
Economic Benefits and Infrastructure Assessment

Review of local development
opportunities and capacities in
environmental remediation in the
Khaidarkan area, KYRGYZSTAN

DRAFT

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1. Introduction

The goal of this research is to assist the Government of the Kyrgyz Republic in a decision-making scenario to move forward in phasing out (replacing) the primary mercury production at the Khaidarkan Mercury Plant in a socially and environmentally responsible manner.

Mercury is a global pollutant which can be transported over long distances across borders. One of the highest levels of impacts of global mercury pollution is observed in the Arctic region due to the accumulation of mercury in marine products, which makes up a significant proportion of the local diets. In 2003, the UNEP mercury programme was established under the auspices of the United Nations, recognising the need for coordination of global action on the reduction of mercury pollution of the environment.

Some 140 countries have supported the UN Environment Programme's (UNEP) Governing Council decisions (Nairobi, February 2009) to launch negotiations on an international mercury treaty to be effective by 2013. This treaty is expected to include actions to reduce global mercury pollution and human exposure, by obligatory or voluntary reducing use of mercury in industrial processes and products, reducing emissions from coal plants and smelters, reducing supply of primary mercury and tackling the mercury waste issues.

In parallel to this international process, the European Union and the United States had already agreed to ban future mercury exports, the E.U. starting in 2011 and the U.S. in 2013, and are in the process of developing and implementing strategy to tackle the mercury problem. In particular, the EU mercury strategy effective since 2005 contains a list of 20 measures reduce mercury emissions, cut supply and demand, ban export, improve scientific knowledge, protect public health against exposure.

The information presented in the research aims to facilitate making informed decisions to ensure adequate living conditions for the local community and a solution of arising social issues, as well as mitigation/remediation of the negative environmental impacts in case of mine closure.

The research comprises the analysis of alternative mineral resource production options, support of infrastructure and services and employment issues as well as solutions to the environmental problems caused by the long-lasting mercury mining.

The goal of the research is identification of the priority development areas in order to support social and economic development of local communities in case of mine closure, analysis of responsibilities and potential to carry out the environmental protection measures. The research results present a series of data that could enable the Government of the Kyrgyz Republic to make well-informed decisions, while the international community could use it in provision of financial and technical support.

2. Background

2.1 Location

The Kyrgyz Republic occupies the territory of 198 000 km² in the middle of Central Asia. Its population is 5.2 million people. Kazakhstan and Russia, characterized by raw material intensive economies are located to the north of Kyrgyzstan and are connected with KR by the Turkestan-Siberian Railway. Tajikistan, India and Pakistan are to the south of the country and connected by mountain roads. In the east the country borders China, with its dynamic economy and access to the Pacific via Kashgar railway. In the west there is Uzbekistan with the railway access across Fergana and Kazakhstan. Kyrgyzstan borders the most developed parts of Kazakhstan and underdeveloped areas of Tajikistan and China.

2.2 State structure and regional economic situation

Kyrgyzstan is a presidential republic. At the presidential elections in July 2009 the active President K. Bakiev was re-elected. The unicameral parliament consists of 90 deputies. The Prime Minister is appointed by the President with the approval of the Parliament. The administrative and territorial structure consists of: 7 Provinces and 2 cities of Republican status: Bishkek (the capital) and Osh.

Figure 1 Administrative map of the Kyrgyz Republic



2.3 Batken Province

The Batken Province, where the Khaidarkan Mercury Plant is located, was established in October 1999 and comprises the Batken, Kadamzhay, Leilek districts of the Osh Province and towns Kyzyl-Kya and Sulyukta. The villages of Batken and Isphana, being the district centres acquired the town status. The province is divided into 3 districts, 5 urban type settlements and 34 aiyl okmety, which unite 189 settlements. Batken city is the Province centre. The Province occupies the extreme south-eastern part of the country and is part of the densely populated Fergana Valley. Three quarters of its borders are international borders of the country. On the territory of the Province there is one Tajik enclave (Vorukh) and two Uzbek enclaves (Sokh and Shakhimardan).

The territory of the Batken Province is 17 000 km² (8,5% of the total territory of Kyrgyzstan). The Province borders Tajikistan in the north, south and west, Uzbekistan in the north and the Osh Province of the Kyrgyz Republic in the east and partially south. The Province occupies the southern piedmont part of the Fergana Valley with the front chains, foothills and offsets of the Turkestan Range and Alai Range. The lowest point of Kyrgyzstan can be also found in the Province at the height of 401 m above the sea level.

According to the population census in 1999, the Province had 381 000 residents, making of 7,9% of the country's population. At the beginning of 2008 the resident population of the Batken Province made 426 000 people (8% of the country's population). In 2007 the average monthly salary was 2779 soms or around 77 USD according to the official exchange rate of the National Bank of the Republic.

The Province is characterized by the high birth rate, low death rate, high natural increase and significant level of migration over the recent decade.

Economy:

The economy of the Batken Province holds a special place in the production sector of the Republic with its industrial potential - mercury in Khaidarkan, antimony in Kadamzhay as well as coal in Kyzyl-Kya and Sulyukta. Agriculture is well set up with apricot, tobacco, wool, meat and dairy products, and fermentation tobacco.

Transport:

The modern transport network of the Batken Province is represented by motor, railway, air and pipeline transport. Motor transport provides for the main share of passenger and cargo transportation. Motorways cross the enclaves of the neighboring countries several times, which has a negative impact on the normal movement of transport vehicles and freedom of passenger and cargo transportation as a result of the customs and border regulations and procedures, including passport control and other checks in the Province. Despite this fact, motor transport ensures the transport and economic links of the most hard-to-get-to settlements with the district centres, Batken, the Province centre and Osh. The total length of

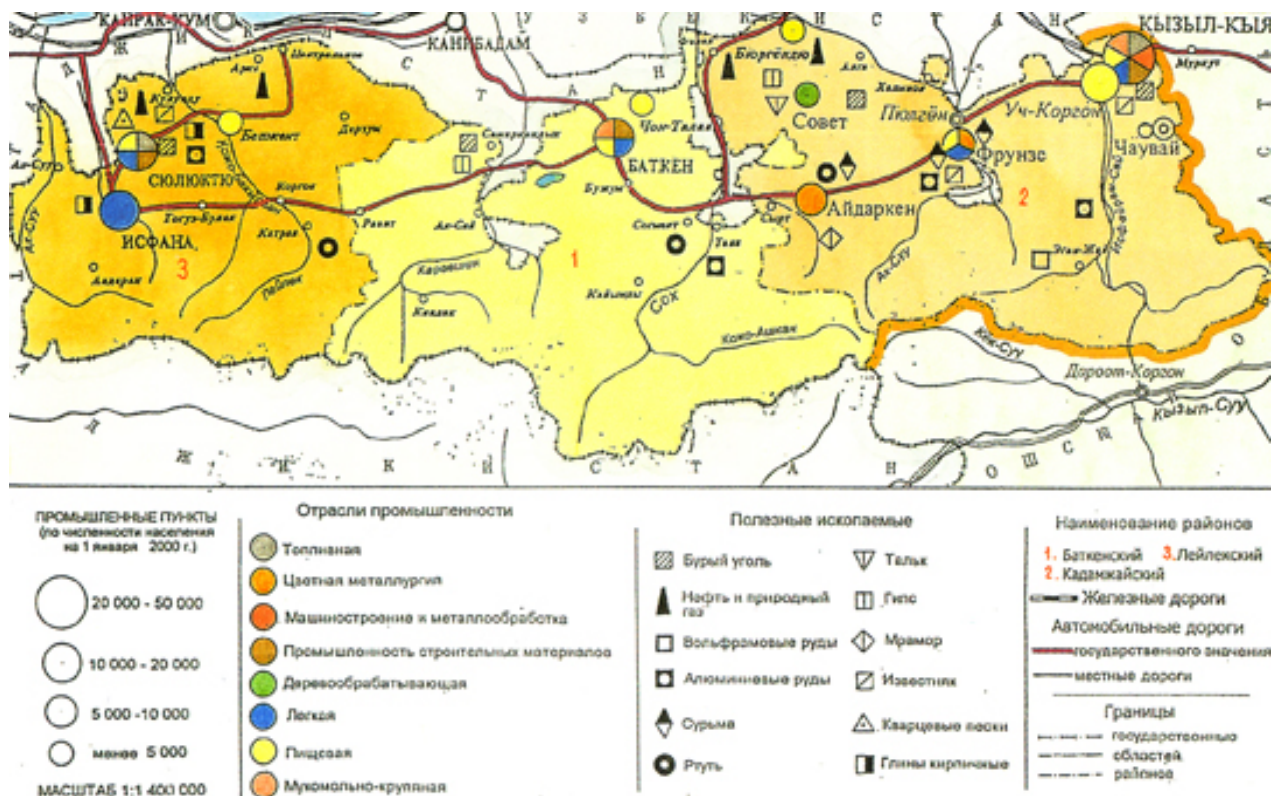
the motor roads is more than 1200 km, out of them 414 km – asphalt type road, 466 km– gravel road.

The railway transport is presented by two short dead end railway spurs. The first was laid in 1907 to Sulyukta with the total length of 37 km. The second railway road connects Kyzyl-Kya with the Uzbek railway system Fergana-Kuvasaj (Uzbekistan) – Kyzyl-Kya (42 km). These railway tracks were constructed primarily to transport extracted coal from brown coal fields. They are of high significance for bulky cargo transportation, especially for the mining industry enterprises.

Air is mainly used for passenger and mail transportation in the country and is of local significance. The airports were built in Batken (1950), Isphana, Kyzyl-Kiya and Khaidarkan. At the moment, only the first 3 are in operation, as there is no demand for the services of the airport in Khaidarkan.

Pipeline transport is in operation in the Province through the gas pipeline Fergana (Uzbekistan) – Kadamzhay and Ursat'yevskaya (Uzbekistan) - Khaidarkan. The gas pipelines supply natural gas to the industrial enterprises and residents in these settlements.

Figure 2 Economic map of the Batken Province



Source: www.welcome.kg

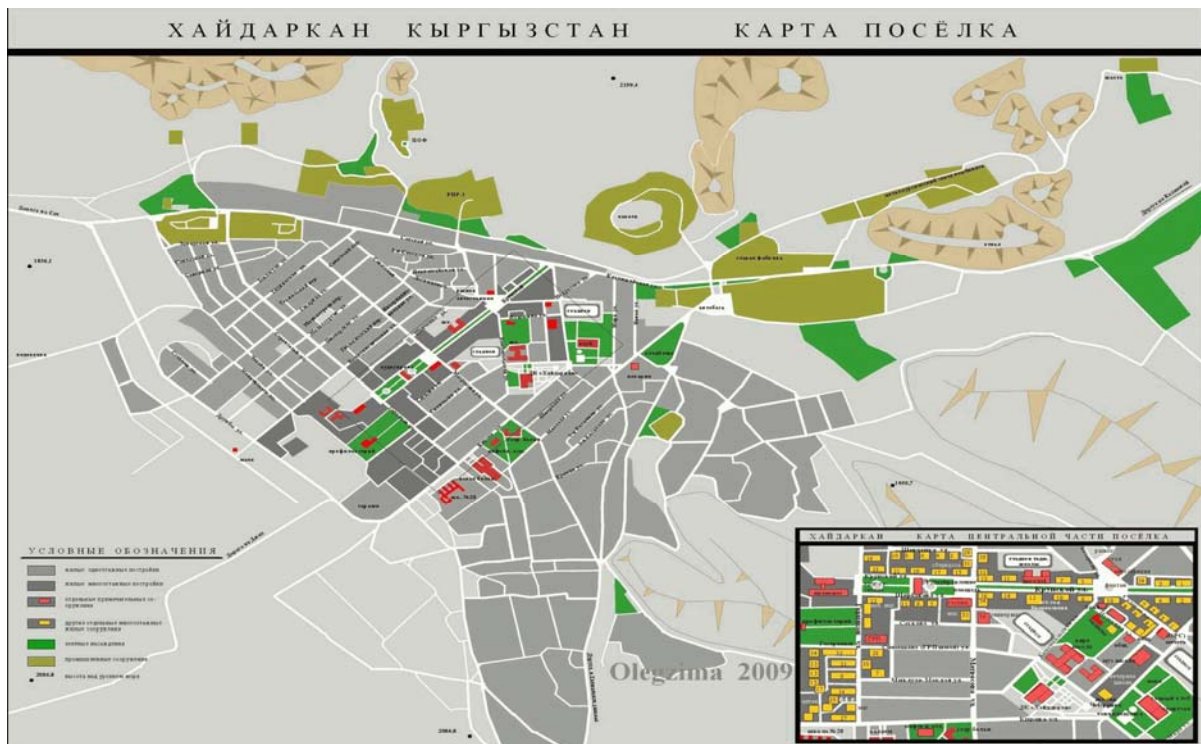
2.4 Khaidarkan town

Geography:

Mercury production is practiced in Khaidarkan town located in the valley (altitudes 1700-2000 m) sandwiched between the Alai-Turkestan mountains in the south and Eshme mountains in the north. The average height of mountains is 3000-4000 meters above the sea level with some peaks exceeding 5000 m. The length of the valley is 50 km, 10-40 km wide. The landscape ranges from gentle foothills consisting mostly of loose Quarternary deposits and debris cones to the high ridged mountains. The Khaidarkan botanical reserve for preservation of endemic tulip (area 30 hectares) is located nearby at the Khaidarkan pass.

Khaidarkan is characterized by a dry continental climate with the average annual temperature +6°C. The winter average temperature minimum could reach -20°C, and summer maximum exceed +25°C. The annual average precipitation is 415 mm.

Figure 3 Khaidarkan town, overview map



Source: <http://win.mail.ru/cgi-bin/readmsg?id=12463467770000001007>

Population:

Khaidarkan settlement first appears in records in 1898. In 1942 it has obtained the status of an urban type village. Currently its territory is 4450 hectares. The town is managed by the village authority. The village council (Kenesh¹) consists of 17 deputies

The population of the village is 10957 people (as of 2009) (2,5% of the Batken Province population), and out of that number there are 4689 able-bodied residents. The number of working residents is 2538 people, and out of that 860 people work at the plant. A certain proportion of unemployed residents (2150 people) work in Kazakhstan and Russia. The number of registered unemployed varies from 100 to 180 people. The number of temporary employed in Kazakhstan and Russia can be estimated at around 2000 people.

Representatives of different ethnic groups include: Kyrgyz – 5565, Tajik – 5020, Uzbek – 35, Russian – 219, Tatar – 10, others – 108.

Table 1 Population composition by age and gender

Population (categories)	Number of people
Population total	10957
Men	4143
Women	6814
Children, male 0-15 years	1809
Children, female 0-15years	1198
Children, male 16-17 years	1611
Children, female 16-17 years	1208
Women, 16-59 years	1320
Men, 16-59 years	2746
Women, over 60 years	417
Men, over 60 years	648

Table 2 Population Employment Structure

Population by the employment group	Approximate assessment
Pre school children 1-6 years	1244
School children 6-16 years	2527
Civil servants	1282
Engaged in the education sector	233
Engaged in the health care sector	242
Engaged in the industry	682
Engaged in the service industry	99
Retired	117
Unemployed	180

¹ Kenesh – council, local self-governance body.

According to the records of the Khaidarkan town authority, on the territory under its jurisdiction there are 5738 households, which occupy a total area of 50 000 m² with the living space of 30 000 m². There are 56 housing blocks consisting of 1721 flats. In 2008 there were 3244 families and 1341 privately owned houses on the territory of the Khaidarkan town authority. According to the evaluation of local residents, about half of all housing blocks are abandoned or in urgent need of repair. In 2007, 75 people moved to the territory and 200 people left the territory of the Khaidarkan town authority.

Banks and other institutions:

- “Ecobank”
- “Asiauniversalbank”
- “Amanbank”
- “Finka”

The number of registered non-governmental organizations – 1 (business incubator), number of community organizations (zhamaat, community, initiative groups) – 11.

