



Plains CO₂ Reduction (PCOR) Partnership Monthly Update July 1–31, 2014

PHASE III ACTIVITIES

Task 1 – Regional Characterization (Wesley D. Peck)

Highlights

- Continued work on Zama-focused posters for upcoming meetings.
- Updated the North Dakota and Montana Petra projects with current well information.
- Began review of CO₂ source information for the annual update.
- Met with programming staff regarding the partners-only Decision Support System (DSS) and discussed the following: an upgrade to Flex 3.6, improvements to the interactive mapping feature, enhanced search capability, data exportation, and improved data response time.
- Continued work on posters and papers for the 12th International Conference on Greenhouse Gas Control Technologies (GHGT-12) to be held in October in Austin, Texas.
- Continued work on the third target area (Deliverable [D]7, due September 2014), the Minnelusa Formation in Wyoming.
- Continued work on several value-added reports, including the following:
 - Continued information gathering for a regional characterization report summarizing all past and present efforts.
 - Continued work on the report summarizing methods of original oil in place and CO₂ storage calculations.
- With regard to the **Aquistore core work** (12 samples):
 - Continued analysis of the thin sections.
- With regard to the **Aquistore** project's static modeling and dynamic predictive simulations effort:
 - Held an in-house meeting to review the Aquistore model on July 8.
 - Participated in a modeling seminar with the Petroleum Technology Research Centre (PTRC) on July 17, and discussed the modeling work conducted both by the Energy & Environmental Research Center (EERC) and Schlumberger Carbon Services (Schlumberger).
 - Continued work on the new simulation scenarios as requested by the PTRC SERC (science and engineering research committee).
 - ♦ Data were received from PTRC regarding the depths of perforations and monitoring sensors. This information will be used in the new simulations to help more accurately measure pressure changes at the monitoring sensors due to injection.
 - Began running simulation for D93, the geologic modeling and simulation report due September 30, 2014.
 - ♦ On July 18, held an in-house meeting to discuss the outline and executive summary.

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.
- Continued to revise three draft Phase II project fact sheets including meetings with project personnel to discuss content.
- Presented at the International Workshop on Public Education, Training, and Community Outreach for Carbon Capture, Utilization, and Storage July 30–31, in Decatur, Illinois, and distributed PCOR Partnership information (atlas, documentaries, fact sheets, presentation).
- Participated in a number of conference calls this month, including the following:
 - On July 9, 2014, participated in a conference call with the SaskPower Boundary Dam Science Day and Carbon Challenge Group.
- Continued an in-house review of outreach products using a standard, industry-accepted framework.
- Continued efforts with regard to the public Web site (www.undeerc.org/pcor), including the following:
 - Submitted D13 – Public Site Updates, including the Web tracking standard operating procedure.
 - Upgraded from Google Analytics (GA) Standard Web tracking to GA Universal.
 - Performed a Web site check to ensure tracking of all PCOR Partnership Web items (Web pages, PDFs, and videos) were not affected by the upgrade.
 - Continued ongoing identification and repair of broken links.
- Continued collaborative efforts with Prairie Public Broadcasting (PPB), including the following:
 - Discussed next steps on D21, the 30-minute documentary (Bell Creek) with senior management and was directed to continue planning discussions with the point of contact at Denbury.
 - Prepared draft letters to potential interviewees and locations in Europe for the D22 coal documentary.

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

Highlights

- Attended a Webinar entitled, “Innovation and Effective Stakeholder Engagement on Water and Energy Issues” sponsored by C2ES.
- Reviewed compressed air storage regulations in an effort to compare and contrast them with CO₂ storage regulations.
- Continued review of the U.S. Environmental Protection Agency-proposed rule for carbon emissions from existing stationary sources.

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

Highlights

- **Bell Creek** test site activities included the following:

- Continued working on the 1-D and 3-D mechanical earth models (MEMs). Properties and log data in both models were updated. The gridding of the 3-D MEM was optimized.
- Began work on the pulsed-neutron logging (PNL) poster for the upcoming GHGT-12 conference.
- Continued preparing for the geomechanical simulations.
- Used upscaled well logs and 3-D seismic inversion to generate geomechanical properties.
- Performed saturation modeling using the baseline PNLs for monitoring, verification, and accounting and to help update the geologic model and simulations.
- Held three half-day in-house training sessions for Techlog software (used for petrophysical analyses).
- Worked on reviewing and testing RadExPro seismic software.
- Continued work on Bell Creek characterization.
- Worked on updating the properties in 1-D MEM and 3-D MEM in Techlog and Petrel.
- Threshold entry pressure work by Core Labs is ongoing.
- Applied Geology Laboratory activities included the following:
 - ◆ With regard to the 33-14R core (collected April 2013):
 - Continued work on the thin-section descriptions and x-ray diffraction data.
 - Permeability-to-air testing anticipated the week of August 4.
 - ◆ With regard to the 56-14R full-core plugs (collected March 2013):
 - Continued work on the 56-14R full-core plugs.

