

Development of the heap leaching of low-grade uranium ores for conditions of OJSC Priargunsky Mining and Chemical plant (PPGKhO)

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The treatment of low-grade commercial uranium ores by heap leaching has been carried out at the enterprise since 1996.

During the initial stage of development, the ore piles were formed of the raw ore having the run-of-mine coarseness with uranium content around 0.08%. Under such conditions, recovery of the metal to the solution is 60-65% in case of a pile treatment lasting 2 years.

To intensify the process and to provide a stable concentration of uranium in the productive solutions transferred to sorption, the enterprise developed and implemented a method of percolation leaching of low-grade ores with re-circulation of productive solutions through the re-treated ore bulk (RF patent No. 2226564). The main peculiarity of such leaching is simultaneous moistening of the ore by productive solutions and by barren solutions that are sharpened with sulphuric acid; that gives the possibility to wet far bigger areas of piles under constant volume of productive solutions outputting to the sorption treatment. Such scheme enables to treat successively first the piles at the "re-treatment" (where the metal is mainly extracted), and then the piles at the "active leaching" stage (where the metal is mainly inside the ore bulk).

The technical and economic indexes of the heap leaching of low-grade uranium ores were significantly increased in 2006, when the X-ray-radiometric treatment plant was commissioned. The technological scheme of ore treatment at the processing plant includes mould and grating of the raw material with delivery of undersized products enriched with uranium: -5 mm are transferred to the pulp process; fractions (-200+40) mm to the X-ray-radiometric separation; the material of size (-40+5) mm, washed-out from clayey and fine particles, are sent to the uranium heap leaching in piles.

Delivery of the ore material having size (-40+5) mm to treatment by the acid leaching method excluded colmatage and creation of zones impermeable for water, and in combination with re-circulation of productive leaching solutions it enables to intensify the process and to increase the recovery of uranium to the solution up to 75%, with the time of an ore pile treatment equal to 1.2 to 1.5 years.

The next stage of the uranium heap leaching process intensification shall be implementation of the scheme of fractioning of the ore at the X-ray-radiometric treatment plant before creation of piles from the material having size below 15 mm. Use of such method will give the possibility to increase the recovery of uranium to 85% in case of the ore with the initial uranium content ~ 0.06-0.07% and the leaching period having duration of less than one year.