



Plains CO₂ Reduction (PCOR) Partnership
Energy & Environmental Research Center (EERC)

Plains CO₂ Reduction (PCOR) Partnership Monthly Update June 1–30, 2012

PHASE III ACTIVITIES

Task 1 – Regional Characterization (Wesley D. Peck)

Highlights

- Shipped approximately 250 copies of the *PCOR Partnership Atlas*, 4th Edition, to partner contacts.
- Continued to acquire updated cumulative oil production numbers for the fields and pools in the U.S. portion of the PCOR Partnership region. This effort includes gathering reservoir values in Montana, Nebraska, and Wyoming, such as original oil in place, porosity, permeability, and production acres, that will be used to update CO₂ enhanced oil recovery (EOR) estimates for many fields.
- Continued discussing options for the characterization of a third target area (Deliverable [D] 7, due September 2014).
- Discussed CO₂ storage opportunities with a partner in Nebraska.
- Continued Rival oil field characterization efforts, including the following activities:
 - Continued performing uncertainty and sensitivity analysis on the updated geologic model.
 - Continued work on the drill stem test review.
 - Began planning for a July 2012 meeting with TAQA North, Ltd., at the Energy & Environmental Research Center (EERC).

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

Highlights

- Continued planning for a value-added video short focused on smart casing installation for carbon capture and storage (CCS) reservoir monitoring.
- Gave presentations entitled “Foundations of CO₂ and Energy I” and “Foundations of CO₂ and Energy II” to the 25 attendees at the Teacher Training Institute entitled “The Changing Face of North Dakota” cosponsored by the North Dakota Geographic Alliance and Prairie Public Broadcasting (PPB) on June 4, 2012, in Dickinson, North Dakota.
- Completed review of time code for more than 5 hours of raw footage shot by PPB in February 2012 at Fort Nelson and produced a 2-minute scene sampler for the Fort Nelson project review meeting held on June 6 and 7, 2012, in Grand Forks.
- Presented a review of Fort Nelson-related outreach activities at the project review meeting held at the EERC.

- Gave a presentation entitled “Energy and CO₂ Management: Carbon Capture and Storage” on June 19, 2012, for the 127 attendees at the Lignite Energy Council’s teacher seminar entitled “2012 Lignite Education Seminar: Energy, Economics & Environment” in Bismarck, North Dakota.
- Submitted an update to the Fort Nelson PowerPoint presentation (D19) on June 29, 2012.
- Continued efforts to update the public Web site (D13) due July 31, 2012.
- Distributed approximately 210 teacher tote bags, including an atlas, fact sheets, and at least two documentaries, at three separate North Dakota teacher seminars sponsored by the Lignite Energy Council, North Dakota Petroleum Council, and North Dakota Geographic Alliance, respectively.
- Continued review of a “test-phase” outreach materials tracking database.
- Participated in semimonthly conference calls for the Aquistore Project, led by the Petroleum Technology Research Centre (PTRC).
- Participated in monthly conference calls for the Outreach Working Group, featuring a presentation by the ENGO Network on CCS (Environmental NGO Network on Carbon Capture and Storage) (www.EngoNetwork.org).
- Ordered 1000 “Global Energy and Carbon” DVDs to replenish stock; over 1000 DVDs have been distributed since October 2010.
- Began planning for a PPB filming trip to the Bell Creek site in August 2012 to capture the 3-D seismic survey and baseline surface sampling activities.
- Presented an overview of Bell Creek-related outreach activities at the Denbury Onshore LLC (Denbury) meeting held June 25 and 26, 2012, at the EERC.
- Posted the latest version of the atlas on the public Web site (<http://undeerc.org/pcor/newsandpubs/atlas>).
- Began planning for a presentation (and distribution of PCOR Partnership outreach materials) at the Missouri Minerals Education Foundation 13th Annual “Missouri is a State of Mines – Rocks, Minerals, and our Environment” workshop scheduled for July 15–20, 2012, in Park Hills, Missouri (www.mmef.org/workshops.htm).

