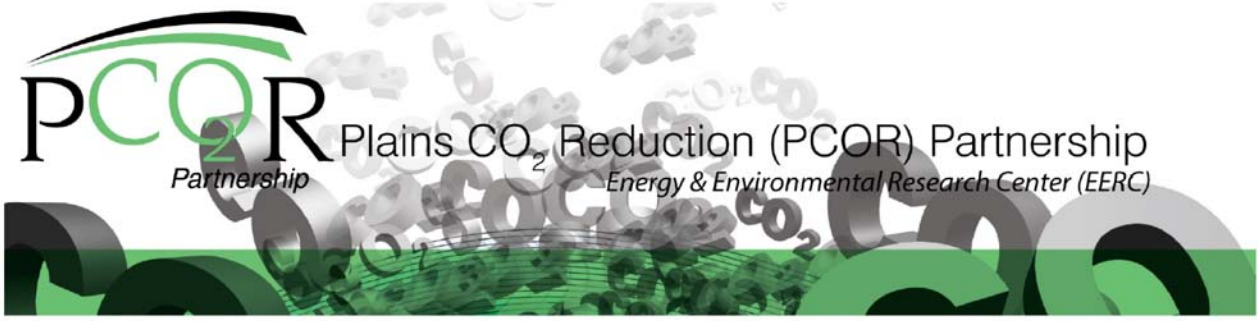


PLAINS CO_2 REDUCTION PARTNERSHIP PHASE III

Quarterly Technical Progress Report
Task 13 – Deliverable D58/D59

(for the period April 1 – June 30, 2011)

Prepared for:

Federal Information Tracking System (FITS)
U.S. Department of Energy
National Energy Technology Laboratory

Cooperative Agreement No. DE-FC26-05NT42592
EERC Funds 15422 and 15577
DOE Project Manager: Andrea T. McNemar
Principal Investigator: Charles D. Gorecki

Prepared by:

Charles D. Gorecki
John A. Harju
Edward N. Steadman
Lucia Romuld
James A. Sorensen
Daniel J. Daly
John A. Hamling
Melanie D. Jensen
Lisa S. Botnen
Ryan J. Klapperich
Wesley D. Peck
Katherine K. Anagnost
Tami Jo Votava

Energy & Environmental Research Center
University of North Dakota
15 North 23rd Street, Stop 9018
Grand Forks, ND 58202-9018

July 2011

DOE DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government, nor any agency thereof, nor any of their employees makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

EERC DISCLAIMER

LEGAL NOTICE This research report was prepared by the Energy & Environmental Research Center (EERC), an agency of the University of North Dakota, as an account of work sponsored by the U.S. Department of Energy and the North Dakota Industrial Commission. Because of the research nature of the work performed, neither the EERC nor any of its employees makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement or recommendation by the EERC.

NORTH DAKOTA INDUSTRIAL COMMISSION DISCLAIMER

This report was prepared by the Energy & Environmental Research Center (EERC) pursuant to an agreement partially funded by the Industrial Commission of North Dakota, and neither the EERC nor any of its subcontractors nor the North Dakota Industrial Commission nor any person acting on behalf of either:

(A) Makes any warranty or representation, express or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or

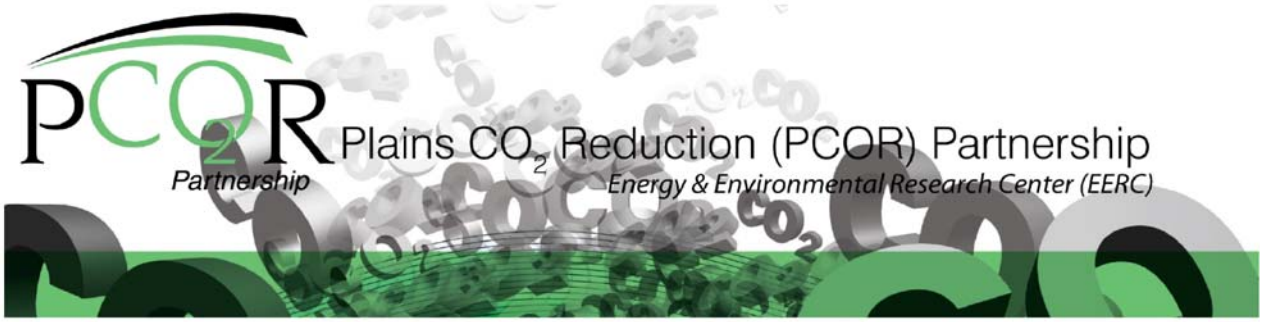
(B) Assumes any liabilities with respect to the use of, or for damages resulting from the use of, any information, apparatus, method, or process disclosed in this report.

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the North Dakota Industrial Commission. The views and opinions of authors expressed herein do not necessarily state or reflect those of the North Dakota Industrial Commission.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES



PLAINS CO_2 REDUCTION PARTNERSHIP PHASE III
Quarterly Technical Progress Report
April 1 – June 30, 2011

EXECUTIVE SUMMARY

The Plains CO_2 Reduction (PCOR) Partnership is one of seven Regional Carbon Sequestration Partnerships (RCSPs) competitively awarded by the U.S. Department of Energy (DOE) National Energy Technology Laboratory in 2003 as part of a national plan to mitigate greenhouse gas emissions. The PCOR Partnership is led by the Energy & Environmental Research Center (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_2) into deep geologic formations for CO_2 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 April 1, 2011, through June 30, 2011.

Effective April 29, Charles Gorecki has assumed the duties of the PCOR Partnership Principal Investigator/Program Manager. He is replacing Ed Steadman, who had served as the Principal Investigator/Program Manager beginning with the program's inception in 2003 and who received a promotion at the EERC to Deputy Associate Director for Research. Also on April 29, DOE approved a deep monitoring well in the Bell Creek Field to gather additional baseline data. Plans are already under way to spud the monitoring well in fall 2011.

During this reporting period, nearly 200 regional teachers learned about the PCOR Partnership Program and received various outreach materials, including the regional atlas, documentaries, and fact sheets. Presentations were given and materials were distributed in June 2011 at teacher seminars sponsored by the North Dakota Petroleum Council and the Lignite Energy Council. In addition, planning is well under way to reach additional educators via the Prairie Energy & Carbon Teacher Training Institute to be hosted by Prairie Public Broadcasting on November 18 and 19, 2011, at the EERC.

In addition, geochemical analyses of the target injection formation and key sealing formations for the Fort Nelson carbon capture and storage (CCS) Project site continued, and the detailed assessment of the Rival oil field in north-central North Dakota saw progress on geologic model and petrographic analysis.

PLAINS CO_2 REDUCTION PARTNERSHIP PHASE III
Quarterly Technical Progress Report
April 1 – June 30, 2011

INTRODUCTION

The Plains CO_2 Reduction (PCOR) Partnership is one of seven regional partnerships operating under the U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL) Regional Carbon Sequestration Partnership (RCSP) Program. The PCOR Partnership is led by the Energy & Environmental Research Center (EERC) at the University of North Dakota (UND) in Grand Forks, North Dakota, and includes stakeholders from the public and private sector. The membership as of June 30, 2011, is listed in Table 1. The PCOR Partnership region includes all or parts of nine states (Iowa, Minnesota, Missouri, Montana, Nebraska, North Dakota, South Dakota, Wisconsin, and Wyoming) and four Canadian provinces (Alberta, British Columbia, Manitoba, and Saskatchewan).

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

The RCSP Program initiative is being implemented in three phases:

- Phase I – Characterization Phase (2003–2005): characterized opportunities for carbon sequestration
- Phase II – Validation Phase (2005–2009): conducted small-scale field validation tests
- Phase III – Development Phase (2007–2017): involves large-volume carbon storage demonstration tests (Figure 1)

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

BP3: October 1, 2007 – September 30, 2009
BP4: October 1, 2009 – September 30, 2015
BP5: October 1, 2015 – September 30, 2017
Note: BP1 and BP2 were effective in Phase II.

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

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

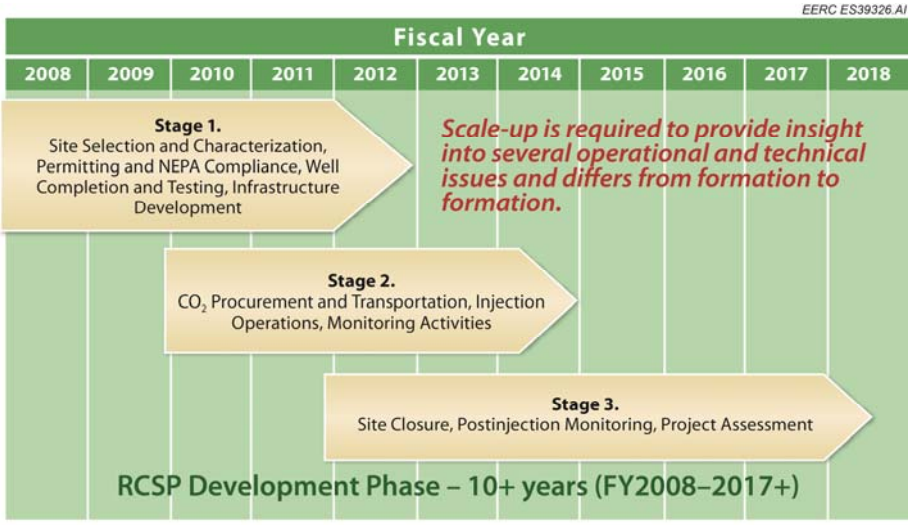


Figure 1. RCSP development phase: scaling up toward commercialization (figure taken from DOE NETL).

The overall mission of the Phase III program is to 1) gather characterization data to verify the ability of the target formations to store carbon dioxide (CO_2), 2) facilitate the development of the infrastructure required to transport CO_2 from sources to the injection sites, 3) facilitate development of the rapidly evolving North American regulatory and permitting framework, 4) develop opportunities for PCOR Partnership partners to capture and store CO_2, 5) establish a technical framework by which carbon credits can be monetized for CO_2 stored in geologic formations, 6) continue collaboration with other RCSPs, and 7) provide outreach and education for CO_2 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_2 injection volumes. A programmatic RCSP Phase III goal is the injection of approximately 1 million tons of CO_2 a year into at least one regionally significant geologic formation. Each of the RCSP's large-volume injection tests is designed to demonstrate that CO_2 storage sites have the potential to store regional CO_2 emissions safely, permanently, and economically for hundreds of years.

