Water Coning Control; a New Solution to Old Problem

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Abstract

Production of oil and gas at the maximum rate with applying the minimum cost and safety is the primary objective in the petroleum industry. For years the issue of water coning has been a concern for petroleum engineers. Various methods were employed to solve the problem such as Perforating far away from the original oil water contact, producing oil below the critical rate, using polymers and gels to create a barrier between oil and water zones, use horizontal wells and injecting oil back to the reservoir. Then a relatively new technique DWS was invented of which the outcome was good in terms of oil production It proved very useful stop problem of water coning but with the hindrance referring to cost in terms of lifting the water to the surface, use of separate tubing strings for oil and water and the pressure drop due to weak bottom water drive. DWL technique provides the facility to inject the water back to the aquifer. This aim is achieved by a triple completion in the same well. Analytical, mathematical analysis of the new technique gave positive results which concluded in an increase in the recovery efficiency, low water cut higher oil rates. Stabilized production was achieved.

As we know that when pressure drops in the area where perforations to produce oil has taken place. The water cut tends to move upwards also due to the pressure reduction in the perforated area. The two zones, the aquifer and the oil producing zone are separated by a packer system which prevents the water from being produced. Both completions the top completion from which oil is produced and the bottom completion from which water are drained contain submersible pumps. The top pump helps to lift the oil towards the surface while the bottom pump drains and injects water back to the aquifer. In this way water breakthrough is avoided and water free oil is produced.

The analytical model was analyzed and studied the basic approach used in order to avoid the inclusion of the whole oil water interface to set an energy balance equation along the vertical of the DWL well the critical rates and D/I spacing factors were found with the help of mathematical relationships developed by the solution of the differential equation for down hole water sink technique .The results obtained validated the technique itself and met with the objective of better production with respect to this new technique. A comparison was done to show the effect on critical oil production rate due to D/I spacing, critical water drainage rate due D/I spacing and the effects the critical rates themselves were determined and shown in graphical form in Microsoft Excel. Results obtained clearly indicated the improvement in producing capacity due to DWL.

The data obtained from the field and the results obtained by analytical model were in conformity with each other. The results fall in the typical ranges as were expected. Model calculated results approach the real data which verifies our model as well.
The model can estimate the performance of DWL in reservoirs fast and give reasonable results.
The critical oil rate can be increased dramatically by using DWL well compare to the conventional wells;

Small values of D/I spacing rapidly increase the critical oil production rate. Hence, the DWL system could work even in reservoirs with small bottom water drive

DWL well could increase oil rate and recovery reduce pollution by keeping the water in-situ, and maintain water drive by returning the water back to the aquifer.

The critical rates were also compared and results indicated an increase in the productivity as the thickness of the aquifer increases similarly an increased amount of drainage rate is required.