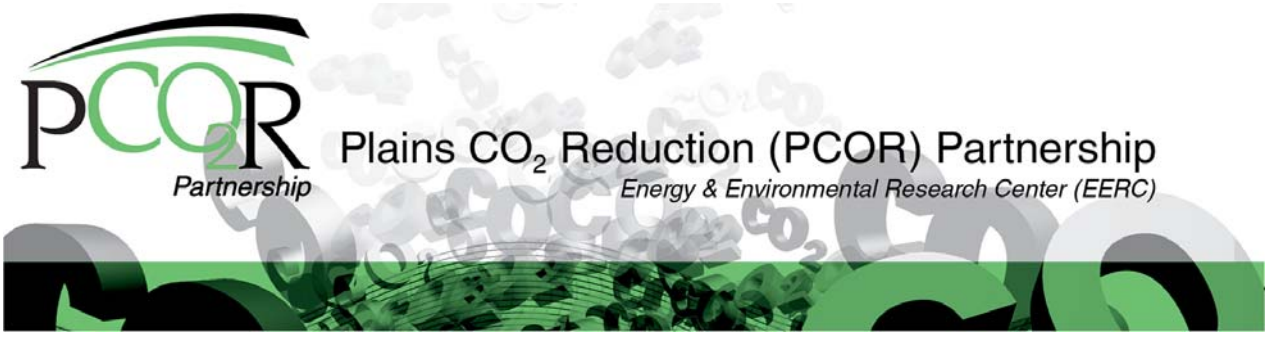

DEMONSTRATION PROJECT REPORTING SYSTEM (DPRS) UPDATE

Plains CO_2 Reduction Partnership Phase III
Task 1 – Deliverable D10

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DEMONSTRATION PROJECT REPORTING SYSTEM (DPRS) UPDATE

INTRODUCTION

The Plains CO_2 Reduction (PCOR) Partnership, led by the Energy & Environmental Research Center (EERC), is performing two demonstration projects focusing on the injection of carbon dioxide (CO_2) into deep geologic formations for the purpose CO_2 capture and long-term storage. These demonstration projects, known as Bell Creek and Fort Nelson, are part of the PCOR Partnership's Phase III activities under the U.S. Department of Energy (DOE) National Energy Technology Laboratory Regional Carbon Sequestration Partnership (RCSP) framework.

The Bell Creek project involves the injection of CO_2 into the Bell Creek oil field in southeastern Montana for the dual purpose of CO_2 storage and enhanced oil recovery (EOR).

The Fort Nelson project will involve monitoring, verification, and accounting (MVA) support for the injection of CO_2 into a saline formation in British Columbia, Canada, captured from one of the largest gas-processing plants in North America.

To provide updates to DOE and partners on the progress of the Bell Creek and Fort Nelson projects, approved information (e.g., reports, summaries, tables, maps, etc.) is posted to a DPRS within the password-secured area of the PCOR Partnership's Decision Support System (DSS, ©2007–2012 EERC Foundation®) – a database-driven, password-protected Web site containing both traditional static pages and an interactive geographic information system (GIS).

CURRENT DPRS LAYOUT AND DESCRIPTION

In the previous DPRS update report, dated March 2011, a description of the planned layout and content of the DPRS was provided. As presented in the previous report, the DPRS navigation structure for the Bell Creek and Fort Nelson demonstration projects is as follows:

- **Scope of Work**. This section describes the objectives of the demonstration project and provides basic information about the effort.

- **Benefits to the Region**. This section includes materials and discussion on how the individual demonstration projects fit into the broader context of carbon capture and storage (CCS) within the PCOR Partnership region.

- **Characterization Data**. This section includes subsurface information on geologic characteristics, overlying seal(s) and formations, and formation storage injectivity and capacity.

- **Modeling**. Modeling activities will feed into the MVA and risk management components of project development. Approved results of modeling runs and the input parameters are provided in this section.

- **MVA**. Data in this category include information on the MVA techniques being employed at the sites. As the MVA activities mature, this area will contain summaries of monitoring results and interpretations.

- **Risk Management**. An integrated risk management concept is central to the PCOR Partnership approach to the demonstration projects. Discussion and products related to this concept are housed in this section.

- **Permitting**. This section includes discussions on how regulatory and permitting issues were addressed at the two demonstration sites.

- **Site Operations**. Material pertinent to how the site is operating, including injection rates and cumulative injection data, is included in this section, which also includes information on the transportation of the CO_2 to the site.

