Plains CO_2 Reduction (PCOR) Partnership Monthly Update
October 1–31, 2014

PHASE III ACTIVITIES

Task 1 – Regional Characterization (Wesley D. Peck)

Highlights

- With regard to the upcoming U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL) Atlas V:
  - Uploaded the Bell Creek project atlas pages October 17, 2014, to NETL.
  - Corrected oil field carbon dioxide (CO_2) storage values and integrated them into the National Carbon Sequestration Database and Geographic Information System database.
- With regard to the partners-only decision support system Web site:
  - Reviewed the current GIS (geographic information system) interactive map.
  - Continued working with programming to improve the online GIS map.
  - Continued updates to the partners-only Web site, including a 2014 annual meeting landing page.
  - Updated North Dakota and Montana monthly oil production values.
  - Updated North Dakota and Montana Petra projects with the latest general well information from each state's online resource, as follows: 75 new North Dakota wells and seven new Montana wells.
- Attended and presented at the 12th International Conference on Greenhouse Gas Control Technologies (GHGT-12) in Austin, Texas, October 5–9, 2014, and presented the following:
  - Evaluation of Large-Scale Carbon Dioxide Storage Potential in the Basal Saline System in the Alberta and Williston Basins in North America
  - A Regional Wellbore Evaluation of the Basal Cambrian System
  - A Workflow to Determine CO_2 Storage in Deep Saline Formations
  - Model Development of the Aquistore CO_2 Storage Project
- Continued work on several value-added reports, including the following:
  - Reviewed and modified the draft regional characterization report summarizing all past and present efforts.
  - Continued work on the report summarizing methods of original oil in place and CO_2 storage calculations.
  - Continued efforts on the Cedar Creek Anticline (CCA) white paper:
    - Created production charts from data to populate the report.
    - Worked on incorporating CO_2 sources in proximity to the CCA and began making a map of the CCA area with pertinent information related to CO_2 enhanced oil recovery (EOR) and CO_2 storage.

- With regard to the **Aquistore core work** (12 samples):
  - Continued work on the value-added lab report.
- With regard to the **Aquistore** project's static modeling and dynamic predictive simulations effort:
  - Held a WebEx meeting on October 2, 2014, with the Petroleum Technology Research Centre (PTRC) and members of its Science & Engineering Research Committee to discuss progress on the Aquistore project, including the three simulation cases requested by SERC during the last WebEx. SERC requested access to the models and simulation results.
  - Worked on several corrections to the Geologic Modeling and Simulation Report for the Aquistore project (Deliverable [D] 93), which was submitted September 30, 2014.
  - Worked on running three additional simulation cases with hysteresis included.
  - Continued work on the new simulation scenarios to investigate when the pressure front reaches the monitoring well.
  - Continued work on facies model.

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

Highlights

- Continued efforts to expand the type and presentation of statistics for overall past outreach activities and for planning.
- In response to a request from Aquistore outreach personnel, provided information on a graphic dealing with types and relative positions of site-monitoring instruments.
- Continued to revise three draft Phase II project fact sheets, including meetings with project personnel to discuss content, with a focus on terrestrial and McGregor projects.
- Began work on an approximately 90-second Bell Creek video teaser to show Denbury Resources, Inc. (Denbury).
- Participated in the monthly Outreach Working Group conference call on October 27, 2014. Topics discussed included an upcoming community information session scheduled for early December in Regina, Saskatchewan.
- Attended the GHGT-12 Conference in Austin, Texas, October 5–9, 2014.
- Continued efforts with regard to the public Web site (www.undeerc.org/pcor), including the following:
  - Continued ongoing identification and repair of broken links.
  - Added the permanent downhole monitoring (PDM) video short in the video clip library (under the "Oil Production" category).
  - Added the updated Lignite Field Validation Test Site fact sheet (value-added) (www.undeerc.org/pcor/newsandpubs/pdf/FactSheet10B.pdf).
- Continued collaborative efforts with Prairie Public Broadcasting (PPB), including the following:
  - Worked on a four-part educational video series called "Meeting the Challenge."

