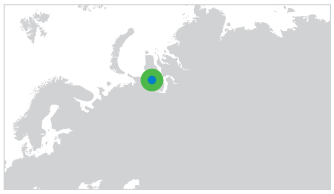
Case study Horizontal Flow

Identifying gas breakthrough in a horizontal oil producer with multistage fractures helps to optimise fracture design



Location: Russia
Customer: Gazpromneft
Field: Novoportovskoe
Well type: Horizontal oil producer
Reference: SPE-207237

Case benefits

— Delivered a detailed reservoir flow profile along a horizontal wellbore using 3D fine-grid temperature modelling
— Confirmed the presence of out-of-zone fracture growth
— Helped to optimise the fracture design programme for future wells in the field

Challenge

Low-permeability oil rim reservoirs can be developed using horizontal wells and multistage fractures. The challenge for operators is to find a hydraulic fracture design that improves production while minimising the risk of gas or water breakthrough from adjacent formations. Fluid breakthrough harms well economics and can lead to significant environmental impacts, for example, through the need for gas flaring.

Predicting and preventing water or gas breakthrough is one of the most important tasks faced by reservoir engineers. Operators will typically use pressure-transient analysis to assess fracture sweep efficiency, but this provides only average fracture parameters. A deeper understanding of downhole flow dynamics can provide an early warning of the locations where water or unwanted gas is reaching the well.

A horizontal well had been drilled into the oil rim of a low-permeability reservoir formation and hydraulically fractured in 12 stages. The gas/oil ratio for the well was high, indicating a potential issue with the fracture design that would need to be addressed before delivering or completing further wells in the field.

Solution

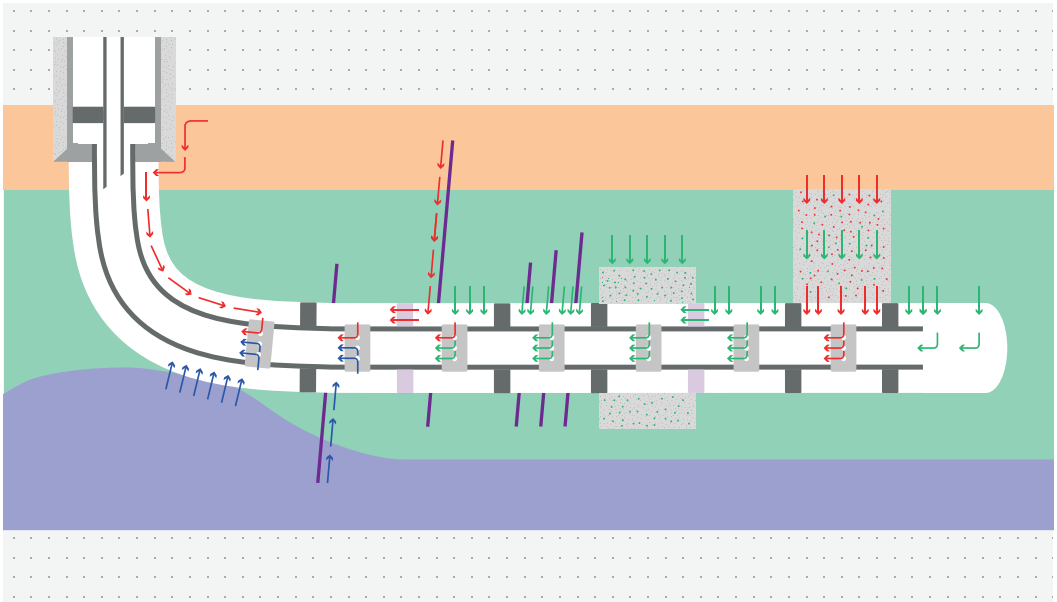
TGT's new Horizontal Flow diagnostics with Cascade3 technology has been created to provide asset teams with the flow insights they need to manage horizontal well and reservoir performance more effectively. This technology can locate fracture entry points and accurately quantify flow in horizontal well systems. This enables operators to assess the fluid contributions from various fractures and porous matrix zones across a wide range of completion designs.

In this case, combining Cascade3 flow modelling and Chorus acoustic sensing

Quantifying flow dynamics in horizontal well systems and accessing accurate reservoir flow profiles is fundamental to managing well and reservoir assets.

Horizontal Flow with Cascade3 is designed to help Production and Reservoir Engineers complete daily tasks with greater certainty and confidence. Whether its locating water/gas breakthrough, understanding the influence of fractures, or maintaining an accurate reservoir model, Horizontal Flow delivers reliable flow profiles in a wide range of completion scenarios.

Equipped with the right information, asset teams can take direct action to keep well and reservoir performance on track.



