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Evaluation of the efficiency of the geological and technical measures aimed at intensification of the oil field

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ABSTRACT: The article deals with the definition of oil production growth in the course of a certain activity, taking into account the impact of the natural flow coefficient. Oil production growth was calculated in well No. 168 of the Lyalmikar field. Forecasted terms of validity of the measure and calculation of oil production growth in certain periods of time have been determined.

KEY WORDS: region, field, horizon, oil, oil recovery, development, oil recovery ratio, mode, reserves, effect, deposit

I. INTRODUCTION

After oil field development, after a certain period of time, changes in well production volumes begin, accompanied by deteriorating filtration properties of the well bottomhole zone with a simultaneous drop in the flow rate and an increase in formation water content in produced fluid. In order to remedy the situation, the geological service of oil producing companies carries out certain geological and technical measures (GTM) on the impact on productive formations in order to intensify oil production.

II. LITERATURE STUDY

At the same time, it should be noted that it is very important to make a reliable calculation of the obtained economic effect from each conducted GM. In practice, the effect of geological and engineering works for a given time interval is defined as a difference between actual oil production and oil production according to the "basic" option.
A great number of theoretical, field and experimental studies have been devoted to substantiation of application of modern CTMs to calculate the final value of a CTM and its efficiency for various geological and physical conditions of oil deposits.

S.H. Abdulmyanov, A.V. Afanasiev, R.A. Bagautdinov, V.S. Boiko, V.A. Vasilyev, M.N. Galliamov, A.N. Huseynov, K.M. Dontsov, L. S. Boyko, V.A. Vasilyev, M.N. Galliamov, A.N. Huseynov, K.M. Dontsov, and L.A. Bagautdinov are devoted to the study of these problems. H. Ibragimova, A. G. Kahn, Y. P. Kislyakov, A. N. Kolevatova, A. N. Komissarova, V. I. Kudikov, V. D. Lysenko, I. T. Mischenko, G. A. Orlova, V. I. Smirnova, M. L. Surgucheva, etc.

For the conditions of the fields of Uzbekistan, this issue was studied by S.N. Nazarov, E.K. Irmatov, B.H. Khuzhaerov, A.H. Agzamov, U.S. Nazarov, V.N. Sipachev, A.G. Posevich, B.Sh. Akramov, R.K. Sidikhodjaev and other scientists and specialists who were engaged in the study of the problems of hydrocarbon fields development.

III. METHODOLOGY

As it is stated in [1, 3], nowadays the additional oil produced during the implementation of this or that activity is determined without taking into account the influence of the natural flow coefficient, which often leads to significant errors in the estimation of the obtained effect.

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Effectiveness of an activity is determined during the calculation period covering the time interval from the beginning of the activity to the end of its action [2, 3]. Oil production growth for the calculation period is formed as a sum of production growth for separate time intervals of the calculation period ΔQ_P[3]:

$$\Delta Q_P = \Delta Q_P^1 + \Delta Q_P^2 + \cdots \Delta Q_P^n, \qquad (1)$$

where $\Delta Q_P^1, \Delta Q_P^2$, etc. - oil production growth in certain periods of time, thous. tons.

Oil production growth in the first calculation year is determined [5]:

$$\Delta Q_P^1 = \frac{1}{2}[(q_п^1 + q_п^2) - (q_0^1 + q_0^2)] \cdot 30{,}4 \cdot T \cdot K_э - \Delta Q_п; \qquad (2)$$

and the next and subsequent years [3]:

$$\Delta Q_P^{2\ \text{и т.д.}} = \frac{1}{2}[(q_п^2 + q_п^3) - (q_0^2 + q_0^3)] \cdot 30{,}4 \cdot T \cdot K_э. \qquad (3)$$

If the number of months of effectiveness is less than a year [3]:

$$\Delta Q_P^п = \frac{1}{2}[(q_п^3 + q_K) - (q_0^3 + q_K)] \cdot 30{,}4 \cdot \Delta T \cdot K_э. \qquad (4)$$

The total volume of oil production for the calculation period is [3]:

$$\boldsymbol{\Delta Q_P = \frac{1}{2}\left[(q_п^1 + q_K) - \left(q_0^1 + q_K\right)\right] \cdot 30{,}4 \cdot T \cdot K_э - \Delta Q_п}, \qquad (5)$$

where $q_п^1$, q_0^1 - average daily well flow rates before and after the event, respectively, are taken in accordance with the relevant indicators for calculating oil production growth in individual intervals of the calculation period, t / day; T,T_1, T_2 - respectively, the duration of individual intervals for the entire calculation period of the effect, month. ΔT - duration of the event in the final part of the calculation period, months; 30,4 - average number of calendar days in a month; $K_э$ - well operation factor;$\Delta Q_п$ - oil losses as a result of downtime of the well during the event, t.

