

Needs and challenges in managing tailings by operators in Central Asia (Republic of Kyrgyzstan)

Kyrgyz Chemical and Metallurgical Plant
(KCMP OJSC)

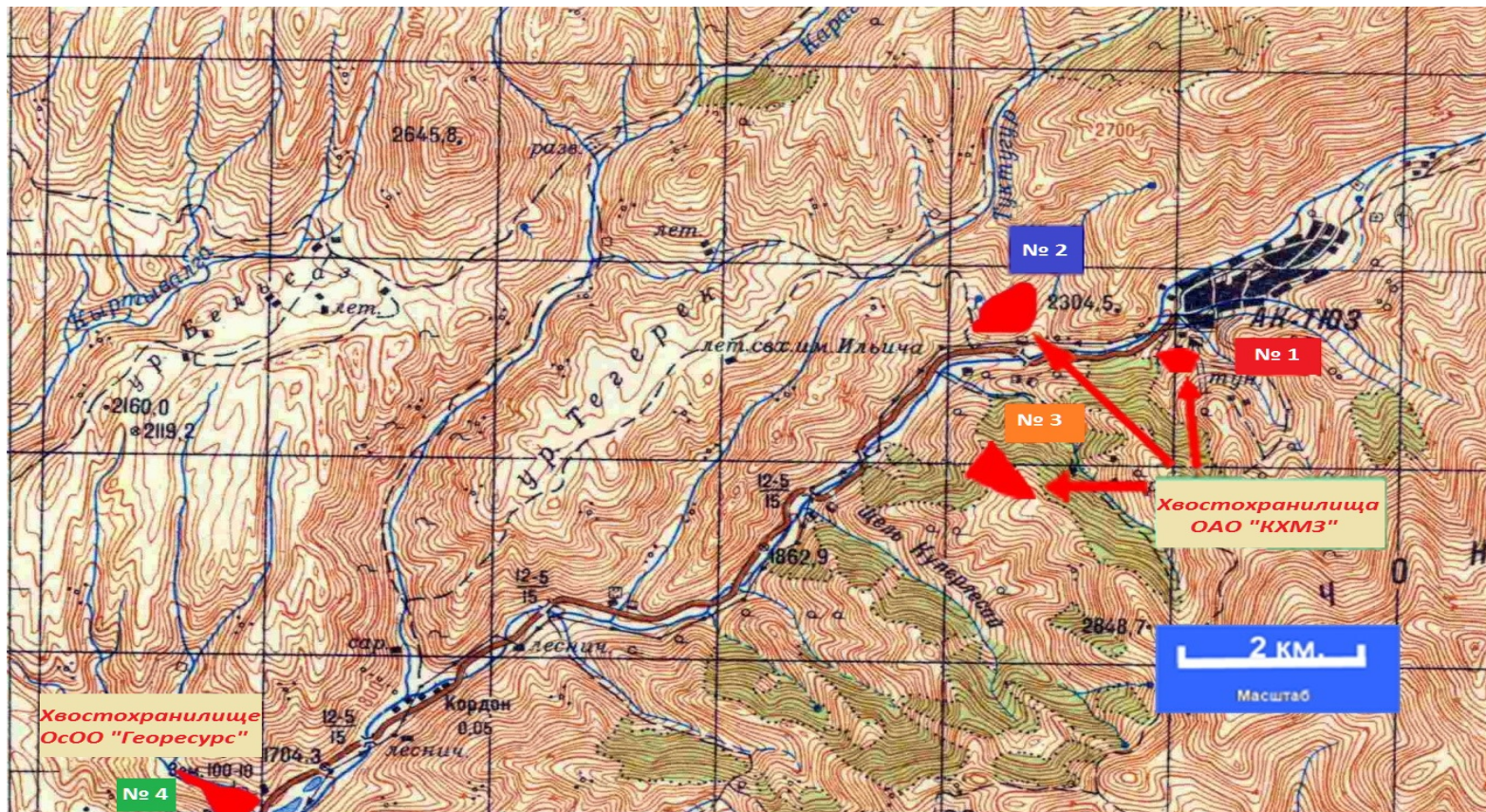
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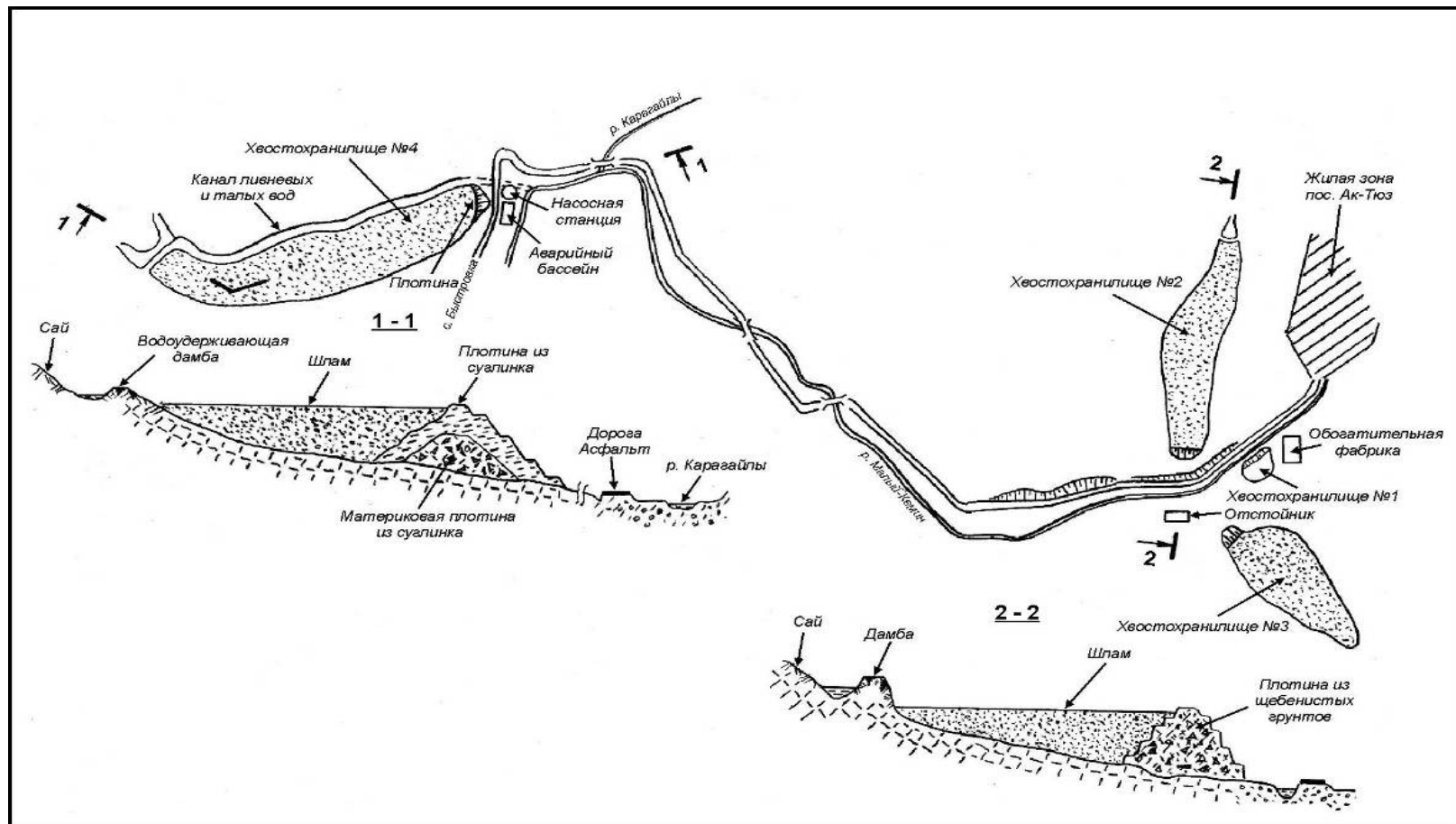
Information on tailing dumps of KCMP OJSC