Table 3 Education and other public establishments

Type and number of establishments	Number of children
Schools – 3	2527
Kindergartens – 1	150

Health care establishments: General Practice Centre – 1, dental surgery – 1, sanitary and epidemiological department – 1, drug store – 3. In the village there are a House of Culture, music school, library, bath houses and a club.

Agriculture and private domestic land:

The agricultural land is limited and the climate in Khaidarkan valley is not very favourable for agriculture. Hence the agricultural sector is not very developed. The homestead land takes up 83 ha (less than 25% of the village territory), and out of that 52 hectares are taken up by potato, and the rest by carrots and other vegetables. In the village there are 11 farms and 1295 personal land plots.

There are 4 mills, 1 mechanical workshop, 2 petrol stations, and 3 markets: main bazaar, vegetable and cattle bazaar, 36 small shops.

Infrastructure, including the access roads to the railway road:

The territory of the Khaidarkan town authority is 44 km away from Kadamzhay town, the centre of the Kadamzhay district, 65 km away from Batken and 75 km away from the nearest railway stations Kyzyl-Kya (Kyrgyzstan) and Margelan (Uzbekistan). The industrial cargo for Khaidarkan is transported by the Uzbek railway to the Margelan station.

There are 3 airports nearby Khaidarkan: Batken, Fergana (Uzbekistan) and Kyzyl-Kya. Civil use of the Fergana military air field, which is 75 km away from Khaidarkan, is restricted. The airports in Kyzyl-Kya and Batken are not big and their runway can only accommodate small planes. The nearest international airport is located in Osh, which is 170 km away.

The main transport infrastructure is the road “Osh – Isfana” – a route of republican significance. This is an asphalt covered road, but is in the unsatisfactory state as it hasn’t been repaired for more than 20 years. This road goes through the village and links it with Tajikistan, Uzbekistan, Kazakhstan, Turkmenistan and Russia. The capital road repair works are planned in the near future.

The transport infrastructure of the Khaidarkan village also includes a hard-surface road of 44 km, and gravel and dirt roads of 15 km.

Water supply:

The shaft waters pumped by the Khaidarkan Mercury Plant are discharged into the stream “Shakhtnaya” without any water treatment. These waters are used by the residents of the villages Eshme, Sur, and Chechme located downstream for irrigation purposes with the total territory of up to 500 hectares being irrigated using this water– about one quarter of all agricultural lands of the Khaidarkan valley.

In Khaidarkan the drinking water is supplied from surface water sources including the river Gavian. The same is true of the other nearby settlements. Surface water sources are also used for irrigation purposes.

At present, the annual water consumption of the Khaidarkan town and mining-smelting enterprise is about 1-2 mln m³ of water from surface (the river Gavian) and artesian sources. In the past the level of water consumption by the enterprise was about 4 mln m³. Tailing dump overflows and mine waters are drained into the Sokh river, and other waters (from the smelting industry) are discharged on to the top of the soil.

Table 4 Water supply network

Name	Length, km	Construction date
“Gauyan Taza Suu”	48	2005
Old water supply system	23	1961

Table 5 Access to irrigation water

Installations	Quantity	Length in km	State
Internal irrigation network	4		
Including non-covered	2	8	Unsatisfactory
	2	12	Satisfactory

Canals:	2		
1. Gauyan		18	Unsatisfactory
2. Gorotu		12	Satisfactory

The length of the sewage collector is 12 km. In 1970 three triple deck wet pits were constructed. The sewage generation volume is 440 m³ a day.

Solid household waste is centrally collected and delivered to the underground waste storage, which complies with the sanitary norms and also to the waste dump, which is 10 km away from the town. The annual solid household waste generation is about 5000 m³.

Energy Consumption:

Electricity is supplied by Khaidarkan branch of the “Oshelectro”. The staff is 8 people.

KMJSC is an energy-intense enterprise. Its electricity consumption totals 4500 Kw a month, whereas the pumping facilities to maintain appropriate water levels in the shaft consume 3100 thousand Kw.

KMJSC receives electricity via high-voltage electric mains of 35 kW and further el. transfer is done internally (within the enterprise) with of 35 kW, including up to 40% in the electric grid of the distribution company JSC “Oshelectro” for the residents of the Khaidarkan town. The main electricity consumer at the plant are the drain pumps of the mine, which are followed by rotary furnace of the smelting plant.

Other energy (electricity) consumers:

- Hotel recreation clinic and cultural palace;
- Town authority, kindergarten and 3 schools;
- Military base, rescue brigade;
- Khaidarkan hospital.

Population – 2823 subscribers, commercial bodies – 148 subscribers.

The length of the overhead electric system of 6 kW is around 14 km and of 0,4 kW – 18,3 km. The number of transformer substations in operation is 43 and out of that number 21 transformers belong to the Kadamzhay distribution zone.

Accounts receivable for electricity payment made (as of 1.05.09):

- Population – 11 669 523 som;
- Khaidarkan hospital – 455 603 som;
- Military base – 138 645 som;
- Village authority – 656 910 som.

Provision of the population with electricity is 90%, gas – 20%, coal – 50%, wood – 80% of the families.

3. Overview of the Khaidarkan Mercury Joint Stock Company (KMJSC)

3.1 Background

The first rotary kiln in Khaidarkan was built and started trial production of mercury in 1940.

Khaidarkan Mercury Plant named 'Combine plant no.5' was formally established in 1941 as a production facility alternative to Nikitovskiy Mercury Plant in Ukraine occupied by Nazi troops during the Second World War.

In 1950, it was renamed into Khaidarkan Mercury Plant (KMP). In 1990, the plant employed over three thousand persons.

In 1995, KMP was subject to modernization financed by the World Bank grant in the amount KGS 24 million and a loan of KGS 4 million for replenishment of the working capital. In the course of the re-construction and efficiency improvement intensification of operations in the mine was implemented; the government reduced the royalty from 12% to 2%. However, the prices for fuel and electricity grew up at the same time. As a result, the economic condition of the plant improved insignificantly. The number of employees decreased from 3,500 to 1,300 persons.

In 1996, due to a sharp fall in the world prices for mercury KMP was declared a bankrupt and was re-organized into Khaidarkan Mercury State Joint Stock Company under PESAC programme. All of its tax and payment debts were written off.

In 2002, the status of a state-run joint stock company was taken off and the plant was renamed into **Khaidarkan Mercury Joint Stock Company (KMJSC)**, and the state-owned share in the plant remained at the level of 95%.

Over the time of its operation the plant utilised several mercury deposits including Chauvay, Symap, Chonkoy, which no longer exploited because of unfavourable mining and technical conditions and reduced reserves. Currently, only deep layers of Khaidarkan deposit are being developed. Initially, simple mercury ores were extracted, and in 1968 mining of compound ore reserves in 'Mednaya' and 'Plavikovaya Mountain' started. For their treatment a processing plant producing mercury-antimony and fluorite concentrate was built.

The main product of the plant is metallic mercury and its compounds, as well as antimony concentrate and fluorite spar concentrate. Mercury is purchased by US, Netherlands, Russian and Kazakh firms. The importers of fluorite spar are countries of the CIS region: Russia, Kazakhstan, Tajikistan, and Uzbekistan. Material and technical supply is made through import from the CIS.

3.2 Structure of KMJSC

Currently, the structure of KMJSC incorporates the following units:

- 1) Management (Administration);
- 2) Two underground works;
- 3) Ore processing (enrichment) plant including tailings pond;
- 4) Metallurgical plant;
- 5) Laboratory (department of technical control and chemical laboratory)
- 6) Electromechanical shop;
- 7) Motor-transport shop;
- 8) Production shop;
- 9) Guards.

I. Underground works-I (RPR-1, Rudnik podzemnih rabot) specializes in the production of mono-metallic mercury ores with annual output of 150 000 tons. Mining operations have been conducted here from the Soviet times. Upper seams have been depleted. The number of employed is 275 persons, among them 250 workers, 25 engineering and technical staff;

PRP-1 includes: 'Vspomogatel'naya' mine, 'Novaya' mine, 'Vostochnaya' mine and '16' mine.

Currently, ore mining is conducted at deep levels.

1) 'Vspomogatel'naya' mine reaches the maximum depth of 400 m and includes eight extraction levels. An intensive influx of ground water (240 m³/hour) requires continuous water pumping up to 1000 m³/hour.

Static water level is located approximately at depth of 260-300 m. As a consequence, continuous water pumping with electricity consumption of 2600 kWh is required for ore mining at four lower seams.

2) 'Vostochnaya' mine with the output of 50-70 000 tons of ore is operated at three levels at a depth of 240 m. Equipment of 'Vostochnaya' mine is in good working order. Ore is delivered from two levels where 100-150 tons of ore are produced daily. The planned annual productivity is up to 70 000 tons of ore and 200 tons of metal per year. An average percentage of mercury in ore is 0.3%.

II. Underground works-II (RPR-2) was opened in 1989. It specializes in the production of complex ore in the 'Zapadnaya' mine. The number of employed is 142 persons, including 124 workers and 18 engineering and technical staff;

Operations at 'Zapadnaya' shaft are currently stopped due to financial difficulties of KMJSC. Before this halt, ore was mined at the depths max 580 m. All equipment is in good working order, except for some elements.

According to the initial plan, it was supposed to produce 300 000 tons of ore per year, although current potential productivity of 'Zapadnaya' shaft is estimated at 100 000 tons/y.

The content of the commercial components in ore is as follows: CaF₂ – 13-15%, Hg – 0.04%, Sb – 0.5%.

Ore mined in 'Zapadnaya' mine is processed at the enrichment plant. The planned extraction of mercury is 92%; antimony is 42%; and fluorite – 42%.

With this extraction level the annual commercial output is expected to be the following:

- mercury in concentrate – 40 t;
- antimony in concentrate – up to 500 t;
- fluorite – 5000 t.

The distance between the levels of the main workings is 40 m. The mined ore is loaded into cars by means of a track-riding loader and overhead wire locomotive delivers the filled cars to the shaft. The cars with ore are put into the shaft elevator and lifted up to the surface. The ventilation in the mine is of an induced air supply type. There is no natural ventilation. The applied system is open-faced mining, sublevel stoping, chamber-and-pillar method, shrinkage mining. Hand hammer drill, scraper and rail-tracked loader are used for extraction operations. A plan of geological exploration aimed at maintaining ore production in the future is not carried out.

According to the conclusion of Japanese experts [11], available mining machines are not suitable for operation with the existing ore bodies.

III. Ore processing (enrichment) plant treats complex ore delivered from RPR-2 to produce fluorite spar concentrate. Mercury and antimony are associated components. The plant consists of a desulphurizing floatation line for removal of cinnobar and antimonite, and a line for floatation of fluorite spar.

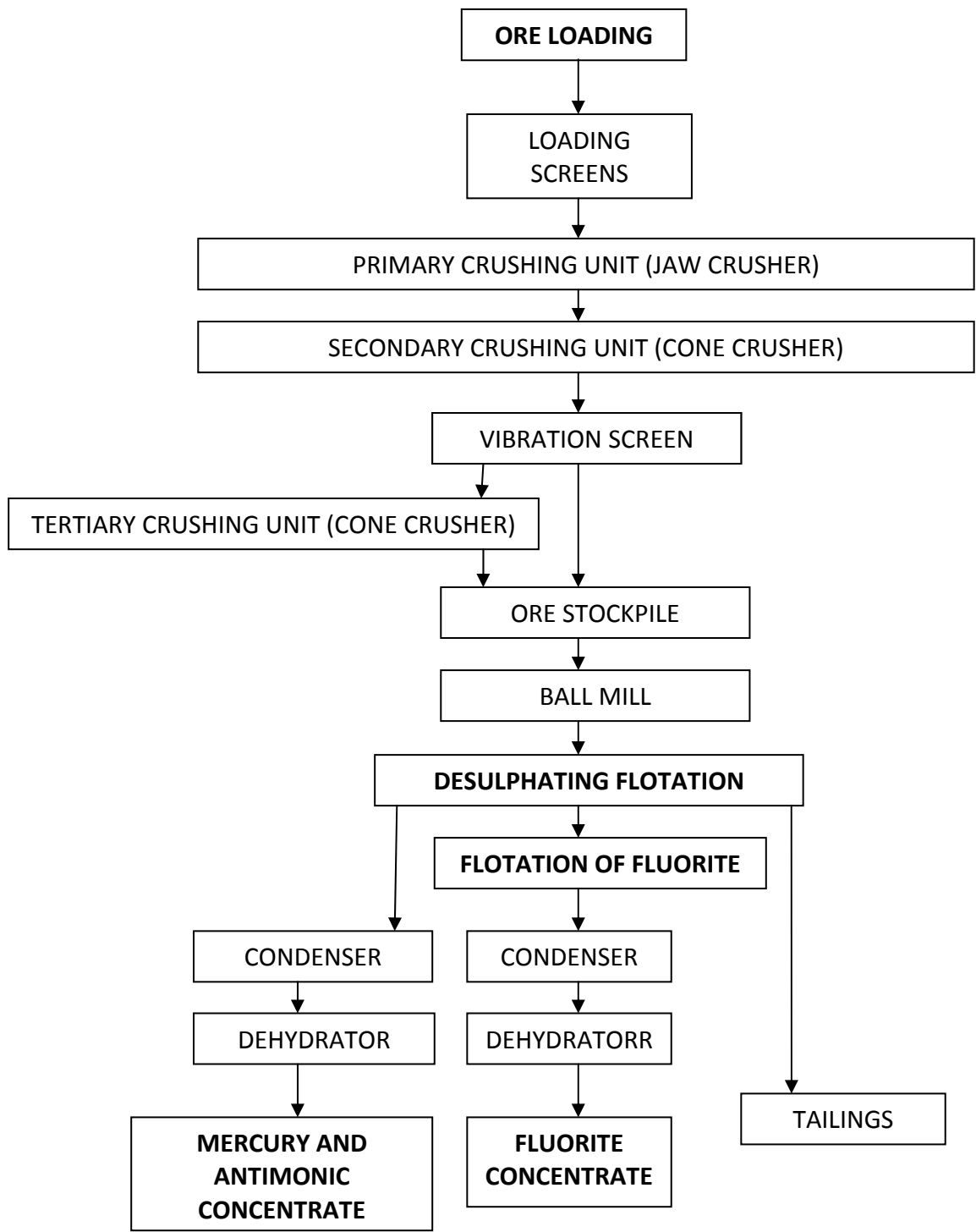
The productivity of the plant is 300 tons of ore per day. Annually, the plant is capable of processing 100 thousand tons of ore. All the equipment of the processing plant is in working condition, but reconstruction of certain elements is required. Japanese experts who conducted the study of facilities in 1998 [11], concluded that the existing equipment is subject to the substantial level of wearing, and automation is inadequate. The number of employed is 71 persons including 62 workers and 9 engineers and technical staff.

The tailings storage of the processing plant has been operational since 1967. The area of the tailings is 22.8 hectares; the planned capacity is 8.4 million tons. Sludge from the processing plant is delivered to the tailings via a conduit 5,500 m long. The waste comprises of: mercury (0.003 mg/l), arsenic (0,005 mg/l), antimony (21.5 mg/l), sulphates, nitrites, chlorides (26.5 mg/l), other chemicals: aluminium sulphate, liquid glass, sulfonate, flotation oil.

Chemical cleaning of the sludge is made by feeding solution of aluminium sulphate and lime milk to the tailings settlement pond at the processing plant, which purifies the sludge of metal salts and reagents and avoids accumulation of the sludge in water. The tailings dump has not waterproof sealing at the bottom or sides.

Currently, the state of tailings conduits is not satisfactory. Leakages of the waste containing mercury, arsenic, antimony, floating chemical agents are frequently registered. The installed piezometers are out of operation

Figure 4 Process flow chart of the dressing plant at Khaidarkan Mercury Plant



IV. Metallurgical plant treats ore delivered from RPR-1 without preliminary treatment. It also processes mercury–antimony concentrate from the processing plant. The number of employees is 102 persons; incl. 12 technical and engineering staff. The working day at the plant is six hours and consists of four shifts.

