



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 Task 13 – Deliverable D58/D59

*(for the period July 1 – September 30, 2017)*

*Prepared for:*

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

Cooperative Agreement No. DE-FC26-05NT42592  
EERC Funds 21310, 21321, and 9850  
DOE Project Manager: William W. Aljoe  
EERC 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  
Wesley D. Peck  
Ryan J. Klapperich  
Loreal V. Heebink  
Lawrence J. Pekot  
Janelle R. Ensrud  
Tami J. Votava

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

October 2017

## **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 (DOE) National Energy Technology Laboratory (NETL) 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.

## **ACKNOWLEDGMENT**

This material is based upon work supported by DOE NETL under Award Number DE-FC26-05NT42592.

## **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.

## **NORTH DAKOTA INDUSTRIAL COMMISSION DISCLAIMER**

This report was prepared by the 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 .....	ii
LIST OF TABLES .....	iii
EXECUTIVE SUMMARY .....	iv
INTRODUCTION .....	1
PROGRESS OF WORK .....	5
Task 1 – Regional Characterization .....	5
Task 2 – Public Outreach and Education .....	7
Task 3 – Permitting and NEPA Compliance.....	13
Task 4 – Site Characterization and Modeling .....	13
Task 5 – Well Drilling and Completion .....	14
Task 6 – Infrastructure Development.....	14
Task 7 – CO <sub>2</sub> Procurement.....	14
Task 8 – Transportation and Injection Operations .....	14
Task 9 – Operational Monitoring and Modeling.....	14
Task 10 – Site Closure .....	19
Task 11 – Postinjection Monitoring and Modeling.....	19
Task 12 – Project Assessment .....	19
Task 13 – Project Management .....	20
Task 14 – RCSP WWG Coordination.....	22
Task 15 – Further Characterization of the Zama Acid Gas EOR, CO <sub>2</sub> Storage, and Monitoring Project .....	23
Task 16 – Characterization of the Basal Cambrian System .....	23
PHASE III COST STATUS.....	23
PHASE III SCHEDULE STATUS.....	24
PHASE III PRODUCTS OR TECHNOLOGY TRANSFER ACTIVITIES.....	44
Abstracts.....	44
Submitted .....	44
Accepted for Presentation.....	44
Presentations.....	44
Poster Presentation .....	45
Deliverables/Milestones .....	45
Draft Submitted .....	45
Approved .....	45
Draft Submitted and Approved.....	46
Progress Reports.....	46
Monthlies .....	46
Quarterlies.....	47
MEETINGS/TRAVEL .....	47

## **LIST OF FIGURES**

1	DOE Carbon Storage Program technology areas featuring regional partnerships.....	3
2	Location of large-scale sites with PCOR Partnership Phase III participation .....	4
3	Map of PCOR Partnership Web site global traffic for this reporting period .....	10
4	Map of PCOR Partnership Web site regional visits for this reporting period .....	11
5	PCOR Partnership public Web site traffic sources for this reporting period.....	11
6	PCOR Partnership Phase III, BP5, Years 9–12 funding .....	24

## LIST OF TABLES

1	PCOR Partnership Membership Phase III .....	2
2	Phase III Responsibility Matrix .....	5
3	Sessions/Visit Activity from the Top Ten Countries and the PCOR Partnership Region .....	9
4	Top “Page Views” on the PCOR Partnership Public Web Site .....	12
5	Top Five EERC PCOR Partnership-Related YouTube Channel Videos Accessed.....	12
6	PCOR Partnership Documentaries on PPB YouTube Channel Accessed .....	13
7	Bell Creek CO <sub>2</sub> Gas Injection Totals for July 2017.....	16
8	Cumulative Total Gas Purchased and Estimated Associated CO <sub>2</sub> Storage for the Bell Creek Field .....	16
9	Oil and CO <sub>2</sub> Gas Stream Sampling and Analyses.....	17
10	Proposed Papers for PCOR Partnership IJGGC Special Issue .....	21
11	Phase III Budget – BP5 .....	23
12	Phase III, BP5, Years 9–12 Spending Plan.....	25
13	Phase III Milestones and Deliverables.....	26
14	Phase III, BP5, Years 9–12 Gantt Chart .....	42



**PLAINS CO<sub>2</sub> REDUCTION PARTNERSHIP PHASE III**  
**Quarterly Technical Progress Report**  
**July 1 – September 30, 2017**

**EXECUTIVE SUMMARY**

The Plains CO<sub>2</sub> Reduction (PCOR) Partnership is one of seven Regional Carbon Sequestration Partnerships competitively awarded by the U.S. Department of Energy (DOE) National Energy Technology Laboratory in 2003 as part of a national plan to mitigate greenhouse gas emissions. The PCOR Partnership is led by the Energy & Environmental Research Center at the University of North Dakota and continues to include stakeholders from the public and private sector in Phase III. The PCOR Partnership region includes all or part of nine U.S. states and four Canadian provinces.

Phase III, the multiyear (2007–2018, extension pending approval) development phase, is an extension of the characterization (Phase I) and validation (Phase II) phases and is intended to confirm that commercial-scale CO<sub>2</sub> capture, transportation, and storage can be achieved safely, permanently, and economically over extended periods in the PCOR Partnership region. Budget Period 5 began April 1, 2016.

This progress report presents an update of Phase III PCOR Partnership activities from July 1 through September 30, 2017.

PCOR Partnership activities focused on the preparation and submittal of comprehensive deliverables, planning for the PCOR Partnership Annual Membership Meeting and Workshop, and participation in conferences/meetings and workshops. Writing continued on several deliverables detailing best practices and lessons learned, with the submittal of “PCOR Partnership Best Practices Manual for Subsurface Technical Risk Assessment of Geologic CO<sub>2</sub> Storage Projects.” Work continued on proposed papers for a planned special issue of the *International Journal of Greenhouse Gas Control* (IJGGC). The PCOR Partnership Annual Membership Meeting and Workshop will be held October 24–26, 2017, in Plano, Texas. The PCOR Partnership was represented at 11 conferences and meetings and two workshops.

Ten tasks continued. In addition to the foregoing, modeling and simulation activities continued in support of the Aquistore project, Web site updates continued, work continued on an update to the CO<sub>2</sub> capture technologies overview value-added document, check shots were acquired for the borehole array system, Bell Creek modeling and simulation activities continued, decommissioning efforts commenced, and development of an article or report on the major research focuses for water and carbon capture and storage continued.



**PLAINS CO<sub>2</sub> REDUCTION PARTNERSHIP PHASE III**  
**Quarterly Technical Progress Report**  
**July 1 – September 30, 2017**

## **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 Partnerships (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 September 30, 2017, 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 Storage Program (Figure 1) 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 (2007–2018, extension pending approval): involves large-volume carbon storage demonstration tests

Phase III is divided into three budget periods (BPs), running from October 1, 2007, to December 31, 2018, pending approval:

- BP3: October 1, 2007 – September 30, 2009
- BP4: October 1, 2009 – March 31, 2016
- BP5: April 1, 2016 – December 31, 2018, pending approval

BP1 and BP2 were effective in Phase II.



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

DOE NETL	Halliburton	Omaha Public Power District
UND EERC	Hess Corporation	Otter Tail Power Company
Abengoa Bioenergy New Technologies	Huntsman Corporation	Outsource Petrophysics, Inc.
Air Products and Chemicals, Inc.	Husky Energy Inc.	Oxand Risk & Project Management Solutions
Alberta Department of Energy	Indian Land Tenure Foundation	Peabody Energy
Alberta Department of Environment	Interstate Oil and Gas Compact Commission	Petro Harvester Oil & Gas
Alberta Innovates – Technology Futures	Iowa Department of Natural Resources	Petroleum Technology Research Centre
ALLETE	Lignite Energy Council	Petroleum Technology Transfer Council
Ameren Corporation	Manitoba Geological Survey	Pinnacle, a Halliburton Service
American Coalition for Clean Coal Electricity	Marathon Oil Company	Prairie Public Broadcasting
American Lignite Energy	MBI Energy Services	Pratt & Whitney Rocketdyne, Inc.
Apache Canada Ltd.	MEG Energy Corporation	Praxair, Inc.
Aquistore	Melzer Consulting	Ramgen Power Systems, Inc.
Baker Hughes Incorporated	Minnesota Power	Red Trail Energy, LLC
Basin Electric Power Cooperative	Minnkota Power Cooperative, Inc.	RPS Energy Canada Ltd.
BillyJack Consulting Inc.	Missouri Department of Natural Resources	Saskatchewan Ministry of Industry and Resources
Biorecro AB	Missouri River Energy Services	SaskPower
Blue Source, LLC	Montana–Dakota Utilities Co.	Schlumberger
BNI Coal, Ltd.	Montana Department of Environmental Quality	Sejong University
British Columbia Ministry of Energy, Mines, and Petroleum Resources	National Commission on Energy Policy	Shell Canada Limited
British Columbia Oil and Gas Commission	Natural Resources Canada	Spectra Energy
C12 Energy, Inc.	Nebraska Public Power District	Suncor Energy Inc.
The CETER Group, Ltd.	North American Coal Corporation	TAQA North, Ltd.
Computer Modelling Group Ltd.	North Dakota Department of Commerce	TGS Geological Products and Services
Continental Resources, Inc.	Division of Community Services	Tri-State Generation and Transmission Association, Inc.
Dakota Gasification Company	North Dakota Department of Health	Tundra Oil and Gas
Denbury Resources Inc.	North Dakota Geological Survey	University of Alberta
Eagle Operating, Inc.	North Dakota Industrial Commission	University of Regina
Eastern Iowa Community College District	Department of Mineral Resources, Oil and Gas Division	WBI Energy, Inc.
Enbridge Inc.	North Dakota Industrial Commission	Weatherford Advanced Geotechnology
Encore Acquisition Company	Lignite Research, Development and Marketing Program	Western Governors' Association
Energy Resources Conservation Board/Alberta Geological Survey	North Dakota Industrial Commission	Westmoreland Coal Company
Environment Canada	Oil and Gas Research Council	Wisconsin Department of Agriculture, Trade and Consumer Protection
Excelsior Energy Inc.	North Dakota Natural Resources Trust	Wyoming Office of State Lands and Investments
General Electric Global Research Oil & Gas Technology Center	North Dakota Petroleum Council	Xcel Energy
Great Northern Project Development, LP	North Dakota Pipeline Authority	
Great River 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 the 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 CCS 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

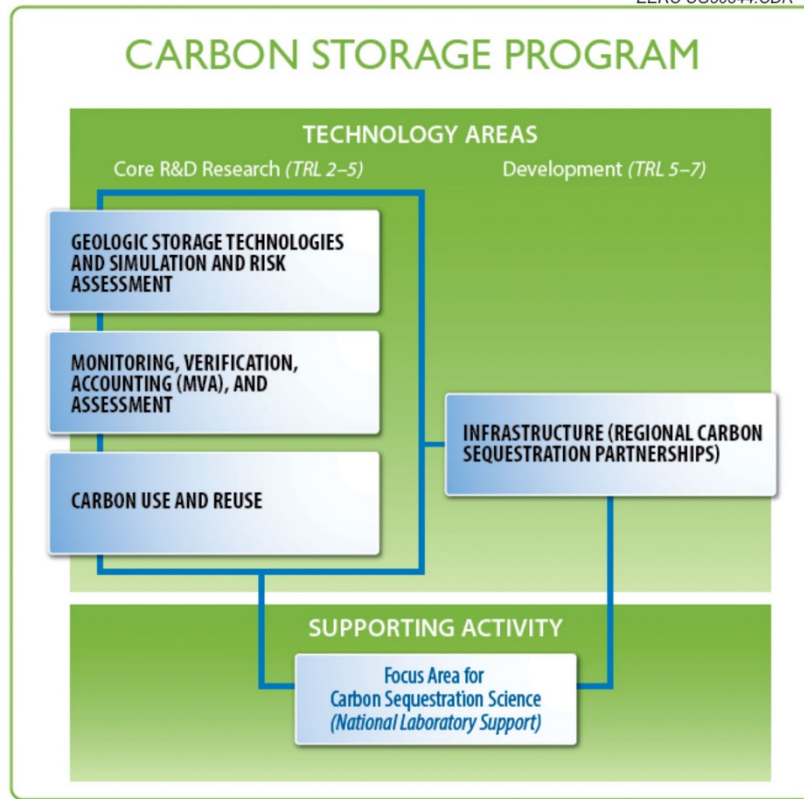


Figure 1. DOE Carbon Storage Program technology areas featuring regional partnerships (courtesy of DOE NETL; “TRL” stands for technology readiness level).

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 tonnes of CO<sub>2</sub> per project. Each of the RCSP large-volume injection tests is 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 with Denbury Onshore LLC (Denbury) in the Denbury-operated Bell Creek oil field in Powder River County in southeastern Montana. The PCOR Partnership has also conducted a feasibility study for Spectra Energy Transmission’s (Spectra’s) Fort Nelson gas-processing facility, situated near Fort Nelson, British Columbia, Canada. In addition, the PCOR Partnership is collaborating with the Petroleum Technology Research Centre (PTRC) on site characterization; risk assessment; and monitoring, verification, and accounting (MVA) activities associated with the Aquistore project near Estevan, Saskatchewan, Canada. The PCOR Partnership’s work concluded with Apache Canada Ltd. to further characterize the Zama Acid Gas Enhanced Oil Recovery (EOR), CO<sub>2</sub> Storage, and Monitoring Project in Alberta, Canada, as well as its work on a multiyear, binational characterization effort of the basal Cambrian system (Figure 2).



