FEATURES OF CLASSIFICATION AND DEVELOPMENT OF HARD-TO-RECOVER RESERVES

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Annotation: *In general, the production of hard-to-recover oils is a global task of the modern oil industry, in the solution of which analytical, scientific and engineering approaches are used, which make it possible to identify the most effective method of increasing oil recovery for a particular well.*

Key words: *Hard-to-recover reserves, cost-effective, unconventional technologies, thermal methods, reagent injection*

For a complete understanding of the term "hard-to-recover oil", first of all, it is necessary to consider the factors of difficulty and characteristics of the fluid, referring it to the "difficult" oil.

Hard-to-recover reserves (TRR) of oil and gas - reserves of fields, deposits or their individual parts, which are comparatively unfavorable for extraction by geological conditions of oil occurrence and (or) its physical properties (concentrated in deposits with low-permeability reservoirs and viscous oil).

There is no approved formulation for TRIZ.

"Hard-to-recover reserves should be considered reserves, the economically effective (profitable) development of which can be carried out only with the use of methods and technologies that require increased capital investments and operating costs in comparison with traditionally used methods."

Complicated conditions include well operating conditions with factors that impede production. These include:

-low gas saturation;
-increased amount of mechanical impurities;
-a large amount of salts and resin-paraffin fractions;
-oil with abnormal physical properties;
-reservoirs with heterogeneity in permeability;
-reservoirs with low initial oil saturation;
-low formation temperature in combination with other factors.

It should be emphasized that some of the above factors are dependent on the time and stages of development.

The share of TRIZ in the structure of oil reserves is growing due to the predominant development of easily recoverable reserves.

For the production of TRIZ, it is required:

-increased costs of financial, material and labor resources,

-unconventional technologies,

-special non-serial equipment,

-scarce reagents and materials.

According to the economic criteria for the effectiveness of the development of TRIZ, reserves occupy an intermediate position between off-balance (unprofitable under the existing economic conditions, technology and technology of oil production) and recoverable oil reserves, the development of which can be carried out cost-effectively in modern conditions.

Oil reserves belong to TRIZ:

- enclosed in complex reservoirs with a low recovery factor (less than 0.05 μm2), including oil and gas in dolomites, tight sandstones, shales, chalk rocks, intermediate sediment complex, bazhenites;

-in oil-water contact zones (oil-water zones) or oil and gas deposits in the oil-gas contact zone (gas-oil zones);

-containing viscous oil, which is characterized by low mobility in the formation, difficulty in lifting to the surface and further transportation. For production, technologies are used: injection of hot water (steam) into the reservoir, the use of special heaters and screw pumps;

-characterized by high gas saturation and the extraction of which is limited by the maximum allowable drawdown value that does not cause irreversible deformation of the rock;

-which contain aggressive components (hydrogen sulfide, carbon dioxide) in dissolved and / or free gas in quantities that require the use of special equipment and technology for drilling wells and oil production;

-occurring at great depths (more than 4000 m);

-with reservoir temperature 1000 ° C and above;

-with a low difference between the formation temperature and the pour point of paraffin and resins,

-recoverable using thermal methods or reagent injection,

-reserves of gas cap parts of thin (up to 3 meters) oil rims and reserves of peripheral parts of deposits, which have oil-saturated thicknesses less than the limit for profitable development by a network of production wells, characterized by a low oil recovery factor (ORF). Uncontrolled gas breakthroughs to oil wells can be a problem. For production, special technologies are used to isolate oil and gas reservoirs,

-unconventional reserves: super heavy oil, tar sands, kerogen oil, oil shale.

It is recommended to refer to depleted (residual) reserves of deposits (development objects):

-after recovering 80% of the initial recoverable oil reserves of industrial categories approved by the state expertise;

-with the current water cut of the produced products over 90%;

-with a current gas ratio exceeding 10 initial (oil and gas deposits).

The costs of extracting residual reserves exceed the proceeds from their sale and make the further operation of the facility economically unprofitable.

The main problems in the production of hard-to-recover oils can be divided into three groups:

Paraffins in oil under reservoir conditions are in a dissolved state. When it moves along the elevator, paraffins are deposited on the walls of the well, forming paraffinic plugs, thereby creating many technological and technical tasks for oilmen to eliminate them. The wax deposits themselves are a complex hydrocarbon physicochemical mixture, which includes, in fact, paraffins, asphalt-resinous compounds, silica gel resins, oils, water, mechanical impurities. A decrease in pressure, temperature, and oil degassing to a large extent affects the intensity of deposits. To combat paraffin deposits, various methods are used, for example they can add: the use of scrapers (mechanical method), the introduction of chemical compounds into the oil emulsion (chemical method), the effect of a heat source on the fluid (thermal methods).

Porosity is the ability of rocks to contain liquid or gaseous hydrocarbons, expressed by the ratio of the free space of the rock to its total volume. The larger the pore channels, the more they contain hydrocarbons. Porosity depends on the granulometric composition of the rock, its heterogeneity, the ratio of the number of large and small pores and usually decreases with increasing depth of rocks.

Permeability is a filtration parameter of a rock, which characterizes its ability to pass oil, gas and water to the bottom of wells. Permeability is influenced by pore sizes and pressure drops in oil reservoirs. The phase composition of the fluid also has a significant effect on the permeability.

Low values of these parameters create difficulties when the fluid moves to the bottom.

Complicating fluid physical properties

High viscosity and density are properties that can significantly increase the cost of oil production. They impede the movement of fluid to the bottom and along the wellbore. When producing heavy and high-viscosity oils, specialized technologies are used to reduce the values of these parameters.

In general, the production of hard-to-recover oils is a global task of the modern oil industry, in the solution of which analytical, scientific and engineering approaches are used, which make it possible to identify the most effective method of increasing oil recovery for a particular well. Of all the variety of problems in the production of hard-to-recover oils, it is worth highlighting paraffinization, since regardless of the quantitative content of paraffins in oil, wax deposits appear on the walls of the well over time. Of course, the use of different methods requires a clear justification from a financial point of view.

Engineers of each oil company strive to use methods of combating wax deposits that maximize the inter-treatment period of the well, and in some cases even refuse to clean them.

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