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

The PCOR Partnership's objectives for the demonstration projects are as follows: 1) conduct a successful field demonstration to verify that the region's large number of oil fields have the potential to store significant quantities of CO_2 in a safe, economical, and environmentally responsible manner and 2) conduct a successful demonstration at the Fort Nelson site to verify the economic feasibility of using the region's carbonate saline formations for safe, long-term CO_2 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_2 Procurement, 8) Transportation and Injection Operations, 9) Operational Monitoring and Modeling, 10) Site Closure, 11) Postinjection Monitoring and Modeling, 12) Project Assessment, 13) Project Management, 14) RCSP Water Working Group (WWG) Coordination, 15) Further Characterization of the Zama Acid Gas Enhanced Oil Recovery (EOR), CO_2 Storage, and Monitoring Project, and 16) Characterization of the Basal Cambrian System. Table 2 lists the responsibility matrix for these 16 tasks.

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

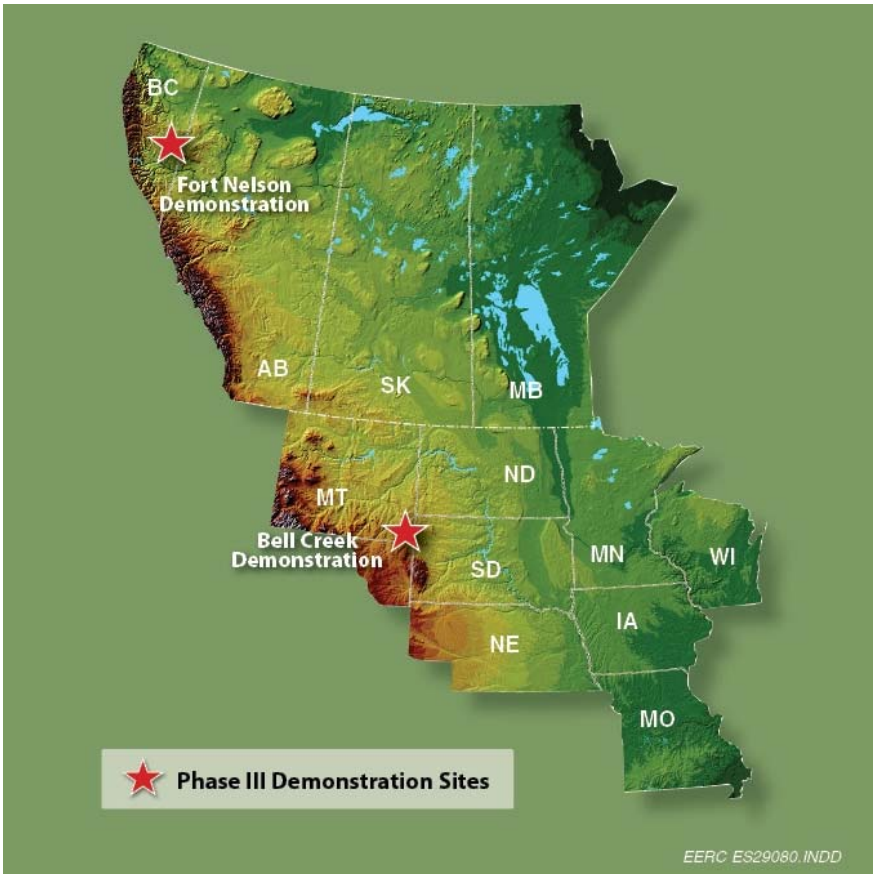


Figure 2. PCOR Partnership Phase III demonstration sites.

PROGRESS OF WORK

Task 1 – Regional Characterization

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

- Continued efforts on the revised atlas (4th edition).
- Continued maintenance and upgrades to the partners-only Decision Support System (DSS, © 2007–2011 EERC Foundation) located at www2.undeerc.org/website/PCORP/, as described below.
  - Began updating the sources spreadsheet by replacing 2009 data with 2010 data and double-checking source locations using newer Google Earth maps that are now in focus.
  - Continued compilation of advanced programming components for the site modifications.
  - Added geographic information system-(GIS)-mapping layers common to many of the project tasks to the central geodatabase.
  - Began improvement of the search feature for the products database housed on the site.

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_2 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[1]
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_2 Storage, and Monitoring Project	James A. Sorensen
Task 16 – Characterization of the Basal Cambrian System	Wesley D. Peck

[1] To be announced.

- Continued development of a regional map detailing the oil and gas fields within the greater Williston Basin area.
- Progress continues on the detailed assessment of the Rival oil field in north-central North Dakota, including the following:
  - Held several conference calls with TAQA North, Ltd., regarding the status of the project.
  - Continued the characterization of the Dwyer and Grenora Fields in the Williston Basin.
  - Conducted a literature review regarding the 3-D seismic analysis.
  - Began incorporating project details into a geological, engineering, and petrophysical analysis software named PETRA.
  - Created a new Techlog (wellbore software) project with all LAS (digital) files from the PETRA database for petrophysical analysis.
  - Began log-binning the data for petrophysical analysis.
  - Gathered baseline input values for Mineral Solver (formation analysis software) from previously computed core plug data.
  - Imported tops from Petrel (seismic to simulation software) into Techlog for zoning purposes.
  - Created cross-plots to compare core versus log porosity and permeability.
  - Continued facies modeling in Petrel using truncated Gaussian simulation with trends.
  - Updated the Rival model with thin-section descriptions, including depositional facies, lithological facies, and petrophysical classes.
  - Prepared an initial draft of the petrographic analysis report.

- Presented at the American Association of Petroleum Geologists (AAPG) Rocky Mountain Section (RMS) 2011 Annual Meeting on June 28 in Cheyenne, Wyoming.
- Completed the draft work plan for the EERC's Applied Geology Laboratory (AGL) analysis of Rival Field core samples, and initiated the work during the week of April 18, 2011. Additional AGL activities included the following:
  - Requested four additional core plugs cut from the Rival Field for further petrographic analysis.
  - 28 thin sections were analyzed and photographed.
  - Prepared a first draft of the thin-section report.
  - Started preparation (cleaning) of the Rival core plug samples.
  - Prepared 55 thin sections for analysis, and analyzed using optical mineralogy.
  - Drilled, cleaned, and performed permeability-to-water measurements using the flexible-wall permeameter on five core plugs.

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

- EERC staff are overwhelmed with preparations for upcoming conferences and have fallen slightly behind on design and layout of the atlas. It is hoped that lost time can be recouped and the atlas will be back on schedule for the August 31 due date as well as distribution at the annual meeting.
- EERC staff are facing challenges with programming the new features on the partners-only DSS, including Flash and GIS. Flash is the leading program for creating fast-loading animations that will dramatically enhance the Web site. There are unique challenges to combining GIS software, data, and programming that often create time overruns. Programming staff are on a steep learning curve, but have fallen behind by approximately a month with their planned activities. It is anticipated that as familiarity with the programs grows, lost time will be recaptured.

Task 2 – Public Outreach and Education

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

- Eighteen EERC employees attended 11 conferences, resulting in approximately 4227 external participants that were exposed to the PCOR Partnership name, messaging, and informational materials. Specifically, the PCOR Partnership outreach activities included 17 oral presentations. The following quantities of outreach materials were distributed:
  - PCOR Partnership documentary entitled "Nature in the Balance: CO_2 Sequestration" – 14
  - PCOR Partnership documentary entitled "Reducing Our Carbon Footprint: The Role of Markets" – 15
  - PCOR Partnership documentary entitled "Out of the Air: Into the Soil" – 16
  - PCOR Partnership documentary entitled "Managing Carbon Dioxide: The Geologic Solution" – 280

  - PCOR Partnership documentary entitled "Global Energy and Carbon: Tracking Our Footprint" – 246
  - PCOR Partnership Atlas 3rd Edition, Revised – 267
  - PCOR Partnership product list – 10
- Continued efforts as a member of the Weyburn–Midale Project Outreach Panel, including participation in conference calls on May 12 and June 7, where discussions were held regarding the use of focus groups to improve communication with stakeholders.
- Continued active participation in the RCSP Outreach Working Group (OWG), including the following:
  - Participated in the development and delivery of an OWG workshop at the 10th Annual Conference on Carbon Capture & Sequestration on May 4, in Pittsburgh, Pennsylvania.
  - Participated in the monthly conference call on April 21, discussing strategies for interaction with print media led by the editor of Climate Wire.
  - Participated in the monthly conference call on May 19.
  - Participated in the monthly conference call on June 9, and volunteered to develop a matrix of available video shots for a short video under development.
  - Participated in a conference call held June 30, and subsequently prepared materials for use at the Carbon Sequestration Leadership Forum's (CSLF's) next ministerial meeting.
- Received documentary broadcast activity from Prairie Public Broadcasting (PPB).
- Continued efforts with PPB's education services on planning the Prairie Energy & Carbon Teacher Training Institute scheduled for November 18 and 19, 2011, at the EERC in Grand Forks, North Dakota (www.prairiepublic.org/education/teachers/professional-development/pectti).
- Continued efforts to establish an outreach plan in conjunction with Spectra Energy for the Fort Nelson demonstration site.
- Continued efforts to create a database to more efficiently track the outreach products.
- Continued preparation of the Bell Creek demonstration site poster (Deliverable [D] 25) due September 30, 2011.
- Submitted an update to D19 – Fort Nelson Test Site PowerPoint presentation on June 30 for review and approval.
- Submitted an update to D17 – the general Phase III information PowerPoint presentation.
- Continued outreach planning efforts in conjunction with the Petroleum Technology Research Centre (PTRC) regarding the Aquistore project.
- Completed participation in a 3-week online seminar regarding integration of social media into outreach activities.
- Met with UND Education Department personnel on May 20 to discuss potential development of a Web-based game to help students, educators, and the general public learn about CCS.
- Presented to a group of approximately 50 teachers on June 8 at the North Dakota Petroleum Council (NDPC) Teacher Seminar (www.ndoil.org), and distributed various PCOR Partnership outreach materials to the attendees.

