Regulation of Processes of Working Horizon D₁ of the Romashkino Field

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Regulation of the processes of working fields with internal and external injection has one main purpose - complete extraction of the oil from the stratum-reservoir by water injection. Without detailed study of the geology of the strata and also without reliable control during exploitation of a field, scientific selection of these measures is not possible. Control and regulation of the exploitation processes should be more strict in the Romashkino field where exploitation of the lithologically nonhomogeneous strata of horizon D₁ is accomplished by opening these strata with a single net of wells with an overall filter both in production and injection wells.

Horizon D₁ of the Romashkino oil field is characterized by complex lithologic-reservoir nonuniformity of the strata, and this influences the effectiveness of the present system of working the field. The sandstone reservoirs of the field have three forms of occurrence, although this difference is not always readily apparent.

To the first type are referred continuous sandy reservoirs that cover large areas, or large lenses the dimensions of which exceed the distance between wells. Under such conditions the strata have a great thickness and good reservoir properties. To this group are referred: stratum g over almost the entire area of the pool; stratum v in the west of the Minnibayev area; and stratum a in the Vostochno-Suleyev and Al’met’yev areas.

Under such conditions the position of the sectioning rows of injection wells is not an important factor, and as a rule the entire stratum is activated by the water injection. For example, in five areas of the field (Yuzhno-Romashkino, Pavlov, Al’met’yev, Zelenogora, and Zay-Karatay) the injection of water along strata g and b through the rows of injection wells provided a stable flowing production in sectors containing 85% of the reserves of oil. In the remaining sectors, which contain 15% of the reserves and are worked by mechanical methods, flowing production can also be secured by increasing the volume of injection (not counting sectors that yield a high percentage of water).

Thus, in sectors of sandy reservoirs having wide areal extent, the working of the field can be regulated by varying the volume of injection through the existing sectioning rows of injection wells.

Another type of occurrence of sandy reservoir has an elongate belt-like form. These generally cut across the area of the field in a north-south direction. As a rule the width of such belts ranges from hundreds of meters to 2-2.5 km. Maximum thickness and better reservoir properties are distinctive of the axial portions of the belts. Zones of merging with other strata are common.

Examples of such belts are the sandy reservoirs of stratum b in the Abdrakhmanov area, stratum v in the east of the Minnibayev area, and stratum a in the Vostochno-Suleyev area.

The effectiveness of injection in pools with this form depends on the areal orientation of the rows of injection wells. With a north-south distribution of rows of injection and production wells, the belt-like pools may be penetrated over a great distance. In other cases, however, the effectiveness of a system of internal flooding may be very low. For example, in stratum v in the Zay-Karatay and Pavlov areas the reserves of oil concentrated in the sandy belts and elongate lenses and subjected to injection sufficient for a steady flowing production constitute only 48%. The remaining 52% of the reserves are extracted by mechanical methods with considerably less rate of recovery.

The effectiveness of injection is greater when the rows of wells are transverse to the trend of the belt. In such a case with sufficient volumes of injection the extraction of reserves from a sandy belt is at a high rate, and this may lead to the formation of a natural line of sectioning in the stratum. Such a natural line of sectioning is found along a sandy belt for strata b and v in the central part of the Yuzhno-Romashkino area (north of injection well 503). This line of natural sectioning can be used to improve the working of this area.

The third type of sandy reservoir is a relatively small sandy lens, the dimensions of which are commensurate with the distance between wells. The sandy reservoirs of stratum a of the Minnibayev and Zay-Karatay areas may have such a structure. In such cases the distribution and orientation of the sectioning rows of injection wells are not a significant factor because with any variant a large part of the sandy lenses will be penetrated by only a single injection or production well. Flooding of such sandy lenses can be accomplished only by wide use of focused injection. For example, in the Zay-Karatay area 86% of the reserves of the sandy reservoirs of stratum a, which consists of such lenses, cannot be reached by flooding with the existing lines of injection. Such a category of reserves reaches 60% for stratum b in the Zelenogora area.

At the present time the intensity of working of each stratum of horizon D₁ is directly dependent on the predominant type of