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IMPORTANCE OF USING THE WATER CIRCULATION SYSTEM IN THE MINING ENRICHMENT PLANTS

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Teghut tailings as a representative of the general condition and risks of tailings in Armenia are studied accordingly, we have made laboratory (solid material and water composition) and social analysis and we have concluded that the high amount of hazardous heavy metals in these tailings spread to nearby territories and contaminate the soil, water and air, enter the food chain, and adversely affect the human health. At first glance, these problems seem unsolvable. However, correction measures must be implemented in order to reduce the pollution.

Keywords: mine tailing, water circulation, heavy metals, metallic ores, tails enrichment.

Introduction. Mine tailings and accidents related to them are one of the most dangerous environmental problems all over the world. This problem is specially acute in small countries where mining industries are important, particularly mining of metallic ores. Armenia, being a mountainous country with a small area, problems of occupation of space and soil and water pollution become particularly acute and urgent to be solved. In fact, there are more than 1 million tons of mining wastes in Republic of Armenia already located in the tailing dams of more than 20 enrichment tailings [1]. The construction of new storage facilities, and consequently, the occupation of new territories appear regularly, and it becomes a serious, unsolvable problem since those areas used for tailings become unsuitable for further use.

Conducting experiments and discussion of results. Besides the destruction of ancient forest ecosystem, the Teghout mine also causes other serious negative consequences, like the extreme deterioration of the Shnogh River water flowing in the areas adjacent to the mine [2].

The quality of the river water is steadily deteriorating parallelly with the mining activity from 2009-2015. As compared with 2009, the average concentrations of some elements (Mn, Ni, Cu, Zn, As, Se, Mo, Pb) have increased according to the hydrological seasons. As a consequence, the Shnogh River is classified as a risk water body according to the EU Water Framework Directive [3].

There are sufficient grounds to suspect that the tails produced by the ore dressing plant flow directly into the river, whose water is used to irrigate the orchards. River water is used for irrigation and as drinking water for domestic animals. Local farmers have reported health problems in livestock and the decreasing quality in their crops [4].

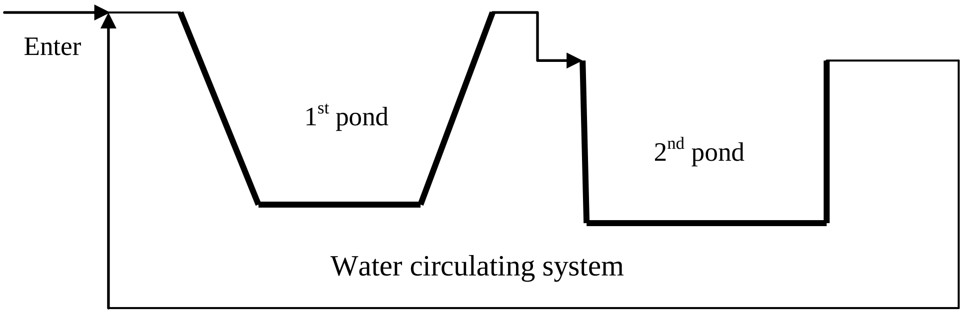

Fig. Technical scheme of Teghut tailing

The Teghut tailing consists of 2 parts: the first is a genuine tailing dump, where the mixture from the mine is emptied (stream 1) and undergoes sedimentation. After this process, the effluent is transferred to the second part, a pond where the water is cleaned by sedimentation (Stream 2) and is pumped back to the factory(fig.).

Water samples from the first and second ponds of the tailings were collected on February 2015. Each sample was split into two parts, and one of them was filtered through a 0.45μm filter. The retentate (Table 3) and filtrate (Table 4) obtained were analyzed along with the other part of the samples using ICP-MS. The results are presented in Table 1 for the first pond, and Table 2 for the second pond.

It must be noted that the sedimentation and removal of suspended particles in the first pond reduces the levels of several metals, including Ag, Mo, Nb, Rb, Zn, Cu, Fe, Ca, K, Si, Cl.

