After more than four years of data gathering and testing, the REACT team at the PRRC is now ready to go public with the showpiece of their NPTO-sponsored project, “Risk Reduction with a Fuzzy Expert Exploration Tool.” Demonstrations of the Delaware Basin Fuzzy Expert Exploration (FEE) Tool will begin this August in southeastern New Mexico, targeting small and medium-sized independent producers.

Ultimately, the interactive web-ready software will be available for anyone who wishes to use this public-domain exploration tool to evaluate drilling prospects in two major plays in southeast New Mexico. The pilot for REACT's effort was the lower Brushy Canyon Formation in the Delaware Basin.

As all oil and gas producers know, sparse or missing information about a given prospect means added risk for drilling new wells. Soft computing (fuzzy logic, neural nets, expert systems) has been shown effective for mitigating these risks in other areas, such as business and medicine. Expert systems using fuzzy logic (mathematical treatment of imprecise or non-explicit parameters or values) are as yet untried in hydrocarbon exploration. Large corporations usually employ human “experts” to evaluate exploration risks, but the tighter exploration budgets of the small or medium-sized independent corporations that now dominate onshore exploration in the U.S. can stretch these resources, and an unexpected staff departure can cause the loss of critical knowledge.

In response to this perceived need of New Mexico independents, and with the interest and support of a number of these companies, the REACT group set out to acquire the necessary data and knowledge for evaluating the effectiveness of soft computing tools that could model human exploration experts.

The Brushy Canyon pool in the Delaware Basin was chosen as the initial target for the database of information. A massive database of public domain information for the Lower Brushy Canyon has been compiled, and additional Brushy Canyon data has been generated by the project. In effect, the project has created a Brushy Canyon knowledge base. REACT Group Leader Dr. Robert Balch says, “Basically, we dissected the Lower Brushy Canyon, so that when predicting drilling success we would have a basis for measuring the predictive success of the expert system.” There are approximately 800 million bbl/oil recoverable remaining in the lower Brushy Canyon; “an enticing exploration area for independents,” he adds.

Once all required Brushy Canyon data resided in network-accessible databases, development and training of the expert system began. A crisp model (i.e., employing formal logic) was developed and tested for the Brushy Canyon using more than 100 rules (codified expert information). Then a graphical user interface (GUI) for the fuzzy inference engine was developed using those rules. The objective: to create a speedy, multi-tiered system with components running in parallel, that could be customized as little or as much as the user desires. The system breaks analysis into several separate categories.

Though trained on public domain information, the FEE Tool is also 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.

How well does the FEE Tool work? How well does it predict Lower Brushy Canyon prospects? REACT wanted to find out, so the project databases were frozen in early 2000, to allow any new wells that were drilled to reach one year of continuous production, and thus be candidates for blind testing. Eighty-nine new wells were drilled in the Brushy Canyon in the time since the data-

(cont’d on p.2)
base was frozen with these constraints. The Expert System predicted these wells, as a group, to be “good” prospects.

Their results showed that the FEE Tool offers a very good simulation of an expert Delaware explorationist. Based on these results, REACT expects that, in questionable cases, the FEE tool will help support objective decisions and make prospect location both faster and more consistent.

How will consultants feel? Will we still need geologists? “There’s no substitute for real experts,” says Dr. Balch. But this “expert” will ultimately be free—in the public domain—and constant—it won’t quit, leave the area, or succumb to corporate downsizing. Small companies are expected to gain the most from this new tool to start. Then, as they streamline the process of drilling successful wells, bigger companies will likely examine the software to remain competitive.

In the near future, REACT will translate the software to examine the Devonian Carbonates of SE New Mexico. The group plans to seek funding for additional FEE Tool development and to examine more petroleum systems in southeastern New Mexico. Possible targets are the Strawn Patch reefs, Bone Springs/Avalon reefs/channel sands, or the Upper Pennsylvanian (a new Dagger Draw type field would be a plus). The final goal is to develop a more broadly applicable software package that can be used anywhere and could be heavily customizable by experts, allowing them to input their own rules that are applicable to their exploration area.

A workshop will be held Wednesday, August 27 in Roswell at the ENMUR campus for a number of companies to train on the FEE tool. There is a $15 materials charge. Seating is limited; if you’re interested in attending contact Liz at 505-835-5406 or email at lizb@prrc.nmt.edu. Feedback is highly sought for this innovative software. The annual meeting/project review is tentatively scheduled for late September.

Anyone wishing to beta-test this software is welcome to contact Dr. Robert Balch, head of the REACT Group, at 505-835-5305, or email him at balch@prrc.nmt.edu.

PTTC Features GO-TECH, MesaVerde

The Southwest Regional Lead Organization of the Petroleum Technology Transfer Council (PTTC), based at PRRC, offered several workshops in the first half of 2003.

GO-TECH

In Spring 2003, the PTTC offered a series of half-day workshops on training in the use of GO-TECH, the electronic resource for New Mexico’s oil and gas data. The popular workshops were offered in Artesia on Feb. 26, Midland on Feb. 27, and Farmington on March 18. A second Midland workshop was held April 30 for the overflow crowd, and still another will be held in Roswell.