Figure 2. Location of large-scale sites with PCOR Partnership Phase III participation.

The PCOR Partnership's objectives for the demonstration projects are as follows: 1) conduct a successful Bell Creek demonstration to verify that the region's large number of oil fields have the potential to store significant quantities of CO<sub>2</sub> in a safe, economical, and environmentally responsible manner and 2) support Spectra's feasibility study of a Fort Nelson 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 (completed); 5) Well Drilling and Completion (completed); 6) Infrastructure Development; 7) CO<sub>2</sub> Procurement (completed); 8) Transportation and Injection Operations (completed); 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 EOR, CO<sub>2</sub> Storage, and Monitoring Project (completed); and 16) Characterization of the Basal Cambrian System (completed). Table 2 lists the responsibility matrix for these 16 tasks.

**Table 2. Phase III Responsibility Matrix**

<b>Phase III Task Description</b>	<b>Task Leader</b>
Task 1 – Regional Characterization	Wesley D. Peck
Task 2 – Public Outreach and Education	Daniel J. Daly
Task 3 – Permitting and NEPA Compliance	Charles D. Gorecki
Task 4 – Site Characterization and Modeling (completed)	James A. Sorensen
Task 5 – Well Drilling and Completion (completed)	John A. Hamling
Task 6 – Infrastructure Development	Melanie D. Jensen
Task 7 – CO <sub>2</sub> Procurement (completed)	John A. Harju
Task 8 – Transportation and Injection Operations (completed)	Melanie D. Jensen
Task 9 – Operational Monitoring and Modeling	John A. Hamling and Lawrence J. Pekot
Task 10 – Site Closure	John A. Hamling
Task 11 – Postinjection Monitoring and Modeling	John A. Hamling and Lawrence J. Pekot
Task 12 – Project Assessment	Loreal V. Heebink
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 (completed)	Charles D. Gorecki
Task 16 – Characterization of the Basal Cambrian System (completed)	Wesley D. Peck

## PROGRESS OF WORK

### Task 1 – Regional Characterization

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

- Submitted Deliverable (D) 81 entitled “PCOR Partnership Atlas Update” on August 31, 2017, and received approval on September 28, 2017. The “PCOR Partnership Atlas, 5th Edition Revised,” will be available on the public Web site and the partners-only Decision Support System (DSS) Web site. At this time, there is no plan to print hard copies.
- Submitted D1 entitled “Review of Source Attributes,” and received approval on September 27, 2017.
- Attended the Esri User Conference: Applying the Science of Where, held July 10–14, 2017, in San Diego, California.
- Shipped additional copies of the “Plains CO<sub>2</sub> Reduction Partnership Atlas, 5th Edition” (D81) to Denbury for distribution.
- Continued activities to update the content of the **PCOR Partnership partners-only DSS Web site**, including the following:
  - Prepared files for the 2015 and 2016 PCOR Partnership Annual Membership Meeting pages under the PCOR Partnership Annual Meetings section.

- The 2016 PCOR Partnership Annual Membership Meeting pages went live August 25, 2017.
- Continued activities to update the content of the **PCOR Partnership general database**, including the following:
  - Updated North Dakota well and production data.
  - Updated South Dakota, Montana, Wyoming, Nebraska, Manitoba, and Saskatchewan well information.
  - Continued database preventive maintenance of Petra projects.
- Continued work on regional models, including collecting input data for the Gooseneck Field and extracting the field history production data for history matching.
- Continued internal review and modifications on a value-added report on the geologic characterization and CO<sub>2</sub> storage potential of the state of Nebraska. Continued work on the Lodgepole model for the report.
- With regard to the **Williston Basin** CO<sub>2</sub> storage sink relative permeability laboratory characterization effort:
  - Made revisions to the draft value-added report based on comments from the internal review.
- With regard to the **Aquistore** project:
  - Attended PTRC’s Aquistore Project 2017 Annual General Meeting held September 12–13, 2017, in Ottawa, Ontario, Canada. Presented a poster entitled “Updated Numerical Modeling and Simulation Study of the Aquistore CO<sub>2</sub> Storage Project.” Presented as part of the Modeling Panel Discussion and Question-and-Answer Session.
  - Received comments from PTRC on draft D93 – Geological Modeling and Simulation Report for the Aquistore Project, on September 15, 2017. D93 will be revised based on PTRC’s comments and submitted to DOE NETL by the October 31, 2017, due date.
  - Participated in Science and Engineering Research Committee (SERC) conference calls on July 6, August 2, and August 23, 2017. Highlights included that SaskPower’s Boundary Dam Power Station is not currently sending CO<sub>2</sub> to the Aquistore site. Intermittent CO<sub>2</sub> supplies are consistent with the normal operations of the power plant. No SERC conference calls were held in September 2017.
  - As of September 26, 2017, 104,622 tonnes of CO<sub>2</sub> has been injected at the Aquistore site.
  - With regard to static **modeling** and dynamic predictive **simulation** activities:
    - ◆ Completed work on a history match of the pressure response and well log data.
    - ◆ Ran simulation cases to observe plume evolution and pressure response. Worked on analyzing the simulation results.
    - ◆ Downloaded and processed injection and pressure data through September 5, 2017.
    - ◆ Reprocessed field data to create clean data set for simulation purposes.

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

- There has been a change in leadership at PTRC. Dan MacLean is the new chief executive officer, and Erik Nickel is the new Aquistore project manager.
- Bottomhole pressure and temperature gauges of the injector well have malfunctioned, causing temporary suspension of injection operations. Injection resumed near the end of the reporting period; however, bottomhole pressure and temperature values are based on an analytical correlation.

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

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

- Received approval for Milestone (M) 47 entitled “Bell Creek Test Site – 30-minute Documentary Broadcast” on July 19, 2017.
- During the quarter, the PCOR Partnership was represented by EERC personnel at 11 meetings/conferences and two workshops. Specifically, the PCOR Partnership outreach activities included nine oral presentations, one booth, and one poster. The following quantities of PCOR Partnership outreach materials were distributed:
  - PCOR Partnership documentary entitled “Reducing Our Carbon Footprint: The Role of Carbon Markets” – 1
  - PCOR Partnership documentary entitled “Managing Carbon Dioxide: The Geologic Solution” – 2
  - PCOR Partnership documentary entitled “Global Energy and Carbon: Tracking Our Footprint” – 1
  - PCOR Partnership documentary entitled “The Bell Creek Story: CO<sub>2</sub> in Action” – 13
  - PCOR Partnership Atlas, 5th Edition – 14
- Presented a screening of the draft Documentary D22 (Coal Powered) to approximately 60 EERC staff members on September 12, 2017, over the lunch hour. Solicited comments from staff members.
- Shipped additional copies of Documentary D21 entitled “The Bell Creek Story – CO<sub>2</sub> in Action” to Denbury for distribution.
- Prepared text for an update to the Phase III PCOR Partnership General Fact Sheet (D14).
- Worked on updates to the Bell Creek Test Site Fact Sheet (D15).
- Continued revising text and compiling images for the draft updated Phase II Zama fact sheet.
- Prepared text for a value-added documentary flyer.
- **Conference call** activity this quarter included the following:
  - No monthly Aquistore Outreach Advisory Group phone calls were held this quarter.
  - With regard to the monthly RCSP Program Outreach Working Group (OWG) conference calls:

- ◆ Participated in the monthly OWG conference call on July 20, 2017. Discussion included topics for future calls, the model outreach budgeting framework from earlier calls, and the form of the final products from the OWG effort.
  - ◆ Participated in the monthly OWG conference call on August 24, 2017. An update was provided on the progress for planning for and securing a speaker for the September 21, 2017, conference call.
  - ◆ Participated in the monthly OWG conference call on September 21, 2017. The topics were the form of the final products from the OWG effort and topics for future calls.
- Continued efforts to update the **public Web site** ([www.undeerc.org/pcor](http://www.undeerc.org/pcor)), including the following:
  - Continued content updates and preparation for Web site format on the following pages:
    - ◆ Home page
    - ◆ Aquistore Project
    - ◆ Boundary Dam Project
    - ◆ Climate, CO<sub>2</sub>, and Sequestration
    - ◆ Weyburn–Midale
    - ◆ Fort Nelson
    - ◆ Basal Cambrian
    - ◆ CO<sub>2</sub> Sequestration Project
    - ◆ North Dakota CarbonSAFE (Carbon Storage Assurance and Facility Enterprise)
    - ◆ CarbonSAFE-Nebraska
    - ◆ Wyoming CarbonSAFE
    - ◆ Red Trail Energy (CCS for Ethanol Production)
    - ◆ Carbon and CO<sub>2</sub> on Earth – Things Have Changed!
    - ◆ Climate Change
    - ◆ CO<sub>2</sub> from Human Actions
    - ◆ CO<sub>2</sub> Sources
    - ◆ Greenhouse Effect
    - ◆ Technical Reports
  - Reviewed draft video clips from Documentary D21 entitled “The Bell Creek Story – CO<sub>2</sub> in Action” for use on the PCOR Partnership Web site.
  - Continued ongoing identification and repair of broken links. Fixed and reviewed broken Web site links. They are now live.
- Continued collaborative efforts with **Prairie Public Broadcasting (PPB)**, including the following:
  - Held a conference call with PPB on August 28, 2017, to discuss regional and national distribution of Documentary D21 (The Bell Creek Story – CO<sub>2</sub> in Action) to public television markets via the National Educational Telecommunications Association (NETA). PPB will initiate the paperwork and prepare the materials for submittal to NETA. PCOR Partnership Task 2 personnel will contact partners to request they contact their local public television markets to request that the D21 product be aired. D21 video clip completion was also discussed.

- Held a conference call with PPB on August 28, 2017, to discuss the path forward for finalizing draft Documentary D22 (Coal Powered). A time line has been established for postproduction, with the broadcast date in the first quarter of 2018.
- Information regarding the **site sessions/visits** to the PCOR Partnership public Web site included the following:
  - There were 7194 sessions/visits to the public Web site ([www.undeerc.org/pcor](http://www.undeerc.org/pcor)). Traffic decreased over 30% from last quarter (10,390 sessions/visits).
  - There were 6273 unique visitors to the public Web site, representing a 31% decrease from last quarter (9201 visitors). In particular, over 86% of these visitors were new to the Web site (visitors whose visit was marked as a first-time visit in this quarter).
  - Of the 7194 sessions/visits, 39% of the Web traffic was domestic, and 61% was international. Table 3 lists the top ten countries for visits to the PCOR Partnership Web site: United States, India, United Kingdom, Australia, Canada, Philippines,

**Table 3. Sessions/Visit Activity from the Top Ten Countries and the PCOR Partnership Region**

	Country	Sessions/ Visits*	PCOR Partnership State/Province	Visits*
1	United States	2837		
			North Dakota	62
			Minnesota	56
			Missouri	44
			Wisconsin	30
			Nebraska	25
			Iowa	24
			Wyoming	15
			Montana	7
			South Dakota	4
2	India	937		
3	United Kingdom	373		
4	Australia			
5	Canada			
			British Columbia	54
			Alberta	48
			Saskatchewan	23
			Manitoba	5
6	Philippines	273		
7	Russia	273		
8	Nigeria	102		
9	Malaysia	96		
10	Pakistan	89		
	Other 131 countries	1622		
<b>Total Sessions/Visits</b>		<b>7194</b>	<b>Total PCOR Partnership Visits</b>	<b>397</b>

\*Arranged by the number of visits to the site.



Russia, Nigeria, Malaysia, and Pakistan. There was traffic from 141 countries overall (Figure 3).

- There were 397 sessions/visits originating from within the PCOR Partnership region (a 45% decrease from last quarter) (Figure 4). Approximately 67% of the regional visits originated from the United States, and 33% came from Canada. Visits from within the PCOR Partnership region represent approximately 6% of the overall traffic to the public Web site (it should be noted that the totals are exaggerated to some degree because the visit location data were aggregated at the state and province levels, even though the PCOR Partnership region formally includes only portions of British Columbia, Montana, and Wyoming).
- During this reporting period, a breakdown of how visitors came to the PCOR Partnership Web site, also referred to as **traffic sources** (Figure 5), was determined and is provided below:
  - Search traffic refers to the use of search engines such as Google, Bing, and Yahoo. Search traffic accounted for almost 84% of the overall traffic that came to the public Web site. Google Analytics provides keywords that visitors used to find the public Web site. The top three search phrases were “CO<sub>2</sub>,” “carbon sequestration,” and “what is CO<sub>2</sub>.”
  - Direct traffic consists of those visitors who bookmark or type a specific URL (e.g., [www.undeerc.org/pcor](http://www.undeerc.org/pcor)) into the Web address bar. It is likely that most of the direct traffic (11%) is from persons familiar with the PCOR Partnership.

