EVALUATION OF SIDE POCKET MANDREL APPLICATION IN IMPROVING VERTICAL DISTRIBUTION OF WATER INJECTION

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ABSTRACT

The Pelana Field is a mature waterflood field in the Central Sumatera Basin that consists of multi-layer sands with contrasted properties. Waterflood has been applied since 1997, targeting all producing reservoirs. These layering reservoirs are challenging in achieving a good alignment in term of waterflood optimization. In multi-layer injectors, such a condition will lead to bad vertical distribution of injection, where the poorest quality sand receives the least water injected.

This is a problem occurring in some injectors in the Pelana Field, where the injection is not evenly distributed vertically so that the topmost reservoir, which also has the poorest quality with permeability of around 100 md, does not receive enough injection to balance its production. Most of the injected water goes to MN_XX sand which has permeability of about 1000 md. Injector PL-55, for instance, injects into both sands to support the production from both reservoirs. However, the previous completion uses only open ended tubing and therefore, based on the spinner result, the water will be distributed naturally based on the well-to-reservoir pressure difference, being directly affected by reservoir permeability. This practice resulted in an unbalanced performance for both sands. While MN_XX has a good sweep efficiency with recovery factor (RF) increment > 8%, the BK_AA sand would has an opportunity to be optimized due to its current low incremental of RF.

Side Pocket Mandrel has been chosen to resolve the vertical distribution problem in PL-55 and improve the injection rate into BK_AA sand. It is observed that the well can finally split its injection into more desirable allocation, allowing more water to flow into BK_AA sand. This paper presents the application of this technology in PL-55 well, including the technology principles, the tool design, the strategy to improve the injection distribution and the enhanced performance to the surrounding producers.

INTRODUCTION

Sound waterflood management and good understanding of reservoir characteristics are necessary to be mastered and applied in order to achieve a balanced waterflood process. The Pelana field is a mature waterflood field in the Central Sumatera Basin which has applied a waterflood mechanism using an irregular pattern. The field has already reached a recovery factor of greater than 30% and has a cumulative injection volume more than its pore volume. This result shows that waterflood has been effectively applied and quite successfully enhanced the field recovery. However, this field-wide result of oil recovery is not equally good to each reservoir.

Although the good result has achieved in the Pelana Field, the performance of individual reservoirs is different from one reservoir to another. The Pelana field consists of 4 major formations, namely BK, BN, MN and PM and is divided into several sand units according to its lateral continuity. The waterflood process is practiced in all of the reservoirs at different processing rates. It only performed well in the good quality reservoirs such as BK_BB and MN_XX, proven by the incremental RF of 8% after waterflood started. This is not the case in reservoir BK_AA which is characterized by lower reservoir quality. PL-55, as the completion is shown by figure 1, has commingled completion in BK_AA and other better quality reservoir MN_XX. It is observed from a spinner survey that no injection water flows to BK_AA. In order to increase the performance of waterflood in BK-AA sand, SPM was applied as a solution to redistribute the injection in well PL-55.