

# ProTechnology

## COMPLETION DIAGNOSTICS NEWS FROM PROTECHNICS

PROTECHNOLOGY IS A REGULAR TECHNICAL REVIEW FOR CLIENTS OF PROTECHNICS, A DIVISION OF CORE LABORATORIES, L.P. FOR MORE INFORMATION, OR TO COMMENT ON THIS NEWSLETTER, PLEASE CONTACT US AT 713-328-2320, OR VISIT OUR WEBSITE AT WWW.CORELAB.COM/PROTECHNICS.

### THE RIGHT TOOL@ THE RIGHT TIME

#### DIAGNOSTICS ADDS 8,000 BOPD TO COMPLETION RESULTS

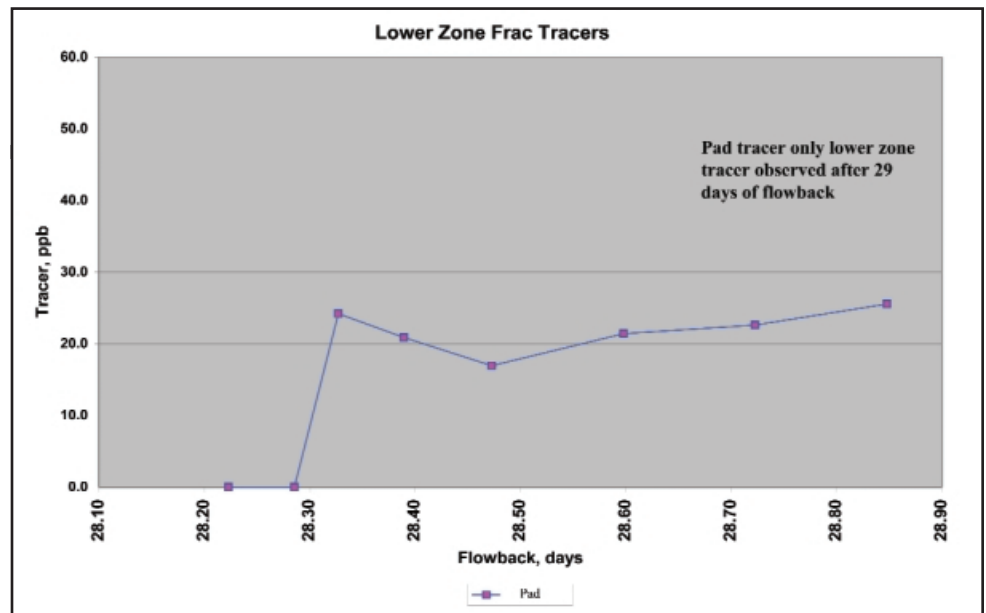
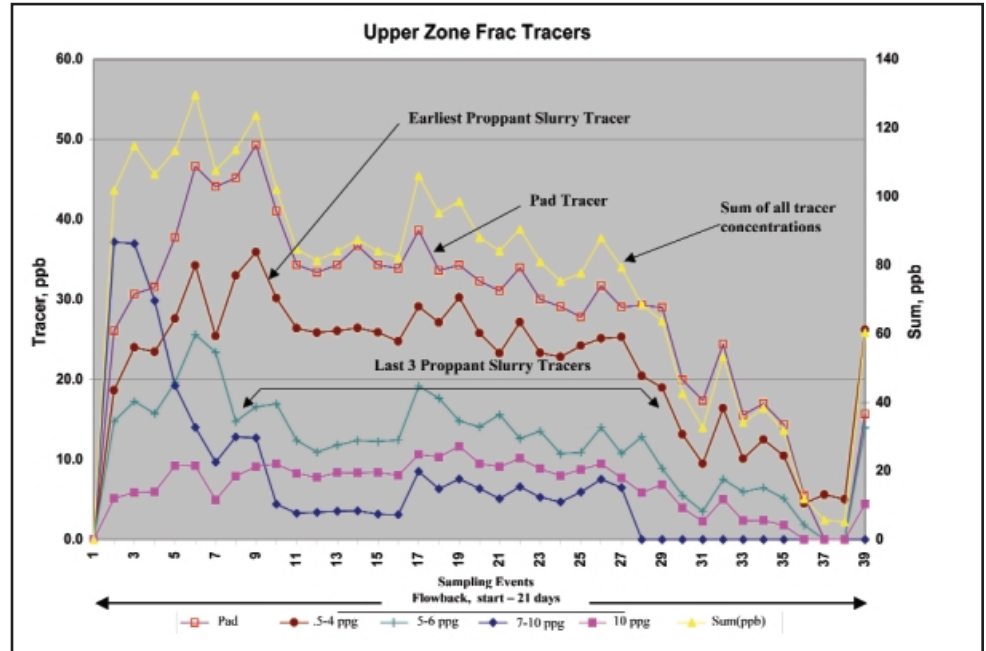
In the harsh and demanding conditions of the deepwater GOM, an engineering team must have "the right tools at the right time." This is especially true for the very complex completions that are being planned and executed in this environment. At the top of the list is the stacked frac-pack completion using downhole selective equipment or smart systems.

