Plains CO_2 Reduction (PCOR) Partnership Monthly Update
November 1–30, 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:
  - Submitted new information and images for incorporation into the Bell Creek section.
- With regard to the partners-only decision support system (DSS) Web site:
  - The new and enhanced search tool for the geographic information system (GIS) application can be seen on the partners-only Web site (moved to "live" on November 25), http://www2.undeerc.org/website/PCORP/DSS/. The advanced search tool was implemented to better serve client needs and improve the ability to search using different attributes. User can now search by source type, source name, the source CO_2 amounts and also use these same attributes to remove sources that do not fit certain criteria. For example, in a search for "all ethanol plants," any sources with a CO_2 output of less than 25,000 tons can be eliminated, and there is also the option of exporting the remaining results. Searching the oil fields has now been broken into "all oil fields" and "unitized oil fields," and the oil fields can be searched by name.
  - Continued working with programming to improve the online GIS map.
  - Continued updates to the partners-only Web site.
  - Continued work on a presentation outlining the DSS capabilities.
  - 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: 66 new North Dakota wells and five new Montana wells.
- Continued work on several value-added reports, including the following:
  - Reviewed and modified the draft regional characterization report summarizing all past and present efforts. This report is currently with senior management for review.
  - 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:
  - 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 the facies model.

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

Highlights

- Spoke with teachers in North Dakota and Minnesota who are interested in becoming part of the classroom activities for the Carbon Challenge (related to the kickoff of the Boundary Dam carbon capture and storage [CCS] facility at the end of September 2014).
- 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, with a focus on terrestrial and McGregor projects.
- Finalized draft narration and initiated cover (images) for the 90-second Bell Creek video teaser for Denbury Resources, Inc. (Denbury).
- Initiated activities for the update to the Bell Creek project poster (deliverable [D] 25, due March 31, 2015).
- Participated in the monthly Outreach Working Group conference call on November 24, 2014. Topics discussed included the schedule for calls in 2015 and potential topics for discussion.
- Prepared for the monthly Aquistore outreach advisory panel conference call scheduled for November 24, 2014 (call was canceled).
- Agreed to attend and participate in the Aquistore Open House on December 11, 2014, in Estevan, Saskatchewan.
- Continued efforts with regard to the public Web site (www.undeerc.org/pcor), including the following:
  - Continued ongoing identification and repair of broken links.
- Continued collaborative efforts with Prairie Public Broadcasting (PPB), including the following:
  - Worked on revisions and updated narration for Parts 3 and 4 of the four-part education video series "Meeting the Challenge." New narration was cut on November 21 at PPB.
  - Met with PPB on November 21, 2014, in Fargo, North Dakota, to discuss potential strategies for improved tracking of PCOR Partnership materials posted on PPB's YouTube channel, the North Dakota Studies education Web site, and the national PBS educator-focused Learning Media site.
  - Discussed logistics for producing the ~90-second Bell Creek video teaser with PPB.
  - Received summary tracking information (on a quarterly basis) for the period of January 1, 2011, to September 30, 2014, for the PCOR Partnership digital materials posted on PPB's YouTube channel.
  - Discussed the potential for produced interviews from documentaries (PPB has an ongoing process of producing full interviews from their activities, including PCOR

Partnership documentaries, for inclusion in a publicly available archive database) as value-added products for the PCOR Partnership.

Task 3 – Permitting and NEPA (National Environmental Policy Act) Compliance (Charles D. Gorecki)

Highlights

- Continued review of the U.S. Environmental Protection Agency-proposed rule for carbon emissions from existing stationary sources.
- Announced new Task Leader Charles Gorecki effective November 25, 2014.