The main equipment of the plant is the crusher, rotary kilns and condenser. The metallurgical plant consists of the two smelter divisions: rotary kilns section and fluid-bed furnace section.

1) rotary kilns process ore of two grades (high grade ore and run-of-mine ore), as well as cakes and recyclable products (sludge, imported mercury waste etc). Rotary kiln consists of a drum, burner and dust chambers, cyclone separators for removal of dust, condensation system for capture of gaseous mercury, ventilator, receiving hoppers for ore, and hoppers for scoria.

Currently, only one or two rotary kilns are in operation (d=2.2; L=22 m); the productivity of each rotary kiln 10-12 t/hour with the daily output 240-280 t.

In addition, the metallurgical plant uses 3 jaw crushers of SMD-9 series, one hammer crusher for crushing concentrate, mercury filtration section, filling section, emissions treatment shop, two thickeners, treatment facilities, sludge ponds.

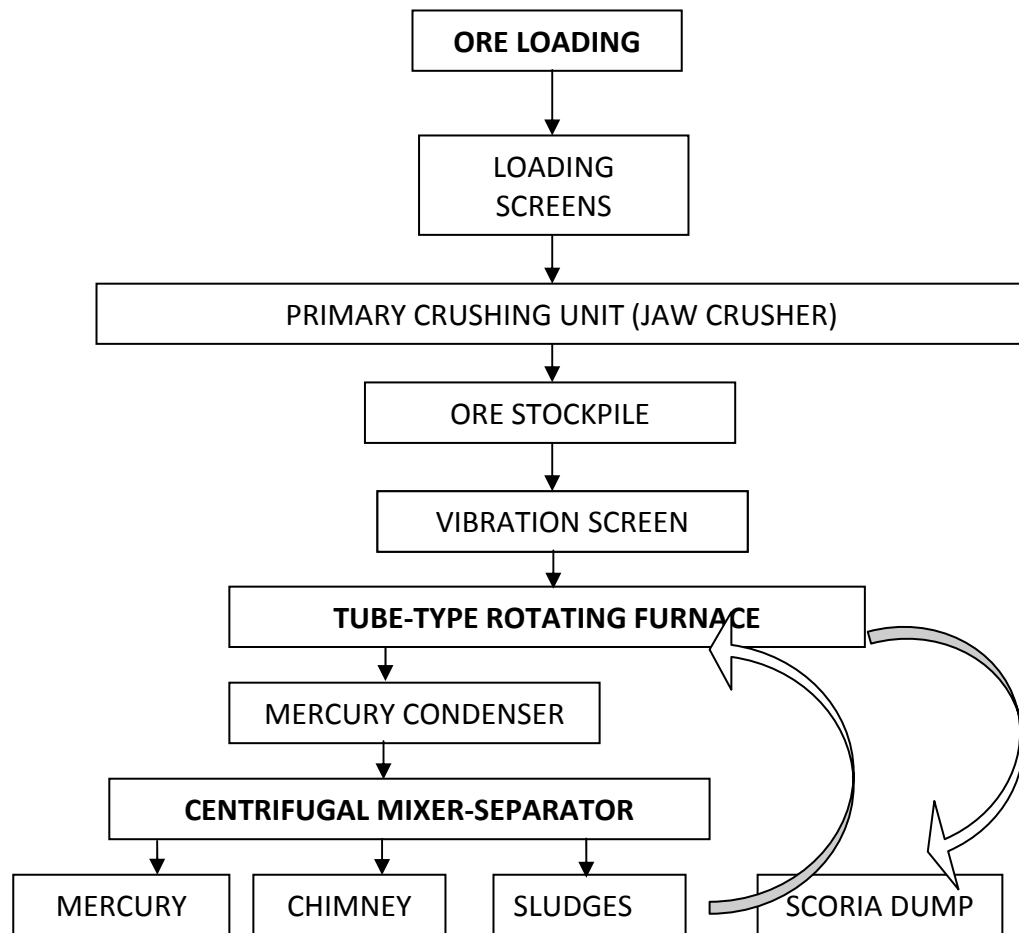
The main fuel is natural gas (with black oil as backup fuel). The natural gas consumption is 6-8 000m³/day; the electricity consumption is 6-7 000 kWh per day.

The level of rotary kilns equipment wear is about 30%; upper and lower seals of the rotary kilns, condensation system and lining need to be repaired.

2) Fluid-bed furnace (FB) is used for processing of mercury-antimony concentrates. The productivity of the furnace is 2 t/hour, the daily productivity is 48 t.

FB furnace facility consists of a furnace shell, a part for charging of the concentrate, an element for discharge of cinder from cyclone separator, a condensation system, a process ventilator, a scrubber for cleaning of gas from dust, an overhead crane, an ore telfer crane and diffuser grid.

Roasting of the concentrate is made in an uninterrupted mode with automatic control of material loading and unloading. The equipment of the FB furnace is in good working condition. Partial repair is required.

Figure 5 Process flow chart: ore treatment at the metallurgical plant

VI. Laboratory (QC and Chemical laboratory)

The laboratory (41 employees) consists of two sections:

- 1) QC – quality control department, which major work is the weighing of the raw materials, ore and scoria sampling, sample drying and preparation.
- 2) The chemical laboratory carries out chemical analysis of mercury, antimony and fluorite spar tests.

VII. Energomechanical shop includes the following units: Water Supply System, Compressor Plant, Telephone Station, Machine Shop, Electrical Substations, Instrumentation and Control Laboratory. The headcount of the shop is 101 persons including 7 employees with engineering and technical qualification.

Water supply to the production facility is provided from the main water intake by gravity flow via a water pipeline of 7 km.

Water consumers are: RPR- 1, Metallurgical Plant, Processing plant, Compressor station, Khaidarkan settlement and Ormosh village. Water is flowing via three water pipelines of 273

– 530 mm in diameter and is distributed among the consumers. The maintenance is carried out by 4 persons: 3 mechanic fitters and 1 electric and gas welder.

Water supply to the process sites of KMJSC is provided from 'Gauyan' water intake via a 273 mm pipeline. The annual water consumption of KMJSC amounted to:

- 1563 000 m³ - in 2005
- 1407 000 m³ - in 2006
- 1297 000 m³ - in 2007
- 1119 000 m³ - in 2008

Compressor station produces compressed air and distributes it among the plant's consumers. The plant possesses 4 compressor of 3NV-4K-315/520 type with output of 100 m³/min, manufactured in GDR (1985). The electricity consumption is 20000 kW/day, with a 3-shift operation. Currently, 1-2 compressors are in operation. Production of the compressed air is 52000 m³/hour.

Service: machine operators on duty – 7 persons, maintenance fitters – 5 persons, electrical welder – 1 person.

Telephone station is equipped with PABX (private automatic branch exchange) – 600, ATSC equipment – 100 and distance dialling translators. Service: 12 persons.

Mechanical shop carries out repair and manufacture of elements for mining equipment and motor-transport shop of the company. The shop has 49 machine-tools of various functions and designations, including the automated ones.

The headcount of the shop is 18 persons, of which: 9 turners, 1 miller, 1 smith, 2 welders, 3 mechanic fitters, 1 cutter on saws and machine-tools, 1 stock keeper.

Electrical substations ensure distribution of electricity for subdivisions of the plant and Khaidarkan settlement. Since interruption in power supply for a technological process cannot be allowed, electricity is also bought from Tadjik and Uzbek power grids. The maintenance is carried out by 17 persons.

KMJSC comprises 2 substations – 'Khaidarkan' and 'Fabrichnaya'. Each of them has two transformers TM – 5600 - 35/6 kV and TM – 6300 - 35/6 kV accordingly. The substations are linked to each other by an electricity transmission line of 35 kV, which ensures reliability of power supply to KMJSC at a level corresponding to the 1st category consumer.

Monthly electricity consumption by the consumers is 4,830 kW. The total annual electricity consumption at the enterprise is 42-54 mln. kW.

Instrumentation and Control Laboratory carries out repair and adjustment of electrical equipment, measurement and automation devices, equipment and devices for surface and underground operations. The enterprise employs 10 persons.

VIII. Motor Transport Shop

The number of employed in the shop is 78 persons including 9 engineering and technical staff. The shop has 41 pieces of equipment, 28 of them are in good working order.

Table 6 Technical equipment at Khaidarkan mine

Equipment item	Type	Number, in working order	Number, out of service
Loader	K-701	-	1
Loader	TO-30	-	1
Dump truck	KRAZ -256	3	2
High sided truck	KAMAZ 5320	3	1
Traction truck	KAMAZ 5410	1	1
High sided truck	MAZ-53234	1	-
Dump truck	KRAZ -6510	1	-
Dump truck	KAMAZ -5511	1	-
Dump truck	BELAZ-540	-	2
Dump truck	Sinotruk	2	-
Dump truck	MAZ -5549	2	-
Dump truck	MAZ-5551	1	-
Bus	PAZ-3205, 4234	2	-
Crew change vehicle	GAZ-66	1	-
Passenger car	GAZ-3130, 3129	2	-
Passenger car	VAZ-21213	1	-
Cargo and passenger vehicle	UAZ-39094	1	-
Truck crane	ZIL-130 GIA	1	-
Sprinkling truck	ZIL-43412	1	-
Cargo platform vehicle	Shidayu	1	-
Bulldozer	T-130	1	-
Digger	EO	1	-

IX. Production shop carries out repair and construction work, saw cut and processing of timber, manufactures garment and polymeric articles. The number of employees 27 persons.

The shop is equipped with:

- power-saw bench P-63;
- wood-working machinery (circular, milling, straightening)
- sewing machines
- injection-molding machine D-3388;
- polyethylene production line

Thus, the total average annual number of employees at KMJCS over the last 10 years is 928 persons, the annual pay-roll – KGS 60 million. According to the Audit Commission's report for 2008, the annual pay-roll amounts to KGS 36.107 million.

4. Economic performance indicators of KMJSC and impact on the local economy²

The gross regional product (GRP) of the Batken province amounts to KGS 3550 million (3% of the Republic's GDP in 2006). GRP per capita totals KGS 8,439, which is 2.5 time below the country's average level.

KMJSC accounts for 4 out of USD 23 million of the region's export (2007), and for USD 1 million of import.

Table 7 Gross regional product and output of KMJSC in the current prices (KGS million)

	2002	2003	2004	2005	2006	2007
Batken Province	2990.6	3452.2	3637.6	3083	3550.3	4958.7
KMJSC	112.9	96.9	178.9	188.9	108.3	169.6
Share in the GRP, %	3.8	2.8	4.9	6.1	3.1	3.4

Table 8 Input into Batken Province GRP by sectors

Sector	%
Agriculture	58.3
Industry	9.1
Infrastructure and maintenance	6.4
Construction	7.2
Service sector	5.8
Public sector	7.4
Social sector	6.9

Industry is the second largest sector of the region's economy. The industry's input into GRP is about 10%, including 3% of KMJSC.

Product of KMJSC:

In 2000-2008, industrial operations at Khaidarkan annually produced on average 400 tons of mercury and 2135 tons³ of fluorospar concentrate. The output per employee at KMJSC amounts to KGS 170 thousand.

² Since figures taken from different sources vary, variances in the text are also possible

³ According to the study [9] with adjustment

The table below shows the actual revenue of the company and its annual productivity over the period from 2000 to 2008.

Table 9 Revenue and productivity of KMJSC in the period of 2000-2008

		2000	2001	2002	2003	2004	2005	2006	2007	2008	Aver.
1. Mercury	tons	550	574.4	541.7	370	488	303.5	169.6	331.5	270	400
2. Fluorite concentrate	tons	3232	1175	2656	1234	3358	3139	2845	898	1159	2188
3. Marketable product in real prices	KGS mln.	126	120	112	96	178	188	108	169	147	138

Development investments and financial state of KMJSC:

Over the period of 2000-2008, no any work to disburse capital expenditures involving contractor organizations was carried out.

In 2008, KMJSC product sales amounted to KGS 147.8 million⁴. The proceeds from sold product, services and materials totalled KGS 160.8 million.

The funds spent for payment of pay-roll were KGS 36 million, for procurement of materials and services – KGS 95.6 million. Deductions to the social fund made up KGS 12 million; other payments – KGS 17.2 million.

As of the 01.05.2009, the company's accounts payable amounted to KGS 52.2 million, including the debts under the following items:

- pay-roll – KGS 12.8 million,
- payment for natural gas supplies – KGS 13.5 million,
- payment for electricity – KGS 12.3 million,
- other – KGS 7.1 million.

Labour market:

Over the period 2000–2008, the growth of unemployment was registered in the region, excluding 2002. As of the end of 2007, the official number of the registered unemployed in the region was 6597 persons.

Young people, aged 30-40 years old, accounted for major share of those unemployed making up 30.8% of the total registered unemployment. Men accounted for 66 % of the total number of unemployed population. One in ten officially registered unemployed persons is a specialist with higher education and specialized secondary education. In 2007, an average monthly salary in Batken region was at the level of KGS 2779 (77 USD). Industrial employment makes up 13.9 000 persons, where KMJSC accounts for 6%.

⁴ Source: Report of the Audit Commission on performance of Khaidarkan Mercury Joint Stock Company for 2008

Direct employment:

The table shows the number of employees on the pay-roll of KMJSC split by years over 5 years of the plant's operation.

Table 10 Headcount on the payroll of KMJSC*

	2000	2001	2002	2003	2004	2005	2006	2007	2008	Aver.
Headcount	1054	1030	976	913	930	959	870	867	860	940

* actual employment is approximately 100 persons less.

Indirect employment and scope of services⁵:

In recent years, average annual expenses of KMJSC for procurement of commodities and materials at the local level, for payment of services rendered by external organizations amounted to KGS 113 million, including:

- outsourced services – KGS 49 million
- procurement of commodities and materials – KGS 37 million
- other payments – KGS 27 million

In order to carry out their economic activity, the structural units of KMJSC make use of the services rendered by external organizations (see table below).

Table 11 Cost of services provided to KMJSC by external organizations

List of contractor organizations - suppliers of materials and services	Cost thou. som	Contractor organizations
Railway services	4656	Kyzyl-Kya railway station
Electricity supply	43000	Osh Electric Enterprise (Osh PES), Kadamzhay electricity transmission lines 110 kWt and Bakten electricity transmission lines - 35 kWt
Communication services	1023	Kyrgyztelecom
Customs services	16	Kadamzhay Customs
Bank services	243	PromStroiBank of Kadamzhay settlement
Technical check-up	2	State Traffic Patrol Department in Kadamzhay district
Total	48940	

All other services are carried out by internal resources of the structural units and divisions of the plant. These services include:

- repair services
- cargo forwarding
- personnel training
- water supply
- project design work

⁵ Calculation of indirect and induced employment was taken from [9] with some amendments

- construction work
- sample analysis
- guarding service
- geological exploration, drilling
- road transport services.

Calculation of indirect employment split by enterprises was made on the basis of the scope of work fulfilled for the plant, average monthly salary on the territory of Batken region and specific weight of salaries against the product distribution cost⁶. The calculation of the average annual headcount of contractor organizations providing their services to KMJSC is given below

Table 12 Number of employees in organizations providing services to KMJSC

Suppliers of materials and service providers	Average annual scope of services rendered, in thousand KGS	Average annual salary, in KGS	Specific weight of salary against the cost of scope of provided services, in %	Average annual number of employees
Railway services	4656	14417	20.83	67
Electricity	43000	33910	8.29	105
Communication services	1023	14417	20.83	15
Customs services	16	14417	20.83	1
Bank services	243	14842	43.12	7
Technical check-up	2	14842	18.28	1
Total	48940			196

Supply of commodities and materials:

The applied materials and equipment are mainly imported from the NIS and far abroad countries with local procurement accounting for only a small share. An average annual volume of procurement (commodities and materials) (over 9 years) is 37.270 million KGS.

Data of the National Statistics Committee of the Kyrgyz Republic on the average annual salary in Batken Province and specific weight of labour remuneration of commercial enterprises against the annual commodity turnover [14] were used for calculation of the indirect employment. The number of employees working at the enterprises supplying commodities and materials to KMJSC (per scope of work fulfilled) is 328 persons.

