RESMAN Tracer systems quantify zonal inflow

Optimized ICD completion design and well placement strategy

Challenge

An operator wanted to determine the inflow distribution between five reservoir intervals of a horizontal subsea well, to optimize both the placement and ICD nozzle settings for future wells in the field.

The well had a five-mile tie-back to the FPSO and commingled production with several subsea production wells from the same field, hence gathering this data by well intervention would be costly and of high risk.

Solution

RESMAN tracer systems (RES•OIL) were installed in a total of five ICD compartments in the well. RESMAN patented inflow tracer interpretation methodology was used to quantify the flow contribution from each well interval.

Application

The RES•OIL systems were integrated under the wire wrap of screens that also contained inflow control devices (ICDs), as shown in Fig. 1. Afterwards, the completion was run in hole using standard procedures without additional rig time or extra personnel at the site. Production fluid samples were collected after a 24-hour shut-in, during the restart of the well. The samples were then analyzed for tracer chemicals. The tracer responses were then modeled to identify the inflow in each of the five corresponding ICD compartments. Each square in Fig. 2 shows the tracer concentration of the unique RES•OIL system. The solid lines represent the Flush Out model*, fit for each data set and Fig. 3 represents the inflow, based on the model result and the ICD compartment lengths.

* Refer to technical Bulletin 2 at www.resman.no for more information about RESMAN's Flush Out model and flow loop verification of model accuracy.

Fig. 1 - RESMAN tracers are easily integrated into the screens, eliminating design complexity and operational risk
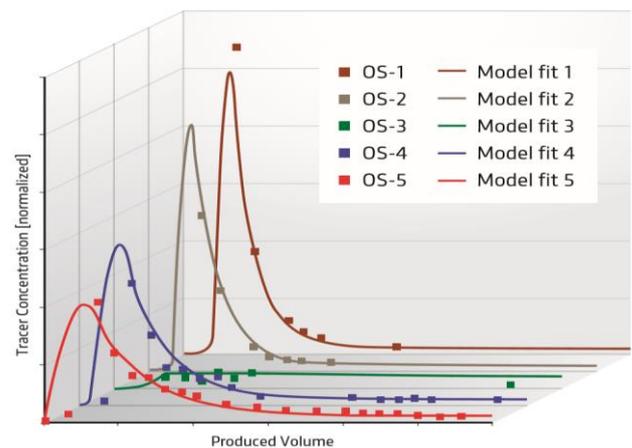

Fig. 2 - RES•OIL concentration (squares) vs. produced volume and Flush Out model fit (solid lines) during transient flow

Zone	Relative inflow contribution
OS-1 (toe)	38%
OS-2	34%
OS-3	1%
OS-4	6%
OS-5 (heel)	21%

Table 1 – Inflow distribution per reservoir compartment

Results

Table 1 shows the inflow distribution, revealing that more than 70% of the production originated from the two compartment closest to the toe of the well, while the middle of the well displayed very poor performance.

By using tracers and modelling provided by RESMAN, the operator gained valuable understanding about zonal inflow, which would enable better well placement and optimization of ICD settings for future well designs.