

Khaidarkan mercury

Addressing primary
mercury mining
in Kyrgyzstan



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Cover artwork: Mural in the palace of culture, Khaidarkan

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**Addressing primary
mercury mining
in Kyrgyzstan**

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Foreword

UNEP and UNITAR are pleased to present to you this overview document outlining the situation regarding the world's last known exporting mercury mine – at Khaidarkan in southern Kyrgyzstan. For the past two years, significant efforts have been taking place at the international level to assist the Government of Kyrgyzstan and national and local stakeholders to consider options regarding the future of the mine and its associated infrastructure.

What is known as “primary” mercury mining is almost a thing of the past. Significant international efforts are taking place under the auspices of UNEP, to ensure that a global legally binding instrument will be agreed by 2013. The issue of mercury supply is to be addressed during these negotiations. The continued introduction of “new” mercury from the Khaidarkan mine – which adds to the already significant international supply of mercury currently being traded – further highlights the need for international action to support alternatives to mercury mining in Kyrgyzstan.

With initial support of the Government of Switzerland and the United States of America, UNITAR and UNEP have

assisted the Kyrgyz Government as they grapple with the complex issues related to the future of the mine. As you will see in this publication, the region of the country where the mine is situated faces long-term economic and environmental challenges that make the possible closure of the mine a contentious issue.

The international community has shown encouraging signs of support for the future of Khaidarkan – asking for options that can be considered for support should a decision to close the mine be firmly made by Kyrgyzstan. Should this decision be made, we all can therefore be more certain that a “win-win” – for the global environment and the local community of Khaidarkan – can be realized. More recent funding support from the Government of Norway has also been warmly welcomed.

We hope that this publication can provide a general overview of the issues at-hand. More information is available from UNEP, UNITAR and our supporting organization, the Zoï Environment Network.



Contents





An aerial photograph of a town built on a hillside, with a large mountain range in the background. The town consists of numerous small, simple buildings with flat roofs. The terrain is rugged and appears to be in a high-altitude or mountainous region. The overall color palette is muted, with earthy tones and a slightly desaturated appearance.

**Make mercury
history**

Make mercury history

Mercury, to the Romans, was the messenger of the gods. Today's mercury is more prosaic: a planet, and also a metal, known sometimes as quicksilver. It was widely used in thermometers, scientific instruments (due to its unique chemical properties), as well as many other products and processes. The use of mercury, however, is being reduced throughout the world due to its toxicity and the availability of substitutes. Certain forms of mercury and its compounds can damage neurological development and affect internal organs. Effects are most pronounced in pregnant women, infants and children. Mercury can spread far and wide through air and water: it is found as far from industrial centres as the Arctic. It is ingested by fish and other marine life, where it becomes concentrated as it moves up the food chain.

The world's governments agreed at the United Nations Environment Programme Governing Council in 2009 to prepare a legally binding instrument on mercury to protect human health and the environment from mercury. The Intergovernmental Negotiating Committee is to develop

a comprehensive and suitable approach to mercury, including provisions to reduce the supply of mercury taking into account the circumstances of countries. Negotiations are to conclude in 2013.

There is now only one known mercury mine in the world which continues to sell its output abroad: Khaidarkan, in the remote mountains of southern Kyrgyzstan.

What will happen to the "kombinat" (the mine, smelter and all the associated installations are known together as "the kombinat"**) is still far from clear. For the international community, continuing mercury mining – business as usual, even if brought up to international standards – raises significant concerns. It is widely recognized in the international community that limiting mercury supply

*Combine (*Комбинат*, kombinat) was the Soviet bloc term for industrial business groups or conglomerates in the socialist countries. Examples include VEB Kombinat Robotron, an electronics manufacturer, and IFA, a manufacturer of vehicles, both in East Germany, or the Erdenet copper combine in Mongolia. (Source: Wikipedia)



is one of the key elements to any comprehensive global approach to address mercury.

If the mine closes, the need for reemployment and rehabilitation of exploited and contaminated areas will remain. The mercury mine is the main source of income for the town – about 10,000 people – and also creates indirect employment that may not continue without the income provided by the mine. Water pumped from the mines to keep shafts accessible is used for irrigation of the few areas suitable for agriculture. While most of southern Kyrgyzstan relies on agriculture as its main source of income, soil fertility and climatic conditions in Khaidarkan valley are unfavourable.