- In the Soviet period, as a result of the production activities of the Kyrgyz Mining and Processing Plant (assignee - KCMP OJSC), five radioactive tailing dumps were formed.
- Four tailings are located in the area of the village. Ak-Tyuz, the fifth Bordun tailing dump is located 3.8 km south of the city of Orlovka, all tailing dumps are located in the Kemin district, Chui oblast.
- Wastes from processing polymetallic ores containing rare-earth elements and heavy metals (lead, molybdenum, cadmium, zinc, etc.) are stored in tailings. Tailings are characterized by increased radioactivity associated with the presence of thorium-containing minerals (monazite, thorite, zircon, etc.).
- Three of the four Ak-Tyuz tailings are on the balance sheet of KCMP OJSC, and tailing dump No. 4 is on the balance sheet of Georesurs LLC.

The location of the tailings of KCMP OJSC



Cross sections of tailings in the area of the village Ak-Tuz



Data on tailing pond No. 1

Tailings storage facility No. 1 - was in operation from 1942-1955, geographically located directly under the processing plant of Ak-Tyuz, Keminsky district, at an altitude of 2140 m above sea level. The tailing area is 4 ha, the volume is estimated at 370 thousand m³.

In the tailings pond there is no antifiltration layer on the bed, hence there is the possibility of groundwater pollution due to sediment infiltration.

Also, the tailing dump is subjected to water erosion - under the influence of precipitation, despite the fact that it is preserved, melt and rain water from it pollutes the surrounding area, and the Kichi-Kemin river.

General view of tailing pond No. 1



General view of tailing pond No. 1



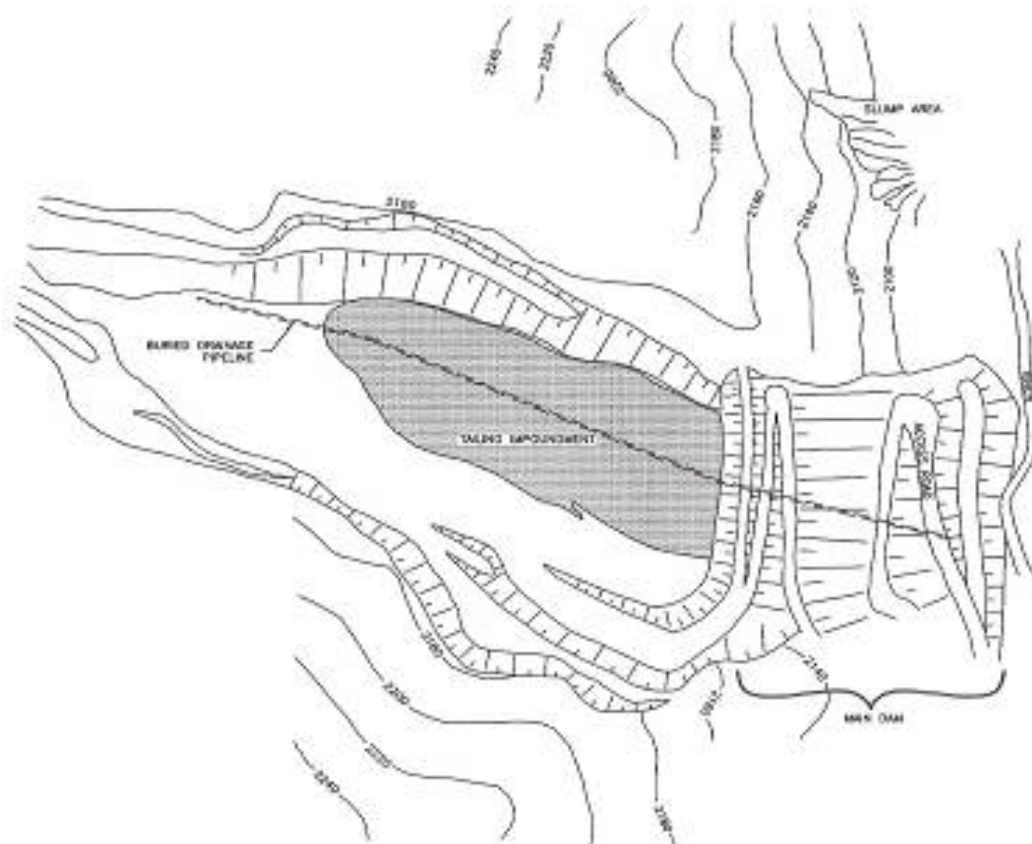
Data on tailing pond No. 2

- Tailings storage facility No. 2 - located on the right side of the Kichi-Kemin river valley, in Kulagan-Tash sai, at elevations of 2070-2150 m. The dam height is 72 m, the tailing area is 13 hectares.
- The tailing dump was operated from 1951 to 1972. Until 1964, the volume of waste disposed was 1,050,000 m³.
- In December 1964, as a result of an earthquake, a retaining dam broke and more than 600 thousand m³ of radioactive and toxic waste (60% of its accumulated volume) flowed from the tailing dump into the channel and valley of the Kichi-Kemin River. Tail flows containing elevated concentrations of thorium and heavy metals, in the form of radioactive mudflow, spread throughout the riverbed and valley. Kichi-Kemin at a distance of 40 km, up to its confluence with the Chu River in neighboring Kazakhstan. The waste laid on a site of 13 hectares contaminated agricultural land, settlements on the removal cone of the river. Kichi-Kemin with a total area of 3600 ha. The consequences of this cross-border disaster were eliminated for many years.
- According to archival data, the waste at tailing dump No. 2 contains the following metals (ppm): Pb 1200, Mo 90, REE 1600, Th 500, Cu 300, Y 440 ppm. The total α -activity of the remaining tail mass is estimated at 1600 Ci.
- The tailing dump has not been recultivated; a technological road has been laid along the lower slope and ledges of the dam.

