

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.

SHINING A LIGHT ON FRAC PERFORMANCE IT'S WHAT YOU KNOW THAT COUNTS

Someone told me once that on a good day with a 5D cell battery flashlight, we can only see about four feet down a well. With limited wellbore vision, it's tempting to fall for the old adage that, "what you don't know won't hurt you". But be careful. As the following true well story depicts, it's what you know that really counts.

An operator working in Eddy County, New Mexico, planned a casing fracture treatment on a deep gas producer. ProTechnics was called in early on this project to provide the operator with an engineered completion diagnostic strategy. Utilizing patented ZeroWash™ tracers, a multiple-isotope treatment was designed to trace the 400,000 gal treated water stage with Ir-192 LDZW and the two subsequent gelled acid stages with Sc-46 LDZW and Sb-124 LDZW, respectively. The fracture stimulation and tracer injection were pumped to completion as designed without incident. Good job and high fives all around! As the completion engineer left location following the fracture treatment, he was certain that the job had been a success.

What He Didn't Know....

After a four hour shut-in period, the operator began flowing the well back. Everything seemed fine with good gas shows and rates. After four days of flowback, a SpectraScan® memory logging tool was run from 12,650' to 13,070'. SpectraScan image 1 shows that all 3 isotopes were present in the zone of interest. The log analyst noted that there was not as high a count rate for the Sb-124, blue tracer, as should be expected.

In preparations to run tubing, a packer and plug were set at 12,000'. The first signs that something was amiss surfaced at this point in the completion operation. The well would not blow down. Fearing that the packer or the plug was leaking, a temperature log was run from 10,000' to 12,000'. The temperature log showed a

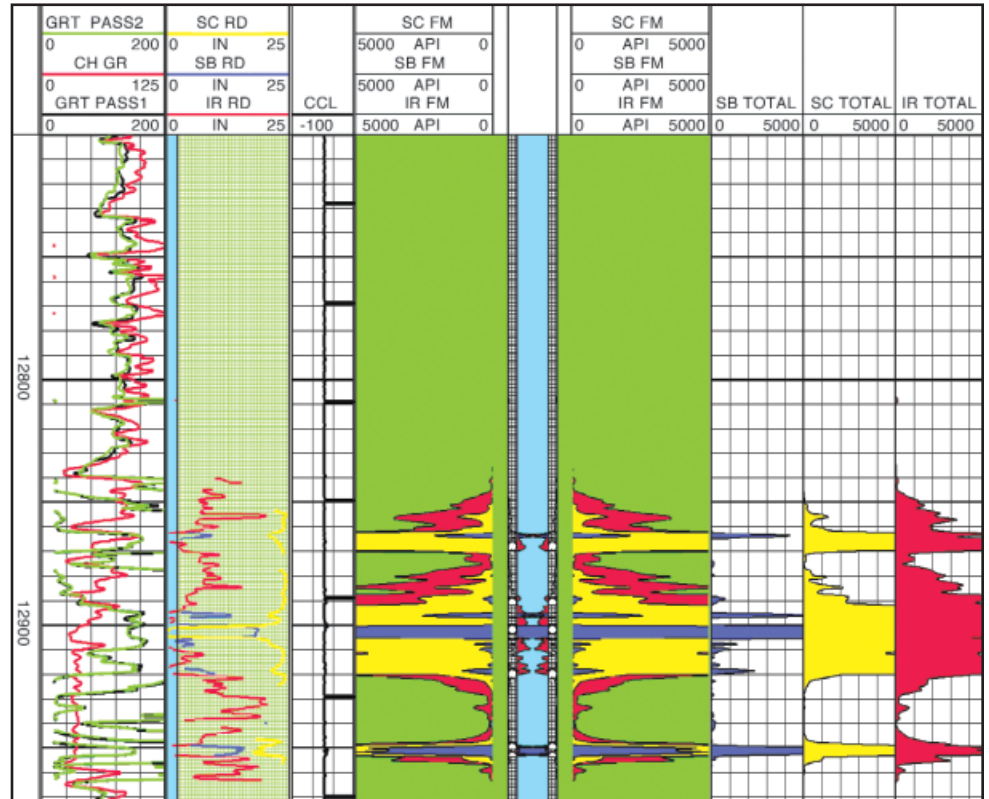


IMAGE 1

normal gradient, indicating that the packer or plug was not leaking. The most viable explanation remaining was that the fracture treatment had parted the casing somewhere. It should be noted that there were two DV tools in the casing string at 8,204' and 4,567'.

