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EVALUATION OF THE EFFECT OF PERFORATING FLUID ON SAFETY RESERVOIR PROPERTIES

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Annotation
We know that the productivity of a judo during the period of use depends on the quality of its primary and secondary opening operations. Therefore, in this article, Hammer, who was selected to organize the secondary drilling, noted that not only does the secondary drilling of the productive layer affect the quality, but also the chemical and physicist properties of the fluid that fills the well during beams perforation.

Keywords: reservoir, wells, process, reservoir, perforation, bottom hole, pressure, fluid, permeability, secondary, openings

Introduction

The purpose of the secondary opening of productive formations is to create a reliable hydrodynamic connection between the productive formation and the well to ensure the inflow of fluid from the formation into the well, injection of fluid into the formation and achieve the planned production volumes [1].

Secondary Opening Requirements:

- to ensure a high degree of hydrodynamic perfection of the well according to the nature of the opening;
- to ensure the safety of the well support.

Main Part

Influence of technological processes of secondary opening on the state of the well and the reservoir

The degree of hydrodynamic perfection of the well by the nature of the opening depends on the level of additional hydrodynamic resistance in the bottomhole formation zone with the influx of formation fluid into the well, associated with the preservation of the reservoir properties of the productive formation in the perforation channels, the perforation density, the size and depth of the perforation channels.

It is important to preserve the well lining in the process of creating perforation channels, which prevents the possibility of annulus crossflows in the annular space during the influx call, development and operation of wells. Thus, in the process of secondary opening of productive formations as a result of the influence of technological processes on the bottomhole formation zone, the state of the well is possible: a decrease in the reservoir properties of the productive formation in the created perforation channels due to the impact of the components of the perforation fluid on the reservoir; violation of the tightness of the well lining in the casing pipes and the annular space of the well. In accordance with this, it is necessary to choose a method and technology for the secondary opening of productive layers, taking into account the geological conditions of the occurrence of the productive reservoir: reservoir properties and location near the reservoir saturated with another fluid (water and gas saturated for oil deposits or water and oil saturated for gas deposits), as well as level of the development stage of oil and gas fields.

Secondary Opening Methods

The methods of secondary opening of productive formations, depending on the ratio of reservoir and bottomhole pressures during opening, are divided into: opening under conditions of repression on the formation; equilibrium of reservoir and bottomhole pressures and under drawdown conditions on the reservoir.

The highest priority in order to preserve the reservoir properties of the reservoir is the secondary opening under drawdown conditions on the reservoir.

The second priority in order to preserve the reservoir properties of the productive formation is the secondary opening in equilibrium conditions.

For the purpose of safety during the secondary opening in the conditions of drawdown on the reservoir and the balance of reservoir and bottomhole pressures, it is necessary to carry out sealing at the wellhead. In accordance with this, the secondary opening in the conditions of depression and equilibrium is carried out with tubing lowered into the well with annulus sealing.

The applied method of secondary opening is determined depending on the porosity properties of the reservoirs and the degree of influence of the perforating fluid on the decrease in the permeability of the reservoir.

Technologies of Secondary Opening

To create hydrodynamic channels in the well-reservoir system, various technologies for the secondary opening of productive layers are used.

Secondary opening technologies are divided into bullet perforation, cumulative perforation created by an explosive jet in hydrodynamic channels, and sparing technologies that exclude explosive processes during secondary opening.

Evaluation of The Effect of Perforating Fluid On Safety Reservoir Properties of the Formation According to Laboratory Studies

In the process of re-opening after separation of productive layers, the composition and properties of the perforating fluid play a very important role. The components of the perforating fluid in the created hydrodynamic channels, penetrating into the reservoir, can significantly affect the reservoir properties of the reservoir. A decrease in the reservoir permeability in the perforation channels causes additional hydrodynamic resistance in the well-reservoir system when inducing inflow from the reservoir during the development and commissioning of wells, which can adversely affect the production characteristics of the objects being commissioned.

Thus, the assessment of the degree of influence of the perforating fluid on the reservoir properties of the productive formation, from the point of view of the quality of the secondary opening, is relevant. In accordance with this, before the field use of the perforating fluid in the process of secondary opening, it is advisable to conduct laboratory studies to assess the coefficient of recovery of the permeability of core samples after exposure to the perforating fluid under thermobaric conditions similar to field ones.

Laboratory studies are carried out to assess the change in the formation permeability after the impact of the perforating fluid on natural core samples and core samples exposed to the mud filtrate, which makes it possible to assess the real effect of the perforating fluid on the formation during the secondary opening, taking into account the depth of the filtrate penetration zone and the length of the perforation channels [2]. Research is carried out on automated units such as FDES-650Z, FDS-350, FDTES-100-140 and other similar units under conditions close to reservoir ones. Tests are carried out on natural rock samples of a regular cylindrical shape with a sustained diameter under thermobaric conditions simulating field conditions. To determine the fluid permeability, a formation fluid model is used, which is mainly used as kerosene. The essence of the ongoing laboratory studies is to compare the fluid permeability of the core column before and after exposure to the perforating fluid under conditions simulating reservoir. Initially, the initial permeability of core samples is determined using the reservoir fluid model. Then, in the opposite direction to the formation fluid flow, the impact on the core samples with the perforation fluid in the static filtration mode is carried out. After that, the reservoir fluid moves in the forward direction in several modes with different pressure drops, and the residual permeability of the core column after exposure to the perforating fluid is determined. On a core column with identical stratigraphic and physical-capacitive properties, studies are carried out to assess the effect of perforating fluid on core samples that were previously exposed to drilling fluid filtrate. To assess the degree of influence of the perforating fluid on the core samples, the coefficient of permeability recovery $\beta_{п}$ is determined, which represents the ratio of the residual permeability of the samples after exposure to the perforating fluid $k_{п}$ to the initial permeability k_{o} as a percentage:

$$\boldsymbol{\beta_{п} = k_{п} / k_{o} \cdot 100\%.} \quad (1)$$

To assess the degree of influence of perforating fluid on core samples previously exposed to drilling fluid filtrate, the permeability recovery factor $\beta_{1п}$ is determined, which represents the ratio of the residual permeability of core samples after exposure to drilling fluid filtrate and perforating fluid $k_{1п}$ to the initial permeability k_{o} as a percentage:

$$\boldsymbol{\beta_{1п} = k_{1п} / k_{o} \cdot 100\%.} \quad (2)$$

Based on the conducted laboratory studies, the influence of the perforating fluid of the secondary opening of productive formations on the state of the bottomhole formation zone is determined depending on the composition and formulation of the perforating fluid, the depth of penetration of the drilling fluid filtrate into the formation, and the length of the perforation channels.

Conclusion

Thus, according to laboratory studies, it is possible to evaluate the effectiveness of using various formulations of perforating fluids for high-quality secondary opening of productive formations and to choose the most priority perforating fluid.

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