Delivering success in HP/HT reservoirs
through experience, innovation and reliable technologies

Solving challenges™
**HSE & Operational Excellence**

In the energy industry, companies must meet or exceed a vast array of environmental, health and safety standards. Halliburton goes beyond compliance to focus on sustainability in everything we do, striving to leave the places where we work better than we found them. Our goal is to provide products and services that have minimal environmental impact, are safe in their intended use, consume resources efficiently and can be recycled, re-used or disposed of safely. We have always embraced the job of ensuring that all our technologies meet the highest safety and environmental standards.

**Reliable equipment, people and processes are key to dealing with high temperature/high pressure situations**

High temperature and/or high pressure environments present significant dangers to people, property and the environment. High temperature situations can cause equipment failures that may lead to pressure issues and possible spills that could adversely affect the environment. In high pressure situations, the higher the pressure, the more stored energy is available. Should there be an uncontrolled release, it could cause serious injury to people and damage to property.

Halliburton's commitment to health, safety and the environment extends itself to high temperature/high pressure situations. Our reliable equipment, experienced people and best-in-class processes are key and essential to dealing with high temperature/high pressure environments.

**Risk Management Solutions**

Boots & Coots, A Halliburton Service, offers Risk Management Solutions (RMS) that can help identify your HP/HT risks before they arise, reducing the potential for catastrophe and mitigate damages in the event a loss occurs.

Our pre-event engineering services put Boots & Coots’ unmatched experience with deep, high-pressure, high temperature wells—on land and offshore—into your organization in the early stages of a project. We provide customized prevention plans that may include training, risk analysis, contingency planning, audit programs, deepwater application and well inspections, as well as blowout prevention and control counsel or assistance in addressing identified risks. RMS saves time and money by reducing the frequency of critical well events and, when one does occur, getting production back on line as quickly as possible with as little damage as possible.
As conventional sources of oil and gas decline, operators are increasingly turning their attention to unexplored or underdeveloped areas. High temperatures and/or high pressures are often found in these uncharted territories, presenting complex challenges including casing buckling, accelerated drilling fluid chemical reactions and rock collapse.

**Halliburton is well equipped to handle your HP/HT challenges**
Halliburton has more than 1,500 global HP/HT experts and the largest selection of HP/HT capabilities in the industry. Our experts approach HP/HT challenges by initially establishing a detailed understanding of your reservoir. After developing the most effective plan, we help operators execute, using the latest HP/HT evaluation, well construction, completions and stimulation technologies.

Halliburton continually creates innovative HP/HT technologies and processes that increase efficiency, recovery, safety and reliability in our specialized HP/HT research and development (R&D), testing and manufacturing facilities. These world-class facilities are equipped with the greatest number of test wells and cells in the service industry.

**Challenge spurs innovation that creates better tools and technologies**
From high pressure oil reservoirs in the deepwater to deep, hot, high pressure gas reservoirs, operators entrust Halliburton with their toughest challenges.

---

**About HP/HT**

According to the SPE E&P glossary, high temperature is where the undisturbed bottom hole temperature (at prospective reservoir depth or total depth) is greater than 300°F or 150°C. As for high pressure, that definition is met when the maximum anticipated pore pressure of the porous formation to be drilled exceeds a hydrostatic gradient of 0.8 psi/ft, or the well requiring pressure control equipment has a rated working pressure in excess of 10,000 psi or 69 MPa.

**Halliburton has further defined HP/HT wells as follows:**

<table>
<thead>
<tr>
<th>Borehole Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>HT</td>
</tr>
<tr>
<td>&gt;300°F (150°C) - 350°F (175°C)</td>
</tr>
<tr>
<td>Extreme HT</td>
</tr>
<tr>
<td>&gt;350°F (175°C) - 400°F (200°C)</td>
</tr>
<tr>
<td>Ultra HT</td>
</tr>
<tr>
<td>&gt;400°F (200°C) and above</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Borehole Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP</td>
</tr>
<tr>
<td>&gt;10,000 psi (69 MPa) - 15,000 psi (103 MPa)</td>
</tr>
<tr>
<td>Extreme HP</td>
</tr>
<tr>
<td>&gt;15,000 psi (103 MPa) - 20,000 psi (138 MPa)</td>
</tr>
<tr>
<td>Ultra HP</td>
</tr>
<tr>
<td>&gt;20,000 psi (138 MPa) and above</td>
</tr>
</tbody>
</table>

As tools and technologies for these wells become conventional, the temperatures and pressures considered high, extreme or ultra will continue to rise.