Operators on almost all major deepwater GOM projects are routinely applying ProTechnics completion diagnostic services as part of their completions. A typical diagnostic program for a stacked frac-pack/smart-well completion consists of placing a multiple isotope tracer in each of the frac packs and logging each interval with a tandem washpipe-deployed SpectraScan® (after-frac log) and/or PackScan™ (density log) tool string.

Now SpectraChem™ tracers can be added to this typical completion diagnostic program. SpectraChem is a family of 22 chemical tracers that are HSE-friendly and meet all MMS, NPDS and OSHA requirements. These water-soluble chemicals are injected at very low concentrations (ppm) with standard ProTechnics injection equipment. Flowback fluid samples are collected and analyzed for the presence and concentration (ppb) of these chemicals. Flowback efficiency, total load recovery and zonal contribution are some of the information obtainable from SpectraChem analysis

As the following case history demonstrates, SpectraChem tracers were the right tool at the right time for the engineering team of the Matterhorn deepwater GOM project operated by Total.

This project was planned as a stacked-pack completion with selective commingled final production over a long interval. ProTechnics was called in to assist the completion team



in evaluating the effectiveness of each of the frac-pack completions. A routine multiple-isotope design incorporating Sc-46 tracer in the early proppant and Ir-192 tracer in the late proppant was planned. SpectraScan and PackScan images were to be obtained via the washpipe for each of the zones.

In planning meetings, it was noted that because of hardware considerations it was

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not possible to determine if both zones were contributing in the commingled production state without a well intervention. To acquire this information, the ProTechnics sales engineer proposed that SpectraChem tracers be placed in each of the frac-pack fluid phases. The completion team agreed and the completion diagnostic program was implemented using radioactive and chemical tracers. The two SpectraScan images depict the results of the placement of the frac packs (See accompanying logs).

After both frac-pack stages were completed, the selective tool was shifted to open both zones and the well was tested at 5,000 BOPD. This production level did not meet expectations but the well was still cleaning up and the operator was certain that the mechanical operation of the selective tool was correct.

The operator was periodically sampling the aqueous fluid phase from the load recovery and sending these samples to the ProTechnics laboratory in Houston. The lab results (See Page 1) for the first 21 days of production showed that only the chemicals from the upper zone were present in the samples.