General view of tailing pond No. 2



Tailings Plan No. 2



Data on tailing pond No. 3

- Tailings storage facility No. 3 is located on the left bank of the Kichi-Kemin river valley, in the estuary of the Kutesai stream, directly under the dumps of the empty rock of the Kutesai -2 quarry, at an altitude of 2200 m
- The height of the dam is 81 m, the tailing area is 3 ha. It stores about 1.05 million m³ of waste. The dose rate of gamma radiation on the surface of the tailings reaches 80 μ R / hour. The total α -activity of tail materials is estimated at 2100 Ci.
- The tailing dump was operated between 1965 and 1978, and in 1979 it was mothballed, but no protective layer was laid.
- Water and wind erosion take place on the surface of the tailing dump. Concerned over the tailing dump. In the event that this dump begins to collapse in the event of a strong earthquake, a waste discharge from the tailing dump into the Kichi-Kemin River is possible.

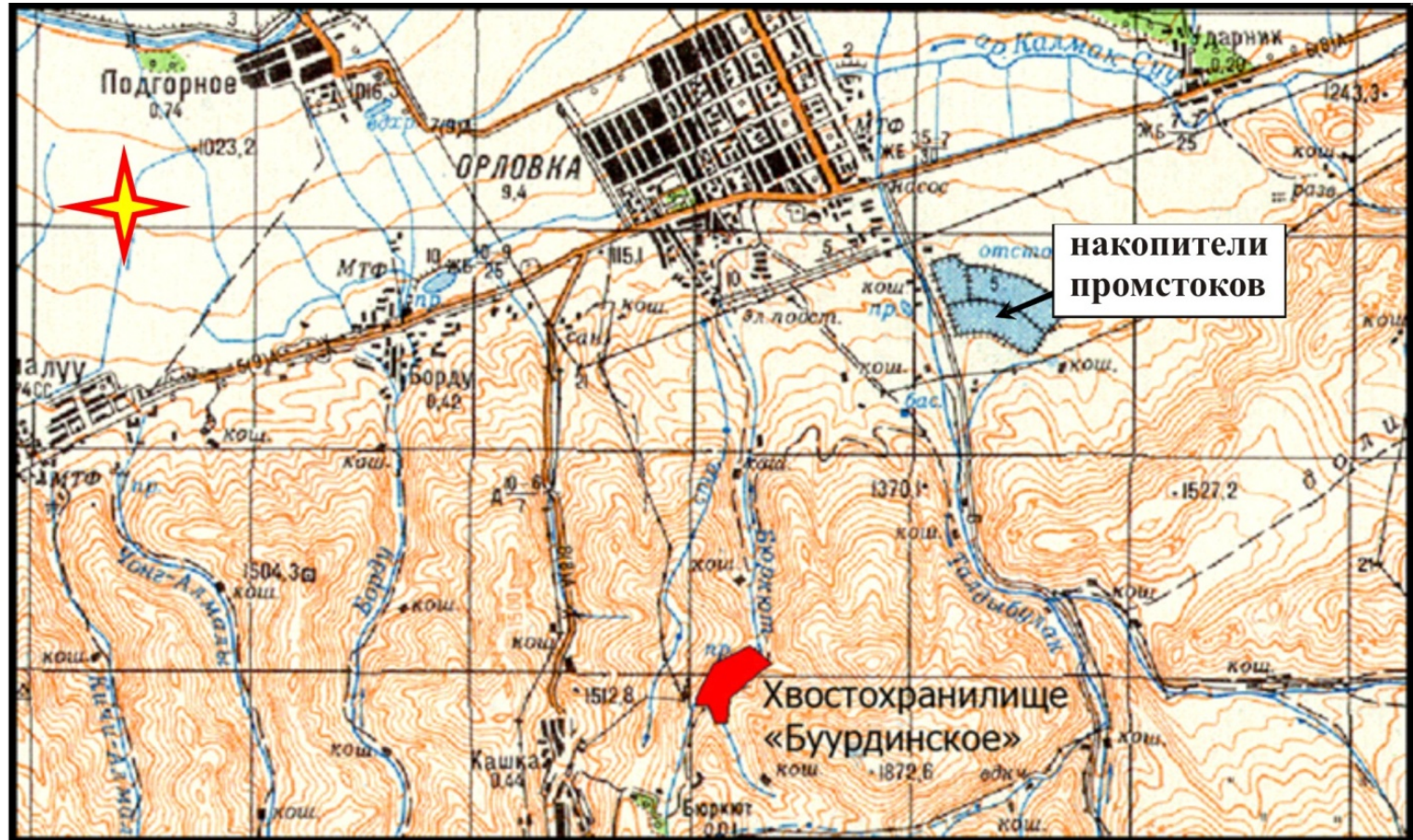
Data on tailing pond No. 3



Bordun tailing data

- The Bordun tailing dump is located in the mountain frame of the Chuy Depression, 3.8 km south of the village of Orlovka.
- The tailing dump is located in the valley of the Burkut stream, at altitudes of 1412-1525 m above sea level. The geographic coordinates of the central part of the tailings are as follows: $\phi = 42^{\circ}39'$ north latitude; $\lambda = 75^{\circ}37'$ East.
- The tailing dump contains tailings (waste) of flotation concentration of polymetallic (lead-zinc) and rare-earth ores. As a result of the activities of BGOK, KGMZ and KCMP, the total amount of lead and rare-earth ore dressing waste stored in the Bordun tailing dump, according to various estimates, is from 3.2 to 3.7 million m³, and the occupied area is 130 thousand m².
- The particle size distribution of the tailings according to the research of KAZMEKHANOBK (1985) is represented mainly by dusty particles of the following particle sizes: 1.0-0.5 mm (8.2%); 0.5-0.25 mm (36.6%); 0.25-0.10 mm (26.7%); 0.10-0.05 mm (17%); 0.05-0.01 mm (5.6%); 0.001-0.005 mm (1.5%); less than 0.005 mm (4.1%). The weighted average particle size is 0.17 mm, and the average density is 1.65 g / cm³.
- At present, drainage channels have been laid on both sides of the tailing dump for the removal of storm and flood waters of the Burkut stream and its tributaries. The canals are concrete trays, on the eastern side, for the most part blocked, on the western - passing into a steel pipe with the subsequent discharge of water into the lower tail of the tailings dam.

