Accelerating GOGD Long Tail Volumes in Fractured Carbonate Field through Data Integration

Khalda H. Barwani[1], Manish Choudhary[2], Fatema Abu Qasida[1], Fahad Hosni[1]

[1]PDO
[2]PDO

Abstract

Objectives
A Mature field that is nearly 60 years old continues to generously produce oil from stacked fractured carbonate reservoirs. The primary reservoir, Natih E, was initially developed using waterflood methods but later transitioned to Gas Oil Gravity Drainage (GOGD) in 2010. This reservoir alone accounts for approximately 25% of the total stock tank oil initially in place (STOIIP) of the entire field.

The field utilizes vertical gas injectors and horizontal producers. Injected gas in the crest preferentially invades the fracture network and into the matrix blocks. The matrix oil drains downwards due to gravity into the horizontal producers. As the gas oil contact moves deeper, gas breakthrough occurs in the oil producers, resulting in bypassed oil in the matrix blocks. A redevelopment project was initiated to target bypassed oil to increase recovery and enhance GOGD efficiency.

Infill development of around 100 wells was introduce through data Integration of fracture characterization and understanding, visualisation of GOC movement across fractures and matrix blocks, and NFA wells performance analysis and optimisation.

Methods
The team integrated data across disciplines to comprehensively characterize the nature of fractures, including reprocessed seismic data, mud losses, image log, cores, outcrops, as well as well production data and production logs (PLT) and noise logs. These data sets were used to understand fracture orientation, density, and nature (whether they are closed or open) and their fluid conductivity.

The team created an integrated visualisation of Gas-Oil Contact (GOC) movement across fractures and matrix blocks by analysing well tests, PLTs, logs, RSTs and thus identified bypassed oil shallower than fracture GOC. Eight Gradio wells are distributed across the layer next to fractures used to visualized fracture GOC and Oil-Water Contact (OWC) in time lapse. Integration of gradio data, geological understanding and well performance data aided in the understanding of oil rim with time, thereby managing the GOGD process.

Newly appraisal wells validated the current oil up to (OUT) and oil down to (ODT) to be shallower than 300m TVDss, enabling the maturation of shallow rim wells to accelerate oil production.

Results and Observations

An improved understanding of fracture corridors supported WRFM optimization, involving water and gas shutoff to extend oil production of existing wells. Furthermore, this understanding enabled the redrilling of wells with gas breakthrough as split wells avoiding the fracture corridors. Integration of data allowed for the identification of around 100 new infill opportunities across shallow, transitional, and final rim locations. Filling gaps with additional shallow wells at depth of less than 400 m TVDss and transitional wells at 450 m TVDss and 420 m TVDss in the matrix block, aims to draw gas into underperforming GOGD areas. Rim wells supports aquifer pump of, thereby accelerate the transition to GOGD.

Conclusions

Integration of various log data, seismic data and well performance has been instrumental in understanding bypassed oil in matrix of GOGD field, gas and water breakthrough zones. Furthermore, the mapped fracture corridors across the field suggest split and shorter horizontal length wells.

The inclusion of 100 new infill wells aims to accelerate oil production, reduce greenhouse gas (GHG) emissions and increase recovery from the field.