



**Plains CO<sub>2</sub> Reduction (PCOR) Partnership Monthly Update  
January 1–31, 2014**

**PHASE III ACTIVITIES**

**Task 1 – Regional Characterization (Wesley D. Peck)**

**Highlights**

- Continued efforts to characterize saline formations for carbon dioxide (CO<sub>2</sub>) storage, including the following:
  - Continued review of the value-added Broom Creek Formation outline.
  - Continued drafting value-added outline for the Leduc Formation.
  - Worked on revising the value-added Inyan Kara Formation outline.
- Began work on the third target area (D7, due September 2014), the Minnelusa Formation in Wyoming.
- Continued work on several additional value-added reports, including the following:
  - Outline for a general regional characterization report summarizing all past and present efforts.
  - Report entitled “Montana Abandoned Oilfield Creation,” approximating the oilfield boundaries in Montana based on oilfield information contained within oil well shape files.
  - Report summarizing methods of original oil in place and CO<sub>2</sub> storage calculations.
  - White paper on characterization of the Cedar Creek Anticline.
  - Report on characterization of the state of Nebraska for CO<sub>2</sub> storage opportunities.
- Participated in a conference call regarding the U.S. Department of Energy (DOE) Atlas V and worked on the PCOR Partnership pages for inclusion in the atlas.
- Continued efforts to find reservoir characteristics and info for the Pennel Field in Montana and the Cedar Hills Fields in North Dakota.
- Continued activities to update the content on the partners-only Decision Support System (DSS), including the following:
  - Added a link to the PDM (permanent downhole monitoring) video short to the home page.
  - Updated the CO<sub>2</sub> source information (with the September 2013 report information).
- With regard to the **Aquistore** project static modeling and dynamic predictive simulations effort:
  - Discussed in-house the relative permeability test data and worked on fitting the property curves for simulation.
  - Summarized the base simulation results and made several new cases.
  - Worked on running the new-case simulation for the short injection period and rate.
  - Worked on running the new-case simulation with fitted relative permeability curves.

- Began summarizing the simulation results inclusion in D93, Geological Modeling and Simulation Report for the Aquistore Project, due March 2014.
- Learned a new chief executive officer was named to the Petroleum Technology Research Centre (PTRC), Ken From.
- Continued running simulations and summarizing the results.

## **Task 2 – Public Outreach and Education (Daniel J. Daly)**

### Highlights

- Continued an in-house review of outreach products using a standard, industry-accepted framework.
- Provided outreach materials for presentation at the 2014 IEA Greenhouse Gas R&D Programme (IEAGHG) Social Research Network meeting in Calgary, Alberta, Canada.
- Accepted the invitation to give a presentation at the Global Carbon Capture and Storage (CCS) Institute’s educational outreach workshop scheduled at the Canadian Embassy on February 26, 2014.
- Continued work on updating the general outreach poster (D24, due March 2014).
- Participated in an Aquistore outreach working group conference call on January 27, 2014.
- Continued efforts to prepare and update project-related fact sheets, including the following activities:
  - Continued drafting the four-page Lignite Field Validation Test site overview fact sheet.
  - Continued value-added updates/revisions to the other Phase II site fact sheets.
  - Updated the Bell Creek Integrated CO<sub>2</sub> Enhanced Oil Recovery (EOR) and Incidental CO<sub>2</sub> Storage fact sheet with updated incremental oil recovery estimates.
- Continued efforts to update the public Web site ([www.undeerc.org/pcor](http://www.undeerc.org/pcor)), including the following:
  - Continued planning for the next update report (D13, due July 2014).
  - Posted the updated Bell Creek fact sheet on the Web site on January 15, 2014 ([www.undeerc.org/PCOR/pdfs/PCOR\\_Bell\\_Creek\\_Integrated\\_CO2\\_EOR\\_and\\_Storage\\_Fact\\_Sheet\\_17.pdf](http://www.undeerc.org/PCOR/pdfs/PCOR_Bell_Creek_Integrated_CO2_EOR_and_Storage_Fact_Sheet_17.pdf)).
  - In conjunction with Task 14, uploaded the Regional Carbon Sequestration Partnership (RCSP) Water Working Group (WWG) fact sheet entitled “Monitoring, Verification, and Accounting Plans for Protection of Water Resources During the Geologic Storage of Carbon Dioxide” to the Web site ([http://undeerc.org/pcor/pdfs/WWG\\_Fact\\_Sheet\\_3.pdf](http://undeerc.org/pcor/pdfs/WWG_Fact_Sheet_3.pdf)).
  - Held in-house Web update meetings on January 9 and 31, 2014.
  - Held an in-house quarterly outreach update meeting on January 17, 2014; proposed updated materials for the Web site and reviewed status of activities under way.
  - Continued repair of broken links as identified on an ongoing basis.
- Provided a password-protected link to the RCSP Outreach Working Group to view the PDM video short online.
- Continued collaborative efforts with Prairie Public Broadcasting (PPB), including the following:
  - Participated in a meeting at PPB headquarters on January 23, 2014, to discuss documentary schedules and education videos.
  - Received National Energy Technology Laboratory (NETL) project manager (PM) approval to create a new D22, Energy from Coal 60-minute documentary, due January