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

Highlights

- Attended the Interstate Oil and Gas Compact Commission (IOGCC) Midyear Meeting held June 3–5 in Vancouver, British Columbia, Canada.
- Received approval from the U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL) to proceed with research conducted with IOGCC on operational and postoperational liability issues.
- Continued planning for the 4th Annual Regulatory Roundup meeting to be held July 31 – August 1, 2012, in Deadwood, South Dakota.
- Sent out an e-mail blast to Regulatory Roundup invitees on June 27, 2012.
- Held several discussions with a representative of the North Dakota Industrial Commission (NDIC) regarding the state of North Dakota’s primacy application for Class VI wells.
- With regard to the Lignite Site (Phase II) closure: visited the site to monitor the reclamation process with the following results:

- Canadian thistle is present, triggering the need for weed spraying.
- The solar panel for the electric fence is gone. For now, it is assumed stolen. It will need to be replaced, and a cost estimate is under way.

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

Highlights

- Fort Nelson test site activities included the following:
 - Submitted the geochemical report (D41/Milestone 32 [M32]) on June 29, 2012.
 - Continued building a 1-D mechanical earth model (MEM) and continued analyzing logs for geomechanical properties.
 - Held technical and management meetings on June 6 and 7, 2012, respectively, with Spectra Energy Transmission (SET) in Grand Forks. Topics discussed included the following:
 - ◆ Geology update
 - ◆ Modeling update
 - ◆ Monitoring, verification, and accounting (MVA)/Bayesian approach update
 - ◆ Status of Canadian government funding and related business case agreements
 - ◆ Public outreach update
 - ◆ Overview of British Columbia Oil and Gas Commission meeting and regulatory update
 - ◆ Overview of Winter 2012–2013 activities
 - ◆ Project master schedule review
 - Continued work on improving the latest iteration of the static geologic model, particularly with respect to well log analysis and lithofacies distribution.
 - Continued the multimineral analysis of well logs for the updated static geologic model.
- Bell Creek test site activities included the following:
 - Submitted an abstract entitled “Mechanism of Subnormal Pressure Generation in the Bell Creek Oil Field and the Implications to CO₂ Storage” for the International Petroleum Technology Conference (IPTC) scheduled for March 2013 in Beijing, China (www.iptcnet.org/2013).
 - Continued work on the 1-D MEM.
 - Continued review of seismic data.
 - Continued building the updated geologic model.
 - Began preparations for building a lithofacies model based on the core reviewed.
 - Completed EERC Applied Geology Laboratory (AGL) testing on nine priority sidewall core samples from the 0506 OW monitoring well and provided the data to Denbury during its visit to the EERC on June 25 and 26, 2012.
 - Continued AGL analyses on additional samples (81 intervals) collected from the U.S. Geological Survey Core Research Center in Denver, Colorado, including the following activities:
 - ◆ Prepared 135 of 243 thin sections.
 - ◆ Submitted 20 of 20 samples for point count scanning electron microscopy analysis; 20 of 20 scans completed.
 - ◆ Submitted 22 samples for x-ray diffraction analysis.
 - ◆ Measured porosity, bulk volume, and skeletal density on all samples.

- ◆ Completed permeability-to-water measurements.
- ◆ Prepared data sheets and distributed them to Denbury during its visit.
- Continued planning for AGL petrographic analysis on the full-diameter (slabbed) core.
- Began sample selection for a CO₂ exposure study of 14 samples within the Mowry and Muddy Formations.

