

PRRC Review

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The Petroleum Recovery Research Center is a division of
the New Mexico Institute of Mining and Technology

New Projects for PRRC Researchers



The Southwest Regional Partnership on Carbon Sequestration recently launched their Phase II Project featuring three geologic and two terrestrial pilot tests.

The PRRC was recently awarded three new projects from the U.S. DOE through the National Energy Technology Laboratory (NETL) for energy-related studies.

Carbon Sequestration

“Southwest Regional Partnership on Carbon Sequestration, Phase II,” began October 2005. Dr. Brian McPherson, Dept. of Hydrology and Head of the PRRC Carbon Sequestration Group, is PI for this \$17.8 million, four-year project, of which \$2.3 will go to NMT as the lead organization.

The Southwest Regional Partnership on Carbon Sequestration comprises a diverse group of expert organizations specializing in carbon sequestration science and engineering, as well as economics, public policy and outreach. Industry partners include KinderMorgan, Burlington Resources, Resolute Natural Resources, and Advanced Resources International. The Southwest Partnership is one of seven Regional Carbon Sequestration Partnerships across the

US. chosen through a competitive solicitation by DOE under their Carbon Sequestration Research Program initiative. Partnerships are charged with the task of identifying CO₂ sources and potential sinks in their regions, and with the development of the infrastructure and framework for future deployment of sequestration technologies.

In Phase I, sequestration opportunities were ranked by proximity to sources and/or pipeline infrastructure in addition to economic, safety, risk mitigation potential, and other factors. Phase II will feature validation tests of the most promising sequestration technologies for the Southwest Region, including three geologic pilot tests and two terrestrial pilot test programs. The geologic pilots are located on the CO₂ pipeline infrastructure in the Southwest Region: the Aneth Field, Paradox basin; the San Juan Basin Coal Fairway; and the SACROC-Claytonville Fields, Permian Basin. In addition, a local terrestrial (riparian restoration) sequestration pilot, and a regional terrestrial sequestration pilot program focusing on improved terrestrial MMV methods and reporting approaches specific for the Southwest region are planned. These pilots are all planned to maximize the goals of the DOE Carbon Sequestration Roadmap.

The Kickoff Meeting of Phase II of this important project was held Dec. 15–16 at New Mexico Tech. On the first day, overviews of Phase I and Phase II were followed by more specific presentations on the working groups into which the Partnership is divided. On the second day, attendees participated in working group breakout sessions aimed at determining each group’s goals and tasks in the larger framework of the project, followed by panel discussion sessions within a matrix of questions/issues to gain feedback from the whole partnership and the public on the geologic projects. A CD of the Kickoff Meeting Presentations is available from the PRRC Publications Office (please phone 505-835-5406 or email lizb@prc.nmt.edu).

San Juan Basin Data

A PRRC research team led by PI Martha Cather of PRRC’s Industrial Services and Outreach Group (ISOG) was recently awarded a U.S. Department of Energy (DOE) research grant for approximately \$600,000 for their project, “Petrophysical Analysis and Geographic Information System for San Juan Basin Tight Gas Reservoirs.” This project entails the creation of a database system that compiles accumulated data from northwestern New Mexico’s San Juan Basin gas and oil wells.

The co-PIs are Tom Engler, PRRC Research Engineer and Associate Professor of Petroleum Engineering at NMT, and Robert Balch, Research Scientist and head of PRRC’s REACT Group.

This 24-month project will result in a database system that contains data on oil and gas wells in the San Juan Basin, as well as information about special core analyses performed on specific wells in the basin. The primary goal of this project is to increase the availability and ease of access to critical data on the Mesaverde and Dakota tight gas reservoirs of the San Juan Basin. A relational GIS will be created to archive this data and the information will be analyzed to fine-tune regional well log interpretations, improve pay zone recognition, determine permeability ratios, and analyze water chemistries and compatibilities within the study area.

This project started as a data recovery mission. Over the years, a large amount of paper data on the San Juan Basin has been collected and stored in a number of public repositories, including the New Mexico Bureau of Geology and Mineral Resources, another research division at New Mexico Tech. Researchers plan to compile this data into a useful and useable database.

This project is expected to have several positive impacts on SJB production. A significant increase in availability of critical information that producers can choose to utilize in their own work processes, such as regional permeability trends and ratios, will

Three Projects (cont'd)

help them make better decisions on placement of infill wells. Identifying and quantifying bypassed pay zones in existing wells should increase the rate of development and improve the efficiency of recovering natural gas from these low-permeability formations.

