

PRRC Review

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

SLO Data Now at GO-TECH



Many of New Mexico's oil and gas-producing areas are on state lands (Map created with ArcMap software from ESRI)

The New Mexico State Land Office (SLO) and New Mexico Tech have partnered to provide the public with information about oil and natural gas production, royalties and taxes on State lands. Data compiled on the ON-GARD computer system are now available on New Mexico Tech's GO-TECH website, along with additional screens relating to lessee and land status. Inquiries into leasing availability, contact information for surface lessees, lease rental amounts and due dates, and lessee of record for assignments are now easily obtained on the website.

Like the GO-TECH production data provided by the New Mexico Oil Conservation Division, this data is updated on a periodic basis and is usually current to within one to two weeks.

Data screens now available include land details (State leases present in a given section), lessee information, in-depth lease information, and operator listings.

Screens retrieve the requested data and provide hyperlinks to other pages, or where applicable, the GO-TECH production database. Additionally, the data can be converted to a printer-friendly version.

The SLO's own web site at (<http://www.nmstatelands.org>) offers additional useful information in the Mineral Resources section for oil and gas producers regarding state lands.

The State Land Commissioner, in a press release, identifies this new service as part of an ongoing effort to establish a more customer-friendly agency,

and one that will help the SLO to market state lands and generate more revenue (SLO press release, October 9, 2003).

PRRC's Industrial Services and Outreach Group leader Martha Cather notes, "The web site is already a good success. It has only been online since October, and quickly began to generate an average of 600 hits per day. We've had a lot of compliments from our users for the clean and easy-to-use interface."

Dr. John Heller, 1923-2003

Dr. John Heller, senior scientist emeritus at the PRRC, passed away on Dec. 1, 2003 at the age of 80. He was with the PRRC from 1979 until his retirement in 1994.

Dr. Heller's specialty was mobility control in CO₂ flooding and reservoir heterogeneities. He was also an adjunct professor in the Department of Petroleum and Natural Gas Engineering

Director Emeritus Dr. Joe Taber says, "He was a top scientist and a special individual, with an excellent background in the physics of oil recovery. He was a good mathematician with a knack for understanding complicated relationships and explaining them clearly to others. Whenever we had a tough technical question, John was the one we went to. He had a wonderful sense of humor, too, that we will all miss."



SOUTHWEST REGIONAL LEAD ORGANIZATION

PTTC gratefully acknowledges that its primary funding comes through the U.S. DOE's Office of Fossil Energy through the National Petroleum Technology Office (NPTO) and Strategic Center for Natural Gas (SCNG) within the National Energy Technology Laboratory (NETL)

FEE Tool Project Review Held in ABQ

The fifth Consortium Meeting and Project Review for the NPTO-sponsored project, "Risk Reduction with a Fuzzy Expert Exploration Tool," was held at the Wyndham Hotel in Albuquerque, October 29–30.

PI Robert Balch, co-PI Ron Broadhead of the NM BMGMR, Research Scientist Tongjun Ruan and Graduate Student Susan Schrader presented results of this year's research, which focused on the development and use of the beta Delaware FEE Tool, and the Devonian Expert system, currently under development.

The FEE Tool, interactive web-ready software, is now available as a public-domain exploration tool to evaluate drilling prospects in two major plays in southeast New Mexico. The FEE Tool was profiled in last summer's *PRRC Review* (Vol 18, No. 2) Demonstrations of the Delaware Basin FEE Tool were held this August (see PTTC column, this page).

Though trained on public domain information, the FEE Tool is set up so that users can add proprietary data, in a secure and confidential fashion, to modify the Expert system to their personal or corporate philosophies used to calculate drilling risks. In effect, users can customize this software to fit their own needs.

Permian Basin expert explorationists contributed their experience with the Delaware Basin in the development of the expert system. The considerable resources and expertise of the New Mexico Bureau of Geology and Mineral Resources also played an important role in the development of the software.