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

Highlights

- Continued review of MVA work ongoing at other regional CCS projects.
- Submitted an abstract entitled “Integrated Monitoring Program for a Combined CO₂ Enhanced Oil Recovery and CO₂ Storage Project in the Bell Creek Oil Field” for IPTC scheduled for March 2013 in Beijing, China (www.iptcnet.org/2013).
- Continued work on the Event 2 (April 23–29, 2012) landowner packages that include water analysis baseline MVA activities.
- Held a joint Denbury–EERC update meeting on June 25 and 26, 2012, in Grand Forks. Topics discussed include core analyses, modeling and simulation, and MVA work plans for the Phase 1 injection area.
- Completed the Event 3 (June 18–23, 2012) baseline soil gas and water sampling MVA activities.
- Continued drafting a value-added preinjection surface water, groundwater, and soil gas baseline MVA sampling and analysis report including results.
- Continued deep surface monitoring activities including an evaluation as to the feasibility of installing two deep groundwater monitoring wells and planning preinjection baseline logging and seismic acquisitions.
- Participated in the IEA Greenhouse Gas R&D Programme (IEAGHG) 2nd Joint Network Meeting held on June 19–21, 2012, in Santa Fe, New Mexico, and hosted by Los Alamos National Laboratory.

Task 6 – Infrastructure Development (Melanie D. Jensen)

Highlights

- Submitted the phased pipeline network approach report (D84) on June 29, 2012.
- Continued review of the interactive capture technology tree on the partners-only Decision Support System (© 2007–2012 EERC Foundation[®]) test Web site.
- Answered a partner’s questions regarding CO₂ storage capacities in its vicinity.
- Continued plans to attend the upcoming NETL CO₂ Capture Technology Meeting scheduled for July 9–13, 2012, in Pittsburgh, Pennsylvania.

Task 7 – CO₂ Procurement (John A. Harju)

Highlights

- Participated in ongoing project discussions with Denbury including meetings at the EERC held on June 25 and 26, 2012.

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

Highlights

- Participated in project discussions with Denbury during its meeting at the EERC held June 25, and 26, 2012.

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

Highlights

- Gave a presentation entitled “The Use of CMG’s GEM and CMOST for Modeling CO₂ Storage and CO₂ EOR for the PCOR Partnership Program” for the Computer Modelling Group (CMG) Technical Symposium held in Calgary, Alberta, Canada, on June 19–21, 2012.
- Participated in CMG simulation training entitled “2-Day History-Matching & Optimization (CMOST)” on June 5 and 6, 2012, in Houston, Texas.
- Modeling staff attended the ISRM–ARMA (International Society of Rock Mechanics–American Rock Mechanics Association) Workshop on Petroleum Geomechanics Testing and the 46th ARMA Symposium held June 22–26, 2012, in Chicago, Illinois.
- Continued Fort Nelson site activities, including the following:
 - Met with SET personnel while in Calgary (June 19–21, 2012).
 - Continued development of the two-track deep geological system MVA plan.
 - Continued revisions to the MVA plan for surface and shallow subsurface based on recent discussions with SET.
 - Participated in a technical meeting with SET on June 6 and 7, 2012, in Grand Forks, North Dakota.
 - Submitted an abstract entitled “An Integrated Optimization for Reservoir Modeling and Simulation: Method and Case Demonstration” for IPTC scheduled for March 2013 in Beijing, China (www.iptcnet.org/2013).
- Continued Bell Creek site activities, including the following:
 - Continued work on the Phase 1 model prediction.
 - Began work on the Bell Creek Test Site – Simulation Report (D66, due August 2012).
 - Continued efforts to improve the results of the 1-D simulation of slim-tube experiments.
 - Continued work tuning numerical settings for speeding up the predictive simulations.
 - Worked on TOUGH2 and FLAC3D™ simulators for simulation and continued studying the use of these two simulators.
 - Discussed live oil preparation procedures and other minimum miscibility pressure-related issues with EERC lab staff.

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

- The next assessment report is due by December 31, 2012.

