

Development of Budenovskoye Deposit in South Kazakhstan

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Budenovskoye deposit was discovered in 1979 in permeable alluvial deposits of the Upper Cretaceous and is the world largest sand type deposit. The prospecting and exploration works were started there in 1987 with inferred resources of the southern flank only estimated at about 200,000 tU.

Key geology features of the deposit are:

- The deposit is located in the maximum submerged part of the depression formed in the Upper Cretaceous period by channel facies; a very complex morphology of mineralisation in plan, large vertical area, multilayer structure, relatively high productivity of the deposits.
- High-pressure nature of groundwaters with positive occurrence of piezometric level, very high water conductivity, permeability of horizons and their water abundance, lack of consistent confining layers, and location of the deposit in the artesian basin at the junction with hydrogeological massif of B.Karatau Range.
- Relatively low concentration of main syngenetic genesis reducing agents in ore-bearing rocks in combination with other factors causes the insufficiently contrastive reducing barrier and extraordinary stretched profile of epigenetic zonation with fuzzy boundaries between separate zones and subzones.

These and other factors were considered for successful operation of Karatau:

- During exploration, the “stretched” profile of epigenetic zonation was first of all evaluated in the central and “bag” parts; the flanks of this site will be drilled during operational exploration. This allowed reducing the time and cost of exploration, as well as the transition to production. About 100 tonnes of explored uranium reserves were accounted for 1 exploration hole.
- A profound differential algorithm is used to interpret gamma-ray logging and assess stem reserves of uranium taking into account both the position of well in epigenetic zonation and the average concentration of radium in the section.
- Drilling of multi-layered deposits is performed step-by-step, from a simple and large ore body, to complex ones, with consequent more precise determination of ore boundaries. Several such ore bodies projected together to the daylight surface are mined successively, when possible, using the same piping of technological blocks at different times.
- The experimental block piping is used at positive piezometric level: production wells are constructed as injection wells (without submersible pumps); the system is equipped with additional 1- 5 small pumping wells equipped with powerful pumps arranged in the wells below the dynamic level. The wells are all connected by pipes to get a system of communicating vessels that does not require placing the pump in a certain point or having the infrastructure for it; the required movement vector of reservoir water at such point is created remotely with the use of pumping wells. This tremendously optimizes the operation and allows any combination of production and injection pumps at any time reducing the production costs.
- The minimum difference between drilled, acidified and prepared reserves (“K” of prepared reserves is ≤ 1.5) is mainly defined by hydrogeological characteristics of the site what also reduces the well field development costs.
- About 6,000 tU is produced per one worker with the record low cost figures.

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