

## **MULTIPLE APPLICATIONS OF GEOCHEMICAL PRODUCTION ALLOCATION IN NORTH SEA OPERATIONS**

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The geochemical production allocation technique is an adaptation of oil fingerprinting technology that has been used within the oil industry for the past 20 years (Kaufman et al., 1990). Shell has developed a proprietary chromatographic fingerprinting technique called Multi-Dimensional Gas Chromatography (MDGC), which is a quantitative measurement (ppm) of aromatic compounds in the C8-C10 alkane range of oils (Ganz et al., 1999). The MDGC methodology is now routinely used in Shell UK as a tool for determining production allocation of commingled fluids. In this paper we describe three different case studies where geochemical production allocation has been successfully applied, including multiple reservoir commingling within a single well, subsea flowline mixing of multiple fields and use as the Fiscal Metering of production between two Fields.

A Central North Sea field well has been commingling oils from Tertiary, Jurassic and Triassic reservoirs. MDGC fingerprints from the Triassic and Jurassic reservoirs are very similar and significantly different from the tertiary fingerprints, making reservoir fluid allocation possible between the Tertiary and Triassic/Jurassic fluids. The oil geochemical results not only provide allocation of the stratigraphic horizons, but also helps to identify production related scaling issues in the well. Allocation determinations of both the produced waters and hydrocarbons helped to identify the location of the scaling issues in the Tertiary reservoir and the effectiveness of subsequent treatments.

Due to the very significant differences in absolute amount of the fingerprinting components in biodegraded and non-biodegraded oils, the use of ratios for allocation studies is not possible and therefore ppm concentrations are used. In this case study we show the challenges that came up from the allocation of such fluids from a subsea tie-back operations of two fields, e.g. emulsion tendency of the biodegraded crudes leading to inaccurate aromatic compounds measurements.

Shell UK was able to win approval from the UK Government DTI and partners to use geochemical production allocation as the primary production allocation technique for commingled Field A-Field B production (Figure 1). Oil production from both fields is mixed on the Field B production platform, with only one fiscal metering point. The samples are

obtained from the weekly flow proportional sampler and the geochemical results are used as the primary determination and fiscal measurement for the oil production split. The UK Government DTI has shown a very keen interest in following the results of this first use of geochemical production allocation. They visualize its use in many of the commingled subsea tiebacks where metering facilities are unavailable for proper allocation of production.

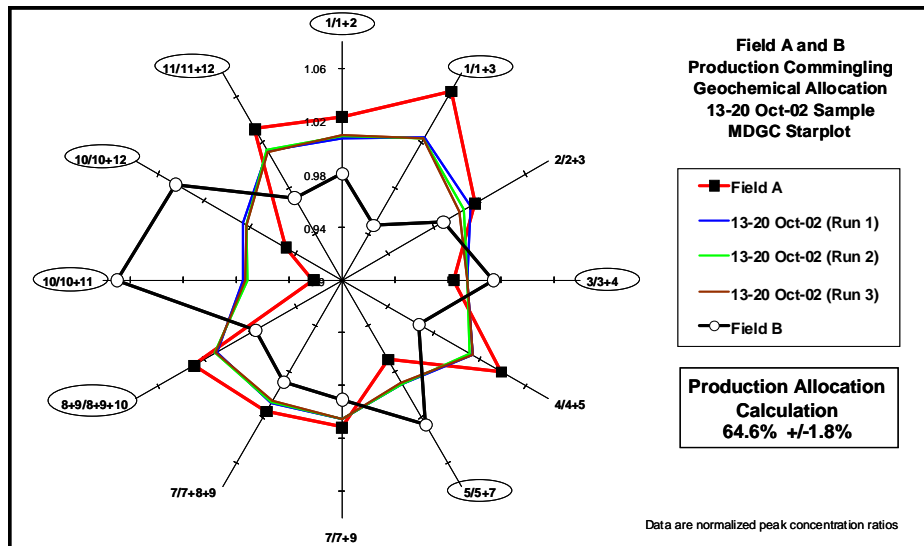


Figure 1. MDGC Starplots for the triplicate analyses of the commingled sample and the end-member oils. The ratios that are circled were identified in a calibration exercise to be the 8 mixing lines for calculating the % Field B in the 2 end-member commingled samples.

These three case studies show the variety of applications of the geochemical production allocation technology, which is becoming increasingly recognised as a cheap and reliable method for de-convolving commingled fluids. These successes essentially rely on (i) the quality of both the samples and the analytical data and (ii) the user understanding of the limitations of this technology, such as subsurface variability, contaminations from chemicals or the effects from multiphase flow systems.

## REFERENCES

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