Task 13 – Project Management (Charles D. Gorecki)

Highlights

- Continued planning for the upcoming PCOR Partnership Annual Meeting and Workshop scheduled for September 11–13, 2012, in Milwaukee, Wisconsin.
 - Began processing the rock samples from the Milwaukee-area quarry in preparation for the Core Analysis Basics Workshop.
 - Began photographing the rock samples and lab equipment in preparation for print materials for the Core Analysis Basics Workshop.
 - Sent a letter to the Milwaukee-area quarry owners to seek access authorization for the field trip.
 - Began work on a new postcard to all partners with information about the annual meeting and workshop.
- Responded to the DOE Office of Fossil Energy request for information on the maturity level of current research development and demonstration projects within its Clean Coal Research Program, including the Fort Nelson and Bell Creek projects.
- Received Modifications (Mods) 22 and 23 (dated April 30 and June 18, 2012, respectively) to the DOE NETL cooperative agreement. These modifications authorized the following:
 - Incremental funding
 - Revised statement of project objectives (SOPO).
 - Revised NEPA requirements.
 - New SOPO Subtask 3.5 entitled “IOGCC Carbon Storage Task Force Activities.”
 - Cost increase for SOPO Task 5.
 - New SOPO Subtask 1.4 entitled “Collaboration with PTRC’s Aquistore Project” and related outreach and education activities at Subtasks 2.4, 2.7, and 2.8.
 - Expanded SOPO Subtask 4.3.2 regarding Bell Creek site baseline geology determination.
 - Expanded SOPO Subtask 16.2 regarding geologic characterization.
 - Recognizes increased cost-share requirement.
- Submitted an abstract entitled “The Plains CO₂ Reduction (PCOR) Partnership: CO₂ Sequestration Demonstration Projects Adding Value to the Oil and Gas Industry” for IPTC scheduled for March 2013 in Beijing, China (www.iptcnet.org/2013).
- Wes Peck presented at the Comision Federal De Electricidad/Asia-Pacific Economic Cooperation (CFE/APEC) Workshop for Introducing Carbon Capture and Storage in Earth Sciences Undergraduate Programs in Mexico City on June 28, 2012.
- Ed Steadman participated in the Carbon Storage Leadership Forum (CSLF) Meetings of the Technical Group and Technical Workshop held June 11–14, 2012, in Bergen, Norway (www.cslforum.org/meetings/bergen2012/index.html).
- Ed Steadman participated in the IEAGHG’s 2nd Joint Network Meeting hosted by Los Alamos National Laboratory in Santa Fe, New Mexico, on June 19–21, 2012. Topics discussed included risk assessment, monitoring, modeling, wellbore integrity, environmental impacts of CO₂ storage, and there was a field trip to the Chimayo natural CO₂ release site.

- Held a task leader meeting on June 27, 2012. Topics discussed included Mod 23 to the cooperative agreement; budgets; and upcoming conferences, including the 34th International Geological Conference (IGC, Australia), the 11th International Conference on Greenhouse Gas Technologies (GHGT-11, Kyoto), and the DOE Carbon Storage R&D Project Review Meeting (Pittsburgh).
- Began preparations for IGC, including two oral presentations (PCOR Partnership and Bell Creek) and one poster (Fort Nelson).
- Received notifications on June 25, 2012, that nine PCOR Partnership-related abstracts were accepted for GHGT-11, including eight posters and one oral presentation. The following are the titles of the abstracts:
 - “Relative Permeability of Supercritical Carbon Dioxide to Water for Rocks of the Basal Cambrian Formation, North Dakota”
 - “Visual Message Mapping for CCS Outreach”
 - “Overview of the Bell Creek Combined CO₂ Storage and CO₂ Enhanced Oil Recovery Project”
 - “A Phased Approach to Building a Pipeline Network for CO₂ Transport During CCS”
 - “CO₂ Storage Resource Potential of the Cambro–Ordovician Saline System in the Western Interior of North America”
 - “A Simulation Study of Simultaneous Acid Gas EOR and CO₂ Storage at Apache Zama Pool”
 - “The Role of Static and Dynamic Modeling in the Fort Nelson CCS Project”
 - “Overview, Status, and Future of the Fort Nelson CCS Project”
 - “Laboratory Evaluation of Wellbore Casing Steel and Cements for the Zama Acid Gas EOR, CO₂ Storage, and Monitoring Project”
- Began preparing poster abstracts (due by July 6) for the upcoming DOE Carbon Storage R&D Review Meeting.
- Deliverables and milestones completed in June:
 - May monthly update
 - Task 2: D19 – Fort Nelson Test Site PowerPoint Presentation (Update)
 - Task 4: D41/M32: Fort Nelson Test Site – Geochemical Report
 - Task 6: D84 – Report – A Phased Approach to Building Pipeline Network for CO₂ Transportation During CCS
 - Task 14: M23 – Monthly Water Working Group conference call held