Behind all these needs is the reduction of the resources available to the Government of Kyrgyzstan for preventing pollution, since independence from the former Soviet Union.

UNITAR and UNEP, in partnership with Zoï Environment Network, with funding support from Switzerland, the United States of America and Norway, have assisted Kyrgyzstan with capacity building for Action Plan development. With inputs from and the participation of a wide variety of stakeholders, an Action Plan on Primary Mercury Mining and its Impact on the Environment has been produced and is being considered at the highest levels of government. The following key areas have been identified for action at Khaidarkan in the Action Plan:

- Development of socially responsible plans for mine closure, with environmentally acceptable and economically affordable rehabilitation techniques defined to deal with contaminated waste and land;
- Promotion of other viable economic activities and ways of sustaining livelihoods that do not involve primary mercury mining must be developed;
- Improved public awareness, strengthened controls, improved information and reporting are also needed.







Geography and geopolitics

Geography and geopolitics

By most standards Khaidarkan is remote, wedged in the precipitous mountains of south-west Kyrgyzstan and reached by a narrow road over a 2,300-metre pass. The mercury mine and smelter date from 1941, from the days of the Soviet Union. The mine equipment and infrastructure were located at Khaidarkan following evacuation of industrial facilities from Ukraine during the Second World War. The Khaidarkan region had exploitable mercury deposits and it was unthinkable that the enemy could reach

Central Asia. The remoteness of the mine, which was an advantage during the war, is now considered a challenge to the further economic development of the region.

Significant mercury reserves remain at deeper depths at Khaidarkan, but investment has not been forthcoming to allow their exploitation. Even if this were possible, there are also significant cash flow challenges, which impact on workers' pay. The region, much as many other regions

Why Khaidarkan is the only one still producing

While other mines have long closed their mining activities within Kyrgyzstan and elsewhere in the world, Khaidarkan remains the only operation which supplies primary mined mercury to the global market place. Mines in Slovenia and Algeria have ceased operations due to economic and technical difficulties, others like the Almaden mine in Spain also experienced pressure from growing international concern regarding mercury pollution which led to closure of this, the biggest mercury mine in the world in 2004. China also has some mines but it is believed that their production remains within the country.

So why is Khaidarkan the only one still mining mercury for the global market? The main reason is the economic challenges facing Kyrgyzstan, particularly the region where the mine is located. The company that manages the complex has been struggling with fluctuating mercury prices and continuous technical difficulties such as low ore grades and flooding of shafts with underground water. Many times the state-owned company has had to request subsidies and state support for continuing its operations and the initial efforts to privatize the mine did not yield results. Due to a lack

of international regulations and control, Khaidarkan primary mercury is still in demand on the international market which contributes to the continuation of mining operations.

The Khaidarkan plant remains important to the local community, both as a source of income and also for the people's identity. Before mining started in the early 1940s, there was no urban settlement in Khaidarkan, people came with the mine to be miners. At its height about 12,000 people lived there, now it is below 10,000. For them it is their home, they do not want to leave. In other places in Kyrgyzstan where industry vital to a town's existence has collapsed, people have been forced to leave, many ending up in the outskirts of Kyrgyzstan's capital Bishkek where they try to make a living. The government seeks to avoid these movements commonly associated with increased poverty by keeping relevant industries alive as long as possible. While it is recognized that mercury mining poses environmental risks, the means to invest in new industries or restructure the regions that could help the transition away from such activities have to date been very limited.



in the former Soviet Union, has also experienced a significant “brain drain” of skilled workers, who have left for better opportunities elsewhere. And beyond every calculation of survival there looms the reality of the upcoming negotiation of a global legally binding instrument on mercury that will include provisions to reduce the global supply of and demand for mercury. However, there is loyal and strong support for the kombinat by the population in and around Khaidarkan.