- **Products**. Topical reports, final reports, posters, presentations, and fact sheets directly related to the demonstration project are accessible in this portion of the DPRS. Programming allows for a dynamic link to the DSS Products Database, which houses all PCOR Partnership products. At the time of this writing, the Products Database contained 29 and 31 products related to the Bell Creek and Fort Nelson demonstration projects, respectively.

The DPRS content proposed in the March 2011 update report has been developed and is currently operational on the DPRS Web site.

PLANNED DPRS ADDITIONS

As the Bell Creek and Fort Nelson demonstration projects progress, new information, once approved for public exhibit, will be added.

Current and planned activities for the Bell Creek demonstration project involve the development of the MVA protocol, baseline sampling at the site, and other initial site operations such as observation well installation. Therefore, these two sections of the Bell Creek

demonstration project Web site (MVA and site operations) will be most dynamic, with new information being added each quarter. Planned additions, if any, to the Fort Nelson demonstration project Web site over the next quarter will be in the MVA section.

Appendix A contains information related to the planned additions to the DPRS during the next quarter. Currently, this includes a thorough description of recent site operations, including installation of an observation well, coring and logging activities, downhole monitoring, and data analysis.

APPENDIX A

INFORMATION RELATED TO PLANNED DPRS ADDITIONS

EERC BS45431.CDR

WELCOME PCOR PARTNERSHIP MEMBER

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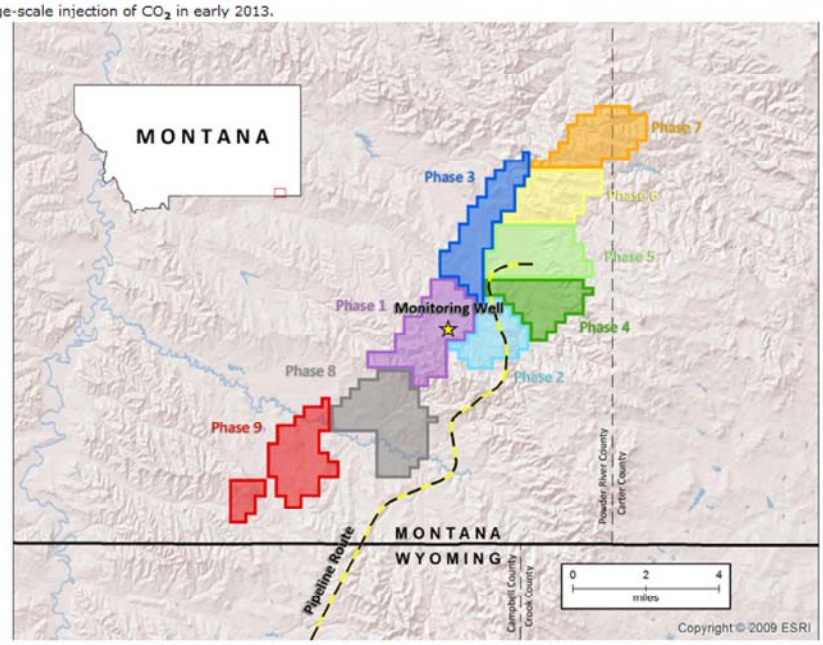
Site Operations

The commercial CO_2 enhanced oil recovery (EOR) project has nine phases. Each phase involves preparing selected wells for CO_2 injection, which includes running feeder pipe to carry CO_2, installing compressors, and building a facility to separate dissolved CO_2 from the produced oil.

The Bell Creek project is currently in the infrastructure development and baseline characterization phase, with the bulk of the PCOR Partnership activities focusing on baseline characterization, modeling, risk assessment, and monitoring, verification, and accounting (MVA) baseline data acquisition. Denbury is currently in the process of constructing a pipeline from the ConocoPhillips Lost Cabin natural gas-processing plant to the Bell Creek oil field. The project is scheduled to begin large-scale injection of CO_2 in early 2013.



The project has nine phases. Each phase focuses on a different area.

Observational Well

In order to meet both PCOR Partnership and Denbury project objectives, a new observation well was drilled in January 2012 between injection and production wells in the portion of the field that will first undergo CO_2 EOR operations in early 2013. The positioning of the well allowed for the collection of a modern, robust data set to enhance ongoing geologic characterization activities and will provide access for a downhole monitoring program that will not interfere with oilfield operations.

Web page continues.

Coring Operations

An extensive coring and well-logging program was conducted at the observation well to provide critical data for geologic characterization and predictive simulation efforts. Data and samples collected during drilling operations provide critical information to evaluate how fluids will move and interact with the reservoir during CO_2 injection.