---

1  High Pressure/High Temperature
Challenges and Solutions

Higher pressures and temperatures pose significant challenges—and opportunities

Reservoirs with pressures and temperatures deemed higher than what was considered typical in the past are now frequent targets for exploration and development.

However, temperature and pressure affect the physical strength, electronic function, sealing technology and chemical reaction of a technology or process. This imposes very real limitations on much of the technology currently available to help develop these reservoirs. Halliburton realizes the importance of investing in high pressure/high temperature (HP/HT) research, development (R&D) and new technology as a result of the industry undertaking the daunting challenge of commercializing deeply buried reservoirs. With more than 1,500 dedicated HP/HT experts around the world and the largest selection of HP/HT capabilities in the industry, Halliburton, continues to create innovative HP/HT technologies and processes that increase efficiency, recovery, safety and reliability.

So how can high pressure and high temperature reservoirs be explored and developed successfully and cost effectively?

Halliburton experts work with clients to better understand their reservoir and develop customized well plans specific to their asset. Through continuous collaboration, our specialists recommend solutions, not just specific technologies, to help the client get to production faster and safer.

Our capabilities in HP/HT are the most extensive in the industry and one-of-a-kind due to our commitment to clients and our strong engineering, R&D and testing facilities. Our technologies have proven to be effective and reliable time over time making Halliburton the go-to provider for all of your HP/HT needs.
3 High Pressure/High Temperature
Halliburton can meet your HP/HT well construction challenges

Halliburton HP/HT engineers designed our portfolio of well construction products to withstand heat, pressure and cyclical loading over the life of the well while providing maximum drainage for the reservoir. Our drilling fluids were developed to withstand temperatures up to 550°F/288°C with density values of up to 20 ppg without the use of weighting agents—thus minimizing the possibility of particle invasion.

Operators can also reduce non-productive time (NPT) while delivering precise wellbore placement via Halliburton’s directional drilling tools. Using our Geo-Pilot® XL rotary steerable system that’s engineered to withstand temperatures up to 374°F/190°C and pressures up to 30,000 psi/207 MPa, these tools help clients achieve better hole quality and stay on target. For higher temperatures, Halliburton can provide turbines built to withstand temperatures up to 572°F/300°C. Our cementing service has been consistently ranked #1 in value by independent surveys of oil and gas customers and we offer cementing systems specifically designed for high-temperature wells, including cementing solutions tested and proven at temperatures as high as 750°F/399°C.

Halliburton can meet your HP/HT formation and reservoir evaluation challenges

To ensure equipment reliability, the highest quality data acquisition and a reduction of non-productive time during the formation and reservoir evaluation phase, Halliburton developed a fleet of electronic components, systems and seals that can endure pressures greater than 35,000 psi/241 MPa, and temperatures up to 500°F/260°C—all while undergoing vibrations for extended periods of time.
Halliburton can meet your HP/HT well completion and intervention challenges

From years of experience and extensive collaboration with our clients, Halliburton has designed well completion tools that maximize production, despite the many environmental challenges HP/HT reservoirs pose. From casing inner diameter constraints to finding a seal compound that can withstand high pressures and/or temperatures or safety valves that can qualify for high pressures—Halliburton offers solutions that solve these and many more HP/HT challenges. Our well completion technologies are rated for temperatures up to 500°F/260°C and pressures up to 30,000 psi/207 MPa.

As the global completions leader in swellable technology, surface and subsurface safety systems, high-pressure packer systems, intervention solutions, flow controls, service tools, expandable liner technology, engineering capability, testing facilities and manufacturing capacity, Halliburton focuses on increasing net present value by taking a systems approach to well completions for maximum recovery. In addition, our intelligent completion architectures, including SmartWell® intelligent completions and multilateral systems, enable efficient drainage of complex reservoirs. Halliburton’s full range of successful HP/HT completion technologies can have long-lasting benefits for the reservoir’s profitability.