According to the authors of the paper [3], the reliability of oil production growth calculation depends on how well the flow rate and its changes over time are determined. If the flow rate changes uniformly in time, the dependence can be expressed by linear equation [3]:

$$q_{0(п)} = q_{0(п)}^1 - \Delta q_{0(п)} \cdot T, \qquad (6)$$

where$q_{0(п)}^1$- the initial values of the daily average rate before and after the event, t/day, respectively; $q_{0(п)}$ - increases in the daily average rate before and after the event, t/day.

After the end of the GTM, the daily average daily flow rate before and after coincide, expressed in the following identity [3]:

$$q_п^1 - \Delta q_п \cdot T_п = q_0^1 - \Delta q_0 \cdot T_п. \qquad (7)$$

The duration of effectiveness in months is characterized by the following formula [3]:

$$T_п = \frac{q_п^1 - q_0^1}{\Delta q_п - \Delta q_0}. \qquad (8)$$

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IV. CALCULATION RESULTS

The above-mentioned calculation method was used by the authors of this work to assess the real efficiency of technological measures at well №168 of Lyalmikar field.

Forecast of basic oil production at well №168 for the period of effect from well interventions was made by extrapolation of analytical dependence of changes in oil production in the time established in the period before the well interventions.

It should be noted that "basic" means well operation mode before the well intervention. As applied to oil production forecasting, the formula of exponential dependence has been widely used in oilfield practice [3]:

$$q_{0(\text{п})} = q^1_{0(\text{п})} \cdot e^{-c \cdot t}, \qquad (9)$$

where $q^1_{0(\text{п})}$ - the initial values of the daily average rate before and after the event, t/day, respectively; $q_{0(\text{п})}$ - increases in the daily average rate before and after the event, t/day.

As a result of testing from well №168, oil flow was received and on May 17, 2011 the well was put into operation with average daily oil flow rate of 5.0 tons, watercut of 53.6% and drained reserves of horizons I-II. As of 01.01.2020, well №168 was in the production stock of Horizon II. Currently, the oil flow rate of the well has decreased to 3 tons per day with 90.2% water cut. Accumulated oil production is 11.7 thousand tons.

Since commissioning of well №168, within 5 months there has been an increase in water encroachment with a sharp drop in oil production (from 5 to 1.8 tons per day). Therefore, additional perforation was performed from October to November 2011. After the operation, the oil flow rate was 5.1 tonnes per day. The water content of production was reduced to 77%.

Connection equations for characteristics of flow rate changes before and after the operation according to Fig. 1 are expressed by the following dependence (6):

$$q_{0(\text{п})} = q^1_{0(\text{п})} \cdot e^{-a \cdot T_{\text{п}}}, \qquad (10)$$

Changes in the average daily flow rates calculated by the equations of communication ($q_{0(\text{п})}$) are the basis for determining the duration of the effectiveness of the action. After the action is completed, the average daily flow rates before and after coincide. In this case, the equivalence of the average daily receivable with the time factor (7) for this example can be written down as follows:

$$q^1_{\text{п}} \cdot e^{-a \cdot T_{\text{п}}} = q^1_0 \cdot e^{-b \cdot T_{\text{п}}}, \qquad (11)$$

After transformation of this identity, the duration of efficiency in months is characterized by the following formula:

$$T_{\text{п}} = \ln \frac{q^1_{\text{п}}}{q^1_0} / (a - b), \qquad (12)$$

In this case, the duration of the measure efficiency according to expression (12) for well №168 was 85 months.

Water shut-off works were carried out at well №168 on 01.01.2013. In this connection, the duration of effect from additional perforation was 14 months, as the duration of efficiency is characterized before the next activity (Fig. 1).

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Table 1 shows technological indicators of MTF efficiency at square №168 of Lalmikar deposit. Calculated by formula (10), the total additional oil production from the carried out geological and engineering works was 3.4 thousand tons.

Table 1: Technological effect of CT application at well №168

Name of works	Date of event	Average daily well flow rate, t			Circumstances, %			Length of effect, month	Additional oil production, t
		until	after	growth	until	after	reduced		
Additionalperforation	30.10.2011 03.11.2011	1,8	5,1	3,3	90	77	13	14	837,3
Waterproofing	06.12.2012 19.01.2013	0,9	1,3	0,4	96,2	40	56,2	7	346,3
Hydrochloric acid treatment	24.07.2013 06.08.2013	1,3	6,8	5,5	40,9	75	-34,1	6	357,7
Additional	27.02.2014 08.03.2014	0,7	2,3	1,6	96,8	80	16,8	6	681,0
Waterproofing	27.07.2014 02.08.2014	1,9	7,0	5,1	94,8	78,8	16	8	1179,3

As noted above, in practice, the efficiency and duration of the effect from the well intervention is determined by equating the average daily flow rates before and the peak period of well production increase after the well intervention. In this case, the total additional oil production from well №168 at Lalmikar field would be 1522.0 tons.