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

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

Task 6 – Infrastructure Development (Melanie D. Jensen)

Highlights

- Continued work on a journal article (about the attenuation of variable CO₂ sources for use in enhanced oil recovery [EOR]) for submission to *Energy & Environmental Science* (www.rsc.org/publishing/journals/ee/about.asp).
- Attended the DOE CO₂ Capture Technologies Conference July 29 – August 1, in Pittsburgh.
- Continued to update technologies for the CO₂ capture technologies update overview.
- Spoke with Dresser-Rand representative regarding the list of possible sites for a field demonstration of the SuperCompressor.

Task 7 – CO₂ Procurement (John A. Harju)

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

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

Highlights

- Discussed approaches for a report about the surface facilities at Bell Creek.

- Continued to review literature associated with starting up and shutting down CO₂ pipelines as well as how variability in the CO₂ stream may affect pipeline and injection field infrastructure.

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

Highlights

- **Bell Creek** injection-phase site activities included the following:
 - Cumulative CO₂ injection is 997,392 metric tons through June 30, 2014 (Table 1).
 - Used predictive simulation results to create a cross section for Denbury to help them select shot points for repeat 2-D seismic lines. Also selected shot points around the 04-03 OW monitoring well that have a high probability of detecting CO₂.
 - Attended a 2-day COMSOL training. This software is advanced physics simulation software that has diverse applications. It is being investigated for its applicability to the Bell Creek project for potential modeling of the near-surface environment.
 - Participated in the National Ground Water Association Webinar: Environmental Isotopes in Groundwater Studies: Groundwater, Environmental Isotopes, and Salinity.
 - Traveled to Plano, Texas, to meet with Denbury personnel at its headquarters; topics discussed included seismic work (vertical seismic profiles, surface seismic, and passive seismic monitoring), AZMI (above-zone monitoring interval) pressure gauge response, near-surface monitoring program, and modeling and simulation activities.
 - Traveled to Bell Creek to download permanent downhole monitoring (PDM) data (through July 21, 2014) and replace the data acquisition unit at well 05-06 OW.
 - Worked on the Phase 2 Bell Creek simulation, including two simulation scenarios testing different bottomhole injection pressures.
 - With regard to the summer 2014 repeat PNL campaign: finalized evaluation and selection of wells for repeat PNLs, with a planned initiation date of July 21, 2014.
 - Continued tuning the Phase 2 history match model.
 - Continued work on D66, Simulation Update, due August 2014.
 - Worked on the additional simulation cases requested by Denbury.
 - Worked on the history match of CO₂ injection.

Table 1. Bell Creek CO₂ Injection Totals for June 2014 (cumulative totals May 2013 to June 2014)

	June 2014 Injection
Total, Mscf	2,415,034
Total, U.S. tons*	138,136
Total, metric tons*	125,437
Cumulative Total, Mscf ⁺	19,202,788
Cumulative Total, U.S. tons* ⁺	1,098,369
Cumulative Total, metric tons* ⁺	997,392

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.

⁺ Cumulative totals are for the period from May 2013 to the month listed.

- Continued work on reviewing Bell Creek AZMI pressure gauge analysis and created a PowerPoint outlining potential flow rates for various wellbore and reservoir sizes and used for discussion with Denbury.
- Worked on reviewing microseismic interpretation method and software.
- 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 work on developing a methodology to allocate pressure response from the PDM system to individual production/injection wells.
- Continued injection-phase sampling work, including the following:
 - ◆ Continued to work on scheduling/preparation for the “full” Bell Creek sampling event (this activity is tentatively planned for the week of September 15 or 22).
 - ◆ Traveled to the Bell Creek site July 29 – August 1 for the July Bell Creek sampling event and completed the following:
 - Collected CO₂ purchase and recycle samples.
 - Collected Phase 1 oil samples.
 - Collected limited groundwater parameter samples.
 - Met with landowners.
 - Performed maintenance on EERC sites (field office, monitoring well, soil gas profile station locations)
 - ◆ Archived, compiled, and performed quality assurance and quality control on the handheld meter and field (Micro Quad) gas chromatography results (over 210 total soil gas samples were collected).
 - ◆ Continued planning of 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 members and stakeholders.
- **Fort Nelson** site activities included the following:
 - Continued review of the draft Best Practices Manual – Fort Nelson Feasibility Study (D100).

