THERMAL OIL RECOVERY METHOD

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At present, the development of Russian oil industry shows a deterioration in the structure of oil reserves. The Reason of this explains by the following features: hydrocarbon deposits are characterized by high viscosity of oil, the reservoirs themselves have low permeability due to a decrease in the capacity of caverns and channels through which formation fluid is filtered, in addition there are problems associated with the structure of the poroperm system of collectors.

Such problems include the temperature of the fluid inside the reservoir, which is close to the temperature of paraffin deposition; stratification of the rock mass, which can be a collector, by rocks of a different type related to tires, which leads to the fact that the vertical filtration becomes impaired, for the same reason, multidirectional filtration flows may occur in massive carbonate reservoirs within the same reservoir.

Injecting an agent previously brought to a high temperature into the formation allows: to reduce the viscosity of the formation fluid, which increases its mobility; to increase the hydrophilic properties of the medium, as a result of which the oil recovery coefficient is increased due to the extraction of residual oil and additional washing of the oil from the rock.

The subject of the study is the analysis of measures for the conduct and preparation of thermal methods for increasing oil recovery from a technical, technological and economic point of view.

Next, we consider the process under study using the Gremikhinsky field as an example. To do this, you must first disclose the main features of this field.

Gremikhinsky oil is classified as heavy. Under surface conditions, its density varies between 912 and 924 kg / m3, which averages 917 kg / m3. The content of asphaltenes varies from 1.33% to 8.8%, resins in the range from 6.48% to 16.7%. The paraffin content may reach 6.7% by weight of the fluid. Gremikhinskoye oil is sour because the sulfur content can reach 3% by weight. Among other properties of oil, it is possible to distinguish a low pour point, the temperature of the onset of boiling oil, fluctuating in the range 63 - 104 ° C. About 55 - 70% of light oil products reach a temperature of 350 ° C.

The following is a list of technologies that have successfully passed trial tests and, subsequently, implemented in the field [2]:

- Increased oil recovery using liquid phase oxidation;
- Thermopolymer impact on viscous oil deposits;
- Pulse-dosed thermal effects on the reservoir with a pause and without a pause;
- Combined thermal cyclic stimulation of the formation through the systems of injection and production wells;
- Cyclic intrastratal polymer impact.

Consider the technology of pulsed-dosed exposure: when carrying out measures for pulsed-dosed exposure, cyclic injection of a heat agent and then cold water occurs. It is necessary to maintain the injection volumes established by the calculations in order to maintain the required temperature in geological and physical conditions. Sufficient depth of productive strata for their treatment using IDTV is 1000 m or more.

When using this technology, energy resources are saved and heat losses are reduced due to the fact that there is a certain limit for the temperature of the coolant, exceeding which does not lead to further improvement of reservoir conditions, this temperature limit is called the effective temperature (Teff).

Thus, when the temperature reaches Teff, a further decrease in the viscosity of oil does not occur. The Teff value for Gremikhinskoye field is 55-60 ° C, at reservoir temperature of 20 ° C. Moreover, the viscosity of reservoir oil decreases by more than 10 times - from 125 MPa * s to 10-12 MPa * s.

Figure 1 shows the coverage of the facility by thermal methods for increasing oil recovery at the Gremikhinsky field. The largest percentage of the technologies used was in the technology of pulsed-dosed heat exposure, which covered a large central part of the deposit, and its small northern region.

The effectiveness of the application of the technology of pulse-dose exposure at the Gremikhinsky field is confirmed by the following statistics:

- Additional oil production during the period of this technology amounted to 1 million 284 thousand tons;
- The flow rate of the coolant for the extraction of 1 ton of oil was reduced by 2 times (from 6.4 t / t to 3.2 t / t);
- Capital investments and operating costs were reduced by 25% and 27%, respectively;
- The cost of oil production was reduced by 10% compared to water flooding.