Task 14 – Regional Carbon Sequestration Partnership Water Working Group Coordination (Ryan J. Klapperich)

Highlights

- Distributed the meeting notes from the 4th annual meeting held on May 3, 2012, in conjunction with the 11th Annual Carbon Capture Utilization & Storage Conference.
- Distributed the interest inventory results and additional information requested during the May conference call.
- Held monthly conference call on June 28, 2012. Topics discussed included the development of a prioritized “Water and CCS” research agenda, and brainstorming for new fact sheet ideas.

Task 15 – Further Characterization of the Zama Acid Gas EOR, CO₂ Storage, and Monitoring Project (James A. Sorensen)

Highlights

- Continued work on setting CMOST-SA simulation for evaluating the effect of relative permeability curve parameters.
- Initiated the process of modifying the F Pool static geologic model based on a combination of history-matching results and a revised geological interpretation of the pinnacle reef morphology.
- Compiled data from Apache Canada, Ltd., for updated injection and production volumes.
- Discussed static model iteration.
- Prepared and imported the updated production and injection data (through May 2012) to the dynamic model.
- Received approval from DOE NETL on the revised scope of work originally sent for review in April 2012.

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

Highlights

- Continued derivation of log data for multipoint statistical approach to the 3-D model of the Cambro-Ordovician system.
- Continued work on the summarization of wellbore completion and abandonment data for wells penetrating the U.S. portion of the Cambro-Ordovician system.
- Developed a preliminary injection scenario for the 16 large stationary CO₂ source locations across the Cambro-Ordovician area.
- Reservoir simulation modeling is expected to begin in July.

Travel/Meetings

- June 2–6, 2012: Participated in the IOGCC Mid-Year Meeting in Vancouver, British Columbia, Canada.
- June 3–5, 2012: Participated in the Teacher Training Institute entitled “The Changing Face of North Dakota” cosponsored by the North Dakota Geographic Alliance and PPB in Dickinson, North Dakota.
- June 4–7, 2012: Participated in CMG simulation training entitled “2-Day History-Matching & Optimization (CMOST)” in Houston, Texas.
- June 10–15, 2012: Participated in the CSLF Meetings of the Technical Group and Technical Workshop in Bergen, Norway.
- June 14 and 27, 2012: Visited the Phase II lignite field validation test site to check on site closure and reclamation status near Kenmare, North Dakota.
- June 15–26, 2012: Traveled to the Bell Creek Field to visit landowners and conduct Event 3 groundwater, soil gas, and surface water sampling in southeastern Montana.
- June 18–21, 2012: Presented at the CMG Technical Symposium in Calgary, Alberta, Canada.
- June 18–22, 2012: Participated in the IEAGHG 2nd Network Meeting in Santa Fe, New Mexico.

- June 22–28, 2012: Participated in the ISRM–ARMA Workshop on Petroleum Geomechanics Testing and the 46th ARMA Symposium in Chicago, Illinois.
- June 26–29, 2012: Presented at the CFE/APEC Workshop, Introducing CCS in Earth Sciences in Mexico City, Mexico.

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