Improving Gas Reservoir Management by Allocating Production with Multi Flow Rate Sampling and Geochemical Condensate Characterization

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Abstract

In layered gas reservoirs, respective contribution of each produced layer is determined for efficient and reliable Reservoir Management. The Production Logging Tool (PLT) is commonly used to allocate the production to individual layers. Repetition of PLT acquisitions are constrained by cost and logistics, which might prevent to get the desired frequency. Geochemical tools provide additional and reliable data on the hydrocarbon fluid provenance improving accuracy of the layer-based gas rate equations. Geochemical assessment can be done at higher frequencies and at far much lower cost between each PLT.

Production allocation by molecular fingerprinting was tested by Qatargas in cooperation with Total Research Center - Qatar. This geochemical approach is based on a statistical interpretation of high resolution gas chromatography (GC) data of the condensate fraction from the produced fluids. The molecular fingerprinting technique used, including analysis protocols and data processing is described in a previous paper by Sabatier et al. (2015, IPTC).

The present work emphasizes on a new strategy to understand the fluid fluxes using sampling at various flow rates.

The presented data show:

For well A: the Reservoir Y flow rate (gas rate produced by perforations in reservoir Y) is a linear function of the well flow rate for both fingerprinting and PLT with very close slopes (reservoir characteristics) and intersects (reservoir pressure difference). These results suggest for well A that PLT and molecular fingerprinting provide same information.

For well B: the Reservoir Y gas rate plotted against the well flow rate show different slopes for PLT and fingerprinting. Indeed if PLT is providing the bulk gas flow rate produced by the perforations in reservoir Y, the fingerprinting is providing the quantity of gas coming originally from this reservoir. The reason of this difference is that part of the fluids produced by reservoir X originates from reservoir Y and have entered previously the reservoir X through well cross flows or geological connections.

We concluded that geochemical production allocation based on molecular fingerprinting is possible in some areas of the field and that results are consistent with other types of dynamic and geological data. Furthermore, dynamic sampling provides interesting insight in reservoir interconnections establishing which reservoirs the fluids originally are coming from.

These conclusions allow operational application of this study.