

**Status Report on Oil and Gas Research Program Ongoing Research Projects**  
**January 10, 2008**

**Plains CO<sub>2</sub> Reduction Partnership Program – Phase II**  
**Contract No. G-05-014**

This is a project submitted by the Energy and Environmental Research Center. Total value of the project is \$21,487,892 with \$500,000 provided from the Oil and Gas Research Fund. Phase II of the CO<sub>2</sub> Plains Reduction Partnership will include, among other tasks, field-based demonstration projects that focus on injecting CO<sub>2</sub> into geologic formations for the dual purpose of CO<sub>2</sub> sequestration and enhanced hydrocarbon production. The primary objectives of these activities are twofold: 1) to develop data sets that verify the ability of the target formations to store CO<sub>2</sub> and produce hydrocarbons and 2) to develop a mechanism by which carbon credits can be monetized for CO<sub>2</sub> sequestered in geologic formations.

March 1, 2006

Contract signed. A report for the work done through December 31, 2005 has been received. Development of the NEPA document for the Beaver Lodge Field validation test has been initiated. Literature search for documents and data specifically related to the Beaver Lodge Field and development of an experimental design package for the Beaver Lodge Field validation test have been initiated. In regards to the Zama Demonstration Field Validation Test, the draft Experimental Design Package has been completed and is in review. Subcontractors have been obtained and contract negotiations are under way. Baseline fluid samples are being collected for initial characterization work and injection of acid gas is scheduled for February or March.

November 20, 2006

Two quarterly reports have been received for the work completed from January 1, 2006 through September 30, 2006. Work continued on the NEPA documents for the Beaver Lodge Field validation test. Meetings were held with Amerada Hess to resolve details on preliminary information needed for the NEPA documentation. Additional work was done developing a detailed geologic characterization of an area in central North Dakota for the purpose of geologic sequestration of CO<sub>2</sub> from coal-fired power plants in the area. In regards to the Zama Demonstration Field Validation Test, work has focused on meeting preinjection deliverables. The project team has focused their attention on characterization activities related to the injection zone. That has included incorporating data sets from existing sources and creating data where available. The primary focus has been the creation of maps to better describe the geological environment. Testing of core and fluids has begun in order to determine properties that will indicate the reactivity of the system when acid gas is introduced.

April 10, 2007

Regular quarterly reports have been received. Dave Fischer will be providing a more detailed update on this project. The PCOR field validation activities concerned with acid gas injection at Zama field in Alberta have recently been recognized for excellence by the International Carbon Sequestration Leadership Forum. The draft experimental design package has been prepared by the EERC and presented to the field Operator for approval for the Beaver Lodge Field Test in Williams County. The date to begin field activities has yet to be announced by the Operator. The Lignite Field Test in Ward County is scheduled to begin the second quarter of 2007. Five wells, one central producer/injector with four observation wells to be drilled. The

center well will core what is considered the primary lignite seam. The center well will be cased and perforated prior to production testing. Monitoring of reservoir will be conducted in the four observation wells. After a lengthy (possibly longer than 1 year) dewatering/production test, CO<sub>2</sub> will be injected into the center well while monitoring continues in the observation wells.

June 26, 2007

The Contractor will be making a presentation to the Council at their June 26, 2007 meeting. A copy of the presentation can be found at <http://www.nd.gov/ndic/ogrp/info/g-005-014-eerc.pdf>. A letter has been sent on behalf of the Council reflecting the Council's support and potential funding of up to \$250,000 per year for the first two years of the Phase III effort.

