Plains CO_2 Reduction (PCOR) Partnership Monthly Update
May 1–31, 2013

PHASE III ACTIVITIES

Task 1 – Regional Characterization (Wesley D. Peck)

Highlights

- Received U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL) approval of the update to the latest edition of the Plains CO_2 Reduction (PCOR) Partnership Atlas (Deliverable [D] 81, update due August 2013) on May 7, 2013. The atlas is currently in print production (expected delivery is the first week in June).
- 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 calculations on the storage capacity of the Minnelusa Formation (Fm).
  - Continued work on the Broom Creek and Leduc Fms outlines.
  - Continued petrophysical modeling for the Broom Creek Fm.
- 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.
  - Updated the annual meeting information, the EERC contacts, and rearranged the site map structure.
  - Updated the following pages: Field Validation Tests/Terrestrial, Field Validation Tests/Lignite, and Field Validation Tests/Northwest McGregor.
  - Completed the Bell Creek demonstration project pages (with the exception of the permitting section) and this information will be sent to Denbury Resources Inc. (Denbury) for review.
  - Continued improving data management and data access using Petra software.
- Continued work on the value-added oil field/reservoir report, including the following sections:
  - Completed the Montana abandoned oil well section of the report.
  - Began revisions based on recent feedback regarding CO_2 calculations.
  - Continued writing the methodology section, including collection and calculation data.

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

Highlights

- Submitted an update to the general Phase III information PowerPoint presentation (D17) on May 31, 2013.
- Prepared a PowerPoint presentation for the 2013 Lignite Education Seminar: Energy, Economics, and Environment to be held June 18, 2013, in Bismarck, North Dakota.
- Began assembling 200 teacher information packets (atlas, documentaries, fact sheets, etc.) for distribution at the Lignite Energy Council education seminar and the upcoming Prairie Public Broadcasting (PPB) Teacher Training Institute.
- Completed a survey of partner-related Web sites and began compiling the results in order to determine how partners are sharing carbon capture and storage-related information.
- Began planning for the monthly Aquistore Outreach Advisory Panel conference call.
- Prepared presentation materials for the 12th Annual Carbon Capture, Utilization, and Sequestration (CCUS-12) Conference held May 13–16, 2013, in Pittsburgh, Pennsylvania. The Regional Carbon Sequestration Partnership (RCSP) Outreach Working Group presented a session on message mapping.
- Met in-house on May 9, 2013, to discuss Bell Creek project-specific outreach efforts and began a tracking protocol to capture the information.
- Continued collaborative efforts with PPB, including the following:
  - PPB continued to edit the educator presentation for use at teacher-training events and on the Web.
  - On May 7, 2013, met with PPB personnel to review progress on the education video at PPB's offices in Fargo, North Dakota.
  - Reviewed the PDM (permanent downhole monitoring) value-added video (using footage collected from 05-06 OW) with project staff on May 24, 2013, and began making suggested revisions.
  - Tentatively scheduled filming at the Boundary Dam power plant during the week of June 12, 2013.
  - Began scheduling interviews for upcoming documentary projects.
- Continued efforts to review and improve the public Web site, including the following:
  - Continued work on updating the education section.
  - EERC staff added a search feature to the public Web site that searches all EERC Web sites.

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

Highlights

- Continued planning for the 5th Annual Regulatory Roundup scheduled for July 30–31, 2013, in Deadwood, South Dakota, including sending an e-mail with hotel information to participants.
- Continued activities associated with the Interstate Oil and Gas Compact Commission (IOGCC) Carbon Geologic Storage (CGS) Task Force, including the following:
  - Hosted and participated in the CGS Task Force Operational and Postoperational Subgroup on 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.
  - Continued work on Milestone (M)42, Findings and Recommendations of the Operational and Postoperational Subgroups Presented to the CGS Task Force (due June 2013).
- Continued preparation of a presentation to be given in the CO_2 Transportation session at the Introduction to CO_2–Enhanced Oil Recovery (EOR) Workshop scheduled for June 11 and 12, 2013, in Houston and Port Arthur, Texas.
- Continued review of new U.S. Environmental Protection Agency 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 to modify a draft value-added report on closure activities.