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

Highlights

- Continued review of the U.S. Environmental Protection Agency-proposed rule for carbon emissions from existing stationary sources.
- Attended the Interstate Oil and Gas Compact Commission (IOGCC) 2014 Annual Meeting in Columbus, Ohio, October 19–21, 2014.
- Attended GHGT-12 in Austin, Texas, October 5–9, 2014, and presented the paper entitled "Guidance for States and Provinces on Operational and Postoperational Liability in the Regulation of Carbon Geologic Storage."

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

Highlights

- **Bell Creek** test site activities included the following:
  - Attended and presented at the GHGT-12 Conference in Austin, Texas, October 5–9, 2014.
  - With regard to geomechanical activities:
    - Continued working on D32, Geomechanical Report Update (due January 31, 2015).
    - Continued literature review and data collection for data deeper than the Madison Formation for the development of the 3-D mechanical earth model (MEM); the data can include the outcrop data, Williston Basin logs, and surfaces derived from 3-D seismic data.
    - Continued working on the geomechanical modeling workflow, estimating stress and geomechanical properties using 3-D seismic data and preparing reservoir properties for upcoming geomechanical simulations.
    - Continued working on creating synthetic logs for select wells for use in helping populate rock properties into the 3-D MEM.
  - Worked on incorporating lab-generated data into Techlog to supplement data currently in the 3-D model.
  - Worked on developing core photo logs to help determine core depth shifts, particularly for older core, in the model.
  - Worked on interpretation of the baseline 3-D surface seismic survey, including incorporating the analysis into the geomechanical model and maps. Maps were created for the 11.5-square-mile monitor 3-D seismic survey.
  - Continued working on Version 3 of the geologic model, including creating multiple cross sections throughout the field correlating seismic amplitude with depositional facies; began creating facies logs; and worked with the Energy & Environmental Research Center's Applied Geology Lab personnel to interpret their data.
  - Reviewed core analysis data and created cross sections through 190 wells with core analysis.
  - Applied Geology Laboratory activities included the following:
    - With regard to the 33-14R core (collected April 2013):
      - Continued fine-tuning the thin-section descriptions and x-ray diffraction data.
      - Finalized permeability-to-air measurements, and began preparing the report.

- ♦ With regard to the 56-14R full-core plugs (collected March 2013):
  - Finished the perm-to-air measurements that were started October 10, 2014.
  - Permeability-to-water is on hold awaiting equipment availability.

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

- This task ended in Quarter 3 – Budget Period 4 (BP4), Year 7 (June 2014).

Task 6 – Infrastructure Development (Melanie D. Jensen)

Highlights

- Continued work on a journal article (about the attenuation of variable CO_2 sources for use in EOR) for submission to *Energy & Environmental Science* (www.rsc.org/publishing/journals/ee/about.asp).
- Continued to update technologies for the CO_2 capture technologies update overview.
- Attended the GHGT-12 Conference in Austin, Texas, October 5–9, 2014.

Task 7 – CO_2 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

- Researched the effects of different impurities in CO_2 from anthropogenic sources on pipeline operation during start-up and shutdown and at transient conditions. The effects of impurities on operability of injection site infrastructure were reviewed. The effects of CO_2 stream variability on pipeline and injection field infrastructure were also studied.

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

Highlights

- Attended and presented "Characterization and Time-Lapse Monitoring Utilizing Pulsed-Neutron Well Logging at an Incidental CO_2 Storage Demonstration" (Figure 1) and "A Rapid Method for Determining CO_2–Oil MMP and Visual Observations of CO_2–Oil Interactions at Reservoir Conditions" at the GHGT-12 Conference in Austin, Texas, October 5–9, 2014.
- Presented at the Carbon Capture Utilization & Sequestration Workshop in Midland, Texas, October 23–24, 2014.
- Discussed potential to perform a 6-month critical review and update of data management standard operating procedure.
- Finished pulsed-neutron log (PNL) quality assurance/quality control of the processed logs from 19 recently collected wells and compiled field data for the 05-06 OW and 04-04 wells.
- Compared the PNL crossplots using baseline processed data to total porosity with the Version 2 geologic model porosity for each well with PNL data.
- Compared effective porosity values from synthetic logs and PNL residual saturation tool calculations.