The FEE Tool software can be accessed at <http://ford.nmt.edu/>. A *User's Guide*

has been developed, which is a step by step instruction manual for use of the FEE Tool. Bound copies of the *User's Guide* (also available on the web site) and CDs of presentations are still available—contact PRRC Publication Office at 505-835-5406 or email lizb@prrc.nmt.edu. The Principal Investigator for this project, Dr. Robert Balch, can be contacted at 505-835-5305 or by email at balch@prrc.nmt.edu for more information about this project.



FEE Tool Workshop

A workshop on instructing users in Fuzzy Expert Exploration (FEE) Tool use was held on August 27 in Roswell. Producers were invited to participate in a half-day workshop for training on this easy-to-use Internet interface to databases and related useful software developed during the project, "Risk Reduction with a Fuzzy Expert Exploration (FEE) Tool," targeting the Lower Brushy Canyon formation in the Delaware Basin.

GO-TECH in Roswell

The SWRLO offered another half-day workshop on November 13 in Roswell on training in the use of GO-TECH, the electronic resource for New Mexico's oil and gas data. Several of these popular workshops were offered last spring in Artesia, Midland and Farmington. Participants learned how to navigate GO-TECH, the

premier oil and gas web site for New Mexico. The GO-TECH website is at (<http://octane.nmt.edu>) (see PRRC Review vol. 18, no. 2, Summer 2003 for more discussion of these GO-TECH workshops).

CO₂ in Midland

The SWRLO participated with the Permian Region Lead Organization of the PTTC in the ninth annual presentation of this big Permian Basin CO₂ event held in Midland, in "the heart of CO₂ flooding country," December 10-12. About 240 people attended the conference. Twelve countries were represented, with a total of 41 international attendees. Conference organizer Steve Melzer observes that the interest in this event suggests a growing and worldwide interest in CO₂ flooding

This year, the conference was preceded by a separately organized CO₂ sequestration (EOR Carbon Management) workshop on Tuesday, Dec. 9 with its own field trip to the Amerada Hess Seminole Plant facilities.

One hundred and two persons attended this workshop, devoted to the emerging industry of capturing industrially vented or anthropogenic CO₂ (I-CO₂), purifying, compressing and injecting into mature oil reservoirs to simultaneously sequester CO₂ and produce enhanced oil.

The CO₂ Flooding Conference began Dec 10 with a field trip, coordinated by the SWRLO, to Oxy Permian's new North Hobbs Flood, the largest flood implemented in recent years.

Thursday afternoon and Friday morning sessions featured overviews of CO₂ flood operations and pipeline systems, and case history presentations by industry practitioners.

CO₂ Sequestration Project Funded by U.S. DOE

In September 2003, the U.S. DOE selected New Mexico Tech as the lead management organization for the Southwest Regional Partnership for Carbon Sequestration, part of a newly formed nationwide network of universities, state agencies, and private companies tasked with studying the best approaches for capturing and permanently storing, or "sequestering," greenhouse gases that affect global climate change. Partnerships were selected from a number of proposals to the DOE in national competition last spring.

Dr. Robert Lee, Director of the PRRC, is the project manager and Dr. Brian McPherson, adjunct researcher at PRRC and Professor of Hydrology, is the Principal Investigator for the project. Other New Mexico Tech participants are the departments of Earth and Environmental Science, Materials Engineering,

and Petroleum and Chemical Engineering, and the New Mexico Bureau of Geology and Mineral Resources.

New Mexico Tech will be joined by the Western Governors Association (WGA) in coordinating the regional partnership, which is part of the federal initiative announced late last year by the U.S. Department of Energy (DOE) as a key component of President Bush's Global Climate Change research program.

Carbon sequestration (methods of removing carbon gases from the atmosphere and storing them in geologic formations, soils, or vegetation.) research at the DOE has become one of the highest priorities in the agency's energy research programs.