Mercury production

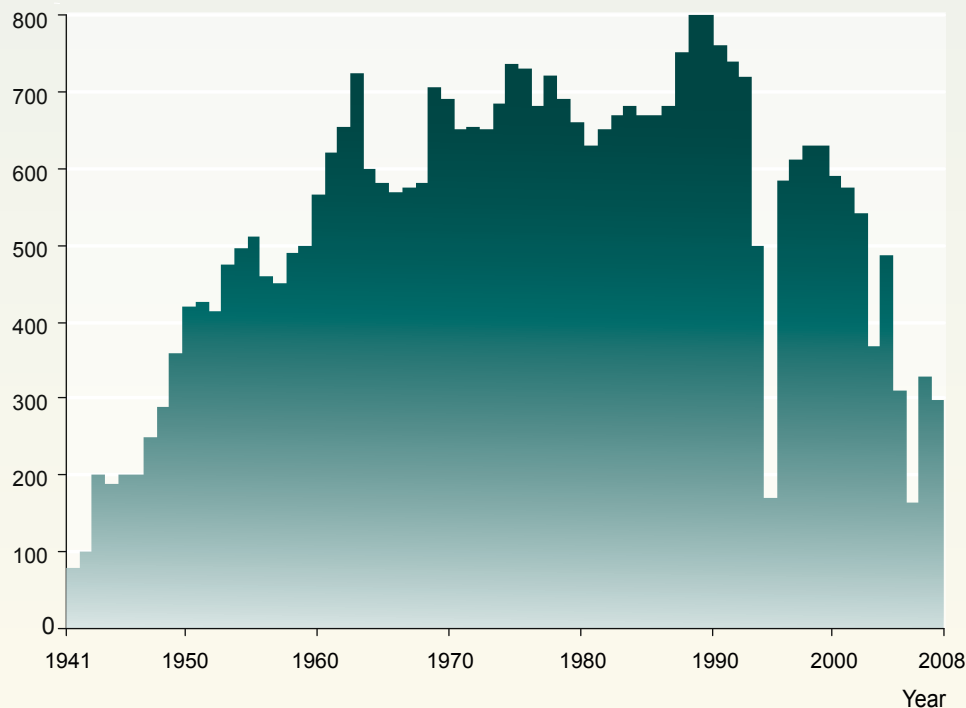


Mercury production

Producing mercury is a fairly simple process: cinnabar ore is brought to the surface, crushed and roasted in rotary furnaces. Metallic mercury separates from sulphur in this process and evaporates. Liquid mercury is collected from the vapour in a condensing column, purified and can then be transported, usually in iron flasks. But it may not always be quite as easy as it sounds. At Khaidarkan, for example, the working conditions can be arduous. Miners descend 400 metres underground in one of the two working shafts to reach the ore deposit, a journey which can involve a walk through knee-high, fast-flowing water.



