Plains CO_2 Reduction (PCOR) Partnership Monthly Update
April 1–30, 2013

PHASE III ACTIVITIES

Task 1 – Regional Characterization (Wesley D. Peck)

Highlights

- Continued review of updates and corrections to the latest edition of the Plains CO_2 Reduction (PCOR) Partnership Atlas (Deliverable [D] 81, update due August 2013).
- Continued efforts to characterize the third target area (D7, due September 2013), including development of a Cedar Creek Anticline (CCA) geologic and operational database.
- Continued efforts to characterize additional saline formations for CO_2 storage, including the following:
  - Continued geological characterization and CO_2 storage potential estimates for Cedar Hills Sandstone and Amazon Dolomite in Nebraska.
  - Continued literature review of the Leduc Formation, focusing on the Golden Spike Reef Complex.
  - Completed the Minnelusa Formation base-case model.
  - Continued work on the Broom Creek Formation structural model.
  - Began petrophysical modeling for the Broom Creek Formation.
- Continued activities to update the Decision Support System (DSS, © 2007–2013 Energy & Environmental Research Center [EERC] Foundation®), including the following:
  - Efforts continued to update the content on the partners-only DSS; revisions are saved to a "test" site for review.
  - Continued writing a report on the methodology used for updating the oil fields in the PCOR Partnership region, including collection and calculation data.
  - Continued improving data management and data access using Petra software.

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

Highlights

- Continued to address revisions to the D17 update, General Phase III Information PowerPoint Presentation, due May 2013.
- Participated in a Regional Carbon Sequestration Partnership (RCSP) Outreach Working Group (OWG) conference call. Provided comments on the draft agenda, the session chair's PowerPoint presentation, and the message-mapping PowerPoint presentation (being presented by a PCOR Partnership representative) for the outreach session to be held at the 12th Annual Conference on Carbon Capture, Utilization, and Sequestration (CCUS-12) scheduled for May 13–16, 2013, in Pittsburgh, Pennsylvania.

- Participated in a conference call with Spectra Energy Transmission (Spectra) on April 4, 2013, regarding outreach tracking related to the Fort Nelson CCS Feasibility Project.
- Continued collaborative efforts with Prairie Public Broadcasting (PPB), including the following:
  - On April 30, 2013, the U.S. Department of Energy (DOE) Office of Fossil Energy released a Techline announcing that the PCOR Partnership–PPB documentary entitled "Global Energy and Carbon: Tracking Our Footprint" received a 2012 Platinum Best of Show Aurora Award in the nature/environment documentary category (www.fossil.energy.gov/news/techlines/2013/13018-PCOR_Documentary_Wins_Award.html).
  - On April 11, 2013, EERC staff captured video footage of the vertical seismic profiling (VSP) installation at the Bell Creek site.
  - PPB continued to edit the educator PowerPoint presentation for use at teacher-training events and on the Web.
  - On April 30, 2013, met with PPB personnel for a narration session for the smart casing video and to review progress on the education video at PPB's offices in Fargo, North Dakota.
  - Reviewed the PDM (permanent downhole monitoring) value-added video with project staff on April 23 and 24, 2013.
  - Began planning filming activities at the Boundary Dam site as part of Aquistore outreach activities.
- Continued efforts to review and improve the public Web site, including the following:
  - Continued work on updating the education section.
  - Began work to add a search feature to the Web site.
  - Added a link to the Web site from the EERC home page.
  - Received in-house approval to upgrade the video clip player to Adobe Media Service. This upgrade will improve navigability and aid in tracking and will increase classroom access to middle and high school students.
- Completed the final revisions to the outreach-tracking database while utilizing its capability to help prepare the Task 2 portion of the quarterly report.

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

Highlights

- Continued planning for the 5th Annual Regulatory Roundup, including the following:
  - Set the dates and location for the meeting: July 30–31, 2013, in Deadwood, South Dakota.
  - Sent an e-mail to participants.
- Participated in a conference call with the RCSP OWG coordinator to discuss Class VI permit cost factors.
- Continued activities associated with the Interstate Oil and Gas Compact Commission (IOGCC) Carbon Geologic Storage (CGS) Task Force, including the following:
  - Continued work on the CGS Task Force Report.
  - Reviewed two sections of the report related to carbon credit liability and Class II–Class VI transition liability.