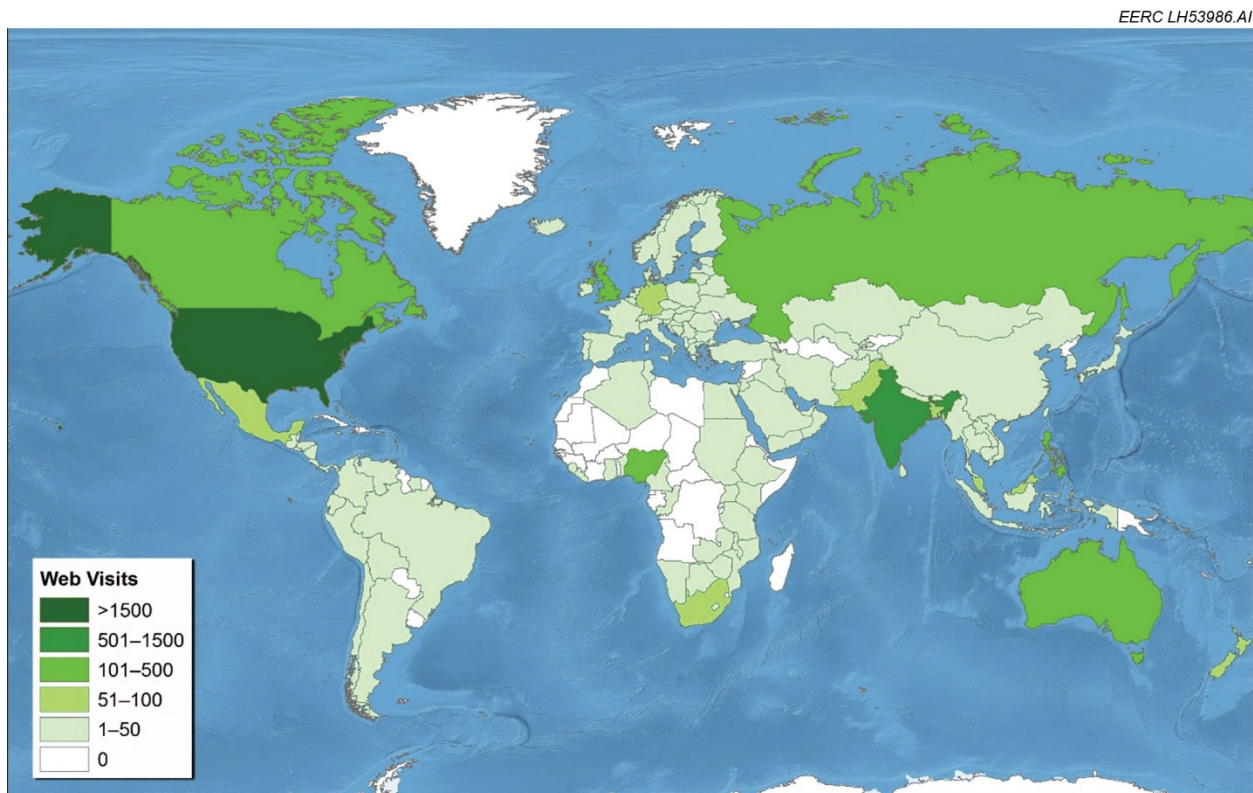


Figure 3. Map of PCOR Partnership Web site global traffic for this reporting period.

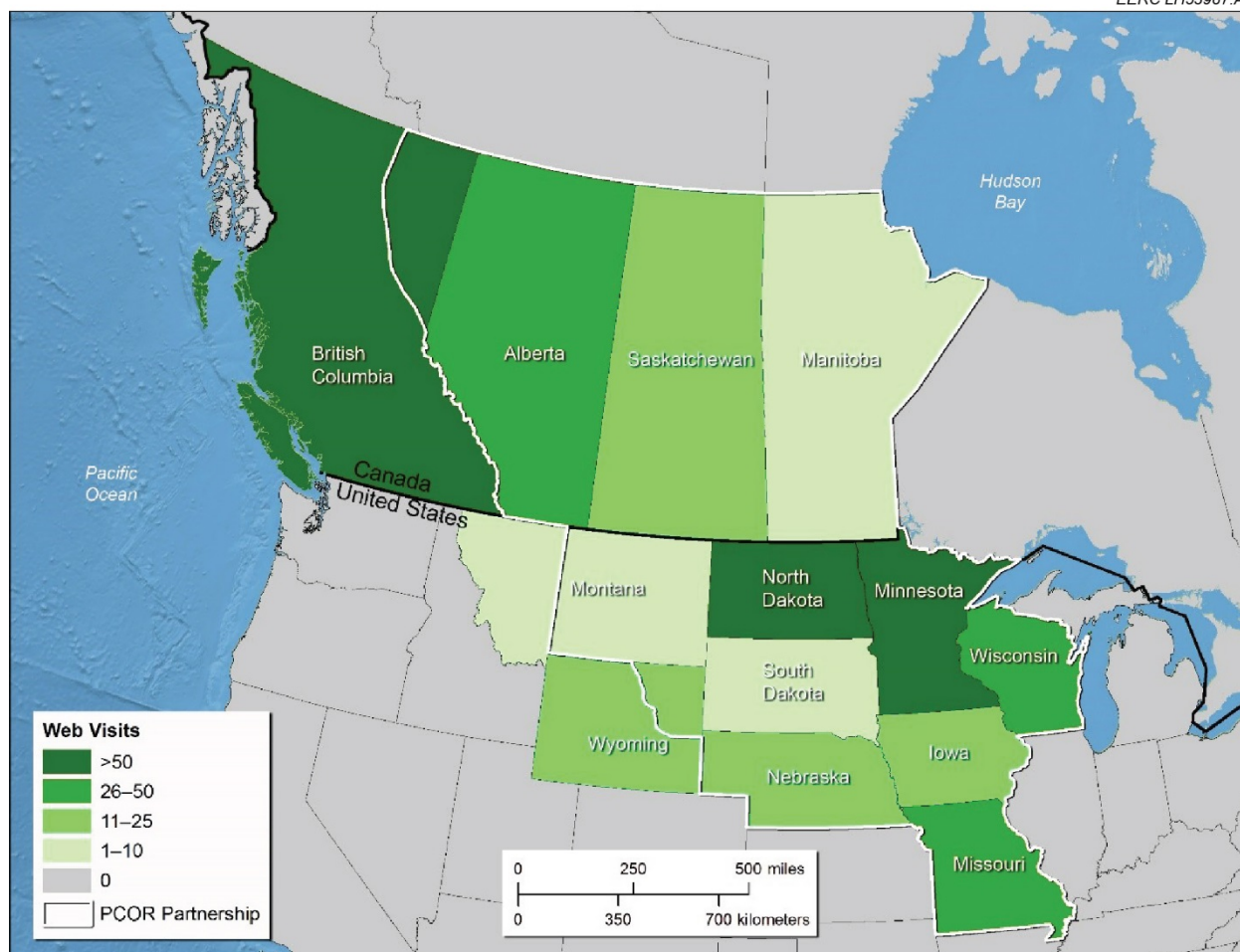


Figure 4. Map of PCOR Partnership Web site regional visits for this reporting period.

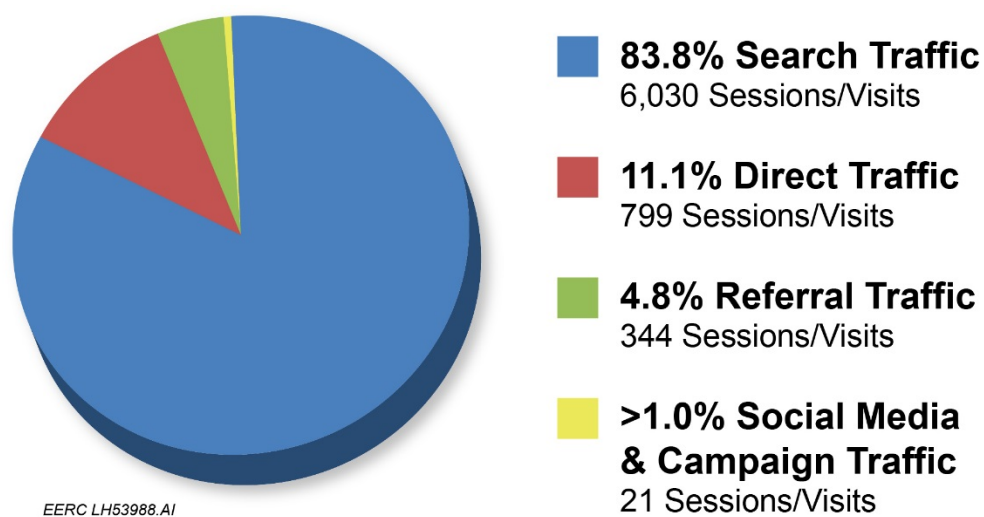


Figure 5. PCOR Partnership public Web site traffic sources for this reporting period.

- Referral site traffic (almost 5%) corresponds to the traffic directed to the PCOR Partnership Web page from other sites via links. The top referring Web sites were undeerc.org (EERC) and arthapedia.in (Indian economy and government Web site).
- Less than 1% of site traffic (21 visitors) resulted from teacher campaigns and social interactions, such as e-mail or social media sources (e.g., Facebook and YouTube).
- During this reporting period, the **nature of the sessions** to the PCOR Partnership public Web site included 11,892 page views (a decrease of over 33% from last quarter); the top five pages viewed are listed in Table 4. These five pages make up almost 73% of total page views.
- All five full-length documentaries and 50 video clips taken from the documentaries have been uploaded to the EERC's YouTube channel. The top five accessed YouTube videos are listed in Table 5. Because of the volume of material, the videos were organized into seven playlists. Each video description includes one or more links to the PCOR Partnership public Web site. Two PCOR Partnership full-length documentaries are also on the PPB YouTube Channel. These are listed in Table 6. These videos can also be streamed on the PCOR Partnership public Web site.

**Table 4. Top “Page Views” on the PCOR Partnership Public Web Site**

<b>Page Title</b>	<b>Page Views</b>	<b>% Page Views</b>	<b>Page</b>
What Is CO <sub>2</sub> Sequestration?	4099	34.5	<a href="http://www.undeerc.org/pcor/sequestration/whatissequestration.aspx">www.undeerc.org/pcor/sequestration/whatissequestration.aspx</a>
What Is CO <sub>2</sub> ?	2961	24.9	<a href="http://www.undeerc.org/pcor/sequestration/whatisco2.aspx">www.undeerc.org/pcor/sequestration/whatisco2.aspx</a>
Carbon Capture and Storage (CCS)	662	5.6	<a href="http://www.undeerc.org/pcor/sequestration/ccs.aspx">www.undeerc.org/pcor/sequestration/ccs.aspx</a>
Terrestrial CO <sub>2</sub> Sequestration Projects	566	4.8	<a href="http://www.undeerc.org/pcor/region/terrestrial/default.aspx">www.undeerc.org/pcor/region/terrestrial/default.aspx</a>
	360	3.0	<a href="http://www.undeerc.org/pcor/co2sequestrationprojects/default.aspx">www.undeerc.org/pcor/co2sequestrationprojects/default.aspx</a>

**Table 5. Top Five EERC PCOR Partnership-Related YouTube Channel Videos Accessed**

<b>Video</b>	<b>Video Length</b>	<b>Views</b>	<b>Est. Minutes Watched</b>	<b>Avg. View Duration</b>
Reforestation in Brazil	4:41	589	1197	2:00
The Phases of Oil Recovery – So Far	2:40	554	945	2:00
Reducing Our Carbon Footprint: The Role of Markets Documentary	26:49	489	2265	5:00
Installing a Casing-Conveyed Permanent Downhole Monitoring System	19:19	178	968	5:15
Reservoir Geology 101: Fluid in the Rocks	1:50	71	88	1:20

**Table 6. PCOR Partnership Documentaries on PPB YouTube Channel Accessed**

<b>Video</b>	<b>Video Length</b>	<b>Views</b>	<b>Est. Minutes Watched</b>
Global Energy and Carbon: Tracking Our Footprint	32:36	664	5085
CO <sub>2</sub> EOR and Geologic CO <sub>2</sub> Sequestration	3:13	128	254
The Bell Creek Story: CO <sub>2</sub> in Action	26:45	101	402

- During this reporting period, the PCOR Partnership received **public television exposure** from documentaries broadcast in the PPB region in four states and one Canadian province. A total of two broadcasts aired, with “Managing Carbon Dioxide: The Geological Solution” and “Global Energy and Carbon: Tracking Our Footprint” each airing once.

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 3 – Permitting and NEPA Compliance**

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

- Attended a meeting in Bismarck, North Dakota, on July 7, 2017, with representatives from the North Dakota Industrial Commission (NDIC) Department of Mineral Resources (DMR) Oil & Gas Division and PCOR Partnership partner Red Trail Energy (RTE) to discuss the status of North Dakota’s Class VI primacy application and the implications of CCS permitting in North Dakota should it be approved.
- Attended the Wyoming Petroleum Section of the Society of Petroleum Engineers (SPE) meeting and met with Denbury staff in attendance to discuss CO<sub>2</sub> delivery operations and pipeline right-of-way permitting.

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 4 – Site Characterization and Modeling**

This task ended in Quarter 1 – BP5, Year 10 (March 2017).

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

This task ended in Quarter 3 – BP4, Year 7 (June 2014).

## **Task 6 – Infrastructure Development**

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

- A PCOR Partnership representative served as an invited mentor at the 2017 International Energy Agency Greenhouse Gas R&D Programme (IEAGHG) CCS Summer School held July 17–23, 2017, in Regina, Saskatchewan, Canada. Presented “CO<sub>2</sub> Transport.”
- Attended the DOE NETL CO<sub>2</sub> Technologies Conference held in Pittsburgh, Pennsylvania, August 21–25, 2017.
- Reviewed existing capture technology information for possible use in the update of the final version of the CO<sub>2</sub> capture technologies overview value-added document (Opportunities and Challenges Associated with CO<sub>2</sub> Compression and Transportation During Carbon Capture, Utilization, and Storage Activities).
- Upon request from a PCOR Partnership partner, examined capture, pipeline, storage, and MVA costs used by the FACETS model to verify the validity of the data. The FACETS model contains unit-level retrofit data, data for new units, and data for storage and transport costs that can be used to indicate the economic viability of applying CCS to a particular plant or set of plants.

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 7 – CO<sub>2</sub> Procurement**

This task ended Quarter 4, BP4, Year 6 (September 2013).