Before attempting the rigorous procedure of trying to establish where the leak was located with a packer and bridge plug operation, the operator called ProTechnics to rerun the SpectraScan Image tool from surface to 12,000'. As SpectraScan image 2 (see next page) clearly demonstrates, the stage tool at 8,204' was leaking. The strong count rates for all three tracers were conclusive evidence that the fracture treatment had exited the wellbore at this point. Additionally the presence and high count rate of all three tracers indicate that the DV tool was leaking from the beginning of the treatment and that a significant portion of the stimulation was placed out of the zone. The log across the upper DV tool at

4,657', SpectraScan image 3 (see next page), did not show any significant tracer proving that it operated as designed.

Two squeeze cement jobs later, the leak at the DV tool was fixed and the well was placed on production. In this area, the productive deep gas zone is an over-pressured zone, and the upper zones across from the leaking DV tool are normally pressured and nonproductive. Because of this, it was determined that the deep gas zone was cross-flowing a substantial quantity of gas into the upper zones.

Interviews with the operator revealed the following values of the completion diagnostic services provided by ProTechnics:

Item: The tracer log determined the exact location of the leak in the casing, saving thousands of dollars in rig time and lost production.

continued on page 2



continued from cover

Item: Operator was able to determine that the DV tool leaked early in the treatment and that the deep gas zone was most certainly under-stimulated.

Item: The deep gas zone in this well is a possible candidate for a later re-stimulation attempt.

The old adage; “What you don’t know, won’t hurt you” in this case should be restated, “What you do know, will help you!”

Take-Away Thought

Always apply a radioactive tracer when fracturing past a DV tool in a casing completion. Always review the log (memory tool) over the entire wellbore, not just the zone of interest.

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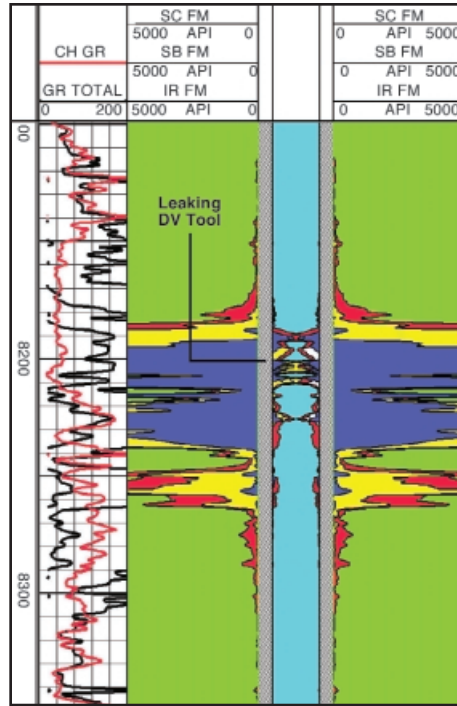


IMAGE 2

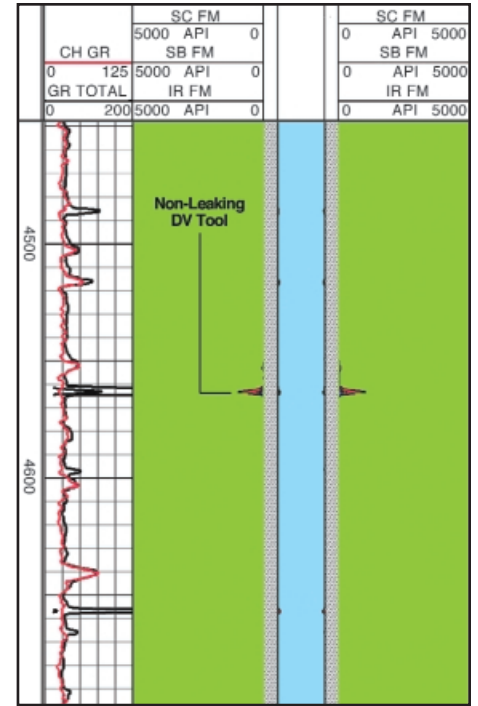


IMAGE 3

A COAL STORY

Zero Wash Tracers Show Need for Re-Stimulation

A major operator working in the San Juan Basin of New Mexico turned to ProTechnics