  - Continued to prepare and plan for the subgroup meeting scheduled for May 8 and 9, 2013, in Minneapolis, Minnesota.
  - Continued to prepare and plan for the CGS Task Force meeting tentatively scheduled for June 19 and 20, 2013, in Denver, Colorado.
- Began review of new U.S. Environmental Protection Agency (EPA) geologic sequestration draft and final guidance documents, including the following:
  - Geologic Sequestration of Carbon Dioxide: Draft Underground Injection Control (UIC) Program Class VI Well Recordkeeping, Reporting and Data Management Guidance for Owners and Operators (comments due May 11, 2013).
  - Geologic Sequestration of Carbon Dioxide: Draft Underground Injection Control (UIC) Program Class VI Well Recordkeeping, Reporting and Data Management Guidance for Permitting Authorities (comments due May 11, 2013).
  - Geologic Sequestration of Carbon Dioxide: Draft Underground Injection Control (UIC) Program Class VI Well Plugging, Post-Injection Site Care, and Site Closure Guidance (comments due June 24, 2013).
- 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 April 4, 2013.
  - Continued to modify a draft value-added report on closure activities.

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

Highlights

- Attended the Williston Basin Petroleum Conference in Regina, Saskatchewan, Canada.
- Modeling staff attended Schlumberger Network of Excellence in Training (NExT) software training entitled “Petrel Workflow Editor and Uncertainty Analysis” on April 11 and 12, 2013, in Houston, Texas.
- Fort Nelson test site activities included the following:
  - Continued efforts to compile a report summarizing the activities and lessons learned at the Fort Nelson test site.
  - Continued work with Spectra on proposed scopes of work for 2012–2013 modeling efforts and sent a revision on April 11, 2013.
  - Sent the Fort Nelson Test Site – Site Characterization Report to Spectra for review and approval in May 2012. Comments were received on February 1, 2013, and revisions are under way.
  - Sent the Fort Nelson Test Site – Geochemical Report to Spectra for review and approval in September 2012. Comments were received on February 7, 2013, and revisions are under way.
- Bell Creek test site activities included the following:
  - Finalized the mineralogy report on 12 Bell Creek sidewall core samples from the 05-06 OW monitoring well on April 4, 2012, and provided the same to Denbury Resources Inc. (Denbury).
  - With regard to the 23 (Denbury – 8 and the EERC –15) sidewall cores collected from 56-14R, received thin sections from Wagner Petrographics on April 17, 2013.
  - With regard to the 60 feet of full-diameter core collected from 33-14R, awaiting receipt of samples from Weatherford Core Laboratories.

- Began planning for an outcrop field trip in July or August 2013 near Hulett, Wyoming.
- Discussed relative permeability testing capabilities.
- Continued work on the Bell Creek Test Site – Preinjection Geochemical Report (D33/Milestone [M]12, due July 2013).
- Discussed a scope of work for processing and interpreting the 3-D surface seismic data.
- Began work on the Bell Creek Test Site – Site Characterization Report (D64, due August 2013), including the following:
  - Conducted a literature review on over 674 well files.
  - Acquired LIDAR for 79 mi^2.
  - Examined over 60 cores and prepared descriptions.
  - Reviewed logs from over 748 wells included in the geologic model.
- Completed the petrophysical assessment (including 21 well packages) of 81 intervals of core from the U.S. Geological Survey (USGS) Denver Core Research Center on April 30, 2013.
- Continued revisions to D32, Geomechanical Report (submitted January 31, 2013), based on Denbury's comments.
- Continued to develop the depofacies object model using historic and recently acquired core data.
- Reviewed SCAL (special core analysis) test data received from Core Laboratories on April 4, 2013.
- Prepared a poster entitled "Subsurface Core and Analogous Outcrop Characterization for the Muddy/Newcastle Formation of the Bell Creek Oil Field, Power River County, Montana" for the American Association of Petroleum Geologists (AAPG) Annual Convention & Exhibition 2013 (www.aapg.org/pittsburgh2013/).

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

Highlights

- Led the monthly Bell Creek project update meeting on April 22, 2013.
- Attended the Williston Basin Petroleum Conference in Regina, Saskatchewan, Canada.
- A field crew traveled to the Bell Creek Field to observe and document the geophone installation in 04-03 OW.
- A field crew traveled to the Bell Creek Field to observe the 3-D VSP acquisition.
- Received clipped 3-D seismic survey data covering approximately 45 mi^2 in Phase 1.
- Scheduled the final baseline PNL (pulsed neutron logging) campaign.
- Submitted on April 15, 2013, an abstract entitled "Baseline Soil Gas Monitoring at the Bell Creek Combined CO_2 EOR and CO_2 Storage Project" for the Carbon Management Technology Conference (CMTC) scheduled for October 21–23, 2013, in Alexandria, Virginia.
- Submitted on April 15, 2013, an abstract entitled "Characterization and Time-Lapse Monitoring of a Combined CO_2 EOR and CO_2 Storage Project at the Bell Creek Oil Field Utilizing Pulsed Neutron Well Logging" for CMTC scheduled for October 21–23, 2013, in Alexandria, Virginia.
- Discussed geophone installation with representative(s) of Denbury and Apex Sigma[3].
- Continued to work on the value-added mitigation plan.

