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Use of stabilized pressure curves in horizontal wells to evaluate the informative value determination of fluid flow parameters at production facilities.

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Abstract

The relevance of the research is caused by the fact that the main sources of information on filtration parameters of the remote zone of the formation are well tests at unsteady regimes with the recording of pressure or level recovery curves pressure recovery curve. To determine the reliable parameters of the formation zone remote from the well, the duration of recording of the pres* sure recovery curve should be long enough, which leads to losses in oil production. To determine the filtration cha* racteristics of the formation, as well as reduce losses during hydrodynamic studies, it is possible to use the method of studying wells without stopping them – the method of stabilizing the pressure. Need to identify the filtration flow regimes for operational determination of the hydrodynamic parameters of oil reservoirs during horizontal well tests by bottomhole pressure buildup curves. However, now, the issue of analyzing and interpreting the results of measurements with the recording the pressure stabilization curves, which, like the pressure recovery curve, can give the required infor* mation about the formation, remains poorly understood.

Keywords: Well test, stabilization curve, production analysis, horizontal wells, pressure transient test, pressure buildup curve, oil reservoirs;

1. Introduction

The analytical and analytical - grapical methods of the flow in porous media determination today are the main sources of information based on the visiual analysis of the BHP derivative from the PBU curve recording. To determine the reliable parameters of the remote zone of the formation, the recording of pressure build-up must be long enough, which leads to significant losses in oil production [1–4]. Therefore, it becomes very important to improve the methods for determining the hydrodynamic parameters of the reservoir at production facilities during a research.

At the present time oil companies due to the introduction of new resource-saving technologies carry out a large amount of drilling and commissioning of horizontal wells equipped with submersible telemetry systems (thermomanometric systems, TMS), which make it possible to switch from costly and not always effective standard methods of hydrodynamic well testing (Well testing) to continuous monitoring and selective interpretation of data received from wells in a constant time mode

Thus in order to determine the physical and reservoir properties of the reservoir, control the reservoir energy condition as well as reduce oil losses during hydrodynamic studies, more and more new methods of well testing are being developed. However, the issue of analyzing and processing the measurement results with the recording of stabilized pressure curves remains insufficiently studied, which, like the pressure build-up test, can provide the required information about the reservoir parameters.

Figure 1 shows a classical model of well inflow with a horizontal toe, where it is possible to define areas of stabilization of the pressure derivative corresponding to early and late radial flow regimes. The reality is much more complicated, the early radial flow, as a rule, is hidden by the effect of the wellbore storage coefficient (WBS), and the late radial inflow is traced at a very significant distance from the well, and may not be achieved during the study period. Without definite stabilization areas it is impossible to reliably estimate any of the parameters characterizing the formation or bottomhole zone[5-6].

