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# FLOW ASSURANCE FOR HIGH VISCOUS OIL-GAS FLOW

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Background. Gas lift is considered as spread applied one among all artificial method of lifting even despite the fact that its application requires the source of high pressure gases from HP wells or by compression. The density reduction and sequent unloading the production column help operator to keep the flow stable mostly in case when he has deal with low-viscous oil taken from shallow reservoir. Moreover, reservoir fluid temperature in such conditions must be high enough and salinity of the brine as less as it is possible.

Statement of the problems. Ukrainian oil and gas field which are located in Dnipper-Donetsk and PreCarpatian basins are characterized as high viscous ones with the low temperature of paraffin forming. Crude from such fields is produced both from shallow and deep reservoirs with different reservoir temperature. Flow assurance of such specific crude oils must be accomplished in three main parts of the systems: injections flow-lines, lifting tubes and gathering systems, because the forms of multiphase flows and appropriate hydraulic resistance and are differed in any of these branch. So flow assurance for such crudes are the great challenge for production companies.

Obtained results.For gas wells, the gas lift method of operation, regardless of its subtypes: continuous or temporary, is considered as the most common and optimal among other methods, which mainly refer to the installation of deep pumps of different types (rocking machines, hydraulic or centrifugal).

Since the basic principle of gas injection is the reduction of the fluid column density in the tubing, and therefore the reduction of the hydrostatic pressure in the column. These factors determine the main advantage of the gas lift: it prevents the operational failure due to presence of mechanical impurities or changes in the multiphase flow structure connected with occurrence of gas bubbles at the inlet pipe of the pump.

Gas lift is a cycling system and it can use both compressed gas processed in one of the field facilities and high-pressure gas from nearby wells. In both cases the effect will be the same. The flow motion in the vertical and horizontal pipes is characterized by certain features that eventually affect the distribution of gas pressure and temperature in the three main systems. Therefore, the optimization of the gas lift operating mode, as well as the injection and gathering systems operation is up-to-date.

The abovementioned factors form the purpose of the work: (1) analysis of the existing system; (2) analysis of the existing P-T profile; (3) finding out plausible system drawbacks; (4) system optimization; (5) 5lotting the new P-T profile; (6) production increase.

For example, the problem of the gas lift system optimization will be considered for the existing oil and gas field where crude oil is produced by injection of high-pressure gas from the cycling plant, which is the source of high-pressure gas up to 250 atm. The compressed gas is injected into the well, with further production done and collection of liquid hydrocarbons at Novotroitsky GOSP.

The technological mode of operation of the well is represents that oil production is substantially limited due to several factors: (1) high paraffin content in the oil; (2) low pressure drawdown (between the static and the flowing BHP), (3) low temperature, which causes paraffin sedimentation on the tubing/flowline walls (4) high salinity of the aqueous fraction of the multiphase flow which in its turn greatly accelerates the paraffin plugs formation at low temperatures.

The actual temperature and operating pressure distributions along the well from the bottomhole to wellhead show that the pressure significantly drops from the bottomhole to the wellhead, despite the injection of gas through the gas lift valve, and the temperature is getting closer to that atmospheric conditions which causes paraffin formation for the oil under consideration. This is the primary reason for additional hydraulic resistance, bottomhole hydrostatic pressure buildup, and pressure drawdown reduction.

Here, the main task of optimization is to increase the drawdown in the reservoir as shown on the figure 1 due to optimization of the gas lift system, in our case, avoiding the paraffin formation.

For this purpose, for the constant water-cut percentage, the influence of the temperature of the injected gas on the volumes of fluid production from the reservoir and gas lift gas to be injected, was assessed. In addition, taking into account that gas-liquid flow structure will change from the bubble into the tubing to the slug in the horizontal pipes, which leads to a significant increase in pressure and temperature gradients, the pressure loss in gas-trunk line, was estimated. The results of the nodal analysis show, that by increasing the temperature of the injected gas at the entrance to the annulus up to 500°C the production of fluid from the reservoir will be significantly increased due to the growth of drawdown, but this will lead to an increase in pressure losses in the flowlines.

In order to evaluate the pressure and temperature distribution in the annulus gas lift system, P-T profiles for the most optimal mode, according to thepreviously performed nodal analysis, were constructed. The results for

P-T profiles are presented in the figures below. As it can be seen from the figures, the pressure loss will be significantly decreased, the temperature along the system will be higher than 40°C, which will avoid paraffin formation.