Concentration of several elements in the water collected from the first (Stream 1) and from the second (Stream 2) ponds of the Teghut tailing

Table 1

Element	Concentration, ppb	Std.Error
Ba	<LOD*	218.632
Sb	<LOD	62.002
Sn	<LOD	64.834
Cd	34.289	17.805
Pd	17.528	10.674
Ag	79,304	16.844
Mo	61.688	35.327
Nb	1203.873	4.965
Zr	12.876	12.325
Sr	<LOD	25.672
Rb	641.833	4.905
Bi	26.517	15.162
As	24.342	24.005
Se	<LOD	25.261
Au	<LOD	33.695
Pb	<LOD	22.673
W	201.852	131.103
Zn	79.733	32.411
Cu	79.884	44.12
Ni	<LOD	87.706
Co	<LOD	120.597
Fe	2208.537	256.969
Mn	<LOD	200.6
Cr	<LOD	103.499
V	<LOD	122.384
Ti	<LOD	176.665
Ca	235397.172	3919.392
K	14980.718	489.775
Al	<LOD	1651.7
P	<LOD	5521.768
Si	8702.750	534.051
Cl	19085.695	304.394

Table 2

Element	Concentration, ppb	Std.Error
Ba	<LOD*	153.291
Sb	<LOD	51.768
Sn	<LOD	42.046
Cd	<LOD	35.339
Pd	<LOD	17.701
Ag	<LOD	17.979
Mo	585.857	22.427
Nb	14.774	5.176
Zr	<LOD	16.792
Sr	838.346	32.181
Rb	14.970	4.244
Bi	<LOD	32.006
As	<LOD	15.5
Se	<LOD	28.171
Au	<LOD	29.984
Pb	<LOD	24.957
W	295.918	138.622
Zn	<LOD	45.364
Cu	<LOD	92.226
Ni	<LOD	86.177
Co	<LOD	95.784
Fe	<LOD	176.899
Mn	<LOD	220.968
Cr	<LOD	165.335
V	91.796	56.418
Ti	<LOD	230.280
Ca	371721.8	5556.849
K	9951.237	388.063
Al	<LOD	1814.552
P	<LOD	453.159
Si	6465.233	482.158
Cl	16767.1	249.843

*<LOD= below the detection limit

Table 3

Sediment from stream 1

Element	Concentration, ppb	Std.Error
Ba	165.06	76.823
Sb	<LOD*	30.055
Sn	<LOD	28.762
Cd	<LOD	16.06
Pd	<LOD	7.650
Ag	<LOD	7.785
Mo	26.289	3.609
Nb	<LOD	3.683
Zr	64.801	5.329
Sr	263.562	9.212
Rb	13.636	2.253
Bi	<LOD	8.904
As	<LOD	6.769
Se	<LOD	4.142
Au	<LOD	13.274
Pb	<LOD	7.839
W	<LOD	91.57
Zn	26.089	15.799
Cu	862.764	56.961
Ni	<LOD	57.836
Co	<LOD	184.609
Fe	20821.3	441.656
Mn	<LOD	187.312
Cr	46.265	29.369
V	97.950	33.161
Ti	1897.329	73.485
Ca	6834.123	347.057
K	9205.72	268.349
Al	14512.4	701.197
P	416.569	148.656
Si	106325.1	14 46.894
Cl	320.463	27.421

*<LOD= below the detection limit

Table 4

Concentration of several elements in the water (after filtering from sediment) collected from the first pond of the Teghut tailing (Stream 1)

