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THE EFFECTIVE GASEOUS TECHNOLOGIES OF RECOVERY INCREASEMENT

To the present the wide experience gas usage for well stimulation of oil and increasement of recovery is enough accumulated. The methods of gas-oil displacement have found the broad applying for the fields of massive type with a fissured carbonaceous reservoir. It is world-known that for these fields the most effective way of exploitation – is the gas drive regime. So, the statistical researches of application the gas drive regime in USA have shown that the success factor has reached 75%. The discovery of large numbers of reef reservoirs in Canada has given the great push to development and implementation methods of gas-oil displacement.

Processing technology of these fields suppose the injector of resolvent oil ring to the top of reef with the following dry gas cap repressuring. The oil recovery realized from the bottom of oil deposit. In CIS countries the methods of gas injection began to put in practice on Ukraine's fields, on fields of republics of Tatarstan and Bashkortostan, on Krasnodar and Stavropol repoints as well. On Bitkovscky field (The Western Ukraine) the oil expulsion mechanism which is carried out by means of high pressure gas distillate under condition of partial miscibility, realized by gas by-passing from underlying oil deposit to the reef part overlying. The positive experience of method's realization is accumulated on fields in the South of republic Bashkortostan.

The applied technologies of gas-oil displacement, projected coefficients of recovery exceeded 50-60 %, and with using of oil rings or during the miscible displacement of reservoir – more than 75-80%. Besides, this effect exhibited as well in oil output increasing and possibility of using the method of flowing exploitation. So, the maintenance of formation pressure and realization of the oil expulsion mechanism by gas injection into the dome part of deposit is the high quality technology of well stimulation and recovery increment. But at the same time, practical applying mode and theoretic researches have revealed the line of negative phenomens, increasing the effectiveness of this method. To them, at first were concerning: the considerable growth of gas factor because of gas leakage into the output wells from 40 up to 2200 m^3/t on Ozerkinscky field, from 116 up to 1200 m^3/t on Grachevscky and with 96 up to 2600 m^3/t on Starokazankovsky fields. It takes place for the non counting of method of the geological discontinuity of a constitution of reservoirs, fracturing of a header, and not effective technology of gas injection and oil cullings regulation.

The experience of gas injection into the reef reservoirs of Bashkortostan, demonstrates:

1) Gas drive is the only way which considerably permits to increase the current oil production, recovery rate of reef type fields.

2) The existing methods of technological regime's determination do not allow to count the geological discontinuity. The large divergences between the planned and actual data are observed. Gas leakage into the recovery wells take place in 2-3 months

and actual oil output is 2-3 times lower than the planned despite of comparatively not large gas injection rates.

3) The implementation of these technologies requires large capital investments and working costs that leads into the long time of their payback (more then 12 years from the moment of its applying)

4) There are no reliable technologies, that rise the bench coverage by influencing and lowering the gas leakage into the operating wells .

In our opinion, the gas injection should be carried out alternately in wells, that stay in different pool reef parts with the argumentation of rates and gas injection bulks. Gas injection rates into the concrete input wells should have the cyclic nature with the injection time duration in 0.5 – 1 month and with 2 – 4 months of idle time under condition of providing the conformitive planned injection bulks. Such time intervals allow at first to make indispensable gas bulk in input well's neighborhood and then to disband the repressuring whirlpool (the heightened formation pressures zone) at gas-oil displacement's discount, gas dissolution in oil and gas implementation into the blocks of reservoir's matrix. The oil cullings on wells should be regulated depending on oil production wells situation and the current gas factor. It allows to heighten the conformance factor by affecting, will shorten costs on gas injection and will lead to the supplementary recovery factor's increasing on a reservoir as a whole. Another way of increasing the effectiveness is the recirculation of passing extracted gas by using the ejector technique. The associated gas is enriched with propane-butane fraction and it's addition to the injected gas will improve conditions of gas-oil displacement. To the present developing of gaseous technologies for the terrigene reservoirs still has not achieved the same level to the present time as for the carbonaceous benches. It's because that for the terrigene reservoirs, including deposits of massive type, the methods of water flood are effective enough. At the same time, during the involving into the development hard extracting oil reserves both on long lasting development and on new fields, successful can be the methods with using gas distillate. It is known that in the reef part many deposits sharply aggravated filtration properties of formations and at the same time contain considerable oil reserves. It's embarpassably to involve these fields into the exploitation by methods of water flood. In this case gas injection through the input wells will lead to the gas implantation from the zone with the best reservoir properties by gravity and under capillary forces into the reef pools, driving oil from it and helping in such way to magnify the recovery factor of benches. The reserves, which are situated in the anticline microstructures of deposit can be similarly involved into the exploitation. The gas injection into the oil benches with zone discontinuity can be effective as well. In this case the effect can be achieved supplementary in account of diffusion and gas dissolution in oil, which is found in lenses with aggravated reservoir properties. Thus the expulsion conditions are improving. Following technology can be advised on the over again developed fields. The oil production without maintenance of the reservoir pressure is as long at the beginning of exploitation as the field pressure will now draw-down to a level a little bit below than the level of the bubble point pressure. Then gas should be injected in such volume that allows to rise field pressure which is above than the bubble point pressure. Thus the oil doesn't with drowned. After finishing the injection, follows the outage time during which the disbandment of the repression whirlpool and front's equalization, gas dissolution and diffusion in oil takes place. Then follows the next cycle-oil culling, gas injection, outage, etc.

The fundamental standards of the technology (the level of pressure's lowering pressure after finishing injection, cyclic duration, etc.) are argumented with hydrodynamic calculations with the discounting of the physical characteristics, of oil and gas. Such technology combines successfully in itself operation conditions: elastic drive, dissolved gas drive and elastic-watered drive.