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

Highlights

- **Bell Creek** test site activities included the following:
  - With regard to geomechanical activities:
    - Continued working on D32, Geomechanical Report Update (due January 31, 2015).
    - Modeling staff attended a NExT (Network for Excellence in Training) Advanced Petroleum Geomechanics course held November 3–7, 2014, in Houston, Texas (to investigate geomechanics beyond simple elastic, isotropic behavior).
    - 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 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.
  - Updated the geologic reference model with core data, and recalculated petrophysical logs and surfaces.
  - Began investigating options regarding microseismic data-processing services and 3-D vertical seismic profiling (VSP) data processing.
  - Continued building the updated the facies model by incorporating new data, including seismic, to create a more accurate model of the field for better prediction of CO_2 movement.
  - Worked on incorporating lab-generated data into Techlog to supplement data currently in the 3-D 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 using AVO (amplitude-versus-offset) analysis to analyze 3-D seismic data in new ways and evaluation of seismic amplitude data and their relation to log character and core.
  - 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):
- 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 (BP) 4, Year 7 (June 2014).

Task 6 – Infrastructure Development (Melanie D. Jensen)

Highlights

- Continued preparation of the update to the "Opportunities and Challenges Associated with CO_2 Compression and Transport During CCS Activities" report (D85, due March 2015).
- Finalized the text and figures for the manuscript (about the attenuation of variable CO_2 sources for use in EOR) that will be submitted to *Energy & Environmental Science* (www.rsc.org/publishing/journals/ee/about.asp). Prepared an overview value-added report explaining the genesis of the research and the manuscript. The manuscript will be appended to the value-added report.
- Continued to update technologies for the CO_2 capture technologies update overview.

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 as well as at transient conditions. The effects of impurities and CO_2 stream variability on operability of injection site infrastructure were also studied.

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

Highlights

- Completed preparations for the December quarterly soil gas- and water-sampling event, scheduled for the week of December 1, 2014.
- Initiated a four-well repeat-pulsed neutron logging (PNL) campaign on November 6, 2014, to provide a tie between wellbore and seismic gas saturations and to evaluate PNL sensitivity to short-term gas saturation changes.
  - Wells logged: 05-01, 04-04, 04-03, and 33-13.
- Updated the near-surface monitoring project database and interactive map product with data from the September sampling event, and implemented minor programming improvements to improve usability.

- Attended meetings with Denbury on November14, 2014, in Plano, Texas, to conduct an operational review, operational planning, and log interpretation review meeting focused on the 19-well repeat PNL campaign conducted in August 2014.
- Investigated methods to improve porosity distribution in geologic models:
  - Compared the PNL total crossplot porosity computed form baseline logs to 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.
- Continued the literature review for CO_2 EOR simulation strategies.
- **Bell Creek** injection-phase site activities included the following:
  - Traveled to Bell Creek (October 30 – November 4 and November 5–11, 2014) to oversee time-lapse 3-D VSP seismic acquisition and provide well site management for operational monitoring PNL acquisition.
  - Worked on Phase 2 simulation file organization.
  - Completed the 4-D seismic acquisition and the 4-D VSP, and began planning for data extraction, processing, and interpretation.
  - Continued reservoir surveillance and analysis of continuous permanent downhold monitoring (PDM) data in the 05-06 OW well.
  - Provided PDM data collected in the field for analysis.
  - 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:
      - September 2014 data sets and archiving status:
        - Completed the final Analytical Research Laboratory, Energy Labs, and Isotech water data.
        - Completed the final Isotech soil gas data.
        - Completed CO_2 purchase and recycle isotech data.
        - Initiated analysis.
      - Landowner packages:
        - All analytical tables were checked for quality assurance and control, and the maps and cover photo are complete.
        - Estimated delivery of landowner packages is December.

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

- Continued working on the annual assessment (D57, due December 31, 2014).