2016. This documentary will replace the former D22 (Domestic Energy and Carbon 30-minute documentary, due May 2015) and D23 (Storage in Carbon Management 30-minute documentary, due April 2017). Changes to the SOPO (statement of project objectives) will be approved via future award modification.

### **Task 3 – Permitting and NEPA (National Environmental Policy Act) Compliance (Lisa S. Botnen)**

#### Highlights

- Participated on January 29, 2014, in the Enhanced Oil Recovery Institute's Webinar titled, "Avoid Air-rors! Discuss the Air Regulations That Impact Oil and Gas Development."
- Continued to review and analyze latest U.S. Environmental Protection Agency (EPA) guidance document on Class II well to Class VI well transition and the final rule related to conditionally excluding CO<sub>2</sub> from the Resource Conservation and Recovery Act.
- With regard to the Lignite Field Validation Test site (Phase II) closure, continued efforts to monitor the site during the reclamation phase, including a site visit on January 23, 2014.

### **Task 4 – Site Characterization and Modeling (James A. Sorensen)**

#### Highlights

- **Fort Nelson** test site activities included the following:
  - Continued to work on revisions to the Fort Nelson Test Site – Site Characterization Report (comments received from Spectra Energy Transmission [Spectra]).
  - Continued to work on revisions to the Fort Nelson Test Site – Geochemical Report (comments received from Spectra).
- **Bell Creek** test site activities included the following:
  - Continued work on the wellbore leakage final report (D36, due March 2014).
  - Continued work on the 3-D seismic report (D96, due March 2014).
  - Continued preparing for the 3-D mechanical earth model (MEM) and geomechanical modeling and simulations.
  - Worked on updating the properties in 1-D MEM and 3-D MEM in Techlog and Petrel.
  - With regard to Applied Geology Lab activities:
    - ♦ With regard to the 33-14R core (collected April 2013):
      - Held an in-house kickoff meeting on January 14, 2014.
      - Completed x-ray fluorescence (XRF) analyses.
      - Continued work on x-ray diffraction (XRD) analyses.
      - Began clay analyses.
      - Mailed thin-section billets on January 17, 2014, and requested 46 thin sections from Wagner Petrophysics.
      - Began porosity and permeability testing.
    - ♦ With regard to the 56-14R full-core plugs (collected March 2013), discussions continued regarding planned additional analyses for 56-14R full-core plugs (CO<sub>2</sub> exposure and comparisons to static vs. flow-through testing).

## **Task 5 – Well Drilling and Completion (John A. Hamling)**

### Highlights

- Completed review of the value-added baseline surface and near-surface monitoring, verification, and accounting (MVA) report and appendixes.
- Continued work on D44 – Drilling and Completion Activity Report.

## **Task 6 – Infrastructure Development (Melanie D. Jensen)**

### Highlights

- Continued work on a journal article (about the attenuation of variable CO<sub>2</sub> sources for use in EOR). The journal selected is *Energy & Environmental Science* ([www.rsc.org/publishing/journals/ee/about.asp](http://www.rsc.org/publishing/journals/ee/about.asp)).
- In conjunction with Task 1, finished rectifying several discrepancies associated with adding a new EPA greenhouse gas identifier to the U.S. portion of the PCOR Partnership region.
- Submitted M41, Decision (Not) to Incorporate Ramgen Compression Technology into Bell Creek Project, on January 29, 2014.
  - Identified two opportunities for implementation of the Ramgen technology, i.e., CO<sub>2</sub> compression leaving the Lost Cabin gas-processing facility and recompression of recycle CO<sub>2</sub> stream at Bell Creek.
  - Because compression had already been installed at Lost Cabin and based on current Rampressor development coupled with project time frame, it has been determined that the compressor cannot be incorporated into the Bell Creek project but may be viable for future EOR projects.