Halliburton can meet your HP/HT stimulation challenges

With technologies that have no temperature and no pressure limitations, Halliburton provides cost-effective HP/HT approaches to fracturing, pinpoint stimulation, acidizing/near-wellbore cleanout and conductivity endurance. Other stimulation solutions include fluids that resist stability breakdown in high temperatures. Halliburton also has the ability to deliver increased horsepower to handle the pressure in these challenging formations.
Halliburton Advantage
Charting a course for a reliable future in high pressure high temperature wells since 1960

Halliburton not only has the industry’s leading experts and the largest HP/HT fleet, we’ve been developing and upgrading our HP/HT capabilities for the last 50 years. From superior pressure management technologies to unique and industry leading advances in HT electronics, sealing technologies, HT elastomers and tailored operating practices that save time and reduce downtime, Halliburton is the one to call on to address the myriad of challenges an HP/HT well can present.

Improving reliability through testing
Halliburton’s primary service quality objective is to exceed our customer’s expectations. A key component of this process is our state-of-the-art testing and design validation facilities. Through the experience and knowledge of our people and a commitment to technological innovation, Halliburton continues to deliver safe, reliable and technically advanced products and services.
High Pressure/High Temperature

HP/HT Testing and Design Validation Facilities

**Duncan Technology Center**
This award winning 230,000 sq ft (21,367 m²) facility is one of the largest facilities of its kind in the world. Testing under realistic conditions is offered by a 2,200 ft (671 m) test well and a deep-well simulator which can test at pressures up to 20,000 psi/138 MPa and temperatures up to 475°F/246°C. The test well and deep-well simulator are located in a building adjacent to the rig, allowing many tool-development and procedural successes that have saved many months of development time.

The facility is also equipped with a Pressure Testing and Tool Assembly unit with the capability to test mechanical burst and collapse pressures, the effects of elevated temperature on tool seals under operating conditions, and port seal crossing. The unit also constructs special pressure testing chambers.

**Carrollton Technology Center**
This center has developed a steady stream of innovative oil industry products with over 1,300 US Patents issued and numerous engineering innovation awards. A High-Temperature Facility and Deep Well Simulator Facility are included within the center and used to test experimental designs for HP/HT wells.

The High-Temperature Test Facility has five below-ground heated test cells and one rapid cool down cell. Each test cell is designed to accommodate assemblies up to 30 ft (9 m) and 30 in (762 mm) diameter and has a temperature range up to 700°F/371°C. The device undergoing testing receives uniformly heated air to simulate severe temperatures downhole. The rapid cool down test cell employs a self-contained chiller unit capable of cooling to 32°F/0°C.

A below-ground test facility, the Deep Well Simulator is designed to accommodate long assemblies up to 63 ft (19 m) with temperatures up to 1,000°F/538°C. Inside the cell, the device undergoing testing receives uniformly heated air, allowing a range of temperatures and pressures found in many severe wells to be simulated.
**North Belt Technology Center**

This facility includes an extensive Mechanical Test Laboratory and an HP/HT Vessel rated to 500°F/260°C, and 40,000 psi/276 MPa. The High Temperature Flow Loop is rated to 446°F/230°C and the Oven Farm currently has 20 chambers in service. To ensure operational reliability, Halliburton subjects all existing HP/HT tools to a specific temperature profile, which includes operational tests at 347°F/175°C and non-operational soaking at 392°F/200°C.

This facility will be home to “Project Victoria”, a project to create ultra HP/HT M/LWD tools for TOTAL’s Victoria field in the North Sea. Scheduled to begin in 2010, “Project Victoria” will require tools to be rated to 446°F/230°C and 30,000 psi/207 MPa. First to be developed are directional probe, gamma ray sensor and pressure-while-drilling sensor. Halliburton is aiming at achieving tool survivability at 482°F/250°C for the length of a 14-day bit run.

**Singapore Manufacturing and Technology Center**

Located in the Jurong industrial area in western Singapore, the 20,252-square-meter (218,000 sq ft) facility is the Company’s second manufacturing facility in Singapore and is designed to support the growing demand for Sperry Drilling Services, Halliburton Wireline and Perforating Services and Security DBS Drill Bits tools worldwide.

The pioneering center produces sophisticated electronic sensors used in the Company’s signature logging-while-drilling tools and openhole wireline logging services, and it serves as a repair and maintenance facility for drilling tools used throughout the region.