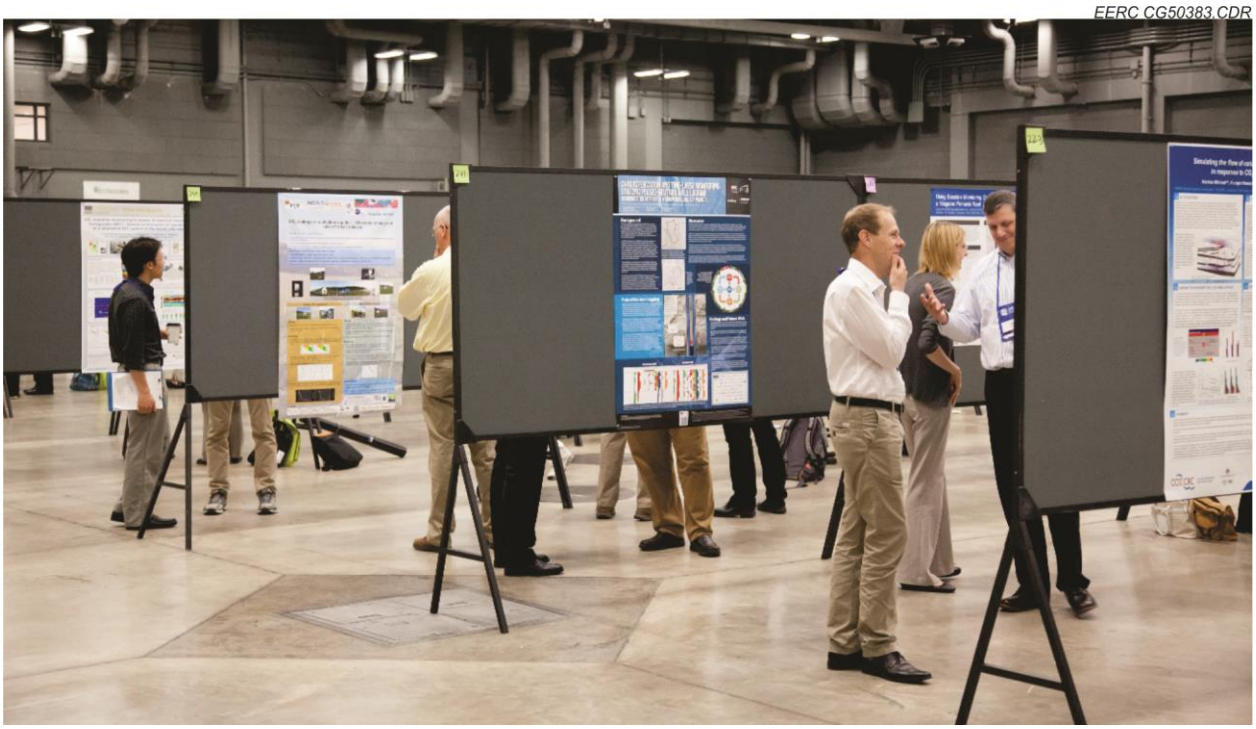

Figure 1. PCOR Partnership poster entitled "Characterization and Time-Lapse Monitoring Utilizing Pulsed-Neutron Well Logging at an Incidental CO_2 Storage Demonstration" displayed (second row, from right) at GHGT-12 in Austin, Texas.

