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Creation of physical barriers to flows of contaminated groundwater

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Problem Statement: Exploration studies, which discovered tungsten, beryllium, iron, coal and fluorite, were carried out since 1930-ies at the territory of Semipalatinsk test site (STS). Development of coal deposits Karazhyra began after STS closure. It is complicated by vicinity of coal-bearing structure to warfare boreholes №№ 1066, 1067, 1071, 1080, 1206, 1207, 1267, where were conducted underground nuclear explosions. "Warfare" boreholes are the sources of radioactive contamination, which can potentially get into the quarry of Karazhyra. The purpose of this study is to prevent groundwater radioactive contamination of the quarry.

Methodology: Radionuclide monitoring of groundwater in the field around Karazhyra has been held since 2003. More than 40 monitoring wells were drilled for observing the groundwater conditions. Sampling of groundwater from wells is made on a quarterly basis. Water samples are analyzed for radionuclides ^3H , ^{137}Cs , ^{90}Sr , $^{239,240}\text{Pu}$.

Findings: Areas with tritium content in groundwater of up to 40 kBq/kg are detected near the quarry. The width of the contaminated groundwater stream, which is moving from warfare borehole № 1071 to the quarry Karazhyra, is approximately 400 m.

Conclusion: Conducted research allows obtaining data on the hydrogeological conditions of the site, building predictive assessments and development of protective measures against the possible arrivals of contaminated groundwater in the drainage water of the existing quarry. Pond-evaporator will be used as engineering protective barrier. A part of water from the evaporation ponds is spent on evaporation, the other part – on the underground water feeding. As a result, the groundwater level around the pond-evaporator increases, resulting in redirection of underground water flows. The area is recommended to place the new evaporation-pond, where it redirects the flow of radioactively contaminated groundwater from the quarry, based on the data on the hydrogeological conditions. The pond-evaporator will last 30 years according to the calculations.

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