**Jet Research Center (JRC)**

Located on more than 800 acres in Alvarado, Texas, JRC’s Explosive Products Center is a fully integrated research, engineering, testing and manufacturing plant that produces advanced perforating systems and specialty explosive devices for the oilfield, including shaped charge perforators, RF-protected detonators, tubing and casing cutters, severing tools and platform removal charges. JRC’s premier technical staff includes a balance of engineers, designers and technicians who are among the most knowledgeable experts in the perforating industry. Their backgrounds range from doctoral and Master’s level engineers to highly skilled explosive technicians—some with more than 25 years experience. Pressure Vessels and Thermal Ovens are available at the JRC to test explosive components and systems to conditions up to 30,000 psi/207 MPa and 500°F/260°C. High-speed multichannel oscilloscopes, piezoelectric pins, ballistic pressure transducers and other specialty instrumentation are routinely used to conduct diagnostic experiments on explosive components and systems.
Sales of Halliburton products and services will be in accord solely with the terms and conditions contained in the contract between Halliburton and the customer that is applicable to the sale.
Sigma® Process Using MRIL® Measurement Technology Identifies Missed Zone, Adds Production Worth Over

Location: Mexico

Challenge
In the Cuitlahuac field in Reynosa, PEMEX drilled a strategic well to prove the existence of new gas reserves, so drilling could be extended to include the west part of the field. Well conditions included 3,930 m depth, 3½-in slim casing completion and 330°F (166°C) bottom hole static temperature.

Halliburton Solution
In order to establish new gas reserves, Halliburton recommended using the Sigma® process incorporating NUMAR's MRIL® measurement technology to estimate the delivery rates of the reservoirs. Conventional log interpretation showed hydrocarbons on entire sand zones and indicated a strong “shale” zone that the operator had been using as a shale barrier. The MRIL log showed effective porosity and important hydrocarbon volume only on intervals within the sand zones. Plus, the MRIL log showed the “shale” zone was in fact a sand zone and contained good grain size distribution and permeability.

Based on Sigma analysis and MRIL interpretation, Halliburton and PEMEX fracturing experts selected the interval exhibiting the best perm and porosity. The interval selected included the former “shale” zone. After the interval was perforated, no appreciable pressure increase occurred and no radial flow.

The usual procedure would have been to abandon the zone and fracture other intervals. However, using the Sigma process and studying drilling records showed that significant amounts of drilling fluid had been lost in the zone. Halliburton recommended an injectivity test before going to the upper intervals in order to remove the damage prior to fracturing.

Economic Value Created
Halliburton's Thermagel™ fluid and Vicon™ NF breaker were used to place 20,000 lb of intermediate strength ceramic proppant. Results: After 10 days, gas production had settled out at 1.88 mmcfd and condensate production at 48 bpd. This production is worth over $1 million per year. In addition, PEMEX avoided fracturing another zone for an additional savings of $220,000.

Note: Thermagel has been replaced by Sirocco, Halliburton’s next generation fracturing fluid system.
Expedite® Service Eliminates Proppant Flowback and Increases Gas Production by Approximately $1.8 Million

Location: Mexico
Challenge
An operator needed to control proppant flowback after a fracturing treatment in a 16,269-feet high-pressure, high-temperature exploration well in a PP1 formation. The well’s bottomhole temperature was 397°F (202.8°C).

Halliburton Solution
Halliburton recommended using its Expedite® service to coat the proppant on the fly. The Expedite service provides a step-change improvement over conventional proppant flowback control systems and offers up to three times the conductivity of resin-coated proppants.

Economic Value Created
Following treatment, the well experienced no proppant flowback. The total economic value created was approximately $1.8 million based on a substantial increase in gas production.

With Expedite® service, capillary action causes flow of the liquid resin, concentrating it between proppant grains and resulting in greater concentration of resin at contact points for increased durability. Above are photomicrographs of a widely used resin.
Rigorous QA/QC Procedure Enables Successful Perforating of HT Wells

Location: East Lost Hills Project, California

Challenge
An operator required a tubing-conveyed perforating (TCP) system for a four-well project after a previous system failed due to elastomer leakage in the firing head. The successful TCP system had to be capable of handling bottomhole temperatures as high as 425°F (218°C) for up to 200 hours before the perforating guns would be fired.

Halliburton Solution
Halliburton’s TCP system was successfully used without any modifications. Due to the critical nature of perforating operations in high-pressure/high-temperature completions, Halliburton performed rigorous quality assurance/quality control (QA/QC) testing on all components before deployment.

