CASE STUDY

Matrix Tracer Study for Fluid Flow Characterization

DANISH TECHNOLOGICAL INSTITUTE

Value for Operator

A matrix study provides the operator with knowledge of the sweep efficiency, the overall water flow in the reservoir, and information on potential fractures. This knowledge will support reservoir management decisions such as whether to drill new wells or change injection pressure and flood pattern.

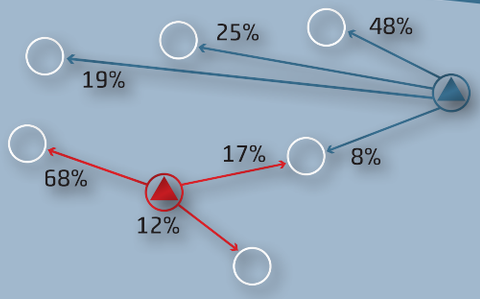

Figure 1. Migration of tracer from injection wells to production wells. The amount of tracer recovered and the time of recovery provide information on the water flow in the reservoir.

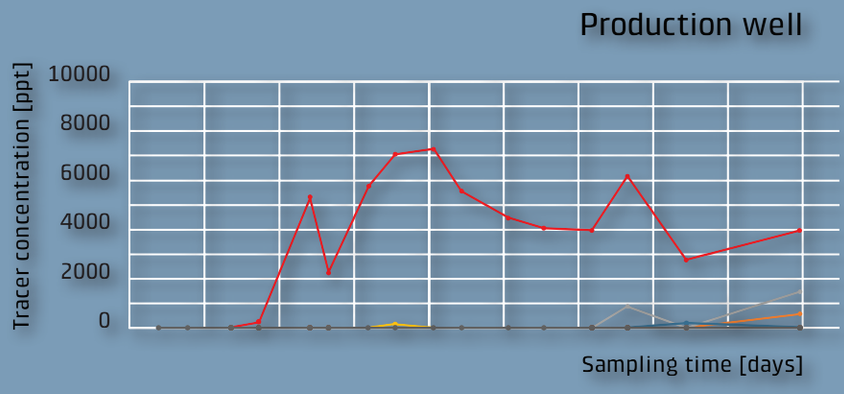

Figure 2. Tracer elution curve displaying breakthrough of tracer (red curve).

Background

How water flows in a chalk reservoir is a determining factor for the overall oil recovery. Here, fractures and differences in permeability of various zones in the reservoir have substantial impact on the water flow and hence recovery rates. Therefore, knowledge of the flow patterns in a reservoir is of great value in respect to reservoir management.

To improve the management of a reservoir an oil field operator wished to investigate the overall water flow by mapping the reservoir using a matrix tracer study.

Prior to this tracer operation, only limited information about inter-well connections and water flow within the reservoir was available.

The Tracer Operation

A range of unique, inert and distinguishable chemical tracers were added to injection water of individual injection wells, one tracer per well. DTI offshore staff conducted the injection and initial sampling. In order to map the reservoir thoroughly the liquid from a substantial number of productions wells were monitored over an extended time period. The long-term sampling was conducted by the operator staff.

To capture the water flow both on a short and longer timescale the sampling frequency was high in the initial part of the study and lower in the later stages of the work. The collected samples were analyzed onshore at DTI's accredited laboratory. The method applied gives a detection limit of below 50 ppt which allows for tracer detection several years after tracer injection.

Communication between injector and producer wells were identified by analysis of water samples from production wells. The tracer response curves (figure 1) can be used to calculate the tracer retrieval percentages and thus the amount of water going between each injector-producer pair. A water flow allocation map (figure 2) can be generated to illustrate the communication pathways between injector and producers.

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