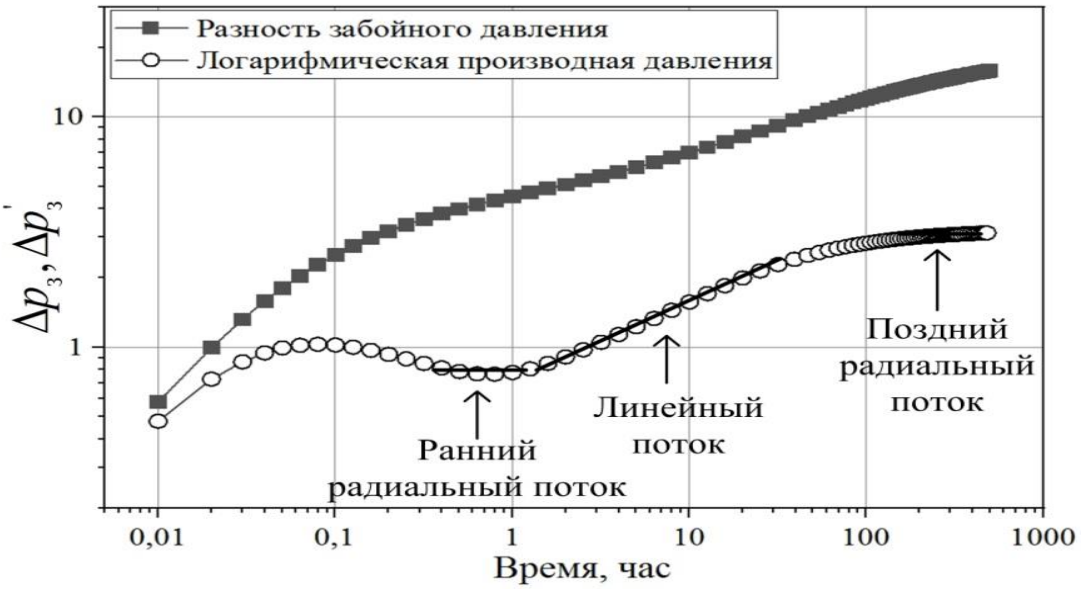

Fig. 1. Horizontal well flow models

2. Materials and methods

The analysis of dynamic data on the stabilized pressure curve can be used to increase the investigating area in comparison with the analysis of the pressure recovery curve, since they have a long investigation duration, which makes it possible to identify the main types of influx to a horizontal well (Fig. 1).

The presence of a significant well stock with hard-to-recover reservoirs leads to the fact that most studies are under-recovered. Underrecovery of pressure build-up affects the accuracy of determining the reservoir filtration characteristics and reservoir pressure

Hence one of the most effective ways to study horizontal wells is the analysis of production history - a natural addition / alternative to the well test analysis tools in the presence of historical data of flow rate and bottomhole pressures. The idea of such a study is very simple - for a long time to monitor the well performance and, based on the data obtained from the history analysis of production rates and bottomhole pressures to assess the parameters of the formation and the well.

The analysis is performed to determine the current and potential volume of well drainage, the type and distance of boundaries, water permeability, inter-well communication, recovery of reservoir pressure history and well productivity, as well as to assess the determination of the reservoir properties without additional field operations[5-7].

In order to identify the dependence on the main operating parameters, a practical study was carried out. A well pattern producting at one site was considered (Figure 2)

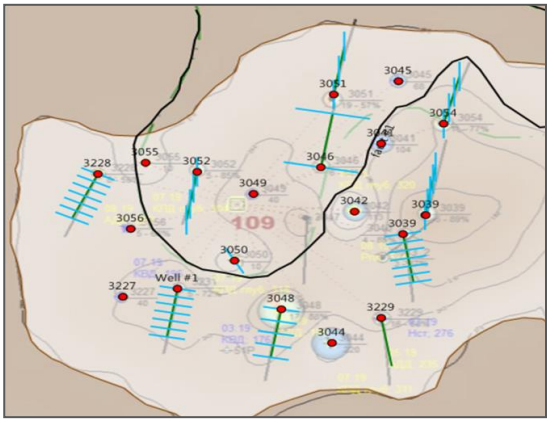

Fig 2. Part of model section

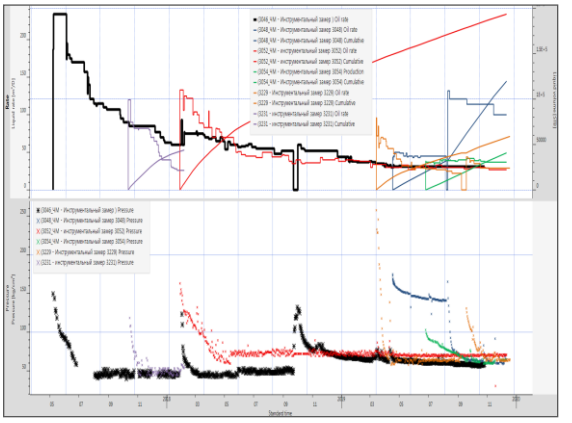

Fig 3. General view of initial data for the analysis of 6 wells

The analysis was carried out at the XXX field. The processing was carried out for 4 wells No. 3046,3048,3052,3054. At wells pressure was continuously recorded using a TMS sensor (telemetry system). The main goal of this study is to restore the history of reservoir pressure and productivity of the reference well for a long time, determine the influence well on well based on the dependencies obtained, evaluate the waterpermeability of interwell intervals, predict the dynamics of reservoir pressure for arbitrary modes of operation of the reference wells.

