PTTC Focused Technology Workshop
Workshop Report

"Horizontal Drilling: A Technology Update for the Appalachian Basin"
May 27, 2004, Salt Fork Lodge, Cambridge, OH

Coordinator's Assessment of the Workshop

PTTC and the Ohio Geological Society (OGS) hosted a very successful horizontal drilling workshop at Salt Fork State Park near Cambridge, Ohio on May 27th. PAG member Greg Mason and OGS officer Jason Henthorne recruited eight speakers who addressed various drilling methods, steering systems, coiled tubing applications, completion methods and how to identify reservoir candidates for under-balanced drilling. Several case studies were included in the presentations.

The workshop was well attended, and most of the attendees remained until the final talk, which unfortunately, was the only weak presentation of the day. Approximately half of the attendees slipped away during this talk.

The rest of the speakers, however, were quite good, especially Doug Wight and Mark Moody. Both presented papers that included actual field studies with before and after results, illustrating the success or failure of horizontal drilling.

Doug Wight, senior exploration geologist with CDX Gas, Dallas, Texas, led off with an excellent presentation on unconventional drilling methods for unconventional reservoirs. His company developed a unique horizontal drilling technique in southern West Virginia coal beds that they later introduced in western basins. This "pinnate" drilling technique is best applied in thick, low permeable coals that have good lateral continuity.

CDX had multiple objectives when they set out to develop coal bed gas resources ahead of mining in southern West Virginia. First, they wanted a means to produce gas from unconventional reservoirs that was economic, and would result in higher and quicker gas recovery. Also, they wanted to develop an under-balanced drilling technology that would maximize efficiency while creating a uniform drainage pattern. And finally, they wanted to optimize dewatering of the coals and minimize the environmental impact of water and gas production operations.

CDX achieved these goals by developing their dual-well, horizontal drilling system that results in a pinnate drilling and drainage pattern. So-named because the final drilling pattern resembles the veins of a leaf, the system begins with two closely-spaced (within 20 ft) vertical wells: one well will serve as an air injection well early in the project and then as a producing well; the second well will serve as the horizontal and service well bore. In the Wyoming County, WV field study, a horizontal well was drilled from the service well to intersect the first vertical well in the lower of two coal seam

targets, creating a cavity in the lower coal. The horizontal leg continued to be drilled from the second well, reaching a length of 4800 feet before drilling stopped and the drill bit was retracted. As the drill bit was retracted, side laterals were drilled at 45 degree angles to the main lateral and 90 degrees to each other.

Using this method, after the first quad is drilled, second, third and fourth mains can be drilled from the horizontal service well, and side laterals can be drilled along each. The final 360 degree pattern can drain 1280 acres and replaces 16 vertical wells, while providing uniform drainage and pressure depletion. The environmental impact is significantly reduced as well.

CDX uses a computer program to determine the optimum spacing of the side laterals that will drain the coals in the amount of time available before the coal reservoir is mined. By doing so, the drilling of unnecessary side laterals is avoided, and no gas is left in the coals that could have been drained prior to mining.

PAG member Leo Schrider attended the workshop, and offered these comments on Wight's paper. "The Pinnate drainage pattern in coal beds has improved recovery to over 80% of the gas in place. Unique pattern design and under balanced drilling also prevent well bore damage and improved permeability performance. While this type of drilling and completion is costly (generally in the $million+ range) it has shown to be cost effective in locals that have conditions which warrant these types of drilling and completion techniques."

Following Wight's paper, three speakers gave technology updates; new tools and drilling systems that are beginning to be used in the region. Jeff "Duff" Smith, Sales Manager & Owner of Directional Drilling Contractors in Traverse City, Michigan, presented a history of the development of horizontal drilling in the basin. He also summarized the various applications for horizontal drilling and developments in related technology. He stated that once measurement while drilling (MWD) systems replaced the wire-line system, the technology was able to develop more rapidly. He concluded that improved bit technology and steering systems are "coming on strong in the Appalachian basin."

Lars Halvorsen from Schlumberger Drilling and Measurements in Charleston, WV, provided more detail on advanced rotary steerable systems, particularly the PowerDrive series. The PowerV vertical control system was designed to drill a true vertical well while reducing drilling cost per foot by staying vertical. He noted that while Appalachian drilling companies are open to new technology, these tools are in high demand due to their dependability, and although 65 of them are in existence, we are lucky to have even one in this area. Unfortunately, new technology often goes where the money is, and right now that is in the international arena.

This migration of new technology out of the US to the international arena was echoed by the next speaker, Kirby Walker, also with Schlumberger in Charleston, who discussed coiled tubing applications. He emphasized two other technologies, SlimPulse

and Viper, and mentioned that although Viper may be "a perfect fit for the Appalachian basin," when you are in competition with the rest of the world for technology, "the northeast U.S. does not always win." He concluded by saying that "coiled tubing drilling was not meant to take over the drilling market, but it has demonstrated the ability to fill certain niches in the Appalachian basin over the past few years."

The first two speakers of the afternoon session continued the discussion of new developments in technology. John Rogers with DOE's National Energy Technology Lab in Morgantown, WV, discussed DOE's programs to develop drilling technologies for tomorrow's exploration and production paradigms. He began with a few givens: we need more gas, much of it will come from the same old places, but it will be harder to get. Therefore, we need new technology to develop deeper on-shore and off-shore gas resources, and to produce oil from old fields. New technology can reduce drilling costs by reducing drilling time from 190 to 60 days in one example, and by improved drilling fluids, hydraulics, motors and rigs. He went on to present a comprehensive overview of DOE's efforts to develop drilling fluids, microhole technology, coiled tubing technology – even ice roads and ice pads in Alaska – while presenting specific examples of each.

Dan Mullins discussed a new method to fracture horizontal wells called SurgiFrac Service, which is being marketed as a quick and cost-effective method to boost production from horizontal wells. However, he cautioned that this technique should not be used in interbedded intervals where the two lithologies have different breakdown pressures. He concluded by saying that they are currently involved in a Trenton-Black River project in New York.

The following speaker, Mark Moody presented a very honest summary of an attempt to re-enter an old vertical Rose Run well in Ohio and drill a horizontal leg to enhance production. The original well at one time was capable of producing a million cubic feet a day with 2-3 barrels of condensate, but over time it began making salt. Fresh water was used to correct the salt damage problem, but because this well was on acreage that was included in a 3D seismic survey, it was decided to drill a horizontal well "with a science project attitude."

The remainder of the presentation was devoted to a summation of a series of disasters with drill bits and motors, one of which was created when a reaction between condensate and foam produced an explosion that killed the motor. The well had to be sidetracked around the problem but after drilling only another 73 feet, the bit quit, the hole began taking the drilling fluid, Baroid came out, and so it continued. He concluded that they put too much fluid in the well while trying to make footage, and the well drank it as quickly as they could pump it in.

Leo Schrider felt that this talk, like the talk by Wight, was particularly will done and presented very useful and practical information, especially because it dealt with a failed project that used horizontal drilling. He felt that the author, Mark Moody, was "very forthright in his discussion of why this project failed," and as a result, "operators should benefit since mistakes were made that may be prevented in future applications of

horizontal drilling. While the project failed, it provides a framework of what one needs to consider in preplanning and design."

Attendee List

The attendance list is attached. It includes both pre-registrants, some of whom were no-shows, and walk-ins.

Evaluation Forms

A copy of all evaluation forms will be mailed separately. The response from attendees was exceptional, as most of those in attendance at the end of the day filled out and submitted evaluation forms.