- Presented to a group of approximately 133 teachers on June 21 at the Lignite Energy Council's 2011 Lignite Education Seminar: Energy, Economics, and Environment (www.lignite.com), and distributed various PCOR Partnership outreach materials to the attendees.
- Accepted an invitation to present at the Society of Petroleum Engineers (SPE) Forum, "CO_2 Geological Storage: Will We Be Ready in Time?," scheduled for October 9–14, 2011, in the Algarve, Portugal (www.spe.org/events/11fse3/pages/about/index.php).
- Continued efforts toward an update to the public Web site (D13, due June 30, 2012).
- Continued to track state-by-state CCS regulations for development of future outreach materials.
- Attended a daylong workshop on media training on June 22 in Houston, Texas, hosted by the Ammerman Experience (http://ammermanexperience.com), and initiated efforts to secure a presentation by them at the PCOR Partnership Annual Meeting on September 13, 2011.

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 3 – Permitting and NEPA Compliance

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

- Hosted the third PCOR Partnership Regulatory Meeting (June 29–30). The meeting followed the IOGCC (Interstate Oil and Gas Compact Commission) Midyear Issues Meeting in Bismarck, North Dakota, and included representation from all the oil- and gas-producing states and provinces in the PCOR Partnership region.
- Continued development of a revised/updated Regulatory Roundup document.
- Submitted a revised NEPA questionnaire for the Bell Creek project.
- Provided, upon request, additional information to DOE NETL to use in its evaluation of the Bell Creek NEPA questionnaire.
- Held discussions with the Montana Board of Oil and Gas Conservation to review regulatory requirements and finalize plans for the proposed monitoring well at the Bell Creek site.
- Participated in a conference call with PCOR Partnership partner, Eagle Operating, to discuss its responsibilities under the U.S. Environmental Protection Agency's (EPA's) Greenhouse Gas Mandatory Reporting Rule, Subpart W.
- Assisted PCOR Partnership partner Aquistore by reviewing and commenting on its project description that needed to be completed in compliance with the Canadian Environmental Assessment Act (CEAA). Once our comments were incorporated, Aquistore submitted its project description to the Canadian federal government for determination on the level of environmental review that will be required for its project.
- Reviewed the Bureau of Land Management's procedures for permitting seismic exploration on federal lands.

- Attended the 10th Annual Conference on Carbon Capture & Sequestration in Pittsburgh, May 2–5. While in Pittsburgh, participated in the Fort Nelson update meeting with DOE officials and project partners.
- Provided input on May 20 to the Global CCS Institute on its document entitled "A Review of Existing Best Practice Manuals for Carbon Dioxide Storage and Regulation."
- On May 24, participated in EPA's training Webinar focused on the Greenhouse Gas Reporting Program's Geologic Sequestration of CO_2 (40 Code of Federal Regulations [CFR], Part 98, Subpart RR).
- On May 26, participated in the North Dakota Pipeline Authority's Webinar entitled "Transporting North Dakota's Natural Gas" that focused on pipeline development in the state.
- Attended a workshop on June 1 and 2 entitled "2011 CO_2 Geologic Sequestration and Water Resources Workshop," and participated in the theme entitled "Water Quality and Impact Assessment/Risk Prediction" sponsored by EPA and hosted by Lawrence Berkeley National Laboratory, that focused on research needs related to geologic carbon storage with a specific focus on water resources.

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

- Efforts scheduled to begin on June 1, 2011, under the Statement of Project Objectives (SOPO), Subtask 3.2 (Assistance in the Development of the Environmental Assessment), were delayed while awaiting NETL review of the NEPA. In the event a categorical exclusion is received, activities under Subtask 3.2 will be significantly reduced or eliminated entirely. [Note: a categorical exclusion was received in July 2011. Details about the resulting reduction/elimination of efforts will be detailed in the quarterly report for the period July–September, 2011.]

Task 4 – Site Characterization and Modeling

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

- Bell Creek test site activities included the following:
  - EERC staff traveled to Denbury's Bell Creek field office April 11–15 and electronically scanned all relevant on-site well file information to aid in field evaluation.
  - Electronically scanned possible depositional analogs to the Bell Creek Field from the AAPG Memoir 31 (Sandstone Depositional Environments).
  - Continued work on the geologic model, including loading well tops into Techlog for 98 wells with sonic and density curves.
  - Continued discussion of operational issues and pricing for well-logging activities.
  - Submitted D34: Baseline Hydrogeological Experimental Design Package for concurrent review by Denbury and DOE NETL.
  - Continued efforts on the geologic model, including receiving feedback from the site owner on the model methodology.

- Continued planning for an outcrop field trip to Wyoming. A scouting trip was held on June 20–23, with the actual field trip scheduled for July 11–12.
- Pursued reduced-price procurement of three 2-D seismic lines previously ordered and licensed by Denbury.
- Continued review of underpressurized reservoirs as related to the Bell Creek Field.
- Reviewed relevant literature for determining possible mechanisms of subpressure generation in the Bell Creek Field.
- Continued data collection for performing calculations to estimate the pressure drop because of uplift and erosion.
- Prepared information on the possible mechanisms responsible for generating subnormal pressure in the Bell Creek Field.
- Made arrangements for the collection of lidar (light detection and ranging) elevation data for the Bell Creek Field.

- Fort Nelson test site activities included the following:
  - Participated in weekly conference calls with Spectra to discuss various issues related to the project.
  - Held an in-house project update meeting on May 23.
  - Held the monthly project management conference calls on April 20, May 25, and June 13 between the EERC and the Spectra team.
  - Scheduled the next quarterly meeting in Vancouver, British Columbia, Canada, on July 19–20.
  - Continued the geochemical analyses of the target injection formation and key sealing formations, including the following:
    - Analyzed cuttings using x-ray diffraction (XRD).
    - Continued the data interpretation analysis of cuttings.
    - Continued development of reports on the results of additional analytical work on the core.
    - Continued geomechanical analytical activities on the core collected from the exploratory well.
    - Completed six thin sections of cap rock samples, and initiated preparation of an additional six thin sections.
    - Initiated work on XRD, QEMSCAN, and thick-section mounts for the scanning electron microscope.
  - Adjusted the Fort Nelson June 2010 model to run several “worst-case” scenarios for Spectra’s 2010 risk assessment.
  - Selected several alternative well locations both around Well No. C-61-E and the proposed C-47-E wells.
  - Weatherford Labs completed its geomechanical analytical activities on the core collected from the exploratory well. The analyses and results were provided to the EERC in June.
  - RPS Energy Canada continued the process of developing reports on the results of analytical work on the core as well as the results of a wellbore integrity study.
  - Interpretation of data from analysis of cuttings using XRD is ongoing.
  - Initiated analysis of thin sections of the cap rock samples.
  - Identified approximately 30–40 wells in the Fort Nelson area for the purchase of LAS data (well logs) for use in Version 4 (July 2011) of the geologic model.

- Participated in the IEA Greenhouse Gas R&D Programme (IEAGHG) Monitoring Network Meetings in Potsdam, Germany. Specific topics of discussion with direct relevance to the Fort Nelson project included presentations on innovative approaches to soil gas monitoring and the use of remote sensing technologies, such as INSAR, for monitoring isolated areas such as are found in northeastern British Columbia.

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 5 – Well Drilling and Completion

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

- Effective April 1, John Hamling, Research Engineer, assumed responsibility for Task 5.
- On April 29, DOE approved an amendment to the award (Modification No. 20) to approve drilling, testing, logging, and completing a deep monitoring well in the Phase 1 area of the Bell Creek Field to gather additional baseline data and a point in the field to monitor CO_2 as it moves between injectors and producers.
- Submitted comments regarding NETL draft manual entitled "Best Practices for: Drilling, Well Installation, Permitting, Operations, Mitigation, and Closure for CO_2 Storage in Deep Geologic Formations."
- Completed a proposed monitoring well characterization, budget, and tool deployment plan to address the Bell Creek site owner's needs.
- Created a well prognosis containing all currently available relevant information pertaining to operational and well design issues for two proposed monitoring well locations.
- Met with Denbury Bell Creek field office personnel and performed reconnaissance of two proposed monitoring well sites in order to determine accessibility issues.
- Obtained high-resolution areal imagery of the Bell Creek Field for use in monitoring site evaluations.
- Received approval from the site owner on the proposed monitoring, verification, and accounting (MVA) work plan for the surface, near-surface, existing wellbores, and deep monitoring wells. The MVA plan will also include:
  - Detailed maps with sample Phase I field locations.
  - Landowner maps (inputting the plats into GIS).
  - Cost estimates.
  - A health and safety plan.
  - A detailed existing deep well map.
- Prepared a landowner permission form for use during the surface baseline sampling program.

- Prepared detailed sampling maps and an explanatory handout to accompany the landowner permission form.
- Continued work on the groundwater-sampling plan.
- Investigated potential technologies for use in coring the monitoring well.
- Continued efforts to purchase a portable gas chromatograph for use in the surface MVA baseline program to analyze soil gas samples.
- Hosted a joint Denbury–EERC meeting on May 11 in Grand Forks to discuss MVA activities and the proposed monitoring well location, completion and operational issues, and characterization program. Results of the meeting included the following:
  - Selected the location of the proposed monitoring well along with a preliminary well-logging, coring, and core analysis program.
  - Selected a tentative well completion design program (with a finalization date set for June 15, 2011).
  - Work began with procurement to solicit bids on surface characterization and MVA baseline services, and a follow-up meeting was scheduled for May 26 to help finalize a monitoring well authority for expenditures (AFE) and completions program.
  - Tentatively scheduled the spud date for the monitoring well for fall 2011.
  - Discussed the surface MVA program, and a revised surface-monitoring plan is under development to address site owner concerns.
- Continued reviewing all well files in the Phase 1 area to assess risk and completions designs.
- Began review of all plugged and abandoned wells in the Phase 1 area to assess the feasibility of reentry and outfitting as additional monitoring wells.
- Received verbal approval from the site owner to run a pulsed neutron log in one of the current production or injection wells adjacent to the proposed monitoring well location in order to determine porosity zones overlying the Muddy Formation to assess the feasibility of pressure monitoring for leakage to overlying permeable zones using pressure gauges mounted outside of the monitoring well casing.
- Plans are under way to visit the site and meet with landowners and Denbury field office staff in July or August.
- Modified the monitoring well design to account for additional requirements necessary to deploy permanent downhole monitoring (PDM) pressure, temperature, and acoustic sensors.
- Attended the IEAGHG 7th Monitoring Network Meeting in Potsdam, Germany, to remain apprised of current and planned CCS monitoring activities performed around the world.
- Toured the Ketzin (Germany) injection site and examined wellhead completions which incorporated multiple monitoring systems similar to proposed Bell Creek monitoring technologies.

