

A tall, white and red oil drilling rig stands in a field of golden-brown crops. The rig is positioned on the right side of the frame, extending vertically towards the top. The background features a clear blue sky with scattered white clouds. In the foreground, there are rows of harvested crops and a large pile of dark soil. A white pipe or hose runs across the middle ground, curving from the right towards the left. The overall scene depicts an active oil drilling site in a rural, agricultural setting.

Under pressure to produce:  
Protecting your shale oil investments



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# Under pressure to produce: Protecting your shale oil investments

The shale oil boom that began in 2008 appears to have staying power, unlike the boom-and-bust period of the late 1970s through early 1980s. Technology first developed to remove natural gas from shale rock has been refined to extract oil from shale formations across the country, most notably in Eagle Ford in Texas and Bakken in North Dakota. In 2010, more than 1,000 drilling permits were issued for Bakken, up from 94 permits in 2009. North Dakota has produced oil for decades, but in the past three years the Bakken shale oil play has made it the fourth largest oil producing state in the country.

More favorable economics, easier permitting and technology advances are making shale oil exploration and drilling more attractive than ever. Higher oil prices, political instability in the Mideast and federal government limits on offshore permits are fueling the explosion in shale oil development over the last few years. In addition, most shale oil plays are occurring in states where there are limited federal lands and mineral rights. Individuals or companies own most mineral rights in Texas and North Dakota, as opposed to the Green River formation in Colorado where the federal government owns 80% of the land. Fracking technology has evolved to the point where almost 60% of the oil in the rock can be extracted, up significantly from the technologies used in the past.

From large multinationals to smaller regional operators, companies are investing billions of dollars in the technology, infrastructure and personnel required to extract shale oil. One multinational drilling conglomerate announced the hiring of 11,000 workers alone this year for their North Dakota operations. This “rush-to-produce” scenario may help ease the country’s dependence on foreign oil and improve the nation’s employment figures, but it can also leave a company vulnerable to new and costly risks that can turn boom optimism into bust profits.

## Largest Shale Oil Plays in the U.S.\*

Name	Location	Barrels
Green River	Colorado/Wyoming	1 trillion
Monterey/Santos	Southern California	15.4 billion
Bakken	North Dakota/Montana	3.6 billion
Eagle Ford	Texas	3.4 billion

\*U.S. Energy Information Administration (EIA) “Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays”

## Challenges of Shale Oil Development

Since the Monterey and Green River plays are currently off the table because of the federal ban on drilling, most of the shale oil development is concentrated in North Dakota’s Bakken and Texas’ Eagle Ford. Each of these plays have their own challenges, reflected by the drilling history and location of the plays. Unlike the Marcellus shale gas play in Pennsylvania where environmental concerns surrounding the fracking process have slowed some of the development, both Bakken and Eagle Ford are located in states where oil drilling and fracking operations are more accepted and encouraged.

***As developers learn more about the geology in these new shale oil plays, drilling and completion techniques often need to be adjusted, which means additional investments in drilling procedures and personnel time.***