## **Task 7 – CO<sub>2</sub> Procurement (John A. Harju)**

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

## **Task 8 – Transportation and Injection Operations (Melanie D. Jensen)**

### Highlights

- Nothing to note at this time.

## **Task 9 – Operational Monitoring and Modeling (Charles D. Gorecki)**

### Highlights

- **Bell Creek** injection-phase site activities included the following:
  - Cumulative CO<sub>2</sub> injection is 359,872 metric tons through December 31, 2013 (Table 1).
  - EERC staff attended the Society of Petroleum Engineers (SPE) Williston Basin Section annual meeting held January 15, 2014, in Dickinson, North Dakota.
  - Continued building the updated facies model for the fieldwide model.
  - Worked on the Bell Creek simulation to include CO<sub>2</sub> injection and production data.
  - Worked on preparing data for the Phase 2 simulations, including cutting the geomodel.
  - Attended in-house personal protective meter training.
  - Prepared cost estimates for surface and near-surface activities for 2014.

– **Table 1. Bell Creek CO<sub>2</sub> Injection Totals October–December 2013 (cumulative totals May to October–December 2013)**

	October 2013 Injection	November 2013 Injection	December 2013 Injection
Total, Mscf	1,155,008	978,071	1,315,521
Total, U.S. tons*	66,065	55,944	75,246
Total, metric tons*	59,991	50,801	68,328
Cumulative Total, Mscf <sup>+</sup>	4,635,018	5,613,089	6,928,610
Cumulative Total, U.S. tons* <sup>+</sup>	265,116	321,060	396,306
Cumulative Total, metric tons* <sup>+</sup>	240,743	291,544	359,872

Source: Montana Board of Oil and Gas [MBOG] database.

\* There is an approximately 2–3-month lag in posting of injection/production volumes to the MBOG database. This was calculated utilizing a conversion of 17.483 Mscf/U.S.ton and 19.253 Mscf/metric ton.

<sup>+</sup> Cumulative totals are for the period from May 2013 to the month(s) listed.

- Worked on the Bell Creek simulation.
- Continued work on the PNLs (pulsed-neutron logs), including the following:
  - ◆ Completed repeat PNL logs on the 05-06 OW and 04-04, 33-12, and 56-08 wells.
- Continued injection-phase sampling work, including the following:
  - ◆ Completed analysis of the December 2013 monthly sampling event, comprising soil gas profile station (SGPS)/Phase 1/interspaced locations (133 total samples) and two Fox Hills Formation groundwater-monitoring wells. Processing of these datasets is under way.
  - ◆ Completed the monthly January sampling event on January 15, 2014, comprising SGPS/Phase 1/interspaced locations (approximately 130 samples) and two Fox Hills Formation groundwater-monitoring wells. Data analysis and processing are under way.
  - ◆ Initiated development of an interactive map data retrieval and utilization concept of all baseline and operational near-surface monitoring data.
  - ◆ Traveled to Bell Creek during the week of January 27, 2014, to distribute the October and November 2013 landowner package water quality documents to nine landowners.
- **Fort Nelson** site activities included the following:
  - Continued work on the Best Practices Manual – Fort Nelson Feasibility Study (D100, due June 2014).
  - Continued review of Spectra’s comments on the Fort Nelson Test Site – Simulation Report (D67).

#### **Task 10 – Site Closure (to be announced [TBA])**

- This task is anticipated to be initiated in Quarter 1 – Budget Period (BP) 5, Year 9 (October 2015).