for completion diagnostic technologies to help them understand the effectiveness of their completions in the Fruitland Coal. In this particular area, the completion challenge was how to effectively complete 4-5 coal stringers in a single treatment. Adding to the complexity, the lower two coal stringers were extremely low pressured

and highly fractured, and contributed to cementing problems and concerns over stimulation effectiveness. The operator also wanted to determine if the upper coal zones were economically productive after stimulation and needed a means to verify that the upper coals were actually stimulated.

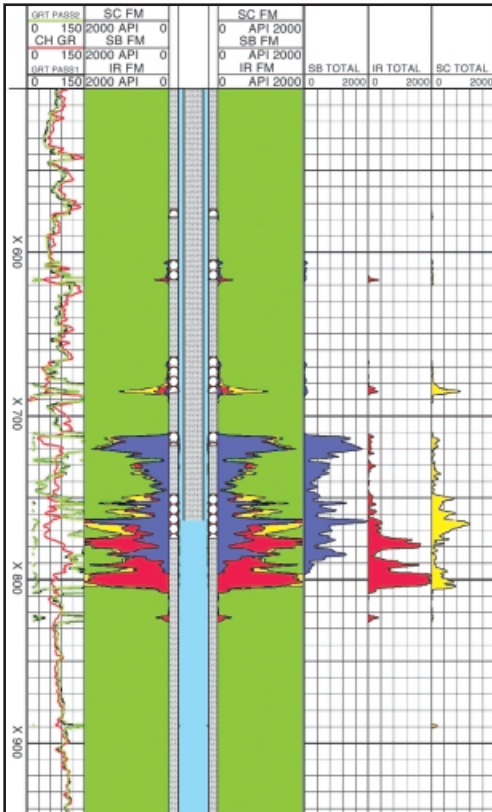


IMAGE 1 (JULY 10, 2003)

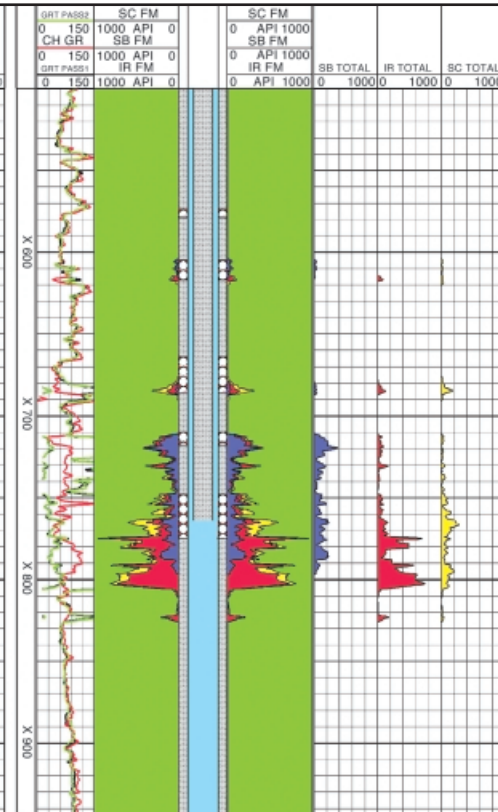


IMAGE 2 (DECEMBER 16, 2003)