Mercury production in Kyrgyzstan
in tonnes

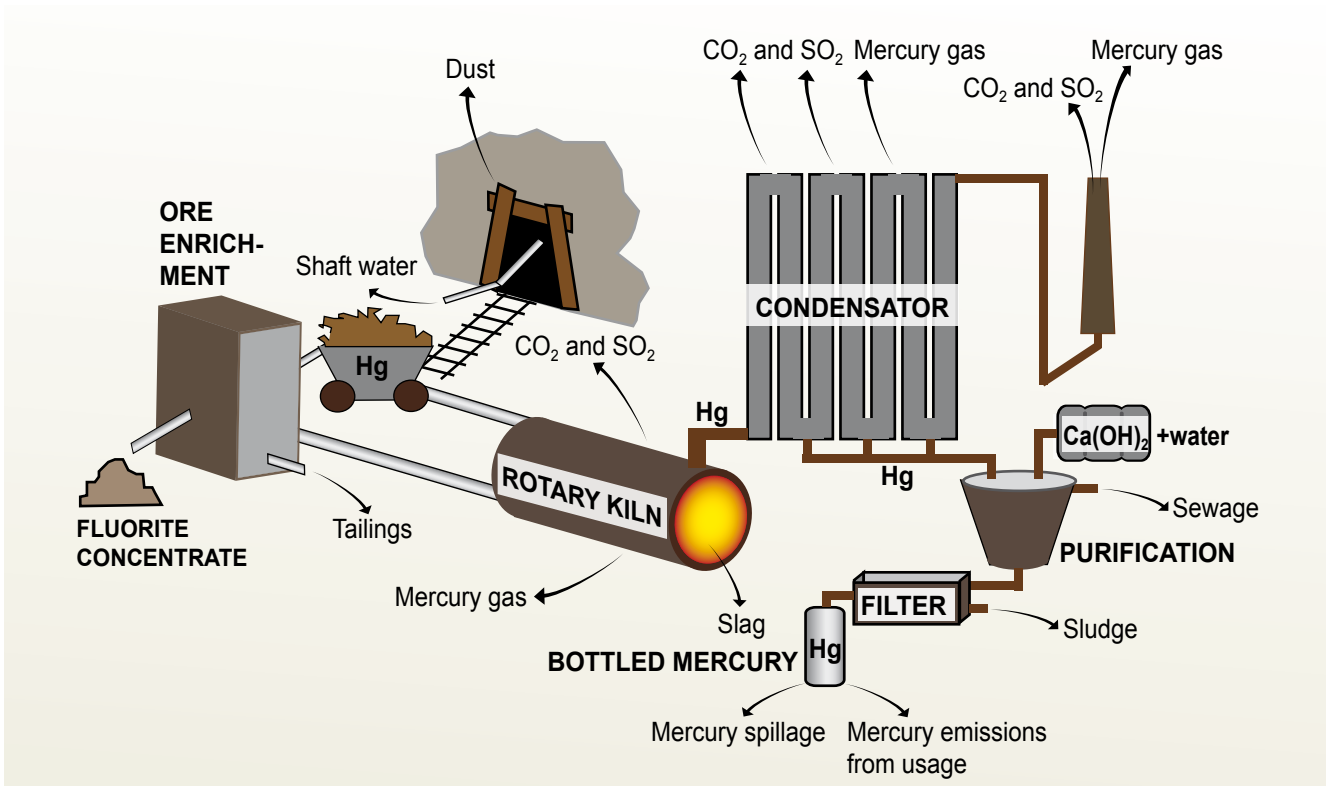


Workers at the rotary kilns in Khaidarkan often do not wear any respiratory protection. This is of concern to worker health because the kilns are not well-sealed and so may emit high levels of mercury vapour to the atmosphere. The poor seals can also allow hazardous liquids to leak onto the floor of the smelter building. The exhaust gases from the condenser are vented through a chimney, and it is important to ensure their temperature does not exceed 30°C to prevent mercury escaping. It was estimated that over the last few years the kombinat emitted about 3.5 tonnes of mercury annually. The mercury levels and other contaminants in slag, sludge (waste from the kilns) and tailings (waste which

has been treated with chemicals but not heated) are high enough to pose a risk to local people and the environment.

In its working life the Khaidarkan mine is estimated to have produced more than 36,000* tonnes of mercury. Mercury production was understandably modest in 1941, at under 100 tonnes, and peaked in the late 1980s at almost 800 tonnes. In 2008, Kyrgyzstan produced less than 300 tonnes.

*Apart from Khaidarkan, historically there were two other mercury mining sites in the region, Chonkoy and Chauvay, which produced 9,000 tonnes of mercury before closing in the early 1990s.







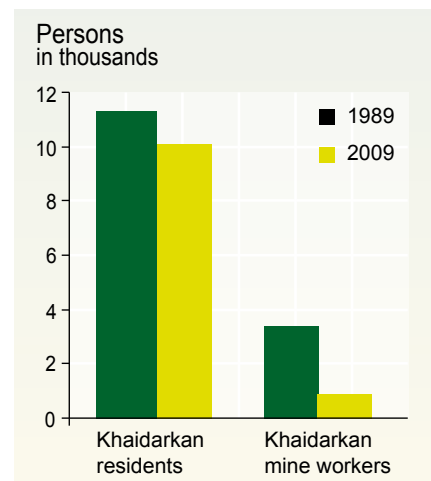
Mining town and people

Mining town and people

Khaidarkan feels like a frontier town, but a quiet one. Even the market seems relaxed and unhurried. The few people in the streets are friendly enough to visitors, but they do not bother to hide their concern about the future of the kombinat – and their own. It is in every sense a company town. Not only does the town's economy depend on the mercury mine – for example, irrigation water is also supplied directly by the kombinat. The town is home to about 10,000 people. In 1989 3,500 of Khaidarkan's townspeople were directly employed by the kombinat. That number had fallen to 1,500 by the mid-1990s, and to 750 in 2008. The main alternative employment is agriculture – livestock, or growing apples, potatoes, carrots and cereals. Some 40% of people in Batken province still earn less than the minimum subsistence level. There are not many options for job-seekers in this district of south-western Kyrgyzstan,

which explains the anxiety in the town that the kombinat should continue working, even if it has to find a very different *raison d'être*. This in turn probably helps to explain the apparent indifference of many people in Khaidarkan to the possibility that they are living in a polluted environment.

Further afield, though, food and textile industries and service sectors are expanding in the Batken province, where Khaidarkan is located. This should hopefully provide more opportunities for work for the people of Khaidarkan. Many of the province's young people also work in Kazakhstan and Russia, sending remittances home to support their families. But with the difficult global economic situation causing many people working abroad to return to Kyrgyzstan, employment and income for the entire region is likely to fall even further.