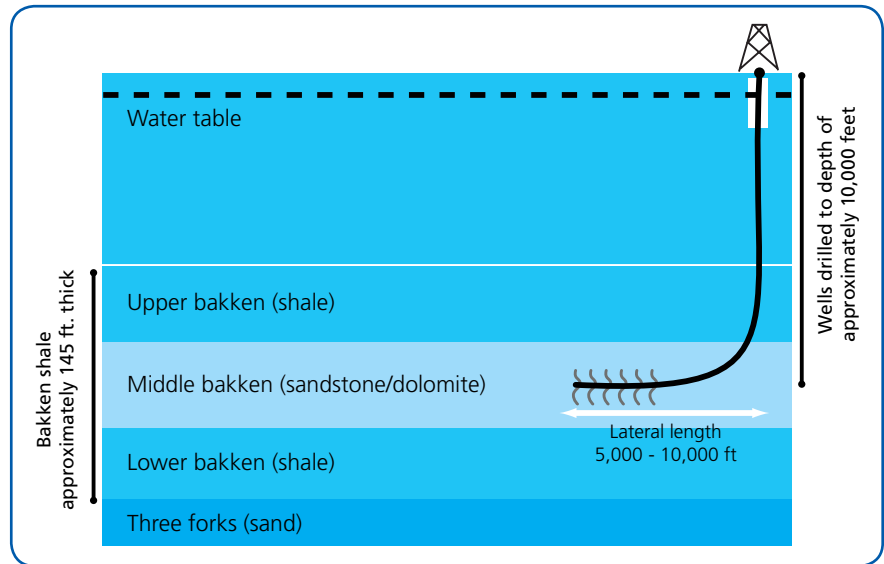
One of the major obstacles to shale oil drilling in North Dakota is the cost of creating infrastructure and assembling a workforce. Rigs are in scarce supply, and workers are in such demand that companies are bringing in both skilled and unskilled workers from other states. Housing is also in short supply, and many companies have no choice but to rent out hotel and motel rooms for both short- and long-term accommodations for employees. RV and camper set-ups, or “mancamps,” in close proximity to rigs are common, where employees eat, sleep and work within yards of each other and the operations. Some fracking personnel are working round the clock to keep up with the demand, as there can be six-month waiting times for crews. The close quarters, long hours, and pressure to perform in new and physically demanding conditions can fray the nerves and increase the chances for injuries and accidents among a company’s workforce.

The lack of equipment in both North Dakota and Texas requires the available large rigs to be moved between multiple wellheads. This increases the demand for qualified truck drivers on-site personnel, and puts an extra strain on the existing roads that are already choked with well workers and other service personnel. North Dakota also lacks the traditional oil transportation infrastructure found in Texas. The cost of accessing existing pipelines in North Dakota is so high, that some companies have found they can save \$5 to \$10 a barrel by moving oil by rail instead of pipelines.

North Dakota and Texas also have their unique weather challenges. The last few winters in North Dakota have been some of the coldest and snowiest, with temperatures often dropping to -40F. This extreme weather often requires companies to suspend production until wells can be accessed again and produced oil can be transported. In Texas, the brutal summer heat can expose workers to heat stroke, especially when they are required to wear OSHA-mandated fire-retardant clothing.

As developers learn more about the geology in these new shale oil plays, drilling and completion techniques often need to be adjusted which means additional investments in drilling procedures and personnel time. The Bakken shale play consists of three layers, an upper layer of shale rock, a middle layer of sandstone/dolomite and a lower layer of shale rock (see illustration). As engineers began to understand more about how to access the shale oil in this geological formation, it was determined that combining horizontal drilling with multistage fracking and longer laterals was the best technique. The number of frac stages has dramatically increased in the Bakken wells, growing from single digits just a few years ago per well to about thirty today. This technique increases the the cost of drilling, but can increase the initial production rates and the ultimate recovery of oil from each well.

## Bakken shale oil formation



\*\*Source: EPRINC, "Bakken Oil Boom: An Introduction To North Dakota's Shale Oil", August 2011

Although the states and public generally do not consider contamination of the water supply from fracking a big risk in the West compared to the East, the issue of having enough water for both fracking operations and the local community could pose a potential problem in the future. Six billion gallons of fresh water are needed each year for a hydraulic fracturing operation, raising eyebrows among local farmers who also depend on the local water supply for their crops and animals. As drilling increases in North Dakota and Texas, the issue of adequate water supply will likely bring more scrutiny, especially if summers bring the brutal, rainless conditions experienced in 2011 in Texas.

While fracking additives have already come under scrutiny by the EPA and some states, the Securities and Exchange Commission (SEC) announced on August 25, 2011, that they will ask oil and gas companies to provide detailed information on chemicals used and the associated environmental impacts. Currently, the SEC is requiring this information be provided confidentially to the agency and not made public at this time.

