Improving the safety of tailings management facilities in Kyrgyzstan

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Tailings management facility of the Altynken mine
(Source: Oleksandra Riedl)

Summary

This project was financed by the German Federal Environment Ministry's Advisory Assistance Programme (AAP) for environmental protection in the countries of Central and Eastern Europe, the Caucasus and Central Asia and other countries neighbouring the European Union. It was supervised by the German Environment Agency (UBA).

Climate change or the climate crisis is likely to lead to the introduction of so-called “smart technologies”, which cause significantly less greenhouse gases and are significantly more energy efficient. However, these technologies also require appropriate energy storage devices, which in turn lead to an enormous increase in mining activities worldwide to ensure the raw material supply for these batteries. To the same extent, however, the increase in mining activities for the extraction of raw materials will also lead to an increase in Tailings management facilities (TMF) for the storage of mining waste.

Due to the physical characteristics and the chemical nature of substances which can be found in the tailings, TMFs pose risks to the environment and population. Also, the pollution of waterbodies and the related risk or damage to environmental resources often have a negative transboundary effect. Moreover, accidents at TMFs may lead to long-term water and soil pollution and have negative chronic effects to human health.

The mining industry is very important to the economies of many countries. And Kyrgyzstan is among them. The share of gold mining alone in the country's GDP is about 11%, 40% in industrial production and 48% in exports.

Worldwide, at least 99 major tailings dam failures, which caused significant pollution, were reported in the period of 2008–2021 resulting in 790 deaths and significant environmental pollution. (https://www.umweltbundesamt.de/en/topics/sustainability-strategies-international/cooperation-eeca-centraleastern-european-states/project-database-advisory-assistance-programme/capacity-development-to-improve-safety-conditions).

The devastating impacts of such disasters, including in a transboundary context, have been demonstrated by major industrial accidents within and beyond the United Nations Economic Commission for Europe (UNECE) region over the past decades. The management of the safety of TMFs remains a huge problem worldwide, which regularly leads to major disasters. Unfortunately, this database almost does not contain information regarding the failures in former USSR countries such as Kyrgyzstan.

The most recent example of a TMF failure with human fatalities is an accident in the TMF in Minas Gerais State, Brazil on January 26, 2019. The incident has become one of Latin America’s worst mining disasters ever. This disaster has killed 249 people and more than 21 people were reported missing. It is the second incident of its type occurring in less than four years as on 5 November 2015, another TMF accident occurred in the same area, killing 19 people, 60 million cubic meters of mud flowed down through several rivers towards the Atlantic Ocean. In China, the Ministry of Environmental Protection

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responded directly to 56 reported tailings-related pollution accidents in the period of 2006–2014.

The severe environmental damage in the Danube River Basin, caused by a TMF dam breaching at the Baia Mare gold processing facility in Romania in 2000, is a well-known example of mining disasters. The polluted waters eventually reached the Tisza and then the Danube, killing large quantities of fish in Hungary and Serbia. On 4 October 2010 the dam of a TMF located near Ajka, a town in Hungary collapsed and a huge amount of red mud was released. The disaster killed 10 people and almost 150 others were slightly or severely injured, including both, the local residents and the participants in the rescue operations.

Such accidents have in the past also occurred in the Kyrgyz Republic.

The 1958 Mailuu-Suu tailings dam failure in the industrial town of Mailuu-Suu, Jalal-Abad Region, southern Kyrgyzstan, caused the uncontrolled release of 600,000 cubic metres of radioactive waste. The event caused several direct casualties and widespread environmental damage. About 50% of the entire volume of the content of the TMF dam flowed into the Mailuu-Suu River, which is located only 30 metres downhill from the breach. The waste then spread about 40 kilometres downstream across the national border into the heavily populated Fergana Valley in Usbekistan.