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

Highlights

- 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 Energy Transmission (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:
  - Met internally to discuss 56-14R and 33-14R core analyses.
  - EERC staff traveled to the Bell Creek Field to observe the VSP (vertical seismic profile) acquisition on May 15–19, 2013. Bottomhole pressure (BHP) tests were completed May 13–15, 2013.
  - Continued review and modification of the petrophysical assessment (including 21 well packages) of 81 intervals of core from the U.S. Geological Survey Denver Core Research Center.
  - Began preparations for a reconnaissance trip to the Muddy Outcrop (near Hulett, Wyoming) during the week of June 10, in order to prepare for a hosted field trip later in the summer.

- Explored several topics to pursue for publication on Bell Creek geology and petrographic interpretations.
- Continued work on the pressure model, adding in temperature and pressure from the reservoir model.
- Continued work on the Bell Creek Test Site – Preinjection Geochemical Report (D33/M12, due July 2013).
- Continued working on a scope of work for processing and interpreting the 3-D surface seismic data.
- Reviewed and updated the SCAL (special core analysis) work progress.
- Continued work on the Bell Creek Test Site – Site Characterization Report (D64, due August 2013), including review of the following:
  - Over 674 well files
  - LIDAR survey for 79 mi^2
  - Over 60 cores, including descriptions
  - Logs from over 748 wells included in the geologic model
- Continued revisions to D32, Geomechanical Report (submitted January 31, 2013), based on Denbury's comments.
- Began outlining the information to be included in the Wellbore Leakage Final Report (D36, due March 2014).
- Continued improving the reservoir simulation model with Computer Modelling Group GEM software – the improved model has simulated initial pressure and water saturation. Performed more case runs to test the input parameters.
- Presented a poster entitled "Subsurface Core and Analogous Outcrop Characterization for the Muddy/Newcastle Formation of the Bell Creek Oil Field, Powder River County, Montana" for the American Association of Petroleum Geologists (AAPG) Annual Convention & Exhibition 2013 (www.aapg.org/pittsburgh2013/).
- Began brainstorming for future AAPG journal article ideas.

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

Highlights

- Led the monthly Bell Creek project update meeting on May 28, 2013.
- Submitted to Denbury, for its review, a poster abstract entitled "Baseline Monitoring, Verification, and Accounting (MVA) at the Bell Creek Combined CO_2 Enhanced Oil Recovery and CO_2 Storage Project" for the Combined IEAGHG (IEA Greenhouse Gas R&D Programme) Monitoring and Environmental Research Network Meeting.
- Installed protective fencing around the soil gas-profiling stations.
- Reviewed comments and updated figures on the value-added Bell Creek MVA report.
- Continued efforts on the Fox Hills groundwater-monitoring wells (05-04 and 33-12), including the following:
  - Received and began reviewing confirmatory analysis data from Cameron Cole Consulting regarding the monitoring well sampling conducted April 4, 2013.
  - Continued planning for the installation of permanent pumps and well seals (scheduled for the first week in June).
  - Began planning for a soil gas and groundwater-monitoring well sampling trip in mid-June.

  - Worked on bore logs.
  - Reviewed the PDM data processing procedures.
  - Tabulated the BHP surveys from July 2012 – January 2013 for selected wells for map creation.
  - Discussed the CO_2 exposure experiments.
  - Examined dried drill cuttings under a microscope and submitted a sample for mineralogical analyses.
  - Reviewed the chemical analysis results.
- Continued analysis of pressure gauge response from the 05-06 OW well, including the following:
  - Prepared and plotted the new PDM pressure and temperature data.
  - Continued work on the reservoir simulation model.
  - Continued work on the geomechanical model as well as the pressure and temperature model.
- Submitted a draft of the Bell Creek Test Site – Monitoring Experimental Design Package (D43) on May 31, 2013.