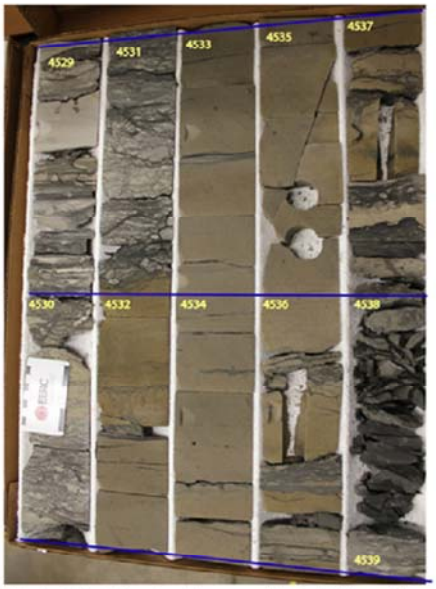
The Capstar 314 drilling rig.

In total, 110 feet of 4-inch-diameter core was recovered along with forty-seven 1½-inch-diameter side wall core plugs. The wireline-conveyed sidewall cores were recovered at half-foot intervals over the majority of the Muddy sandstone interval in order to provide a quick turnaround analysis of critical rock properties and chemical testing. The full-diameter core is largely continuous and represents a portion of the Mowry shale (upper confining unit), the Muddy sandstone (reservoir unit targeted for CO_2 EOR operations), and the Skull Creek shale (lower confining unit). A spectral gamma ray log was run on the full-diameter core after retrieval, allowing for precise correlation with the wireline log suite. A tracer was added to the drilling mud prior to coring operations to determine fluid invasion into the core during recovery to better estimate native oil and water saturations present in the formation.

The core material is being analyzed to gain geologic and geomechanical insight into the reservoir and sealing formations. Sealing formations are being investigated to determine the effectiveness of the confining units to contain CO_2 during and after injection. The reservoir portion of the core is being investigated to garner key properties for characterization efforts and to determine how the reservoir and fluids will interact during CO_2 injection.

Ongoing core analysis includes the following:

- Thin-section petrographics
- X-ray diffraction, x-ray fluorescence, and scanning electron microscopy work
- Porosity
- Permeability
- Bulk density
- Grain density
- SCAL work



This photo illustrates a transition zone within the Muddy sandstone. The slabbed core allows for stratigraphy and facies description throughout the cored interval.

A Baker Inteq coring specialist removing a piece of full diameter core from the core barrel at the 0506 OW well site.

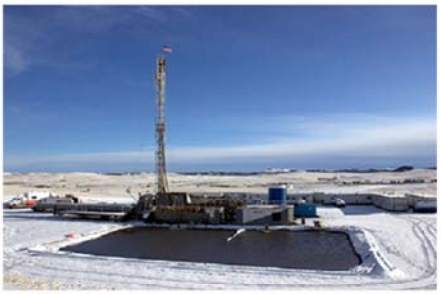
The initial core-testing results will be used to select intervals of interest for further special core analysis (SCAL) such as three-phase relative permeability to gas, oil, and water; threshold entry pressure; geomechanical testing; and uniaxial pore volume compressibility work. SCAL testing will provide additional insight into advanced geomechanical and reservoir properties associated with the dynamic reservoir and cap rock for reservoir fluid flow and geomechanical simulation activities.

Web page continues.

Logging Operations

Once drilling operations were completed, a comprehensive logging and pressure test program was conducted, providing a robust data set through the Muddy Formation and surrounding strata.

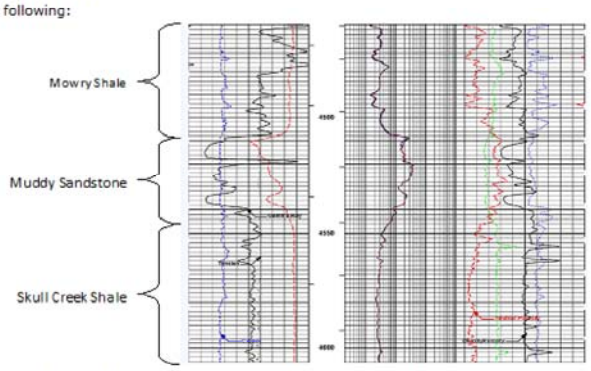
The new high-resolution suite of well logs acquired is being used to supplement and calibrate the hundreds of vintage well logs available throughout the field (the majority of which were collected in the late 1960s and early 1970s) and will provide new types of data and resolution that were previously unavailable.