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 6 – Infrastructure Development

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

- Distributed hard copies of the value-added report entitled "Current Status of CO_2 Capture Technology Development and Application" on June 17 to the partners.
- Continued to adapt the capture technologies table (included as an appendix in the value-added capture technologies overview report submitted in March 2011) for the DSS.
- Continued the annual update and quality assurance/quality control of the CO_2 emission sources master data spreadsheet.
- Continued revision of a draft CO_2 Pipelines technical brief, with plans to distribute the final brief at the upcoming annual meeting in September 2011.

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

- Initiation of SOPO Subtask 6.3 (Ramgen Compression Technology Slipstream Test) did not begin on April 1, 2011, as a result of delays associated with the postacquisition reorganization of the site owner. A 2-month delay was anticipated before the evaluation of the applicability of the Ramgen Power Systems compressor technology to CO_2 streams at the Bell Creek project would begin. Activities commenced on June 1, 2011.

Task 7 – CO_2 Procurement

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

- The following activity occurred in the quarter:
  - A meeting at EERC headquarters in Grand Forks, North Dakota, was held on May 11.
  - The transfer of data continued.
  - Plans are under way for a meeting in Plano, Texas, in July to discuss appropriate expenditures for a cost-share commitment to the project.

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:

- Attended several in-house Bell Creek project status meetings.

- Continued reading about surface facilities design at an EOR injection site in *Nontechnical Guide to Petroleum Geology, Exploration, Drilling, and Production* (2nd edition) by Norman J. Hyne, Ph.D.
- Began collecting information about CO_2 stream generation and infrastructure needs for the Bell Creek demonstration.

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

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

Task 9 – Operational Monitoring and Modeling

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

- Participated in the RCSP Sim/Risk Working Group conference call on May 24, where topics discussed included an update on the Sim-SEQ project, and a request for updated modeling status/protocols for each RCSP was made.
- Participated in the RCSP Sim/Risk Working Group conference call on June 21.
- Participated in the IEAGHG 6th Risk Assessment Network Meeting in Pau, France, including a site visit to the Lacq project.
- Modeling staff participated in a Subsurface CO_2 Modeling Short Course in Minneapolis, Minnesota.
- Continued Bell Creek site activities, including the following:
  - Participated in the 10th Annual Conference on CCS, including a poster presentation on May 3, entitled "The Plains CO_2 Reduction (PCOR) Partnership's Phase III Bell Creek Integrated CO_2 EOR and Storage Project."
  - Continued preparation of D50 entitled "Site Characterization, Modeling, and Monitoring Plan" due September 30, 2011.
  - Worked on production, injection, perforation, and stimulation treatment data. Data are ready for the simulation.
  - Conducted a test run of the simulation for the Phase 1 area.
  - Continued to work on the five-spot pattern simulation.
  - History match is under way using the basic geologic model in preparation for simulations to predict reservoir performance.
  - Updated the west–east cross section for an MVA core analysis discussion.
  - Continued work on the Bell Creek Phase 1 model, including the following:
    - Initiated data analysis, transformations, and variograms.
    - Created Gaussian realizations.
    - Created a pressure grid based on initial pressures received from site owner.
  - Utilized Strater® software to update the stratigraphic column including depths.
  - Created a well section view to help convey the purpose of oil-based mud for proper core recovery and logging applications.
  - Continued discussion of operational issues and pricing for seismic activities.
  - Reviewed relevant literature on CO_2 EOR and storage.

  - Continued training on Computer Modelling Group (CMG) simulation software.
  - Studied the NIPER (National Institute for Petroleum and Energy Research) report on reservoir characterization of the Bell Creek Field.
  - Worked on latest Petrel geological model by assigning different reservoir properties to the static model and its export to CMG Builder software.
- Continued Fort Nelson site activities, including the following:
  - Presented on Fort Nelson risk assessment activities at the IEAGHG Joint Modelling and Wellbore Network Meeting held April 27–29, in Perth, Australia.
  - Participated in the 10th Annual Conference on Carbon Capture & Sequestration, including a presentation on May 3 entitled "An Integrated Characterization, Modeling, Risk Assessment, and Monitoring Plan for the Fort Nelson CCS Project."
  - Continued work on history matching, i.e., component, temperature, pressure, and anisotropic permeability.
  - Continued work on the history matching (pressure in injection and transient regions). Final history matching was completed by June 3.
  - Continued work on the history-matching report.
  - Continued work on prediction simulation (gas production rate control and water recycle). Preparation of D67 – Simulation Report was initiated following the predictive simulations (due July 31, 2011).
  - Continued risk assessment activities, including the following:
    - Continued preparation of the 2010 risk assessment update.
    - Participated in weekly calls with Spectra personnel.
    - Received Simeo-ERM software training from Oxand Risk & Project Management Solutions.
    - Worked on the cases for risk sensitivity analysis.
    - Provided input regarding frequency and severity with respect to each of the identified features, events, and processes to the latest version of the risk register.
    - Provided draft document for Spectra's review on May 20.

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

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

Task 10 – Site Closure

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

Task 11 – Postinjection Monitoring and Modeling

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

Task 12 – Project Assessment

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

Task 13 – Project Management

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

- On April 29, DOE issued an award amendment (Modification No. 20) which, among other items, authorized a change in the Principal Investigator from Ed Steadman to Charles Gorecki.
- Continued planning the PCOR Partnership Annual Meeting and Foundations of CCS Geology workshop (www.undeerc.org/pcor/pcor11) to be held September 12–14 in Denver, Colorado. Efforts included the following:
  - Sent a "Registration is now open" e-mail blast to the partnership on June 29.
  - Continued plans for the workshop to be held at the U.S. Geological Survey's Core Research Center (http://geology.cr.usgs.gov/crc/), followed by a visit to the I-70 road cut (Figure 3) through the Dakota Hogback, which exposes about 50 million years of geology.
  - Efforts are under way to secure a media consultant (Ammerman Experience) to speak during the annual meeting.
  - Selected the Denver Museum of Nature & Science as the site for the evening social and dinner on September 13.
- Held an in-house Bell Creek project update meeting on June 27.
- Submitted D88 – Programmatic Risk Management Plan for review and approval on April 29, 2011.
- Participated in the 10th Annual Conference on Carbon Capture & Sequestration, including oral presentation of the following:
  - On May 4, a presentation given by Ed Steadman entitled "The Plains CO_2 Reduction (PCOR) Partnership: A Regional Carbon Sequestration Partnership Conducting Large-Scale Field Tests"
  - On May 4, a presentation given by Ed Steadman entitled "The Plains CO_2 Reduction (PCOR) Partnership: Collaborative United States–Canada Carbon Capture and Storage Demonstration Activities"
- Participated in Bell Creek project meetings on May 10 and 11 with Denbury at the EERC.
- Continued efforts toward populating and updating the partners database which was programmed in-house.
- Began organizing a project facilitation and planning meeting with Spectra on the Fort Nelson project for July 2011.
- Continued meeting with task leaders and key personnel on budget status and (re)allocation.

Figure 3. I-70 road cut in Denver, Colorado, site of one of the field trips planned as part of the Foundations of CCS Geology Workshop scheduled for September 12, 2011 (photo courtesy of Dan Daly).

- Held a task leader meeting on May 19, where the following topics were discussed: a recap of the Denbury (May 10–11) meeting; the Basal Cambrian (Deadwood Formation) project; upcoming deliverables; and updates on the Bell Creek, Fort Nelson, Aquistore, Rival, and Zama projects.
- Welcomed visitors from C12 Energy, and provided an overview of the PCOR Partnership Program on June 7.
- Began preparation of responses to the IEAGHG Expert Review Panel's comments and recommendations. [Note: IEAGHG performed an Expert Review of the RCSP Initiative on March 14–17, 2011. The PCOR Partnership presentation was held on March 16. Following its presentation and the question-and-answer session, the Expert Panel discussed its assessment of the PCOR Partnership Program and compiled comments and recommendations for each of the two demonstration projects.]
- Deliverables and milestones completed in April included the following:
  - March monthly update
  - Task 13: D58/D59 – Quarterly Progress Report/Milestone Quarterly Report
  - Task 13: D88 – Programmatic Risk Management Plan
  - Task 14: M23 – Monthly Water WWG Conference Call Held
- Deliverables and milestones completed in May included the following:
  - April monthly update
  - Task 2: D17 – General Phase III Information PowerPoint Presentation (Update)
  - Task 4: D34 – Baseline Hydrogeological Experimental Design Package

  - Task 14: M23 – Monthly WWG Conference Call Held
- Deliverables and milestones completed in June included the following:
  - May monthly update
  - Task 2: D19 – Fort Nelson Test Site PowerPoint Presentation (Update)
  - Task 14: M23 – Monthly WWG Conference Call Held

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 14 – RCSP WWG Coordination

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

- Effective April 1, Ryan Klapperich assumed responsibility for Task 14.
- Held the monthly conference calls on April 21, May 5, and June 23, and subsequently distributed the associated minutes.
- Held the WWG annual meeting on May 5 in conjunction with the 10th Annual Conference on Carbon Capture & Sequestration in Pittsburgh, Pennsylvania.
- Presented the WWG preapproved PowerPoint presentation at the American Water Resources Association Spring Specialty Conference entitled "Managing Climate Change Impacts on Water Resources: Adaption Issues, Options, and Strategies" in April in Baltimore, Maryland.
- Continued work on the value-added document entitled "Challenges and Opportunities in the Carbon Capture and Storage and Water Nexus: A Technology Gap Assessment."
- Discussed the potential for the WWG to advise further development of the National Carbon Sequestration Database and Geographic Information System (NATCARB) database and potential for development of client-focused WWG fact sheets.
- Provided feedback on the development of a brine database.
- Compiled a list of potential stakeholder groups for an outreach document.
- Scheduled travel to attend the 2011 Ground Water Protection Council Annual Forum on September 24–28, 2011, in Atlanta, Georgia.