Economic Value Created
Halliburton’s QA/QC process resulted in the allocation of a quality-controlled TCP inventory that was successfully used on all four wells in the project without lost time. This procedure was also used to establish a contingency thru-tubing perforating inventory required for some of the project’s completions.
GeoTap® Formation Pressure Tester Saves Operator US $3-6 Million

Location: Deepwater Gulf of Mexico

Challenge
An operator was drilling a subsalt deepwater [water depth of 4,986 feet (1,520 m)] well in the Gulf of Mexico and required real-time pore pressure measurements of the formation to help optimize mud weight and manage equivalent circulating density. Miocene formations in the Gulf of Mexico are characterized by narrow pore pressure/fracture gradient margins which can result in ballooning events when the mud weight reaches the fracture pressure of the formations. In this environment, predicting pore pressure with resistivity sensors is difficult because of the well’s close proximity to salt formations. Uplifted formations can result in the pore pressure in the sand formations being higher than the shale pore pressures due to buoyancy effects. A combination of these challenges prompted the operator to run a real-time pore pressure measurement tool.

Halliburton Solution
Halliburton drilling services recommended the GeoTap® formation pressure tester for real-time formation pressure measurements. The drilling team utilized the 9-1/2-in. and 8-in. GeoTap formation pressure testers to measure the actual formation pressure as the team drilled to help optimize mud weight. The GeoTap tester provided real-time formation pressure measurements, delivering early and reliable results. This aided in determining and maintaining optimal mud weight, reduced formation damage and increased rate of penetration.

Economic Value Created
The operator saved approximately $3 million when information provided by the GeoTap testers made it possible to eliminate a planned expandable casing string, and saved an additional estimated $3 million by eliminating the need for a contingent casing string. Based on this success, the GeoTap tester is now part of the standard bottomhole assembly on subsalt deepwater exploration wells for this operator.

In addition to saving the operator a substantial amount of money, the 8-in. GeoTap formation pressure tester demonstrated record performance in this well. It achieved the deepest-ever high-quality test, taken at 29,898 feet (9,113 m) measured depth, 28,525 feet (8,694 m) true vertical depth. The tool also acquired two of the highest measured pressures to date, with a hydrostatic pressure measurement of 22,538 psi (155 MPa) and formation pressure of 22,008 psi (152 MPa).
Weighted Fracturing Stimulation Fluid Reduced Surface Treating Pressures, Allowing Record-Setting Well Test in Deepwater GOM Project

Location: Deepwater Gulf of Mexico

Challenge
Chevron's Jack #2 well at Walker Ridge Block 758 in the Gulf of Mexico (GOM) Lower Tertiary trend is in 7,000 feet (2,134 m) of water, with a reservoir target greater than 20,000 feet (6,096 m) below mudline. Because of the high fracture gradient and friction in the wellbore tubulars, the surface treating pressure generated by a conventional fracturing fluid system was expected to exceed the 15,000 psi (103 MPa) surface equipment safety limitations.

Chevron was confronted with finding a proven, weighted fracturing stimulation fluid that could meet the challenges of this deepwater environment.

Halliburton Solution
Halliburton designed the DeepQuest® treatment fluid that would work within the safe pressure parameters, which was pioneered on the deepwater GOM Tahiti prospect in 2004. The fluid helps ensure that surface treating pressures stay within the operating limits of the flexible treating line from the marine vessel and the surface treating lines on the rig floor at the required pump rates. In combination with the proven deepwater FracPac™ tool system, the fluid made it possible to enhance the productivity of the ultra-deep Jack #2 well using fracturing stimulation.

Economic Value Created
The well test and fracpack were successful, exceeding Chevron's expectations. Surface treating pressures with the DeepQuest weighted fluid were substantially reduced, which allowed the operator to successfully perform the treatment in the challenging deepwater GOM environment.

Without fracturing, the economic viability of projects like the Jack #2 well would be significantly challenged. The ability of Halliburton's stimulation fluid service to reduce surface treating pressure allowed the operator to safely complete the frac within the surface equipment limits, and reduced Chevron’s need and cost for obtaining higher-pressure equipment. Chevron successfully drilled the Jack #2 well to a total depth of 28,175 feet (8,588 m) and completed a record-setting well test with a sustained flow rate of more than 6,000 bbl/day.
Diesel-Based Fluid Successful in Deep, High-Pressure Wells with Hard Formations Project

**Location: West Texas**

**Challenge**

Maximum mud weights in the 17.2 ppg range and hard Pennsylvanian era formations in a West Texas field made drilling slow and challenging. The highly pressured Atoka formation and lower pressured zones including the Strawn and Morrow were drilled within the same interval. Mud weight was critical and equivalent circulating density (ECD) control was a primary concern. Tripping operations required spotting pills and staging in and out of the hole.