- Continued literature review for CO_2 EOR simulation strategies.
- **Bell Creek** injection-phase site activities included the following:
  - Traveled to Bell Creek (October 19–27, 2014) to oversee field work and collect data, including a 3-D seismic survey (11.6 sq mi), a 3-D vertical seismic profile (VSP) (at the 04-03 OW), and four PNLs.
  - Worked on Phase 2 simulation file organization.
  - Coordinated the 3-D VSP and 3-D seismic acquisition. The VSP acquisition was completed on October 30, 2014 (Figure 2).
  - Worked with the in-house geophysicists on the 3-D seismic data, specifically on fracture identification.
  - Continued building the updated facies model for the fieldwide model.
  - Worked on preparing data for the Phase 2 simulations, including cutting the geomodel.
  - Continued reservoir surveillance and analysis of continuous PDM data in the 05-06 OW well.
  - Continued injection-phase sampling work, including the following:
    - Completed the September 2014 surface and near-surface monitoring, verification, and accounting annual full-field repeat sampling event, as follows:
      - Water samples collected:

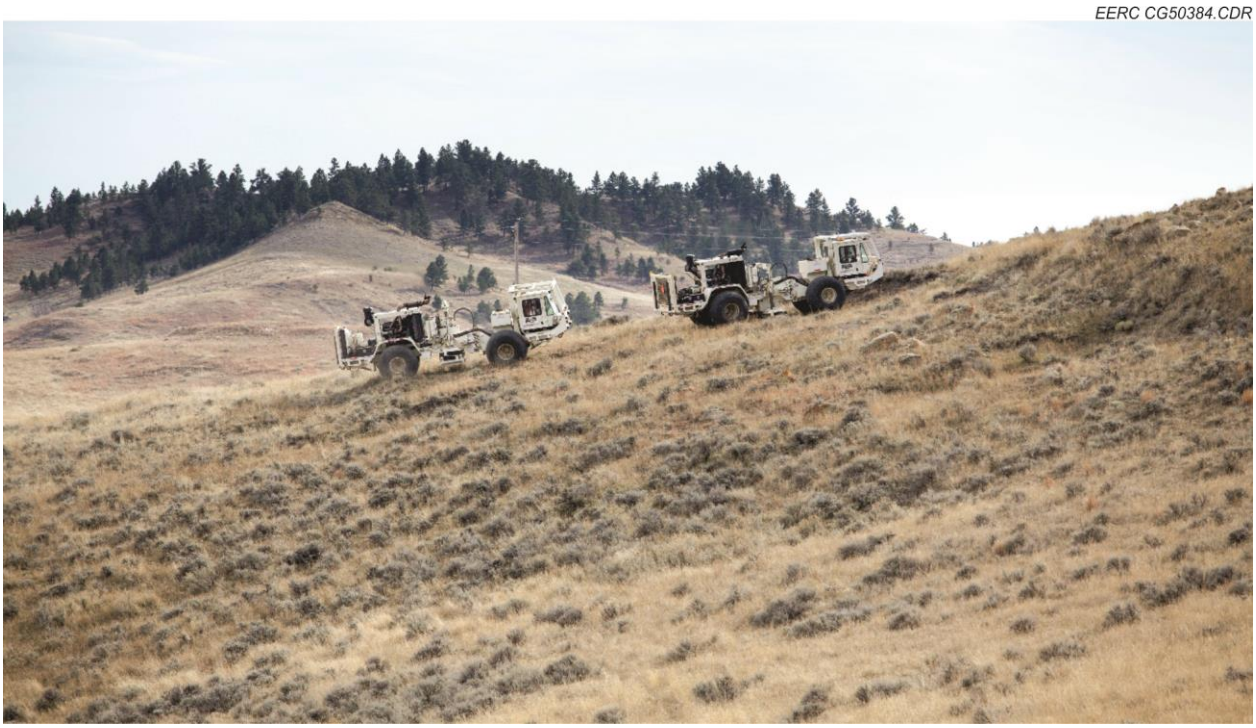

Figure 2. Vibroseis trucks are used to conduct 3-D VSP surveys in the Bell Creek Field.

- Residential well water samples = eight project samples + two duplicate samples.
- Stock well samples = six project samples + one duplicate sample.
- Surface water samples = eight project samples.
- Fox Hills Formation groundwater-monitoring wells = two project samples.

o Soil gas samples collected (includes individual well pads, interspaced, soil gas profile station plugged and abandoned, and #04-03 grid):

- Project samples = 339
- Duplicate samples = 36
- Field blanks = 24

♦ Analysis is under way.

