Heritage of Mining in Sovereign Kyrgyzstan (Kyrgyzstan during the Soviet era and since independence acquisition)

Oleg V. Pecheniuk, Vitalii V. Bortsov

Independent Ecological Expertise, 7 microdistrict, 30 h., Bishkek, Kyrgyz Republic, 720028

Abstract Since the Kyrgyz Republic became an independent country, economic relationships of many mining companies in Kyrgyzstan were lost. A lot of mine pits were partially or completely closed. Due to this reason huge amount of mine waters that were not pumped out, filled the subsurface horizons. Untreated mine water is used by local citizens for irrigation and cooking purposes. The most populated south part of the Kyrgyz Republic and adjacent territories of the neighboring countries such as Uzbekistan and Tajikistan are highly impacted by such harmful elements as uranium, antimony, mercury, arsenic, etc.

Key words mine waters, uranium, mercury, antimony, pollution

Introduction

There are few case studies related to abandoned or partially flooded mines, which waters are able to affect environment and health of local citizens.

1. The largest deposits of mercury ores and complex mercury-antimony in Kyrgyz Republic– fluorite ores (Khaidarkan, Ulu-Too, Chauvai, Symap and others) are located on the territory of Kyrgyzstan. They were developed since 1941 by Khaidarkan mercury plant. Khaidarkan mercury OJSC is energy-intensive mining company. The reason of energy-intensity is need to pump out large volumes of underground mine waters uninterruptedly year-round. The volume of pumped-out mine waters is up to 3500 m3/hour from the 400 m depth. Under average monthly consumption of company of 4500 kWh in total; the share of pumps is 3100 kWh. Due to decreasing of mercury output, the lowest mine horizons were flooded in 1990th. So far pumping out of mine waters from the lowest horizons does not seem possible from economical point of view.

Mine waters of Khaidarkan mining plant are discharged into Shakhtnaya spring without treatment. Water from this spring is used by communities located downstream for irrigation of lands with total area up to 500 hectares (about one forth of total agriculture lands of the Khaidarkan area).

Drinking water in Khaidarkan village are withdrawn from the surface source – Galuyan river. In the nearest populated areas drinking water is also of surface origin. Surface water sources are also used for irrigation purposes.

The length of Galuyan river is 30 km. it has 2 inflows, 1 research station (hydrological post). Galuyan river flows across 8 communities with population of 14335 citizens; only 1 commu-

nity has water supply system. There is no long-term data on river flow. Water of Galuyan river is the source of water intake for Khaidarkan village water supply pipeline. Mercury concentrations in the soil of Galuyan river basin on the area of the rural water supply facilities (and below at the distance from 2 to 10 km) are as follows:

Figure 1 *Mine waters, Jalalabad Oblast, Kyrgyzstan*

Table 1 *Water quality analyses (Galuyan river)*

Concentration in samples analyzed (Hg)	Average value (Hg)	MAC (KR) (water supply)(Hg)
0,057 – 0,1 µg/l	0,058 µg/l	0,0005 mg/l or 0,50 µg/l

Table 2 *Soil quality analyses (Galuyan river basin)*

Concentration in samples analyzed (Hg)	Average value (Hg)	Background values for soil of studied area (Hg)
0,11 – 0,85 mg/kg	0,39 mg/kg	0,39 mg/kg

Table 3 *Water quality analyses (random sampling points on the sites of Khaidarkan mercury plant)*

Concentration in samples analyzed (Hg)	MAC (KR) overlimits (Hg)	Background values for Galuyan river (Hg)
0,27 – 5,58 µg/l	exceeds 5,4 – 111,6 times	0,058 µg/l

Figure 2 *Exhausted adit, Batken Oblast, Kyrgyzstan*

- The results of water samples quality analyses taken from springs flowing around Khaidarkan mercury plant's mine dump have shown 400 MAC (KR) overlimits on mercury in water.
- In Eshme village located nearby Khaidarkan mercury plant citizens use untreated mine water for irrigation. The fresh potato samples results have shown 2-2,5 MAC for products (KR) exceed on mercury.

2. Kadamjai tailing storage facilities (7 ponds) accumulate industrial wastewater from Kadamjai antimony plant. Kadamjai tailing storage facilities are located on the mountain slope toward north and north-east direction at the distance of 2 km at 1150 – 1050 m elevation, 50/100 m higher the nearest valley in Uzbekistan. Since 1937 till 1990 Kadamjai antimony plant was worked at full-scale operation capacity. After USSR collapse the plant operation was ceased due to economic crisis and difficult social problems in region.

As of now the lowest horizons are flooded and a mine water pumping-out is impossible due to economic reasons. The mines are located near Kadamjai village (Kadamjai district Batken Oblast), about 500 m from Uzbekistan border. According to the available results of studies, antimony was detected in all environmental samples: soil, water and air. The reasons are both of nature origin and due to anthropogenic activities. It is necessary to mention that the plant is the main pollution source. Antimony has been found in 74% of analyzed samples

taken from surface waters. The MAC (KR) overlimit is 0.05 mg/l. The highest concentration has been identified near Kadamjai and Pulgon villages. Few samples of underground waters, water from Shakhimadran river and soil have been studied for determination of seven main pollutants (mercury, antimony, lead, arsenic, cadmium, zinc, fluoride ions). Both historical and project analyses have shown that underground waters (under tailing storage facilities) are highly polluted especially by antimony, mercury and arsenic. Sometimes there are hundred and thousand times MAC (KR) overlimits. High concentrations of antimony and arsenic have been also identified in soil around tailing storage facilities.