(with thanks to George Zamora, NM Tech Information Services)

Publications, Presentations

- Al-Maamari, R.S.H. and Buckley, J.S.: "Asphaltene Precipitation and Alteration of Wetting: The Potential for Wettability Changes during Oil Production," *SPE REE* (Aug. 2003) 210-214.
- Balch, R.S.: "The Devonian Expert System: Ideas for Today and Tomorrow," presented at "Reducing Exploration Risk with the Fuzzy Expert Exploration (FEE) Tool," project review, Albuquerque, Oct. 29-30, 2003.
- Balch, R.S.: "FEE Tool Verification," presented at "Reducing Exploration Risk with the Fuzzy Expert Exploration (FEE) Tool," project review, Albuquerque, Oct. 29-30, 2003.
- Balch, R.S.: "The Fuzzy Expert System Model," presented at "Reducing Exploration Risk with the Fuzzy Expert Exploration (FEE) Tool," project review, Albuquerque, Oct. 29-30, 2003.
- Balch, R.S.: "Reserve Estimation Using the FEE Tool," presented at "Reducing Exploration Risk with the Fuzzy Expert Exploration (FEE) Tool," project review, Albuquerque, Oct. 29-30, 2003.
- Balch, R. S. "Risk Reduction with a Fuzzy Expert Exploration Tool," Project update presented at the U.S.DOE NPTO, Tulsa August 7, 2003.
- Balch, R. S., "Risk Reduction with a Fuzzy Expert Exploration Tool," presented at the West Texas Geological Society Lunch Talk, Midland, September 9, 2003.
- Balch, R., and Broadhead, R.: "Risk Reduction with a Fuzzy Expert Exploration Tool," semiannual report, U.S. DOE Contract No. DE-AC26-99BC15218, April 16, 2003 through Oct. 14, 2003 (Oct. 2003).
- Balch, R.S., Ruan, T., and Schrader, S.: "Automating Basic Exploration Processes Using an Expert System: Applications to the Delaware Basin," West Texas Geological Society Annual Symposium, Midland, Texas, Oct. 9, 2003.
- Balch, R.S., Ruan, T., Weiss, W.W. and Schrader, S.: "Simulated Expert Interpretation of Regional Data to Predict Drilling Risk", paper SPE 84067 presented at the SPE ATCE, Denver, Oct. 4-8.
- Bethapudi, L.: "Comprehensive Literature Review of Foams and A Laboratory study of CO₂ Flowing in Indiana Limestone versus Flow Rates, Temperature and Stresses," Independent Masters Study, (2003) Socorro, New Mexico Institute of Mining and Technology.
- Broadhead, R.: "Brushy Canyon 2003," presented at "Reducing Exploration Risk with the Fuzzy Expert Exploration (FEE) Tool," project review, Albuquerque, Oct. 29-30, 2003.
- Broadhead, R.: "Geologic Characterization and Analysis: Siluro-Devonian Carbonates," presented at "Reducing Exploration Risk with the Fuzzy Expert Exploration (FEE) Tool," project review, Albuquerque, Oct. 29-30, 2003.
- Buckley, J.S. and Lord, D.L.: "Wettability and Morphology of Mica Surfaces after Exposure to Crude Oil," *J. Pet. Sci. Eng.* (2003) **39**, 261-273.
- Buckley, J.S., Skalli, L., Bryant, E., Wang, J.X., and Bowman R.: "Update on Surface Tests of Synthetic Oil-Based Mud Components," Technical Progress Report on "Wettability and Prediction of Oil Recovery from Reservoirs Developed with Modern Drilling and Completion Fluids," Contract No. DE-FC26-01BC15164, US DOE (PRRC Report 03-21, Nov. 2003).
- Buckley, J.: "Evaluation of Asphaltene Stability," presentation, Petrobras Research Center, Rio de Janeiro, Brazil, Sep 12, 2003
- Buckley, J.: "Asphaltene Stability in Crude Oil Mixtures," presentation, IS COP'03, Iguassu Falls, Brazil Sep 16-17, 2003
- Buckley, J.: "Overview of Wettability and SBM Studies," presentation, IFP, Rueil Malmaison, France Sep 19, 2003
- Buckley, J.: "Wetting Estimates from Crude Oil Chemical Properties SCA International Symposium," presentation, Pau, France, Sep 21-24, 2003
- Buckley, J.: "Overview of Wettability and Asphaltene Studies," presentation, Total, Pau, France, Sep 25, 2003
- Buckley, J.: "Asphaltene Stability in Crude Oil Mixtures," presentation, Shell, Amsterdam, The Netherlands, Sep 29, 2003
- Buckley, J.: "Wetting Estimates from Crude Oil Chemical Properties," presentation, Shell, Ryswijk, The Netherlands, Sep 30, 2003
- Buckley, J.: "SBM Project Update," presentation, Chemical Engineering Dept., University of Wyoming, Oct 10 2003.
