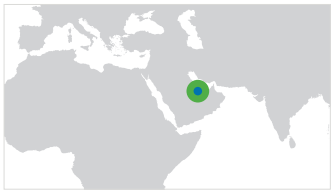
Case study Dual String Flow

Accurate evaluation of reservoir flow reveals short-string production profile and guides workover plan



Location: Abu Dhabi
Well type: Dual-string oil producer
Reference: SPE-182889

Case benefits
- Evaluated the short-string production profile in a dual-completion well
- Identified crossflow behind casing
- Located and quantified source of water
- Enabled the operator to adjust and optimize workover plans

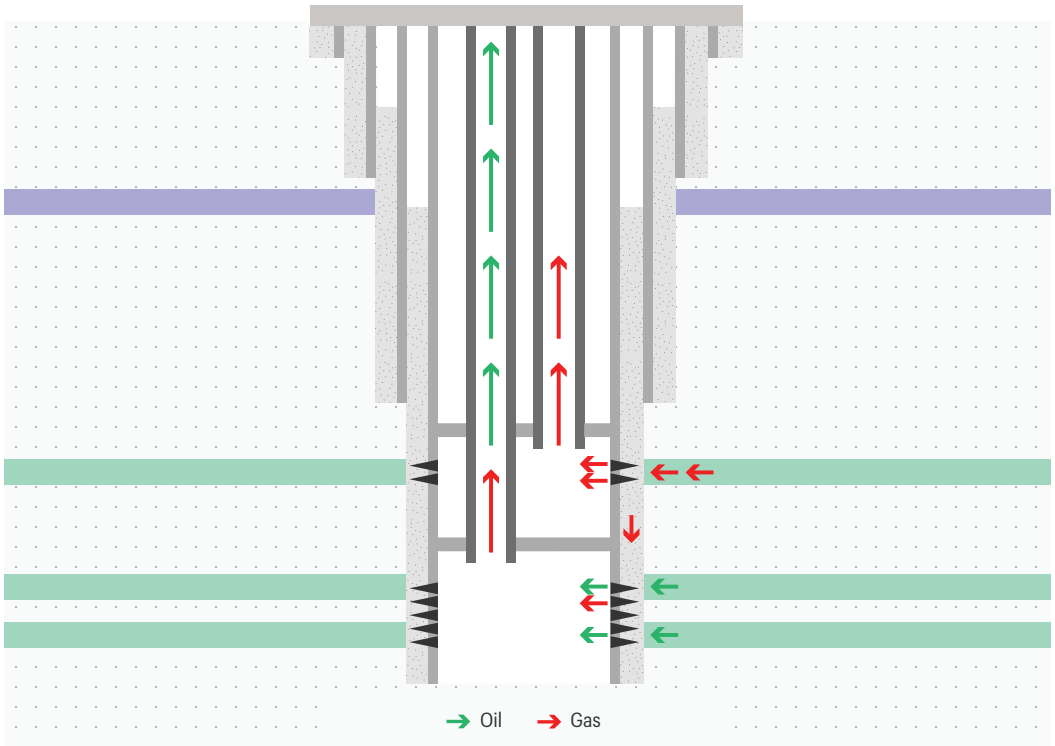
Challenge

A dual-string completion is a cost-effective method for producing from multilayered reservoirs using a single wellbore. However, the perforation interval in the upper reservoir is not usually surveyed because of safety concerns about conventional tools becoming entangled around the long string as they exit below the short-string tubing shoe. An Abu Dhabi offshore well was drilled and completed as a dual-string producer in 2014. However, the well showed a 20%-water cut, presumably from the aquifer. The principal challenge was to evaluate the production profile in the short string and find the true source of water. This would require a diagnostic platform with a depth of investigation that extended beyond the tubing.

Solution

The operator selected TGT's Dual String Flow product for evaluating the short-string production profile in the well. Delivered by the True Flow diagnostic system, using the Chorus acoustic platform and Cascade thermal platform, Dual String Flow could provide the insights needed to manage well system performance more effectively.

Cascade high-precision temperature and Chorus spectral acoustic surveys were carried out under flowing and shut-in conditions. Both platforms have large radii of investigation and can detect acoustic signals and temperature variations caused by fluid flowing in the reservoir into the wellbore. Chorus can record acoustic signals through multiple pipe barriers and up to 3 m into the reservoir.



Dual String Flow example well sketch.

Dual String Flow brings all the advantages of our Total Flow product to dual string wells. It locates and quantifies wellbore and reservoir flow, even at the short-string reservoir.

Delivered by our True Flow system with Chorus and Cascade technology, Dual String Flow provides the clarity and insight needed to manage well system performance more effectively.

Dual String Flow is used to diagnose unexpected or undesirable well system behavior, especially in relation to the short string. It can also be used proactively to ensure the well system is working optimally.

The active production zones and thicknesses identified using Chorus were used as input for Cascade's temperature modelling and to produce quantitative reservoir production profiles. The thermofluid modelling also required production history data, the thermophysical properties of the reservoir and the surrounding rocks, the geothermal profile, the hydrodynamic reservoir parameters and the well trajectory including completion components.

Result

The Chorus survey and analysis (Chorus panel in Figure 1) clearly show two acoustic signals which relate to the reservoir flow: the first across the upper part of perforated unit C (zone 1) and the second from the unperforated units A and B (zone 2). Cascade modelling showed that 35% of the total production was coming from the unperforated units A and B, with the fluid crossflowing behind tubing and casing, entering the wellbore through the perforation in the tubing.

There was no production from the lower part of unit C or in unit D. Cascade temperature modelling indicated that the fluid inflow from the upper part of unit C was redistributed behind the casing and enters the wellbore across the perforated interval, although only the upper interval is actually contributing to production.

Behind-casing communication with off-target formations and the actual distribution of production for the target reservoir zones were identified and quantified. Despite not being able to distinguish between oil and water, the diagnostics could make the correlation with open hole data, thus making it possible to determine that 20% of water was coming from the off-target unit B. The operator was able to use information acquired by the Dual String Flow product to improve the vertical sweep around the surveyed well by selecting the most appropriate workover for the well—water shut-off and acid stimulation.

Behind-casing crossflow from upper unperforated units.