

## Pilot Highlights Potential Of LAK Ranch

By Al Pickett  
Special Correspondent

VANCOUVER, BRITISH COLUMBIA—The oil business is heating up—literally—in the middle of the world's hottest coalbed methane development area over the past decade: the Powder River Basin in Wyoming.

Two Canadian-based independent oil and gas companies—Derek Oil & Gas Corporation and Ivanhoe Energy—are jointly developing the LAK Ranch Field, an 8,000-acre sweet crude oil property located along Interstate 16 in Weston County in northeastern Wyoming. The field is conveniently located just five miles from the Wyoming Oil Refinery in Newcastle and its interconnected shipping points for refined oil products.

Although the enhanced oil recovery

project targets heavier crude in the shallow Lower Newcastle sandstone underlying the LAK Ranch property using a modified steam-assisted gravity drainage (SAGD) process, production from the field is sold at a premium to lower-quality regional sour grades. "We are producing a high-quality oil with low sulphur and low paraffin content that receives a premium to other Wyoming sweet crude pricing," says Erica Bearss, vice-president of corporate communications for Derek.

The LAK Ranch EOR project uses vertical and horizontal well bores drilled in combination, with steam injected into the vertical wells and crude produced from the lower horizontal wells. "LAK Ranch contains millions of barrels of high-quality oil, but the oil is viscous in-situ and requires EOR methods such as modified SAGD to extract it," Bearss re-

lates.

At the heart of the field is a computerized control center, where a single staff member can monitor and control the day-to-day operations of the entire project using fully automated production facilities, including steam generation and injection, water treatment, heater treater and oil storage equipment. The production operation also maintains a digital simulation model to continuously update and evaluate the reservoir's reaction to additional drilling and steam flooding.

In January 2005, an extensive 3-D seismic survey was completed over 4.5 square miles of the LAK Ranch project area. The interpretation of the 3-D seismic data identified several "sweet spots" with very significant reservoir potential in the Newcastle formation. "In addition to the potential identified in the Newcastle, the interpretation indicates multiple exploration targets in deeper horizons below the Newcastle formation," reports Bearss.

"We have identified several hydrocarbon targets and are considering numerous options available with respect to the exploration and development of these deeper targets," she updates. "The upside hydrocarbon potential identified in deeper horizons from the 3-D seismic is a major part of Derek's future development program. However, at least for the time being, the focus is on increasing production levels from the Newcastle before initiating an exploration program targeting the deeper hydrocarbon potential."

### Perfecting The Technology

Operators have been exploring for oil in this region of the Powder River Basin since the 1920s, but never with much success because of the viscosity of the oil in-situ. Bearss says major companies



Derek Oil & Gas Corporation and Ivanhoe Energy are jointly developing the LAK Ranch Field, an 8,000-acre property located along Interstate 16 in Weston County, Wy. The project is in the pilot phase of a modified steam-assisted gravity drainage EOR process targeting a high-quality viscous oil in the Newcastle Sand formation.



The surface facilities at LAK Ranch include a computerized control center, steam generator, aerial cooler, heater treater, oil production and storage equipment, and a water separation unit to treat and reclaim steam and co-produced water. The day-to-day operations of the project are monitored and controlled using state-of-the-art automation systems.

drilled a total of 13 wells on the property in the 1950s and 60s. “Those early wells were not very productive,” she explains. “They were making one or two barrels of oil a day. In contrast, we have been producing 40-60 bbl/d in the pilot phase of this project, and in some cases, as high as 75-85 bbl/d through enhanced oil recovery.”

Improving production and recovery rates from a heavy oil property like LAK Ranch requires the right technologies, a bit of experimentation and healthy commodity prices. “It is a matter of perfecting the technology and finding more effective ways of getting the oil to the surface,” Bearss states. “You have to use natural gas or coalbed methane to generate the steam for injecting into the heavy oil reservoir. Of course, it is more expensive. If oil was \$15-\$20 a barrel, we would not be looking at this project. But at today’s oil prices, there is no question of its potential profitability, even with higher natural gas prices increasing the value of the feedstock used to generate steam.”

