TECHNOLOGICAL PROCESSES OF FLOODING. THE MAIN TIPES OF FLOODING. THEIR INFLUENCE ON THE RESERVOIR

Tuhbiev Ramil Fanicovich, Kemalov Ruslan Alimovich

Kazan Federal University, Kremlyovskayastr, 18, 420008, Kazan, Russian Federation

Abstract: The purpose of this work is: selecting and providing the most optimum type of flooding on the reservoir, identifying its advantages and its application in practice. The objectives of this work are the following:
-to analyze the types of flooding;
- to identify the main advantages and disadvantages of their using.

Keywords: water flooding, oil field, well.

1.INTRODUCTION

In the period of depletion of main oil reserves on the deposits of the Ural-Volga region at the expense of the primary production of highly productive high-permeability reservoirs, increasing number of remaining reserves are transferred to the category of hard. In such conditions existing stationary field development systems become ineffective.

At present the main way of development of oil fields is an oil formation flooding. The effectiveness of this method of development is largely dependent on the geological structure of the manifold.

With the good geo-physical conditions during flooding of final oil recovery does not exceed 50 - 60 % of the initial oil reserves, and under adverse conditions - 30 - 40 %. Low percentage of extraction of oil is mainly due to the low coverage of the formation flooding. To increase the efficiency of the flooding process of heterogeneous reservoirs it is necessary to increase the current reservoir sweep flooding due to implementation of water in low-permeability oil-saturated areas.

2.METHOD OF THE WATER FLOODING

1.The method of edge water flooding is used in the development of relatively small size deposits. It consists in the injection of water into the reservoir through injection wells, placed in the outer contour of oil content at a distance of 100 m and more. Development wells are located inside the contour of oil-water boundary parallel to one contour. In the result of the flooding water inflow to the reservoir is increased and pressure in oil deposits maintained at a high level.

Conditions of use edge water flooding:
-contour of oil-water boundary must be clearly defined;
-distance from the injection wells to oil-water boundary should be 400-600 meters;
-oil-water area should be minor;
-the reservoir should be sufficiently similar, high-permeable and oil-low viscous;
-there should be good hydrodynamic connection between edge water and contour parts;

While flooding up by this type about 60% of the injected water may leave aquifer in the area of water contect is being wasted, solving basically only one task-maintenance of reservoir energy.

Disadvantages:
-low efficiency of the process;
-the probability of formation of lateral coning and cones of watering;

2.Selection flooding.This type of flooding injection wells have at some distance from the external circuit of oil within the water area of the deposit.

It is mainly used in the same characteristics of deposits as edge water flooding, but at considerable width of oil and water areas, as well as the bad hydrodynamic connection deposits with out of edge area [1].

Conditions of application of the selection of flooding:

-low hydrodynamic connection of oil-saturation area of the reservoir with the area of power;
-long distance between the external and internal oil-contenting contour;
-small size of deposits.

The main advantage of this kind lies in the approximation of artificial circuit of upply to internal oil-contenting contour intensifies reserves by reducing resistance filtering.

Disadvantages:

-increases the risk of formation of lateral coning and cones of watering
-water injection is not just wet, but in the saturated part reservoir

3.Contour flooding

Contour flooding is divided into the following types:

-cut series of the injection wells;
-pattern flooding;
-selective;
-focal;
-head;
-barrier.

Contour flooding is provided by a number of varieties When cutting deposits by series of injection wells water injection into the reservoir is made through injection wells located within the deposits of series, called the cutting rows or lines cut. Usually, all wells of cutting after drilling shortly exploited for oil at higher flow rates. It allows to clear the bottom hole formation zone and to reduce pressure in the range, i.e., creates conditions for successful exploration wells to water injection. Then well over one master under pressure, continuing intensive oil production of intermediate wells of the row. It facilitates the movement of injection water along the cutting line [2].

There is a number of podvel cutting the ranks of injection wells - cutting area, block and roof.

1.1Cutting operational object on the area

The great advantage of the system design with cutting object on the area is the ability to start the design and development of areas with the most productive and with the greatest reserves.

During flooding with cutting operational object on the area of self-development of cutting the ranks have therefore to highlight the area of self-development that vary in geologic characteristics.

1.2Block flooding

In the block injection oil deposit is cut by rows of injection wells into the strips (blocks), within which the series production wells in the same direction are placed. In case of the drawn-out form of a deposit rows of slits locate usually perpendicularly to its long axis (Fig. 18). In case of the "circle" form of deposits, especially with extensive areas of oil bearing capacity, the direction of the series of wells are chosen, taking into account zonal heterogeneity of the productive formation - in the cross revealed according to intelligence prevailing orientation zones with increased capacity (and, as a rule, with high porosity and permeability of the reservoir (Fig. 19). The result is the intersection of all zones, containing the main part of oil reserves, lines, cutting and therefore ensuring greater influence in them water injection. In the other direction of blocks, adopted without taking into account data on the borders of zones of different productivity, cutting the ranks in significant parts can be in areas with low permeability of the reservoir, which will cause the low permeability of a significant part of injection wells and no part of the highly productive zones of influence of injection water.

When designing systems of development with the considered views of flooding special attention should be paid to the justification width of the blocks and the number of producing wells in the block. The width of the blocks is chosen from 4 up to 1.5 km in accordance with the reduction of hydroconductivity formation.

Depending on the number of producing wells in the block flooding is called as five-or three-row. Reducing the number of extractive series in conjunction with narrowing unit also increases the activity of the system by increasing the horizontal pressure gradient and reduce the number of production wells per injection. At five-and three-row systems, the latter indicator amounts to about 5 and 3.

