

## Final Report for the program “Dialogue-2”

May 2016

Tahoe Lake

### Introduction

Peer-to-Peer Dialogue-2 is designed to exchange the best practices in control of mining water and water treatment technology between Russian and American specialists. The project is focused on Lake Baikal in Russia and the Southwest of the USA and is a continuation of the project and associated partnerships established during the Russian American Dialogue about the risks for health (Dialogue-1), which was conducted during 2014-2015.

[http://sric.org/russia\\_dialogue/index.php](http://sric.org/russia_dialogue/index.php)

The scope of “Dialogue-2” included 5 Webinars (webinars 1 and 5 were about organization and logistics). Materials and documents are available at the following site [http://sric.org/mine\\_water/index.php](http://sric.org/mine_water/index.php) [Испанский](http://sric.org/mine_water/index.php)

During the webinars we covered practices of control and technology of treatment of mining water at 4 abandoned mines in USA (Pecos (Terrero), Gold King, Red and Bonito and Empire) and the mine “Holodninskii” in the north of Lake Baikal in Russia. [http://sric.org/mine\\_water/docs.php](http://sric.org/mine_water/docs.php)

May 19-30 the delegation of six people of the Republic of Buriatia of RF visited 4 abandoned mines in the states of New Mexico and California (Pecos, Qwesta, Spanish, Empire) and a trip to Lake Tahoe, where the Russian participants of the project saw the organization of the tourist-recreational activities at the protected areas in the US, which is very applicable to the situation in Baikal, where they currently construct special tourist-recreational zones (Baikal Bay, etc.)

[http://sric.org/mine\\_water/NM\\_CA\\_trip\\_May2016.php](http://sric.org/mine_water/NM_CA_trip_May2016.php)

During the exchange we conducted two round tables, where the Russian and American participants discussed questions of comparison analysis and adaptation of experience, collected at the abandoned mines in the USA, which are applicable to the abandoned mines in the area of Lake Baikal on the territory of Russia.

In this final report we make conclusions of our joint discussions. The main focus of the Russian sites is on the project of reclamation and liquidation of accumulated ecological damage from mining industry in the region of Zakamensk, the problem of mining water and waste at Holodninsky mine of polimetalls, Holbodzhinski and Tugnuisky coal faults.

## **I. Dzhedinski volfram-molibdinim Company (DVMK, Zakamensk)**

### **1.1 Project Implementation Stage**

*The name of the project*

***“Liquidation of the volfram-molibdian complex. Activities of the global scope”***

*Public hearings of EIA took place and the preparation for the state and public expertise is in progress*

### **1.2.Problems/Specifics**

*A)Applied Legal practices*

*1. Within this project the cleanup technology for South-Western adit is discussed (but not the other two)*

*2. The seasonal and annual climate differences (climate cycles of atmospheric precipitation) in regards to the total amount of adit mining discharge water has not been considered enough. In addition, it is also necessary to discuss the impact of ground water at Modonkul.*

*3. Possible discharge of mining water from the adits to the surface from the boreholes in certain instances has not been considered.*

*4 Projects of using disturbed land for various types of post-mining activities are not considered*

*B) Legal*

*The future owner of the clean-up operations responsible for the reclamation work at the sites as well as the ecological monitoring and technical maintenance has not been determined.*

### **1.3. Recommendations**

#### **1.3.1. Round Table #1**

*A)Technological*

Options for the prevention of water discharge into the river and the clean-up of mining drainage water have been discussed in Taos, New Mexico.

Recommendations:

1. Belogolovov V.F.

Block adit exit with concrete walls (put concrete blocks at the adit exit)

Comments of Rogalev, Robinson and Shaphaev:

When the pressure is built up and it reaches the critical level, mining water will reach the surface area and will pollute the nearby rivers.

1. Rick Hamphree

Put concrete blocks and drain mine water to prevent pressure from reaching critical levels (not to allow mining water to come to the surface); regulate pressure with special valves.

2. Rogalev A.

Collect water from the three adit exits and direct it into one area for treatment. Release treated/clean water into the river; similar to the way it is done at Questa.

3. Paul Robinson

Put concrete walls at adit exits, bore holes into each audit and pump water to the nearby treatment facility. Monitor water pressure as it can come to the surface through the bore holes once it reaches the critical levels.