#### **Task 11 – Postinjection Monitoring and Modeling (TBA)**

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

## **Task 12 – Project Assessment (Katherine K. Anagnost)**

### Highlights

- Submitted D57, the annual assessment report for Program Year (PY) 6 (October 1, 2012, to September 30, 2013), on January 31, 2014.
- Key highlights from PY6 included:
  - With regard to Bell Creek activities:
    - ◆ Injection began at Bell Creek in May 2013.
    - ◆ Bell Creek facilities were completed, and the site commissioning ceremony (attended by Montana Governor, DOE, Denbury, the EERC, and others) was held in August 2013.
    - ◆ Completed bottomhole pressure surveys.
    - ◆ Completed 40-square-mile 3-D seismic acquisition.
    - ◆ Completed PNLs in 35 wells.
    - ◆ Completed two 3-D vertical seismic profiles (VSPs).
    - ◆ Completed baseline soil gas monitoring and soil gas profile station sampling.
    - ◆ Completed baseline groundwater monitoring and near-monthly monitoring of two wells from the deepest regional underground source of drinking water.
  - With regard to other PCOR Partnership activities:
    - ◆ Held PCOR Partnership Annual Meeting in Minneapolis in September 2013.
    - ◆ Won a 2012 Platinum Best of Show Aurora Award for the documentary “Global Carbon and Energy: Tracking Our Footprint.”
    - ◆ Submitted 18 abstracts, published nine journal articles, gave 75 presentations (oral and poster combined), completed 21 deliverable reports, achieved ten milestones, and submitted 16 progress reports.
    - ◆ Throughout course of project, distributed 4858 copies of the regional atlas and 8552 copies of the five different documentary DVDs.
    - ◆ Continued leading the RCSP WWG.
    - ◆ Held the 5th annual Regulatory Roundup in July 2013.
    - ◆ Provided petrophysical and modeling support for the PTRC’s Aquistore Project.
    - ◆ Continued characterizing and modeling additional pinnacles at Zama, Alberta, Canada.
    - ◆ Continued the joint United States–Canada characterization of the basal Cambrian system.

## **Task 13 – Project Management (Charles D. Gorecki)**

### Highlights

- Continued planning the 2014 PCOR Partnership Annual Membership Meeting scheduled for September 16 and 17, 2014, at the Embassy Suites in downtown Denver, Colorado.
  - Sent an e-mail “Save the Date” notification on January 13, 2014, to the partners and interested parties regarding the annual meeting (Figure 1).
  - Worked on content for the annual meeting registration Web site.
- Presented an e-Poster entitled “CO<sub>2</sub> Enhanced Oil Recovery: The Plains CO<sub>2</sub> Reduction Partnership’s Approach to Carbon Capture and Storage” at the International Petroleum Technology Conference (IPTC) in Doha, Qatar.



Figure 1. Save the Date e-mail flyer sent in January 2014, about the upcoming PCOR Partnership Annual Membership Meeting.

- Submitted abstracts to the 13th Annual Carbon Capture, Utilization & Storage Conference (CCUS-13), including the following:
  - “Carbon Dioxide Storage Potential of the Basal Saline System in the Alberta and Williston Basins of North America”
  - “The Plains CO<sub>2</sub> Reduction Partnership’s Adaptive Management Strategy for CO<sub>2</sub> Storage”
  - “Development of a Monitoring, Verification, and Accounting Plan for a Potential CCS Project at Fort Nelson, British Columbia, Canada”
  - “Modeling of Acid Gas Injection for Enhanced Oil Recovery and Long-Term Storage in Devonian-Aged Pinnacle Reefs”
- In addition to the seven abstracts submitted in December 2013, submitted an additional six abstracts to the 12th International Conference on Greenhouse Gas Control Technologies (GHGT-12) as set forth below:
  - “A Rapid Method for Determining CO<sub>2</sub>-Oil MMP (minimum miscibility pressure) and Visual Observations of CO<sub>2</sub>-Oil Interactions at Reservoir Conditions”