⁶ Data for calculation were taken from the publications of the National Statistics Committee of the Kyrgyz Republic "Industry of the Kyrgyz Republic in 1999-2003" tables 30, 31 and "Finances of enterprises of Kyrgyz Republic"[14].

Induced employment:

Average annual number of regular employees of KMJSC over the last 9 years is 940 persons. Number of people employed in social sector of Khaidarkan is 581 persons:

- education - 234 persons
- healthcare - 242 persons
- trade -105 persons.

The average family in Khaidarkan settlement consists of 6 persons. Taking into account all dependants, the population directly related to KMJSC was determined to be $940 \times 6 = 5640$ persons, or 52% of the total number of residents. Thus, the number of people employed in the social sector, who are connected with the plant, makes up to 300 persons.

Table 13 Indirect and induced employment of population resulting from activity of KMJSC

Indicators	Average annual headcount, persons
Organizations providing services	196
Suppliers of materials, equipment	328
Total	524
Induced employment	302
Total employment	823

The average annual indirect and induced employment totals 823 persons, i.e. one working place at the plant creates 0.9 related working places.

Input into public revenue:

An average annual amount of revenues from KMJSC to the budget of the Republic and to the local budget over the 9-year period amounted to 14.9 million KGS, payments to the social fund –10.4 million KGS. Payments of regress suits amounting to 1.4. million KGS are referred to additional payments.

The table below shows annual proceeds to the state budget from tax and payments.

Table 14 *Annual proceeds to the budget of the republic from taxes and payments resulting from KMJSC operation (thousands of KGS)*

	2000	2001	2002	2003	2004	2005	2006	2007	2008	Aver.
Taxes paid	24172	19707	26876	15728	19530	24814	2551	802	0	14909
Social deductions	7192	6466	13558	8556	10404	12616	11451	11250	11990	10387
Total	31364	26173	40434	24284	29934	37431	14002	12052	11990	25296

The company exports its product with zero VAT rate that is why all VAT payments to suppliers for services and materials (electricity, fuel and lubricants, spare parts, transport

costs) and VAT paid when importing raw stuff and materials from abroad (explosives, spare parts) are reimbursed to the company from the state budget, or are compensated by setting off the accrued taxes.

Table 15 Average retained cost resulting from administrative activity of KMJSC

Indicators	Average annual amount, thousands KGS
Services provided by external organizations	48940
Cost of commodities and materials manufactured in Kyrgyzstan	638
Cost of imported commodities and materials purchased in Kyrgyzstan	37270
Mark-ups of procurement agencies 20%	7454
Salaries	36108
Taxes and payments to Social Fund	25296
Regress suits	1499
Total	119935

5. Potential for mineral resources in the area of the Khaidarkan Mercury Plant⁷

The Batken province, where the Khaidarkan Mercury Plant (KMP) is located, is among the key areas of the Kyrgyz Republic in terms of diversity and concentration of industrially significant mineral resources. For many years it has been the place where oil, natural gas, coal, antimony, mercury, fluorite, have been extracted together with raw materials for the production of glass, concrete, agloporite, fire-resistant and construction bricks. Over the years a significant mining skills and traditions have been developed in the region. The Khaidarkan mercury and Kadamzhay antimony deposits are of global significance due to their high initial metal reserves. There are also unexplored resources of gold, tantalum, niobium, alumina, mineral pigments and gypsum. This range of minerals and resources provides various options to convert the mercury mining practices to alternatives and keep a mining profile of the town.

Of many mineral deposits in the region experts have selected the most promising that could potentially be developed by the Khaidarkan Mercury Plant. Descriptions of the reserves of some mineral deposits in the Batken Province and rough estimates of their economic potential are presented below with the emphasis being on those deposits which are commercially accessible for the Khaidarkan Mercury Plant.

5.1 Nadir Iron Deposit

This deposit is 5 km to the north of KMP in the valley of the Sartaly river. It is located in an economically developed and accessible area. The deposit is found as a series of steep sheetlike deposits of hematite (micaceous iron ore) and black iron ores. The northern and southern ore zones have a length of 4,5 km and thickness of 2 to 15 meters and have been explored at the Central ground, where the iron content varies from 30,5% to 53%. According to different assessments the iron ore reserve is about 2 mln tons. The average iron content in black iron ore is about 44%. Apart from iron, the ore also contains manganese – 2,11%, nickel – 0,05%, titanium – 0,3% and vanadium – 4%. The experts conclude [1] that it is possible to organize exploratory and operational works in the Southern zone for technological magnetic iron ores using low-tonnage Chinese technologies.

5.2 Alumina

Zardalekskoye deposit of nephelinic syenites is located on the right side of the gorge in the mid-section of the river Sokh and is found at the height of 1800 – 3200m. The nearest railway station, Isphara, is 80 km away and KMP is 40 km to the east. A gravel road (4,5 – 5 km) connects the low areas of the deposit with the tarmac surfaced road along the valley of

⁷ The section has mainly been developed on the basis of [1].

the Sokh river. The area is well settled and explored. The nepheline content in the ore is about 70%. Areas for primary quarrying have been identified:

“Nizhneye” (“low”) (aluminum oxide content 22,42%, silicious module 3,87, alkaline module 0,88, reserves of Al_2O_3 for C1+C2 categories – 19, 68 mln tons).

“Yuzhnoye” (southern) (Al_2O_3 content – 22, 62%, silicious module – 3,79, alkaline module – 0,86, reserves of Al_2O_3 for C1 category – 53,86 mln tons).

“The Youth” (Al_2O_3 content – 22, 31%, silicious module – 3,90, alkaline module – 0,90, Al_2O_3 stock, C1 category – 49.37 mln tons)

Technological tests of ores have been conducted and deposits of carbonaceous material, fluorspar, as well as coal make this location even more attractive. The prospects of the expanding nepheline ore extraction in the adjacent deposits are quite significant. The total predicted reserves of aluminum oxide are 4 bln tons.

A group of small bauxite and allite deposits with a relatively high content of aluminum oxide (42 to 59%) have been discovered in the Batken Province.

Akshagyl deposit is located in the Batken district in the low foothills of the Turkestan Range on the left bank of the Karabulak river. This is 30 km south-east of the Shurab railway station, 15 km southwest of Batken town and the electric main and 50 km to the west of Khaidarkan. It is located at 1150-1921 m above sea level. The aluminum oxide content varies from 39% to 76%; silicious module 4.3 – 8.8.

The possible reserves of aluminum oxide are 217,7 thousand tons with the average content of about 46%.

Shadymirskoye deposit is located in Lyalyak district on the northern side of the Ravatsk depression, 25 km east of Lyalyak river. The distance to the nearest motor road is 6 km and to the nearest railway station, electric main and settlement is 25 km. The height above sea level is 1600-2500 m. The width of the bauxite bearing zone is 4 km. The size of the ore body is 38-226 m in length and 0.6-14 in thickness. . The aluminum oxide content is 43%. It has been calculated that there are 245 800 tons of reserves of aluminum oxide.

Kantranbashynskoye deposit is located in Kadamzhay district on the southern slopes of the Katranbashi mountains. It stretches for 32 km from the Sokh river to Sartala-Okhtinskaya valley and is 0,5-3 km wide. The deposit consists of a large group of more than 100 contiguous ore zones. There are no permanent water courses at the site of the deposit. The nearest settlement is Boz-Adyr, 7-8 km to the south-west and the height above sea level is 1280-3171 m. The distance to the electric main is 20 km, to railway access 75 km, and to the Khaidarkan mercury plant, 7-15 km. The length of the ore bodies is 10 to 160 meters, and they are 1-20 m thick. The bauxites belong to the high aluminacategories and an aluminum oxide content varying from 38,4% to 62,8% with an average of 46,8%. The content of the silicic acid is 6,4% to 20,9% and silicious module is 3.0 to 6.0. The reserve of the aluminum oxide has been assessed for 18 ore bodies and predicted reserves assessed for 22 further

bodies or ore with aluminum oxide content at the level of 46%. In total they make up 1431 thousand tons of ore reserves. The mining conditions are favourable for local quarrying.

Karangalinskoye deposit is located in Kadamzhay district along the northern foot of the Aktash in the foothills of Turkestan mountains. It stretches for 21 km from the Shakhimardan river to the Dangurek-Dange gorge. The width of the minable (bauxite containing) outcrop is 3-4 km. The area is well developed. Height above sea level is 1450 – 1800 m. The distance to the road and the river is 1-2 km, and to the electric mains, 5-7 km. At the deposit 3 lenses are known - 60m, 1959m and 970m. The productive layer is south facing flat pitch at 0-15°. The average aluminum oxide content is 38,3%, silicious module 0,98 to 1.04. The forecast of possible reserves has been assessed for 3 lenses and is 18 681 thousand tons.

Also there are other smaller bauxite and allites occurrences. These deposits should be studied for the possibility of mining by small mining partnerships to supply the ore or aluminum oxide to the Tajik Aluminum Plant located 400 km away by railway road)=.

The experts [1] assume that the exploration and development of the aluminum oxide s may be profitable if the prime cost for aluminum oxide makes 15\$ per ton.

5.3 Polymetals

The polymetal deposit of Dzhilisu is located in the high-altitude part of the northern Turkestan Range slope in the Dzhilisu river basin, at the height of 3000 to 3500 m. It is a very hard to get to area. The nearest motor road and small settlements are 45 km to the west of the deposit in the valley of the Sokh river. Geological and industrial type – crosscutting steeply dipping crushed veins and lodes. The ore composition is multi component (copper, lead, zinc, silver). The crushed vein is up to 4 km in length and the average thickness is 8.7 meters. The lead content varies from 0,07 to 22,96%, copper 0.95- 3,24, zinc – 0,9%, gold

5.4 Wolfram and Molybdenum

In the Batken Province there are 8 registered wolfram and molybdenum sites of which five – Meliksy, Kumush-Tash, Besh-Archa, Kichikalaj, Krarkanysh – are classified as small deposits. The first three of these form the group of contiguous deposits in the upper part of the Isphairam river. The nearest road and the settlement are 1,5 – 5 km away and the distance to the electric mains, railway and to KMP are about 60 km.

Meliksu deposit: This was prospected in detail and then partially developed during the Second World War. Rich ores from the upper horizons have been extracted, whilst the lower ones have not been studied well. The concentration of the tungsten trioxide in the upper horizons was 2,6% to 12,4%, with the average concentration being 6,6%. The recovery technology with gravitational floatation, showed recovery in the laboratory tests up to 62%.

Possible reserves of the lower horizons (up to the depth of 150m) include 72 thousand tons of tungsten trioxide and 4,35 thousand tons, WO_3 with a concentration of 6%.

Kumysh-Tash and Besh-Archa deposits of wolfram and molybdenum are located at the height of 2800 – 3000 meters above sea level and have not been explored in detail.

Estimated possible reserves include 14800000 tons in ore, and 53000 tons of WO_3 with an average concentration of 0,35%.

According to the conclusions of the authors [1], exploitation of the tungsten trioxide mineral base is possible at the Meliksuiskaya group of contiguous deposits, with possible reserves of 61700 tons of WO_3 .

5.5 Deposits of gold and accompanying elements

About 25 gold mining sites of various scale have been identified in the Batken Province. This number includes 4 medium sized stock deposits (Altyn-Dzhilga, Tchakush, Nichkesu, Kanyzak), and 13 small deposits (Aprelskoye, Arasang, Gavian, Duvatash, Dry Lake, Southern, Chonkimisdyyky, Kugandy, Dzhumasy and others). All auriferous deposits are concentrated on the northern slope of the Turkestan Range in an area from the river Sokh to the rivers Karavshin, Lyailyak at the height of 1500 – 4000m above the sea level within the Turkestan sector of the Turkestan-Alay auriferous belt. These are in an economically developed district.

The common sizes of auriferous veins are 20-300-500 m x 0,1-7 m (max 15,7m), of ore bearing zones – 25-600m x 1.0-4.6 m (max 25 m), skarn gold-bearing bodies 0-35-400m x 2.5 – 17.60 m, mineralized dikes – 900 x 7.25x450m. These are mainly crude ores (gold content 3-7g/t) and rich ores (7-11,6 g/t – Aprelskoye, Gavian, Southern, Nau-M and other). The gold bearing deposits have not been prospected in detail.

The Aprelskoye deposit is located in the Lyailyak district at the source of the Almaly spring (left influent of the Lyailyak river) at a height of 1800 – 2000 meters above the sea level in the economically developed area. The distance to the nearest motor road in the Lyailyak river valley is 6 km and to the Uzgurmash settlement – 8km, and the main motorway Isphana – Batken – Osh – 20km, and to the nearest railway station Proletarskaya (in Tajikistan) – 100 km. The distance to the Khaidarkan mercury plant is 150 km.

Possible gold reserves for the ore constitute – 122 thousand tons, for gold – 1,42 tons with the average content of 11,63 g/t. These are golden-quartz and polysulphide ores. The Bonantzevaya vein is most prominent at the deposit and the gold content is 26,3 g/t with total reserves of about 1 ton of gold.

Kanyzak deposit is located in the upper part of the Karavshina river at a height of 1650-2900m above the sea level. The distance to the nearest settlement Bedek is 24 km, to the motor road Isphana-Batken-Osh – 55 k and to the railway station Isphara (in Tajikistan) – 70 km. The distance to the Khaidarkan mercury plant is about 100 km. It consists of a base ore with gold content of 0,5 – 9.0 g/t. The possible reserves have been calculated up to a depth of 10 meters as 6584 kg of gold, and up to 50 meters as 32.9 tons. It is possible that additional mineralized zones might be discovered. The authors point out at the high commercial prospects of the deposit.

The high gold content zones of these 2 deposits mean that ore can be transported for processing to the Khaidarkan mercury plant despite the significant distances.

Altyn-Dzhilga deposit is located in the Batken district on the left side of the river Sokh valley at a height of 1800 – 2400 m above the sea level with easy to access an economically developed area. It is very close to the motor road and electric mains. The distance to the nearest railway is 80 km and to the Khaidarkan mercury mine, 60 km. The deposit has been explored in good detail. The technological ore tests demonstrate the possibility of 91.6% gold recovery using a flotation-cyanide scheme or 90.5% using gravitation-cyanide, and 89.4% using direct leaching Based on the works conducted by the Japanese company Mindeko in 1998-1999, the stock and gold reserves has been assessed as follows for C2+P1+2 categories: ore – 3821 thousand tons, gold – 29,3 thousand tons (content – 7,67g/t). The total deposit reserves constitute 35-40 tons of gold.

Chakush deposit is located in the mid part of the Sokh river at a height of 1500 – 2400 meters above the sea level in an easily accessible developed area next to a motor road and electricity supply. The dirt road connects the deposit with Augul settlement (4 km) which is 10 km to the north-east of the Altyn-Dzhigla deposit. The distance to the Khaidarkan mercury plant is 55 km and the nearest railway station is 100 km. Altyn-Dzhigla deposit is located 10 km to the south along the Sokh river valley, and Duvatsh deposit is 10 km to the north.

Geological type – veined, gold-quartz-sulphide ores, ranging from basic to rich. Gold content varies from 0,5 g/t up to 25 g/t, rarely up to 50,6 g/t (ore body 1). The average gold content in 22 main veins is from 3,25 -8,82 g/t (16 veins) up to 10.4 – 18.2 g/t (6 veins).

The possible reserves of gold for P1 category at depths of 30-200 m is (as of 01.01.2007): 1 mln 52 thousand tons of ore and 6104 kg of metal. Five ore veins (1,2, 12, 15, 17) might contain about 3,5 tons of gold with the average content of 11.0g/t in ore. The possible reserves of the flanks and deep adits for P2 category are assessed at 30 tons of gold. The authors of the report recommend this deposit for priority mining by mining partnerships.

Duvatash deposit is located on the left side of the Sokh river valley next to the motor way, electric supply and Sogment settlement at the height of 1600 – 1700 m above the sea level. The distance to the motor road Isphana – Batken – Osh is 3,5 km, to Khaidarkan settlement 35 km, and to the nearest railway station at Isphara – 60 km.