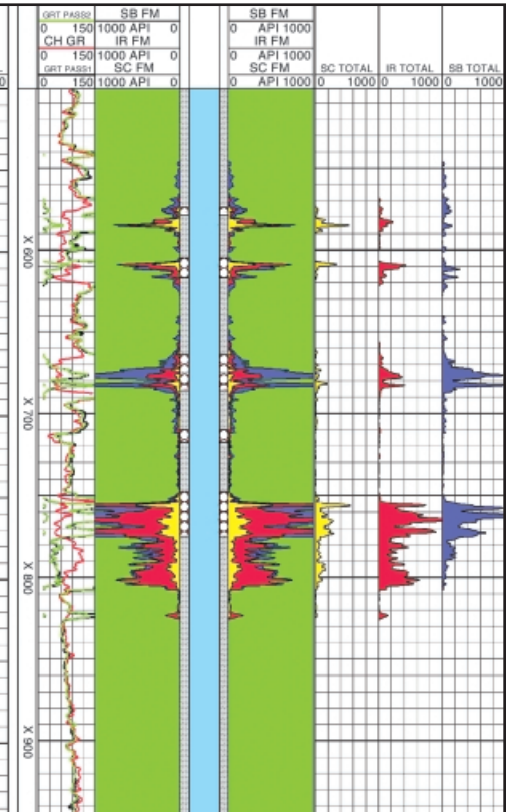


IMAGE 3 (DECEMBER 31, 2003)

A candidate well was selected and a completion procedure was designed to fracture stimulate the entire Fruitland Coal in a single treatment. After consulting with ProTechnics engineers, a radioactive tracer injection program utilizing patented Zero Wash tracers was designed and implemented. The accompanying SpectraScan image 1 reveals that the lower two coal zones took virtually the entire treatment. The upper three coal sections were left un-stimulated.

Cementing in the area had proven difficult due to the nature of the lower two coal stringers. In this particular well, an external casing packer and DV tool were placed at X672'. A cement bond log determined that there was almost no bond across the lower two coals from X674' down, and good cement bond from X674' up across the three upper coals. Because they had good cement across the upper three coal stringers, the operator planned to come back at a later date and re-stimulate the upper three coals.

Five Months Later

After almost five full months of production, the operator again asked ProTechnics to design a completion diagnostic strategy to determine the effectiveness of their re-frac attempt. Because all three available tracers (Ir-192, Sc-46, and Sb-124) were used in the first treatment, it was recommended that a base log be run to re-define the placement and count rate of the previously injected tracers.

It is very rare that two SpectraScan images from the same well with such a long time interval between each log event can be compared. Please take time to study the comparison between SpectraScan image 1 (logged July 10) and SpectraScan image 2 (logged December 16). Notice the placement of the isotopes between the July

image and the December image is remarkably the same. The only major difference is the count rate reduction due to half-life decay (note that the count rate scale is 0-2,000 on the June log and 0-1,000 on the December log)

A bridge plug was placed at X710' prior to re-fracing the upper three coals. Each of the three coals was broken down individually with acid. The fracture stimulation was again traced with all three isotopes. SpectraScan image 3 depicts the placement of the re-frac attempt. It is clear that the upper three coal stringers have now been adequately stimulated, as evidenced by placement of all 3 tracers at a suitable count rate in each of the coals. Notice that the tracers in the perforated interval from X710' to X740' have been removed. It is suspected that the breakdown acid treatments actually found the bad cement interface between the upper coals and lower coals, and displaced the tracers from the near wellbore area. The lowest coal from X750' to X775' also took some of the re-frac, as is evident from the increased count rates for all three tracers. It is clear that the cement problem contributed to the containment problem encountered in the re-frac attempt.

Currently the well is not producing to its full capability because the operator has yet to install adequate surface compression. However, the operator is hopeful that the well will match offset producers once compression is installed.

Take-Away Thought

Tracers should be used whenever multiple zones with varying pressures are being stimulated with a single-stage treatment.

**FOR MORE INFORMATION PLEASE CONSULT PROTECHNICS REPRESENTATIVE WADE HUTCHINSON
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GROWING TO MEET DEMAND

MEETING THE DEMAND

ProTechnics has again increased its service capabilities to meet the demand for its products and services.

Welcome aboard:

Morris Moody – International Service Specialist, Houston, Texas
Mike McKenzie – Field Service Supervisor, Rock Springs, Wyoming

GOOD LUCK AND BEST WISHES

Don Dumas has accepted a Core Laboratories Corporate position as Vice President. He promises he will not be that far down the hall when we need him. Thanks Don, for helping make ProTechnics "The Best Little Service Company" in the industry.