Figure 3 *Water sampling from antimonic adit, Osh Oblast, Kyrgyzstan*

3. Fersman mine. The mine is located about 2 km toward the west from Dangi valley. West of the river is Fersman's cave (240 m depth), it is located in the left side of Aravan river canyon cutting Tuya-Mun mountain. The total length of old caverns and quarries in Fersman system is 4130 m.

Exhausted radium mine it is adits, drifts and natural cavities. The cave was used as radium and then uranium deposits since the beginning of XX. By the end of 1950th it was completely developed and liquidated (entries were blocked or blasted). Historically local citizens were mining copper here. In the middle ages this mine was actively developed by the Chinese.

Radiochemical analyses of water samples taken from stream outflowing from drain adit of ex-mine located near the entry to Aravan-Sai river gorge and taken from the river up-

stream and downstream of mine did not show uranium contamination. Radon gas (product of radium degradation in water and adits of ex-mine) was measured by electrometer. The measurement results have shown that the water is clean from radon, but the content of radon is high in air of adits – from 2x10^-10 Ci/l up to 5x10 –10 Ci/l (7-19 Bq/l) (maximum permissible level is 0,1 Bq/l). Consequently, the primary hazard for local citizens in the area of ex-mine is opened entries to the mine facilities and unprotected rock dumps.

Activities

Main areas of Independent Environment Expertize NGO (IEE) activities are improvement of environmental policy and legislation, EIA of projects/initiatives, etc., protection of public environmental interests, promotion of public participation both at the national and international levels. In 2008 IEE together with "Eco Partner" NGO and Mining Operators Guild of Kyrgyzstan have created Consortium by signing of memorandum on cooperation (MoC). Present partnership is implemented under close cooperation with the Ministries and Authorities of Kyrgyzstan and allows joining efforts of major stakeholders in order to affect the process of strategic initiatives development by the Government in the field of subsurface resources management, legislation, and improvement of monitoring system, corporate and social responsibility.

Figure 4 *Mine water sampling*

In spite of scientific and technical capacity, the surface waters protection problem, particularly, sanitary protection of water resources against contamination from mine waters is actual and still unsettled. Decreasing of pollutants discharged to natural water sources is one of the sanitary protection measures. Implementation of this measure mainly depends on the degree of mine waters treatment methods study, efficient affixment of treatment facilities, their construction rates and proper utilization. It seems that currently Kyrgyzstan is not able to settle this problem by itself without attraction of the best available technologies, and application of the advanced international experience in the field of mine waters treatment. In the process of EIA (environment impact assessment) of projects in the field of subsoil use, IEE focuses on water treatment, application of closed-cycle technology, increasing of drinking water security for population (local citizens). IEE specialists have great experience in the environment status assessment the field of mining industry in the Kyrgyz Republic. More than 50 studies in this field have been carried out for the recent 10 years. In order to increase investigation results quality IEE cooperates with the State Authorities responsible for sanitary and environmental control and also international laboratories on the permanent basis. Due to these activities IEE has vast environment databases that could be basis for further studies and inventory of the most environmentally vulnerable areas of the Kyrgyz Republic polluted by mining companies and identification of the most reasonable solutions for improvement of situation and mitigation of risks.

Existing problems and ways of their settlement

Permanently occurring conflicts between mining companies and local population are indicators of political -economic instability and unavailability of information required for conflicts settlements in accordance with the law. The environmental safety issues related to mining companies are hot topic for the recent period. In order to ensure that mining companies undertake environment protection responsibilities and local population act in accordance with law, the reliable and objective information produced based on the results of independent environmental monitoring is required.

IEE together with its partners deals with development and testing of mechanisms for public participation in decision-making by creation of civil observations network and training of environmental NGO how to make environmental sampling correctly.

Conclusions

For making of environmentally-friendly decisions it is necessary to carry out inventory of all abandoned or partially flooded mines and open pit mines, to analyze mine waters in the context of local citizens health hazards.

Based on data received it will be possible to make decisions on risks mitigation and minimization. The mitigation and minimization of risks could be achieved by application of new technologies in the field of mine waters treatment and/or by provision of local population with available alternative source of drinking water – wells drilling to deeper horizons or use of safe imported water. In any case it is necessary to establish and ensure proper mine waters monitoring system and introduction of treatment technologies. The Kyrgyz Republic

needs in an attraction of the best available technologies and we are ready to provide platform for pilot projects on mine waters treatment for ensuring of environmental security.

Acknowledgements

Hereby authors thank the Finnish Environment Institute for support in preparation of present material and participation in IMWA 2017.

References

The State Agency of Environment Protection and Forestry under the Government of the Kyrgyz Republic, (2009) Social and Economic Assessment of Primary Mercury Production at Khaidarkan mercury plant

Pogodin S.A., Libman E.P, (1971) "How Soviet Radium was Developed". Moscow, Atomisdat

A.M. Djusmamatov, M.T. Omurzakov, I.I. Karavshkin. Osh Oblast center of the State sanitary and Epidemiological Supervision Center. (2016) Radium mine Tuya-Muyun on the south of Kyrgyzstan. History and nowadays