Composition	Concentration Ppm	Error
Ba	<LOD	170.656
Sb	<LOD	48.136
Sn	62.094	38.267
Cd	<LOD	33.698
Pd	<LOD	18.846
Ag	<LOD	17.872
Bal	373363.5	8520.186
Mo	439.801	21.455
Nb	11.433	5.612
Zr	<LOD	16.108
Sr	836.307	36.725
Rb	12.547	4.587
Bi	<LOD	25.359
As	<LOD	31.388
Se	<LOD	24.945
Au	<LOD	36.571
Pb	<LOD	24.035
W	406.539	170.887
Zn	<LOD	77.082
Cu	93.725	54.886
Ni	<LOD	100.029
Co	<LOD	95.191
Fe	<LOD	284.539
Mn	<LOD	241.846
Cr	146.399	94.112
V	<LOD	106.679
Ti	<LOD	297.458
Ca	444819.6	7195.210
K	11074.95	438.167
Al	<LOD	2280.635
P	<LOD	511.237
Si	6225.832	515.487
Cl	19840.1	301.870

Conclusion. As we saw from the article we have a huge amount of sedimentation in tailings with useful metals, we propose to open a new part in front of the tailing to extract all useful minerals and reuse it, and after a little part of sedimentation, send it to the tailings. We also propose:

● To use the water circulation method in all tailings, it is very effective for reducing the amount of hazardous materials for the environment.

● To reuse all useful products from ore materials and leave as little waste as possible (nowadays, most of the tailings accumulate millions of tons of useful substances).

● Arrange a good isolation of tailings, especially for the floor, because of bad isolation, heavy metals can penetrate into the ground water.

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ՋՐԻ ՇՐՋԱՆԱՌՈՒ ՀԱՄԱԿԱՐԳԻ ՕԳՏԱԳՈՐԾՄԱՆ ԿԱՐԵՎՈՐՈՒԹՅՈՒՆԸ ԼԵՌՆԱՀԱՐՍՏԱՑՄԱՆ ՖԱԲՐԻԿԱՆԵՐՈՒՄ

Ա.Վ. Թադևոսյան, Տ.Ս. Բաղդասարյան, Հ.Ա. Զարգարյան, Ա.Ա. Սաֆարյան

Ուսումնասիրվել և պոչամբարների պինդ ու հեղուկ նյութերի (ֆազերի) լաբորատոր և դրանց սոցիալ-տնտեսական հետազոտությունների վերլուծության արդյունքում կատարվել է եզրակացություն: Պոչամբարներից մեծ քանակությամբ վտանգավոր ծանր մետաղներ տարածվում են հարակից տարածքներ և աղտոտում հողը, ջուրը, օդը, ներթափանցում սննդի շղթա և բացասաբար են ազդում մարդու առողջության վրա: Առաջին հայացքից այս խնդիրները անլուծելի են թվում: Սակայն մեր կողմից առաջարկվող միջոցառումների

շնորհիվ կարելի է աղտոտումը նվազեցնել: Հայաստանում պոչամբարների ընդհանուր վիճակի և դրանց ռիսկերի վերլուծությունը, ինչպես և ընդունված է, կատարվել է Թեղուտի պոչամբարի օրինակով:

Առանցքային բառեր. պոչամբար, ջրի շրջանառություն, ծանր մետաղներ, մետաղական հանքաքարեր, պոչերի հարստացում:

ВАЖНОСТЬ ИСПОЛЬЗОВАНИЯ СИСТЕМЫ ЦИРКУЛЯЦИИ ВОДЫ В ГОРНО-ОБОГАТИТЕЛЬНЫХ КОМБИНАТАХ

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Рассматривается важность использования системы циркуляционной воды в горно-обогатительных комбинатах. С целью общего состояния и риска хвостохранилищ в Армении используется хвостохранилище Техута. Результаты лабораторных (твердый материал и состав воды) и социальных анализов показали, что большое количество опасных тяжелых металлов в этих хвостохранилищах распространилось на близлежащие территории, загрязняя почву, воду и воздух, входят в пищевую цепь и неблагоприятно влияют на здоровье человечества. На первый взгляд, эти проблемы кажутся неразрешимыми. Предлагается ряд мер по коррекции опасных тяжелых металлов с целью уменьшения загрязнения окружающей среды.

Ключевые слова: хвостохранилище, циркуляция воды, тяжелые металлы, металлические руды, обогащение хвостов.