The productive gold ore mineralization is concentrated in 3 ore bearing zones, which are 400 – 440 meters long, 1-8 to 5-28 meters thick and the gold content ranging from 0.12 to 14.4 – 52.4 g/t. Type of ore –sulphide-kwartz-gold

The known and possible reserve for categories C2+P1+P2: ore – 1936 thousand tons, gold – 8185 kg with the content of 4,22%. The deposit has been referred to as prospective.

Nichkesu deposit is located in Kadamzhay district on the northern slopes of the Alayi Range at the source of the Tegermach spring at a height of 3300 – 4000 meters in a poorly economically developed area. The nearest settlement and electricity supply is located 40 km to the north of the deposit. The deposit appears as a series of 58 veins of various mineralization types. The length of the auriferous veins and mineralized zones is 220 meters, with a thickness of between 1,35 and 10,4 meters; The gold content ranges widely from 1,0 – 17,8 g/t, with a maximum of – 180 g/t. The composition is sulphide and gold with arsenic iron. The ore body number 10 has the highest mineralization concentration.

A laboratory study has recommended direct leaching as the main enrichment method. This ensures a gold recovery of about 98%.

In 1995 stocks and reserves for C2+P1+P2 were: ore – 16070 thousand tons, gold – 90492,3 kg (content 3,87 g/t), silver – 2379,2 tons (content 101,7 g/t), copper – 12,45 thousand tons (content 0,05%). In 2004, it was calculated that ore zone 10 the most well-studied zone, 11,6 tons of gold with the content of 5,38g/t. could be found. The deposit, together with contiguous ore occurrences of Chonkimisdikty, Kugandy, Dry Lake, Southern, Dzhymasu form an ore cluster, which according to an expert assessment contains 71 tons of gold.

Savoyardy deposit is located in the Karakuldzhinskiy district of the Osh Province at a distance of 370 km from the Khaidarkan mercury plant. Despite such a significant distance, the company owning the reserve intends to transport ore for processing to the Khaidarkan mercury plant. The deposit is 2,5-3,0 km away from the motor road. Stocks of antimony, gold and silver has been assessed on the basis of geological and exploratory work results. The deposit is recommended for mining as a small complex deposit by the authors of the geological report. Six ore bearing zones of gold and sulphide mineralization have been identified at the deposit. The lengths of the zones with the established mineralization is 1350 m, with a thickness of 0,5 to 8 meters. Various authors have calculated reserves for P1 category: antimony – 40460-42291 tons and gold – 6 to 11.5 tons.

Alluvial gold deposits

An alluvial deposit 12 km long, can be found in flood plain and terraces the Aksu river. Possible gold reserves for category P1 are assessed as 300 kg with content 0,2 g/m³.

The possible reserves of the channel-fill placer and flood plain placer along the Sokh river (25 km long) in the enriched parts are assessed as category P1 of 260,7 kg with gold content in the sand being 0,395 g/m³, and total for placer – 960 kg (0,192 g/m³).

5.6 Non metallic mineral resources

The area is very rich in non metallic mineral resources. First of all, there is a demand for fire resistant material by the concrete plants which are being built in the southern part of the country, and by the the steel industry and the deficit of refractories in neighbouring Uzbekistan.

The magnesite and serpentinite deposits, which located in the district nearby the Khaidarkan mercury plant are of the main interest.

Shuranskoye magnesite deposit is located in Kadamzhay district and is 20 km away from the Khaidarkan mercury mine. The deposit has been known since 1930 and has been mined through small quarries. Productive minerals are concentrated in serpentinites, which are the refractory material on their own. The Magnesite bearing zone is 3000x300-500m x 10-12m in size and the magnesite content in ore is up to 45%. The magnesite reserves have been assessed as category C1 with 31,4 thousand tons, possible reserves for category P1, depth - 10 meters constitute 200 thousand tons at the average magnesite content of 10%. The state balance has recorded 17 thousand tons of magnesite for C1 category. The stockpiled ore is available and is 1250 tons.

Kan serpentinit deposit is 30 km to the north of KMP. The deposit was discovered at the beginning of 1950s and at that time it was explored for flux and refractory magnesium materials. The length of the productive body is 8 km, and it is 2km wide with a vertical depth of 400 m. The magnesium oxide content is 36,42%. The assessed serpentine reserves of C2 category are 21.0 mln tons, which could yield 7mln tons of magnesium oxide, and mining gain is unlimited. Dolomites, suitable for the production of refractory materials containing at least 19% magnesium oxide and 33% of calcium oxide are practically unlimited. Admixture of earth silicon makes not more than 0,5-1%. The dolomite strata stretch for 150 km through the lowland part of the Turkestan Range with large deposits (Aksujskoye, Gazskoye, Akshagylskoye) having a known distribution. The largest nearest deposit to KMP is Gazskoye (50 km) with possible reserves estimated at 300 mln tons.

The Shamatal-Kazy talc deposit is 25 km to the north-east of the Khaidarkan village in the low mountains and is in easily accessible area close to motor roads, electricity supply and different villages. The deposit is localized in the Kann terrace of serpentine ultrabasites, enclosing 18 bodies of the talc rocks and talcites with the average content of talc being 68%. The length of the bodies ranges from 60 to 460 meters, with a thickness of between 25-140 meters. The talc reserves for 3 surveyed areas (category C1) are 2 mln 845 thousand tons, including for area 1, category A+B+C – 1 mln 412 thousand tons of talc.

Deposits of the lining stone of sedimentary and volcanic (magma) origin are concentrated in the area of Khaidarkan village. The Sartalinskoye deposit of lining gabbroids is 10 km to the north-east of the village and in an easily accessible area. the Gabbroids form an intrusive body, which is 2 km long and 500 m wide. These are light and dark grey highly ornamental rocks which can be easily processed and mirror polished. The physical and mechanical properties of gabbroids have a block size of 20-40 cm³. Gabbroids can be used to produce lining materials and precious crafts. Possible reserves up to a depth of 50 meters constitute 50 mln m³.

Nadirskoye deposit of black lining picrite in Kadamzhay district is 25 km to the north of the KMP at the height of 2180 – 2250 m. Thickness of the picrite strata is 150 – 200 m, length 45 km, including productive parts – 30 m, 600m and 800 m. Three allotments with the parameters 700x600m. 60x330m and 100x800m. The colour of the rock is ultimate black and the ornamental properties are very high. The rock can be easily sawcut and mirror polished. Block size on the surface corresponds to the V category with the block sizes up to 0.4 m³. In the natural cutting the possible reserves of the lining picrites are assessed for category P2 as 2 mln 750 thousand m³. Blocks of the V category can be used for mournful and ceremonial lining and as an ornamental rock.

The Dekabrskoye deposit of bowenite-jade is 25 km to the north of the KMP at the height of 700 – 1300m in an economically developed area. The jade is thick and can be easily sawcut, drilled, tumbled and polished. The colour of the polished stone varies from grey-green to dark-green. The stone has got good decoration properties. The size of allotments with no defects is from 40 to 400 meters. The possible reserves for the category make 1166 tons of bowenite recommended for jewelry and decoration.

Nearby there are occurrences of various jewelry and ornamental stones, including diopside (Shuran), agate chalcedony and agate (Orus-Bulak, Dzholabars), rodingites.

Badamcha gypsum deposit is located in Kadamzhay district. It is 5 km to the north-east of Limbur village and 30 km to the north west of the KMP. It is an accessible area. Two gypsum seams occur in argillaceous cretaceous strata. The upper seam is productive. The mapped seam length is 2 km, and 30 metres thick.. The Gypsum is white, sugary and sparkling and can be recommended as the raw materials for the production of construction, technical, moulding and medical gypsum, as well as the production of plaster boards, and agricultural fertilizer. Possible reserves for category P1 are 5,2 mln tons.

Kan gypsum deposit is 25 km to the north of the KMP. This seam is of the pure crystalline gypsum and is 2 km long and 30 m thick with a gypsum content of 99,10%. Possible reserves for category P1 – 1,8 mln m3. These are of grade 1.

5.7 Bentonite Clay

The major accumulations of bentonite clay are located in the low mountain, accessible and economically developed parts of the Lyailyak and Batken districts and consist of 3 deposits: Beshkenskoye, Kyzyl-Utek, Ak-Turpak. The productive seams occur in the Paleocene strata but the locations have been only irregularly surveyed. Beshkenskoye deposit has been surveyed in most details and was exploited from 1969 to 1977. It is located in the Lyailyak district 8 km to the north of the Margun village at a height of 1350 – 1450 m above the sea level. The productive seam of the bentonite clays is 5-20 km thick and 820 m long.

The clays are heavy, tenacious, dispersed and of high plasticity. The plasticity number is 34. They consists of montmorillonites and beidellites. The clay grain texture fracture composition is as follows: over 0,1mm – 1,14%, less than 0,0005mm – 74,13%. Industrial tests have proved the clay's suitability for the production of drilling fluid. Balance clay reserves of the West Allotment for categories A+B+C1 is 587 thousand tons, off-balance 809 thousand tons.

5.8 Deposits of antimonial ores

The Kadamzhay deposit is located in the well developed and densely populated Kadamzhay district at 500 – 1200 m above the sea level and is in close proximity to the motor road Isphana – Batken – Osh. The distance to the Fergana and Margilan railway stations (Uzbekistan) is 30 km, and to the Khaidarkan mercury plant – 50 km. Regular mining of the deposit started in 1934 and continued until 2004. Since 1964, the productivity of the mine gradually declined being replaced by concentrates imported from Yakutiya, China, Tajikistan, and the Khaidarkan mercury plant. About 133 thousand tons of antimony were extracted from the deposit over the 70 years of its operation.

At present, the Kadamzhay deposit comprises a group of contiguous industrial allotments: Antimony Crest, Western Flank, Intermediate, South-Western Flank and Left Bank. Besides, a series of small mineralization zones, which are not of practical interest at the moment, has been discovered. The average metal content at the deposit ranges from 2,04% to 5,32%.

The state balance for the Kadamzhay deposit has got the following antimony reserves: ore – 29,74 thousand tons, metal – 77 thousand tons as of 01.01.2007. The total known and potential reserves make 4397 thousand tons of ore and 145266 tons of metal with the

average content of 3,3%. The authors of the report consider that the mineral base of the Kadamzhay deposit remains significant and reliable. The stocks of the category B+C1 will allow mining for at least 15 years; The C2, prospected at the Left Bank allotment including P1 resources has reserves for another 14 years.

Nevertheless, at present the Kadamzhay plant is not interested in the extraction of these ores and ceased mining in 2006.

The northern Aktash deposit of auriferous antimonial and fluorite ores is 3-4 km to the east of Kadamzhay village on the mining allotment of the Kadamzhay antimony plant. It has been surveyed in detail. The state balance for Northern Aktash deposit holds the following reserves: antimonial and fluorite ore – 3 mln 259 thousand tons, antimony (content 0,514%) - 758 tons, fluorite (CaF₂ content – 20,09%). The possible gold reserves for P1 +P2 categories up to 230 meters have been assessed as 7.9 tons, Au content – 1,85g/ton.

The Nurlau deposit of antimony and gold-bearing ores is located on the northern slope of the highland part of the Turkestan Range in the Kshemysh river basin at the height of 2700 – 3450 m above the sea level. The nearest road is 4 km away from the deposit in the Nurlau valley river. The distance to the motor road Isphana-Batken-Osh and to the Khaidarkan mercury plant is 50 km.

The assessment of possible antimony reserves for P2 category at a depth of 250 meters is: ore – 792 thousand tons, antimony – 21 thousand tons.

5.9 Mercury

About 83% of country's mercury and mercury-antimony deposits are located in the Batken Province. There are 48 mono-metal mercury deposits and 7 complex ore deposits with antimony and mercury registered in the province. The possible reserves of mercury in the Batken province are assessed at 29 thousand tons, including 13 thousand tons available for industrial development in the Khaidarkan area.

There are about 50 small mercury deposits which could be mined by small-scale methods.

Khaidarkan deposit of mercury, antimony and fluorite

Meting-Bel passage in the east to the Zarkhar gorge in the west (a length of 12 km). These have been given the status of allotments with the common title "Khaidarkan Deposit". The "Novoye" deposit, which is mentioned separately is in fact part of the Khaidarkan deposit.

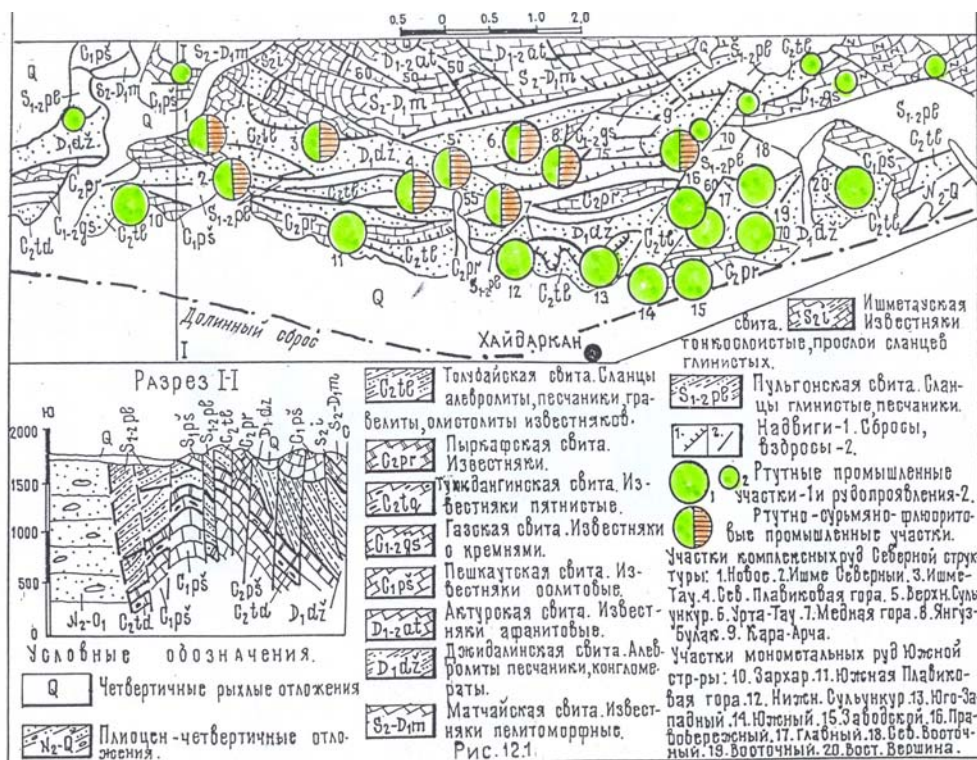
This deposit borders the Khaidarkan town in the north. The main southern motor road of the country "Osh-Batken- Isphana" goes through the mining settlement. The nearest railway station is Fergana, Margilan in Uzbekistan and is 100 – 110 km away.

Actual mining has been undertaken at 14 allotments: 8 allotments of mono metal mercury ores and 6 allotments of complex ores (mercury – antimony and fluorite). From 1940 to 2005 about 17 mln 934 thousand tons of ore have been extracted, and 29 thousand tons (27 –

according to other sources) of mercury metallic ore produced (excluding mercury production in other mercury mines: Ulug-Too and Chauvay). The level of mercury recovery was 92%.

Complex ores with low concentrations of mercury c (0,019 – 0,04%), antimony (0,30 – 0,82%) and fluorite (9,5% to 15,67%) were delivered to the processing plant, which produced mercury- antimony and fluorite concentrates. Mercury and antimony concentrates (mercury concentration 1,6% to 5,35%) were fluid bed roasted. After mercury recovery (of 91,5%) the antimony concentrate was sent to the Kadamzhay Antimony Plant. The fluorite concentrate (KF-5 standard) was exported.

Figure 6 Schematic Geological Map of the Khaidarkan Mercury Deposit



The last decade has been characterized by a significant decline in mercury extraction.