In 1964, during the accident in TMF No. 2 in the area of the Ak-Tuz village in Kyrgyzstan 1.5 million cubic meters of radioactive tailings contaminated the transboundary Kichi-Kemin river and the lower part of the Kichi-Kemin valley with thorium, lead, copper, zinc, beryllium, and other heavy metals.

There are six transboundary rivers originating in the country. No rivers flow into the Kyrgyz Republic. The Syr Darya River basin: called the Naryn River before it reaches the Fergana valley, the Syr Darya flows to Tajikistan and Uzbekistan. In Uzbekistan, the Syr Darya receives the Chatkal, a tributary which originates in the Kyrgyz Republic. The Chu, Talas and Assa rivers which are flowing to neighbouring Kazakhstan.

The south-eastern river basins: These mainly consist of small catchment areas draining to China. The main rivers are the Aksay, Sary Jaz and Kek Suu, and are situated at high elevations.

Tailing sites, with the exception of the tailing site in Kaji-Sai village, are located in the basins of the Naryn, Malusu, Chu rivers and are of a transboundary nature. The tailings site in Kaji-Sae is located near Issyk-Kul Lake.

Many areas where Kyrgyz TMFs are located are seismically active and landslide hazardous. In the event of accidents at TMFs, waste can spread over the largest lake - Issyk-Kul.

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In the Kyrgyz Republic all mining enterprises are classified as hazardous production facilities, of which TMFs are the most hazardous to the environment - storage facilities for toxic and radioactive industrial wastes.

In the past when designing and establishing the TMFs, the long-term measures to protect the facilities from hazardous natural processes (landslides, floods, and mudflows), anti-seepage solutions, measures to protect the population (sanitary protection zones, etc.) were not envisaged. Currently there is a high risk of hazardous environmental accidents, in the zone of possible impact of which, in addition to the territory of the Kyrgyz Republic, areas of the territory of the Republic of Kazakhstan, the Tajik Republic and the Republic of Uzbekistan can be affected.

Therefore, it is important to strengthen the safety of TMFs in Kyrgyzstan in order to prevent the accidental release of hazardous substances into the environment and to limit the risk to the population which may be affected.

The key environmental problems that pose a threat to the environment and the safety of the country's population associated with a large amount of inadequately contained waste are:

- *pollution of the environment in the areas of TMFs with radionuclides and other toxic elements,*
- *the growing risk of destruction of waste storage due to climate change due to the threat of natural disasters and natural-man-made disasters typical for the mountainous, seismically active regions of the Tien Shan.*

Thus, the allocation of TMFs and waste heaps to a separate list, as well as considering aspects of land use planning, are key to ensure the safety of tailings and protect human life and the environment.

In 2020 the first TMF project in Kyrgyzstan was provided to discuss optimization options and identify existing problems of the country. Based on the discussion, the responsible authorities and ministries discussed the optimal approach to applying the TMF methodology and what opportunities exist for the sustainable transfer of this knowledge to the administrative structures of Kyrgyzstan. As a result, the TMF project “Improving the safety of tailings management facilities in Kyrgyzstan” was implemented.

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The main tasks of the TMF project were:

- Deepening the knowledge of invited operators, inspectors and experts on TMF management by a training event;
- Amending an existing hazard and risk assessment method and integrating land use planning aspects into it (risk zones);
- Further enhancing and completing a previously developed detailed checklist method;
- Updating and completing the TMF inventory for the Kyrgyz Republic;
- Providing recommendations for the Kyrgyz Republic on managing TMFs.

Long-term objectives of the project are:

- The main goal of the project is to further develop the tailings safety methodology and consolidate it for sustainable use throughout the UNECE region.
- Narrowing the knowledge gaps and raising awareness on the TMF issue
- Strengthening the technical and management capacity at the concerned facilities and responsible authorities
- Establishing a regional framework for national training programs on TMF safety management (train the trainer)
- Respecting a common set of minimum standards and safety requirements
- Ensuring adaptation and further sustainable use of the TMF checklist, THI (Tailings Hazard Index) and TRI (Tailings Risk Index) methods, which were developed in the context of earlier UBA projects
- Exchange of experience and lessons from transboundary cooperation for accident prevention, preparation, and response to industrial accidents
- Updating the database of TMFs and starting discussions on their inclusion in the cadastral system
- Creation of a map for integration into the cadastral system of Kyrgyzstan.