January 10, 2008

The Contractor has continued to provide regular reports on the PCORP project. The semiannual technical progress report for the period April 1 – September 30, 2007 is posted on the Oil and Gas Research Council website. During this time period significant progress was made in both the field validation test tasks (Tasks 2-5) and in the supporting tasks (Tasks 1, 6–10). Significant progress has been made at the Zama Field Validation Test site with the implementation of a solid monitoring, mitigation and verification (MMV) program. The official start-up of the 100/01-13-116-6W6 acid gas injector on the Zama Keg River F Pool was December 17, 2006. Preparatory work for the Williston Basin Oil Field Validation Test is ongoing, and significant progress has been made gathering baseline information on Williston Basin oil fields to identify candidate fields to host the injection and MMV activities. Progress in the Lignite Field Validation Test includes procuring the necessary permits and developing commercial partners. During the period April 1 – September 30, 2007, the Lignite Field Validation Test completed drilling a five-spot CO<sub>2</sub> injection and monitoring pattern. The preliminary logs and coring data are currently being reviewed and analyzed. The drilling prognosis has been completed. Initial work on the carbon sequestration program brochure and the detailed fact sheet for investors is under way. Regional characterization continues, and the Decision Support System (DSS) continues to evolve and improve. The regulatory, outreach and program integration tasks are continuing to meet program goals.

The Council will be considered funding for Phase III of this project at their January 10, 2008 meeting.

**Cretaceous Gas/Shale-Gas Expansion**  
**Contract No. G-05-016**

This is a project submitted by Continental Resources. Total cost of the project is \$630,120 with \$186,120 provided from the Oil and Gas Research Fund. The purpose of this project is to provide information on how the use of newer well logging technologies could expand current North Dakota shallow gas production and generate interest in Cretaceous gas prospects statewide. The intent of the project is to develop a well logging template to be utilized throughout the state to help in identifying shallow Cretaceous gas reservoirs. The duration of this project is 12 months.

November 20, 2006

The contract has been signed. The first status report was received. Four wells have been drilled through the Eagle Formation. (Only two wells were anticipated under the grant.) Two

wells were drilled in the southern portion and two were drilled in the northern portion of the Cedar Hills North Unit. As of the end of August, 2006, two of the wells were completed. Portions of the core is being analyzed to determine gas desorption isotherms. Analysis is also being done on the logs to be incorporated with the core data as it becomes available. All the data has been obtained and is now waiting for analysis. Anticipate next report before the end of the year.

April 10, 2007

Dave Fischer will be providing a more detailed report at the meeting. Four wells were drilled and tested. One well was cored – Rosenthal 1-27. Modern log suite was run for comparison to core and production data. All four wells were fracture treated. Production test results show high water production and small gas volumes; uneconomical unless dewatering works. Ongoing activities include incorporation of the TICORA final analytical results; development and finalization of a log template; performance of numerical simulation to evaluate dewatering economics and putting wells on artificial lift for further field evaluation.

June 26, 2007

Dave Fischer provided the following report at the June 26, 2007 meeting: CRI continues to make progress on the project. Core work, including description, x-ray diffraction analysis, P & K data; TOC measurements; gas isotherm data, etc. has been completed. A complete core report is available in the NDIC well file (#16103). CRI has completed work on a formula adjusting log measured gas content to the gas content measured from the core. From the core description and photos there may have been some unexpected lithological changes in the section. At present the four project wells have been completed, but are not on-line. Initial production tests resulted in only minor gas production with water. The wells will need to be pumped down prior to any final production evaluation and before CRI can compare production rates to core and well log data. CRI would like to extend the time frame of this project to allow for a more complete evaluation of the wells drilled. An extension would allow CRI to ‘fine tune’ the results of the project and potentially create a more realistic and usable template.

January 10, 2008

The Contractor has not requested an extension for this project and no further reports have been filed.

**Polymer Gel Treatment: A Remediation for Produced Waters**

**Contract No. G-08-017**

This is a project submitted by Aeon Energy Corp. Total cost of the project is \$101,000 with \$50,500 provided from the Oil and Gas Research Fund. The purpose of this project is to test the viability of a chemical polymer gel treatment to reduce the volume of produced water from marginally economic wells. Aeon Energy had requested funding to test two wells. The Council authorized funding for testing on one well. The duration of the project is 4 months.

