**Plains $CO_2$ Reduction (PCOR) Partnership Monthly Update**
**February 1–28, 2013**

## PHASE III ACTIVITIES

### Task 1 – Regional Characterization (Wesley D. Peck)

Highlights

- Continued review of updates and corrections to the latest edition of the PCOR Partnership Atlas (Deliverable [D] 81, update due August 2013).
- Continued efforts to characterize the third target area (D7, due September 2013), including the following:
  - Transferred historic production and injection data into the Petra database.
  - Created maps and cross sections illustrating the vertical and aerial distribution of production information.
- Provided NATCARB (National Carbon Sequestration Database and Geographic Information System) personnel with documentation on the PCOR Partnership latest carbon dioxide ($CO_2$) source inventory.
- Continued efforts to characterize additional saline formations for $CO_2$ storage, including the following:
  - Continued to digitize structure and isopach maps for formations in the Power River and Williston Basins.
  - Reviewed existing Broom Creek Petrel models and associated documentation.
  - Began creating 2013 Broom Creek Petrel model.
  - Began a Web-based literature review of the Broom Creek Formation (North Dakota) and the Minnelusa Formation (South Dakota and Montana).
  - Began compiling data for the Mission Canyon Formation using LAS (Log ASCII Standard) files to fill the gaps.
- Conducted a preliminary investigation of $CO_2$ enhanced oil recovery (EOR) potential of the area along the Miles City Arch in southeastern Montana.
- Continued updating the Petra database with Montana well data and formation tops.
- Participated in a conference call with the Petroleum Technology Research Centre (PTRC) on February 28, 2013, to discuss the Aquistore collaboration.
- Continued activities to update the Decision Support System (DSS, © 2007–2013 Energy & Environmental Research Center [EERC] Foundation®), including the following:
  - Compiled images from the PCOR Partnership Atlas for inclusion in the online image gallery.
  - Continued efforts to update the current GIS (geographic information system) well files with new and corrected well information where discrepancies were identified.

- Continued development of a new monitoring, verification, and accounting (MVA) section for the Bell Creek portion of the demonstration project reporting system. Anticipated completion is March 2013.
- Reviewed the partners-only site Bell Creek Web pages and prepared draft updates.

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

Highlights

- Participated in the monthly Regional Carbon Sequestration Partnership Outreach Working Group conference call on February 21, 2013, and agreed to participate in an outreach session at the upcoming 12th Annual Conference on Carbon Capture, Utilization, and Sequestration scheduled for May 13–16, in Pittsburgh, Pennsylvania.
- Participated in the monthly Aquistore Outreach Advisory Panel conference call on February 25, 2015, where marketing literature, recent press coverage, and upcoming events were discussed.
- Secured Denbury Resources, Inc. (Denbury), approval of the Bell Creek portion of the Phase III general fact sheet (D14).
- Submitted the Phase III general fact sheet (D14) on February 28, 2013.
- Continued the update to and revision of the Lignite Field Validation Test fact sheet and brochure (value-added).
- Continued efforts to revise the permanent downhole monitoring (PDM) value-added video short.
- Continued collaborative efforts with Prairie Public Broadcasting (PPB), including the following:
  - Held a meeting at the EERC on February 8, 2013, to review the planned scope of work.
  - Made plans to film geophone installation in the Bell Creek Field.
  - Reviewed PowerPoint presentations given at past teacher seminars as a basis for preparing a filmed version to be used for future education activities.
  - Practiced the educator PowerPoint presentation at PPB studios on February 27, 2013, in preparation for upcoming filming; the presentation will be used on the Web and in future partnership education activities.
- Continued efforts to populate, test, program, and refine the outreach-tracking database.
- Continued efforts to review and improve the public Web site, including an in-house meeting on February 11, 2013, to discuss the current video clip library, additions to the education section, and improved user tracking.

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

Highlights

- Provided information upon request regarding a cost comparison between Class II and Class VI wells.
- Provided an overview upon request of North Dakota's proposed Class VI rules and primacy application to an interested party.
- Continued planning for the 5th Annual Regulatory Roundup to be held this summer.