The main commercial minerals of the deposit are mercury, antimony and fluorite. Additionally, in some places and mainly in complex ores of mercury, antimony and fluorite, gold is found in the quantity of 0,0012 – 0,4 g/t, and in rare places exceeding 1gramm per ton. The mercury and antimony concentrates contain selenium (0,032% - 0,38%) and gold (2,0 – 2,6 g/t). The concentrate calcination products also contain selenium – 0,010% and gold – 0,2 g/t.

The economy of the Khaidarkan mercury plant is based on the extraction and processing of the monometallic ores. Over the period of 1969-2005 the proportion of mercurial-antimonial-fluorite ores comprised 19,8% of the total ore extraction (4680 thousand tons), 27,5% of the total mercury extraction. 19423 thousand tons of antimony and 547172 thousand tons of fluorite extracted. In 1996-2005 extraction and processing of mono mineral mercury ores reached 72,6% for the ore and 97,26% for mercury.

Table 16 The state balance of the Kyrgyz Republic for the Khaidarkan deposit*

Stock category	Mercury			Antimony			Fluorite		
	Ore, thousand tons	Concentration %	Metal, tons	Ore, thousand tons	Concentration %	Metal, tons	Ore, thousand tons	Concentration %	Metal, tons
C1	4194	0.126	5305	3362	1.82	61223	3276	14.8	485
C2	6630	0.168	11122	4190	1.10	45990	4447	12.95	576
C1+C2	10824	0.152	16427	7552	142	107213	7723	13.74	1061
Off balance	942	0.158	1494	150	0.97	1459	150	4.00	6

*as of 01.01.2007

Novoye deposit holds the following reserves: mercury – 200 tons, antimony – 3579 tons, fluorite – 81,4 thousand tons. The lower seams are flooded. The annual extraction of mercury is 20 tons (about 5% of the annual mine production), antimony – up to 500 tons and fluorite – 10 to 12 thousand tons. The rest of the mercury is mined from mono mineral mercury ores. According to the specialists of the Khaidarkan mine, the reserve of the mono mercury ore is sufficient for the next 5-7 years.

The authors of the report [3] make a conclusion that despite 66 years of mining, the raw materials reserves of the Khaidarkan Plant for mercury, antimony and fluorite are substantial and would provide for the work of the Plant for many years. The report specially refers to the complex ores, as only two out of nine proved allotments have been mined. Recovery of commercial minerals is assessed as extremely low compared to the results achieved in the course of the industrial tests.

Chauvay mercury-antimony-fluorite deposit

This deposit is located in the Isphairam river basin in an economically developed area at 1300 – 3000 m above the sea level. Administratively it belongs to the Kadamzhay district and is 100 km eastwards of the Khaidarkan mercury plant and 25 km to the south of Kyzyl-Kya.

Table 17 The state balance of the Kyrgyz Republic for the Chauvay deposit*

Stock category	Mercury			Antimony			Fluorite		
	Ore, thousand tons	Content	Metal tons	Ore, thou. tons	Content	Metal tons	Ore, thou. tons	Content	CaF2 Thou. tons
C1	135	0.227	306						
C2	187	0.32	569						
C1+C2									
Off balance	68	0.1	69						
C+P1+P2			11		0.43-1.07	53100		1.98-14.34	720.9

*as of 01.01.2007

Symap Mercury Deposit

This deposit is located in the central part of the Batken Province at the northern slopes of the Turkestan range in the mid section of the Sokh river, 2700 – 3000 m above the sea level. Economically the area is well developed. The nearest settlement, called Raut, is 3-5 km away. The distance to the Khaidarkan mercury plant is 50 km to the southwest.

The deposit exploitation was stopped in 1973. The remaining reserves contain up to 545 tons of mercury, with average concentration in the ore 0.11%.

6. Mine Transitioning Prospects

This section discusses several options which are considered reasonable from the industrial and geological point of view in the context of mine transitioning away from mercury production⁸. Short description of possible activities and opportunities to create or maintain jobs in the transitioning process to replace income from mercury mining is also provided.

6.1 Regional gold processing plant

In 1999, experts from MITSUI company (Japan) having carefully studied the prospects development at KMP recommended a continuation of its mining activity based on the processing of adjacent gold deposits [11]. The relevance of this project has increased as a result of the increase of the world price for gold.

It is suggested that a further study and on the possibility of establishing a regional gold processing plant at the KMP should be encouraged and supported by donors in order to attract the major investors.

The experts of the Kyrgyz State Agency of Geology and Mineral Resources concluded that the development of gold deposits in the Batken Province should be a priority [1]. As mentioned, 25 large and small-scale gold deposits have been identified in the areas accessible to KMP. The total potential of gold in medium and small gold deposits in the Batken province is assessed at 282 tons.

Deposits at Altyn Dzilga, Chakush, Duvatash, Gavian are 50-60 km away from the KMP and their mining should be considered in the first place.

The intention of the Kentor Gold LLC to process ores of the Savoyardy deposit using the Khaidarkan enrichment plant demonstrates that such a project is realistic⁹.

Despite a significant haul distance (370 km from Savoyardy deposit in the Osh Province to the KMP), the Australian company Kentor Gold LLC which holds the rights for the site considers transportation of ore to the Dressing Plant of the KMP to be economically justified. The total operational costs have been identified as 370\$/oz.

⁸ Prevention of future releases of mercury and contamination of the environment and reduction of health risks is one of the key priorities of action plan. In this context, based on the analysis of the range of options industrial alternatives which would continue to contribute to mercury generation and release to the environment – such as mining of Novoye deposit or cement production from the mercury-rich slag – are not recommended.

⁹ Source: the statement of the Kentor Gold Company Ltd (Kentor Gold LTD, ACN 082 658 080) to the Australian Stock Exchange as of 12.05.09

The management of the company rightly assumes that the gold ore processing at the KMP has got a number of advantages to the construction of a new enrichment plant:

- Smaller capital costs,
- Less negative impact on the environment;
- Fewer necessary permits;
- Shorter period before the start of the operation;
- Existing professionals at the KMP;
- Operational infrastructure, including energy infrastructure,
- Available capacity for ore processing.

The above mentioned advantages should be complemented by the saving made on the survey works for GRP plant construction, availability of the tailings facility, and possibility to start mining immediately combining mining with further exploration of the deposits.

In order to convert the enrichment plant at the KMP for gold recovery it will be necessary to gradually increase its capacity from 100 000 tons to 1 mln ton a year.

In order to start this type of industrial alternative development the Khaidarkan factory has to replace wear parts and upgrade the ore enrichment plant/concentrator, which would require an expenditure of US\$2-3 million. Khaidarkan management is keen to proceed on this option as a way to generate cash and create employment for at least 70 people. The processed concentrate could then be sent to Kazakhstan or China for biological leaching (BIOX or BACOX technology) and gold extraction. One more option for the future is installation of a biological leaching plant at Khaidarkan that would be available on a commercial basis to other gold producers in the region. Recently completed test work has shown high gold recovery (95%) after BIOX leaching. As a result of the BIOX leaching, all the arsenic present in the concentrate is fixed in an inert form that can be safely stored in tailings.

The full scale development of options associated with gold extraction and processing would cost around 40-60 mln USD. According to calculations, the simultaneous mining of the nearest gold deposits and processing at the regional factory could create 1700 jobs. This option would completely compensate for the loss of jobs at the mercury production and create an additional indirect employment of 1200 people.

Disadvantages of the project:

- Reserves of the nearby deposits have not been proven by the geological and exploratory works. According to the data of the State Geology Agency the cost of geological exploration of these deposits may exceed 30 mln USD.
- Different companies hold the licenses/rights for the deposits.

The project **is considered a realistic and attractive by experts**. However, it requires significant organizational work to engage the license holders into the project.

In order to calculate the number of workers this project will create we assumed a production level of 753 tons per worker per year a year based on the following data:

Mine	Number of workers, persons	Extraction volume, thou tons	Production per worker per year, tons
Khaidarkan mine 1	275	150	545
Khaidarkan mine 2	142	100	704
Tereksaiskij mine	150	150	1000
Makmalskij mine	393	300	763
Average			753

Table 18 Main economic indicators for gold mining projects

Indicator	Unit *	Gold deposits							TOTAL
		Altyn-Dzhilga	Chakush	Duvatash	Nichkesu	Kanyzak	Aprlelskoye	Gavian	
Investments, total	mln \$	61.00	43.97	16.97	43.72	21.40	3.74	38.53	229
Investments without factory construction	mln \$	20.3	14.7	5.7	14.6	7.1	1.2	12.8	76.4
Overall gold production, average annual	kg	1629	1095	427	1092	412	171	869	5695
Overall gold production, average annual	mln \$	42.4	28.5	11.1	28.4	10.7	4.4	22.6	148.3
Mined ore, annual	Thou tons	281	205	84	227	156	15	87	1054
Distance to Khaidarkan	km	60	55	35	80	100	150	30	
Transport expenditure to deliver ore to the plant, average annual	mln \$	16.8	1.7	0.4	2.7	2.3	0.3	0.4	24.8
General taxes, average annual	mln \$	8.49	5.71	2.22	5.69	2.15	0.89	4.53	30
Export balance, average annual	mln \$	42.4	28.5	11.1	28.4	10.7	4.4	22.6	148
Employment total		709	518	211	572	394	38	219	2660
<i>Including:</i>									0
Direct	Persons	373	272	111	301	207	20	115	1400
Indirect and induced		336	245	100	271	186	18	104	1260

* The price for gold is assumed at the level of 810/oz

6.2 Construction of fire-resistant bricks factory

Local experts and technicians in Khaidarkan propose to build a factory for fire-resistant bricks and magnesite powder production. According to the project design, the marketing area and potential buyers include ten enterprises in Kyrgyzstan and Tajikistan. The production capacity of such factory is proposed at 500 tons per month. For implementation of the project it will be necessary to install a crushing facility and two furnaces 250 tons capacity each.

The estimated investment amounts USD 643000. The project's payback period of 6.5 years employing 86 people. Shuranskoye magnesite and serpentinite deposits are located 20 km north of the Khaidarkan Mercury Plant are proposed as main sources for materials supply.

Apart from firebricks, magnesite in the form of a mineral powder is used in production of asphalt and concrete mixtures of various categories. As distinct from earlier powders that were used, this one is more hydrophobic. It also has high bitumen capacitance allowing for more even distribution in bitumen. The application of this product leads to a higher density and homogeneity of asphalt and concrete mixtures. It prevents the permeation of moisture and therefore reduces the likelihood of water saturation of asphalt and concrete mixtures. This has a positive influence on the life of roads where it is used. The possibility of its use in asphalt and concrete mixtures where clay fractions are present takes on special significance. The manufacture of asphalt filling compounds is increased in importance bearing in mind the intention of Tajikistan and Kyrgyzstan to build a highway along the southern border of Fergana valley¹⁰.

Magnesite is also used as a natural magnesium fertilizer. It is an effective, long-acting fertilizer on acid soils that have a low magnesium content. It possesses high neutralizing property exceeding that of a limestone powder. There is a 20-40% increase in yield resulting from its application. The fertilizer contains soluble MgO of over 20%, and also microelements of cobalt, copper, zinc, manganese, iron, as well as talc as soil ripper. Magnesite is an equivalent substitute for magnesium sulphate, in contrast to which it does not acidify, but neutralizes the soil. When applied it improves the preservation and quality of crop product.

Serpentines are used as a basis for production of antifriction grease for internal combustion engines and absorbents for potable water purification. The project is estimated to be reasonably feasible, economically attractive and it deserves further study and elaboration.

6.3 Gypsum production

Kann first-class gypsum deposit is located 25 km to the north of the KMP. The seam of the pure crystalline gypsum is 2 km long and 30 m thick with gypsum content of 99% and possible reserves of 1.8 million tons of category P1.

Badamcha gypsum deposit is located 30 km to the north-west in the river Sokh valley and is easily accessible and within an economically developed area. It is the first grade gypsum (GOST 4013-82) and is suitable for construction, technical, moulding and medical use. Possible reserves are 5 mln tons. The plant which is equipped with rotary kilns can easily

¹⁰ Source: <http://uraltalc.ru/param.html>

manage this type of production. The demand for construction for gypsum building plaster is growing steadily. It is proposed to focus on the production of gypsum panels, gypsum fiber slabs and gypsum partition blocks, for which the demand is growing.

An example of a similar production facility is a project started by “Mega Union Industry” in Suzak district of Jalal-Abat province [13]. The production capacity of this plant is 1,5-2 mln m² of gypsum panels and 30 000 tons of gypsum flour. This project attracted investment 1 mln USD. Out of this sum 250 000 USD was spent on the purchase of machinery, 250 000 USD for construction and assembly works and 500 000 USD on equipment for 2 new workshops. The value of products in current prices is 107 million soms per year year (2,5 mln USD). The plant employs 80-100 people.

This project for KMP could be easily implemented and should be considered as high priority. Transport costs could be reduced significantly considering availability of the infrastructure and production capacity. It would be necessary to carry out a provisional assessment of the reserves in the deposit and undertake a survey of the works needed to establish the quarry. This would cost about 0.5 mln USD.

6.4 Bentonite production

Three bentonite clay deposits – Kyzyl-Utek, Ak-Turpak and Beshkenskoje – are located in the territory of the Batken Province. During the Soviet times the latter was mined by Tajik enterprises to prepare drilling fluids and hence the deposit is ready for operation and requires minimal costs to prepare for mining.

The industrial and agricultural use of bentonite is wide and diverse varying from heavy industry to the production of litter boxes for cats. Bentonite is successfully used in wineries and juice recycling plants for clarification of juice, grape and fruit wines and wine material.

A colloidal fraction of bentonite is used in the production of various pastes, creams, lipsticks and other cosmetic products of the perfume industry and acid-activated bentonite can be used as catalyzer and absorbent in the production of aromatic compounds. Bentonite replaces edible fat in soapmaking providing significant economic benefit. In the textile industry bentonite successfully replaces expensive starch for cotton warp dressing and it is also effectively used in the process of textile print. Bentonite is used in the production of the cleaning, scouring and bleaching powders, liquids and pastes, emulsions, as suspension in corrosion preventive compounds for cars. In large volumes bentonite is used to produce iron ore concentrate pellets ensuring the required resistance. Activated powder bentonite is used as a binder of the moulding sand mixtures in the production of iron moulds at the mechanical and automated lines for superduty casting out of ferrous and non-ferrous alloys.

Low grade bentonite can also be used for remediation of mercury waste slag/tailing dumps.

The above mentioned deposits require additional exploration to identify the clay quality and suitability for different industries. An approximate calculation for bentonite clays at production volume of 25 thousand tons a year indicate the cost 1.5 mln USD. About 75 people could be directly employed and 65 people, indirectly employed.

6.5 Small development projects

The projects involving the possible conversion of the KMP to other types of activity to replace mercury production, described above would require at least 2-4 years before being actually implemented. Within this period of time the social situation in Khaidarkan will be deteriorating. In order to mitigate the negative consequences of the phasing out of mercury production it is recommended to create a scheme of small grants and micro credits mechanisms provided by various international donor organizations in order to support small development projects.

The government of the Kyrgyz Republic has adopted the necessary institutional reforms that open up the way for the donor activity. As the result numerous international donors work in Kyrgyzstan. The actions of the international donors are regulated by the Donor Coordination Council which interacts with the government. Regional Donor Coordination Councils have been set up at Province Administrations including at the Batken Province.

The range of the assistance provided is quite wide:

- Grants unrequited;
- Provision of co-financing;
- Support of the credit unions and cooperatives;
- Interest free loans to small business;
- Preferential loans to small and medium business.

However, because of the different specializations not all donor organizations could be engaged in the provision of assistance to population of Khaidarkan. For example, ARIS financed by the World Bank has implemented 46 grants and joint projects in Khaidarkan with the total budget of KGS 6 mln over the period 2005-2008. The majority of projects are focused around infrastructure improvement. Acknowledging huge significance of the projects aimed at the quality of life improvements for the local residents, it should be noted that ARIS programme does not focus on maintaining or increasing permanent employment, which is an important factor in the context of phasing out of the mercury production.