November 20, 2006

The polymer treatment by Aeon Energy began 11/1/06 and was completed 11/4/06. Production prior to the treatment was measured at 1 BOPD with 600 BWPD. A total of 2,412 barrels of polymer were pumped. Although the results of the project are yet to be determined through production, there were some indications that the procedure may have some effect based on

'bled off' tests conducted during the process. The well is currently shut-in prior to the beginning of production testing.

April 10, 2007

Dave Fischer will be providing a more detailed report at the meeting along with his recommendations. Treatment is completed; testing is continuing, results do not look encouraging. February production rates were 3 BO & 2710 BW for 5 days of production. Tiorco has recommended at least 4 months of production prior to assessment. Tiorco believes the produced water is associated with draining the area of the reservoir that has been swept (coned).

June 26, 2007

Dave Fischer provided the following report at the June 26, 2007 meeting. Treated a well with high water production with a polymer gel to reduce the water production. At the time of treatment the well was producing <1 BOPD and >600 BWPD. After treatment and 6+ months of testing the well continue to produce excessive amounts of water (>600 BWPD). There is some indication that the polymer treatment did have a positive affect on the reservoir. Prior to the treatment the fluid level in the well was to the surface and could not be 'pumped down'. After the treatment, with the same equipment, the fluid level dropped to between 1400' – 1500'. After treatment the well did begin to make small amounts of gas, where there was none before. Aeon is currently waiting on a reply from Tiorco to see if they have any other suggestions for producing the well. The OGRC should consider participating in a 'post-mortem' to help determine what went wrong. The OGRC may need to seek another well to test this concept.

January 10, 2008

Aeon continues to wait for a reply from Tiorco. Final report has not been filed.

**Surface Tiltmeter Study of a Bakken Fracture Stimulation**  
**Contract No. G-07-020**

This is a project submitted by Marathon Oil Company. Total cost of the project is \$240,000 with \$120,000 to be provided from the Oil and Gas Research Fund. The objective of this project is to conduct a surface tiltmeter study of a fracture stimulation on a well in Dunn County. A surface tiltmeter study consists of burying an array of highly sensitive levels, called tiltmeters, in the ground around the target well. These tiltmeters measure minute deflections in the earth's surface that occur during the fracture stimulation. Data from the array will be processed in order to reveal the orientation of the fracture created during the stimulation. This information will allow for better well designs, which will enhance the economic viability of the Bakken play. The final report from this project will be held confidential until June 30, 2008. Marathon will make available preliminary general study results in September, 2007.

April 10, 2007

Because of the delay in drilling the well Marathon Oil Company suggested we delay entering into a contract until closer to the drilling date. A contract should be executed shortly. It is anticipated that the well will spud shortly if it has not already done so the first week of April. Marathon has indicated they will make every attempt to have some results in 2007.

June 26, 2007

The contractor, Marathon Oil Company, provided an update on this project at the June 26, 2007 meeting. Marathon will provide a summary of any results that are available at the time of the September ND Petroleum Council meeting.

January 10, 2008

*The final report has been received and will be released after June 30, 2008.* Marathon did provide preliminary general study results at the North Dakota Petroleum Council meeting held on September 20, 2007. A copy of their presentation is available at <http://www.nd.gov/ndic/ogrp/info/g-007-020-021.pdf>

**Vertical Seismic Profiling Test of Seismic Fault and Fracture Detection  
in the Bakken Formation  
Contract No. G-07-021**

This is a project submitted by Marathon Oil Company. Total cost of the project is \$300,000 with \$150,000 to be provided from the Oil and Gas Research Fund. The objective of this project is to conduct a vertical seismic profile (VSP) in a well in Dunn County. A VSP study consists of recording seismic data in the vertical portion of the well from the Bakken level up to thousands of feet uphole. The seismic signal is generated by a surface seismic source (Vibroseis) at one or more locations above the lateral portion of the well. The high resolution seismic image can be correlated to observations in the well and demonstrate the detectability of fractures and faults by the seismic method. This VSP data, along with other well data, will provide the basis for testing the viability of using 3D seismic for fracture and fault detection in the Bakken. This information will allow for better well designs, which will enhance the economic viability of the Bakken play. The results from this project will be held confidential until August 1, 2008.