The project team is now assessing the status of San Juan Basin data available in the public domain, and asking industry and researchers what information would be most relevant and useful to have in the new database. The kickoff meeting for this project will take place in Farmington, in February 2006.

Nanotechnology Research

“Development of NanoCrystalline Doped-Ceramic Enabled Optical Fiber Sensors for “High Temperature In-Situ Monitoring of Fossil Fuel Gases,” U.S. DOE-NETL \$207,298 is a 12-month project that began in July 2005.

Hai Xiao, Assistant Professor of Electrical Engineering is PI and Junhang Dong, Associate Professor of Chemical Engineering is Co-PI. Both researchers are PRRC adjuncts in its Membrane Technology Group. Other co-PIs are at Arizona State University

In this project, researchers aim to create a low-cost, reliable, miniaturized gas sensor capable of fast, accurate, in-situ monitoring of gas composition in flue or hot gas streams in harsh environments. Currently available gas chemical sensors cannot withstand the hostile environment found in fossil fuel energy systems.

The resulting sensor will be one of many sensors developed using nanotechnology at New Mexico Tech. These sensors have recently attracted considerable interest because of their capability for in-situ monitoring, small size, immunity to electromagnetic interference, safety, remote operation, and survivability in extreme environments. These new types of sensors would be useful in many critical areas besides emission control and environmental pollutant monitoring: including food and water quality assurance, biological and medical analysis, and in homeland security for the detection of explosives.

(we gratefully acknowledge Shawna Carter of the New Mexico Tech Public Information Office for material in this article)



A number of successful PTTC workshops were held by the ISOG group during the past six months. There is also a new link to data on GO-TECH.

Introduction to Mining the Internet: Using Free GIS Data and Low Cost Software for the Oil and Gas Professional

Instructor: Dave Bickerstaff

Sept. 13, 2005, Midland TX

Sept. 15, 2005, Farmington NM

A hands-on computer class designed to introduce participants to the vast amounts of free GIS and petroleum-related data available on the Internet featured browsing and downloading data such as well spots, PLSS, water features, roads, DEMS, and topographic maps. Participants learned to use Manifold mapping software, loading and displaying data, and import/export and map projection options.

Hydrogen Sulfide: Issues and Answers

December 7, 2005

Farmington, New Mexico

This workshop addressed the presence of hydrogen sulfide as an evolving problem in the San Juan Basin, anywhere from a simple nuisance to a real headache. The BLM is considering some preliminary guidelines to operators dealing with this growing problem.

In this workshop, San Juan Basin operators were able learn more about the issues. Topics included the presence of H₂S in the San Juan Basin, likely causes of H₂S, management and mitigation in operations, safety, regulations, and some different treatment methods.

Presenters from BLM, OCD, and service companies discussed occurrence, regulation, safety procedures, and treatment strategies.

CO₂ Conference

Dec. 8–9, 2005, Midland, Texas

(SW PTTC is a co-sponsor of this annual event.)

This year's CO₂ flooding conference focused on the use of carbon dioxide for enhanced oil recovery, featuring theme sessions that examined current industry best practices in operations and reservoir management.

The event will also showcased the latest technologies, strategies and expertise in CO₂ flooding based on the 32 years of CO₂ injection in the Permian Basin and around the world. A field trip was offered during the conference to provide attendees with an on-site examination of EOR practices in use today.

Carbon Sequestration Phase II Kickoff Meeting

Dec. 15–16, 2005

Socorro, NM

(Co-sponsored by SW PTTC)

The Kickoff Meeting for this DOE-sponsored project presented an overview of Phase I and introduced the Phase II partnership and tasks. The second phase of this project will involve validation tests of the most promising sequestration technologies for the Southwest Region, including three geologic pilot tests and two terrestrial pilot test programs. Sites and technologies were evaluated in Phase I. (see story, page 1)

Corrosion Data New on GO-TECH

The GO-TECH website now has a link to “Corrosion Source,” an excellent web site for corrosion information of all types. This link is on GO-TECH's main page, at <http://www.octane.org>, under “Quick Picks.”

If you are interested in conference CDs or workshop materials, contact the PRRC Publications Office, 505-835-5406 or email lizb@prrc.nmt.edu to see what we have available.