Task 13 – Project Management (Charles D. Gorecki)

Highlights

- Held a task leader meeting November 20, 2014. Topics discussed included hiring for open positions, updates on Bell Creek and Aquistore, upcoming deliverables/milestones and travel, as well as updates from task leaders present.
- Traveled to Denver, Colorado, on November 21, 2014, to meet with C12 Energy to discuss risk assessment activities.
- Staff members attended the 2014 Midwest Carbon Sequestration Science Conference on November 5 and 6, 2014, in Champaign, Illinois.
- A staff member attended the 2014 Midwest Regional Carbon Sequestration Partnership Annual Partners Meeting on November 18, 2014, in Columbus, Ohio.
- Attended a DOE Subsurface Technology Engineering Challenges and R&D Opportunities: Wellbore Integrity Briefing on November 21, 2014, at the U.S. Energy Association in Washington, D.C.
- Presented at the Asia–Pacific Economic Cooperation (APEC) Expert Workshops on carbon capture, utilization, and storage (CCUS) on November 10–11, 2014, in Beijing, China.
- Finalized plans to attend CO_2 Conference Week scheduled for December 8–12, 2014, in Midland, Texas (www.co2conference.net/).
- In response to a request from DOE, provided slide and video clip information to a NETL program manager.
- Continued planning for the winter Technical Advisory Board meeting. The destination is Phoenix, Arizona, with proposed dates of either the last week in February or the first week in March.
- Deliverables and milestones completed in November:
  - October monthly update
  - Task 14: M23 – Monthly Water Working Group (WWG) Conference Call Held

Task 14 – RCSP (Regional Carbon Sequestration Partnership) WWG Coordination (Ryan J. Klapperich)

Highlights

- Continued working with the consultant to finalize an outline for the best practices manual (BPM) (D80, due November 30, 2016).
- Held the monthly WWG conference call on November 25, 2014. Topics discussed included partnership updates, the revised CCS and water–nexus figure, and the draft outline to the WWG BPM deliverable. In addition to the comments that were fielded during the call, some participants have provided comments on those documents via e-mail. Will begin reviewing these comments and making revisions and progress during the month of December.
- Presented the WWG Web site to Energy & Environmental Research Center senior management, and began implementation of their suggestions.
- Continued review of a journal article submission to the International Journal of Greenhouse Gas Control (reviewer comments are due December 4, 2014).
- Arranged travel and began preparing presentation materials for the Water–Energy Workshop hosted by Lawrence Livermore National Laboratory on December 4, 2014, in San Francisco, California.

- Received revisions from DOE, and finalized the WWG fact sheet entitled "Long-Term Protection of Freshwater Resources Following CO_2 Storage."
- Continued the redesign of the water–CCS nexus graphic for both the WWG Web site and future fact sheet revisions.
- Edits to the WWG draft Web site were sent to Derek Vikara.

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 30 – November 4, 2014: traveled to Gillette, Wyoming, for site work at the Bell Creek Field.
- November 4–7, 2014: traveled to Champaign, Illinois, to attend the 2014 Midwest Carbon Sequestration Science Conference.
- November 5–11, 2014: traveled to Gillette, Wyoming, for site work at the Bell Creek Field.
- November 7–13, 2014: traveled to Beijing, China, to present at the APEC Expert Workshops on CCUS and for academic exchange discussion.
- November 13–14, 2014: traveled to Plano, Texas, to attend meetings with Denbury.
- November 15–18, 2014: traveled to Chicago, Illinois, for the Sask CO_2 User Progress Meeting.
- November 17–19, 2014: traveled to Columbus, Ohio, to attend the Midwest Regional Carbon Sequestration Partnership Annual Partners Meeting.
- November 20–21, 2014: traveled to Washington, D.C., to attend the Subsurface Technology Engineering Challenges Briefing.
- November 20–24, 2014: traveled to Denver, Colorado, for meetings with C12 Energy.
- November 21, 2014: traveled to Fargo, North Dakota, to meet with the PPB Educational Department.
- November 30 – December 7, 2014: traveled to Gillette, Wyoming, for sampling at the Bell Creek Field.

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