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

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

Task 15 – Further Characterization of the Zama Acid Gas EOR, CO_2 Storage, and Monitoring Project

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

- Effective April 19, James Sorensen assumed responsibility for Task 15.
- Bill Jackson, Manager, Joint Venture at Apache Canada and PCOR Partnership Pioneer Award recipient, retired on May 13, 2011.
- Participated in conference call with Apache Canada Ltd. to discuss EERC support on regulatory issues associated with the Zama Field.
- Uploaded petrophysical properties into the geologic model.
- Discussed the inclusion of different reservoir properties into the static geological model.
- Adjusted reservoir properties and began history matching and predictive simulation.
- Reviewed relevant literature on relative permeability and capillary pressure data for heterogeneous carbonate rocks.
- Reviewed published literature on the generation of relative permeability curves using vuggy carbonate cores.
- Studied different numerical methods for computing capillary pressure and relative permeability curves using log data.
- Evaluated the utility of different numerical methods for generating capillary pressure and relative permeability curves for the "F pool" using available data.
- Continued discussion of information to be included in D86, an update to the regional technology implementation plan due April 2012, including this summer's reservoir simulation work and documentation for the monetization of carbon credits.
- Performed extraction of historical perforation history from the RPS Energy (subcontractor) report.
- Met with representatives of Apache Canada in Calgary on June 22 to discuss the status of the PCOR Partnership's work at Zama.
- Continued efforts in the EERC's AGL, including the following:
  - Used two sets of steel coupons to determine the net change that may occur as these samples were exposed to combinations of acid gas and straight CO_2.
  - Used conditions analogous to Zama for pressure, temperature, acid gas composition, and brine salinity.
  - Utilized steels in this evaluation that are analogous to typical oil field casing materials.

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

- Apache Corporation was planning to divest certain conventional properties in Canada, including its EOR project in the Zama Field located in Alberta. Because of Apache's corporate planning strategies and personnel redistribution, efforts to initiate the seismic profiles, logging suites, and MVA activities have been delayed.

  However, during the meeting held in Calgary on June 22, Apache Canada revealed that it will be retaining ownership and operation of the Zama Field. It is in the process of

determining a new operational framework under which it will be managing the Zama operations and set a planned implementation date for August 2011. The geoscience manager for Apache Canada and the team lead – Oil & EOR Business Unit for Apache Canada both stated that they intend to continue working with the EERC/PCOR Partnership Program as they move forward with operating the Zama oil field.

Task 16 – Characterization of the Basal Cambrian System

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

- Effective April 1, Wes Peck assumed responsibility for Task 16.
- Participated in the 10th Annual Conference on Carbon Capture & Sequestration in Pittsburgh, Pennsylvania, including the following:
  - Wes Peck gave an oral presentation on May 4 entitled "Application of the U.S. Department of Energy (DOE) CO_2 Storage Resource Estimation on the Deadwood Formation, Williston Basin."
  - Stefan Bachu gave an oral presentation (coauthored by Wes Peck) on May 4 entitled "The Potential for and Possible Effects of CO_2 Storage in the Basal Aquifer in the Northern Plains – Prairie Region of North America: A Joint United States–Canada Project."
- Participated in the Joint United States–Canada Basal Aquifer Project's technical and steering committees meeting held at NETL headquarters in Pittsburgh, Pennsylania, on May 25.
- Discussed synergies between PTRC's Aquistore project and Basal Cambrian (Deadwood) project.
- Participated in a meeting on June 22 in Calgary with the science and engineering technical team to discuss geologic data availability and needs. Geological data regarding the Basal Cambrian (Deadwood) Formation and other formations under evaluation by the Basal Cambrian project were shared from both the PCOR Partnership and Aquistore characterization activities.
- Participated in several in-house project-planning meetings.
- Worked with procurement personnel to purchase digitized well logs.
- Continued work on data organization and guidance.
- Worked on organizing wellheads/welltops for data across the Montana and North and South Dakota portions of the project area.
- Selected the first batch of 30 LAS files for acquisition.
- Initiated work to compile previous works on the groundwater chemistry, recharge areas, and subsurface regional flow.
- Continued efforts to collect data on previous work, including specifics on local geology and hydrogeochemistry.
- Finished a second draft of the relative permeability report.
- Continued work on the development of the geologic model.
- Hosted a meeting with Alberta Innovates – Technology Futures (AITF) and Saskatchewan Ministry of Energy and Resources staff on June 27–28, 2011, at the EERC.

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

- Because of delays associated with the reallocation of program responsibilities and transfer of responsibility, initiation of CO_2 source characterization was delayed. Activity ramped up again in June 2011, and an in-house report detailing CO_2 emissions, likely stream compositions, and reference annotations is anticipated to be completed by August 31, 2011, instead of May 31, 2011.

- In order for an assessment of the general overall integrity of the system to be conducted (Subtask 16.4), it is necessary that the characterization and storage capacity evaluation need to be under way. Because the capacity evaluation is not anticipated to begin until August 2011, the start date for the storage integrity assessment initiation needs to be delayed until August 2011 as well. Initiation was originally set for May 2011.

PHASE III COST STATUS

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

Table 3. Phase III Budget – BP4

Organization	Approved Budget, $	Actual Costs Incurred, $
DOE Share – Cash*	55,670,206	10,087,168
Nonfederal Share – Cash	2,411,971	810,302
Nonfederal Share – In-Kind	17,400,865	16,949,204
Total	75,483,042	27,846,674

*Does not include $1.5M for Environmental Impact Statement.

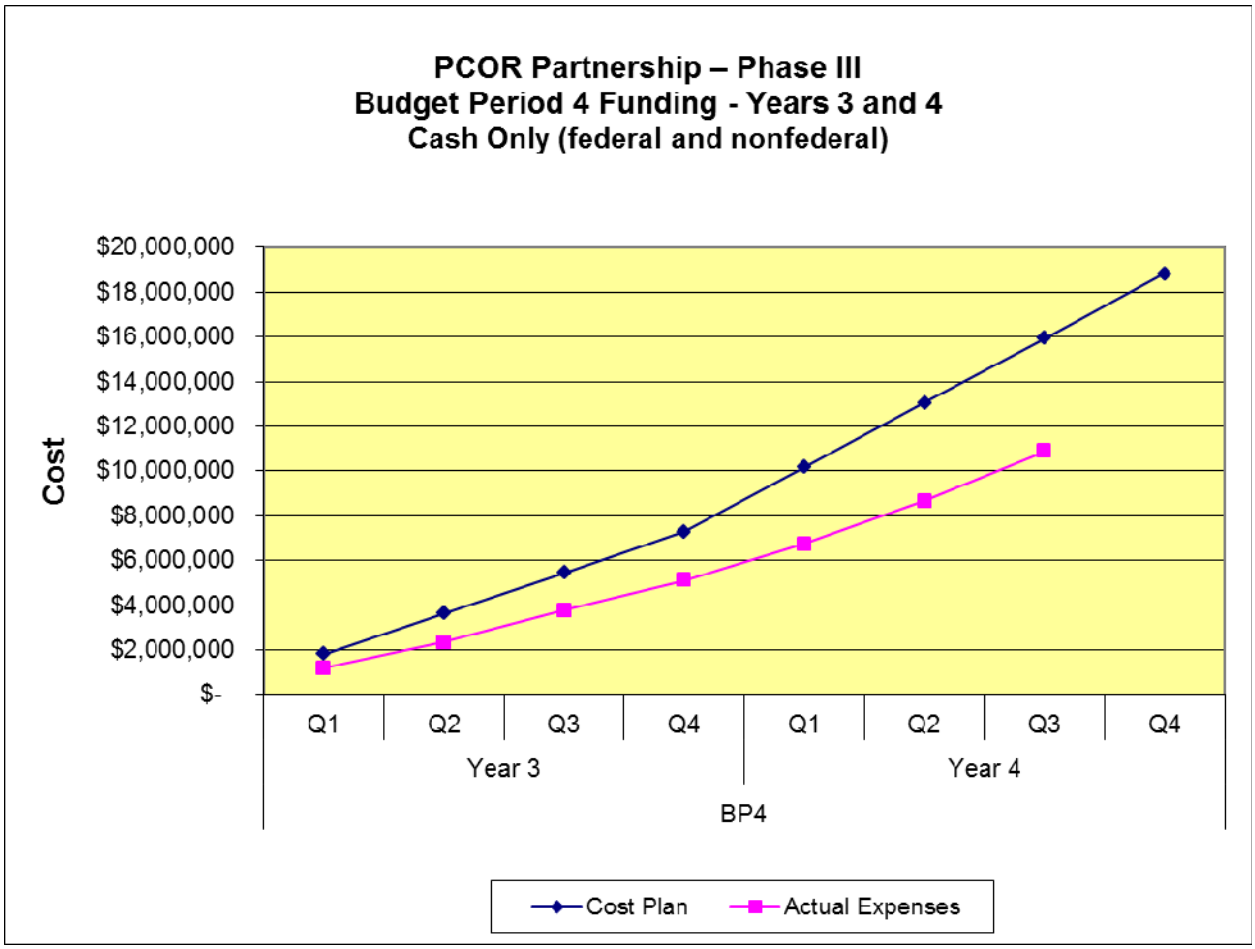


Figure 4. PCOR Partnership Phase III, BP4 – Years 3 and 4 funding (cash only).

Table 4. BP4 – Years 3 and 4 Spending Plan

	Year 3								Year 4							
Baseline Reporting Quarter	Q1		Q2		Q3		Q4		Q1		Q2		Q3		Q4	
	Q1	Cum. BP Total	Q2	Cum. BP Total	Q3	Cum. BP Total	Q4	Cum. BP Total	Q1	Cum. BP Total	Q2	Cum. BP Total	Q3	Cum. BP Total	Q4	Cum. BP Total
Baseline Cost Plan																
Federal Share	$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
Actual Incurred Cost																
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		
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		
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		
Variance																
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		
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		
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		

Table 5. Phase III Milestones and Deliverables

Title/Description	Due Date	Actual Completion Date
Year 1 – Quarter 1 (October–December 2007)		
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
Year 1 – Quarter 2 (January–March 2008)		
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
Year 1 – Quarter 3 (April–June 2008)		
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
Year 1 – Quarter 4 (July–September 2008)		
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
Year 2 – Quarter 1 (October–December 2008)		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	10/31/08	10/31/08
D20: Task 2 – Documentary Support to PowerPoint and Web Site	12/31/08	12/31/08
D57: Task 12 – Project Assessment Annual Report	12/31/08	12/31/08

Continued . . .