Donor assistance in the form of small grants and micro credits aimed at the development of small business is very relevant for Khaidarkan, and has included:

- Establishment of the agricultural cooperatives;
- Gardening and bee farming;
- Storage of natural medicinal herbs;
- Animal skin processing and manufacturing goods
- Production of the construction materials;
- Souvenirs making;
- Development of the household services: car repair, plumbing, carpentry.

Switzerland is one of the key donors providing development assistance to Kyrgyzstan within the Country Development Strategy, which covers health care reform, water resources management, natural disasters risk mitigation, infrastructure and private sector development via SDC office in Bishkek. USAID is another key agency in the Batken region.

There are many examples of the effective implementation of projects and successful results including Small Business Financing Programme, which has been implemented by European Bank for Reconstruction and Development (EBRD) and co-financed by other donors. This project was successful in the development of small loans mechanism, which was required by small and medium businesses and which commercial banks could not support

UNDP's Batken Province Regional Development Programme implemented since 2005 with budget of 1 800 000 USD (equally funded by UNDP and Government of Korea) does not cover Khaidarkan at the moment. However, if the additional funding would be available, the Programme could expand to address the specific issues of local development. The Batken Programme proven to be successful in meeting the most challenging development issues in the region and tailoring its approach to the local circumstances: the Batken province was the poorest in the country before the start of the programme in 2003 with the majority (85 per cent) of the local population living in poverty. In 2007 the incidence of poverty in Batken reduced by half (40 per cent) and became closer to the country average (35 per cent). As a result, the Batken province is no longer the poorest region in the country.

The German Organization of Technical Assistance (GTZ) is one of those that support development of mini-business and entrepreneurship through the business-incubator networks. One of the business-incubators was established and still active in Khaidarkan.

FINKA, the micro credit company was established in Kyrgyzstan in 1995. At the moment, its current portfolio is about 1 bln KGS and the regional network of the FINKA company consists of more than 50 branches all over Kyrgyzstan. Over the last year, about 15 000 new jobs were created and supported as a result of FINKA loans. The company provides individual as well as group loans. The maximum sum of the loan is 800 000 KGS for two years with interest rate at 2.2% a month. The company applies flexible requirements to loan coverage and the documents consideration period is minimal. Group loans are provided for the development of new "start up" businesses, as well as active businesses, including agriculture. Group loans are provided without loan guarantees at the interest rate of 3% a year. The average value of loan is 500 USD. [13]

Other large and well known micro-credit providers that offer affordable products to the poor are Ayil Bank (state institution) and Bai-Tushum which have the most widely branched network to extend non-collateral lending in the most isolated areas of Kyrgyzstan.

Strengthening support for private entrepreneurship is one of the key priority economic development areas of Kyrgyzstan as it helps to alleviate poverty, establish new jobs, promote competition. To encourage these developments the government of the Kyrgyz Republic set up a micro credit company JSC "Entrepreneurship development fund" in 2004.

The Entrepreneurship development fund provides loans for the following activities:

- Production of the industrial products
- Processing of agroproducts and materials;
- Agriculture;
- Cattle breeding development;
- Services;
- Trading and commercial activity;

- Transport;
- Public catering;
- Construction;
- Tourism;
- Purchase of main assets and equipment;
- Consumer loan.

The European Bank of Reconstruction and Development (EBRD) lending line is set to help the financial sector of Kyrgyzstan to increase the credit flow into the real economy. In May 2009 EBRD provided the credit line to ATF bank in the amount of 20 mln USD. Another credit line by EBRD in the amount of 4 mln USD was provided to Demir Bank. The targeted use of the loan is financial support of micro, small and medium size enterprises in Kyrgyzstan. The sum of the loan varies from 50 000 to 200 000 USD up to 3 years. The loan can be used to finance the current assets, purchase of the main assets and investments into other projects. The Programme applies a flexible and effective approach to collateral meaning that it can be personal surety, moveable and immovable property, pledged inventory, personal property, autos and equipment. By 2007 EBRD partner banks issued credits in the amount of 200 mln usd. Since the programme start, the enterprises that have received loans established or kept over 120 000 jobs¹¹.

To a various degree all the opportunities and examples described above might be applied to assist the Khaidarkan community if the mercury production is ceased and the plan converted. The government of the Kyrgyz Republic has to address the Donor Coordination Council to design and finance this programme.

The preliminary list of donors and other international organizations that are active in the country and might be able to assist in this respect is provided in Annex 1.

¹¹ Source: www.ibr.kg

7. Environmental remediation in the mining sector of Kyrgyzstan and outlooks for the Khaidarkan Mercury Plant

7.1 Environmental concerns

More than 60 years of mining activity have had considerable impact on the landscape and environmental conditions in the area around Khaidarkan. Previous work identified that mercury rich waste accumulated on the site as major sources for heavy metal contamination. Smelter emissions affect ambient air quality and introduce heavy metals into the surroundings of the mine. This source is strongly related to the activity of the smelter, in case of mine closure this contaminant source will deplete. However, atmospherically deposited mercury from smelter emissions is likely to re-emit and continuously impact air quality in the area even after smelting activities have ceased.

About 13.3 million tones of slag, a waste product from mercury smelting, are currently deposited on an area of 39 ha around the smelter and the settlements. The material is stored in 50 m high stockpiles on in the vicinity of the mine and Khaidarkan town. According to data supplied by the plant, the deposited slag contains about 5 mg/kg mercury. However, slag analyses conducted by the project team in 2008 showed that the average mercury concentration is around 200 mg/kg. There are no protective covers or base lining to prevent wind erosion, water drainage or other contamination pathways. The waste area is easily accessible for the public and livestock.

According the National Environment and Health Action Plan (NEHAP) jointly produced by the Kyrgyz Ministry of Health and the Ministry of Environment Protection in 1998, the stored wastes violate nature-protection rules and present a direct threat to the environment and the population.

Further attention should be drawn to risk reduction at the tailings facility about 3 km west of the smelter. Tailings is mine waste created during the processing of complex ores in which the raw material is crushed and treated in a floatation process to extract the desired commodity. Compared to slag, tailings are finer in grain size and disposed of in suspension with water and chemicals used for the floatation. In Khaidarkan, antimony and fluorite were extracted using this technique in addition to mercury smelting.

About 4 million tonnes of tailings are accumulated in the tailings pond across an area of 22.8 ha. The plant reports the following chemical composition for the suspension:

- mercury 0.003 mg/l
- antimony 21.5 mg/l
- fluorite 6.7 mg/l

Tailings analyses conducted in 2008 yielded 126 mg/kg mercury in the dry material. The analysis revealed that the waste pond and its superficial layers contain large quantities of

hazardous chemicals (mercury, antimony and arsenic), with a prevailing pathway of contaminant distribution by air (dust and wind).

There are clear signs of farm animals entering the pond to drink from the accumulated water. Furthermore, local farmers repeatedly expressed their concerns over water quality impacts from waste seepage and dust formation at the tailing during dry periods.

7.2 Potential risk reduction interventions

At mining sites, remediation and land reclamation activities can be carried out during or after the mining operations have ceased. While the mine in Khaidarkan remains operational for the time being, action is required to achieve safer conditions and prevent further deterioration of its surroundings. Environmentally sound mine closure should address all aspects of the mine. This will require an orderly, safe and environmentally sound conversion to a closed state. Areas affected by mining activity should become viable and self-sustaining ecosystems that are compatible with a healthy environment and with human activities. This will address mine components such as:

- Buildings and other structures;
- Chemical storage areas and facilities;
- Tailings disposal facilities;
- Slag disposal facilities
- Waste management
- Pipelines and electrical transmission lines;
- Mine and site drainage systems;
- Mine workings;
- Mine shaft,
- Site water quality, including water flows leaving the site;
- Recycling of materials; and
- Revegetation of the site.

Proposed measures

For Khaidarkan, it is proposed to investigate protection measures that reduce physical and chemical risk affecting human health, environment and local development. While the situation at Khaidarkan is complex and pollution sources are difficult to isolate, it is important to identify robust and feasible solutions that meet local demands in a time and cost efficient manner. Any solution should take into consideration socio-economic aspects and related remediation works as well as the remote location and limited technical and financial capacity in the area. For this purpose, prominent areas of concern such as slag deposits and tailings pond should be prioritized in the first instance.

Main contamination pathways for slag and tailings waste are airborne and waterborne transport of the material, therefore removal/containment of the hazardous material will be required limit the negative impacts. Furthermore, there is a need to ensure stability of the waste deposits and identify physical risks by analyzing engineering structures.

Possible interventions for slag deposits comprise backfilling of waste material into the mine shafts as part of the mine closure procedure. Backfilling will also support isolation and stabilization of the shafts which is crucial for mine closure. Other techniques could comprise capping (clay, soil) and re-vegetation of the impacted area. Required materials can be sourced locally and are expected to be readily available.

For the tailings dam, relevant activities comprise physical stabilization of the installation taking in to account the high risk for earthquakes and landslides in the area. Experts should investigate the need for water diversion structures, a standard installation at many similar sites, and containment measures preventing wind and water erosion, similar to the ones described above. Rehabilitation of the sludge pond and other mercury-rich material may include pre-treatment in smelter, application of locally available or synthetic mercury absorbers (e.g. Almadén's experience). The current best available technologies combine chemical and biological methods including application of inexpensive chemical substances (dolomite) that bind mercury and plant species that are capable of bio-accumulation.

Different mercury forms may occur at a polluted site and their decontamination may require different techniques. Because of its high vapor pressure, metallic mercury distributed in the affected territory disperses relatively quickly into the atmosphere which serves as a secondary emission source (primary emission source being ongoing mercury smelting operations). Several techniques can be used for the reclamation of mercury-polluted areas such as adsorption on a substrate with activated carbon, filtration ions exchange resins, stabilization, biological reduction. Although quite some experimental work has been conducted in the area, it remains open how such techniques can be applied in Khaidarkan.

Cost estimates

To cover the deposited mine waste to limit the airborne transport of mercury a clay layer of about 0.5 m thickness could be applied on the surface of slag waste heaps. According to estimates, this will require about 200 000 m³ or 300 000 tons of clay

Other measures reshaping and active revegetation may be added depending on the chosen remediation concept. The simple rehabilitation project would occupy a team of 20- 40 people to ensure that transport capacity of at least 100 000 tons per year. Additional investments for the purchase of equipment is estimated at 300-400 thousand USD (loader, grader, bulldozer, etc).

Considering the average cost of clay extraction 3 \$/ton and transportation distance of 5 km, the annual running costs for reclamation activities at smelter's slag waste hips will 0.4-0.5 million U.S. dollars. The total cost of basic reclamation of the slag hips is estimated at 1.6 million U.S. dollars. This amount is minimal and does not take into account the specific aspects of remediation of mercury contaminated environment.

Based on the technical capacities available for remediation (geo-engineering) works at Khaidarkan, the project could apply modern technical expertise and experience from mine remediation in Spain or Slovenia.

The contamination of river sediments (Gauyan-Shahtnaya rivers) in the cross-border Sokh river basin offers the opportunity to seek GEF co-funding, which would allow the local

authorities and specialized governmental agencies to implement concrete pollution reduction initiatives to reduce potential risks in the international waters.

Overall, implementation of remediation measures would provide several benefits for public health and the environment due to reduction of hazardous substances in air and water bodies, safer land use practices and risk reduction for local communities, temporary employment and new skills.

7.3 Context for environmental restoration around the Khaidarkan mercury mine

Decades of mercury mining in Khaidarkan resulted in environmental legacies posing considerable risk to environment and human health in the area. In the past, the Khaidarkan mercury plant and associated mines was a strategic industry for the Soviet Union, providing the military and others with valuable mercury. Soon after the dissolution of USSR, two mercury mines associated to Khaidarkan (Chonkoy and Ulug-Too) quickly became abandoned after subsidies from Moscow ceased while Khaidarkan proper remained operational throughout the 1990's. However, since then the mine remained in a very fragile technical and economic shape. Kyrgyzstan's Programme on Production and Consumption Wastes (2005-2011), puts the Batken province of Kyrgyzstan to the top list of the hazardous industrial waste locations (mainly at the Khaidarkan mercury and Kadamjai antimony plants).

Mercury production at Khaidarkan remains ongoing and the mining site continues to accumulate mercury-rich waste (slag and sludge from smelter, tailings from complex ore processing) in the vicinity of the settlement resulting in mercury levels of agricultural soils and river sediments being significantly elevated in the surroundings of the mine and frequently exceeding limits. Annually, the Khaidarkan plant releases more than 3000 kg of mercury into the atmosphere (other estimates suggest 6000 kg and more), in addition to the pollution already present in the area. Linkages between pollution and public health have not been directly investigated, however the available data suggest negative health impacts on mine workers and vulnerable population groups in Khaidarkan.

7.4 Environmental protection and responsible of the Khaidarkan mercury mine

Recent analyses of the site and community showed that environmental protection measures are insufficient coupled with very limited local public awareness on mercury related hazards. The mine management, until recently, does not recognize the need for action and shows only moderate interest in improving its environmental management.

On the other hand, the recent engagement in the project on elaboration of Action Plan to Address Environmental Impacts of Primary Mercury Mining in Kyrgyzstan helped to solicit more up-to-date information for decision making and catalyze an interest in implementing modern approaches for cleanup of environmental pollution.

The urgency of remediation of environmental pollution at the Khaidarkan mercury mine (and other poorly maintained or orphaned mines) is reflected in the 1995 National Environmental Action Plan (NEAP) of Kyrgyzstan and is consistent with provisions of the Environmental Security Concept (2007).

Laws pertaining to mining and environmental issues in Kyrgyzstan regulate the decommissioning of mine workings and implementation of environmental protection measures as well as environmental remediation and land reclamation as integrated part of the mine closure process in order to reduce potential risks to the minimal acceptable levels. All operators are obligated by law to develop a management plan and remediation measures and to allocate sufficient funds for the implementation. However, in practice only very few operators effectively comply with these requirements. Those who do, mostly foreign investors, are often pressured by the lending institutions they work with to apply best practice. These institutions often also oblige them to comply with multiple standards in addition to national legislation. In the case of Khaidarkan mine, no plans and funds for decommissioning and remediation are available. This information is to be provided by the “Ecological Passport” of Khaidarkan which also informs about the ecological impact of the plant but currently no up-to-date document of this type exists.

Taking into account that Khaidarkan mine is an active enterprise, it is considered as an owner of waste and environmental legacies, it is therefore liable for appropriate mine closure and environmental remediation of the territory in accordance with national legislation.

7.5 Legal requirements

This section provides brief information on national frameworks pertaining to required works in Khaidarkan in connection with responsible authorities and their respective competences. It also provides an overview on the existing estimated financial and technical capacities for executing environmental remediation planning and implementation of mine closure in a responsible manner.

7.6 Legal frameworks and programmes addressing remediation issues

The Environmental Code of Kyrgyzstan (2009) requires those who exploit natural resources to take appropriate measures to restore the ecological status of the affected territories.

Financial security for required environmental measure is provided through the Law on Minerals (2009, under revision) which requires that mining operators should set aside special funds for remediation through a bonding system which has to be established at the beginning of the mine operation and funds accomplished during the mines operational lifetime. In case of premature mine closure or bankruptcy, funds should be transferred to the owner of land.

7.7 Implementation responsibilities

Engineering design and project approval:

At the moment, there are several firms in Kyrgyzstan based in Bishkek are known to design mine decommissioning and remediation projects. Selected companies include: “Eco-Service” which is dealing with all aspects of mine planning, decommissioning and remediation; “Asiarudproekt” “Ken-Too” with focus on geo-engineering aspects. In addition the scientific

information center “Geopribor” of the Institute of geo-mechanics and mineral exploration of the Kyrgyz National Academy of Sciences is dealing with the assessment of tailings ponds safety, geological and hydro-geological risks affecting the mines.