- “The Nexus of Water and CCS: A Regional Carbon Sequestration Partnership Perspective”
- “Evaluation of Large-Scale Carbon Dioxide Storage Potential in the Basal Saline System in the Alberta and Williston Basins in North America”
- “Characterization and Time-Lapse Monitoring Utilizing Pulsed-Neutron Well Logging at an Incidental CO<sub>2</sub> Storage Demonstration”
- “An Adaptive Management Approach to CO<sub>2</sub> Storage Projects”
- “Monitoring One Year’s Worth of CO<sub>2</sub> Injection and Incidental Storage at the Bell Creek Oil Field”
- Held the monthly task leader meeting on January 7, 2014. Topics discussed included updates on the Bell Creek, Fort Nelson, Aquistore, and basal Cambrian projects; a review of upcoming conferences and deliverables; and updates from each task leader present.
- Received Modification No. 27 to DOE NETL Award No. DE-FC26-05NT42592, dated January 22, 2014. This modification increased the government financial share and EERC cost share and updated the SOPO.
- Submitted the quarterly progress report (D58/D59) for the period October 1 – December 31, 2013, on January 31, 2014.
- Continued reviewing recommendations for the organization of PCOR Partnership data, especially all of the data generated regarding the Bell Creek project.
- Participated in a WebEx meeting with DOE, NETL, and the other regional partnerships to discuss the National Risk Assessment Partnership (NRAP) on January 16, 2014.
- Worked on a presentation for the upcoming NRAP Stakeholders Meeting scheduled for February 4 and 5, 2014.
- Checked the status of the CSLF Task Force “Review of CO<sub>2</sub> Storage Efficiency in Deep Saline Aquifer” and the March CSLF meeting in Korea.
- Agreed to serve on an abstract review panel for GHGT-12 (assigned 36 of the 1174 total abstracts to review).
- Participated in a conference call with BillyJack Consulting on January 15, 2014.
- Continued planning the Technical Advisory Board (TAB) meeting scheduled for March 4 and 5, 2014, in Austin, Texas.
- Participated in a conference call on January 24, with DOE NETL regarding the IEAGHG expert panel’s comments and recommendations.
- Deliverables and milestones completed in January:
  - Task 6: M41 – Decision to Incorporate Ramgen Compression Technology into Bell Creek Project
  - Task 12: D57 – Project Assessment Annual Report
  - Task 13: D58/D59 – Quarterly Progress Report/Milestone Quarterly Report
  - Task 14: M23 – Monthly WWG conference call held

#### **Task 14 – RCSP WWG Coordination (Ryan J. Klapperich)**

##### Highlights

- Finalized and submitted an abstract to GHGT-12.
- Held a pre-WWG monthly call with NETL Project Manager.
- Scheduled and held the monthly conference call on January 28, 2014. Agenda items included the following:



- Outline upcoming plan for year.
- Review IEAGHG water-related, partnership-submitted abstracts.
- Discuss potential fact sheet topics (next fact sheet due October 2014).
- Review RCSP updates.
- Continued working on a plan for the upcoming WWG year; options for the annual meeting venue and upcoming deliverables are under consideration.
- Continued to work on proposed content for a WWG-related Web site.

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

#### Highlights

- Continued work on the Updated Regional Technology Implementation Plan for Zama (D86, due February 2014).

### **Task 16 – Characterization of the Basal Cambrian System (Wesley D. Peck)**

#### Highlights

- Continued work on D92, Report – Storage Capacity and Regional Implications for Large-Scale Storage in the Basal Cambrian System, due March 2014.
- With regard to the **Aquistore** project (20 core samples) mineralogical characterization:
  - Rechecked porosity on one of the core plugs on the relative permeability apparatus and began testing another core.
  - Cleaned core sample via Dean–Stark extraction to remove salt residue; porosity testing will be completed on the humidified plug.
  - Tested an additional sample (higher permeability) that will be provided to the modelers when possible.
  - Reran permeability to air on the sample.
  - Continued work on the final summary of lab results.

### **Travel/Meetings**

- January 12–17, 2014: Traveled to the Bell Creek area for sampling activities.
- January 12–18, 2014: Remotely located staff participated in project-related meetings in Grand Forks, North Dakota.
- January 14–15, 2014: Attended the SPE Williston Basin Section annual meeting in Dickinson, North Dakota.
- January 18–23, 2014: Presented at IPTC in Doha, Qatar.
- January 21–23, 2014: Attended meetings with the North Dakota Public Service Commission and NDIC Oil and Gas Research Council in Bismarck, North Dakota.
- January 23, 2014: Attended a meeting with PPB at its offices in Fargo, North Dakota.
- January 23–25, 2014: Inspected the Phase II Lignite Field Validation Test site near Kenmare, North Dakota, and visited the Bell Creek site for data download.
- January 28–31, 2014: Traveled to the Bell Creek area for landowner visits.

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