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

This task ended Quarter 4, BP4, Year 8 (September 2015).

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

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

- Submitted the executive summary of D66 entitled “Bell Creek Test Site – Simulation Report (Update 6)” on August 30, 2017. The report is under concurrent review by Denbury and may contain confidential material. If deemed not confidential, the client-approved version will be submitted upon completion of Denbury’s review.

- Submitted M55 entitled “Investigation of Crude Oil Composition Changes During CO<sub>2</sub> EOR,” and received approval on September 25, 2017.
- A PCOR Partnership representative served as an invited mentor at the 2017 IEAGHG CCS Summer School held July 17–23, 2017, in Regina, Saskatchewan, Canada. Presented “Wellbore Integrity.”
- Submitted two memos regarding official updated volumes of tonnes of CO<sub>2</sub> purchased for injection and tonnes of CO<sub>2</sub> stored at Bell Creek. At the end of BP4 (March 31, 2016), 2.979 million tonnes of CO<sub>2</sub> had been stored.
  - Submitted a memo on July 24, 2017. As of May 31, 2017, 3.939 million tonnes of total gas (composition of approximately 98% CO<sub>2</sub>) had been purchased for injection into the Bell Creek Field, equating to an estimated **3.879 million tonnes of CO<sub>2</sub> stored.**
  - Submitted a memo on August 7, 2017. As of June 30, 2017, 4.017 million tonnes of total gas (composition of approximately 98% CO<sub>2</sub>) had been purchased for injection into the Bell Creek Field, equating to an estimated **3.956 million tonnes of CO<sub>2</sub> stored.**
- Continued work on the best practices manual – Monitoring for CO<sub>2</sub> Storage and CO<sub>2</sub> EOR (D51), including revised and added content to several portions of the deliverable and revised content based on an initial internal review.
- Based on mutual agreement with the DOE project manager, the PCOR Partnership plans to submit an update to D69 (Best Practices for Modeling and Simulation of CO<sub>2</sub> Storage), which was submitted May 31, 2017, that incorporates additional reviewer perspectives and findings. Met to discuss the path forward for revisions. Continued work on revisions to lessons learned, recommended best practices, case studies, and text.
- Worked on preparing materials for a meeting planned with Denbury on October 23, 2017, in advance of the PCOR Partnership Annual Membership Meeting and Workshop.
- Continued developing strategy and plan for a PCOR Partnership data set to be submitted to NETL’s Energy Data eXchange (EDX) in 2018.
- Continued **Bell Creek** site activities, including the following:
  - Used the most recent publicly available data to determine that cumulative CO<sub>2</sub> gas injection is 7,967,974 tonnes through July 31, 2017. This value represents the total gas injected, which includes purchase and recycle streams and is NOT corrected for a gas composition of approximately 98% CO<sub>2</sub> (Table 7).
  - As of June 30, 2017, the most recent month of record, 4.017 million tonnes of total gas (composition of approximately 98% CO<sub>2</sub>) has been purchased for injection into the Bell Creek Field, equating to an estimated 3.956 million tonnes of CO<sub>2</sub> stored (Table 8), with the difference comprising other trace gases in the purchase gas stream. A separate method from that used to calculate estimated total gas injected was used to calculate cumulative associated CO<sub>2</sub> storage by correcting the gas purchase volume (approximately 98% CO<sub>2</sub>) obtained from Denbury’s custody transfer meter with gas compositional data.

**Table 7. Bell Creek CO<sub>2</sub> Gas Injection Totals for July 2017 (cumulative totals May 2013 to July 2017)<sup>1</sup>**

	<b>July 2017 Injection</b>
Total, Mscf	4,645,863
Total, tons <sup>2</sup>	265,736
Total, tonnes <sup>3</sup>	241,306
Cumulative Total, Mscf <sup>4</sup>	153,407,410
Cumulative Total, tons <sup>2,4</sup>	8,774,662
Cumulative Total, tonnes <sup>3,4</sup>	7,967,974

Source: Montana Board of Oil and Gas (MBOG) database.

<sup>1</sup> Total gas injection quantities are **NOT CORRECTED** for gas composition and include the combined purchased and recycled gas streams.

<sup>2</sup> Calculated utilizing a conversion of 17.483 Mscf/ton.

<sup>3</sup> Calculated utilizing a conversion of 19.253 Mscf/tonne.

<sup>4</sup> Cumulative totals are for the period from May 2013 to the month listed.

**Table 8. Cumulative Total Gas Purchased and Estimated Associated CO<sub>2</sub> Storage for the Bell Creek Field<sup>1</sup>**

	<b>June 2017 Gas Totals</b>
Monthly Total Gas Purchased, MMscf <sup>2</sup>	1499
Monthly Total Gas Purchased, million tons <sup>2</sup>	0.086
Monthly Total Gas Purchased, million tonnes <sup>2</sup>	0.078
Cumulative Total Gas Purchased, MMscf <sup>2,3</sup>	77,331
Cumulative Total Gas Purchased, million tons <sup>2,3</sup>	4.423
Cumulative Total Gas Purchased, million tonnes <sup>2,3</sup>	4.017
Cumulative Total CO <sub>2</sub> Stored, MMscf <sup>3,4</sup>	76,168
Cumulative Total CO <sub>2</sub> Stored, million tons <sup>3,4</sup>	4.357
Cumulative Total CO <sub>2</sub> Stored, million tonnes <sup>3,4</sup>	3.956

<sup>1</sup> Conversion factors of 17.483 Mscf/ton and 19.253 Mscf/tonne were used to calculate equivalent purchase and storage quantities.

<sup>2</sup> Total gas purchased **NOT CORRECTED** for gas composition.

<sup>3</sup> Cumulative totals are for the period from May 2013 to the month listed.

<sup>4</sup> Total CO<sub>2</sub> stored **CORRECTED** for gas composition.

- With regard to **injection-phase monitoring** efforts:
  - ◆ Continued reservoir pressure and distributed temperature monitoring of 05-06 OW (observation well) from the permanent downhole monitoring (PDM) system using the casing-conveyed pressure–temperature (P–T) gauges and fiber-optic distributed temperature system:
    - Near-continuous operation since April 2012.
    - Traveled to Bell Creek Field August 15–17, 2017, to download data from the PDM system. Updated the sampling rate and software recording P–T data.
    - Completed processing downloaded PDM data through August 16, 2017.
  - ◆ Worked with a representative from Denbury to set up several check shots with a trailer-mounted weight-drop source (source purchased for use on a separate DOE project) to aid in calibration and interpretation of data collected using the permanent borehole array in Well 04-03 OW. Traveled to Bell Creek Field

July 10–13, 2017, for borehole array reactivation and check shot acquisition. The upper 25 sensors powered up for recording; the lower 25 channels would not respond to power. Data acquisition was completed successfully from several check shot locations using the 25 active sensors. The borehole array system was powered down, and surface computer and acquisition equipment was returned to the EERC.

- With regard to **injection-phase sampling** activities:
  - ◆ Worked with Denbury on the seventh and eighth rounds of oil sample collection from a select group of wells in the Bell Creek Field. Received samples from the seventh round.
  - ◆ Worked with Denbury to collect purchase/recycle samples in the Bell Creek Field.
  - ◆ A summary of all oil and CO<sub>2</sub> gas stream samples collected for analyses to date is provided in Table 9.

**Table 9. Oil and CO<sub>2</sub> Gas Stream Sampling and Analyses**

Date Sampled	Purchase/ Recycle <sup>1</sup>	Production Stream by Development Phase, Well <sup>1</sup>									
		Phase 1				Phase 3			Phase 4		
		56-14R	32-02	05-06	04-04	28-02	21-10	21-14	34-09	34-07	34-03
Jan 2014		O	O	O							
Mar 2014		O	O								
May 2014	P	O	O	O							
Jun 2014	PR	O	O	O							
Jul 2014	PR	O	O	O							
Sep 2014	PR	OG	OG	O							
Oct 2014	PR	O	O								
Nov/Dec 2014		OG	OG	G							
Jan 2015			O	OG							
Mar 2015		G	G	G							
Apr 2015	PR										
Jun 2015		O	O	O							
Jul 2015	PR	G	G	G							
Sep 2015	PR										
Nov 2015		O		O							
Jan 2016	PR										
Apr/May 2016		O	O	O	O	O	O	O			
Jun/Jul 2016	PR	O		O	O	O	O	O			
Aug/Sep 2016		O	O		O	O	O	O	O		
Oct 2016				O							
Nov/Dec 2016 <sup>2</sup>	PR	O	O	O	O	O	O	O	O	O	O
Feb 2017 <sup>2</sup>		O	O		O	O	O	O	O	O	O
May 2017 <sup>2</sup>	PR	O	O	O	O	O	O	O	O	O	O
July 2017 <sup>2</sup>		O			O	O	O	O	O	O	O

<sup>1</sup> P = purchase CO<sub>2</sub> gas stream, R = recycle CO<sub>2</sub> gas stream, O = produced oil stream, and G = produced CO<sub>2</sub> gas stream.

<sup>2</sup> Oil samples collected but not yet analyzed.



- With regard to **modeling** and **simulation** efforts:
  - ◆ Continued dynamic reservoir pressure and multiphase fluid flow simulation efforts. The modeling and simulation focus remains on Bell Creek Field Phase Areas 1–4. Accomplishments and activities include the following:
    - History matching of the simulation model is complete for Phase Areas 1–3. Predictive simulation is complete for Phase Areas 1 and 2. Long-term simulations of CO<sub>2</sub> migration are complete for Phase Areas 3–7. History matching of the simulation model is complete for the primary depletion, waterflooding, and CO<sub>2</sub>-flooding stages for Phase Area 4 using the simulation model based on the Version 3 geologic model.
    - Completed two long-term CO<sub>2</sub> migration simulation cases for Phase Areas 1 and 2.
    - Ran simulation cases for CO<sub>2</sub> EOR and storage prediction in Phase Area 4 using different operating premises.
    - Designed more simulation cases to investigate the associated CO<sub>2</sub> storage performance in Bell Creek with different scales and various operational conditions.
    - Continued conducting simulation for associated CO<sub>2</sub> storage in the Bell Creek oil field using models with different scales—the most important storage mechanisms are considered in these models.
  - ◆ Continued work with the seismic data set. Accomplishments and activities include the following:
    - Worked on time-to-depth conversion of the 2012/2014/2015 seismic data set.
    - Worked on integrating seismic data into the Bell Creek Phases 1 and 2 long-term simulation model.
    - Continued work with seismic attributes. Extracted seismic attributes from the difference seismic data (2012–2015 and 2014–2015). Worked on tying seismic attributes from the three sets of seismic difference data to the pulsed-neutron log (PNL) well data.
- Continued work with InSAR (interferometric synthetic aperture radar) data. The current data in house are from June to December 2016.
- Continued with interpretation of the results from the relative permeability hysteresis laboratory study to inform simulation model parameters, including the following:
  - ◆ Developed relative permeability hysteresis curves for simulation based on oil and gas relative permeability curves measured using CO<sub>2</sub>–oil drainage–imbibition cycles performed previously in the lab.
  - ◆ Integrated the new relative permeability gas hysteresis curves into simulation models.
  - ◆ Ran simulation cases to investigate the effects of relative permeability hysteresis and CO<sub>2</sub> solubility on CO<sub>2</sub> EOR and associated storage in the CO<sub>2</sub>-flooding process.

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 10 – Site Closure**

Significant accomplishments for Task 10 for the reporting period included the following:

- Worked on the abstract, outline, and text for D54 (Site Closure Procedures).
- Cancelled Internet service and began decommissioning of passive seismic array at Bell Creek Field.
- Developed decommission plan/schedule for EERC mobile operations support trailers located in the field.

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 11 – Postinjection Monitoring and Modeling**

Significant accomplishments for Task 11 for the reporting period included the following:

- Completed the draft outline for D73 (Monitoring and Modeling Fate of Stored CO<sub>2</sub>).

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 12 – Project Assessment**

Significant accomplishments for Task 12 for the reporting period included the following:

- Continued updating sections in the BP5 Program Year 10 annual report based on deliverables and milestones.

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 13 – Project Management

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

- Submitted D103 entitled “PCOR Partnership Best Practices Manual for Subsurface Technical Risk Assessment of Geologic CO<sub>2</sub> Storage Projects” on August 29, 2017, for review.
- Attended the DOE NETL RCSP Principal Investigator Meeting held July 13, 2017, in Morgantown, West Virginia.
- Attended the Carbon Management Technology Conference 2017 (CMTTC 2017) held July 17–20, 2017, in Houston, Texas. Presented “Demonstration of Secure CO<sub>2</sub> Geological Storage Associated with Enhanced Oil Recovery in the PCOR Partnership Region.”
- Attended the 2017 Mastering the Subsurface Through Technology Innovation, Partnerships and Collaboration: Carbon Storage and Oil and Natural Gas Technologies Review Meeting held August 1–3, 2017, in Pittsburgh, Pennsylvania, and presented “Bell Creek Field Project – Plains CO<sub>2</sub> Reduction Partnership.”
- Attended the European Association of Geoscientists and Engineers (EAGE) Technical Programme of the Fourth Sustainable Earth Sciences Conference held September 3–7, 2017, in Malmö, Sweden, and presented “The Plains CO<sub>2</sub> Reduction (PCOR) Partnership: Successes Leading to New Innovation.”
- Attended the 2017 Midwest Carbon Sequestration Science Conference held September 19–20, 2017, in Champaign, Illinois, and presented “The Plains CO<sub>2</sub> Reduction (PCOR) Partnership.”
- Attended the Mission Innovation Carbon Capture Utilization and Storage Experts’ Workshop held September 25–29, 2017, in Houston, Texas.
- Attended the North Dakota Petroleum Council Annual Meeting held September 26–28, 2017, in Bismarck, North Dakota.
- Submitted an abstract for consideration to the 2018 Carbon Capture, Utilization, and Storage (CCUS) Conference entitled “Regional Update of CCUS Field Projects Within the PCOR Partnership Region: Improving the Commercial Viability of CO<sub>2</sub> Storage Through Improved Performance Monitoring and Operational Management” to be held March 20–22, 2018, in Nashville, Tennessee. The proposed presentation will include updates from the PCOR Partnership project and other EERC projects.
- Continued work on a planned special issue of the *International Journal of Greenhouse Gas Control* (IJGGC) focused on Bell Creek activities. Team members began drafting outlines and writing text for potential papers. A revised list of proposed papers with lead author is shown in Table 10.
- Held a task leader meeting August 24, 2017. Topics discussed included deliverables, planned journal articles and conference papers, site decommissioning, planning for the 2017 PCOR Partnership Annual Membership Meeting and Workshop, and task updates.