Issues
- Nothing to note at this time.

Opportunities
- Nothing to note at this time.

Partners Contacted
- Russ Welch, Howard Miller, Jim Rawson, Trevor Richards, and Patrick Ditty of Denbury
- Wayne Rowe and Bob Butsch of Schlumberger Carbon Services

Task 6 – Infrastructure Development (Melanie D. Jensen)

Highlights
- Completed research into pipeline sizing for sources that produce variable amounts of CO_2 and calculated the volume for temporary CO_2 storage. Prepared the first draft of a document describing the approach and results, which will serve as the 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 the Carbon Management Technology Conference that will be held 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

- Nothing to note at this time.

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

Highlights

- Continued Bell Creek site activities, including the following:
  - Began reviewing the 2012 simulation report in preparation for writing the 2013 Simulation Report, Update 3 (D66, due August 30, 2013).
  - Set up and ran prediction of CO_2 flooding.
  - Correlated logs using Techlog.
  - Continued PVT (pressure–volume–temperature) modeling work.
  - Conducted a literature review on experimental value of cap rock for CO_2 storage.
  - Continued work on Phase 1 history matching of the simulation model using CMOST (reservoir simulation software).
  - Worked on modeling and analysis of the pressure gauge response from 05-06 OW.
  - Met internally to discuss the geochemical modeling progress.
- 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

- Upon request from DOE NETL, provided brief information on May 9, 2013, regarding the lack of acid gas injection for EOR in the United States, and an indication that acid gas injection for disposal would fall under Class II.

- Upon request from DOE NETL, provided information on May 9, 2013, on the number and type of Phase II wells that used DOE NETL direct funding or cost share.
- Staff traveled to Plano, Texas, to meet with Denbury on May 7 and 8, 2013, regarding various Bell Creek-related matters. Core samples were viewed, the 3-D seismic was reviewed, and an update presentation on Bell Creek activities was given as well as a brief overview of the work to date on the CCA characterization efforts.
- Staff traveled to, presented at, and hosted an exhibit booth at the Williston Basin Petroleum Conference (WBPC) held April 30 – May 2, 2013, in Regina, Saskatchewan.
- Staff attended and participated in the CCUS-12 conference held May 13–16, 2013, in Pittsburgh, Pennsylvania.
- Participated in a conference call with BillyJack Consulting on May 16, 2013, and discussed plans for upcoming Technical Advisory Board (TAB) events. Also participated in a call on May 30, 2013, and received an update on personnel changes at Apache Canada (Zama project).
- Continued planning for the Dr. Deutsch geostatistics training scheduled to be held August 5–8, 2013, at the EERC.
- Began planning for a TAB WebEx scheduled for August 23, 2013, to discuss the Basal Cambrian project.
- Received the poster invitation and abstract submission form (due by July 5) for the 2013 Carbon Storage R&D Project Review Meeting and began discussing submittal options.
- In response to a request received from DOE NETL, on May 17, 2013, provided MVA cost estimates.
- Participated in a conference call on May 7, 2013, with other regional partnerships as led by the Carbon Storage Program Infrastructure Coordinator, regarding the RCSP plenary panel discussion at CCUS-12.
- Prepared talking points for the CCUS-12 panel discussion.
- Participated in a monthly conference call with Spectra management on May 9, 2013.
- Conducted the monthly task leader meeting on May 17, 2013. Topics discussed included updates on the Bell Creek, Fort Nelson, Aquistore, and Basal Cambrian projects; a recap of the CCUS-12 conference; review of upcoming conferences and deliverables; and 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 preparation of a preliminary meeting agenda.
- Deliverables and milestones completed in May:
  - April monthly update
  - Task 2: D17 – General Phase III Information PowerPoint Presentation (Update 4)
  - Task 5: D43 – Bell Creek Test Site – Monitoring Experimental Design Package
  - Task 14: M23 – Monthly Water Working Group (WWG) conference call held
  - Task 5: M27 – Bell Creek Test Site – MVA Equipment Installation and Baseline MVA Activities 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.
- Continued to discuss plans for the upcoming WWG annual meeting scheduled for August 2013, in Pittsburgh, Pennsylvania.
- Held the monthly conference call on May 30, 2013, and discussed comments to the fact sheet outline.
- Distributed the April 25, 2013, conference call notes on May 23, 2013.

