CASE STUDY

Accurately Perforate Two Zones in an Underbalanced Condition

Real-time gamma ray for accurate depth control helps save time and money

**CHALLENGE**

Minimize the coiled tubing (CT) run and accurately perforate the well in an underbalanced condition.

**SOLUTION**

- Use Jet Blaster* jetting scale removal service to clean out, drift, and initiate the required underbalance on the well prior to perforating operation.
- Utilize ACTive* in-well live performance service—including Gamma Ray (GR)—combined with the CIRP* completion insertion and removal under pressure and two CT-deployed perforating systems—the eFire-CT* electronic firing head system for CT deployment, and the eFire-TCP* tubing conveyed perforating system to accurately perforate the well in an underbalanced condition on the same run.

**RESULTS**

Provided precise depth control in real time for accurate gun placement. Perforated two zones in one single CT run.

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**Getting the well ready for intervention**

An operator drilled and completed a well in early 2010. It is a horizontal cased hole producer in the Middle East, with a total measured depth of over 13,000 ft.

There are two zones of interest—a bottom zone that is 70 ft long and an upper zone that is 80 ft long—that need to be accurately perforated. These zones are 280 ft apart. The solution requires running a wellbore cleanout and drift to ensure that there is no debris left in the completion, followed by setting the well on an underbalanced condition for a smooth perforating operation. An accurate perforating gun placement will be required for the underbalanced perforating technique.

Based on the results of the flowback, an additional production log run may be considered to optimize the well’s production.

**Using real-time gamma ray for accurate gun placement**

Operators typically approach a horizontal well perforation using memory logging tools or a wired CT unit, which means that a mobilization of a CT unit and an electric wireline unit is required. Also, a simulation of the CT movement in the well is a critical factor to ensure that the BHA can be deployed all the way to the targeted zones.

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The firing sequence of the eFire-TCP perforating system, used on the lower zone.
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The choice requires precise knowledge of the perforating gun placement and an equally precise pressure reading for creating the underbalanced condition.

Looking for an efficient and effective solution, the operator elected to use the Schlumberger ACTive, eFire-CT, eFire-TCP, and CIRP to efficiently and accurately perforate the well.

For the well, the following sequence of intervention was performed:

1. ACTive was run with the Jet Blaster to ensure that the wellbore was clean, drift, and to displace the well to diesel, creating a static underbalanced condition, confirmed by the real-time BHP measurement. Real-time GR was also used for efficiency and depth control confirmation, checked against the baseline log.

2. ACTive was run with the eFire-CT, eFire-TCP perforating gun assembly, and GR package. The 250 ft BHA includes the two eFire systems with a total of 150 ft of 2-7/8-in HSD* high shot density gun system that was deployed using the CIRP. Real-time BHP measurements confirmed the gun detonations.
   - Perforate the lower zone using the eFire-TCP.
   - Perforate the upper zone using the eFire-CT.

Efficient perforating

The real-time ability of ACTive service to provide real-time downhole information, combined with the CIRP CT deployment system and the eFire technology, proved to be a highly advantageous method for underbalanced perforating in a horizontal well. The operator saved time and money using this method instead of the conventional alternative for horizontal well perforating. This resulted in operation efficiency and simplicity.

Correlation run showing ACTive GR correlation against baseline log.