- Planned for and conducted a new (Event 6) complete baseline soil gas- and water-sampling trip during the week of April 22, 2013.
- Collected, scanned, and archived the soil gas data collection from March 2013. Analyzed nine (9) total samples, including:
  - Four (4) soil gas profile stations.
  - Two (2) interspaced (between active well) locations.
  - Three (3) active wells.
- Continued efforts on the Fox Hills groundwater-monitoring wells (05-04 and 33-12), including the following:
  - Prepared drill cuttings for mineralogical analyses. Analytical results will be used for CO_2–rock exposure testing.
  - Explored options for electric power metering.
  - Continued water-sampling efforts.
  - Discussed permanent pump options in the field on April 22, 2013.
  - Collected and archived recent (April 4, 2013) baseline field data for the two Fox Hills groundwater-monitoring wells. Results indicate that water quality is very good in both wells.
- Met with the remaining landowners to deliver the water-sampling results from the two previous baseline sampling events.
- Continued analysis of pressure gauge response from the 05-06 OW well, including the following:
  - Continued work on the reservoir simulation model.
  - Continued work on the geomechanical model as well as the pressure and temperature model.
  - Continued drafting a report.
- Continued work on a draft of the Bell Creek Test Site – Monitoring Experimental Design Package (D43, due May 2013).

Task 6 – Infrastructure Development (Melanie D. Jensen)

Highlights

- Continued research into pipeline sizing for sources that produce variable amounts of CO_2 and calculated the volume for temporary CO_2 storage. Began preparation of the document describing the approach and results, which will be prepared as basis for a paper for a trade or peer-reviewed journal.
- Submitted an abstract entitled “Assessing Temporary Storage Options to Attenuate Variable-Rate CO_2 Emissions for Use During Enhanced Oil Recovery” to CMTC scheduled for October 21–23, 2013, in Alexandria, Virginia.

Task 7 – CO_2 Procurement (John A. Harju)

Highlights

- Participated in ongoing project discussions with Denbury.

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

Highlights

- No work was performed on this task in April 2013.

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

Highlights

- Modeling staff attended Schlumberger Oil Field Management (OFM) software training entitled "OFM Using Oil and Waterflood Examples" and "OFM Forecast Analysis & Mapping Applications Fundamentals Combined Course" held April 15–18, 2013, in Denver, Colorado.
- Continued Bell Creek site activities, including the following:
  - Continued PVT (pressure–volume–temperature) modeling work.
  - Conducted a literature search and review on PVT modeling.
  - Continued work on Phase 1 history matching of the simulation model using CMOST (reservoir simulation software).
  - Conducted literature review on heavy-water capillary pressure test.
- Continued Fort Nelson site activities, including the following:
  - Continued working with Spectra on a scope of work for the next stage of dynamic modeling.
- Continued review of Spectra's comments on the Fort Nelson Test Site – Simulation Report (D67, originally submitted September 2011). Comments were received February 4–7, 2013, and revisions are under way.

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, on December 28, 2012.

Task 13 – Project Management (Charles D. Gorecki)

Highlights

- Staff attended and presented at the Carbon Sequestration Leadership Forum (CSLF) Technical Group Meeting and CO_2-Monitoring Workshop held April 16–19, 2013, in Rome, Italy.

- Submitted an abstract on April 18, 2013, entitled "CO_2 Enhanced Oil Recovery (EOR): The Plains CO_2 Reduction Partnership's Approach to Carbon Capture and Storage" to the International Petroleum Technology Conference (IPTC) scheduled for January 2014 in Doha, Qatar.
- Compiled comments on the 2nd Annual Technical Advisory Board (TAB) Meeting minutes.
- Discussed participation in CCUS-12 with the conference coordinator.
- Participated in a conference call with BillyJack Consulting.
- Met on April 11, 2013, to discuss potential adjustments to the statement of project objectives.
- Participated in a conference call on April 12, 2013, with DOE National Energy Technology Laboratory project management staff to discuss Bell Creek Phase 1 well information.
- Conducted the monthly task leader meeting on April 2, 2013. Topics discussed included the annual meeting, upcoming conferences, and deliverables as well as updates from each task leader present.
- Continued planning for the upcoming PCOR Partnership Annual Meeting scheduled for September 25–26, 2013, in Minneapolis, Minnesota, including the following:
  - Sent an e-mail blast to all partner contacts on April 16, 2013, announcing that registration is open.
  - Mailed a postcard to all partner contacts on April 1, 2013, announcing the date and location for the annual meeting.
  - Began preparation of the preliminary meeting agenda.
- Deliverables and milestones completed in April:
  - March monthly update
  - Task 13: D58/D59: Quarterly Progress Report/Milestone Quarterly Report
  - Task 4: M14 – Bell Creek Test Site Geological Characterization Data Collection Completed
  - Task 14: M23 – Monthly Water Working Group (WWG) conference call held
  - Task 16: M35 – Basal Cambrian Dynamic Capacity Estimation Completed