**Table 10. Proposed Papers for PCOR Partnership IJGGC Special Issue**

<b>Title</b>	<b>Lead Author</b>
Introduction: The Plains CO <sub>2</sub> Reduction (PCOR) Partnership Program and large-scale demonstration of associated CO <sub>2</sub> geological storage	Neil Wildgust, David Nakles, and Ryan Klapperich (editors)
CO <sub>2</sub> storage associated with CO <sub>2</sub> enhanced oil recovery: a statistical analysis of historical operations. <i>International Journal of Greenhouse Gas Control</i> (IJGGC), 2015, v. 37, p. 384–397. <sup>1,2</sup>	
Characterization of a case study CO <sub>2</sub> EOR project to support the assessment of associated CO <sub>2</sub> storage	Nick Bosshart
Quantifying CO <sub>2</sub> storage efficiency factors in hydrocarbon reservoirs: a detailed look at CO <sub>2</sub> enhanced oil recovery <sup>1</sup>	Wes Peck and others <sup>3</sup>
Using pulsed-neutron lifetime (PNL) logs to monitor wellbore integrity at a CO <sub>2</sub> storage site: lessons learned from field deployment by the PCOR Partnership	Nick Bosshart
Laboratory measurements of CO <sub>2</sub> draining oil relative permeability and hysteresis effects for a conventional clastic reservoir	Steven Smith
Evaluation of recycle gas injection and associated impurities on performance of associated storage	Lu Jin
Lessons learned and best practices derived from environmental monitoring at a large-scale CO <sub>2</sub> injection project	Kerryanne Leroux
Effects of gas relative permeability hysteresis and solubility on associated CO <sub>2</sub> storage performance	Lu Jin
Detection of subsurface CO <sub>2</sub> migration using 4-D seismic monitoring to update history matching and improve reservoir simulation	Lu Jin
Comparison of saturation values from PNLs and seismic	Shaughn Burnison
Application of 4-D seismic inversion to improve seismic amplitude interpretation of a reservoir undergoing CO <sub>2</sub> injection	Olarinre Salako
How green is my oil? A detailed look at greenhouse gas accounting for CO <sub>2</sub> enhanced oil recovery (CO <sub>2</sub> EOR) sites. <i>International Journal of Greenhouse Gas Control</i> , 2016, v. 51, p. 369–379. <sup>1,2</sup>	
Life cycle analysis: case study of associated storage with enhanced oil recovery	Melanie Jensen

<sup>1</sup> These papers were developed under separate funding and are either under journal review or have already been published. These papers are planned to be included in the special issue because of the relevant subject matter.

<sup>2</sup> This paper has already been published by the journal.

<sup>3</sup> This paper is currently submitted to IJGGC and under peer review.

- Continued planning for the PCOR Partnership Annual Membership Meeting and Workshop to be held October 24–26, 2017, in Plano, Texas, including the following:
  - Held planning meetings on July 13, August 8 and 31, and September 18 and 29, 2017. Discussions included workshop format, agenda development for workshop and

- meeting, potential speakers, materials for meeting distribution, booths and posters, meeting room setup, e-mail blasts, audiovisual needs, side meetings, pioneer awards, and food and beverage costs.
- Continued development of the draft workshop and meeting agendas, the workshop interactive activity, and meeting materials, including booths that will be displayed during the meeting.
- Worked with the hotel events manager on meeting room preparations.
- Traveled to Plano, Texas, August 21–22, 2017, to conduct a site visit of the hotel.
- Sent e-mail blasts on September 1, 20, and 27, 2017, to announce the preliminary agenda, remind participants of the hotel registration deadline, and serve as a sponsorship agenda. The e-mail blasts contained meeting registration and hotel links.
- Continued work on securing speakers and updated the meeting Web site with recent speaker confirmations.
- Worked on planning a Technical Advisory Board (TAB) meeting in conjunction with the PCOR Partnership Annual Membership Meeting and Workshop.
- Worked on edits to the project management plan.
- Deliverables and milestones completed in July:
  - June monthly update
  - Task 13: D58/D59 – Quarterly Progress Report/Milestone Quarterly Report
- Deliverables and milestones completed in August:
  - July monthly update
  - Task 1: D81 – PCOR Partnership Atlas Update
  - Task 9: D66 – Bell Creek Test Site – Simulation Report (Update 6) executive summary
  - Task 13: D103 – PCOR Partnership Best Practices Manual for Subsurface Technical Risk Assessment of Geologic CO<sub>2</sub> Storage Projects
- Deliverables and milestones completed in September:
  - August monthly update
  - Task 1: D1 – Review of Source Attributes
  - Task 9: M55 – Investigation of Crude Oil Composition Changes During CO<sub>2</sub> EOR
  - Task 14: M62 – Research Related to Water and CCS Nexus Completed

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 14 – RCSP WWG Coordination**

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

- Submitted M62 entitled “Research Related to Water and CCS Nexus Completed,” and received approval on September 25, 2017.
- Held the WWG Annual Meeting on August 2, 2017, in Pittsburgh, Pennsylvania. The meeting hosted two guest speakers. Dale Skoff, Tetra Tech, discussed potential

wastewater injectivity in western Pennsylvania and Omkar Lokare, University of Pittsburgh, discussed quantity and quality of produced waters generated in western Pennsylvania and how these change over a well's life cycle.

- Continued development of the draft D107 (Journal Article or Topical Report – Major Research Focuses for Water and CCS). Received approval of the draft outline from Andrea McNemar. Continued developing and revising content for the first three sections. Requested input from WWG members. Anticipate submitting abstract to Greenhouse Gas Control Technologies (GHGT)-14 and will create a final product that conforms to typical GHGT paper requirements. Progress was made on the text and appendix materials.

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

This task ended Quarter 2, BP4, Year 7 (February 2014).

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

This task ended Quarter 2, BP4, Year 7 (March 2014).

### **PHASE III COST STATUS**

The approved BP5 budget along with actual costs incurred and in-kind cost share reported are shown in Table 11. A spending plan for BP5 and actual incurred cost by quarter of cash funds for BP5 are provided in Figure 6 and Table 12.

**Table 11. Phase III Budget – BP5**

<b>Organization</b>	<b>Approved Budget, \$*</b>	<b>Actual Costs Incurred, \$</b>
DOE Share – Cash	13,946,212	9,108,375
Nonfederal Share	5,711,194	5,759,054
<b>Total</b>	<b>19,657,406</b>	<b>14,867,429</b>

\*As of Modification No. 36.

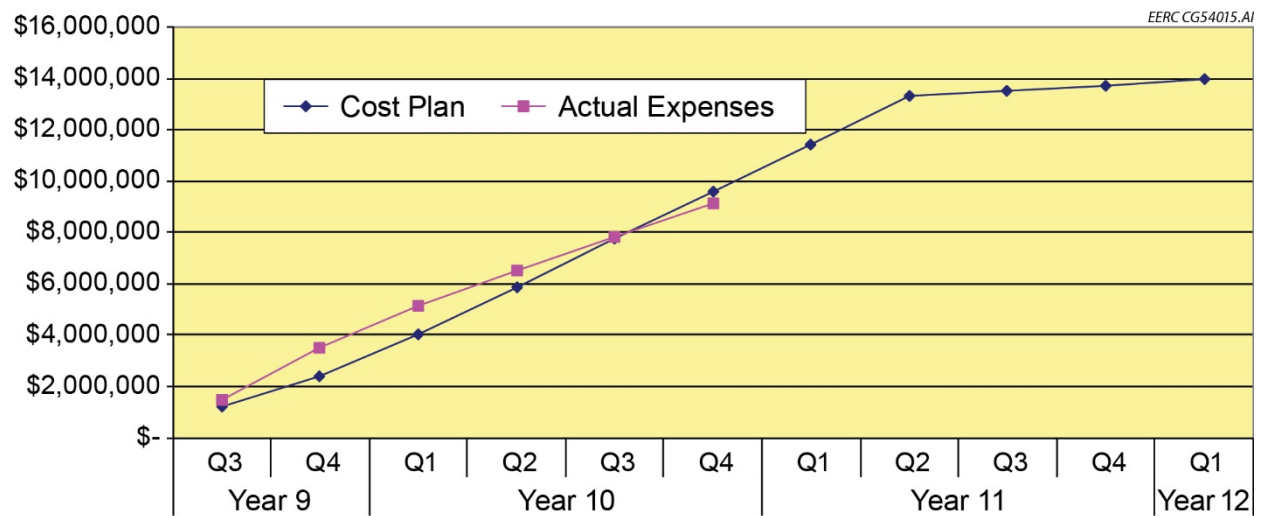


Figure 6. PCOR Partnership Phase III, BP5, Years 9–12 funding (cash only).

### PHASE III SCHEDULE STATUS

Table 13 lists all deliverables and milestones by quarter, with completion dates, through the end of the reporting period (see Table 14 for the Gantt chart for BP5, Years 9–12).

**Table 12. Phase III, BP5, Years 9–12 Spending Plan**

Budget Period 4					Budget Period 5											
Baseline Reporting Quarter	Year 9								Year 10							
	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	\$ 2,250,000	\$ 62,873,437	\$ 2,250,000	\$ 65,123,437	\$ 1,202,894	\$ 1,202,894	\$ 1,202,894	\$ 2,405,788	\$ 1,623,146	\$ 4,028,934	\$ 1,855,986	\$ 5,884,920	\$ 1,855,986	\$ 7,740,906	\$ 1,855,986	\$ 9,596,892
Nonfederal Share	\$ -	\$ 2,411,971	\$ -	\$ 2,411,971	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Total Planned	\$ 2,250,000	\$ 65,285,408	\$ 2,250,000	\$ 67,535,408	\$ 1,202,894	\$ 1,202,894	\$ 1,202,894	\$ 2,405,788	\$ 1,623,146	\$ 4,028,934	\$ 1,855,986	\$ 5,884,920	\$ 1,855,986	\$ 7,740,906	\$ 1,855,986	\$ 9,596,892
Actual Incurred Cost																
Federal Share	\$ 1,909,898	\$ 57,914,662	\$ 2,562,356	\$ 60,477,018	\$ 1,497,211	\$ 1,497,211	\$ 1,962,929	\$ 3,460,140	\$ 1,623,146	\$ 5,083,286	\$ 1,362,782	\$ 6,446,068	\$ 1,342,971	\$ 7,789,039	\$ 1,319,336	\$ 9,108,375
Nonfederal Share	\$ (4,110)	\$ 2,991,641	\$ 10,655	\$ 3,002,296	\$ 7,501	\$ 7,501	\$ 30,340	\$ 37,841	\$ 10,788	\$ 48,629	\$ 530	\$ 49,159	\$ 14	\$ 49,173	\$ 217	\$ 49,390
Total Incurred Cost	\$ 1,905,788	\$ 60,906,303	\$ 2,573,011	\$ 63,479,314	\$ 1,504,712	\$ 1,504,712	\$ 1,993,269	\$ 3,497,981	\$ 1,633,934	\$ 5,131,915	\$ 1,363,312	\$ 6,495,227	\$ 1,342,985	\$ 7,838,212	\$ 1,319,553	\$ 9,157,765
Variance																
Federal Share	\$ 340,102	\$ 4,958,775	\$ (312,356)	\$ 4,646,419	\$ (294,317)	\$ (294,317)	\$ (760,035)	\$ (1,054,352)	\$ -	\$ (1,054,352)	\$ 493,204	\$ (561,148)	\$ 513,015	\$ (48,133)	\$ 536,650	\$ 488,517
Nonfederal Share	\$ 4,110	\$ (579,670)	\$ (10,655)	\$ (590,325)	\$ (7,501)	\$ (7,501)	\$ (30,340)	\$ (37,841)	\$ (10,788)	\$ (48,629)	\$ (530)	\$ (49,159)	\$ (14)	\$ (49,173)	\$ (217)	\$ (49,390)
Total Variance	\$ 344,212	\$ 4,379,105	\$ (323,011)	\$ 4,056,094	\$ (301,818)	\$ (301,818)	\$ (790,375)	\$ (1,092,193)	\$ (10,788)	\$ (1,102,981)	\$ 492,674	\$ (610,307)	\$ 513,001	\$ (97,306)	\$ 536,433	\$ 439,127

