report (January 1–31, 2013) 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.

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., Klapperich, R.J., and Saini, D., 2013, Plains CO<sub>2</sub> Reduction (PCOR) Partnership: Phase III monthly report (February 1–28, 2013) 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.

### *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., 2013, Plains CO<sub>2</sub> Reduction Partnership Phase III: Task 13 Deliverable D58/59 quarterly technical progress report (October 1 – December 31, 2012) 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.

### **Meeting Minutes**

Klapperich, R.J., 2013, Minutes—Regional Carbon Sequestration Partnership Water Working Group conference call: January 16, 2013.

Klapperich, R.J., 2013, Minutes—Regional Carbon Sequestration Partnership Water Working Group conference call: February 26, 2013.

## Journal Articles

Jensen, M.D., Pei, P., Snyder, A.C., Heebink, L.V., Botnen, L.S., Gorecki, C.D., Steadman, E.N., Harju, J.A., 2013, A Methodology for Phased Development of a Hypothetical Pipeline Network for CO<sub>2</sub> Transport During Carbon Capture, Utilization, and Storage: Energy Fuels [in press].

## MEETINGS/TRAVEL

Representatives from the PCOR Partnership attended and/or participated in the following 16 meetings/conferences, three training opportunities, and nine project management site trips in this reporting period:

- January 7–18, 2013: Traveled to the Bell Creek oil field for site activities in southeastern Montana.
- January 10 and 24, 2013: Traveled to the Lignite Field Validation Test site near Kenmare, North Dakota, to inspect the site.
- January 16, 2013: Attended a meeting at PPB headquarters in Fargo, North Dakota.
- January 20–25, 2013: Attended the 2013 UIC Conference in Sarasota, Florida.
- January 26 – February 1, 2013: Participated in the 2013 Energy, Utility & Environment Conference (EUEC) in Phoenix, Arizona.
- February 5–9, 2013: Traveled to Gillette, Wyoming, for sampling work near the Bell Creek Field.
- February 7 and 21, 2013: Traveled to the Lignite Field validation site near Kenmare, North Dakota, to inspect the site.
- February 10–18, 2013: Attended Schlumberger NExT software training entitled “Petrel Property Modeling” in Houston, Texas.
- February 16–20, 2013: Attended the SPE 2013 Reservoir Simulation Symposium and premeeting training courses entitled “Fundamentals of Reservoir Simulation” and “Reservoir Simulation for Practical Decision Making” in The Woodlands, Texas.
- February 19–22, 2013: Visited NETL offices in Morgantown, West Virginia, and Pittsburgh, Pennsylvania, to discuss project activities.
- February 19–23, 2013: Participated in a meeting of the Steering Committee of the Basal Aquifer Technical Group in Berkeley, California.
- February 20–23, 2013: Traveled to view proposed geophone installation in the Bell Creek Field.
- February 24 – March 1, 2013: Attended Schlumberger’s NExT software training entitled “Techlog Formation Evaluations” in Houston, Texas.
- February 26–28, 2013: Participated in the IOGCC CGS Subgroup meeting in Minneapolis, Minnesota.
- February 27, 2013: Traveled to PPB headquarters to discuss educational materials in Fargo, North Dakota.
- February 27 – March 1, 2013: Presented at the Rice 2013 Oil & Gas HPC Workshop in Houston, Texas.

- March 2–10, 2013: Provided technical advice during 56-14R core collection in the Bell Creek Field.
- March 4–7, 2013: Hosted the 2nd annual TAB meeting in Orlando, Florida.
- March 7 and 21, 2013: Traveled to the Lignite Field validation site near Kenmare, North Dakota, to inspect the site.
- March 11–12, 2013: Participated in a logging review meeting with Denbury and Schlumberger in Denver, Colorado.
- March 11–13, 2013: Presented at the SECARB 8th Annual Stakeholders' Briefing in Atlanta, Georgia.
- March 15–22, 2013: Provided technical advice during 33-14R core collection in the Bell Creek Field.
- March 18–22, 2013: Traveled to the Bell Creek Field for sampling activities.
- March 20, 2013: Filmed preliminary version of the education presentation at PPB in Fargo, North Dakota.
- March 20–23, 2013: Presented at the CanGEA 2013 Geothermal Conference in Calgary, Alberta, Canada.
- March 22–29, 2013: Presented at the 6th IPTC in Beijing, China.

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.