April 10, 2007

Because of the delay in drilling the well Marathon Oil Company suggested we delay entering into a contract until closer to the drilling date. A contract should be executed shortly. It is anticipated that the well will spud shortly if it has not already done so the first week of April. Marathon has indicated they will make every attempt to have some results in 2007.

June 26, 2007

The contractor, Marathon Oil Company, provided an update on this project at the June 26, 2007 meeting. Marathon ran the vertical seismic profile in its Klatt 31-14H well (Dunn County, ND) in early May 2007. The job went very smoothly with no operational difficulties. Additionally, the data quality on the job is good. The results from the processing of the data have come in and the subsequent interpretations will follow.

January 10, 2008

*The final report has been received and will be released after August 1, 2008.* Marathon did provide preliminary general study results at the North Dakota Petroleum Council meeting held on September 20, 2007. A copy of their presentation is available at <http://www.nd.gov/ndic/ogrp/info/g-007-020-021.pdf>

**Energy and Transmission Needs Study on North Dakota Oil Development**  
**Contract No. G-012-023**

This is a project submitted by Basin Electric Power Cooperative. Total cost of the project is \$201,600 with the Oil and Gas Research Council providing \$49,000. The overall objective of the proposed project is to perform an analysis of oil development activities in the Williston Basin and to determine the implications these activities may hold for power demand and power delivery. The analysis will evaluate oil drilling plans, develop oil pumping load curves for major formations of the Williston Basin, analyze oil recovery techniques, determine pipeline capacity, outline major environmental issues and identify other potential oil development.

June 26, 2007

When the Council recommended approval of the project they had suggested certain reporting requirements. The Industrial Commission approved those conditions. However, Basin Electric Power Cooperative, because of confidentiality agreements, could not provide the data in the format suggested by the Council and Commission. The Commission and Basin are continuing to negotiate the reporting format of the data. A contract has not yet been agreed upon.

January 10, 2008

An agreement was reached with the condition that the breakdown of the information by region for the State of North Dakota be held confidential until July 16, 2008. The final report has been received and a summary has been posted on the OGRC website. A presentation is being made by Basin Electric Power Cooperative at the January 10, 2008 Oil and Gas Research Council meeting. After that presentation final payment will be made to the contractor. *The breakdown of information by region for the State of North Dakota will be released after July 16, 2008.*

**Identification of a Shallow Gas Source System in**  
**Southwestern Steele County, North Dakota**  
**Contract No. G-013-024**

This is a project submitted by Fischer Oil & Gas, Inc. for the May 1, 2007 grant round. Total cost of the project is \$30,200 with \$15,100 provided from the Oil and Gas Research Fund. The purpose of this project is to identify a shallow gas source system in southwestern Steele County. This will be accomplished by collecting water and gas samples from a NDWC well that has some measurable gas at the water-atmosphere interface and then having the gas samples analyzed to determine source type; water will be incubated to determine if gas is currently being generated and to culture gas producing methanogens.

January 10, 2008

The November 1, 2007 status report has been received and posted on the OGRC website. The field activities took place during the week of September 3, 2007. Data collected during this phase of the project returned results that were inconsistent with previous field work. Lower than anticipated FID response was measured in the focus well, as well as other, older observation wells in the area. The inconsistent results obtained in the focus well resulted in the following decisions. It was decided to cap the wellhead for 12 hours with a plastic membrane and test the FID response well again the following morning. The FID response 12 hours later showed that some methanogens were present and the system was active. It was also decided that it would be imprudent to collect water samples for the incubation at this time.

The variations of measurable methane in shallow groundwater observed during this phase of the project may indicate a more dynamic and subsequently more sensitive system associated with shallow methane generation. Additional field screening of selected wells in southeastern Stutsman County also showed a suppression of detected gas concentrations, similar to what was found in the wells in Steele County. However, detected gas concentrations also were shown to have increased in several other wells tested. This further supports the conclusion that these ultra-shallow gas systems are likely to be sensitive and respond to changes in system conditions.

