

Assessment of sweep improvement

Operator used water tracers to verify polymer effect and identify un-swept oil

Challenge

An operator wanted to use tracer data to assess the potential gain from application of polymer injection in an onshore brown field (see SPE191481). An additional objective of the study was to assess the overall connections, their magnitudes and sweep in the reservoir sector studied.

Solution

After polymer injection, RESMAN tracers were deployed and compared to pre-polymer tracer results. The tracer concentration vs. time (tracer profiles) were used in combination with injection and production rates to derive the residence time distribution (RTD) for all injector-producer pairs, which provide a quantification of injector-producer connection magnitude and sweep volumes.

Application

Tracer was added to the polymer injector and yielded tracer curves in the offset producers (see Fig. 1 for an example).

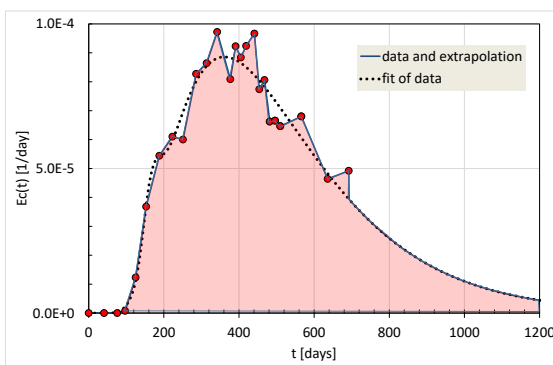


Fig. 1 – Tracer results from one of the offset producers in the pattern.

RESMAN's interpretation method was then used to characterize and summarize the flow pattern, as displayed in Fig. 2. This interpretation identifies connections in the field provides a quantification of the magnitude of each connection.

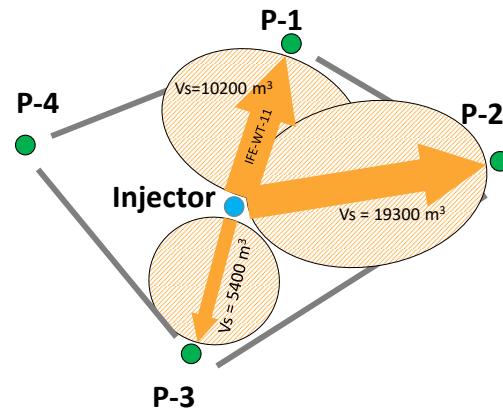


Fig. 2 – Summary of flow characteristics of a polymer flood in a five-spot pattern. Sweep volumes (V_s) are illustrated as shaded areas. Flow directions and magnitude are illustrated as arrows where the arrow widths are proportional to the percentage of water from the injector towards each producer.

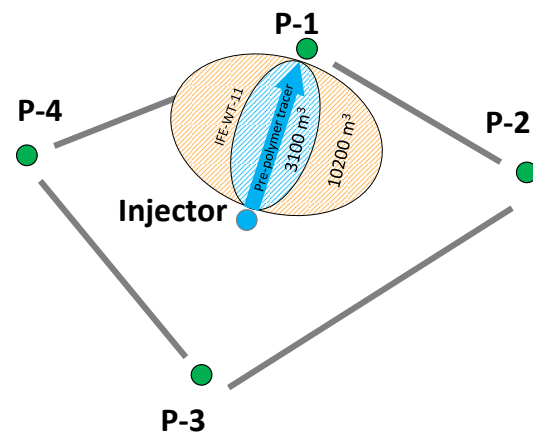


Fig. 3 – Sweep volume increase resulting from the polymer injection. The post-polymer tracer test finds a sweep volume three times larger than the sweep volume before the polymer flood (10200 m³ vs. 3100 m³).

Results

By comparing the sweep volume from tracers injected before and after polymer injection direct proof of a more than tripled sweep volume was found – supporting decisions on polymer injection in the field.

Additionally, the tracer test also revealed the main flow directions in the flow pattern.

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