Environmental and health concerns



Environmental and health concerns

Within a short distance of the Khaidarkan facilities mercury contamination has been a problem for 70 years and continues to be a challenge in some instances. High mercury concentrations are found in slag, sludge and tailings from the mine. These may significantly impact the town, surrounding farmland, and natural waterways, all of which show elevated mercury concentrations, often exceeding Kyrgyzstan's national standards. Environmental protection is very limited, and monitoring and reporting are inadequate. Due to waste deposits and contaminated agri-

cultural soils, pollution will continue even when production stops. Limited studies suggest human health may have suffered in the past, with some workers still facing higher health risks today and children's neurological systems suffering damage. But mercury's global dispersal means that concern over contamination in Khaidarkan is much more widely spread. Rivers which flow from Kyrgyzstan to both its neighbours, Tajikistan and Uzbekistan, and the importance to all of them of the fertile Fergana Valley, mean Khaidarkan's shadow probably falls on them as well.



Environmental issues and approaches in Khaidarkan

Most of the mercury and other pollutants that enter the environment from the Khaidarkan kombinat consist of gaseous emissions from the mercury smelter or from waste streams that are generated during mining and processing of the ore. Over 13 million tonnes of slag, 4 million tonnes of tailings and several million tonnes of waste rock deposited in close proximity to the town are posing significant instability and pollution risks to the community. Next to these huge deposits, there also is a smaller sludge pond that contains several thousand tonnes of high concentration mercury waste originating from the mercury purification process. Water is draining from all these waste sites, none of which are contained or fenced off. Water is used for irrigation or is drunk by cattle in the area. Mercury is probably transported away from these areas, slowly but steadily, entering the global cycle. None of the other mercury mines recently closed

has had comparable amounts of waste stored on the surface – most of these facilities “backfilled” such waste into the shafts or buried it beneath soil and clay caps.

There are a number of straightforward measures that can reduce the local and global negative environmental impacts from these sites. Such activities comprise capping, water drainage modifications, and re-vegetation. National experience of such remediation work is limited but the technical requirements can be fulfilled with existing workforce. Implementation of remediation measures would also create relevant employment in Khaidarkan over several years and create skills which can then be utilized at other hazardous waste sites in the region. Given that Khaidarkan is a state-owned company, there is limited local capacity for investing in environmental remediation.







Alternatives

Alternatives

The future of the mine, the smelter and ultimately the town of Khaidarkan itself largely depends on how mercury production can be replaced with other economic activities. Sustaining people's livelihoods beyond cinnabar mining and processing will be the main objective and here the UN project and the Kyrgyz action plan have sketched out potential solutions:

Gold mining

Given the history of the area, existing experience and skills, and technical equipment in place, activities related to extraction of other, less hazardous minerals, appears to be a real option. This is recognized in the Country Development Strategy of the Kyrgyz Republic for 2009–11 that prioritizes the development of gold mining and production. There are many gold deposits in southern Kyrgyzstan that were considered technically challenging during Soviet times and therefore not further developed. With new technologies in place, their exploitation becomes feasible and constitutes a promising opportunity for the entire region. However, since many of these deposits are small, individual processing facilities and tedious bureaucratic processes for licenses are costly and may have a deterrent effect. As an alternative, ore mined at those deposits could be transported to processing plants in China or Kazakhstan. To retain the benefits of such operations in Kyrgyzstan, it would be of interest to develop a hub for ore processing in southern Kyrgyzstan, for example in Khaidarkan. The existing ore enrichment plant is suitable for this type of work although it requires refurbishment.

The Khaidarkan plant is interested in diversifying its activities towards gold extraction and processing and has recently received an offer to process gold ores mined about 400 kilometres east of Khaidarkan. The estimated investment required to initiate gold processing is between US\$1 and 2 million.

Industrial minerals

Apart from gold, there are also opportunities for non-metallic mining in the area around Khaidarkan. Construction materials, such as magnesite, serpentinite and gypsum appear to be very attractive for the local market. Magnesite and serpentinite are used for fire-resistant bricks, which are essential for cement kilns: with two newly constructed cement plants in the vicinity of Khaidarkan, there are potential clients nearby. Gypsum is of use in cement production and in construction materials, likely to find markets in the current construction boom in southern Kyrgyzstan and the Ferghana Valley.