Table 5. Phase III Milestones and Deliverables (continued)

Title/Description	Due Date	Actual Completion Date
Year 2 – Quarter 2 (January–March 2009)		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	1/31/09	1/30/09
M21: Task 14 – Outline of White Paper on Nexus of CO_2 Capture and Sequestration (CCS) and Water, Part Subtask 14.2 – White Paper on Nexus of CCS and Water	2/28/09	2/27/09
D24: Task 2 – PCOR Partnership Region Sequestration General Poster	3/31/09	3/31/09
Year 2 – Quarter 3 (April–June 2009)		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	4/30/09	4/30/09
M23: Task 14 – Monthly WWG Conference Call Held	4/30/09	4/15/09
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
Year 2 – Quarter 4 (July–September 2009)		
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)

Title/Description	Due Date	Actual Completion Date
Year 3 – Quarter 1 (October–December 2009)		
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
Year 3 – Quarter 2 (January–March 2010)		
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
Year 3 – Quarter 3 (April–June 2010)		
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
Year 3 – Quarter 4 (July–September 2010)		
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)

Title/Description	Due Date	Actual Completion Date
Year 4 – Quarter 1 (October–December 2010)		
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
Year 4 – Quarter 2 (January–March 2011)		
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_2 Compression and Transportation During CCS Activities	3/31/11	3/31/11
M23: Task 14 – Monthly WWG Conference Call Held	3/31/11	3/22/11

Continued . . .

Table 5. Phase III Milestones and Deliverables (continued)

Title/Description	Due Date	Actual Completion Date
Year 4 – Quarter 3 (April–June 2011)		
M30: Task 5 – Bell Creek Test Site Baseline MVA Initiated	4/01/11	3/24/11
M23: Task 14 – Monthly WWG Conference Call Held	4/30/11	4/21/11
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	4/30/11	4/29/11
D88: Task 13 – Programmatic Risk Management Plan	4/30/11	4/29/11
D17: Task 2 – General Phase III Information PowerPoint Presentation (Update)	5/31/11	5/31/11
D34: Task 4 – Bell Creek Test Site – Baseline Hydrogeological Final Report	5/31/11	5/31/11
M23: Task 14 – Monthly WWG Conference Call Held	5/31/11	5/5/11
D19: Task 2 – Fort Nelson Test Site PowerPoint Presentation (Update)	6/30/11	6/30/11
M23: Task 14 – Monthly WWG Conference Call Held	6/30/11	6/23/11
M24: Task 14 – WWG Annual Meeting Held	6/30/11	5/5/11
Year 4 – Quarter 4 (July–September 2011)		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	7/31/11	
D67: Task 9 – Fort Nelson Test Site – Simulation Report	7/31/11	
M23: Task 14 – Monthly WWG Conference Call Held	7/31/11	
D29: Task 3 – Permitting Action Plan	8/31/11	
D81: Task 1 – Regional Carbon Sequestration Atlas (Update)	8/31/11	
M23: Task 14 – Monthly WWG Conference Call Held	8/31/11	
D66: Task 9 – Bell Creek Test Site – Simulation Report	8/31/11	
D1: Task 1 – Review of Source Attributes	9/30/11	
D4: Task 1 – Permitting Review – Two Additional States	9/30/11	
D9: Task 1 – Updated DSS	9/30/11	
D25: Task 2 – Bell Creek Test Site Poster	9/30/11	
D50: Task 9 – Bell Creek Test Site – Site Characterization, Modeling, and Monitoring Plan	9/30/11	
M23: Task 14 – Monthly WWG Conference Call Held	9/30/11	
M31: Task 9 – Bell Creek Test Site – Site Characterization, Modeling, and Monitoring Plan Completed	9/30/11	
M33: Task 16 – Basal Cambrian Baseline Geological Characterization Completed	9/30/11	

Continued . . .

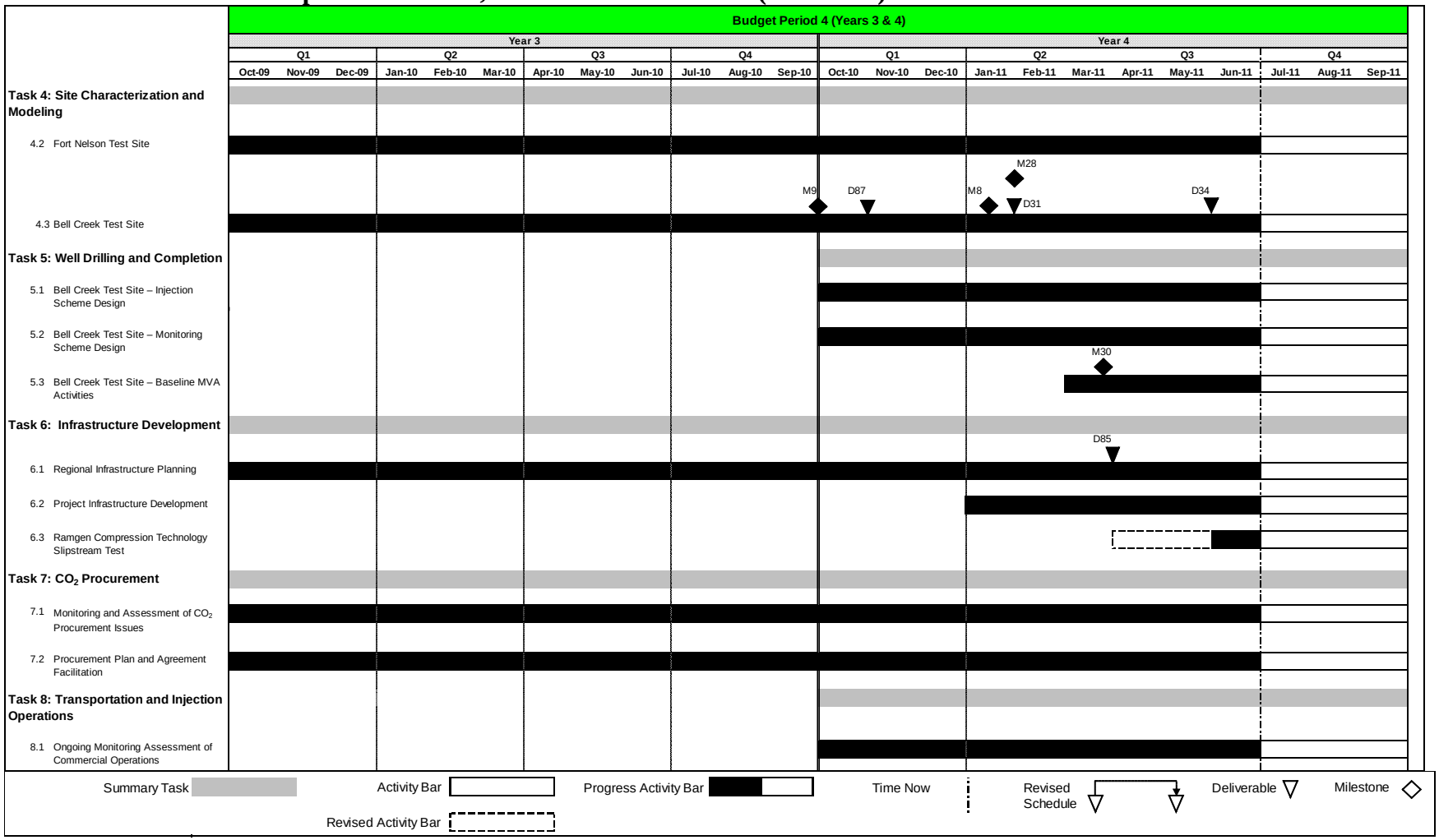
Table 5. Phase III Milestones and Deliverables (continued)

Title/Description	Due Date	Actual Completion Date
Year 5 – Quarter 1 (October–December 2011)		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	10/31/11	
D65: Task 4 – Fort Nelson Test Site – Site Characterization Report	10/31/11	
M23: Task 14 – Monthly WWG Conference Call Held	10/31/11	
M29: Task 4 – Fort Nelson Site Characterization Report Completed	10/31/11	
M23: Task 14 – Monthly WWG Conference Call Held	11/30/11	
D41: Task 4 – Fort Nelson Test Site – Geochemical Final Report	12/15/11	
M32: Task 4 – Fort Nelson Geochemical Final Report Completed	12/15/11	
D57: Task 12 – Project Assessment Annual Report	12/31/11	
M23: Task 14 – Monthly WWG Conference Call Held	12/31/11	
M34: Task 16 – Basal Cambrian Static Geological Model Completed	12/31/11	

