

# Nitrified Pressurized Mud-Cap Drilling

## Enables Continued Drilling With Zero NPT Through Highly Depleted and Karst Zone

### Objectives

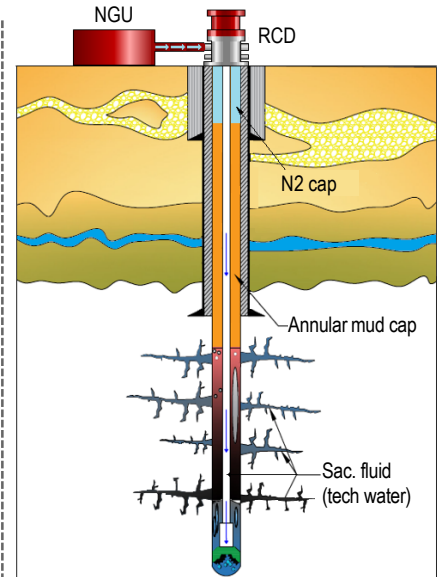
- Drill a 6-in. hole section from a 15,882 to 17,582 ft (4,841 to 5,359 m) measured depth (MD) through a depleted and karst zone with high levels of sour gas. These conditions precluded the use of conventional methods.

### Our Approach

- Operators in the area had previously used the pressurized mud-cap drilling (PMCD) technique to drill nearby wells. However, reservoir pressures continued to drop with each new well drilled, and the technique no longer proved successful. Even using the lowest density mud did not help to maintain the mud cap, otherwise known as the annular mud levels at the surface.
- Based on the high concentration of hydrogen sulfide (H<sub>2</sub>S) and local regulations, the customer ruled out a floating mud-cap solution and decided to consider nitrified PMCD. The newly considered technique enables maintaining communication with the reservoir during drilling and tripping operations while stopping returns to the surface.
- In conjunction with the operator, the Weatherford team tested the rotating control device (RCD) for use with nitrogen in accordance with API 16 RCD requirements. Various tests—including static, stripping, and rotational—at 500 and 1,000 psi (3.4 and 6.9 MPa) in ambient temperatures validated its use with the gas.
- Using the RCD as a wellhead barrier, the team placed a pressurized nitrogen cap above the drilling fluid to maintain hydraulic communication with the reservoir and prevent returns to the surface.
- During drilling, tripping, logging, and stripping, the nitrified PMCD technique enabled maintaining positive annular surface pressure within the working limits of the RCD and continuously monitoring the well.

### Value to Customer

- When historical methods no longer proved viable, nitrified PMCD enabled the customer to drill in the depleted reservoir sections without nonproductive time (NPT) or safety incidents.



Weatherford introduced a nitrogen storage system with a nitrogen-generating unit on the location. The system connected to the well via the kill line to deliver instant nitrogen for nitrified PMCD operations.

#### LOCATION

Kazakhstan

#### WELL TYPE

Onshore, deviated, oil and gas

#### FORMATION

Anhydrite, limestone, and clastics

#### HOLE SIZE

6 in.

#### LINER SIZE

7 in.

#### SECTION LENGTH

1,700 ft (518 m)

#### DEPTH

17,582 ft (5,359 m) MD

#### PRODUCTS/SERVICES

- Managed pressure drilling
- Nitrogen-generating unit
- Nitrogen storage system
- SafeShield® Model 7100 RCD