FILLING THE VACANCY

Dean Johnson has been named Director of Sales, filling the vacancy left by Don's departure. Dean brings 20+ years in sales and sales management from the downstream energy segment.

LEADING THE INDUSTRY

Dr. Mahmoud Asadi, ProTechnics Technology Development Manager, has been selected to chair the Perforating Session of the Well Completion Committee at the upcoming 2004 SPE Annual Technical Conference in Houston. As an active member of the International Symposium on Formation Damage Control, Dr. Asadi recently co-chaired the Perforating Session at the Formation Damage Control Symposium held February 18-19 in Lafayette, La. Go to www.spe.org for more information on the technical papers presented at this meeting.

NORTH TO ALASKA

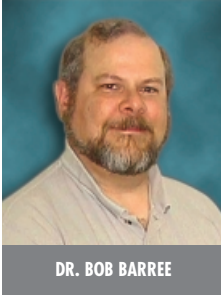
Just in time for the first snowfalls of winter, ProTechnics secured a long-awaited and much-anticipated approval from the Nuclear Regulatory Commission. After performing all necessary environmental impact studies, the NRC approved regulations for the injection of radioactive flow-back material into Class II disposal wells as an environmentally responsible and a best-practices disposal method. With the approval of the Alaska Oil and Gas Conservation Commission (AOGCC) and the new NRC regulations, operators in Alaska are lining up again to include radioactive and chemical tracers as part of their completion strategies. ProTechnics is providing services on multiple wells in the Kenai Peninsula and the North Slope and is well on its way to becoming a valued member in the community of oil and gas companies working in the great state of Alaska.



EXPERT'S CORNER

Interview with Dr. Bob Barree

ProTechnics is proud to present a rare interview with leading industry stimulation expert Dr. Bob Barree. In this exclusive interview (conducted by ProTechnics and available in its



entirety on our website), Dr. Barree, Barree and Associates, shares his unique knowledge and opinions on fracture stimulation modeling and completion diagnostic technologies. A pioneer in the science of stimulation, Dr. Barree has a distinguished 25-year career in the industry. He is the former stimulation expert for Marathon Oil Company and principal architect of the GOHFER™ fracture model. Today he is a respected industry consultant who continues to bring his industry-leading, cutting-edge approach to completion consultation, and fracture stimulation design and applications.

In this interview, which can be read in its entirety on the ProTechnics website at www.corelab.com/protechnics, the reader will gain valuable insights and understanding from Dr. Barree's pointed and succinct opinions concerning:

- The definition of completion diagnostics
- Making a value assessment of completion diagnostics in the completion strategy
- The power and limitations of fracture models as numerical fracture design simulators
- The value of calibrating fracture models with completion diagnostic technologies
- Primary reasons to employ different completion diagnostic technologies
- A real-world example of the application of completion diagnostics
- An assessment of the future of completion diagnostics as a science

Notable quotes from the interview

"Without the application of completion diagnostics, anyone who designs and performs fracture treatments is shooting in the dark."

"In numerical modeling, as in most fields, the concept of 'garbage in – garbage out' is alive and well. Numerical simulators do a great job of integrating complex physical processes, but they cannot tell us more than what we know already and input to the model."

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

"The direct diagnostic measurements are the only 'ground truth' we have to base model calibration on."

Note from the Editor The Expert's Corner will be a continuing feature of the ProTechnology newsletter. Its objective is to provide interviews and discussions with industry experts so that you benefit from the latest and most current knowledge and opinions on the subject of stimulation. These in-depth, full-length interviews will be previewed in this column and presented in their entirety on the ProTechnics website at www.protechnics.com. Suggestions regarding topics and persons of interest are welcomed. **PLEASE SHARE YOUR THOUGHTS, IDEAS, AND SUGGESTIONS BY WRITING TO WADE.HUTCHINSON@CORELAB.COM**

- EXPERT'S CORNER – DR. BOB BARREE, BARREE AND ASSOCIATES
- GROWING TO MEET DEMAND
- NORTH TO ALASKA
- A COAL STORY
- SHINING A LIGHT ON FRAC PERFORMANCE

IN THIS ISSUE:

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FIRST CLASS
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