Effective Method of Slowing Rates of Drop in Oil Production in the Late Stage of Production

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Many oil fields of Bashkiria, Tataria, the Kuybyshev Region, and elsewhere in the country are now in the late stage of production. In order to recover oil remaining in lenses, blind zones, and water-oil zones, additional wells must be drilled. Four case histories are examined here.

Tuymazy field. The main pay zones of the clastic Devonian (D_I and D_{II}) were discovered here in 1944. The field was produced by maintaining formation by injection, and the production wells were widely spaced. This wide-spaced system was known as the Tuymazy Experiment.

The production wells were in two circular rows 500 m apart, and the distance between wells was 500 m for stratum D_{II}. There were 80 production wells and eight injection wells.

For stratum D_I the net was 500 by 400 m. There were 325 production wells and 30 injection wells.

In 1958-59 a new plan was put into effect that provided for production of the central part of stratum D_I; 210 new production wells were drilled here.

In 1967-68 a project was compiled that called for additional sectioning rows in the central part of the pool and additional production wells on the periphery of stratum D_I. The rate of oil production continued to drop, however.

An evaluation program in 1973-75, in which 24 evaluation wells were drilled, showed that the entire stratum D_I had not been worked, only its lower and middle members. Further, in partially or completely flooded intervals of these members there are local unworked zones with initial oil saturated through the entire thickness. Lens strata of the upper member of D_I retain their primary oil saturation. Production of such zones requires additional wells and focused flooding.

A 1976 plan provides for drilling 142 additional wells of various types. This drilling will bring the area per well for stratum D_I to 21.5 hectares in the initial oil zone and 48.6 hectares for the water-oil zone; average for the stratum is 30.5 hectares. For stratum D_{II} these areas are 15.8, 34.2, and 26.3 hectares, respectively. Final recovery factor should be 58.6%.

Arlan field. The main producer is a clastic unit of the lower Carboniferous, which has eight pay zones: I, II, III, IV°, IV, V, VI°, and VI. These are very inhomogeneous both areally and up the section. The pay zones are combined into two production objectives: lower (IV°-VI) and upper (I-III). Each has an independent net of wells.

The original plan called for drilling 4796 wells; 2704 were production wells, 923 were injection, 202 were control, and 987 were reserve. As of January 1, 1975 a total of 4690 wells had been drilled. Density was 1 well per 26 hectares for production wells. Input of water was impossible in 24% of the injection wells drilled, and in another 20% the capacity did not exceed 50 m³ per day.

Total recovery of liquid is 18.5% less than what had been expected, and 80.5% of the wells are yielding water.

Measures adopted in 1976 provide for drilling 327 additional wells for focused flooding, 867 production wells, 60 control wells, and 333 reserve wells. Density will then be 18.1 hectares per well. Final recovery factor should be 36.6%.

Abdrakhmanov area of Romashkino field. The main production objective in this area is horizon D_I of the Upper Devonian. Production began in 1954. The original plan called for drilling 326 wells including 252 production wells, 68 injection wells, and 6 control wells. Density of the production net was 115.8 hectares per well. There were three rows of production wells 1000 m apart and the wells were 600 m apart on the rows. The injection row along the margin of the areas was 2000 m from the first production row, and the injection wells were 500 m apart.

A 1957 plan provided for two additional rows of production wells and a central row of injection wells. This meant 158 new production wells, 34 injection wells, and 9 control wells. By 1960 the density of the net of production wells was 73 hectares per