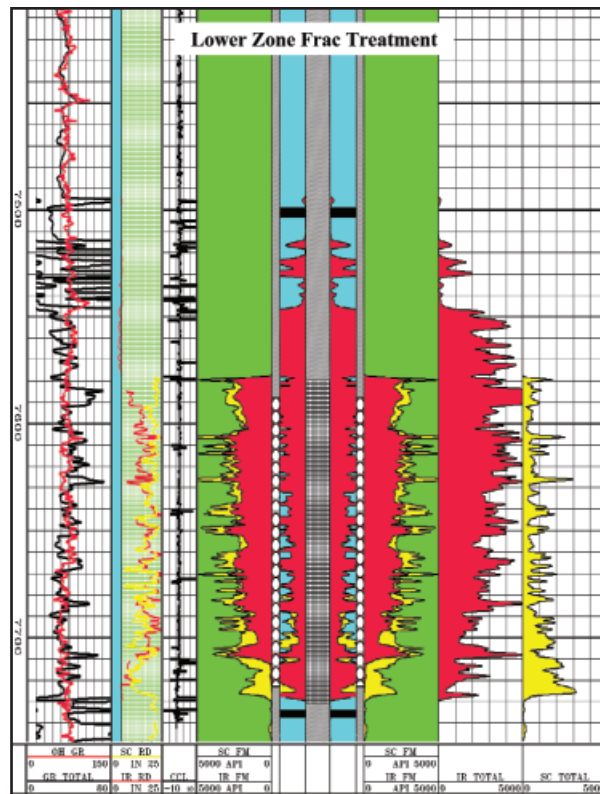
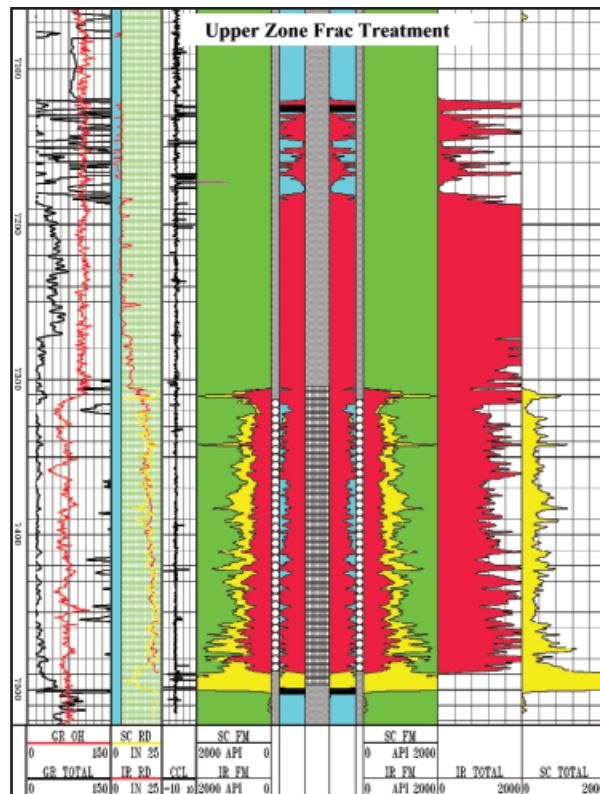
The operator, now believing that a mechanical problem might exist downhole, decided to run a production log to ascertain whether both zones were producing. The results of the log mirrored what the chemical tracers were indicating – there was NO production across the lower zone. A well intervention was planned and implemented to re-shift the selective tool.

It is hard to describe the thrill of the engineering team when they were rewarded with the new 13,000 BOPD flow rate. The net 8,000 BOPD increase paid for the cost of the completion diagnostic program within minutes. Having the right tool at the right time proved critical to optimizing production in this well completion.

### Take-Away Thought

Simple and economical SpectraChem tracers should be added to all stack-pack completions as a means to obtain early confirmation that all zones are contributing to the overall production.

FOR MORE INFORMATION OR INQUIRIES, PLEASE CONTACT  
PROTECHNICS REPRESENTATIVE WADE HUTCHINSON,  
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## GROWING TO MEET DEMAND

### NEW ADDITIONS

ProTechnics has increased its service capabilities.

Welcome aboard:

Field Service Representative –  
**Ron Bush**, Oklahoma City, OK  
**Ryan Herrelson**, Kilgore, TX  
**Tim Oswald**, Rock Springs, WY  
Production Service Specialist –  
**Tim Morgan**, Rock Springs, WY

### 2004 SPE ATCE

Join us at Core Lab booth 418 for the latest in completion diagnostics and reservoir optimization. Also plan to attend, "Optimizing Fracturing Fluid Cleanup in the Bossier Sand Using Chemical Frac Tracers and Aggressive Gel Breaker Deployment," presented by Richard Sullivan, Anadarko Petroleum and coauthored by Buddy Woodroof, ProTechnics.

### WELCOME TO HOUSTON

PROMORE, a Core Laboratories Company, has sent Houston one of their key technology managers from Edmonton, Canada. Welcome **Dennis Larsen**.

PLEASE CONTACT DENNIS AT  
(713) 328-2315 OR  
DENNIS.LARSEN@CORELAB.COM.