The outcomes of the project

A short overview of the Kyrgyz competent authorities that are in charge of the issues related to management of the TMFs and their responsibilities was done. THI and TRI indexes were used for the prioritisation of 62 TMFs which are located in Kyrgyzstan. An updated on completed TMF inventory for the Kyrgyz

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Republic was compiled based on open access data and official national information. This inventory includes basic data as well as THI and TRI assessments for each identified TMF. The created database will be used as a tool for updating the cadastre system of TMFs in Kyrgyzstan together with the questionnaires for active and closed TMFs which were developed within the framework of the project.

An internal agreement was reached between the responsible competent authorities on how the TMF Methodology will be applied in future. In the framework of the project, the TMF Checklist for safety evaluation of individual TMFs has been acknowledged by all participants, tested, proofed, and recommended as a sound practical tool to raise the safety of TMFs. With this method Kyrgyzstan has now tools and experience and would be now able to re-establish a high safety level towards TMF in their national regulatory system and a sustainable education, especially of TMF-inspectors.

Based on these project results, new policy recommendations were proposed and discussed with the representatives of competent authorities and international experts. The policy recommendations were divided by topics:

- *Education and integration of the Checklist Methodology.*
- *Inventory of TMFs.*
- *Land use planning aspects.*
- *Public participation.*
- *Cadastre system.*

As a result, agreements with representatives of the ministries were reached and all recommendations were approved and have been taken into account.

Moreover, during the project the Checklist and TMF Methodology have been updated and aligned to the Kyrgyz Republic conditions. The evaluation method has also been revised and simplified. In addition, the updated TMF Methodology and checklist were translated into Russian.

Finally, the education video was created in Russian and English, which can help in using the checklist and TMF methodology, and also explains the main features of this approach to assessing the safety of TMFs.

After the project implementation the Ministry of the Natural resources, Ecology and Technical Supervision of the Kyrgyz Republic extended its acknowledgment to the project team for all the work done and expressed its interest in continuing and expanding the project on capacity building and transferring new knowledge and technologies for ensuring environmental safety in Kyrgyzstan.

During and also at the end of the project, several high-level meetings were held with heads of departments and Deputy Ministers, who expressed their wishes for further fruitful cooperation in ensuring sustainable development.

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The concepts of follow-up projects was compiled based on the feedback and recommendations received during the Final Workshop discussions, as well as the recommendations of the Deputy Ministers of the Ministry of the Natural resources, Ecology and Technical Supervision of the Kyrgyz Republic, Mr. K.R. Sadykov and Mr. Ibraimov which were received during the meetings with them.

In general, five **concepts for follow-up projects were proposed for further cooperation:**

- Proposal 1. Building capacity to improve TMF safety by establishing a Center of Excellence in Kyrgyzstan.
- Proposal 2. Increasing environmental safety of TMFs by mainstreaming the risk zone methodology to the local planning process and by raising awareness of local communities.
- Proposal 3. Enhancing the Environmental Monitoring System to Ensure Environmental Safety in Kyrgyzstan.
- Proposal 4. Biomining: Environmentally friendly "green" technologies in mining.
- Proposal 5. Reclamation of the TMFs and Mining Sites to Ensure Environmental Safety in Kyrgyzstan.

The follow-up projects can help to provide the adaptation and further sustainable use of the TMF checklist, THI and TRI methodologies, which have been developed within the previous UBA projects. It will also strengthen the technical and the management capacity at the concerned facilities and responsible authorities. Implementation of the follow-up projects will directly utilise the results of the project «Improving the safety of tailings management facilities in Kyrgyzstan» and will ensure sustainability of the achieved results and agreements.

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