Publications, Presentations

- Bai, B., Grigg, R., Liu, Y., and Zeng, Z.: "Adsorption and Desorption of a CO₂-Foam-Forming Surfactant onto Berea Sandstone," paper SPE 95920 presented at the 2005 SPE Annual Technical Conference and Exhibition, Dallas, Oct. 9–12.
- Buckley, J.S. and Fan, T.: "Crude Oil/Brine Interfacial Tensions," paper SCA 2005-01, presented at the 2005 SCA Symposium, Toronto, 21-25 Aug. (selected as best paper)
- Buckley, J.: "Wetting of Carbonates," presented at Schlumberger-Doll Research Center, Ridgefield, Conn, Sep. 27, 2005.
- Buckley, J.S.: "Crude Oil/Brine Interfacial Tensions; Wetting of Carbonates; Oil-Based Mud Effects on Wetting," presented at Total Research Center, Pau, France, 3 Oct 05.
- Buckley, J.S., Discussion leader (invited) for Session 1: "Fundamentals of Fluid Chemistry and Interfacial Phenomena," at SPE Forum: "Molecules on the Move: Physicochemical Effects on Multiphase Transport," Cascais, Portugal, Oct. 23–28, 2005.
- Dong, J., Li, L., Xiao, H., and Lee, R.: "Treating Coal-Bed Methane Produced Water for Beneficial Use by Reverse Osmosis through Zeolite Membranes," Ground Water Protection Council (GWPC) Annual Meeting, Portland, OR, September 24–28, 2005.
- Gu, X., Zhang, J., Dong, J., and Nenoff, T.: "A Platinum-Cobalt-Loaded NaY Zeolite Membrane for Nonoxidative Conversion of Methane to Higher Hydrocarbons and Hydrogen," *Catal. Lett.*, **102**, 1-2 (2005), 9–13.
- Gu, X., Dong, J., and Nenoff, T.: "Synthesis of defect-free FAU-type zeolite membranes and separation for dry and moist CO₂/N₂ mixtures," *Ind.Eng. Chem. Res.*, **44**(2005), 937–944.
- Hui, J., Li, L., Zhang, J., Luo, M., Dong, J., and Xiao, H.: "Investigations on Adsorption-Dependent Optical Thickness Changes of Molecular Sieve Zeolite Thin Films for Chemical Sensor Development," presented at SPIE (the Intl. Soc. Opt. Eng.), Optics East, Boston, MA, Oct. 23–26, 2005.
- Hui, J., Li, L., Zhang, J., Luo, M., Xiao, H., Dong, J., and Normann, R.: "Measurement of the Adsorption-Dependent Optical Refractive Index for B-Oriented MFI Zeolite Films and Development of Zeolite-Fiber Integrated Optical Chemical Sensors," Pacificchem (Intl. Chem. Cong. of Pacific Basin Societies), Honolulu, Hawaii, Dec. 15–20, 2005.
- Kulkarni, A.: "Synthesis and Characterization of Heterophase Nanocrystalline Thin Film Electrolyte for Solid Oxide Fuel Cell," MS thesis, New Mexico Institute of Mining and Technology, Socorro, New Mexico (August 2005)
- Kulkarni, A., Bourandas, A., Xiao, H., Dong, J., and Fuierer, P.: "Nanocrystalline YSZ-SDC Heterophase Thin Films for Solid Oxide Fuel Cells and High Temperature Optical Gas Sensors," presented at Pacificchem (Intl. Chem. Cong. Of Pacific Basin Societies), Honolulu, Hawaii, December 15 -20, 2005.
- Li, L., "Molecular Sieve Zeolite Membranes and Microporous/Mesoporous Clay Membranes for Liquid and Gas Separations." PhD dissertation, New Mexico Institute of Mining and Technology, Socorro, New Mexico (July 2005)
- Monroe, J., Gu, X., and Dong, J.: "Synthesis of Pt/alpha-alumina and Pt/NaY Catalysts for Liquid Phase Conversion of Methanol to Hydrogen," presented at Pacificchem (Intl. Chem. Cong. of Pacific Basin Societies), Honolulu, Hawaii, Dec. 15–20, 2005.
- Murphy, M. "Advanced Oil Recovery Technologies for Improved Recovery from Slope Basin Clastic Reservoirs, Nash Draw Brushy Canyon Pool, Eddy County, NM," Final Technical Progress Report to U.S. DOE, Contract No. DE-FC-95BC14941 (Sep. 2005).
- Price, M., Dong, J., Gu, X., Speakman, S., Payzant, E., and Nenoff, T.: "Formation of YSZ-SDC Solid Solution in a Nanocrystalline Heterophase System and Its Effect on Electrical Conductivity," *J. Am Ceram. Soc.*, **88**, 7(2005), 1812–1818.
- Ruan, T., Balch, R., Schrader, S. and Hart, D.: "A Web-Based Fuzzy Ranking System and Application," presented at the 9th World Multiconference on Systemics, Cybernetics and Informatics, Orlando, July 10–13, 2005
- Ruan, T., Balch, R., and Schrader, S.: "A Fuzzy Expert System for Oil Prospecting in the Lower Brushy Canyon of Southeast New Mexico," presented at the 2005 IEEE International Conference on Information Reuse and Integration, Las Vegas, Aug. 15.
- Schrader, S., Balch, R., and Ruan, T.: "Knowledge Management, Collection and Storage in Expert System Development," presented at Upstream CIO, Sep. 2 2–24, 2005.
- Xiao, H., Zhang, J., Dong, J., Luo, M., Lee, R., and Romero, V.: "Synthesis of MFI Zeolite Films on Optical Fibers for Detection of Chemical Vapors," *Optics Letters*, **30**, 11(2005), 1270–1272.
- Xu, W: "Interface Definition and Generator for a Customizable FEE Tool," Masters Independent Study Report, Socorro, New Mexico, New Mexico Institute of Mining and Technology (August 2005).
- Zhang, J., Xiao, H., and Dong, J.: "Zeolite-Coated Optical Fiber Sensors for In-Situ Detection of Organics in Gas and Liquid Phases," SPIE (the Intl. Soc. Opt. Eng.), Optics East, Boston, Oct. 23–26, 2005.
- Zhang, J., Dong, J., Luo, M., Xiao, H., Murad, S., and Normann, R.: "Zeolite-Fiber Integrated Optical Chemical Sensors for Detection of Dissolved Organics in Water," *Langmuir*, **21** (2005), 8609-8612.
- Zhang, Y., Wang, J.X., Morrow, N.R., and Buckley, J.S.: "Effect of Synthetic Drilling Fluid Base Oils on Asphaltene Stability and Wetting in Sandstone Cores," *Energy & Fuels* (2005) **19**, 1412-1416.