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

Highlights

- Continued work on the next WWG fact sheet (D99, due October 31, 2013) focused on water-monitoring technologies.
- Discussed plans for the upcoming WWG annual meeting scheduled for August 2013 in Pittsburgh, Pennsylvania.
- Held the monthly conference call on April 25, 2013.
- Continued review of the WWG white paper for potential journal submission.
- Continued review of source material for the methodologies document.
- Distributed the March 28, 2013, conference call notes on April 24, 2013.
- Distributed on April 18, 2013, a "mission statement" on the next fact sheet for WWG review and discussion.
- Two abstracts were revised based on various coauthor comments and submitted to CMTC, one related to the WWG white paper and another based on the IEA Greenhouse Gas R&D Programme (IEAGHG) extracted water project.

- Submitted on April 15, 2013, an abstract entitled "Regional Carbon Sequestration Partnership Water Working Group White Paper on the Nexus of Water and Carbon Capture and Storage" for CMTC scheduled for October 21–23, 2013, in Alexandria, Virginia.
- Submitted on April 15, 2013, an abstract entitled "IEAGHG Investigation of Extraction of Formation Water from CO_2 Storage: Beneficial Use Options and Requirements for Extracted Water" for CMTC.

Task 15 – Further Characterization of the Zama Acid Gas EOR, CO_2 Storage, and Monitoring Project (Dayanand Saini)

Highlights

- Met on April 2, 2013, to discuss next steps in drafting the Updated Regional Implementation Plan for Zama (D86, due September 2013).
- Submitted an abstract entitled "Acid Gas Injection for Enhanced Oil Recovery and Long-Term Storage in Devonian-Aged Pinnacle Reefs" on April 26, 2013, for IPTC scheduled for January 2012, in Doha, Qatar.
- Continued activities with regard to the G2G Pool, including the following:
  - Finished sensitivity analysis and began looking into analog core from Williston Basin pinnacle reefs for reference on porosity values.
  - Worked on water saturation modeling and considered alternative approaches for water saturation calculation.
  - Discussed and reviewed the progress of the dynamic simulation.
  - Worked on original oil in place (OOIP) correction.
  - Performed sensitivity analysis model properties.
  - Worked on troubleshooting the static model.
- Continued activities with regard to the Muskeg L Pool, including the following:
  - Worked on PVT modeling.
  - Started petrophysical modeling.
- Continued a literature review on methods for quick CO_2 storage estimation.
- Began exploration of new techniques for oil–water saturation modeling, but this is proving difficult, with only limited data available.

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

Highlights

- Continued work on the report describing the wellbore integrity issues (D90, due September 2013).
- Submitted a report on April 30, 2013, detailing that the basal Cambrian dynamic capacity estimation was completed (M35).
- Submitted an abstract entitled "Carbon Sequestration Case Study: Large-Scale Exploration in a Basal Saline System in Canada and the United States" for CMTC scheduled for October 21–23, 2013, in Alexandria, Virginia.
- Continued injection scenario simulations.
- With regard to the Aquistore Project characterization:
  - Prepared an updated core plug sampling and analysis plan.

– Traveled on April 30 – May 3, 2013, to sample core at TerraTek Labs in Calgary, Alberta, Canada.

Travel/Meetings

- April 1–5, 2013: Traveled to the Bell Creek Field for sampling work.
- April 2–12, 2013: Traveled to the Bell Creek Field for geophone installation.
- April 4, 2013: Traveled to inspect Lignite site reclamation near Kenmare, North Dakota.
- April 4–11, 2013: Traveled to the Bell Creek Field for project work.
- April 10–13, 2013: Attended Schlumberger NExT software training entitled "Petrel Workflow Editor and Uncertainty Analysis" in Houston, Texas.
- April 10–14, 2013: Traveled to the Bell Creek Field for project work.
- April 13–20, 2013: Presented at the CSLF meetings in Rome, Italy.
- April 14–18, 2013: Attended Schlumberger OFM software training entitled "OFM Using Oil and Waterflood Examples" and "OFM Forecast Analysis & Mapping Applications Fundamentals Combined Course" in Denver, Colorado.
- April 21 – May 1, 2013: Traveled to the Bell Creek Field for site sampling.
- April 22–25, 2013: Presented at the U.S.–Canada Clean Energy Dialogue II meeting in Champaign, Illinois.
- April 29 – May 3, 2013: Attended the Williston Basin Petroleum Conference in Regina, Saskatchewan, Canada.
- April 30, 2013: Met with PPB at its offices in Fargo, North Dakota.
- April 30 – May 3, 2013: Supervised core sampling at TerraTek Labs in Calgary, Alberta, Canada.

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