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# Assessment of the Degree of Influence of Geological and Technological Factors on the Flooding of the Production of Wells of Massive Gas Sub-Gas Deposits

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**ABSTRACT**: The results of the analysis of the dynamics of the irrigation of the production of gas wells of massive gas type located in the Bukhara-Khiva region of the Republic of Uzbekistan are presented.

Using the Kullback measure, the degree of influence of geologic-physical and technological factors on the average well production flooding is estimated. It has been established that with small ranges of changes in the viscosity of reservoir oil and reservoir permeability, the grid density, the ratio of the volume of oil deposits to the entire oil and gas-saturated volume and the effective oil-saturated thickness of the reservoir have the greatest influence on the average well watering.

**KEY WORDS**: field, reservoir, water content, factor, information content, well, development, viscosity, oil, thickness, density, permeability, significance, coefficient, extraction.

## I. INTRODUCTION

In recent years, in Western Uzbekistan, a number of massive sub-gas deposits have been put into development with small sizes, with a limited amount of initial geological and field information. In this connection, at the stage of designing such oil deposits, there is no possibility of using hydrodynamic methods for calculating technological development indicators. In such cases, in order to justify certain indicators of the development system, it is necessary to resort to the results of generalizing the experience of deposits in the region that are in the late stage of operation.

Establishing the degree of influence of geological and production factors on the water cut of well production is one of the difficult tasks of developing sub-gas oil deposits. Currently, to solve this problem, depending on specific goals, various research methods are used: theoretical, experimental, statistical, etc.

## II. METHODOLOGY

The main difficulty of such studies lies in the fact that sub-gas deposits are located in different geological and physical conditions, and a large number of factors that vary during the development process simultaneously affect the water cut of wells.

In this regard, to solve the problem, of particular value are the results of studies based on the statistical processing of geological and production factors of sub-gas oil deposits that are at a late stage of development.

As is known, the ratio of oil and water in the production of wells of massive gas sub-gas deposits is determined by the formula [4]:

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$$\frac{q_н}{q_в} = \frac{k_н \mu_в h_н b_в}{k_в \mu_н h_в b_н},$$

Where $q_н$, $q_в$ - oil and water flow rate; $k_н$, $k_в$ - permeability coefficients of oil and water-saturated parts of the reservoir; $\mu_н$, $\mu_в$ - reservoir oil and water viscosity; $h_н$, $h_в$ - thickness of oil-saturated and water-saturated parts of the reservoir; $b_н$, $b_в$ - volumetric factors of oil and water.

Therefore, to study the influence of geological and production factors on the water cut of well production, the following parameters were selected: oil viscosity at reservoir conditions; effective oil saturated formation thickness; average permeability of the reservoir; the ratio of the volume of oil deposits throughout the oil and gas saturated volume; well grid density. As can be seen from table 1., the studied parameters vary within rather large limits, with the exception of the viscosity of oil in reservoir conditions.

## III. RESULTS

To assess the significance and degree of informativeness shown in Table 1 of the geological and fishing factors, the nonparametric criteria method [5, 6] was used, which is used in problems of comparing two groups of observations with an unknown distribution law.

Two comparative pairs of groups of development objects are considered. The first group includes objects with an average water cut of well production less than its average value (A), the second with average water cut of well production is greater than its average value (B).

To measure the degree of information content of each factor, the Kullback measure was applied [5,6,7]. The information content of the i range of the j factor was determined by the formula

$$I(x_j^i) = ДК(x_j^i)\,\frac{1}{2}\left[P\left(\frac{x_j^i}{A}\right) - P\left(\frac{x_j^i}{B}\right)\right], \qquad (2)$$

Where $ДК(x_j^i)$- diagnostic factor of the j factor; $P\left(\frac{x_j^i}{A}\right)$- probability of getting into group A of the i range of the j factor; $P\left(\frac{x_j^i}{B}\right)$- same for group B.

Table 1.