Remediation projects should be designed by licensed companies and could be implemented by state or private entities. Once these have been identified and plans are provided, the remediation projects are required to pass three stages of review by following state institutions in charge:

- State Inspection for Mining Safety, Ministry of emergencies (institutionally to be restructured in the second half of 2009)
- State Inspection for Environmental Safety, State Agency on environment and forestry (institutionally to be restructured in the second half of 2009)
- State Inspection for Construction Safety, State Agency on architecture and construction

Construction works:

For implementation of the required works, a number of activities can be carried with equipment and workforce available at the Khaidarkan mercury mine provided that it remains a state-run. However, for works exceeding mine capacities only limited support is available. The technical capacities of Khaidarkan that can be involved in remediation works include:

- Motor shop with several kinds of vehicles and machines (tracks, bulldozers, excavators)
- Manufacturing workshop, capable to produce plastics, wood and metal items.
- Mercury smelter, capable of waste re-processing and mercury extraction

7.8 Responsibilities for environmental remediation

Internationally, governments which have owned the state mining enterprise usually take responsibility for the legacy of pollution stocks, mainly because they have derived most of the benefits during the operational period prior to take over. The situation of the Khaidarkan is complex with the USSR as the only consumer for its final products (Khaidarkan produced 80% of USSR’s mercury, used mainly in military sector), whereby Kyrgyzstan benefited from social services.

According to the Law on environmental protection, residual pollution or damage to the environment caused before 1992 is considered the responsibility of the state. In the discontinuation of mercury production scenario due to economic hardship or other reasons, plant management should take responsibility for the clean-up. If not, considering that Khaidarkan remains state-owned, it is presumed that responsibility for environmental legacies, such as tackling the problem of land contamination and waste, will likely be assigned to the Ministry of Emergencies and/or local administration. It should be noted that

the potentially affected/polluted sites requiring remediation and clean-up are supposed to be specified in the Ecological Passport, which is not available. Since Khaidarkan plant does not set aside any funds for the purpose of clean-up, rehabilitation of mined out areas and protection of the community benefits, the financial guarantees for mine closure and related environmental works are uncertain. The local community could face all the burden of environmental pollution that is left around production site.

The case of the two abandoned mercury mining sites of Kyrgyzstan in Ulug-Too and Chauvay, which stopped operations in the early 1990s, show that no remediation or safeguarding activities were carried out. This clearly indicates that environmental and mining legislations are not fulfilled due to weak capacities of the state control authorities and limited budget.

According to the Government decree (#161, 23.03.1999), the Department of Monitoring and Forecasting of Emergency Situations and Handling of Tailings under the Ministry of Emergencies is responsible institution for maintenance, control and rehabilitation of non-operational mine tailings and waste rock facilities. However, it has been assessed that the Department lacks technical, professional and financial capacity to deal with the large number sites in the country and the demanding interventions required at many locations. There are 36 tailing sites and 25 waste rock piles currently under supervision by the ministry. In the past 10 years (1997-2007) only 9 million soms were allocated for priority rehabilitation works at the tailing sites, while the estimated amount required is over 1.5 billion soms for seven sites. Until recently, the Ministry of Emergencies is not assigned with responsibilities for safety, environmental monitoring and rehabilitation of the abandoned mercury mines of Ulug-Too and Chauvay or the active Khaidarkan mercury mine.

7.9 Existing country experiences and approaches to the reclamation of mining sites

To date, the only major remediation project in Kyrgyzstan has been carried out at the Mailuu-Suu uranium tailings facilities in the southern Kyrgyzstan. The remediation/risk reduction measures at the site were implemented with financial support from the World Bank and GEF and involve the WISMUT Consultancy (Germany). The measures applied at the site include technical-engineering works to improve safety of the hazardous waste sites and monitoring network, including landslide early warning. Experience gained through project implementation can be relevant to Khaidarkan.

Kumtor gold mine is the major mineral extraction operation of Kyrgyzstan, although no actual remediation work has been carried out yet at the site, there is significant experience created around environmental mine planning and mine closure provisioning. By law and its financial partners, the mine is obliged to allocate more than USD 20 million (as estimated) for environmental remediation activities after mine closure. To date the company has accumulated about 6.5 million USD for this purpose. Whether these funds will eventually be transferred to the government or managed by the company once remediation works start is not yet decided. Kumtor works together with the Canadian environmental firms and Kyrgyzstan's 'Eco-Service' on the conceptual mine closure and remediation plans, which are continuously adjusted according to mine conditions and impacts.

The International Science and Technology Center (ISTC) is an intergovernmental organization founded by the European Union, Japan, Russia and the United States in 1992 to coordinate the efforts of governments and international and private sector from Russia and CIS countries to redirect talents of weapon scientists towards peaceful scientific research and innovation. Several project activities facilitated through the ISTC could be advantageous in the context of waste management and remediation activities applicable to certain extent in Khaidarkan, Kyrgyzstan.

The ISTC project (# KR-072, # KR-715) on monitoring, mathematic modeling and methodology development for hydro- and land pollution sources isolation concerning heavy metals and rehabilitation around Kara-Balta processing plant aims to prepare and test suitable methods for rehabilitation of the territories adjacent to the processing plant and subject to the impacts of toxic waste (Pb, Cd, Zn, Co, As, Sb). The project looks at technical solutions on pollution localization and implementation of protective measures to reduce heavy metals spreading into the environment. The project collaborators are: Kyrgyz Institute of Physics, Wismuth (DE), Russian Research Institute for Integrated Water Management.

Another ISTC project (#KR-1146) on tailings ponds and study of their potential for waste recycling is implemented by the Institute of Automatics, Kyrgyz Academy of Science in collaboration with US EPA and Lawrence Livermore Laboratory aims to collect information on mineral structure and properties of the mine tailings and provide recommendations on the recycling of their useful components and remediation.

The ISTC project (#KR-1401) of the Kyrgyz Research Institute on Livestock and Pastures in collaboration with University of Northern British Columbia is searching for natural mechanisms for soil remediation from technogenic pollution and is carrying out a pilot research on phyto-remediation using different plant species.

The Kyrgyz Institute of Chemistry and Chemical Technology/National Academy of Sciences in 2007 filed the project proposal application to ISTC on joint research for environmentally sound technologies of mercury extraction from minerals and ways for environment pollution reduction.

7.10 Participation of international organizations in environmental restoration projects

The World Bank is a leading donor organization in the region with practical experience in implementing environmental and infrastructural projects. To date, the World Bank's projects related to industrial pollution, risk reduction and environmental remediation in Central Asia include Kyrgyz Disaster Hazard Mitigation Project in Mailuu-Suu (ongoing) and Kazakhstan's Nura River Clean-up Project (starting) and Ust-Kamenogorsk Environment Remediation Project (ongoing).

The objectives of the Disaster Hazard Mitigation Project are to:

- minimize the exposure of humans, livestock, and biodiversity to radionuclides associated with abandoned uranium mine tailings and waste rock dumps in Mailuu-Suu;
- improve the effectiveness of emergency management and response;
- reduce the loss of life and property in key landslide areas

The technical activities in the Mailuu-Suu area include installation of active landslide monitoring and alarm system, stabilization of highly vulnerable tailings, improving drainage and storm water diversion. It was suggested by the WB that next project phase (2010-2014) dealing with further research and hazard reduction measures in the Mailuu-Suu area may involve knowledge sharing and technical support for remediation activities in Khaidarkan. This emerging possibility need to be further explored and negotiated.

The Nura River Clean-up Project deals with remediation of mercury pollution in and adjacent to the Nura River due to former operation of the “AO Karbide” acetaldehyde factory in Temirtau (central Kazakhstan), which which had been discharging large quantities of mercury into the river for more than two decades. The estimated total volume of polluted soil is approximately 1.5 million m³, containing more than 9 tonnes of mercury. The technical activities under the project include:

- 1) construction of a secure, modular landfill and its management and the establishment of its long-term monitoring and maintenance program;
- 2) excavation of contaminated hotspots (factory building, main drain, adjacent waste disposal sites) and other contaminated areas, including the Zhaur swamp, critical areas of mercury accumulation along the banks and floodplains of the Nura River;
- 3) transport of the materials to the landfill;
- 4) technical assistance, training, and equipment needed to increase the institutional capacity of the river basin authorities.

In general, lessons learnt from this project could be interesting in the context of remediation planning and implementation in Khaidarkan and it is recommended that relevant contacts to be established and partnerships promoted in the next stages of Kyrgyzstan mercury project.

Recently concluded the International high-level forum (Geneva, June 2009) on uranium tailings in Central Asia once again underlined the need of urgent attention and collaborative action on the problem of tailings and enhancing environmental awareness among industries, governments and the general public to implement environmental remediation of hazardous mining waste sites. In this regard, synergies and linkages to this regional initiative led by the Government of Kyrgyzstan and UNDP should be further maintained. OSCE Kyrgyzstan with its field office in Osh is also active in improving public awareness, including on environmental issues, via Osh Aarhus center or directly. Its recent experience in supporting alternative development opportunities for Min-Kush community could be relevant to Khaidarkan.

There is no other information available about implementation of environmental remediation projects with involvement of international organizations in Kyrgyzstan.

7.11 Recommended actions

It is recommended to develop a program of land reclamation in the area of waste accumulation therefore a more detailed feasibility study on remediation should be conducted at Khaidarkan for prioritization of the polluted sites and elaboration of most appropriate remedial concepts and targets.

In general, remediation should include measures that eliminate or minimize pollution pathways relevant to the human health and the natural environment. This can be achieved through various measures including installation of cover systems, water diversion and subsequent re-cultivation of waste sites.

Implemented measures should serve as a barrier preventing erosion and dispersion of hazardous material caused by wind and precipitation. In addition, any installation should prevent access for wild or agricultural animals and local population.

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Annex

Preliminary list of donors and international organizations that could be potentially involved in Khaidarkan-related activities in support of an Action Plan

<i>Organization and contact details</i>	<i>Additional information</i>
<p>The Aga Khan Development Network http://www.akdn.org/kyrgyz_republic</p> <p>Nurjehan Mawani, Head of Representation Office in Kyrgyzstan 80 Tynstanova Street, Bishkek Contact: shahid.punjani@akdn.org</p>	<p>Public Foundation Mountain Societies Development Support Programme (MSDSPKG), microfinance, health, education, University of Central Asia (UCA)</p>
<p>The Asian Development Bank (ADB) www.adb.org/kyrm http://www.adb.org/Documents/CSPs/KGZ/2009/COBP-KGZ-2009.pdf</p> <p>L. Wu, Country Director, Kyrgyz Resident Mission 52-54, Orozbekov Str. Bishkek, Tel: (+996 312) 627343 and 900445 Contact: Ms. Cholpon Mambetova (cmambetova@adb.org)</p>	<p>Batken province projects:</p> <ul style="list-style-type: none"> - Infrastructure, services and agriculture development - Urban development <p>GEF CACILM project: http://www.adb.org/Projects/CACILM/documents.asp</p>
<p>Blacksmith Institute (based in New-York, USA) Meredith Block, block@blacksmithinstitute.org New York, Tel: +1 646 742 02 http://www.blacksmithinstitute.org/</p>	<p>Records of the worst globally polluted sites and assistance in implementation of remedial actions with donors support</p>
<p>The European Bank for Reconstruction and Development (EBRD) http://www.ebrd.com/country/country/kyrg/index.htm</p> <p>Kenji Nakazawa, Head of Office 26, Geologicheskij pr, Bishkek, Tel: (+996 312) 530012 and 530016 Contact: Ms. Maral Sagynalievna (sagynalm@ebrd.com)</p>	<p>Small and micro-lending projects (small and medium size companies, local infrastructure development): http://www.ebrd.com/country/country/kyrg/sign.pdf</p>
<p>Delegation of the European Commission in the Kyrgyz Republic</p> <p>236, Abdymomunova Str. Bishkek, Tel: +996 (312) 901260 http://ec.europa.eu Contact: Ergina.Segizekova@ec.europa.eu</p>	<p>The EU strategy for the countries of Central Asia: http://ec.europa.eu/external_relations/central_asia/rsp/07_13_en.pdf</p>
<p>German Organization for Technical Cooperation (GTZ)</p> <p>Kurt Wagner, Country Director, kurt.wagner@gtz.de 150, Panfilova str., Bishkek, Tel: (+996 312) 909070 and 90 65 37 http://www.gtz.de/en/weltweit/europa-kaukasus-zentralasien/655.htm Contact: Rainer.Schliwa@gtz.de, asel.uzagalieva@gtz.de</p>	<p>Promotion of business incubators and micro loans http://www.amfi.kg/ Kamil Abdrahmanov (Manager business incub. in Khaidarkan) + 996 777 33 90 83</p>
<p>The International Science and Technology Centre (ISTC)</p> <p>Vitaly Akimovich Kovalenko, Director, kovalenko@istc.kg Tel: (+996 312) 66 01 40, 43(1) 11 71</p>	<p>Scientific research projects</p>
<p>Japan International Cooperation Agency (JICA)</p> <p>Mr. H. Maruyama, Permanent Representative 115 Chokmorova str., Bishkek, Tel: (+996 312) 900 270 Contact: SuyunalievaGuljan.KG@jica.go.jp</p>	<ul style="list-style-type: none"> - Master Plan Study on Promotion of Metal Mining Industry (completed in 1999 by MITSUI) - Rural community empowerment - Forest management and products

<p>Organization for Security and Co-Operation in Europe (OSCE)</p> <p>Mr. Andrew Tesoriere, Ambassador, Andrew.Tesoriere@osce.org 139, Toktogula Str., Bishkek, Tel: (+996 312) 66 50 15 http://www.osce.org/bishkek/ Contact: Kimberley.Bulkley@osce.org</p>	<p>Alternative development of Min-Kush: establishment of new jobs and support of business initiatives http://www.osce.org/item/36071.html</p>
<p>PanPlan (Austria) Contact: peter.schneyder@panplan.eu</p>	<p>Development of the master plan of the Batken Province, assistance in the donor search</p>
<p>Swiss Cooperation Office</p> <p>Mr. Hanspeter Maag, Country Director, bishkek@sdcc.net 144, Panfilova Str. Bishkek, Tel: (+996 312) 301036 www.swisscoop.kg</p>	<p>Projects on irrigation and energy infrastructure, forest sector, community tourism, health care, trade and small business development, natural disasters risk awareness and prevention.</p>
<p>UNDP in Kyrgyz Republic</p> <p>Mr. Neal Walker, Coordinator, neal.walker@undp.org sultan.hajiyev@undp.org UN House, 160, Chui avenue, Bishkek, Tel: +996 (312) 611211-13 http://www.undp.kg</p>	<p>Batken regional development programme: poverty alleviation in urban and rural territories, support of agriculture and income, social, communal and economic services. Possibility to implement a programme's sub-component "Creation of alternative jobs in Khaidarkan".</p>
<p>UNEP Chemicals and UNITAR Waste and Chemicals Management BKoekkoek@chemicals.unep.ch and craig.boljkovac@unitar.org</p>	<p>Engagement of int. community to facilitate development of an Action Plan on Mercury Mining and remedial measures</p>
<p>US Agency for International Development (USAID)</p> <p>171, Prospect Mira, Bishkek, Tel: (+996 312) 551241 and 551242 http://centralasia.usaid.gov</p>	<p>http://centralasia.usaid.gov/page.php?page=article-2 Interactive Map: http://centralasia.usaid.gov/kgmap/?lang=en</p>
<p>The World Bank – Washington D.C. (Mining Section)</p> <p>Mr. Joop Stoutjesdijk, Project team leader (Maili-Suu) Tel: +1 (202) 473-1000, JStoutjesdijk@worldbank.org candrews@worldbank.org, apugachevsky@worldbank.org</p>	<p>Disaster Consequences Mitigation Project (6,9 mln USD). In the course of second phase implementation for Mailuu-Suu it might be possible to share experience and resources with Khaidarkan</p>
<p>The World Bank – Kyrgyzstan (Country office)</p> <p>Mr. Roger Robinson, Country Manager, rrobinson@worldbank.org 214, Moskovskaya Str. Bishkek, Tel: +996 (312) 610650 www.worldbank.org.kg</p>	<p>ARIS projects in Khaidarkan (implemented 2005-08, 8 mln som): http://www.eng.aris.kg/projects/selo/mobilization</p> <p>Infrastructure development, establishment of the information centre, sowing workshop and bakery, motor shop, etc</p>