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

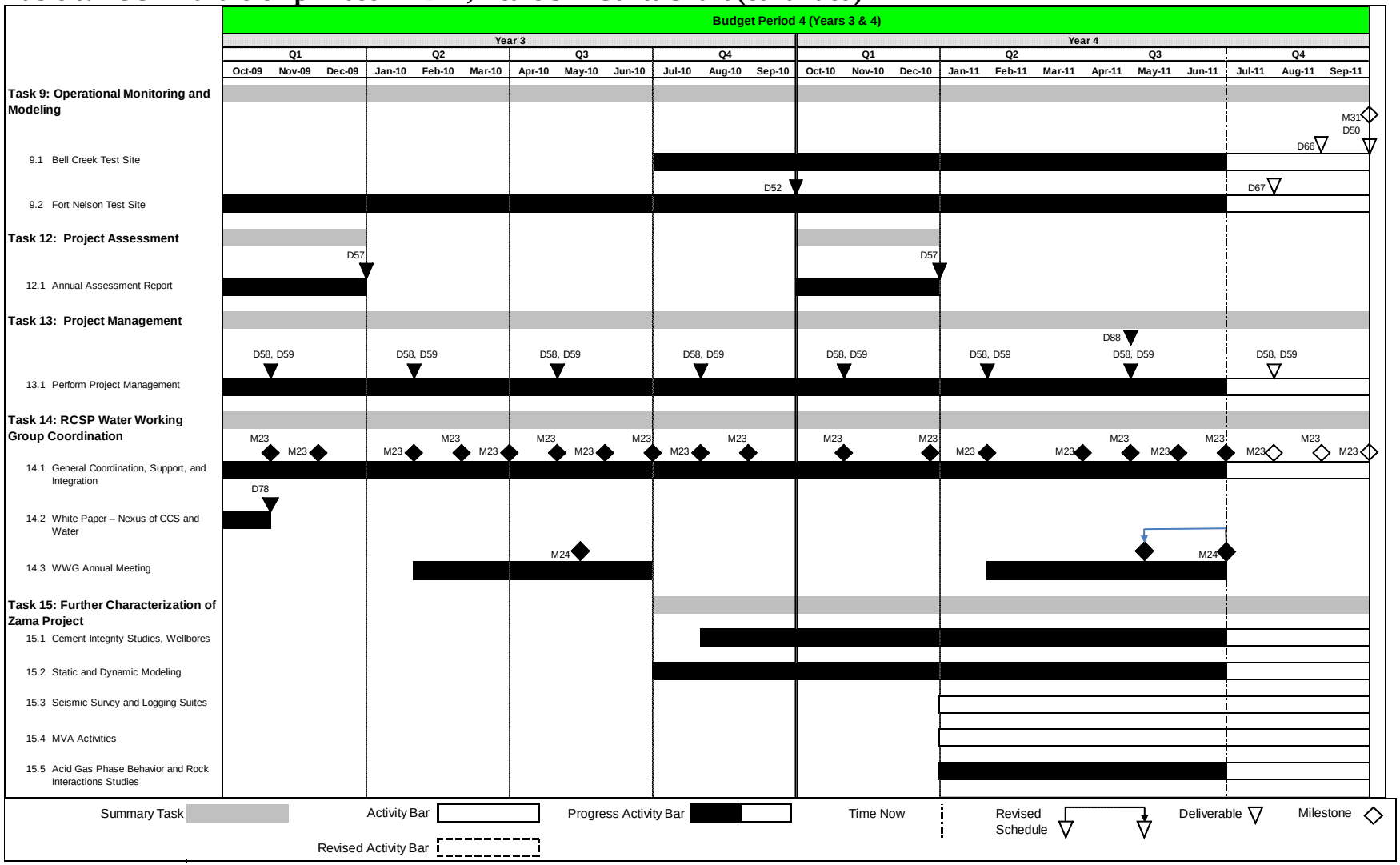
Continued…

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



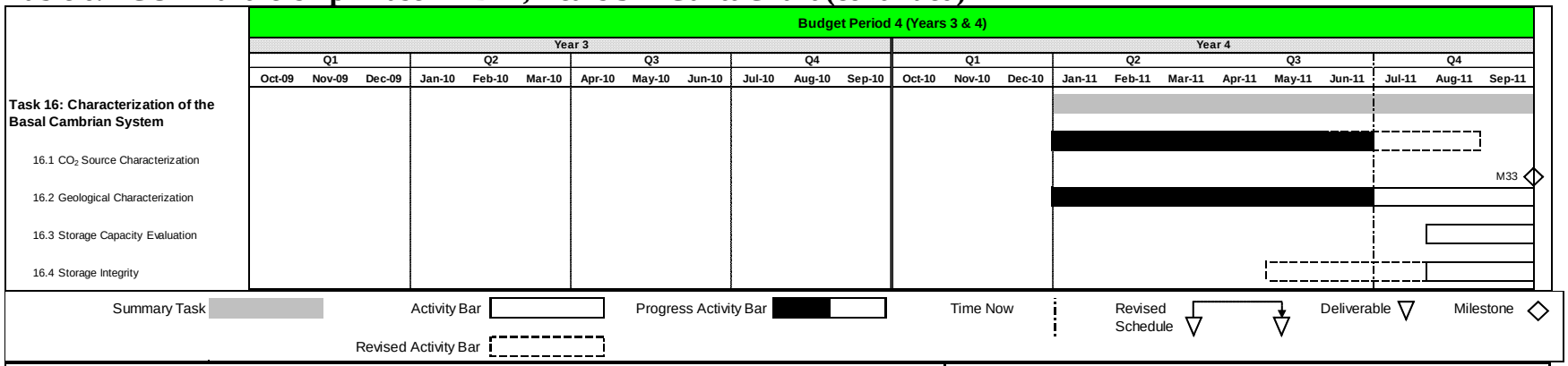
Continued…

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



Continued…

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



Key for Deliverables (D)			
D1	Review of Source Attributes	D29	Permitting Action Plan
D4	Permitting Review – Two Additional States	D31	BC Test Site – Geological Characterization Experimental Design Package
D9	Updated DSS	D34	BC Test Site – Baseline Hydrogeological Experimental Design Package
D10	DPRS Update	D50	BC Test Site – Site Characterization, Modeling, and Monitoring Plan
D11	Outreach Plan	D52	FN Test Site – Site Characterization, Modeling, and Monitoring Plan
D13	Public Site Updates	D57	Project Assessment Annual Report
D15	Bell Creek (BC) Test Site Fact Sheet	D58	Quarterly Progress Report
D16	Fort Nelson (FN) Test Site Fact Sheet	D59	Milestone Quarterly Report
D17	General Phase III Information PowerPoint Presentation	D66	BC Test Site – Simulation Report
D18	BC Test Site PowerPoint Presentation	D67	FN Test Site – Simulation Report
D19	FN Test Site PowerPoint Presentation	D78	White Paper – Nexus of CCS and Water
D20	Video Support to PowerPoint and Web Site	D81	Regional Carbon Sequestration Atlas (update)
D24	PCOR Partnership Region CO_2 Storage General Poste	D85	Report – Opportunities and Challenges Associated with CO_2 Compression and Transportation During CCS Activities
D25	BC Test Site Poster		
D26	FN Test Site Poster	D87	BC Test Site – Geomechanical Experimental Design Package
D28	BC Test Site – Environmental Questionnaire	D88	Programmatic Risk Management Plan

Key for Milestones (M)	
M8	BC Test Site – Wellbore Leakage Data Collection Initiated
M9	BC Test Site – Geological Model Development Initiated
M23	Monthly WWG Conference Call Held
M24	WWG Annual Meeting Held
M28	BC Test Site – Geological Characterization Experimental Design Package Completed
M30	BC Test Site – Baseline MVA Activities Initiated
M31	BC Test Site – Site Characterization, Modeling, and Monitoring Plan Completed
M33	Basal Cambrian Baseline Geological Characterization Completed

PHASE III PRODUCTS OR TECHNOLOGY TRANSFER ACTIVITIES

During the reporting period, there were two abstracts accepted for presentation and 16 presentations given at 11 different meetings/conferences. In addition, four deliverables, three milestones, and a quarterly progress report were completed.

Abstracts – Submitted

Steadman, E.N., Harju, J.A., Gorecki, C.D., Botnen, L.S., Daly, D.J., Jensen, M.D., Peck, W.D., Sorensen, J.A., Smith, S.A., Hamling, J.A., Klapperich, R.J., and Anagnost, K.K., 2011, The Plains CO_2 Reduction (PCOR) Partnership—a regional carbon sequestration partnership in the interior plains of North America [abs.]: EUEC 2012 Energy, Utility & Environment Conference, Phoenix, Arizona, January 30 – February 1, 2012.

Abstracts – Submitted and Accepted for Presentation

Klapperich, R.J., Cowan, R.M., Gorecki, C.D., Liu, G., Kalenze, N.S., and Botnen, L.S., 2011, Extraction of formation water from CO_2 storage reservoirs [abs.]: 2011 Ground Water Protection Council Annual Forum, Atlanta, Georgia, September 24–28, 2011.

Abstracts – Accepted for Presentation but Declined

Gorecki, C.D., Sorensen, J.A., Klapperich, R.J., Smith, S.A., Botnen, L.S., Steadman, E.N., and Harju, J.A., 2011, An integrated characterization, modeling, risk assessment, and monitoring plan for the Fort Nelson CCS project [abs.]: TCCS-6, the Trondheim CCS Conference for CO_2 Capture, Transport and Storage, Trondheim, Norway, June 14–16, 2011.

Presentations, Conference Papers, Posters, and Other Media

Braunberger, J.R., Bremer, J.M., Liu, G., Gorecki, C.D., Peck, W.D., Steadman, E.N., and Harju, J.A., 2011, Characterization and facies modeling of the Midale and Rival “Nesson” beds in the Mississippian Madison Group, Burke County, North Dakota: Presented at the 2011 American Association of Petroleum Geologists – Rocky Mountain Section (AAPG – RMS) Meeting, Cheyenne, Wyoming, June 25–29, 2011.

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

Cowan, R.M., and Pavlish, B.M., 2011, CO_2 separation and capture—status, challenges, and opportunities: Presented at the 61st Annual Environmental Engineering Conference, Lawrence, Kansas, April 14, 2011.

Daly, D.J., 2011, Energy and CO_2 management—carbon capture and storage: Presented at the 2011 Lignite Education Seminar, Bismarck, North Dakota, June 21, 2011.

Daly, D.J., 2011, Energy and CO_2 management—carbon capture and storage: Presented at the North Dakota Petroleum Council Teacher Education Seminar, Bismarck, North Dakota, June 8, 2011.

Daly, D.J., Gorecki, C.D., Peck, W.D., and Steadman, E.N., 2011, Carbon dioxide (CO_2) capture and geologic CO_2 sequestration—growing the economy…shrinking the footprint: Poster presented to Senator Kent Conrad, Grand Forks, North Dakota, April 19, 2011.

Gorecki, C.D., 2011, The Plains CO_2 Reduction (PCOR) Partnership – Fort Nelson CCS feasibility project: Presented at the IEA Greenhouse Gas R&D Programme 2011 Modelling Network Meeting, Perth, Australia, April 27–29, 2011.

Gorecki, C.D., 2011, Plains CO_2 Reduction (PCOR) Partnership and extraction of formation water from carbon dioxide (CO_2) storage reservoirs: Presented to U.S. Department of Energy National Energy Technology Laboratory, Grand Forks, North Dakota, April 18, 2011.

Gorecki, C.D., 2011, Plains CO_2 Reduction (PCOR) Partnership overview and saline aquifer efforts: Presented to C12 Energy personnel, Grand Forks, North Dakota, June 7, 2011.

Gorecki, C.D., and Moffatt, D., 2011, An integrated characterization, modeling, risk assessment, and monitoring plan for the Fort Nelson CCS project: Presented at the 10th Annual Carbon Capture & Sequestration Conference, Pittsburgh, Pennsylvania, May 2–5, 2011.

Gorecki, C.D., Sorensen, J.A., Steadman, E.N., and Harju, J.A., 2011, Bell Creek integrated CO_2 EOR and storage project: Poster presented at the 10th Annual Carbon Capture & Sequestration Conference, Pittsburgh, Pennsylvania, May 2–5, 2011.