**Geological and production parameters of sub-gas oil deposits in the late stage of development**

| oilfield | Oil viscosity in reservoir conditions, MPa.s | Effective oil saturated thickness, m | Well grid density ha / well. | The average permeability, microns $^2$ | The ratio of the volume of oil deposits to the entire oil and gas saturated volume, the share of units. | Current average water cut of well production,% |
|---|---|---|---|---|---|---|
| Kokdumalak | 1,4 | 44,7 | 10,6 | 0,100 | 0,372 | 83,7 |
| North Urtabulak | 1,3 | 38 | 7,44 | 0,122 | 1,000 | 94,0 |
| South Kemachi | 1,17 | 6,2 | 66,2 | 0,100 | 0,114 | 74,5 |
| Umid | 1,17 | 7,0 | 42,4 | 0,100 | 0,230 | 82,3 |
| Kruk | 1,08 | 39,1 | 11,7 | 0,196 | 0,783 | 90,7 |
| Arniyaz | 1,32 | 14 | 72,2 | 0,199 | 0,184 | 91,4 |
| West Kruk | 3,24 | 11,6 | 18,1 | 0,857 | 0,310 | 91,6 |
| Change interval | 1,08-3,24 | 6,2-44,7 | 7,44-66,2 | 0,100-0,857 | 0,114-1,000 | 74,5-94,0 |
| average value | 1,52 | 22,9 | 32,7 | 0,239 | 0,382 | 86,9 |

## IV. CONCLUSION

The information content of the entire sign $x_j$ is equal to the sum of the information content of its ranges. To minimize the influence of the choice of interval boundaries on the results, in each interval we determine the weighted average (smoothed) frequencies by calculating the weighted moving average. At the same time, the frequencies of this trait in four neighboring ranges were taken into account.

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The results of determining the weighted average frequencies for the viscosity of oil are shown in Fig. 1. The results of evaluating the information content of the parameters show that for small ranges of changes in oil viscosity and permeability of reservoirs, the density of wells (J = 15.38) and the ratio of the volume of oil deposits to the entire oil-and-gas-saturated volume have the greatest impact on the average water cut in the production of wells of massive gas reservoirs of massive type (J = 13.62), effective oil saturated formation thickness (J = 9.26).

Due to the small range of changes, the effect of reservoir oil viscosity and average reservoir permeability on the watering of well products turned out to be relatively insignificant. In our opinion, this is due to the close values of these parameters at the objects of study, with the exception of the West Kruk deposit.

It should be noted that at the objects under study, with almost identical values of average well production, various values of the oil recovery coefficient were achieved (Fig. 2). Therefore, in order to achieve high values of the oil recovery coefficient in sub-gas oil deposits of the oil-mass type, it is necessary to compact the grid density of less than 10 ha per well.