Budget Period 5																
Baseline Reporting Quarter	Year 11								Year 12							
	Q1		Q2		Q3		Q4		Q1							
	Q1	Cum. BP Total	Q2	Cum. BP Total	Q3	Cum. BP Total	Q4	Cum. BP Total	Q1	Cum. BP Total						
<b>Baseline Cost Plan</b>																
Federal Share	\$ 1,855,987	\$ 11,452,879	\$ 1,855,987	\$ 13,308,866	\$ 212,449	\$ 13,521,315	\$ 212,449	\$ 13,733,764	\$ 212,448	\$ 13,946,212						
Nonfederal Share	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -						
Total Planned	\$ 1,855,987	\$ 11,452,879	\$ 1,855,987	\$ 13,308,866	\$ 212,449	\$ 13,521,315	\$ 212,449	\$ 13,733,764	\$ 212,448	\$ 13,946,212						
<b>Actual Incurred Cost</b>																
Federal Share	\$ -	\$ -	\$ -	\$ -												
Nonfederal Share	\$ -	\$ -	\$ -	\$ -												
Total Incurred Cost	\$ -	\$ -	\$ -	\$ -												
<b>Variance</b>																
Federal Share	\$ -	\$ -	\$ -	\$ -												
Nonfederal Share	\$ -	\$ -	\$ -	\$ -												
Total Variance	\$ -	\$ -	\$ -	\$ -												



**Table 13. 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 13. 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	Not applicable	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 3 – 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 13. 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 13. 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 13. 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 13. 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 13. 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
<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 13. 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	4/30/13
M14: Task 4 – Bell Creek Test Site Geological Characterization Data Collection Completed	4/30/13	4/30/13
M23: Task 14 – Monthly WWG Conference Call Held	4/30/13	4/25/13
M35: Task 16 – Basal Cambrian Dynamic Capacity Estimation Completed	4/30/13	4/30/13
D17: Task 2 – General Phase III Information PowerPoint Presentation (update)	5/31/13	5/31/13
D43: Task 5 – Bell Creek Test Site – Monitoring Experimental Design Package	5/31/13	5/31/13
M23: Task 14 – Monthly WWG Conference Call Held	5/31/13	5/30/13
M27: Task 5 – Bell Creek Test Site – MVA Equipment Installation and Baseline MVA Activities Completed	5/31/13	5/31/13
M23: Task 14 – Monthly WWG Conference Call Held	6/30/13	6/27/13
M26: Task 9 – Bell Creek Test Site – CO <sub>2</sub> Injection Initiated	6/30/13	May 2013 – sent 6/25/13
M37: Task 3 – IOGCC (Interstate Oil and Gas Compact Commission) Task Force Subgroup Meeting 2 Held	5/9/13	5/29/13
M42: Task 3 – Findings and Recommendations of the Operational and Postoperational Subgroups Presented to the Carbon Geologic Storage (CGS) Task Force	6/30/13	6/20/13 – sent 6/28/13
<b>Year 6 – Quarter 4 (July–September 2013)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	7/31/13	7/31/13
D33: Task 4 – Bell Creek Test Site – Geochemical Final Report	7/31/13	7/31/13
M12: Task 4 – Bell Creek Test Site Geochemical Work Completed	7/31/13	7/31/13
M23: Task 14 – Monthly WWG Conference Call Held	7/31/13	7/25/13
D64: Task 4 – Bell Creek Test Site – Site Characterization Report	8/31/13	8/29/13
D66: Task 9 – Bell Creek Test Site – Simulation Report	8/31/13	8/30/13
D81: Task 1 – Regional Carbon Sequestration Atlas (update)	8/31/13	5/1/13
M23: Task 14 – Monthly WWG Conference Call Held	8/31/13	Waived by DOE

Continued . . .



**Table 13. 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>		
D1: Task 1 – Review of Source Attributes	9/30/13	9/5/13
D6: Task 3 – Permitting Review – Update 1	9/30/13	9/24/13
D48: Task 7 – Bell Creek Test Site – Procurement Plan and Agreement Report	9/30/13	9/24/13
D90: Task 16 – Report – Wellbore Evaluation of the Basal Cambrian System	9/30/13	9/5/13
D94: Task 2 – Aquistore Project Fact Sheet	9/30/13	9/30/13
D95: Task 2 – Aquistore Project Poster	9/30/13	9/30/13
D98: Task 3 – Report – Findings, Recommendations, and Guidance of CGS Task Force	9/30/13	8/30/13
M23: Task 14 – Monthly WWG Conference Call Held	9/30/13	9/30/13
M38: Task 3 – IOGCC Task Force Wrap-Up Meeting Held	9/30/13	8/16/13 – sent 9/5/13
M39: Task 3 – IOGCC Task Force Editing Subgroup Meeting Held	9/30/13	6/3/13 – sent 9/5/13
M40: Task 15 – Further Characterization of the Zama Acid Gas EOR, CO <sub>2</sub> Storage, and Monitoring Project Completed	9/30/13	9/24/13
<b>Year 7 – Quarter 1 (October–December 2013)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	10/31/13	10/31/13
D42: Task 5 – Bell Creek Test Site – Injection Experimental Design Package	10/31/13	10/30/13
D99: Task 14 – Water–CCS Nexus-Related Fact Sheet	10/31/13	10/31/13
M23: Task 14 – Monthly WWG Conference Call Held	10/31/13	10/31/13
M23: Task 14 – Monthly WWG Conference Call Held	11/30/13	11/21/13
M23: Task 14 – Monthly WWG Conference Call Held	12/31/13	Waived by DOE
M24: Task 14 – WWG Annual Meeting Held	12/31/13	8/19/13
M43: Task 9 – Bell Creek Test Site – First Full-Repeat Sampling of the Groundwater-Soil Gas-Monitoring Program Completed	12/31/13	11/15/13 – sent 12/13/13
<b>Year 7 – Quarter 2 (January–March 2014)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	1/31/14	1/31/14
D57: Task 12 – Project Assessment Annual Report	1/31/14	1/31/14
M23: Task 14 – Monthly WWG Conference Call Held	1/31/14	1/28/14
M41: Task 6 – Decision to Incorporate Ramgen Compression Technology into Bell Creek Project	1/31/14	1/29/14

Continued . . .

**Table 13. Phase III Milestones and Deliverables (continued)**

<b>Title/Description</b>	<b>Due Date</b>	<b>Actual Completion Date</b>
<b>Year 7 – Quarter 2 (January–March 2014) (continued)</b>		
D86: Task 15 – Updated Regional Implementation Plan for Zama	2/28/14	2/28/14
M23: Task 14 – Monthly WWG Conference Call Held	2/28/14	2/27/14
D24: Task 2 – PCOR Partnership Region Sequestration General Poster (update)	3/31/14	3/27/14
D36: Task 4 – Bell Creek Test Site – Wellbore Leakage Final Report	3/31/14	3/19/14
D92: Task 16 – Report – Storage Capacity and Regional Implications for Large-Scale Storage in the Basal Cambrian System	3/31/14	3/27/14
D93: Task 1 – Geological Modeling and Simulation Report for the Aquistore Project	3/31/14	3/25/14
D96: Task 4 – Bell Creek Test Site – 3-D Seismic and Characterization Report	3/31/14	3/27/14
M23: Task 14 – Monthly WWG Conference Call Held	3/31/14	3/25/14
M36: Task 13 – Annual Advisory Board Meeting Scheduled	3/31/14	3/4/14 Sent 3/25/14
M44: Task 9 – Bell Creek Test Site – First 3-D VSP Repeat Surveys Completed	3/31/14	3/1/14 Sent 3/25/14
<b>Year 7 – Quarter 3 (April–June 2014)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	4/30/14	4/30/14
M23: Task 14 – Monthly WWG Conference Call Held	4/30/14	4/24/14
D17: Task 2 – General Phase III Information PowerPoint Presentation (update)	5/31/14	5/30/14
D101: Task 14 – WWG Web Site Content Update	5/31/14	5/30/14
M23: Task 14 – Monthly WWG Conference Call Held	5/31/14	5/21/14
D44: Task 5 – Bell Creek Test Site – Drilling and Completion Activities Report	6/30/14	5/30/14
M23: Task 14 – Monthly WWG Conference Call Held	6/30/14	6/26/14
M45: Task 9 – Bell Creek Test Site – First Full-Repeat of Pulsed Neutron Logging Campaign Completed	6/30/14	6/9/14
M46: Task 9 – Bell Creek Test Site – 1 Year of Injection Completed	6/30/14	6/26/14

Continued...

**Table 13. Phase III Milestones and Deliverables (continued)**

<b>Title/Description</b>	<b>Due Date</b>	<b>Actual Completion Date</b>
<b>Year 7 – Quarter 4 (July–September 2014)</b>		
D13: Task 2 – Public Site Updates	7/31/14	7/29/14
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	7/31/14	7/31/14
M23: Task 14 – Monthly WWG Conference Call Held	7/31/14	7/17/14 WebEx
D66: Task 9 – Bell Creek Test Site – Simulation Report	8/31/14	8/27/14 Exec. Sum.
M23: Task 14 – Monthly WWG Conference Call Held	8/31/14	Waived by DOE
D1: Task 1 – Review of Source Attributes	9/30/14	9/24/14
D7: Task 1 – Third Target Area Completed	9/30/14	9/26/14
D93: Task 1 – Geological Modeling and Simulation Report for the Aquistore Project	9/30/14	9/30/14
D100: Task 9 – Fort Nelson Test Site – Best Practices Manual – Feasibility Study	9/30/14	9/30/14
M23: Task 14 – Monthly WWG Conference Call Held	9/30/14	9/30/14
<b>Year 8 – Quarter 1 (October–December 2014)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	10/31/14	10/31/14
D99: Task 14 – Water/CCS Nexus-Related Fact Sheet	10/31/14	10/31/14
M23: Task 14 – Monthly WWG Conference Call Held	10/31/14	10/28/14
M48: Task 9 – Bell Creek Test Site – 1 Million Metric Tons of CO <sub>2</sub> Injected	10/31/14	10/29/14
M23: Task 14 – Monthly WWG Conference Call Held	11/30/14	11/25/14
D57: Task 12 – Project Assessment Annual Report	12/31/14	12/30/14
M24: Task 14 – WWG Annual Meeting Held	12/31/14	8/11/14
<b>Year 8 – Quarter 2 (January–March 2015)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	1/31/15	1/30/15
D32: Task 4 – Bell Creek Test Site – Geomechanical Report (Update 1)	1/31/15	1/28/15
M23: Task 14 – Monthly WWG Conference Call Held	1/31/15	1/27/15
M23: Task 14 – Monthly WWG Conference Call Held	2/28/15	2/26/15
D25: Task 2 – Bell Creek Test Site Poster (update)	3/31/15	2/5/15
M23: Task 14 – Monthly WWG Conference Call Held	3/31/15	3/25/15
M36: Task 13 – Annual Advisory Board Meeting Scheduled	3/31/15	3/31/15

Continued . . .

**Table 13. Phase III Milestones and Deliverables (continued)**

<b>Title/Description</b>	<b>Due Date</b>	<b>Actual Completion Date</b>
<b>Year 8 – Quarter 3 (April–June 2015)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	4/30/15	4/29/15
M23: Task 14 – Monthly WWG Conference Call Held	4/30/15	4/28/15
D17: Task 2 – General Phase III Information PowerPoint Presentation (update)	5/31/15	6/1/15
M23: Task 14 – Monthly WWG Conference Call Held	5/30/15	5/28/15
D85: Task 6 – Report – Opportunities and Challenges Associated with CO <sub>2</sub> Compression and Transportation During CCUS (carbon capture, utilization, and storage) Activities (update)	5/31/15	5/29/15
M23: Task 14 – Monthly WWG Conference Call Held	6/30/15	6/23/15
M49: Task 9 – Bell Creek Test Site – 1.5 Million Metric Tons of CO <sub>2</sub> Injected	6/30/15	6/30/15
<b>Year 8 – Quarter 4 (July–September 2015)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	7/31/15	7/31/15
M23: Task 14 – Monthly WWG Conference Call Held	7/31/15	Waived by DOE
M50: Task 9 – Bell Creek Test Site – 2 Years of Near-Surface Assurance Monitoring Completed	7/31/15	7/21/15
D66: Task 9 – Bell Creek Test Site – Simulation Report	8/31/15	8/27/15 Exec. Sum.
M23: Task 14 – Monthly WWG Conference Call Held	8/31/15	Waived by DOE
M51: Task 9 – Bell Creek Test Site – Initial Analysis for First Large-Scale Repeat Pulsed-Neutron Logging Campaign Post-Significant CO <sub>2</sub> Injection Completed	8/31/15	8/31/15
D1: Task 1 – Review of Source Attributes (update)	9/30/15	9/23/15
D8: Task 3 – Permitting Review – Update 2	9/30/15	9/30/15
D49: Task 8 – Bell Creek Test Site – Transportation and Injection Operations Report	7/31/15	9/29/15
M23: Task 14 – Monthly WWG Conference Call Held	9/30/15	9/30/15
<b>Year 9 – Quarter 1 (October–December 2015)</b>		
D59/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	10/31/15	10/31/15
M23: Task 14 – Monthly WWG Conference Call Held	10/31/15	10/29/15
M23: Task 14 – Monthly WWG Conference Call Held	11/30/15	Waived by DOE
D57: Task 12 – Project Annual Assessment Report	12/31/15	12/31/15
M24: Task 14 – WWG Annual Meeting Held	12/31/15	8/20/15
M53: Task 9 – Expanded Baseline and Time-Lapse 3-D Surface Seismic Survey Completed	12/31/15	12/17/15

Continued . . .