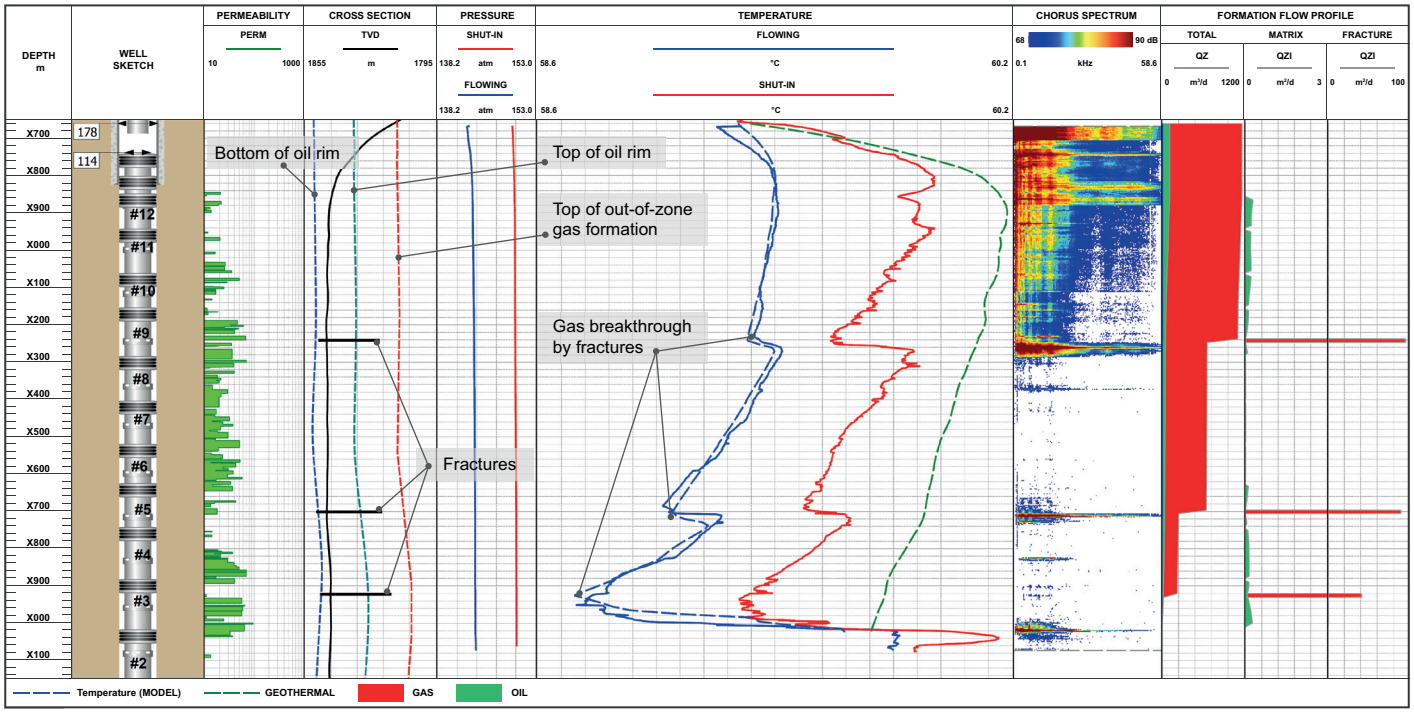
would enable TGT analysts to locate and quantify the gas breakthrough zones present in the well, assess current 'out-of-target' fracture size and potential fracture growth, and confirm the source(s) of gas inflow.

Result

The Horizontal Flow survey identified three gas breakthrough zones responsible for the well's high gas/oil ratio and estimated potential fracture growth, thereby indicating how far the fractures penetrated into the overlying gas-bearing formation (Figure 1). Fracture entry points behind the liner were assessed using the Chorus platform.

This also revealed fractures in the target oil-bearing formation that were idle or non-productive owing to the gas breakthrough.

In this well, the completion contained swellable packers, which meant that gas-producing zones could be mechanically shut off. For future wells, the operator has redesigned the fracture programme so that production from the low-permeability oil rim can be maximised while preventing gas breakthroughs caused by out-of-zone fractures. Reducing the fracture pressure was identified as the most effective way to achieve this.



Horizontal Flow diagnostics with Cascade3 and Chorus technology identified three gas breakthough zones and estimated potential fracture growth for these fractures. Estimated fracture size is shown in 'cross section' track. The results confirmed fracture propagation to an out-of-zone gas bearing formation. The QZI track shows three zones contributing to the gas inflow. There is minor oil contribution from the target formation. The higher formation pressure of the gas-bearing zone reduces the oil contribution from the target formation.