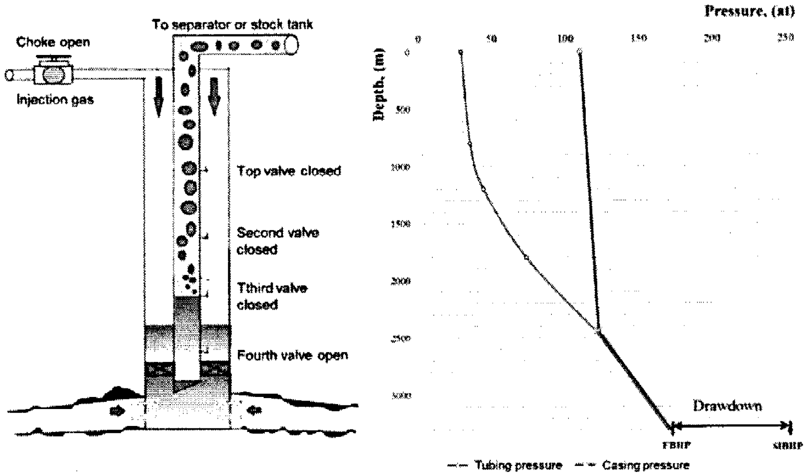
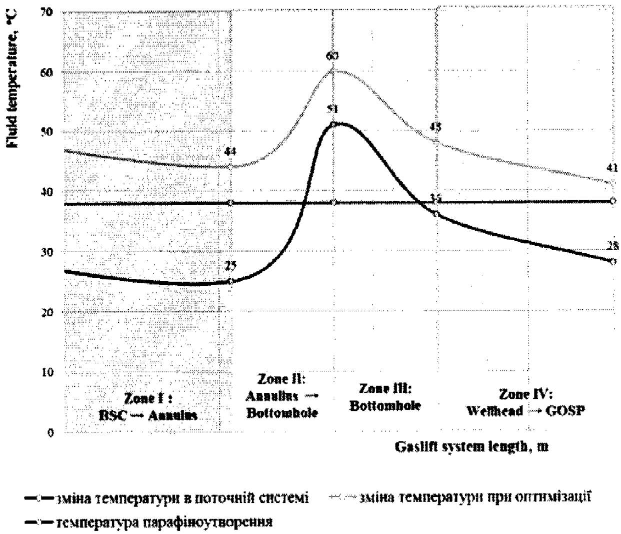



**Figure 1 –The principle of gas lift influence on the drawdown [1]**



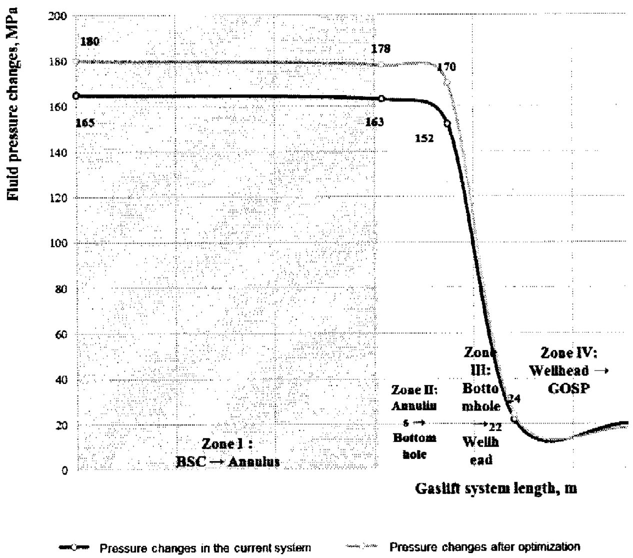



**Figure 2 – The change in the P-T profiles of gas-lift system**

Additive information.Complex decisions in flow assurance: pressure gradients in determination and predictions of paraffin and hydrates forming help production companies to increase the production rate from high viscous crudes reservoirs.

References:

1 Schlumberger Gas Lift Design and Technology. Optimization Project Chevron Main Pass 313 Optimization Project 09/12/00 – 229 c.

# REGULOWANIE GĘSTOŚCI PŁUCZEK WIERTNICZYCH ZA POMOCĄ SZKLANYCH MIKROSFER

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Wiercenie otworów w warstwach o obniżonym gradiencie ciśnienia porowego i złożach częściowo sczerpanych wymaga stosowania płuczek o gęstości poniżej 1 g/cm3, które pozwolą na bezpieczne odwiercenie otworu i uzyskanie optymalnej wydajności ze złoża. Regulowanie gęstości płuczek wiertniczych poniżej 1g/cm3 jest możliwe poprzez zastosowanie medium