- Buckley, J.: "Oil Spill Cleanup—Some Lessons from the Oilfield," presentation, NMT Hydrology Seminar, Nov. 10, 2003
- Buckley, J. and Wang, J.X.: "Evaluation of Asphaltene Stability," presentation, Chemical Engineering Dept., Colorado School of Mines, Oct 6, 2003
- Cather, M.: "NM WAIDS: A Produced Water Quality and Infrastructure GIS Database for New Mexico Oil Producers," Semiannual technical progress report, March 1, 2003 - Sep. 1, 2003 U.S. DOE Contract No. DE-FC26-02NT15134 (Sep. 2003)
- Cather, M: "Produced Water Quality in the San Juan Basin," presented at San Juan College, Dec. 8, 2003.
- Christiansen, S., Andersen, S.I., and Buckley, J.S.: "Detecting and Characterizing Asphaltene Stability," *J. Pet. Sci. Tech.* (2003) in press.
- Grigg, R. B. and Svec, R.K.: "Co-Injected CO₂ Brine Interactions with Indiana Limestone," Paper A65 presented at the 2003 SCA Symposium, Pau, 21-24 Sept.
- Grigg, R.B.: "Improving CO₂ Efficiency for Recovering Oil in Heterogeneous Reservoirs," annual report, U.S. DOE Contract No. DE-FG26-01BC15364, Oct. 1, 2002 through Sept. 30, 2003. (Oct. 2003).
- Gupta, D.B.: "The Effect of Hydrostatic Stresses, Flow Rate, Temperature and Pore Pressure on Pressure Gradient," MS Thesis (2003) Socorro, New Mexico Institute of Mining and Technology.
- Lee, R. and Dong, J.: "Modified Reverse Osmosis System for Treatment of Produced Waters," annual report, U.S. DOE Contract No. DE-PS26-00FT40759, Sept. 15, 2002 through December 15, 2003 (Dec. 2003).
- Li, L., Dong, J., and Lee, R.: "Preparation of α -Alumina-Supported Mesoporous Bentonite Membranes for Reverse Osmosis Desalination of Aqueous Solutions," AIChE Annual meeting, San Francisco, CA, Nov. 16 - 21, 2003.
- Li, L., Dong, J., Nenoff, T.M., and Lee, R.: "Desalination by Reverse Osmosis Using MFI Zeolite Membranes," AIChE Annual Meeting, San Francisco, CA, Nov. 16-21, 2003.
- Koganti, K. K.: "Contributions to the Fuzzy Expert Exploration Tool," Masters Independent Study, New Mexico Tech, Socorro, (2003).
- Schrader, S.M., Balch, R.S., and Ruan, T.: "Preserving and Applying Expert Knowledge: A Case Study for the Brushy Canyon Formation of the Delaware Basin", West Texas Geological Society Annual Symposium, Midland, Texas, Oct. 9, 2003.
- Schrader, S.M.: "Knowledge and Answer Base for the FEE Tool," presented at "Reducing Exploration Risk with the Fuzzy Expert Exploration (FEE) Tool," project review, Albuquerque, Oct. 29-30, 2003.
- Schrader, S.M.: "The Crisp Model Expert System," presented at "Reducing Exploration Risk with the Fuzzy Expert Exploration (FEE) Tool," project review, Albuquerque, Oct. 29-30, 2003.
- Seright, R.: "Conformance Improvement Using Gels," annual report, U.S. DOE, Contract No. DE-FC26-01BC15316, September 1, 2002 through August 31, 2003 (September 2003).
- Seright, R.S., Lane, R.H., and Sydansk, R.D.: "A Strategy for Attacking Excess Water Production," *SPE Production & Facilities* (August 2003) 158-169.
- Seright, R.S., Liang, J., Lindquist, W.B., and Dunsmuir, J.H.: "Use Of X-Ray Computed Microtomography to Understand Why Gels Reduce Permeability to Water More Than to Oil," *J. Petroleum Science and Engineering* (Sept. 2003) **39**, 3-4, 217-230.
- Skalli, L.: "The Effect of Oil-Based Drilling Fluid Emulsifiers on Wettability of Silicate Surfaces," MS thesis, NMIIT, Socorro, NM (Dec. 2003).
- Wang, J.X. and Buckley, J.S.: "Asphaltene Stability in Crude Oil and Aromatic Solvents-The Influence of Oil Composition," *Energy & Fuels* (2003) ASAP Article; DOI: 10.1021/ef030030y.
- Yang, L., Wang, J.X., Fan, T., and Buckley, J.S.: "Wetting Estimates from Crude Oil Chemical Properties," paper SCA 2003-01 presented at the 2003 SCA Symposium, Pau, 21-24 Sept.
- Zeng, Z., Grigg, R. B., and Ganda, S.: "Experimental Study of Overburden and Stress Influence on Non-Darcy Gas Flow in Dakota Sandstone," paper SPE 84069 presented at the 2003 SPE ATCE, Denver, October 5-8.
- Zeng, Z., Roegiers, J.-C. and Grigg, R.: "Imaging the Initiation of Asymmetrical Hydraulic Fractures in Laboratory Experiments," paper SPE 84578 presented at the 2003 SPE ATCE, Denver, October 5-8.