3.Crest flooding

While crest flooding discharging of water into wells is carried out into one almost straight or circular cutting of a row located in crown area of the reservoir. These kinds of flooding is applied for formations, geological and physical characteristic of which is favorable for cutting application generally.

They are rational for deposits with a moderate area of oil-bearing capacity.

Indications for application is low permeability of reservoirs or existence of a screening layer under a deposit, need to add edge water flooding or gain of impact on the central part of a deposit. When designing the dome flooding special attention should be paid to the size of oil-water zone. So, when axial cut in conditions of the big width of this zone of injection wells row may be in pure oil of the reservoir, and most of production wells in oil-water. In this situation it is better to stay on the block flooding.

3.2Areal flood

Areal flooding is also a kind of contour water flooding, which in conditions of a uniform grid wells injection and producing wells alternate in the strict laws, established by a project document for development.

The system design with areal flood (areal system) have a greater activity in comparison with the systems outlined previously. It is purposed by that fact in systems with areal flooding each producing well from the very beginning of the development in direct contact with injection. In addition, at areal flooding on one injection well, it can typically have fewer wells than in previous systems. They use several forms of nets and mutual accommodation of injection and production wells, in which the system of development are characterized by different activity.

For linear and five-spot systems, this ratio is 1: for seven-spot is 0.5 inverse -2: for nine-spot direct is 0.33, inverse is 3; for cellular is 4-6. The five-spot harness, inverse seven-spot and inverse nine-spot of different completion methods of system development with equal distances between all wells are widely used. In these systems, each discharge and its surrounding producing wells constitute the elements of the system. These systems are usually recommended for production facilities, with a relatively homogeneous structure of formations and represented by terrigenous or carbonate reservoirs of pore type. Direct seven-spot and nine spot systems are differ from those inverse systems, by the fact that they injection and producing wells are swapped.

Cellular system largely eliminates these shortcomings and increases the efficiency of development of deposits, providing a sharp increase in the values of quantities of production and injection wells (up to 6: 1 and more), and the distance between the injection and production wells at small distances between the producing wells.

The development systems with areal flood peculiar and some negative moments. They make it almost impossible to regulate the speed of water movement to different producing wells element of system development by redistributing volumes of injected water. This further increases the likelihood of premature watering significant part of production wells. This process is compounded by the timing of the commissioning of new production wells in item system after water injection, prolonged with stops of individual wells for underground and major repairs, by disabling drowned wells and significant differences in the production wells and others. Due to

the original configuration of the current lines at areal flooding between wells can form the dead zones of oil [3].

3.3Selective flooding is a kind of contour water flooding provides the location of wells after drilling, operating object on a uniform grid with given the variability of its geological structure. After drilling of an object on a uniform grid, and some period of operation of all oil wells for the development of water injection choose well, the location of which most suits the geological structure of formations and provides an effective impact on the entire volume of deposits. Electoral technologies used during sharp zonal heterogeneity layers, expressed in liposelection groundwater reservoirs, in the presence of two or three varieties of collectors of different productivity, distributed unevenly across the square and so on, as well as the violation of the object by a series of disjunctive violations.

3.4Focal flooding is essentially an electoral process, but is used as supplement to other varieties flooding , if they do not provide the effect of water injection over the entire area of the object. Pockets of flooding (water injection into individual wells or small group of wells) usually create in areas not experiencing or insufficiently affected by the flooding after mastering designed. Under injection they choose well from the producing, mainly from those who has completed its main task, i.e. located on flooding (depleted) parts of the object of development.

3.5Head flooding. Essentially, this kind close to the dome flooding. The head is called the water is injected into the most elevated area deposits, tectonically or lithological screened in the roof parts. This type of flooding is applied in the development of oil fields of geosynclinal type - in Azerbaijan, Kazakhstan, Western Ukraine and other.

3.6Barrier flooding. This kind of contour water flooding, is used in the development of oil and gas or gas condensate deposits of reservoir type for the purpose of insulation of gas (gas condensate) portion of deposits from oil. Circular row of injection wells have within oil and gas area, adjacent to the domestic gas bearing.

3.CONCLUSION

By applying the barrier flooding develop in Western Siberia (the deposits in the group reservoirs «And» Samotlor field), in the Tomsk region luginetskoe. Thus, in many cases, the design of the system development of operational facility based on its geologopromyslovaya characteristics, it can be recommended or two and sometimes three types of flooding. For example, the selection process can be considered along with axial cut or cross-cutting object into blocks; cutting narrow blocks can be recommended along with areal flood, etc. From among possible options, reasonable geologically, the best option is chosen using the hydrodynamic and economic needs while taking into account other elements of the development system (grid density, wells, pressure differential between zones and discharge criteria.

CONFLICT OF INTEREST

The author confirms that the submitted data does not contain conflict of interest.

THANKS

The work is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University

LINKS

1.Muslimov, R. H. Modern methods of increasing oil recovery: design, optimization and performance evaluation [Text]/ R. Kh. Muslimov// tutorial. -Kazan: publishing house "fen" of Academy of Sciences of Tatarstan, 2005.-S.-688

2.Ibatullin, R. R. enhanced oil recovery at the late stage of field development (methods, theory, and practice) [Text] / R. R. Ibatullin, N. G.Ibragimov, S. F. Takhautdinov, R. S. Khisamov.-M.:Nedra-Business Center,2004.-S.-292.

3.Schurov, V. I. Technology and equipment of oil production [Text] / I. V. Shchurov– M.:OOO TID "Alliance".-2005.-S.-510.