Derek Oil & Gas invested \$9.5 million in constructing the pilot plant, including a horizontal well pair, and conducted a successful production joint test of 5,300 barrels. Derek signed a joint ven-

ture agreement with Ivanhoe Energy in January 2004, whereby Ivanhoe pledged \$5 million to finance the capital cost of the pilot phase and the initial development costs. Ivanhoe owns a working interest of 43 percent, although it has the option to earn up to a 60 percent working interest.



LAK Ranch uses a modified SAGD approach that pairs vertical steam injection wells with horizontal oil production wells, as opposed to a conventional SAGD design using two parallel horizontal wells. Some of the vertical injection wells used in the pilot project are shown here.

SEC Oil & Gas also invested \$600,000 in the installation of the pilot wells, for a 5 percent working interest. In addition to its working interest of 52 percent, Derek Oil & Gas owns a 5.4 percent production royalty.

The state-of-the-art above ground facility at LAK Ranch was engineered by Bateman’s Engineering Inc. It includes the computer control center, a 27-million Btu steam generator, an aerial cooler, a heater treater, oil production and storage equipment, and a water separation unit that cleans the reclaimed steam pumped into the reservoir and co-produced water. The treated water is cooled and released into a nearby creek, or used by area farmers for irrigation.

### Automated Operations

Technology has allowed the entire plant to be almost completely automated. “Each valve can be turned on and off by a computer electro-pneumatically,” Bearss says. “The fact that one man is overseeing the plant’s daily operations illustrates the degree of automation engineered into the operation—from steam generation and injection, to oil production, to water treatment.”

The test site includes three vertical injector wells, one vertical observation well, and two horizontal wells—one that is producing, and one that carries a fiber optic cable that measures the temperature in the reservoir.

“We are in the pilot phase of the proj-



ect to determine the most economically viable way to extract the oil," Bearss notes. "We are pumping steam into the reservoir to heat the viscous oil. When it reaches the optimal temperature, the viscous oil becomes liquid and is pumped to the surface through the use of a pump-jack. The fiber optic cable can measure the temperature in intervals as small as a foot—so we are able to monitor if and when more or less steam is required in the injector wells at any given point."

Although SAGD technology is new to the Powder River Basin, it has been used in other parts of North America, including California and the abundant tar sand fields in Alberta. Randy Metz, a geologist with Pacific Geotechnical Associates Inc. in Bakersfield, Ca., is serving as a consultant on the project.

"Bakersfield is located in the middle of thermal country in the heavy oil reservoirs of California," Metz explains. "I had worked with one of the board members of Derek before, and because of my thermal experience he invited me to get involved. Derek wanted a geologist who had experience with thermal reservoir development."

Metz points out that steam-assisted gravity drainage technology has been around for more than 40 years. "The application of steam to enhance heavy oil recovery took off in a big way in 1964 in California when Shell used it for the first time in the Midway-Sunset Field," he says. "SAGD has also worked well in Canada with heavier oils. Steam has been used in other places, too, such as in Pennsylvania and Kansas. The California oil industry has seen a number of recent rejuvenations from advancements in technology. LAK Ranch is a good opportunity to use advanced technology in a new place."

### Horizontal Drilling

In addition to the thermal technology, horizontal drilling has also aided in the improvement of enhanced oil recovery. "The biggest improvement has been the ability to steer the downhole tools exactly where you want them to go," Metz explains. "We now have much finer control of where the bit is actually going. Initial recovery in heavy oil reservoirs is usually low, often only 10-15 percent. Now, with thermal operations, SAGD technology and horizontal drilling, we are getting 60-70 percent of the oil out of the ground. In fact, with the new applica-

tions, we are now getting as much as 90 percent in some steam-driven projects."