Participants learned how to navigate GO-TECH, the premier oil and gas web site for New Mexico (http://octane.nmt.edu). The Gas and Oil Technology Exchange and Communication Highway (GO-TECH) web site was created in 1994 in response to the oil and gas industry’s need for low-cost, or better yet, free access to New Mexico’s historical production data. The purpose was to help operators who couldn’t afford the high-priced software and data subscriptions that are available from commercial data providers.

GO-TECH has experienced intensive development over the years and now features New Mexico oil and gas production data, a comprehensive well information database for frontier counties, current price sheets and New Mexico lease sale notices, well activity and inactive well information.

The GO-TECH website also offers downloadable software applications (e.g., an infill drilling spread-sheet application to plan or predict well placement and an electronic C115 spreadsheet application for reporting monthly production data), GIS functionality, and online databases and tools for produced water-related issues.

The workshops also included an introduction to the New Mexico Oil Conservation Division’s expanded website with online images of logs and well files. Presenters also talked about troubleshooting data acquisition problems from both the GO-TECH and NM OCD web sites, and demonstrated some of the online maps available both through GO-TECH and the New Mexico Bureau of Geology and Mineral Resources.

Instruction on the use of the New Mexico Well Location Database was a special feature of these workshops. This recently-created database attempts to serve as a public repository for all available well location data in New Mexico for some 123,000 wells. Participants learned how to install software for using the well location data, install the database, and to view data and create their own GIS maps.

Participants also received a workbook that serves as a self-instruction guide to all the features presented in the workshop. The workbook and the New Mexico Well Location CD are still available through the PRRC Publication Office: $20 for the CD and $15 for the workbook; $30.00 for both.

Martha Cather, Outreach Coordinator for the Industrial Services and Outreach Group (ISOG), said “looking through our workshop surveys afterwards showed us that most people thought this workshop was very much worth the time and money. Comments included “…I thought this was very rewarding and it hit the high points” “…excellent presentation for such a large topic….” “…very informative and will be beneficial for filing for permits….” Many people were particularly appreciative of the opportunity to talk with the OCD about their online images and permitting, and also of the fact that most of the workshops allowed people to have some hands-on instruction for the Well Location CD.

MesaVerde Group Reservoirs

On May 22–23, The PRRC’s Southwest Regional Lead Organization of the PTTC hosted the MesaVerde Group Reservoirs Field Trip and Workshop, San Juan Basin in Albuquerque at the Marriott Pyramid. Other organizations that contributed were the New Mexico Bureau of Geology and Mineral Resources and the Petroleum Engineering Department of New Mexico Tech.

This field trip-workshop combination was designed to stimulate new ideas for maximizing the value of current infill efforts by operators in the basin and for locating significant (cont’d on p.3)
new incremental reserves. Both will be necessary in coming years if operators are to slow the decline of gas production in the San Juan Basin.

The workshop presented the results of ongoing efforts by New Mexico Tech to conduct research into one of the most important natural gas basins in the United States. In recent years, Tech has contributed significantly to the understanding of San Juan Basin reservoirs through new reservoir engineering models that support significant continued development and production enhancement of the major reservoirs.

The field trip on May 22 comprised several views of the Menefee Formation, the Lewis Shale, the Mancos Shale, and the Cliff House Sandstone in the central San Juan Basin. Some of the stops were on private land that is usually inaccessible.

On May 23, participants attended a morning workshop at the Marriott Pyramid conducted by Brian Brister of the NMBGMR, Tom Engler of the NMT Petroleum Engineering Department, Consultant Bill Peabody and Steve Hayden of the NM OCD’s Aztec District. Workshop sections included a log correlation exercise to reinforce field observations concerning sedimentology and stratigraphy, reservoir modeling exercises and presentation, presentation and discussion of coalbed methane potential of the Menefee Formation and a paper and presentation on stimulation of the Lewis Shale.

Participants found this workshop very informative, as it became apparent that correlation and connectivity of units within the Mesaverde Group is not always as simple as logs would lead one to believe. Copies of the proceedings on CD are still available at $20.00 from the PRRC Information Office.

**Publications, Presentations**


Balch, R. S., Weiss, W.W., and Ruan, T., 2003, Simulated Expert Interpretation of Data to Predict Drilling Risk on a Regional Scale, Case Study—Brushy Canyon Formation, Delaware Basin, New Mexico (Poster): Transactions Southwest Section AAPG Convention, Fort Worth, Texas, CD-ROM.


Carroll, A. and Cather, M. “Electronic Resources for NM Oil and Gas Data.” (February 2003).


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NM Petroleum Facts

Currently southeast New Mexico produces about 48,000,000 Mcf (thousand cubic feet) of gas, and 5,300,000 barrels of oil per month from 27881 wells, averaged over the past 15 months (1/2002-3/2003). 21,358 are producing primarily oil, while 6523 are primarily gas-producing wells.