♦ Continued planning construction of the SQL database to house and access near-surface monitoring data.

♦ Continued evaluation of creating an interactive map product to facilitate improved access and interpretation for team.

- With regard to the **Fort Nelson** project:
  - Presented the "Application of Canadian Standards Association Guidelines for Geologic Storage of CO_2 Toward the Development of a Monitoring, Verification, and Accounting Plan for a Potential CCS Project at Fort Nelson, British Columbia, Canada" at GHGT-12 in Austin, Texas.

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

- This task is anticipated to be initiated in Quarter 1 – BP5, 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

- Began working on the annual assessment.

Task 13 – Project Management (Charles D. Gorecki)

Highlights

- Held a task leader meeting October 17, 2014. Topics discussed included discussion on upcoming best practice manuals (BPMs), a recap of GHGT-12, updates on Bell Creek and Aquistore, work on Year 8 budgets, upcoming deliverables/milestones and travel, as well as updates from task leaders present.
- In response to a request from DOE, provided progress information to the Carbon Sequestration Leadership Forum Secretariat on October 3, 2014.
- Sent an e-mail blast to the partners regarding the 2014 annual meeting presentations, agenda, posters, and information (located on partners-only Web site).
- Worked on Technical Advisory Board (TAB) meeting minutes.
- Began planning for the winter TAB meeting.
- Attended the Executive Roundtable "Commercial & Financial Structuring of Commercial-Scale Projects with Carbon Capture and Sequestration" in Washington, D.C., October 14–15, 2014.
- Attended the GHGT-12 Conference in Austin, Texas, on October 5–8, 2014 (Figure 3).
- Deliverables and milestones completed in October:
  - September monthly update
  - Task 1: D58/D59 – Quarterly Progress Report
  - Task 14: D99 – Water/CCS Nexus-Related Fact Sheet
  - Task 14: M23 – Monthly Water Working Group (WWG) Conference Call Held
  - Task 9: M48 – Bell Creek Test Site – 1 Million Metric Tons of CO_2 Injected

Task 14 – RCSP Water Working Group Coordination (Ryan J. Klapperich)

Highlights

- Began working with consultant to develop an outline for the BPM (D80, due November 30, 2016).
- Held the monthly WWG conference call on October 28, 2014. Topics discussed focused on events at GHGT-12, progress of Web site and fact sheet, and future products and collaborations for the WWG.
- Submitted the latest fact sheet (D99) focused on future protection of water resources.

Figure 3. Charles Gorecki (third from left) participating in a regional partnerships' panel discussion at GHGT-12 in Austin, Texas.

- Attended and presented "The Nexus of Water and CCS: An RCSP Perspective" at GHGT-12 in Austin, Texas, October 5–9, 2014.

Task 15 – Further Characterization of the Zama Acid Gas EOR, CO_2 Storage, and Monitoring Project (Charles D. Gorecki)

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

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

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

Travel/Meetings

- October 5–9, 2014: traveled to Austin, Texas, to present at the GHGT-12 Conference.
- October 14–15, 2014: traveled to Washington, D.C., to attend the Executive Roundtable "Commercial & Financial Structuring of Commercial-Scale Projects with Carbon Capture and Sequestration."
- October 18–22, 2014: traveled to Columbus, Ohio, for the IOGCC annual meeting.
- October 22, 2014: traveled to Bismarck, North Dakota, for a meeting with ConocoPhillips.

- October 19–27, 2014: traveled to Gillette, Wyoming, for site work at the Bell Creek Field.
- October 23–24, 2014: traveled to Midland, Texas, to present at the Carbon Capture Utilization & Sequestration Workshop.
- October 23–27, 2014: traveled to Gillette, Wyoming, for site work at the Bell Creek Field.
- October 27–31, 2014: traveled to Gillette, Wyoming, for site work at the Bell Creek Field.
- October 30 – November 4, 2014: traveled to Gillette, Wyoming, for site work at the Bell Creek Field.

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