**Table 13. Phase III Milestones and Deliverables (continued)**

<b>Title/Description</b>	<b>Due Date</b>	<b>Actual Completion Date</b>
<b>Year 9 – Quarter 2 (January–March 2016)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	1/31/16	1/31/16
M23: Task 14 – Monthly WWG Conference Call Held	1/31/16	1/27/16
M54: Task 9 – Initial Processing and Analysis of Historic InSAR Data Completed	1/31/16	1/26/16
D14: Task 2 – General Phase III Fact Sheet (update)	2/29/16	2/26/16
D93: Task 1 – Geological Modeling and Simulation Report for the Aquistore Project (Update 2)	2/29/16	2/29/16
M23: Task 14 – Monthly WWG Conference Call Held	2/29/16	Waived by DOE
D11: Task 2 – Outreach Plan (update)	3/31/16	3/28/16
D45: Task 6 – Bell Creek Test Site – Infrastructure Development Report	3/31/16	3/31/16
M23: Task 14 – Monthly WWG Conference Call Held	3/31/16	Waived by DOE
M36: Task 13 – Annual Advisory Board Meeting Scheduled	3/31/16	3/31/16
M56: Task 9 – Life Cycle Analysis for Primary and Secondary Recovery Oil Completed	3/31/16	3/31/16
M58: Task 9 – Bell Creek Test Site – Completion of 2.75 Million Metric Tons of CO <sub>2</sub> Stored	3/31/16	3/22/16
<b>Year 9 – Quarter 3 (April–June 2016)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	4/30/16	4/29/16
D17: Task 2 – General Phase III Information PowerPoint Presentation (update)	5/31/16	5/31/16
D101: Task 14 – WWG Web Site Content Update 1	5/31/16	5/31/16
M57: Task 9 – Life Cycle Analysis for EOR at the Bell Creek Field Completed	5/31/16	5/26/16
M23: Task 14 – WWG Conference Call Held	6/30/16	4/27/16
<b>Year 9 – Quarter 4 (July–September 2016)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	7/31/16	7/29/16
D13: Task 2 – Public Site Updates	7/31/16	7/21/16
D16: Task 2 – Fort Nelson Test Site Fact Sheet (update)	8/31/16	8/29/16
D66: Task 9 – Bell Creek Test Site – Simulation Report (update)	8/31/16	8/31/16
D102: Task 13 – Best Practices Manual – Adaptive Management Approach	8/31/16	8/31/16
M59: Task 9 – Completed the PCOR Partnership Adaptive Management Approach Best Practices Manual	8/31/16	8/31/16

Continued . . .

**Table 13. Phase III Milestones and Deliverables (continued)**

<b>Title/Description</b>	<b>Due Date</b>	<b>Actual Completion Date</b>
<b>Year 9 – Quarter 4 (July–September 2016) (continued)</b>		
D1: Task 1 – Review of Source Attributes (update)	9/30/16	9/29/16
D8: Task 3 – Permitting Review – Update 3	9/30/16	9/29/16
D55: Task 11 – Bell Creek Test Site – Cost-Effective Long-Term Monitoring Strategies Report	9/30/16	9/30/16
M23: Task 14 – WWG Conference Call Held	9/30/16	9/28/16
<b>Year 10 – Quarter 1 (October–December 2016)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	10/31/16	10/27/16
D21: Task 2 – Bell Creek Test Site 30-minute Documentary	10/31/16	10/31/16
D105: Task 9 – Comparison of Non-EOR and EOR Life Cycle Assessments	10/31/16	10/31/16
D15: Task 2 – Bell Creek Test Site Fact Sheet (update)	11/30/16	11/30/16
M52: Task 9 – Initial Analysis of Extended Pulsed-Neutron Logging Campaign Data Completed	11/30/16	11/29/16
D57: Task 12 – Project Assessment Annual Report	12/31/16	12/30/16
D81: Task 1 – Regional Carbon Sequestration Atlas (update)	12/31/16	12/30/16
D106: Task 14 – Special Issue of IJGGC – Nexus of Water and Carbon Capture and Storage	12/31/16	12/29/16
M23: Task 14 – WWG Conference Call Held	12/30/16	11/16/16
M24: Task 14 – WWG Annual Meeting Held	12/31/16	8/18/16
M36: Task 13 – Annual Advisory Board Meeting Scheduled	12/31/16	12/28/16
<b>Year 10 – Quarter 2 (January–March 2017)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	1/31/17	1/31/17
D22: Task 2 – Energy from Coal 60-minute Documentary	1/31/17	1/31/17
D76: Task 3 – Regional Regulatory Perspective	1/31/17	1/31/17
D35: Task 4 – Bell Creek Test Site – Best Practices Manual – Site Characterization	3/31/17	3/31/17
M23: Task 14 – WWG Conference Call Held	3/31/17	3/30/17
M60: Task 1 – Data Submitted to EDX	3/31/17	3/7/17
M63: Task 9 – Initial Analysis of Processed InSAR Data Completed	3/31/17	3/31/17

Continued . . .

**Table 13. Phase III Milestones and Deliverables (continued)**

Title/Description	Due Date	Actual Completion Date
<b>Year 10 – Quarter 3 (April–June 2017)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	4/30/17	4/27/17
D17: Task 2 – General Phase III Information PowerPoint Presentation (update)	5/31/17	5/31/17
D69: Task 9 – Best Practices Manual – Simulation Report	5/31/17	5/31/17
D85: Task 6 – Report – Opportunities and Challenges Associated with CO <sub>2</sub> Compression and Transportation During CCUS Activities	5/31/17	5/31/17
D101: Task 14 – WWG Web Site Content Update 1	5/31/17	5/23/17
D104: Task 9 – Analysis of Expanded Seismic Campaign	6/30/17	6/30/17
M64: Task 9 – Initial Analysis of Expanded Seismic Campaign Data Completed	6/30/17	6/27/17
M23: Task 14 – WWG Conference Call Held	6/30/17	6/28/17
M47: Task 2 – Bell Creek Test Site 30-Minute Documentary Broadcast	6/30/17	6/19/17
<b>Year 10 – Quarter 4 (July–September 2017)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	7/31/17	7/27/17
D66: Task 9 – Bell Creek Test Site – Simulation Report (Update 6)	8/31/17	8/30/17
D81: Task 1 – PCOR Partnership Atlas (update)	8/31/17	8/31/17
D103: Task 13 – Best Practices Manual – Programmatic Risk Management	8/31/17	8/29/17
D1: Task 1 – Review of Source Attributes (update)	9/30/17	9/27/17
M23: Task 14 – WWG Conference Call Held	9/30/17	8/2/17
M55: Task 9 – Investigation of Crude Oil Compositional Changes during CO <sub>2</sub> EOR Completed	9/30/17	9/25/17
M62: Task 14 – Research Related to Water and CCS Nexus Completed	9/30/17	9/25/17
<b>Year 11 – Quarter 1 (October–December 2017)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	10/31/17	
D14: Task 2 – General Phase III Fact Sheet (update)	10/31/17	
D51: Task 9 – Best Practices Manual – Monitoring for CO <sub>2</sub> Storage and CO <sub>2</sub> EOR	10/31/17	
D93: Task 1 – Geological Modeling and Simulation Report for the Aquistore Project (Update 3)	10/31/17	
D15: Task 2 – Bell Creek Test Site Fact Sheet (update)	11/30/17	

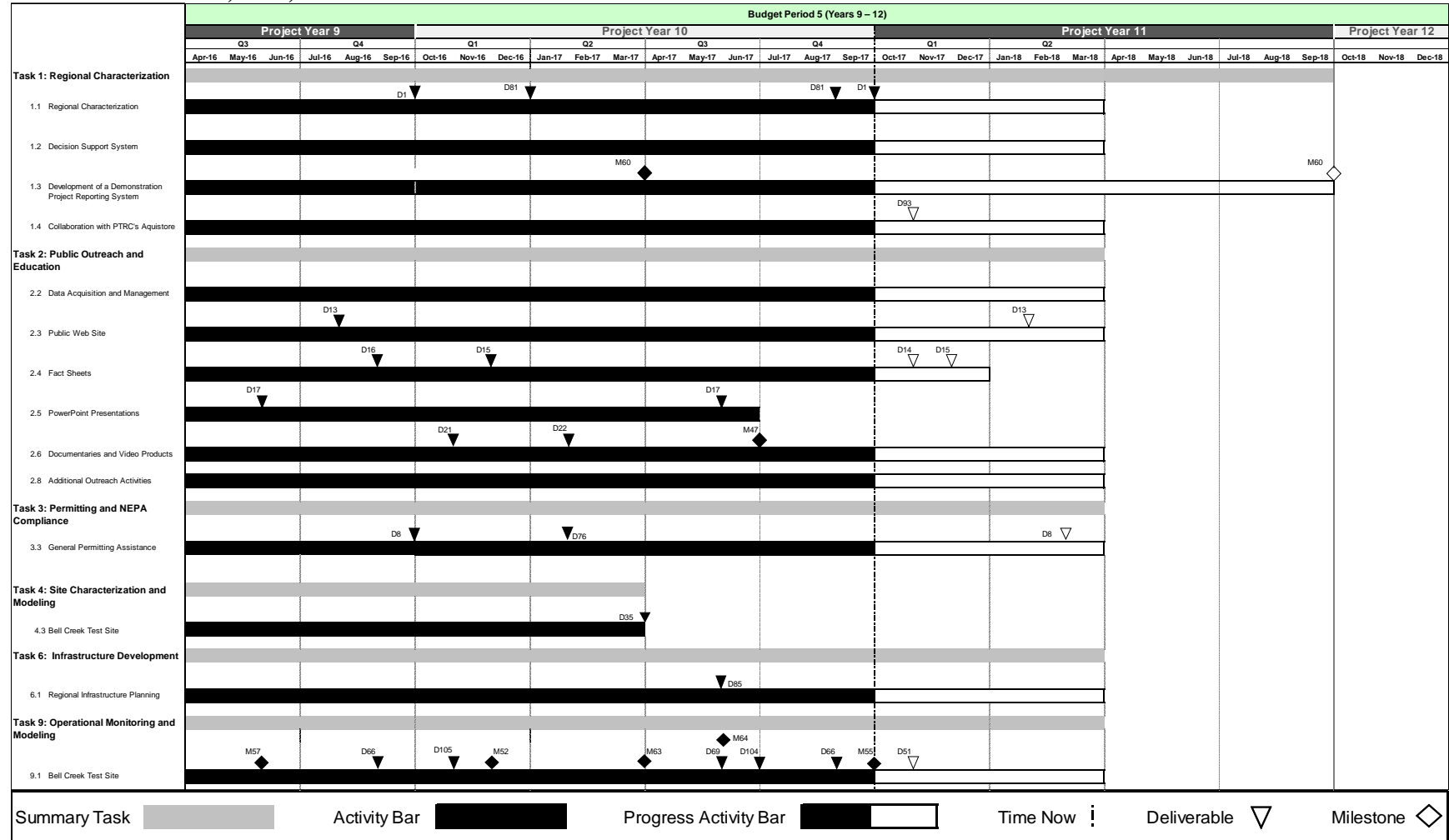
Continued . . .

**Table 13. Phase III Milestones and Deliverables (continued)**

<b>Title/Description</b>	<b>Due Date</b>	<b>Actual Completion Date</b>
<b>Year 11 – Quarter 1 (October–December 2017) (continued)</b>		
D54: Task 10 – Report – Site Closure Procedures	12/31/17	
D57: Task 12 – Project Assessment Annual Report	12/31/17	
M23: Task 14 – WWG Conference Call Held	12/31/17	
M24: Task 14 – WWG Annual Meeting Held	12/31/17	8/2/17
M36: Task 13 – Annual Advisory Board Meeting Scheduled	12/31/17	
<b>Year 11 – Quarter 2 (January–March 2018)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	1/31/18	
D13: Task 2 – Public Site Updates	1/31/18	
D73: Task 11 – Bell Creek Test Site –Monitoring and Modeling Fate of CO <sub>2</sub> Progress Report	1/31/18	
D8: Task 3 – Permitting Review – Update 4	2/28/18	
D107: Task 14 – Journal Article or Topical Report – Major Research Focuses for Water and CCS	2/28/18	
M23: Task 14 – Monthly WWG Conference Call Held	3/31/18	
<b>Year 11 – Quarter 3 (April–June 2018)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	4/30/18	
<b>Year 11 – Quarter 4 (July–September 2018)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	7/31/18	
M60: Task 1 – Data Submitted to EDX	9/30/18	
D62: Task 13 – Final Report	9/30/18	
<b>Year 12 – Quarter 1 (October–December 2018)</b>		
D58/D59: Task 13 – Quarterly Progress Report/Milestone Quarterly Report	10/31/18	
M61: Task 10 – Site Closure for Bell Creek Test Completed	12/31/18	