**Halliburton Solution**

Halliburton personnel recommended drilling with the clay-free, diesel-based INTEGRADE® system because of its ability to help maintain a stable wellbore. Drilling with INTEGRADE fluid can also help increase penetration rates and optimize ECD control.

**Economic Value Created**

The operator agreed to try the INTEGRADE system and the well was displaced with a 16.4 ppg INTEGRADE fluid at 12,753 feet (3,887 m) after drilling out from intermediate casing. The production interval was drilled to 17,650 feet (5,380 m). There were no unforeseen events and casing was set with no problem.
Controlling Well Direction While Opening Hole in HP/HT Deepwater Vertical Well Saves Customer Millions

Location: Mediterranean

Challenge
A vertical well needed to be drilled in the deepwater, high pressure high temperature (HP/HT) environment of the Mediterranean Sea, where maximum temperature and pressure were approximately 390°F (199°C) and 20,000 psi (138 MPa). Several casing strings would be required and hole opening would be needed for the majority of hole sections. Also, hole verticality, especially in the upper section, was considered crucial to minimize the potential dangers of excessive torque and drag.

Halliburton Solution
The Geo-Pilot® system was run in the vertical drilling mode in tandem with the under reamer for several different intervals. The Geo-Pilot system with Geo-Span® downlink service was mobilized where historically in offset wells, formations had naturally built angle. At the final total depth of approximately 22,000 feet (6,700 m), the offset from the wellhead was below 110 ft (33.5 m), giving an average inclination from the surface to bottomhole location of only 0.3°.

Economic Value Created
Being able to control well direction and open the hole at the same time saved the customer an estimated US $1.8 million to US $4.5 million, depending on what other method of drilling could have been used.
DeepQuest™ HT Stimulation Service Helps Unlock Hot, Tight Gas Reservoir

**Location: Saudi Arabia**

**Challenge**

Saudi Aramco faced an extreme high pressure high temperature (HP/HT) stimulation challenge in a new field, with a 375°F (191°C) reservoir temperature and more than 15,000 psi (103 MPa) required for fracturing. Developing an innovative way to frac under these HP/HT tight gas sandstone conditions was crucial to Saudi Aramco for stimulating and proving the reserves of the tight gas formations in northwestern Saudi Arabia.

**Halliburton Solution**

The Halliburton Saudi Arabia Production Enhancement team worked with experts in Duncan, Oklahoma and Houston, Texas to develop the DeepQuest HT fluid system to perform under these extreme conditions.

**Economic Value Created**

The Saudi Aramco job was performed flawlessly by pumping 16.4 barrels per minute at 21,000-psi bottomhole treating pressure. As specified in the design, Halliburton’s Production Enhancement team pumped 80,000 gallons of the gel system and placed more than 150,000 pounds of proppant.
Fracturing Solution Enables Improved Production

Location: Southeastern USA

Challenge
An operator planning an 11,500 ft (3,505 m) total vertical depth Haynesville shale formation well with a 4,000 ft (1,219 m) horizontal section was looking for a fracturing solution to maximize production in an area where results are often disappointing. Because the area is at the outer limits of the Haynesville shale play, initial production typically runs just 3 to 4 million standard cubic feet per day (MMscf/d). Compounding the difficulties, the formation is tight and clay rich, making it difficult to place proppant. Bottomhole static temperature was 315°F (157°C).

Halliburton Solution
Halliburton recommended treated water, and the WaterFrac™ G and Hybor™ G fracturing fluid systems for the multi-stage treatment. Six percent NaCl was used for the base fluid with ViCon NF™ breaker, GasPerm 1000™ additive, SandWedge® conductivity enhancement system, and 30/50 and 30/60 premium proppant.

Estimated Value Created
The frac job proceeded as planned, enabling the well to produce 7 MMscf/d, which is the second highest initial production ever recorded in this area. The total estimated value created is approximately $6.5 million per year based on a gas price of $4.60/Mscf at a sustained production rate of 5 MMscf/d.