- Continued activities associated with the Interstate Oil and Gas Compact Commission (IOGCC) Carbon Geologic Storage (CGS) Task Force, including the following:
  - Participated in a subgroup conference call.
  - Reviewed the final report outline and began writing the final report.
  - Participated in a subgroup call to discuss various insurance options for carbon capture and storage (CCS) projects.
  - Participated in the IOGCC CGS Task Force Subgroup meeting on February 27 and 28, 2013, in Minneapolis, Minnesota.
- With regard to the Lignite Field Validation Test site (Phase II) closure:
  - Continued efforts to monitor the site during the reclamation phase, including site visits on February 7 and 21, 2013.
  - Continued to modify a draft value-added report on closure activities.

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

Highlights

- Modeling staff attended Schlumberger Network of Excellence in Training (NExT) software training entitled "Petrel Property Modeling" on February 10–18, 2013, in Houston, Texas.
- Modeling staff attended Schlumberger NExT software training entitled "Techlog Formation Evaluations" on February 24 – March 1, 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.
  - Participated in a call with Spectra personnel on February 13, 2013.
  - Packaged the June 2010 and July 2011 Petrel static models and transferred them to Spectra at its request.
  - Responded to Spectra's questions regarding well tops and structure interpretations in the transferred static models.
- Bell Creek test site activities included the following:
  - Continued revising the fieldwide static model, including creating a 3-D grid.
  - Continued building a depofacies object model using historic and recently acquired core data.
  - Worked on improving the 1-D mechanical earth model (MEM) with additional analysis of Poisson's ratio and stresses.
  - Continued work on the 3-D MEM of the Phase 1 area.
  - Began creation of a new uncertainty model and documented associated results.
  - Schlumberger completed processing the 27 baseline pulsed-neutron logs.
  - Began planning a pulsed-neutron-logging review meeting with Schlumberger, Denbury, and the EERC on March 12, 2013, in Denver, Colorado.
  - Began evaluation and planning of horizontal sidewall core testing.
  - Continued work on 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/).

- Continued to discuss special core analysis (SCAL) work, including the following:
  - ♦ Discussed basic property testing results and plug selection for planned flow tests.
  - ♦ Discussed drilling additional core plugs in bioturbated zones.
  - ♦ Reviewed the Petrel model and associated Phase 1 logs.
  - ♦ Reviewed the Weatherford cost proposal for planned SCAL work for additional wells.
  - ♦ Began preparations for sidewall core selection in additional wells.
- Continued sidewall core activities in the Applied Geology Laboratory (AGL), including the following:
  - ♦ Continued efforts to modify the value-added mineralogy report on 12 sidewall core samples.
  - ♦ Completed data sheets and porosity point counting for the remaining 35 samples.
- Continued U.S. Geological Survey (USGS) Denver Core Research Center activities on 81 intervals of core in the AGL, including the following:
  - ♦ Scanned thin sections for point counting.
  - ♦ Continued work on photographs as well as x-ray diffraction, x-ray fluorescence, and scanning electron microscopy analyses.

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

Highlights

- Traveled to the Bell Creek Field on February 5–9, 2013, to install the second Fox Hills Formation water-monitoring well.
- Continued work on a bid package for solar-powered pump systems for monitoring Fox Hills Formation groundwater.
- Worked on compiling data needs for modeling Fox Hills Formation $CO_2$ rock exposure using PHREEQC.
- Prepared cross sections of water wells.
- Traveled to the Bell Creek Field (along with PPB film crew) to observe planned geophone array installation on February 21–23, 2013.
- Continued analysis of pressure gauge response from the 0506 OW well, along with an associated literature review.
- Continued review and modifications to the Bell Creek Baseline MVA Report.
- Completed compilation of questions for landowners.
- Completed reviewing and verifying the finalized Baseline Sampling Events 4 and 5 (August and November 2012, respectively) landowner packages for distribution.
  - Collected a total of 24 water samples, including seven surface water, eight stock well, and nine drinking water (residential) well samples during Event 4.
  - Collected a total of 24 water samples, including eight surface water, eight stock well, and eight drinking water (residential) well samples during Event 5.
- Compiled the most recently collected active well and fixed station soil gas data from the January 2013 sampling event.
  - Sampled a total of ten soil gas profile stations, eight active wells, and ten interspaced locations.
  - Compared field and analytical soil gas measurements between all sampling events (October and November 2012 and January 2013).