### MORE EXPERTISE

Kevin Svatek, P.E., has recently joined ProTechnics as senior technical engineer. Kevin brings a decade of completion experience, including an extensive background in fracture theory and modeling.

KEVIN CAN BE CONTACTED AT  
713-328-2304 OR  
KEVIN.SVATEK@CORELAB.COM

## BARNETT SHALE PROMPTS MANY COMPLETION QUESTIONS

### COMPLETION DIAGNOSTICS PROVIDES ANSWERS

Recently designated the largest gas field in the United States, the Barnett Shale near Fort Worth, Texas, is one of the hottest gas plays in the lower 48 states. Since the original well was drilled in 1981, more than 3,000 wells have been drilled – 80% of them in the last 3 years. Operators of all sizes are rushing into this unconventional tight gas play to stake a position.

ProTechnics Business Development Manager, Dick Leonard, has been on the front lines of recent development activity providing operators with state-of-the-art completion diagnostic technologies and interpretations. In the past 5 years, ProTechnics has traced in excess of 350 fracture treatments for over 30 different operators in the Barnett Shale.

This extensive completion diagnostic experience has allowed ProTechnics to provide its clients with answers to many questions concerning aspects of Barnett Shale completions. Those questions include:

- Are your fracture treatments really going where you think?
- Are you maximizing your reserve recovery in the verticals?
- Do the Marble Falls and Viola formations act as barriers to fracture growth? And, is this consistent across the basin?
- What intervals are being treated when a re-frac is attempted?
- What is the optimum number of stages?
- Are horizontal wells better than verticals?
- Should the horizontal wells be cemented or un-cemented?

**WHETHER YOU ARE AN ACTIVE OPERATOR IN THE BARNETT SHALE PLAY OR ARE CONSIDERING GETTING INVOLVED, DICK LEONARD CAN PROVIDE INSIGHTS AND ANSWERS TO THESE QUESTIONS AND OTHER VALUABLE INFORMATION. DICK CAN BE REACHED AT (817) 239-0817 OR [DICK.LEONARD@CORELAB.COM](mailto:DICK.LEONARD@CORELAB.COM).**

## TIGHT GAS II ATW SHARES TECHNOLOGY AND TECHNIQUES

More than 125 SPE members from a diverse group of operators, service companies and consulting companies recently convened in Austin, Texas, for the second annual Tight Gas II Applied Technology Workshop (ATW).

Co-chairs Keith Froebel, Total, and Holly Camilli, ExxonMobil, and their able committee, carried on the tradition set by the 2003 Corpus Christi “Tight Gas I” ATW. Those who attended “Tight Gas II”, held July 29 and 30 at the Lakeway Resort on Lake Travis, were treated to a professional forum and workshop designed to share technology, techniques and case histories surrounding tight gas sands development.

During the course of the two-day workshop, eight sessions with topics ranging from Reservoir Evaluation and Performance Prediction, Frac Technology to Multi Zone Completions and Horizontal Well Technology were presented. (Notes and presentations from the workshop can be found on the SPE web site, [www.spe.org](http://www.spe.org).)

They saved the best for last. Session No. 8, held from 3:00 to 5:00 pm on Friday, kept (by conservative estimates) 80% of the attendees in their seats.

The session, “Frac Models, What are the Most Important Design Considerations and Why?”, was moderated by ProTechnics Technical Manager Buddy Woodroof, and Chevron/Texaco completion specialist Robert Lestz. Panelists Bob Barree, Barree

and Associates (GOHFER™ 3D Model), Chris Wright, Pinnacle Technologies (FracProPT®), and Mike Smith, NSI (StimPlan™), provided a unique opportunity to witness the industry’s foremost fracturing experts discuss issues concerning fracture modeling and theory. Needless to say, the attendees took great advantage of this unique chance to listen and ask questions of the panel.

All three panelists concurred that fracture modeling and optimization is an iterative process of applying what you know to the model, measuring with completion diagnostic technologies the actual fracture parameters and performance, and then comparing the model to the actual case. The panelists agreed that when the two are not in agreement with each other, the operator must investigate the reason for the differences and calibrate the model to these new parameters.