Fig. 4-5 shows the diagnostic plots of the mathematical model of the curve in logarithmic coordinates for wells No. 3046 and 3048:

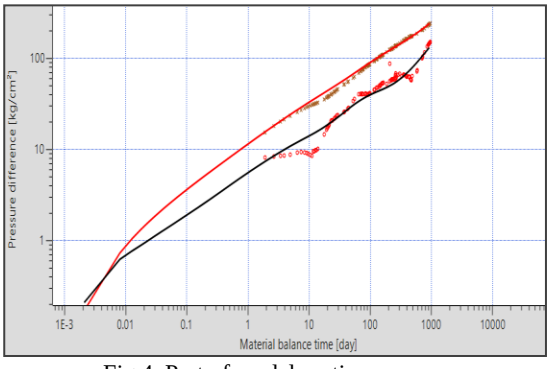

Fig 4. Part of model section

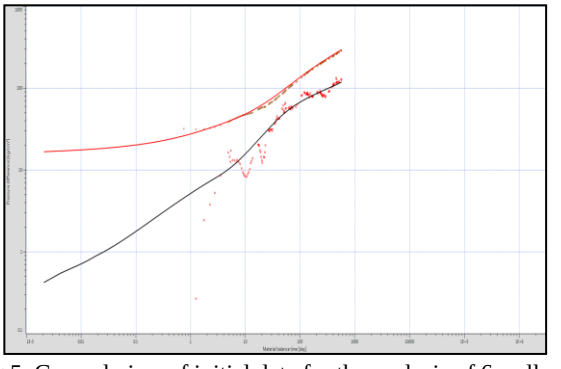

Fig 5. General view of initial data for the analysis of 6 wells

All considered wells are with horizontal wellbore.

Based on the results of the analysis, the parameters of the formation and the well were obtained, the well influence each other, the reservoir properties of the interwell interval and the energy state of the formation was estimated. The results are presented in Table 1.

Table 1. Results

Well №	3046	3048	3052	3054	3231
Permeability, mD	1.02	1.57	1.35	1.25	1.01
Water permeability, mD*m/cP	1.81E+01	5.00E+01	1.13E+01	3.55E+01	1.63E+01
Piezoconductivity m2/s	4.83E-03	7.49E-03	6.44E-03	6.78E-03	7.16E-03
Total skin factor	-7.2	-6.4	-6.89	-3.45	-7.2
Reservoir pressure at the top perfs,atm	170	181	173	180	183

To compare the current reservoir pressure in the wells and the reservoir properties a well shut-in was initiated to conduct a PBU test. As a result of comparing a PBU curve and stabilized pressure curve, a high convergence was obtained and the error was within 8%. Thus, the results based on the interpretations carried out with the pressure stabilization curve method confirm the possibility of its implementation as a supplementary to studies on unsteady – state flow regimes, and in some cases their alternatives. From an economic point of view, the use of the method at the facilities of the production well stock seems to be especially up-to-date and promising

3. Conclusion

Thus in order to determine the physical and reservoir properties of the reservoir, control the reservoir energy condition as well as reduce oil losses during hydrodynamic studies, more and more new methods of well testing are being developed. Hence one of the most effective ways to study horizontal wells is the analysis of production history - a natural addition / alternative to the well test analysis tools in the presence of historical data of flow rate and bottomhole pressures.

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