- Completed a draft outline of the Bell Creek Test Site – Monitoring Experimental Design Package (D43, due May 2013).

**Task 6 – Infrastructure Development (Melanie D. Jensen)**

Highlights

- Addressed all peer-review comments and submitted the final manuscript for publication in *Energy & Fuels*. The paper summarizes the work done to develop and preliminarily test a methodology for estimating a hypothetical phased $CO_2$ pipeline network.
- Received notification that the manuscript submitted to *Energy & Fuels* was accepted for publication. Received an electronic version of the proof pages for careful proofreading.
- Continued studying information about surface facilities, as they play a large role in the site infrastructure development at the Bell Creek site.
- Revised D84, Report – A Phased Approach to Building Pipeline Network for $CO_2$ Transportation During CCS, based on recommendations from DOE National Energy Technology Laboratory (NETL).

**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

- Continued investigating potential sources for fugitive $CO_2$ emissions in the surface facilities at injection sites.

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

Highlights

- Staff attended the Society of Petroleum Engineers (SPE) 2013 Reservoir Simulation Symposium and premeeting training courses entitled “Fundamentals of Reservoir Simulation” and “Reservoir Simulation for Practical Decision Making” in The Woodlands, Texas.
- Staff presented at the Rice 2013 Oil & Gas High-Performance Computing (HPC) Workshop in Houston, Texas.
- Worked with Computer Modelling Group Ltd. (CMG) on licensing renewals.
- Continued Bell Creek site activities, including the following:
  - Continued PVT (pressure–volume–temperature) modeling work, including the following:
    - Performed a literature review on the relative permeability interface between experimental and simulation data.
    - Discussed the recently received Core Laboratories PVT report.
    - Ran PVT simulations.
    - Continued work on PVT in regression to match the experimental data.
    - Worked on PVT in minimum miscibility pressure.

  - Configured CMOST for the numerical tuning process.
  - Reviewed and discussed ongoing dynamic modeling work.
  - Worked on history-matching the simulation model.
- Continued Fort Nelson site activities, including the following:
  - Continued working with Spectra on a scope of work for the next stage of dynamic modeling.

**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
- Conducted the monthly task leader meeting on February 5, 2013. Topics discussed included upcoming in-house training opportunities, conferences, deliverables, and updates from each task leader present.
- Numerous staff members participated in an all-day training session entitled "The $CO_2$ EOR Overview Course for the PCOR Partnership" on February 26, 2013.
- Continued preparations for the Technical Advisory Board (TAB) meeting to be held March 5–6, 2013, in Orlando, Florida, including the following:
  - Participated in several conference calls with the TAB chair and the meeting facilitator.
  - Participated in in-house discussions on the proposed TAB presentation on February 15, 2013.
  - Prepared revised presentation information on Phase III activities.
  - Finalized meeting arrangements.
- Accepted a second review request on a paper for the *International Journal of Greenhouse Gas Control*.
- Contacted the Pacific Northwest National Laboratory regarding GS3 (Geologic Sequestration Software Suite) developed for management of $CO_2$ storage projects. Scheduled a call to discuss further.
- Deliverables and milestones completed in February:
  - January monthly update
  - Task 2: D14 – General Phase III Fact Sheet (Update)
  - Task 14: M23 – Monthly Water Working Group (WWG) conference call held

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

Highlights

- Distributed the February meeting agenda on February 6, 2013.
- Continued efforts on the WWG review of the water–CCS nexus-related fact sheet (D99, due March 2013).
- Distributed the January 16, 2013, conference call notes on February 22, 2013.
- Held the monthly conference call on February 26, 2013. Topics included the following:
  - Discussed revisions to the water resource protection fact sheet (due March 2013).
  - Discussed development of an MVA-centric fact sheet (due October 2013).
  - Reviewed upcoming meetings and scheduling plans for the annual meeting.
  - Received WWG participant updates.
- Continued review of upcoming conferences for possible distribution of the fact sheets.