Halliburton logging trucks collecting log data from the 0506 OW well.

Several geophysical logs were acquired to supplement geologic characterization and geomechanical modeling efforts throughout the field, including the following:

- Gamma ray
- Induction resistivity
- Bulk density
- Neutron porosity
- Spontaneous potential
- Magnetic resonance
- Electrical borehole imaging
- Dielectric
- Capture spectroscopy
- Spectral gamma ray
- Dipole sonic



Triple combo log (gamma ray, spontaneous potential, induction resistivity, density, and neutron porosity) over the Muddy Formation and surrounding strata collected during logging operations at the 0506 OW well.

During logging operations, wireline-conveyed pressure tests were conducted throughout the Muddy interval to determine pressure distributions and connectivity in overlying formations, and to evaluate strata that could be utilized to monitor for out-of-zone fluid migration. The pressure tests indicated isolation may exist between various portions of the Muddy sandstone in the vicinity of the observation well. These new data will allow geologic characterization and simulation activities to account for how potential isolation can affect fluid flow during CO_2 injection. Indications of low permeability were also observed in all tested overlying strata, which further supports the ability of the Bell Creek oil field to safely store and contain CO_2.

Permanent Downhole Monitoring

Permanent downhole monitoring (PDM) equipment consisting of three casing-conveyed pressure and temperature gauges and a fiber optic distributed temperature system from total depth (TD) to surface was installed in the new observation well. The pressure/temperature gauges, connected to a capillary line, were mounted to the outside of the well casing along with a directional perforating charge. Once the system was cemented in place, a hydraulic firing head was activated to fire the perforating charge, opening a pathway through the capillary line, the cement sheath, and into the formation without damaging the integrity of the casing.

Web page continues.

Promore, Qorex, and BMP engineers attaching a centralizer to the casing to protect capillary lines and the multiconductor cable which provides data transmission between the PDM equipment and the wellhead.

The three pressure/temperature gauges were deployed to provide a point measurement of pressure and temperature data in two potentially isolated zones of the Muddy Formation (injection target) and one-point measurement in an overlying zone approximately 400 feet above the target injection formation.

The two gauges deployed in the reservoir will provide downhole pressure correlation data during the CO_2 EOR flood. The upper pressure gauge was placed in an overlying zone of permeability to monitor for out-of-zone fluid migrations into overlying strata.

The PDM equipment will be tied into a remote data transmission system and uploaded for remote viewing by both Denbury and Energy & Environmental Research Center personnel. The combination of pressure and temperature data provided by the PDM system will aid in determination of the phase and miscibility of CO_2 in the formation fluids, while real-time monitoring will allow for immediate detections of pressure anomalies, changes in injectivity, periodic updating and history matching of modeling and simulation results, and the ability to monitor and correlate reservoir response to the injection process. It is anticipated that the PDM system will also provide an indication of CO_2 intersection with the monitoring wellbore that, when combined with simulation predictions, will ensure that other downhole monitoring technologies will be deployed at optimal time steps during the injection process in order to maximize the knowledge gained during each deployment.

Schlumberger perforating specialists arm the casing-conveyed perforating charges on the PDM system.

Promore engineer connecting a pressure/temperature gauge to the casing-conveyed PDM system on the rig floor.

Web page continues.

Data Analysis

Initial analysis of the data collected is currently under way, and results are being utilized to update characterization, modeling, predictive simulation, and guide the monitoring program in preparation for CO_2 injection in early 2013. There are only a handful of carbon capture and storage (CCS) sites operating in the world, and only a few of those sites have a dedicated monitoring well with the robust data set and diverse monitoring capability available at Bell Creek. The 0506 OW well and the Bell Creek combined CO_2 EOR and CO_2 storage project provide a unique opportunity to advance the knowledge of CCS and EOR operations and monitoring practices.

Offset well to the south of the observation well pad. The pump jack will be dismantled in preparation of EOR operations.

Well log and core analysis data are being used to calibrate historic data sets available throughout the field. Once calibrated, these data sets will be integrated into an updated geologic characterization model.

Over the next year, a pulsed neutron well log, a 3-D surface seismic, and a VSP survey will be conducted to provide key characterization data and a baseline data set for later time-lapse evaluation of CO_2 saturations and migration pathways in the near and intermediate wellbore environments.

Public Outreach

Drilling and completion activities were filmed by both Prairie Public Broadcasting and Plains CO_2 Reduction Partnership personnel in anticipation of an upcoming Bell Creek documentary.

Film crew gathers footage for the documentary.

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