The LAK Ranch development uses a modified SAGD technology, Metz notes. "One thing that is different about this project is that vertical wells are paired with horizontal wells, as opposed to a conventional SAGD design that uses two parallel horizontal wells—one on top of the other," he adds. "The approach has been used to try to more efficiently direct where the steam goes in the reservoir. Thermally enhanced oil recovery appears to be successful in the target Newcastle reservoir at LAK Ranch, and expansion of the project should take place in the near future."

Bearss notes that the 3-D seismic survey acquired in early 2005 is also proving beneficial. "This could be highly economic," she exhorts. "The clarity of the 3-D seismic has shown some sweet spots in the reservoir that will be helpful in terms of future drilling of both horizontal production and vertical injection wells."

She says the wells have been drilled to only 2,500 feet in the Newcastle formation, with an approximate 40- to 70-foot thick pay zone. The 3-D seismic has

also identified potential in the Minnelusa and Fall River deeper zones. "That is blue sky potential," she states. "But again, we will not look at the deeper targets identified by Derek's geophysicist and geologic consultants until we establish a consistent cash flow from the SAGD wells in the shallow Newcastle formation."

"Very few wells have penetrated the entire section," Metz adds. "The 3-D seismic gives us a view below where we have drilled. A detailed 3-D survey helps develop a clear picture of the reservoir in the Newcastle zone, but it also provides information on deeper possibilities. We are still evaluating the potential. At some point, we will drill a deep stratigraphic test."

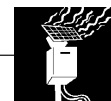
Once Derek Oil & Gas is ready to commence commercial production, the development calls for 60 patterns using an inverted five-spot on 2.5-acre plots, according to Metz. Each pattern will contain vertical steam injectors and production wells, with each injector surrounded by four production wells.

### Simulation Model

Company engineers will carefully



Improving production and recovery rates from the LAK Ranch Field requires the right technologies, a bit of experimentation and healthy commodity prices. Longer term, part of the revenues from the EOR operations may be used to explore the potential of deeper horizons underlying the field that were identified in new 3-D seismic data acquired over the area last year.



monitor the results of steam injection into the reservoir and oil production using a computerized simulation model. “We will be able to drill a well and have a better idea of what the reservoir reaction will be,” Bearss details. “It is a great tool for field development in EOR projects similar to the LAK Ranch. To know the potential impact or how the steam will react in the reservoir before the wells are drilled will save both time and money.”

Metz says his role will be picking injection and production well locations, being involved in the drilling, evaluating logs and thermal surveillance. “Thermal surveillance is extremely critical,” he acknowledges. “The key is heat control, because the biggest cost is the cost of steam that will go into the ground.”

Initial estimates are that 30-70 percent of the field’s 100 million barrels of original oil-in-place could be recovered using thermal techniques. Metz says he believes

that the initial results of the LAK Ranch Field pilot program are encouraging. “What makes me excited is that this has the earmarks of a successful thermal project,” he says. “After a while, you get a sense of what is positive and what is negative.”

He notes that the field has good bed dip, meaning the pay zone is inclined, which assists in gravity drainage. He adds that the nature of the heavy oil found in the Newcastle zone is that it responds well to heat. “In its normal state, it is like molasses,” Metz explains. “The more heat you put to it, the better it flows.”

Metz says the amount of oil available is also critical to a thermal project. “Thermal projects are capital-intensive up front,” he explains. “You need enough oil to make it worth your while, and it looks like there is plenty of oil in the LAK Ranch Field. It just needs steam assistance to get it to the surface. Derek has installed a very nice facility that has been able to operate

all but a few days of the year.”

The geologic conditions appear favorable, as well. “The 3-D seismic data show a cap rock with stratigraphic closure and faults,” Metz explains. “There is also plenty of source rock with the native shale. Porosity and permeability—two key factors in oil recovery—are good and Derek has thus far been able to inject the steam into the ground at acceptable rates.

“In short, the LAK Ranch Field has all the ingredients you look for in a thermal project,” Metz concludes. “The continuous steaming program that began last November as part of the pilot program has demonstrated positive reservoir reactions, increasing temperature readings, decreasing viscosity and increasing oil production. The field’s location along a major highway and close to a refinery is just an added bonus.” □