On this basis, it is reasonable to determine the efficiency of the measure within the calculation period covering the time interval from the start of the measure to the end of each well intervention. As a result, the duration of efficiency is characterized before the next activity.

V. CONCLUSION

Summarizing the aforesaid, it should be noted that the performed calculations of efficiency from carrying out well interventions at well No. 168 of Lyalmikar field, according to the proposed methodology, show that the same should be done for each oil field where different well interventions are planned (or carried out). This will allow optimizing the oil production company's costs, actually estimating the possibilities of each production well and in the future planning the most true production volumes in the field as a whole.

REFERENCES

[1] MukhametshinV.Sh. et al. “Modern technologies of oil and gas business”. Proc. of All-Russian Scientific and Technical Conf. Ufa: USTU Publishing House, pp. 97. 2007.
[2] Dunaev V.F. et al. Economics of oil and gas industry enterprises.Textbook. 4th ed., pp. and dop. M.: TsentrLitNefteGaz, pp. 336. 2010.
[3] Khlamushkin I.K., Garifullina Z.A., Gabzalilova A.H., Khusnutdinova R.R. “To the calculation of oil production growth from the implementation of measures to intensify” / Problems of collection, preparation and transportation of oil and petroleum products, USTU Publishing House, № 1 (95), pp. 21-25. 2014

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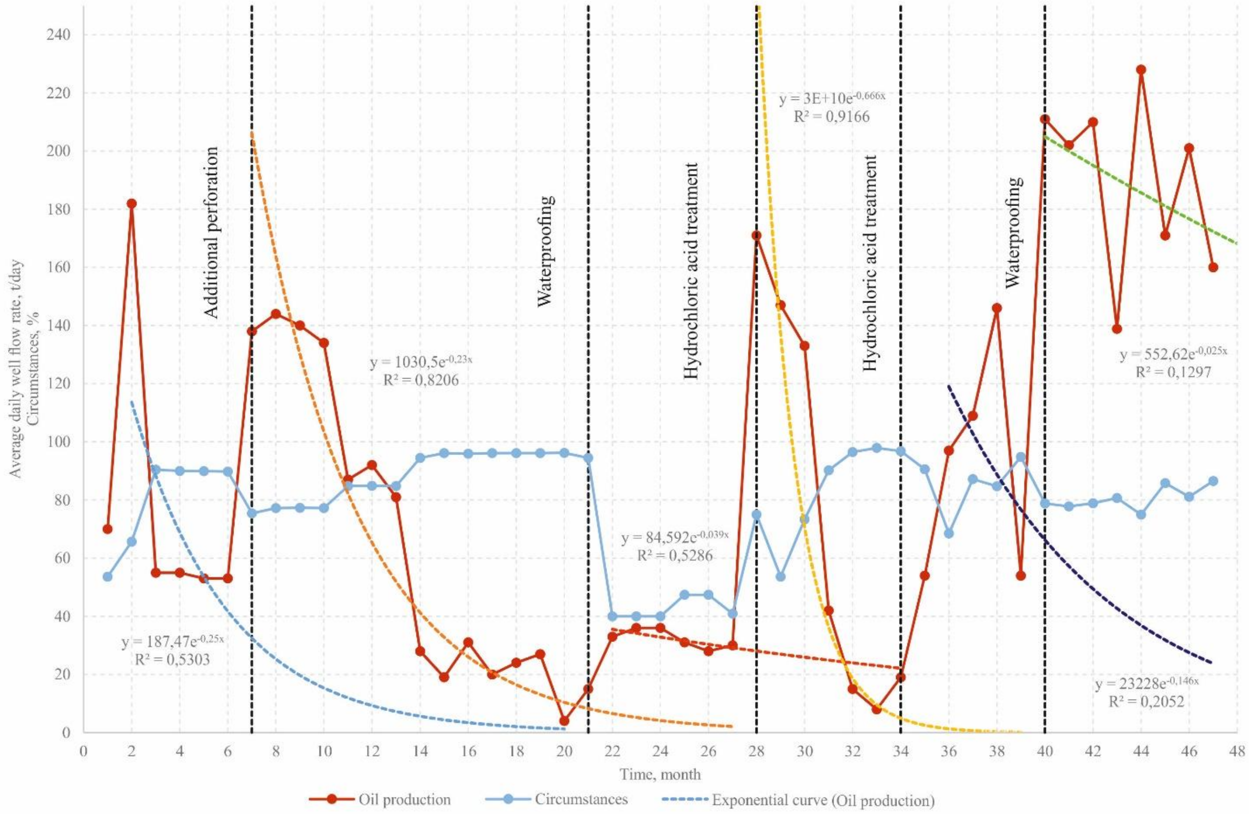

Fig. 1. Oil production growth rates of well №168 at Lyalmikar deposit

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