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

Highlights

- Upon request from DOE NETL, provided information on May 8, 2013, regarding the CO_2 injection masses for the five pinnacles at Zama, namely the F, G2G, NNN, RRR, Z3Z, and Muskeg L Pools.
- Continued drafting the Updated Regional Implementation Plan for Zama (D86, due September 2013).
- Held a Zama update meeting on May 20, 2013.
- Tuned the history match and property model for the G2G Pool.
- Investigated the possibility of using CO_2 Prophet to evaluate the NNN, RRR, and Z3Z pools.
- Viewed three cores at the core library for analog correlation purposes on the porosity found in Devonian pinnacle reefs from the Winnipegosis Formation.
- Continued activities with regard to the Muskeg L Pool, including the following:
  - Completed the Muskeg L pinnacle model.
  - Continued work on permeability, water saturation, and original oil in place.
- Continued a literature review on methods for quick CO_2 storage estimation.

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).
- Continued work on a modeling and simulation report.
- Began preparing an abstract using the simulation data that have been performed on the Basal Cambrian.
- With regard to the Aquistore Project characterization:
  - Obtained 20 core samples with excellent plug recovery at all anticipated intervals.
  - Reviewed the whole core descriptions and compared them to intervals of core received at the EERC.
  - Continued cataloging and photographing samples.
  - Continued cleaning the salt from the samples using the Dean-Stark apparatus. Salts have been successfully cleaned from nine of the first 12 samples run; the remaining eight

samples were through the first cleaning step on May 24, 2013. Samples still showing evidence of salt will be run through polishing the first week in June.
  - Samples have been sent to Wagner Petrographics for thin-section preparation and are expected back the first week of June. They will then be evaluated and described.

Travel/Meetings

- April 21 – May 1, 2013: Traveled to the Bell Creek Field for site sampling.
- April 29 – May 3, 2013: Attended and presented at the WBPC in Regina, Saskatchewan, Canada.
- May 7, 2013: Met with PPB at its offices in Fargo, North Dakota.
- May 7–8, 2013: Participated in meetings with Denbury in Plano, Texas.
- May 7–9, 2013: Participated in the IOGCC subgroup meeting in Minneapolis, Minnesota.
- May 8–10, 2013: Traveled to the Bell Creek Field for site work.
- May 13–19, 2013: Attended and participated in CCUS-12 in Pittsburgh, Pennsylvania.
- May 15–18, 2013: Traveled to the Bell Creek Field for site sampling.
- May 18, 2013: Attended AAPG short courses entitled "Quality Control for Subsurface Maps," and "Sequence Stratigraphy Analysis of Shales: Key to Paleoclimate Archive, Subsurface Fluid Flow and Hydrocarbon Source" in Pittsburgh, Pennsylvania.
- May 18–22, 2013: Attended the IOGCC Midyear Issues Summit in Point Clear, Alabama.
- May 19–22, 2013: Presented at the AAPG Convention and Exhibition in Pittsburgh, Pennsylvania.
- May 19–23, 2013: Traveled to the Bell Creek Field for site work.
- May 28–30, 2013: Traveled to the Bell Creek Field to observe pump installation and to meet with area landowners.
- May 28–31, 2013: Traveled to the Bell Creek Field for sampling and site work.

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