

Managed Pressure Drilling Reduces Mud Losses 83%, Increases Production 60% in Carbonate Formation

Integrated, real-time pressure management system reduced well construction time by 30%, eastern Siberia

CHALLENGE

- Drill multilateral wells through a highly heterogeneous carbonate formation prone to severe lost circulation.

SOLUTION

- Deploy multiphase managed pressure drilling (MPD) techniques and technologies to control fluid losses, mitigate formation damage and drilling risks, and improve well construction efficiency.

RESULTS

- Drilled multilateral well with all six planned laterals to TD with no NPT.
- Reduced mud losses from 9,354 m³ to just 1,619 m³ [330,333.7 ft³ to 57,174.5 ft³].
- Eliminated the need for lost circulation treatments.
- Increased well production 60% higher than expected.
- Reduced well construction time by 30% compared with conventionally drilled offset wells.



Severe mud losses hindered drilling operations and production potential

The Yurubcheno-Tokhomskoye oil field is a remote onshore project located in eastern Siberia. Most of the field's oil and gas reserves are found within highly fractured carbonate reservoirs characterized by extreme heterogeneity. The formation contains cavities ranging from microscopic fissures to large, cavernous thief zones that enlarge under high mud column pressure, leading to severe drilling fluid losses, total loss of circulation, kicks, and well control issues.

To continue drilling in these conditions, the operator applied lost circulation material (LCM), specialized pills, and cement bridges. However, in addition to reducing production rates, these interventions dramatically increased well construction time and total well cost. In some wells, the operator was unable to reach planned TD.

Multiphase MPD provided precise downhole pressure control

M-I SWACO, a Schlumberger company, recommended an integrated MPD solution that would mitigate severe fluid losses and reduce the need for lost circulation treatments. An RCD 3* rotating control device system provided a seal between the wellbore and the surface while enabling the pipe to move, rotate, and divert flow as needed. To help control bottomhole pressure, a LOW-PRESSURE AUTOCHOKE* precision drilling choke console continually monitored for influxes, enabling surface backpressure in response to dynamic downhole conditions. M-I SWACO incorporated the SUPER MUD/GAS SEPARATOR* high-capacity unit to maximize mud/gas separation, which improved circulation rates and safety during underbalanced drilling operations. The CARBONTRACKER* gas flow measurement system measured the amount of gas flow coming from the well so the drilling team could determine equivalent circulating density (ECD) and gain a better understanding of well behavior.

In addition, M-I SWACO decided to use drilling fluid with a specific gravity of 0.83 instead of 0.97, and a mobile membrane-type nitrogen unit for maximum flexibility and control over ECD.

"Excellent technology implementation and great teamwork allowed us to reach such positive results. During the entire operation, M-I SWACO was focused on reducing drilling time and mud losses, proposing optimizations every time they were needed. We are planning to drill two more multilateral wells with multiphase MPD from Schlumberger in 2018 and 2019."

Denis Ganiev
Chief Drilling Engineer

CASE STUDY: Integrated MPD system reduces mud losses by 83% and increases production by 60%, Siberia

Operator drilled multilateral well to TD with minimal losses and zero NPT

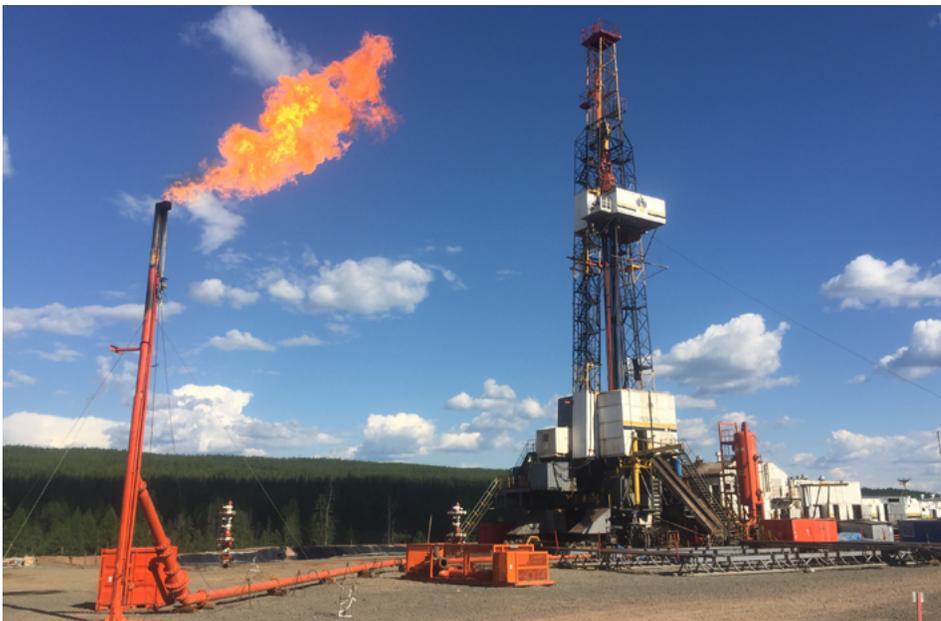
The operator successfully drilled all six planned laterals to TD with no NPT. The combination of nitrogen injection and new procedures for drilling and pulling out of hole reduced mud losses from 9,354 m³ to just 1,619 m³ [330,333.7 ft³ to 57,174.5 ft³—a decrease of 83%.

The MPD solution also eliminated the need for potentially damaging lost circulation treatments, maintaining the formation’s permeability and delivering a production rate 60% higher than predicted. All of these efficiencies helped reduce well construction time by 30% compared with conventional multilateral wells.



The reservoir formation was highly fractured, held cavities, and was extremely prone to swelling under high mud column pressure.

Parameters	Conventional Multilateral Well	MPD Multilateral Well
Number of laterals	3 of 6 (stopped due to severe mud losses that were increasing with every drilled meter)	6 of 6
Drilled distance, m [ft]	1,485 [4,872]	2,571 [8,435]
Mud losses, m ³ [ft ³]	9,354 [330,333.7]	1,619 [57,174.5]
Mud losses per meter [foot] drilled, m ³ [ft ³]	6.3 [67.8]	0.6 [6.46]
Volume of pumped LCM pills, m ³ [ft ³]	90 [3,178]	0 [0]
Total drilling time, days	66	76



In a previous well, the operator was able to drill only three of the six planned laterals due to severe circulation losses. MPD enabled the operator to drill all six planned laterals at an average rate of 34 m/d [111.5 ft/d] with minimal mud losses and zero NPT.

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