Bentonite, a clay material that can be mined locally, serves many purposes ranging from cosmetics to drilling agents. It is commonly used as a capping material for environmental remediation. Given the many problematic areas in Khaidarkan requiring remediation, bentonite production on the site would be very useful.

Agriculture and small-scale development

While for the rest of southern Kyrgyzstan agriculture is the main economic sector, it is relatively poorly developed in the Khaidarkan valley, which is mainly limited by harsh climatic conditions. Agriculture in the valley could however be improved by optimizing land use, strengthening local food processing and improving the marketing of agricultural products. By increasing the local production and promoting related businesses, the valley could become more self-sustaining and less vulnerable to economic changes such as decline of the mercury industry.

Other non-industrial opportunities lie in artisanal products and services such as carpet weaving, handicrafts and souvenir production. Car repair, plumbing, construction are also activities where local business can be developed as an income source. An initiative called



the Khaidarkan Business Incubator, funded by the EU has been set up to support such activities. The overall volume is however still quite low. Another initiative is the UN-facilitated Batken regional development programme which also has potential to create alternative jobs for the Khaidarkan community, especially for women and disabled people. It facilitates farmer cooperatives, improves agricultural processing capacities and marketing of local products.

In order to create alternative livelihoods to primary mercury mining, a combined approach of industrial and small-scale economic activities is probably the most suitable. For both, investment by private investors and the government will be required. Areas for engagement will comprise analysis, refurbishment, market development, training, and related activities before actual business can be started. This will require a wide range of support that Kyrgyzstan itself will find difficult to provide alone.

Product/activity	Description	Potential for direct employment
Gold	Numerous small gold deposits in Southern Kyrgyzstan are known but not yet exploited. Khaidarkan could be developed into central hub for gold processing serving operating mines and support further development in the region.	
	<i>Potential activities:</i>	
	Upgrade and modification of the existing ore enrichment plant to treat gold-bearing sulphide ore at the rate of about 200 tonnes per day (based on a concrete proposal by a foreign investor).	70
	Construction of a new ore enrichment plant to treat gold-bearing sulphide ore at the rate of about 1300 tonnes/day.	150
	Installation of a modern BIOX facility for treatment of the refractory sulphide concentrates produced by gold mining operations around the Ferghana Valley. At present, the nearest commercial facility is in northern Kazakhstan.	50
	Transformation of the Khaidarkan plant's mining department into a mining contracting organisation.	150
	Development and exploitation of gold deposits and ore processing.	~1000
Gypsum	Production of gypsum panels and gypsum for the building industry. The Kann gypsum deposit is located 25 km to the north of the Khaidarkan with possible reserves of 1.8 million tons.	90
Bentonite	Bentonite is a clay material and finds a wide range of applications ranging from cosmetics, food industry, drilling and heavy industry to remediation works. Deposits are located in the vicinity of Khaidarkan.	75
Magnesite and serpentinite	Materials can be used for fire resistant brick production, natural magnesium fertilizer and for asphalt and concrete mixtures of various categories. Deposits are located 20 km north of the Khaidarkan Mercury Plant.	90
Small scale alternative employment opportunities	Small grants, micro credits and training for developing small businesses such as handicraft, repair services, construction, transport, foodstuff production etc.	100–200
Environment and health risk reduction	Required environmental safeguard measures in polluted areas are a short term economic and employment opportunity in the region. Measures might include remediation of the sludge pond, slag heaps and tailings.	20–100

Investment (million USD)	Advantages	Disadvantages
1–2	Use of existing facilities. Limited investment required.	Potentially hazardous waste streams (flotation agents). Operations dependent on external ore supply.
20–25	Modern, safe and reliable operations.	Potentially hazardous waste streams (flotation agents). Operations dependent on external ore supply.
3	Increased value of local production. Technology transfer, increased capacity in the region.	Potentially hazardous waste streams (cyanide). Operations dependent on external ore supply.
no data	Skilled workforce and permits, with basic underground mining equipment already existing.	Operations remote from Kaidarkan. Training required in commercial skills and new technologies.
40–60	Employment generated. Economic development for the entire region. Operations independent from external ore supply.	Difficult to obtain license. Long process until operations can start. High capital investment required.
1.5	Deposit of good quality and relatively well explored. Growing demand for building materials in the area.	Potential mercury contamination through reuse of smelter.
1.5	Product can be used for remediation purposes on the mining site. Robust technology. Limited environmental impact.	Heavy and voluminous product, expensive to transport over great distances.
0.6	Potential costumers identified in Kyrgyzstan and Tajikistan. Robust technology. Limited environmental impact.	Heavy and voluminous product, expensive to transport over great distances.
0.3	Direct impact and capacity building.	Limited benefits for regional development.
0.5–8	Reduced environmental and health risks. Increased area for productive and safe land use. Use of existing workforce and equipment.	Lack of experience.