The hydrodynamic calculations were produced on the bate of three – dimensioned three – phased mathematical model of the one of Kuibeshevscky fields with the discounting of limited fluids miscible displacement with the injected gas and the process's cyclones. The decreasing of reservoir pressure and the pressure at well bore below than the bubble point pressure, as the theory and practice have confirmed – not only reduce the recovery factor of the benches, but on the contrary – is quite allowed. It's arranged that the optimal pressure, around which is suitable to lower the reservoir pressure with the purpose of realization the dissolved gas drive, is between 10% below than the bubble point pressure.

Verifying actual particularities of the geological reservoir feature, which is characterized with the limited connection with the edge pressure water system, two alternative of exploitation of the hydrocarbon gas injections on offered technology, are calculated. The duration of saturation period is determined for there alternatives. It's arranged that for the state of phase equilibrium and formation pressure's stabilization at the end of period, is complete days are necessary researches which were made for the conditions of the examined object was found out that the coefficient of oil expulsion by water – 0,5 by hydrocarbon gas (methane) – 0,63. The cycle duration was limited during the gas injection on the one hand – by the value of critical formation pressure, on the other hand – depending on alternative – by value of formation pressure either which is above or below than the bubble point pressure. For the determination of period's optimal duration in cycles gaseous affiliating on reservoir the maximum saturation at reservoir by gas is providing by it's high penetrability and in joint with the formation pressure recovery up to the origin value allows to increase it's coverage by affecting, that cannot be achieved by water injection. With the aim of the investigation of the exploitation process the series of calculations of alternatives, which are differed in gas injection's bulks, period's duration, the values of formation pressure at the well bore on different stages, cullings levels, etc, were made, as the result of the analyze, which has made, three alternatives with the optimal development indens, were chosen, the first – the base alternative – with the water injection and other two – with hydrocarbon gas injection by the recommended technology. All the variants were predicted with allowance of exciting well spacing and the drilled well's fund, consists of 14 units. As the deposit was entirely drilled over, then during the planned period the transfer of the exploitation wells into the injection is enabled only. According to the recommended technology the gas injection should be carried out in 6 input wells, which are spaced on very roof of deposit, and the input's withdrawn – from exploitation wells, posed on the peripheral of the bench. As the base variant the alternative of exploitation with the maintenance as formation pressure by the water injection into the 3 input wells, spaced on the calotte of reservoir (in accordance with the confirmed protect of development) and the production's withdrawn from 11 exploitation wells was accepted.

The accepted oil recovery ratio (KIN) in 35 years will be – 0,47. The variant with the cyclic injection of hydro gas of high pressure according to the worked technology, are the alternative methods in second variant allowing the achieved state of reservoir's development, value of the minimum formation pressure in 10 MPa is consider to be the

boundary value of the culling stage. At the first stage of the technology the total gas volume is injected – 56,29 million m^3 (consists of the active bulk – 13,07 million m^3; gas bulk, dissolved in remained oil – 30,74 million m^3, gas bulk, which will be injected into the gas cap – 12,48 million m^3) during 63 com plebe days. At the second stage, during 18 days, there is no the reservoir and as a consequent of it is the formation pressure's stabilization on the level 14,6 MPa.

Then the third stage is realizing – the stage of production is culling from wells in the drive of the exhausted formation energy (complete 14 days). The first cycle's duration is 95 complete days. Beginning from the second cycle the duration on the inspection stage shortens to the 15 days, which are indispensable for the indispensable for the injection of the active gas bulk. Thus the duration of the second stage and the rest will be 47 days. For the first year 6 cycles should be carried out, and for the second and subsequent year. The maximum daily average injectivity on gas about one well – 150 thousand m^3/day. In 28 years from the beginning of technology's implementation the oil recovery ratio will be – 0,53. The simulation of development on the third variant was conducted under condition of realization the dissolved gas drive (the value of formation pressure at the end of culling stage was taken below than the bubble point pressure) with the purpose of the arrangement of the value on which it is expediently to lower the formation pressure and the pressure at the well bore. For obtaining maximum effect from the realization dissolved gas drive, were made the series of calculations were in interval 0,1 Pus – 0,8 Pus. The optimal development index were obtained during the lowering the pressure at the well bore into 25%, and decreasing the formation pressure into 16% below than the bubble point pressure

The further pressure's dropping, as formation pressure or the pressure at the well bore – doesn't influence at the KIN, and it connects with the rising of the oil viscosity, dropping its mobility and aggravating the filtration characteristics of face zone of wells. So, boundary condition of the third stage – the stage of saturating – is the value of the formation pressure – 4,3 MPa. At The first stage of the technology it is necessary to injection the total gas bulk into the reservoir 72 millions m^3 composed from the active volume – 21,64 million m^3 ; gas bulk, dissolved in the remained oil – 30,74 million m^3, gas bulk, which will be injected into the gas cap – 20,42 m(n, m^3) during 81 complete days. The second stage – 18 days and nights – the stage of saturating – there is no external afleeting on the reservoir (stabilization of the formation pressure on the level = 14,6 MPa).

The third stage – production's culling from wells in drive of exhausted formation energy – 17 days. The first cycle's duration – 116 days. Beginning from the second cycle, the duration of injection shortens to 24 complete days. There should be carried out four cycles for the first year, and for the second and subsequent stages – 59 days. In 211 years from the beginning of technology's implementation the oil recovery ratio will be 0,56. In summary it is necessary to notice that gas usage for solving the problem of rising the recovery factor and the intensification of oil extracting allows to accumulate the gas reserves in bawls, close to the industrially developed regions.

This, in it's turn, allows to look on the perspectives such accumulations as underground gas reserves, that doubtlessly will influence into the region economics.