## Challenges developers and operators face with shale oil development in North Dakota and Texas:

- Undeveloped transportation infrastructure
- High demand for fracking equipment and crews
- Lack of qualified and trained workforce and subcontractors
- Overworked and highly stressed workforce
- Limited and expensive housing stock
- Excessive strain on service roads and increased accidents
- Weather extremes affecting equipment and personnel
- Competition for local water supply with local community
- Increased reporting requirements by government agencies

## A risk checklist for shale oil development

Protecting your significant investment in shale oil development from unexpected and costly risks is important. The following checklists can help your organization avoid being caught with expensive claims that could occur from hurried well construction, an untrained workforce, fatigued drivers and other scenarios that can occur with new shale oil plays.

### Operational

- **Is the bend in your steel pipe installed correctly?** The pipe needs to fit into a small diameter hole and then curve into the horizontal leg. Although improvements have been introduced to the steering tools used in placing the pipe in horizontal wells, the bend is the one area that is susceptible to failure under high pressure if not installed to the highest standards.
- **Are your pipes and casings being sourced correctly?** Shortages of U.S. milled pipe have led some contractors to buy foreign made supplies that may not be fabricated or rolled to American Petroleum Institute (API) specifications. In addition, if strings of casing are mixed between sources, this can cause breaches. It's important to review the casing program to determine what specific pressures can be applied and limit the squeeze pressures to a level below what the pipe is designed for.
- **Are you watching for perforations of steel casing?** The cyclical stress on the casing can cause perforations. Casing is manufactured to API standards, but repeated high pressure of 8 to 12 thousand pounds can build up stress on the casing. When casing is perforated, the inside of the pipe can be exposed to the outer rock formation.
- **Are you accounting for fracturing pressure on intermediate casing?** Intermediate casing normally has a lesser internal yield or burst pressure, and once it is drilled through has even less. A good casing program should not allow for fracturing through intermediate casing.
- **Do you have good control of fracking operations at the surface?** Having the ability to control fracking operations at the surface is important. Good risk management prefers to see redundancy in frac valves at the surface in order to have back-up if one becomes inoperable.
- **Is your casing cemented adequately?** Fracking fluids can seep into the water table due to an inadequate casing cementing.
- **Are you disposing of fracking fluid appropriately?** Be sure personnel is trained in the correct way to dispose of fracking fluid.
- **Does your general liability and excess casualty cover all potential loss scenarios?**

### Personnel:

- Are your employee safety programs appropriate for shale oil operations? Employee injuries can be caused by blowout preventer malfunction, hose bursts, manual moving of fracturing fluid additives, fleet and transportation accidents to and from the job site and environmental exposures (heat exhaustion, etc.)
- Do you have the proper hiring and screening procedures in place? While eager and hungry jobseekers may seem like good applicants, be sure to take the time to go through appropriate skill assessments and screening procedures before investing in hiring and moving employees.
- Do you have up-to-date medical evacuation directions? It's important to have GPS coordinates for wells, directional signs in place for emergency vehicles, helicopter landing areas, and written medical evaluation procedures for well supervisors.
- Is your workers' compensation coverage up to date?

### Transportation:

- Are you hiring drivers with good records? Many vehicle accidents are caused by inexperienced drivers operating in new terrain or weather conditions.
- Are you training drivers to be sensitive to the community needs? Public nuisance claims can result from damage to neighboring property caused by trucks hauling large rig equipment.
- Do your company-owned vehicles have fleet intelligence systems installed?
- Is your auto coverage up to date for each new employee and vehicle?

Shale oil represents a great opportunity for energy independence and economic growth in the U.S. Paying attention to all the potential risks can help protect your company's significant investments in leases, operations, infrastructure and personnel.

" EOG's big gamble on shale oil " [http://money.cnn.com/2011/07/28/news/companies/eog\\_shale\\_oil.fortune/index.htm](http://money.cnn.com/2011/07/28/news/companies/eog_shale_oil.fortune/index.htm)

\*\* The Bakken Boom: An Introduction to North Dakota's Shale Oil Energy Policy Research Foundation, Inc., August, 2011

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