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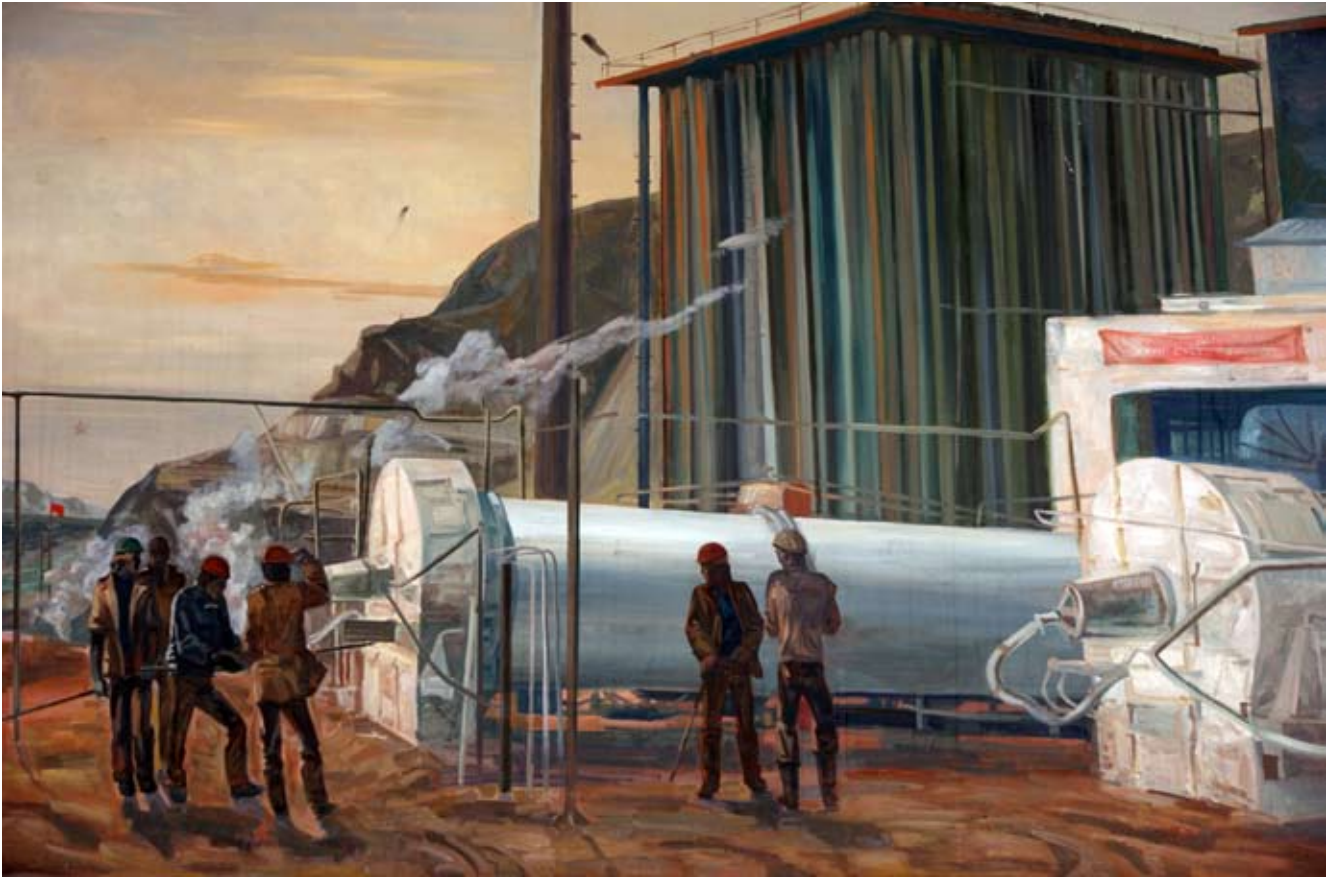
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