Designing and Implementation of the First Steam Flooding Pilot Test in Sudanese Oil Field and Africa

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Abstract

Steam flooding is to heat the oil to higher temperatures in order to decrease its viscosity so that it will be more easily flows through the formation from injector toward the producing wells, as the steam moves out into the reservoir away from the injection well, its temperature drops from heat losses and it begins to condense as hot water in the steam zone, the residual saturation is lowered, and the relative permeability increased. These represent the most important parameters that affect the oil recovery.

The objective of this paper is to select the optimum pilot area and propose the steam flooding injection parameter, the suitable well spacing as well as the required steam flooding facility for FNE oil field.

FNE reservoirs are highly porous (~30%), permeable (1000-2000 mD) and unconsolidated in nature. the fluid properties include viscous crude with 15 to 17.7 API. Corresponding viscosities are in the range of 250 cp and 500 cp at reservoir conditions.

In this paper the model was designed to simulate steam flooding of heavy oil reservoir in FNE oil field in which the reservoir is shallow and thin, six different cases at different well spacing were investigated and compared with the base case, the numerical thermal simulator was used to simulate the data from the present steam flooding experiments.
Steam injection temperature of 270°C, with 5~7 MPa injection pressure, steam injection quality of 0.6, and steam injection rate of 1.6 m³/d/ha/m; were used as Steam Flooding parameters for all simulation cases while the recovery ratio of 1.2 is also considered.

The result showed that converting of Cyclic Steam Stimulation (CSS) to steam flooding after the third cycle could improve the recovery factor of the field up to 43 ~ 50.1%, while CSS only can increase the recovery percent of the suggested well groups by 32.5 - 34.2% of the studied sector model which makes it more attractive method as development scenario for FNE oil field.