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Residues leaching from «Factory of barren ores»

Taboshar uranium deposit is one of the oldest on the territory of former USSR. It was opened in 1936., active ore extraction was carried out here from 1945 till 1965. Nowadays, it is a huge territory with area more than 400 hectares acting as predisposal storage for waste from uranium ore reprocessing plant and mine extractions as well as waste storage of such called “Factory of barren ores” (“FBO”).

Istiklol city (Taboshar) with population of approximately 12 thousands citizens is located just in several kilometers from waste storage locations. Waste complex consists of non-preserved open mine, disassembled industrial premises and three tailings where 10 million tons of uranium ore waste after acid extraction are accumulated.

HMP tailing is located in 3 km above river stream and in 3 km distance from Istiklol city center, where 1,17 million tons of waste are disposed. Dumps of barren rock and off-balanced ores are focused in the neighborhood of open pit. Gamma dose rate around dumps is measured starting from 0,4-0,7 $\text{mSv}\cdot\text{h}^{-1}$ (40-70 $\text{mR}\cdot\text{h}^{-1}$) and reached 3,0-4,0 $\text{mSv}\cdot\text{h}^{-1}$ (300-400 $\text{mR}\cdot\text{h}^{-1}$) in those places where off-balanced ores dumps are located.

“FBO” waste is located in the neighborhood of Istiklol city besides pits and open-pits which is currently flooded by water with depth till 50 m. “FBO” storage is like a hill from grinded pale yellow material after uranium extraction, which was carried out in concrete tubs by means of heap leaching at the same area.

“FBO” wastes are open and already during 50 years are subject for windy and water erosion. Mentioned dangerous natural processes and phenomenon in combination with non-authorized access of local population to these radioactive waste storages permanently worsen ecological condition in areas of waste accumulation. Tailings materials were registered in several kilometer distances along creek (temporary watercourse) which starts from below the “FBO” dump. Materials carrying out consequences from places of their initial localization in tailing are observed on shores and stream of Sarim-Sakhli-Say canal. Residue materials are differing by their specific relatively homogenous fraction size, of reddish color, and places for accumulation of present material have high gamma-dose rates. In dry bed and on re-deposited floodplains of river sites gamma dose rate reaches 250 $\text{mR}\cdot\text{h}^{-1}$ (2,5 $\text{mSv}\cdot\text{h}^{-1}$). Re-depositions are distributed along the whole Archi-Say riverbed till mouth and at its inflow to Utken-Suu River. Formed beach depositions from Istiklol city tailing’ material can be used by local citizens of nearby village. This area requires remediation.

The objective of the present work is safe management of residues from “FBO”, their reprocessing, expenditures reduction for remediation of Istiklol city former uranium tailings.

For this purpose, some experiences were adopted – “FBO” tailing use for filling up the open pit where water with uranium content 3-5 mg/l is located.

“FBO” waste are passed through heap leaching and have some amount of uranium salts dissolved in water. Thus, we propose to dissolve uranium from “FBO” wastes with uranium bearing water flowing out from gallery and filling up the open-pit by radioactive wastes. In so doing, uranium content flowing out from gallery will increase twice, and further, passing them through apricot’s shell, as a sorbent, we will clean the water against radionuclides [1].

Residue samples with uranium content 0,015% from «FBO» and uranium bearing waters from gallery №1 with uranium content 0,0025 g/l were used for laboratory tests.

After which, a slurry was prepared by means of residue mixing with water in ratio of solid and liquid phases (S:L) – 1:2 and 9,7 ml of sulfuric acid ($\rho=1,82$) was added which corresponds consumption by H_2SO_4 176,54 kg/t.

For the first test, leaching was carried out during 4 hours at pH=1,6, at room temperature.

For the second test, leaching was carried out at 60°C and pH=1,6 during 4 hours. Slurry heating and mixing was carried out by means of magnetic mixer. The basic residue leaching indicators are provided in table 1.

Table 1

Results of residues leaching from «FBO» tailing.

Sample, g	S:L	t, C	Consumption H_2SO_4 , kg/t	Filtrate		
				V, ml	pH	U, g/l
100	1:2	20	176,54	200	1,6	0,0053
100	1:2	60	176,54	200	1,6	0,0045

Reference:

1. Barotov B.B., Nazarov Kh.M., Khakimov N., Mirsaidov I.U. Uranium extraction from mine and technical waters of uranium industry wastes. // Doklady AS Republic of Tajikistan. 2007. V.50. №8. - P.703-706.