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

Highlights

- Held biweekly project update meetings.
- Continued work on the G2G Pool, including the following:
  - Generated rock type, porosity, permeability, and saturation logs along existing G2G Pool wellbores and then upscaled into a static model.
  - Began facies, property, and petrophysical modeling.
  - Exported the preliminary G2G Pool static model to dynamic simulation software (CMG–GEM) and started working on a test run.
- Continued work on the Muskeg L Pool, including the following:
  - Started preparing dynamic data.
  - Started preparing fluid property data for PVT model development.
  - Continued to review relevant literature.
- Continued work on the PVT model for the RRR Pinnacle.
- Conducted a literature review for geostatistical modeling.
- Discussed grid thickness, training image, porosity–permeability relationship, water saturation modeling, Zama area geology, and other static modeling issues.

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

Highlights

- Continued work on the geochemical report (D89, due March 2013).
- Continued work on the report describing the wellbore integrity issues (D90, due September 2013).
- Attended and presented at the Joint Technical and Steering Committee Meeting for the Basal Aquifer Project on February 21, 2013, in Berkeley, California. Meeting details included the following:
  - Attended by representatives from AITF, Natural Resources Canada (NRCan), Lawrence Berkeley National Laboratory, and Princeton University (by phone).

  - Focused on review of modifications to the EERC-prepared 3-D geomodel and discussion on preliminary dynamic simulation modeling.
  - Recognized insufficient injectivity at the local extent to accommodate the $CO_2$ (at the current annual rate) for some of large stationary sources even though there is a large storage resource available in the system.
- Began modification of dynamic simulation parameters used to maximize the injectivity at the various large-scale $CO_2$ sources across the study region.
- Continued simulation efforts.
- Began compilation of updated information regarding the emission rates for some of the Canadian $CO_2$ sources.
- Completed a preliminary draft report of the 3-D modeling effort.
- Contacted PTRC regarding core plug extraction and implementation of the core testing program for the Aquistore Project in Saskatchewan, Canada. PTRC will provide the 3-D geomodel in April, and the EERC will add in the core analysis results.

**Travel/Meetings**

- January 26 – February 1, 2013: Participated in the 2013 Energy, Utility & Environment Conference (EUEC) in Phoenix, Arizona.
- February 5–9, 2013: Traveled to Gillette, Wyoming, for sampling work near the Bell Creek Field.
- February 7 and 21, 2013: Traveled to the Lignite Field validation site near Kenmare, North Dakota, to inspect the site.
- February 10–18, 2013: Attended Schlumberger NExT software training entitled "Petrel Property Modeling" in Houston, Texas.
- February 16–20, 2013: Attended the SPE 2013 Reservoir Simulation Symposium and premeeting training courses entitled "Fundamentals of Reservoir Simulation" and "Reservoir Simulation for Practical Decision Making" in The Woodlands, Texas.
- February 19–22, 2013: Visited NETL offices in Morgantown, West Virginia, and Pittsburgh, Pennsylvania, to discuss project activities.
- February 19–23, 2013: Participated in a meeting of the Steering Committee of the Basal Aquifer Technical Group in Berkeley, California.
- February 20–23, 2013: Traveled to view proposed geophone installation in the Bell Creek Field.
- February 24 – March 1, 2013: Attended Schlumberger's NExT software training entitled "Techlog Formation Evaluations" in Houston, Texas.
- February 26–28, 2013: Participated in the IOGCC CGS Subgroup meeting in Minneapolis, Minnesota.
- February 27, 2013: Traveled to PPB headquarters to discuss educational materials in Fargo, North Dakota.
- February 27 – March 1, 2013: Presented at the Rice 2013 Oil & Gas HPC Workshop in Houston, Texas.

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