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

- Nothing to note at this time.

Task 13 – Project Management (Charles D. Gorecki)

Highlights

- Submitted three abstracts to the IEA Greenhouse Gas R&D Programme Monitoring and Modelling Combined Network Meeting scheduled for August 4–8, 2014, in Pittsburgh, including Aquistore, Zama simulation, and Basal Cambrian.
- Staff worked on GHGT-12 papers.
- Staff traveled to Casper, Wyoming, to attend the 2014 Wyoming CO₂ Conference held July 9–10, 2014.
- Staff participated in the in-house Well Drilling 101 training course on July 31, 2014.
- Presented an update on the PCOR Partnership activities to new partner, Sejong University, during a visit to the EERC on July 3, 2014.
- On July 1, held the monthly task leader meeting. Topics discussed included recaps of the regulatory meeting and Technical Advisory Board (TAB) WebEx, a Bell Creek and Aquistore update, as well as upcoming deliverables and conferences.
- Continued planning the 2014 PCOR Partnership Annual Membership Meeting scheduled for September 16 and 17, 2014, at the Embassy Suites in downtown Denver, Colorado, including the following:
 - Continued drafting the preliminary agenda.
 - On July 7, mailed the “member appreciation” postcard to all partners.
- Continued efforts toward a value-added programmatic risk management plan update (including an updated Bell Creek risk assessment) to be completed by August 31, 2014.
- Deliverables and milestones completed in June:
 - Task 2: D13 – Public Site Updates
 - Task 13: D58/D59 – Quarterly Progress Report/Milestone Quarterly Report
 - Monthly Water Working Group (WWG) conference call held (this occurrence was a WebEx)

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

Highlights

- Continued work on paper and poster for GHGT-12.
- Discussed the latest fact sheet (D99, due October 31, 2014) focused on future protection of water resources with The CETER Group.
- Continued preparing for the upcoming WWG Annual Meeting to be held August 11, 2014, in conjunction with the 2014 Carbon Storage R&D Project Review Meeting in Pittsburgh, Pennsylvania, August 12–14, 2014.
- Scheduled and held a WebEx in place of the July conference call milestone (M23) on July 17, 2014. Agenda items included the following:
 - WECSsim model (a presentation was given by WWG member Peter Kobos of Sandia National Laboratory.
 - On July 16, participated in a National Groundwater Association Webinar entitled “Environmental Isotopes in Groundwater Studies: Groundwater, Environmental Isotopes, and Salinity.”

Task 15 – Further Characterization of the Zama Acid Gas EOR, CO₂ 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

- July 7–11, 2014: Traveled to Casper, Wyoming to attend the 8th Annual Wyoming CO₂ Conference.
- July 16, 2014: Traveled to Kenmare, North Dakota, to inspect the lignite site.
- July 18–22, 2014: Traveled to Denver, Colorado, to present at the American Association of Petroleum Geologists Rocky Mountain Section Meeting and attend the short course.
- July 20–24, 2014: Traveled to Gillette, Wyoming, for sampling work at the Bell Creek Field.
- July 21–24, 2014: Traveled to Denver, Colorado, to attend COMSOL Multiphysics Intensive Training.
- July 24–27, 2014: Traveled to Plano, Texas, to attend project meetings with Denbury.
- July 28 – August 1, 2014: Traveled to Pittsburgh, Pennsylvania, for DOE NETL 2014 CO₂ Capture Technology Meeting.
- July 29–31, 2014: Traveled to Decatur, Illinois, to present at the National Sequestration Education Workshop on Public Education, Training, and Community Outreach for Carbon Capture, Utilization, and Storage.
- July 29 – August 2, 2014: Traveled to Gillette, Wyoming, for site sampling work at the Bell Creek Station.

EERC DISCLAIMER

LEGAL NOTICE: This research report was prepared by the EERC, an agency of the University of North Dakota, as an account of work sponsored by DOE NETL. 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.

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.

ACKNOWLEDGMENT

This material is based upon work supported by DOE NETL under Award No. DE-FC26-05NT42592.

NDIC 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 NDIC 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 NDIC. The views and opinions of authors expressed herein do not necessarily state or reflect those of the NDIC.