Many presentations from past workshops and conferences are still available. Please contact us for more information at 505-835-5406, or email at lizb@prrc.nmt.edu



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 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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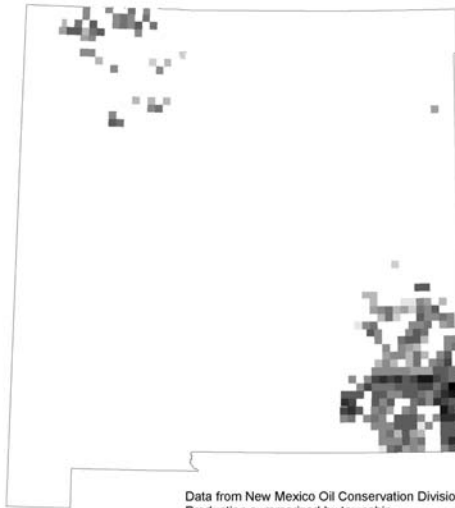
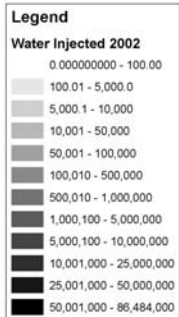
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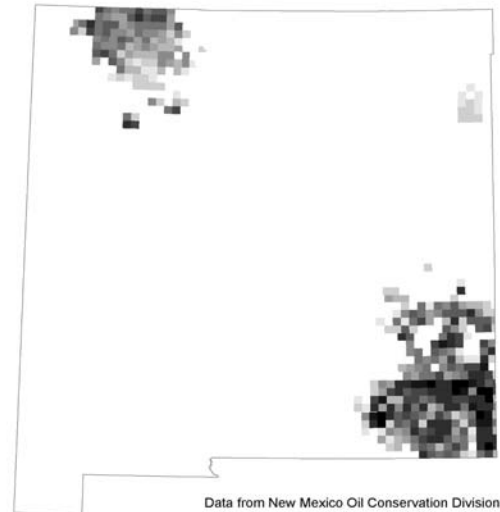
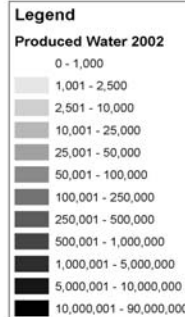
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Injected Water, 2002



Data from New Mexico Oil Conservation Division
Production summarized by township.
M. Cather, Dec. 2003

Produced Water, 2002



Data from New Mexico Oil Conservation Division
Production summarized by township.
M. Cather, Dec. 2003

NM PETROLEUM FACTS: WATER INJECTION AND PRODUCTION STATISTICS FOR NEW MEXICO, 2002



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