Klapperich, R.J., 2011, 3rd Annual RSCP Water Working Group meeting opening presentation: Presented at the Regional Carbon Sequestration Partnership Water Working Group annual meeting, Pittsburgh, Pennsylvania, May 5.

Klapperich, R.J., Gorecki, C.D., Bremer, J.M., Holubnyak, Y.I., and McNemar, A., 2011, Regional Carbon Sequestration Partnership Water Working Group: Presented at the 2011 American Water Resources Association Spring Specialty Conference, Baltimore, Maryland, April 18–20, 2011.

Knudsen, D.J., Gorecki, C.D., Smith, S.A., Sorensen, J.A., Steadman, E.N., and Harju, J.A., 2011, Methodology for assessing uncertainties affecting STOOIP and production in the Zama F Pool, Zama Subbasin, Alberta, Canada: Poster presented at the 2011 American Association of Petroleum Geologists – Rocky Mountain Section (AAPG – RMS) Meeting, Cheyenne, Wyoming, June 25–29, 2011.

Peck, W.D., 2011, Characterization of the Basal Cambrian System – update: Presented at the Basal Aquifer Project Joint Technical and Steering Committee Meeting, Pittsburgh, Pennsylvania, May 25, 2011.

Peck, W.D., Knudsen, D.J., Bremer, J.M., and Gorecki, C.D., 2011, Application of the U.S. Department of Energy's CO_2 storage resource estimation methodology on the Deadwood Formation, Williston Basin: Presented at the 10th Annual Carbon Capture & Sequestration Conference, Pittsburgh, Pennsylvania, May 2–5, 2011.

Steadman, E.N., 2011, Plains CO_2 Reduction (PCOR) Partnership update: Presented to Doosan Power Systems personnel, Grand Forks, North Dakota, April 13, 2011.

Steadman, E.N., 2011, The Plains CO_2 Reduction (PCOR) Partnership—a regional carbon sequestration partnership conducting large-scale field tests: Presented at the 10th Annual Carbon Capture & Sequestration Conference, Pittsburgh, Pennsylvania, May 2–5, 2011.

Steadman, E.N., 2011, The Plains CO_2 Reduction (PCOR) Partnership—collaborative U.S.–Canada carbon capture and storage demonstration activities: Presented at the 10th Annual Carbon Capture & Sequestration Conference, Pittsburgh, Pennsylvania, May 2–5, 2011.

Steadman, E.N., Harju, J.A., Botnen, L.S., Daly, D.J., Gorecki, C.D., Jensen, M.D., Peck, W.D., Smith, S.A., Sorensen, J.A., Braunberger, J.R., and Anagnost, K.K., 2010, The Plains CO_2 Reduction (PCOR) Partnership—demonstrating carbon management options for the central interior of North America: Presented at the 2011 American Association of Petroleum Geologists – Rocky Mountain Section (AAPG – RMS) Meeting, Cheyenne, Wyoming, June 25–29, 2011.

Journal Articles

Daly, D.J., Bradbury, J., Garrett, G., Greenberg, S., Myhre, R., Peterson, T., Tollefson, L., Wade, S., and Sacuta, N., 2011, Road-testing the outreach best practices manual—applicability for implementation of the development phase projects by the regional carbon sequestration partnerships: Energy Procedia, v. 4, p. 6256–6262.

Hawthorne, S.B., Miller, D.J., Holubnyak, Y.I., Harju, J.A., Kutchko, B.G., and Strazisar, B.R., 2011, Experimental investigations of the effects of acid gas (H_2S/CO_2) exposure under geological sequestration conditions: Energy Procedia, v. 4, p. 5259–5266.

Holubnyak, Y.I., Hawthorne, S.B., Mibeck, B.A.F., Miller, D.J., Bremer, J.M., Sorensen, J.A., Steadman, E.N., and Harju, J.A., 2011, Modeling CO_2–H_2S–water–rock interactions at Williston Basin reservoir conditions: Energy Procedia, v. 4, p. 3911–3918.

Holubnyak, Y.I., Mibeck, B.A., Bremer, J.M., Smith, S.A., Sorensen, J.A., Gorecki, C.D., Steadman, E.N., and Harju, J.A., 2011, Investigation of geochemical interactions of carbon dioxide and carbonate formation in the Northwest McGregor oil field after enhanced oil recovery and CO_2 storage: Energy Procedia, v. 4, p. 3612–3619.

Smith, S.A., Sorensen, J.A., Steadman, E.N., Harju, J.A., and Ryan, D., 2011, Zama acid gas EOR, CO_2 sequestration, and monitoring project: Energy Procedia, v. 4, p. 3957–3964.

Sorensen, J.A., Schmidt, D.D., Knudsen, D.J., Smith, S.A., Gorecki, C.D., Steadman, E.N., and Harju, J.A., 2011, Northwest McGregor field CO_2 huff 'n' puff—a case study of the application of field monitoring and modeling techniques for CO_2 prediction and accounting: Energy Procedia, v. 4, p. 3386–3393.

Steadman, E.N., Anagnost, K.K., Botnen, B.W., Botnen, L.S., Daly, D.J., Gorecki, C.D., Harju, J.A., Jensen, M.D., Peck, W.D., Romuld, L., Smith, S.A., Sorensen, J.A., and Votava, T.J., 2011, The Plains CO_2 Reduction (PCOR) Partnership—developing carbon management options for the central interior of North America: Energy Procedia, v. 4, p. 6061–6068.

Technical Reports

Daly, D.J., Crocker, C.R., Gorecki, C.D., and Steadman, E.N, 2011, Plains CO_2 Reduction Partnership (PCOR) general audience CO_2 sequestration outreach PowerPoint: Phase III Task 2 Deliverable D17 (update 2) for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, Grand Forks, North Dakota, Energy & Environmental Research Center, June.

Daly, D.J., Crocker, C.R., Gorecki, C.D., and Steadman, E.N., 2011, Fort Nelson CO_2 sequestration step-by-step virtual tour—concept: Draft Phase III – Task 2 Deliverable D19 (Update 2) for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, Grand Forks, North Dakota, Energy & Environmental Research Center, June.

Gorecki, C.D., Steadman, E.N., and Harju, J.A., 2011, Bell Creek test site baseline MVA initiated: Plains CO_2 Reduction (PCOR) Partnership Phase III Task 5 Milestone M30 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, EERC Publication 2011-EERC-06-12, Grand Forks, North Dakota, Energy & Environmental Research Center, March.

Jensen, M.D., Cowan, R.M., Pei, P., Steadman, E.N., and Harju, J.A., 2011, Opportunities and challenges associated with CO_2 compression and transportation during CCS activities: Plains CO_2 Reduction Partnership Phase III Task 6 Deliverable D85 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, EERC Publication 2011-EERC-06-10, Grand Forks, North Dakota, Energy & Environmental Research Center, March.

Peck, W.D., Buckley, T.D., Steadman, E.N., and Harju, J.A., 2011, Demonstration project reporting system update: Plains CO_2 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 2011-EERC-04-01, Grand Forks, North Dakota, Energy & Environmental Research Center, March.

Steadman, E.N., Harju, J.A., Romuld, L., Sorensen, J.A., Daly, D.J., Jensen, M.D., Botnen, L.S., Peck, W.D., Smith, S.A., Gorecki, C.D., Votava, T.J., and Anagnost, K.K., 2011, Plains CO_2 Reduction Partnership Phase III: Quarterly technical progress report (January 1 – March 31, 2011) for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592 and North Dakota Industrial Commission Contract Nos. FY08-LX111-162 and G-015-030, Grand Forks, North Dakota, Energy & Environmental Research Center, April.

Sorensen, J.A., Smith, S.A., Lindeman, C.D., Steadman, E.N., and Harju, J.A., 2010, Bell Creek test site – geomechanical experimental design package: Plains CO_2 Reduction (PCOR) Partnership Phase III Task 4 Deliverable D87 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, EERC Publication 2011-EERC-06-13, Grand Forks, North Dakota, Energy & Environmental Research Center, October.

Progress Reports, Meeting Minutes, and Project Management Documents

Klapperich, R.J., 2011, Annual meeting minutes—Regional Carbon Sequestration Partnership Water Working Group annual meeting: Pittsburgh, Pennsylvania, May 5.

Klapperich, R.J., 2011, Minutes—Regional Carbon Sequestration Partnership Water Working Group conference call: April 21.

Steadman, E.N., Peck, W.D., Daly, D.J., Botnen, L.S., Sorensen, J.A., Hamling, J.A., Jensen, M.D., Harju, J.A., Gorecki, C.D., Anagnost, K.K., and Klapperich, R.J., 2011, Plains CO_2 Reduction (PCOR) Partnership: Phase III monthly report (May 1–31, 2011) for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, Grand Forks, North Dakota, Energy & Environmental Research Center, May.

Steadman, E.N., Peck, W.D., Daly, D.J., Botnen, L.S., Sorensen, J.A., Hamling, J.A., Jensen, M.D., Harju, J.A., Gorecki, C.D., Anagnost, K.K., and Klapperich, R.J., 2011, Plains CO_2 Reduction (PCOR) Partnership: Phase III monthly report (April 1–30, 2011) for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, Grand Forks, North Dakota, Energy & Environmental Research Center, April.

Steadman, E.N., Peck, W.D., Daly, D.J., Botnen, L.S., Sorensen, J.A., Hamling, J.A., Jensen, M.D., Harju, J.A., Gorecki, C.D., Anagnost, K.K., and Klapperich, R.J., 2011, Plains CO_2 Reduction (PCOR) Partnership: Phase III monthly report (March 1–31, 2011) for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, Grand Forks, North Dakota, Energy & Environmental Research Center, March.

Draft Documents

Botnen, B.W., Gorecki, C.D., and Steadman, E.N., 2011, Bell Creek test site – hydrogeological experimental design package: Plains CO_2 Reduction (PCOR) Partnership Phase III draft Task 4

Deliverable D34 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, Grand Forks, North Dakota, Energy & Environmental Research Center, May.

Botnen, L.S., Steadman, E.N., Harju, J.A., and Nakles, D., 2011, Programmatic risk management plan: Plains CO_2 Reduction (PCOR) Partnership Phase III confidential draft Task 13 Deliverable D88 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, Grand Forks, North Dakota, Energy & Environmental Research Center, April.

MEETINGS/TRAVEL

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

REFERENCES

None.