Location of the Bordun tailing dump and industrial waste storage



Plan and longitudinal section of the Bordun tailing dump



The surface of the Bordun tailing dump and the city of Orlovka below its dam



Problems and risks of an emergency at tailings

- According to tailing pond No. 1 - there is no antifiltration layer on the bed in the tailing pond, hence there is the possibility of groundwater pollution due to sediment infiltration. Also, the tailing dump is subjected to water erosion - under the influence of precipitation, despite the fact that it is preserved, melt and rain water from it pollutes the surrounding area, and the Kichi-Kemin river.
- For tailing ponds No. 2 and 3 and the Bordun tailing pond - as experience in the construction and operation of tailing ponds under the difficult mountainous conditions of Kyrgyzstan shows, alluvial-type dams are less stable in comparison with bulk dams. Under adverse external weather conditions (heavy rainfall, mudflows), an earthquake there is a risk of breaking dams, which can lead to the ingress of tailings, including elevated concentrations of thorium and heavy metals, in the form of radioactive mudflow along the channel and the river valley. Kichi-Kemin n. Ak-Tuz, the Berkut river of the city of Orlovka, until they get into the Chu river, which is a transboundary river with neighboring Kazakhstan.

The needs of KCMP OJSC as a tailings operator

At present, KCMP OJSC does not actually conduct production activities. The company does not have the necessary financial resources to ensure complete safety of the tailings. In order to eliminate risks, emergencies with the above tailings and eliminate environmental disasters, on the territory of the Keminsky district and territories bordering the Republic of Kazakhstan, KCMP OJSC is very interested in finding investors or attracting international grant funds for the implementation of the following works:

- Project development and transfer of the tail mass of Ak-Tyuz tailing pond No. 1 to the existing working tailing pond No. 2 or No. 4.
- Survey and assessment of the stability of dams at Ak-Tuz tailings No. 2,3 and the Bordun tailings of Orlovka.
- In case of instability of the dams, the development and implementation of measures aimed at ensuring the safety of tailings No. 2, 3 and Bordunsky.