Another major position discussed by the panel compliments the subject of this newsletter’s Experts’ Corner interview with Dr. Michael Conway, “Myths and Realities of Created Fracture Length vs. Effective Fracture Length”.

The panelists agreed that shorter-than-designed effective fracture lengths experienced by most operators are not always attributable to unrestricted height growth. Moreover, the panelists concurred that fracture height growth has been routinely over-estimated in the past and that fracture diagnostic technologies such as radioactive tracer studies and downhole tilt and seismic fracture mapping have been proving the same. They also agreed that more emphasis and work is needed on building

a more accurate rock stress and reservoir properties model and understanding the coupling mechanisms between the rock layers.

### Noteable panel quotes:

- *Bob Barree – “I believe that many people in our industry have been greatly overestimating fracture height with some models. Most fractures are more contained than we have traditionally been led to believe. That does not mean that all fractures are well contained, just that simple linear-elastic and homogeneous descriptions of rock behavior don’t apply.”*
- *Chris Wright – “Years ago I believed that fractures generally had large fracture heights and that with linear elastic fracture models we could predict fracture height growth. Both beliefs have been proven wrong. Instead fracture height growth has proven to be highly variable and often not explainable by in-situ contrasts in stress and mechanical properties (i.e. predictive fracture models). Generally we have observed less height growth than models predict – likely due to layer interface effects.*
- *Mike Smith – “In the past, some groups in fracturing apparently believed in NO height confinement anywhere. Now, we hear that fractures are longer and narrower than we thought, and one might conclude that all frac are perfectly confined. Both positions are wrong – there are NO absolutes in fracturing!”*

# EXPERT'S CORNER

## Interview with Dr. Michael Conway

ProTechnics is excited to present another in our series of expert interviews. In this issue, we talk with Dr. Michael Conway, president of Stim-Lab about "Realities and Myths of Created Fracture Length vs. Effective Fracture Length".



Dr. Conway has a rich and esteemed background in fracturing fluids development and proppant conductivity analysis. His 25-year career includes 10 years as chief fluids researcher at Halliburton in Duncan, Okla., and the last 15 years as co-founder and chief scientist at Stim-Lab. Stim-Lab is the industry authority on all issues of proppant performance and fracture conductivity and the mechanisms and resulting effects of damage to the proppant fracture.

Understanding the difference between created fracture length and effective fracture length and its effect on production is one

of the most challenging issues facing the oil and gas industry today. New technologies, such as microseismic mapping, and tested technologies, such as radioactive tracers and full 3D fracture models, have been moving the industry to re-evaluate its beliefs about fracture height and length. Production engineers today must spend more time and effort trying to determine the mechanisms responsible for the difference between created fracture length and the subsequent effective fracture length.

In this interview, which can be read in its entirety on the ProTechnics website at [www.protechnics.com](http://www.protechnics.com), the reader will gain valuable insights and understanding regarding Dr. Conway's pointed and succinct opinions on such topics as:

- Defining created fracture length and effective fracture length and methods to determine same

- Describing the major causes of the difference between created fracture length and effective fracture length
- Strategies to mitigate the negative effects of this difference between created fracture length and effective fracture length.
- Major concepts of fluid damage

### Notable quotes from the interview

*"The fracture has to clean up to take advantage of the created length and lack of cleanup is generally the production limiting factor."*

*"It is also easy to demonstrate that treating pressure history matches are highly non-unique, if not properly constrained by additional data."*

*"Experience is that fracture height growth has been a convenient explanation for the observed short effective fracture length."*

**Note from the Editor** The Expert's Corner is a continuing feature of ProTechnology newsletter. Our objective is to bring you interviews and discussions with industry-recognized experts that examine the latest and most current knowledge and opinions on the subject of stimulation. Because of the length of most interviews, interview highlights are presented in this newsletter with the entire interview published on the ProTechnics website. **TO SHARE YOUR THOUGHTS, IDEAS AND SUGGESTIONS ABOUT EXPERT'S CORNER, PLEASE CONTACT WADE HUTCHINSON AT [WADE.HUTCHINSON@CORELAB.COM](mailto:WADE.HUTCHINSON@CORELAB.COM)**

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IN THIS ISSUE:

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