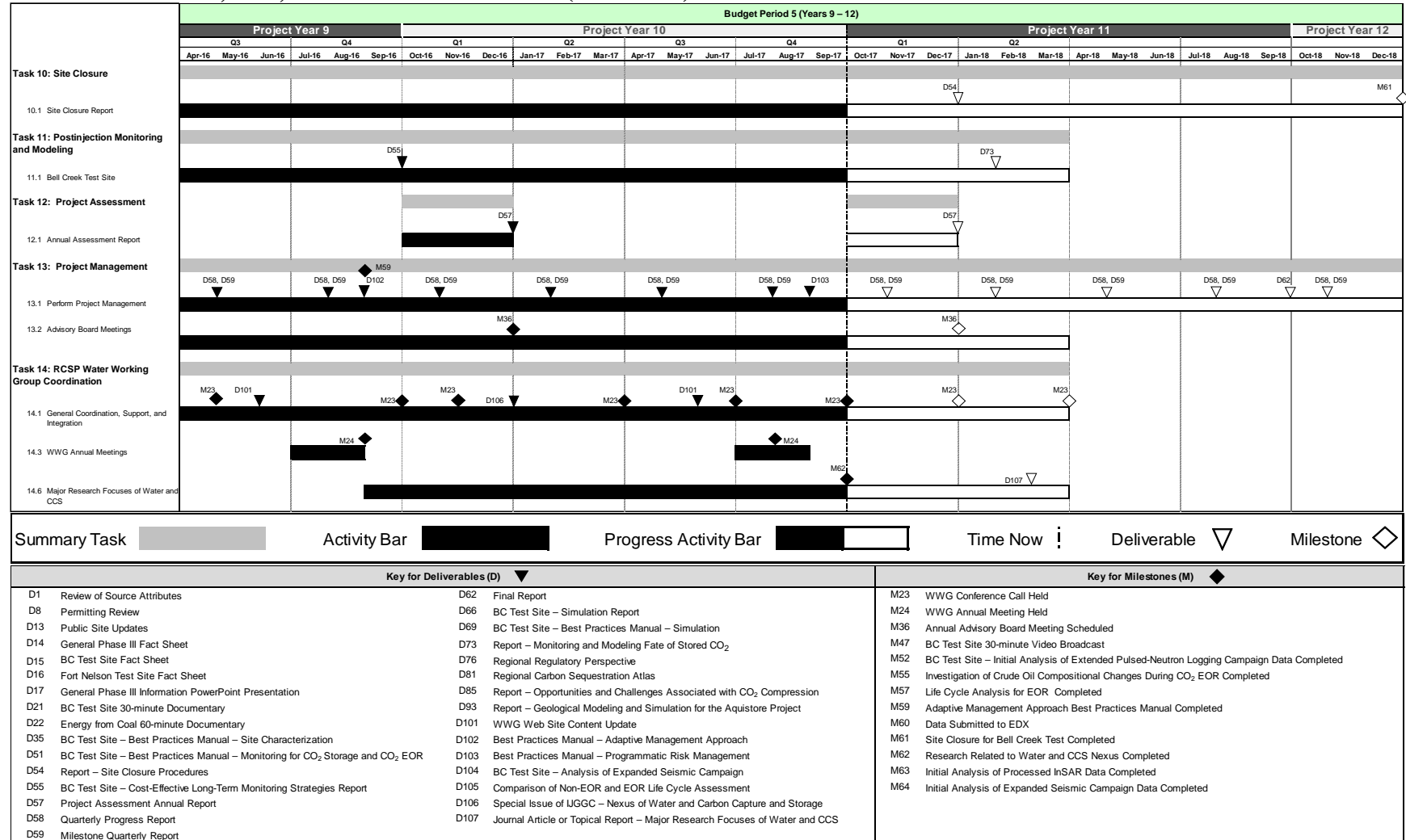


Table 14. Phase III, BP5, Years 9–12 Gantt Chart



Continued . . .

Table 14. Phase III, BP5, Years 9–12 Gantt Chart (continued)



## PHASE III PRODUCTS OR TECHNOLOGY TRANSFER ACTIVITIES

During the reporting period, one abstract was submitted, one abstract was accepted for presentation, and ten oral presentations were given at 11 different meetings and conferences and two workshops. In addition, a quarterly progress report and six deliverables/milestones (two draft and four approved) were completed. One milestone from a previous quarter also received approval. For more detail, see the Meetings/Travel section.

### Abstracts

#### *Submitted*

Hamling, J.A., 2017, Regional update of CCUS field projects within the PCOR Partnership region—improving the commercial viability of CO<sub>2</sub> storage through improved performance monitoring and operational management [abs.]: Carbon Capture, Utilization and Storage Conference, Nashville, Tennessee, March 19–22, 2018.

#### *Accepted for Presentation*

Gorecki, C.D., Ayash, S.C., 2017, The Plains CO<sub>2</sub> Reduction (PCOR) Partnership—successes leading to new innovation [abs.]: Near Surface Geoscience Conference & Exhibition 2017, Malmo, Sweden, September 3–7, 2017.

### Presentations

Glazewski, K.A., 2017, Wellbore integrity: Presented at the IEAGHG International CCS Summer School, Regina, Saskatchewan, July 17–23, 2017.

Glazewski, K.A., and Jensen, M.D., 2017, CO<sub>2</sub> transport: Presented at the IEAGHG International CCS Summer School, Regina, Saskatchewan, July 17–23, 2017.

Gorecki, C.D., and Ayash, S.C., 2017, A look at the Bakken's contributions to American energy: Presented at the North Dakota Petroleum Council Annual Meeting, Grand Forks, North Dakota, September 26, 2017.

Gorecki, C.D., and Ayash, S.C., 2017, The Plains CO<sub>2</sub> Reduction (PCOR) Partnership—successes leading to new innovation: Presented at the Near Surface Geoscience Conference & Exhibition 2017, Malmo, Sweden, September 3–7, 2017.

Gorecki, C.D., Ayash, S.C., and Wildgust, N., 2017, Bell Creek Field project – Plains CO<sub>2</sub> Reduction Partnership: Presented at Mastering the Subsurface Through Technology Innovation, Partnerships & Collaboration—Carbon Storage & Oil & Natural Gas Technologies Review Meeting, Pittsburgh, Pennsylvania, August 1–3, 2017.

Klapperich, R.J., 2017, RCSP Water Working Group Annual Meeting: Presented at the RCSP Water Working Group Annual Meeting, Philadelphia, Pennsylvania, August 2, 2017.

Peck, W.D., 2017, EERC activities in oil and gas, and carbon management: Presented at the Wyoming Oil & Gas Fair, Casper, Wyoming, September 12–13, 2017.

Pekot, L.J., 2017, Modeling panel discussion and Q&A: Presented at the Aquistore Project 2017 Annual General Meeting, Ottawa, Ontario, September 12–13, 2017.

Steadman, E.N., 2017, Bell Creek Field project – Plains CO<sub>2</sub> Reduction Partnership: Presented at the 2017 Midwest Carbon Sequestration Science Conference Annual Meeting, Champaign, Illinois, September 19–20, 2017.

Wildgust, N., Gorecki, C.D., Ayash, S.C., Peck, W.D., Hamling, J.A., Sorensen, J.A., Daly, D.J., Jensen, M.D., Klapperich, R.J., Heebink, L.V., Pekot, L.J., Steadman, E.N., and Harju, J.A., 2017, Demonstration of secure CO<sub>2</sub> geological storage associated with enhanced oil recovery in the PCOR Partnership region: Presented at the Carbon Management Technology Conference 2017, Houston, Texas, July 17–20, 2017.

### **Poster Presentation**

Dalkhaa, C., Pekot, L.J., Jiang, T., Oster, B.S., Bosshart, N.W., and Nickel, E., 2017, Updated numerical modeling and simulation study of the Aquistore CO<sub>2</sub> storage project: Poster presented at the Aquistore Project 2017 Annual General Meeting, Ottawa, Ontario, September 12–13, 2017.

### **Deliverables/Milestones**

#### ***Draft Submitted***

Azzolina, N.A., Nakles, D.V., Ayash, S.C., Wildgust, N., Peck, W.D., and Gorecki, C.D., 2017, PCOR Partnership best practices manual for subsurface technical risk assessment of geologic CO<sub>2</sub> storage projects: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III draft Task 9 Deliverable D103 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, Grand Forks, North Dakota, Energy & Environmental Research Center, August.

Peterson, K.J., Jin, L., Bosshart, N.W., Pekot, L.J., Salako, O., Burnison, S.A., Smith, S.A., Mibeck, B.A.F., Oster, B.S., He, J., Peck, W.D., Ayash, S.C., Wildgust, N., and Gorecki, C.D., 2017, Bell Creek test site – simulation report: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III draft Task 9 Deliverable D66 (Update 6) executive summary for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, Grand Forks, North Dakota, Energy & Environmental Research Center, August.

#### ***Approved***

Crocker, C.R., Daly, D.J., Crossland, J.L., and Gorecki, C.D., 2017, Bell Creek Test Site – 30-minute documentary broadcast: Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III Task 2 Milestone M47 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, EERC Publication 2017-EERC-07-08, Grand Forks, North Dakota, Energy & Environmental Research Center, June.

#### ***Draft Submitted and Approved***

Hawthorne, S.B., Gorecki, C.D., Wildgust, N., and Botnen, B.W., 2017, Investigation of crude oil compositional changes during CO<sub>2</sub> EOR: Plains CO<sub>2</sub> Reduction Partnership Phase III Task 9 Milestone M55 for U.S. Department of Energy National Energy Technology

Laboratory Cooperative Agreement No. DE-FC26-05NT42592, EERC Publication 2017-EERC-09-21, Grand Forks, North Dakota, Energy & Environmental Research Center, September.

Jensen, M.D., Glazewski, K.A., Peck, W.D., and Gorecki, C.D., 2017, Review of source attributes: Plains CO<sub>2</sub> Reduction Partnership Phase III Task 1 Deliverable D1 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, EERC Publication 2017-EERC-09-23, Grand Forks, North Dakota, Energy & Environmental Research Center, September.

Klapperich, R.J., and Gorecki, C.D., 2017, Research related to water and CCS nexus completed: Plains CO<sub>2</sub> Reduction Partnership Phase III Task 14 Milestone M62 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, EERC Publication 2017-EERC-09-20, Grand Forks, North Dakota, Energy & Environmental Research Center, September.

Peck, W.P., Gorecki, C.D., Steadman, E.N., and Harju, J.A., 2017, Plains CO<sub>2</sub> Reduction (PCOR) atlas (5th ed., rev.): Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase III Task 1 Deliverable D81 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, Grand Forks, North Dakota, Energy & Environmental Research Center, August.

## **Progress Reports**

### ***Monthlies***

Gorecki, C.D., Steadman, E.N., Peck, W.D., Daly, D.J., Hamling, J.A., Jensen, M.D., Harju, J.A., Pekot, L.J., Heebink, L.V., Klapperich, R.J., and Ensrud, J.R., 2017, Plains CO<sub>2</sub> Reduction (PCOR) Partnership: Phase III monthly report (June 1–30, 2017)) for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, Grand Forks, North Dakota, Energy & Environmental Research Center, July.

Gorecki, C.D., Steadman, E.N., Peck, W.D., Daly, D.J., Hamling, J.A., Jensen, M.D., Harju, J.A., Pekot, L.J., Heebink, L.V., Klapperich, R.J., and Ensrud, J.R., 2017, Plains CO<sub>2</sub> Reduction (PCOR) Partnership: Phase III monthly report (July 1–31, 2017)) for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, Grand Forks, North Dakota, Energy & Environmental Research Center, August.

Gorecki, C.D., Steadman, E.N., Peck, W.D., Daly, D.J., Hamling, J.A., Jensen, M.D., Harju, J.A., Pekot, L.J., Heebink, L.V., Klapperich, R.J., and Ensrud, J.R., 2017, Plains CO<sub>2</sub> Reduction (PCOR) Partnership: Phase III monthly report (August 1–31, 2017)) for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592, Grand Forks, North Dakota, Energy & Environmental Research Center, September.

## *Quarterlies*

Gorecki, C.D., Harju, J.A., Steadman, E.N., Romuld, L., Sorensen, J.A., Daly, D.J., Hamling, J.A., Jensen, M.D., Peck, W.D., Klapperich, R.J., Heebink, L.V., Pekot, L.J., Ensrud, J.R., and Votava, T.J., 2017, Plains CO<sub>2</sub> Reduction Partnership Phase III: Task 13 Deliverable D58/D59 quarterly technical progress report (April 1 – June 30, 2017) 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, July.

## **MEETINGS/TRAVEL**

Representatives from the PCOR Partnership incurred travel costs for their participation in the following 11 meetings/conferences, two workshops, and three project management site trips:

- July 7, 2017: traveled to Bismarck, North Dakota, to attend a meeting with NDIC DMR and RTE.
- July 9–14, 2017: traveled to San Diego, California, to attend the ESRI User Conference.
- July 10–14, 2017: traveled to Gillette, Wyoming, for field work and to restart the borehole array.
- July 12–13, 2017: traveled to Morgantown, West Virginia, to attend a meeting at NETL.
- July 16–21, 2017: traveled to Houston, Texas, to present at CMTC 2017.
- July 17–22, 2017: traveled to Regina, Saskatchewan, to assist with the IEAGHG CCS Summer School.
- July 18–19, 2017: traveled to Bismarck, North Dakota, to attend the WBI Energy Customer Meeting and the Rainbow Gas Company Luncheon.
- July 31 – August 4, 2017: traveled to Pittsburgh, Pennsylvania, to attend and present at the Mastering the Subsurface: Carbon Storage & Oil & Natural Gas Technologies Review meeting and to host the WWG Annual Meeting.
- August 15–17, 2017: traveled to Miles City, Montana, for a Bell Creek site visit.
- August 20–25, 2017: traveled to Pittsburgh, Pennsylvania, to attend the DOE NETL Capture Technology Project Review Meeting.
- August 21–22, 2017: traveled to Plano, Texas, to conduct a hotel site visit and evening event venue site visits for the upcoming PCOR Partnership Annual Membership Meeting.
- September 2–7, 2017: traveled to Malmö, Sweden, to present at the EAGE 4th Sustainable Earth Sciences Conference.
- September 19–20, 2017: traveled to Champaign, Illinois, to present at the 2017 Midwest Carbon Sequestration Science Conference.
- September 25–28, 2017: traveled to Houston, Texas, to be a panelist for the CCUS Experts Workshop.

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/)).