SCA Best Paper 2005

Selected as the best paper at the 2005 Society of Core Analysts (SCA) symposium

Buckley, J.S. and Fan, T.: "Crude Oil/Brine Interfacial Tensions," paper SCA 2005-01, presented at the 2005 SCA Symposium, Toronto, 21-25 Aug.

The announcement is at <http://www.scaweb.org/>.

Abstract: We measured pendant drop interfacial tension (IFT) between forty crude oil samples and brines of known pH and ionic composition. We showed that there is more variability in IFT, even when the brine pH is near neutral, than is usually assumed for reservoir simulation purposes. Using our database of crude oil properties, we were able to relate the IFT results to chemical properties of the crude oils.

PRRC

Petroleum Recovery Research Center
A Division of New Mexico Tech

The PRRC is a state-supported center that conducts research designed to improve methods of recovering crude oil and natural gas and that transfers petroleum technology to domestic oil producers. Funding for the PRRC comes from three sources: the State of New Mexico, the federal government (Department of Energy), and private industry.

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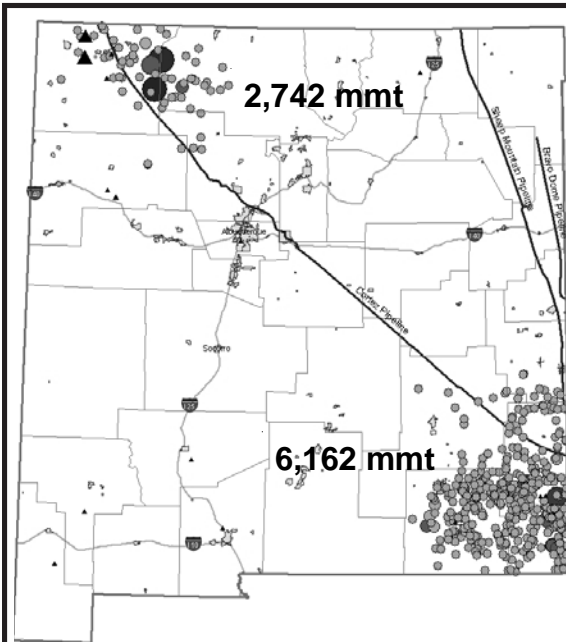
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New Mexico's CO₂ sequestration capacity is an estimated 8,904 MMT (million metric tons) for the state's geologic sinks: oil and gas pools, coalbed methane sinks, and deep saline aquifers, in the San Juan, Raton, and Permian Basins. CO₂ pipelines are also shown: Cortez, Sheep Mountain, and Bravo Dome. (Graphics and information courtesy of R.A. Benson, Sandia National Laboratory).

Petroleum Recovery Research Center
A Division of
New Mexico Institute of Mining and Technology
801 Leroy Place
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