The investigators request that the timeline of the project be extended and the scope of the project be modified. With the approval of the NDSWC, we propose to shut-in a series of observation wells in southwestern Steele County, including the focus well. Wells would be shut-in with a removable cap designed to collect gas samples at the wellhead through a valve. The cap would also include a port that would allow for testing at the water atmosphere interface. The wells would then be monitored, on a schedule to be determined, for a minimum of two years. Data collected through this process should give valuable insight into the dynamic nature of methanogenesis. During this time frame, should background methane levels significantly increase in the focus well, as will be indicated by continued periodic monitoring, gas and water samples will be collected, analyzed, and the water samples collected incubated for methanogens. With the approval of this request by the NDOGRC, an amended proposal and budget will be prepared and submitted for approval.

**Surface Microseismic Study of a Bakken Fracture Stimulation**  
**Contract No. G-013-026**

This is a project submitted by Marathon Oil Company. Total cost of the project is \$310,000 with \$155,000 provided from the Oil and Gas Research Fund. The purpose of this project is to conduct a surface microseismic study of a hydraulic fracture stimulation of a middle Bakken well in Dunn County. The project is designed to identify the orientation of subsurface fractures created during the fracture stimulation of a well. Data gathered will be compared to data collected in a tiltmeter study during the fracture stimulation from a well, also in Dunn County. The tiltmeter study is also designed to identify the orientation of subsurface fractures created during the fracture stimulation of a well. The facies (rock type) of the middle Bakken in Dunn County is one of the most common if not the most common in North Dakota. Surface microseismic data is much less costly to collect than microseismic survey data collected from nearby observation well bores at depth. Success in data collection would prove the validity of the application, reducing the risk of using the technology in a larger area by other operators. *The results from this project will be held confidential until September 30, 2008.*

January 10, 2008

The draft final report has been received.

**Northwest Refining, Inc. Preliminary Engineering Feasibility Study**  
**Contract No. G-014-027**

This is a project submitted by Northwest Refining, Inc. Total cost of the project is \$80,000 with \$40,000 provided from the Oil and Gas Research Fund. The purpose of this preliminary feasibility engineering study is to explore all of the factors involved in the development, construction, and operation of a 50,000 bbl/day oil refinery in the Williston area. The duration

of this project is 4 months. In approving the funding for this project, the Industrial Commission accepted the recommendation of the Oil and Gas Research Council and included the following conditions:

That the preliminary feasibility engineering study include product logistics such as an assessment of the market for refined products in the region and an analysis of available product transportation infrastructure and costs of construction of pipeline infrastructure; a crude oil supply forecast over the anticipated operating life of the refinery; review of all the permitting processes including an analysis of emissions availability under the State's air emissions law; a timeline for the construction of a refinery; and cost estimates of different sized refineries

These conditions were agreed to and a contract has been executed with Northwest Refining, Inc. *The final report is to be released September 30, 2008.*

January 10, 2008

Three status reports have been received regarding this project. To date the following has been completed:

- Preliminary site evaluation was conducted by ENGlobal;
- Crude assays were obtained and a crude blend slate has been created composed of 31% Bakken, 29% Madison and 40% Red River B. A lab in Houston has been selected to perform tests on the chosen crude slate;
- A preliminary proposed process unit scheme has been developed;
- A preliminary block flow diagram has been developed for the preliminary proposed process unit scheme;
- Contacts have been made with pipeline companies in North Dakota and in surrounding states to determine what pipeline availability will be around 2010;
- If no pipeline availability is determined, then ENGlobal will provide an estimate to construct a new pipeline using a cost/mile for the region;
- It has been indicated that there is an adequate large local market for jet fuel but not for the gasoline and diesel products from a 50,000 bbl/day refinery;
- A market study is being expanded to determine if a 100,000 bbl/day refinery can be supported with increased marketing infrastructure.