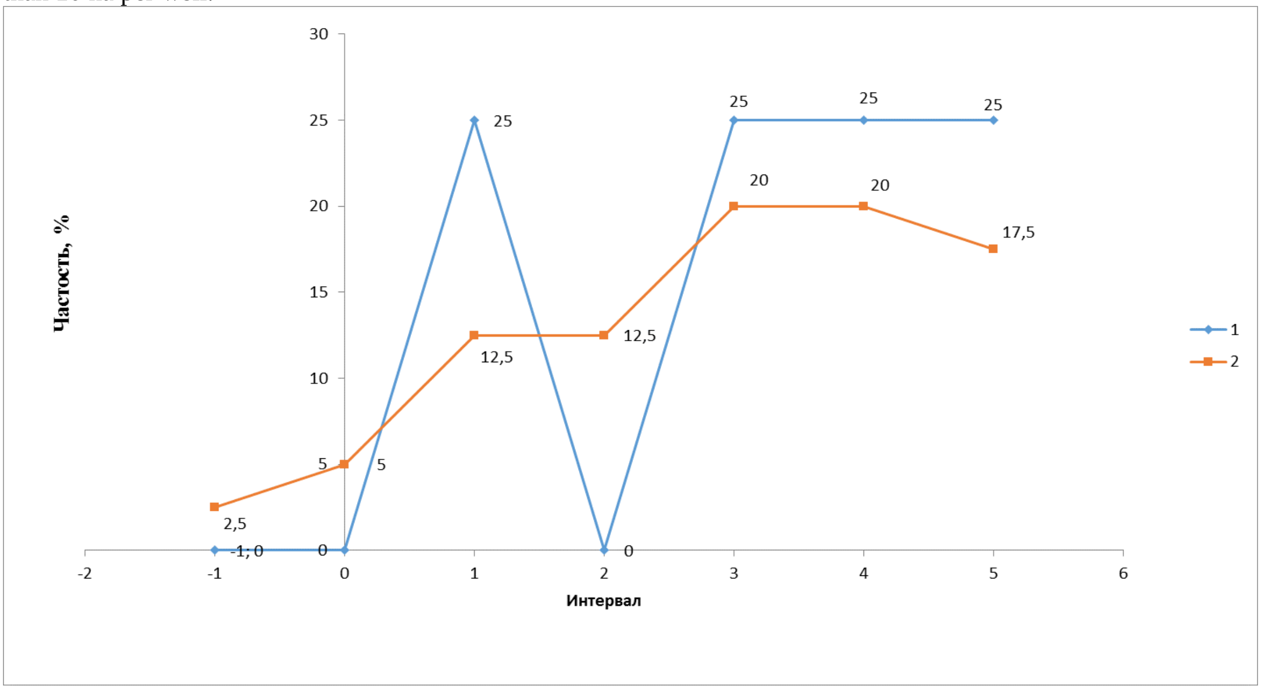


Fig 1: The frequency of oil viscosity in reservoir conditions: 1-probable; 2-smoothed.

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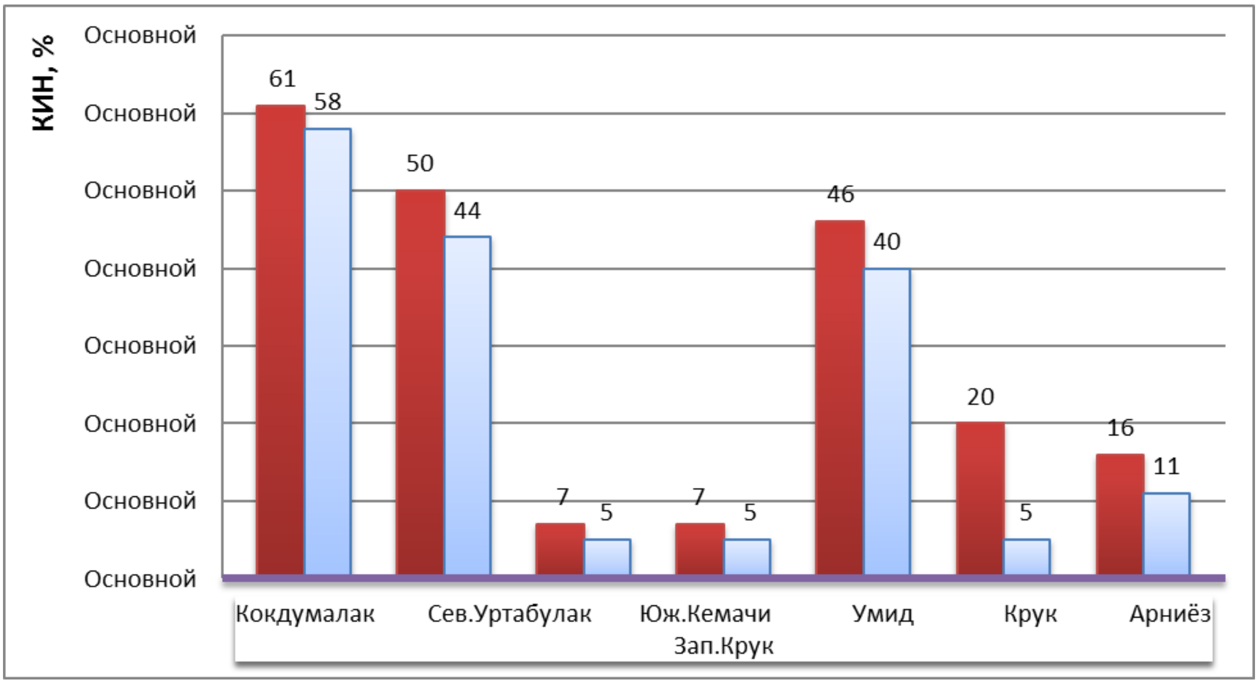


Fig 1: Comparison of design and current values of the oil recovery coefficient:

**- design;** **- current.**

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