For an electric steam generator installation , the calculation sequence for the pulse-dose mode is as follows: the volume of steam for injection is set; a cycle for calculating the generated steam volume is being built, the condition for the cycle will be to achieve the specified estimated steam volume. In the cycle, in addition to the main calculation, the heating and vaporization time is determined [1].

In this case, a cycle is understood to mean the process of successive passage of water by each electrode, during which it is heated and vaporized, from the moment of injection to the moment the formed vapor leaves the device.

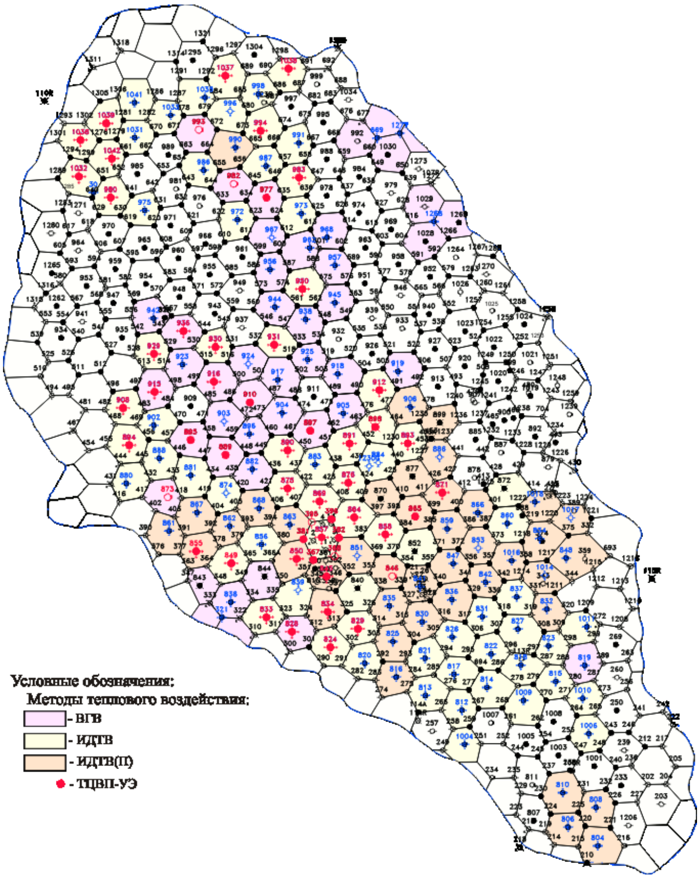

Fig. 1 Thermal exposure technology coverage

The hourly steam capacity of the electric steam generator is calculated according to the data of the water-steam state table:

$$V_n = Q * V`` \qquad (1)$$

where Q is the capacity of the electric steam generator (kg / h), V´´ is the specific volume of dry saturated steam (m^3/ kg).

Knowing the time of one cycle t, it is possible to determine the operating time of the electric steam generator to produce Vp:

$$t` = t * C`` = t * \frac{V_p}{V_n^1} = t * \frac{V_p * C}{V_n} = t * \frac{V_p * 3600}{V_n * t} = \frac{V_p * 3600}{V_n} \qquad (2)$$

where C´´ is the required number of cycles for the estimated volume of steam, is the amount of steam per cycle, Vp is the estimated volume of steam, t is the time of one cycle, C is the total number of cycles.

For example, if in order to create an effective temperature the required volume ratio is one to two, i.e. 20 m^3 steam 40 m^3 cold water, the hourly output for the production of 20 m^3 in the EPG will be [2]:

$$V_n = Q * V`` = 2903 * 0{,}0141 = 40{,}9 \text{ м}^3/\text{ч} \qquad (3)$$

and the duration of the vaporization will be:

$$t` = \frac{V_p * 3600}{V_n} = \frac{20}{40} * 3600 = 1800 \text{ с} \qquad (4)$$

Thus, in this work, methods to increase oil recovery at the Gremikhinsky field were considered. All in all, under deteriorating oil recovery conditions, new, innovative technologies are required. In this article was told about thermal methods for increasing oil recovery, which certainly showed their effectiveness in these geological and physical conditions.

References

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