*B) Legal*

*Внести в федеральные законодательства поправки, позволяющие определить собственника или ответственное юридическое лицо, который будет осуществлять технические и технологический, мониторинг надзор за комплексом очистных сооружений.*

*Write amendments of the federal law to provide a way of determining an owner or a responsible party, who will conduct technical and technological monitoring of complex reclamation activities.*

*C) Social-economic*

*Prepare amendments to the schema of territorial development of the region and to the General Plan of Zakamensk on the disturbed territories for various types of household activities (development of wind and solar power stations)*

*1.3.2. Round table #2*

*A) Technological*

Minimization of impact of tailings on atmospheric air

Recommendations:

1. Paul Robinson

The bottom of tailings must be lined with synthetic lining and covered with special cover that prevents wind erosion. The angle of the slopes must be reduced to prevent wind erosion. Apply Pecos and Questa experience.

2. Rogalev A.

Put concrete blocks around tailings and cover tailings with special cover.

3. Belogolovov V.

Move the tailings from Barun-Narin mine to the basin of Dzhida river.

Lbov's commentary as presented by Shaphaev.

Due to ecological considerations creation of a new source of contamination of surface water at the basin of Dzhida river is not permissible.

2. Shaphaev S.G.

To recommend large scale industrial secondary recovery of metals from tailings on sites followed by safe handling of tailings based on the best available technologies (the primary idea of the project "Liquidation of damages at DVMK")

*B) Legal*

*It is necessary to make amendments to the federal law to create tax breaks for companies, which will conduct reclamation, secondary recovery, and*

*liquidation of waste material at DVMK. Consider measures of compensation to the population, which was effected by the toxic waste.*

### **Andrei Rogolev's Recommendations:**

In the first case (Pecos)-- we observed a method where the waste and tailings are blocked by iron or cement walls (can be cracked), covered with a layer of soil and plants. The streams of water are directed along the lined passages (with a specific liner), which prevents water from getting into waste settlements

In the second case (Questa Mine) – there is pumping of water from adit and treatment of water in a specially constructed water treatment plant. There is an isolation and cover of wasted material by soil and plants.

In the third case (Spanish Mine) cleanup of seeping water from the adit (free flowing) by construction of raised settling pond (the smallest system of water cleanup that we saw).

In the fourth case (Empire Mine) pumping of water from the audit and cleanup of water in a series of three settling ponds.

I am not going to assess the effectiveness and cost of each of these systems; I believe, that there are specialists who do just that.

Here is my opinion on the possibility of adopting these systems for conditions in Zakamensk.

1. Factors, which complicate the implementation of methods to liquidate (reduce) the impact of waste conditions, which need to be considered.
  - Permafrost
  - High number of sources of contaminated water (5 adits); they are spread out
  - Large amount of settled material under technogenic (Barun-Narin); this is relevant when we discuss the method of building isolation blocks.
2. Suggestions for technical implementation.

#### **2.1. Contaminated water.**

There are two sources of contaminated water – this is adit water (4 sources) that come to the surface) and drainage water, which comes from technogenic deposit Barun-Narin.

a) Water, which goes into the stream Modonkul - to be directed into one contained stream and cleaned by putting it through a serious of settling ponds, which are filled with limestone (Victoria's research); to consider sequential treatment ponds, as at Empire Mine.

Contaminated underground water from Barun-Narin—it is necessary to bore holes to reach water and treat water afterwards; direct water to the settling ponds for treatment. This territory already has several hydrolic holes (Plusnin's research); the analysis of composition of underground water; it is necessary to create a map of underground water and determine its place and volume that needs to be pumped.

b) Water, that goes into the stream Mirgensheno (stream Evanovka and stream Gudzhirka); also direct it along the lined stream into one settling pond filled with limestone.

c) As an alternative plan, to build separate settling ponds next to each source of contaminated water.

## **2.2 On isolation of technogenic sand at Barun-Narin**

a) To cover with soil and plant vegetation in order to prevent sand spreading by wind. In my opinion, it is necessary to cover tailing piles with (geo)material to protect it from atmospheric precipitation and then cover it with soil. It will be necessary to flatten the surface; as of right now there is a mountain of tailings after their transportation. If this project is carried out in conjunction with the next suggestion (2.2 b), it is possible to prevent contamination of ground water from Barun-Narin waste pile (new tailings) and pumping of water through holes (2.1) will not be necessary.

b) Isolation of water streams by building additional diverting streams, which will prevent mountain water and water from Barun-Narin flow through the sand. Building of dams will practically be unrealistic because of the large amount of settling material under Barun-Narin (up to 100 meters).

During winter streams freeze and water will flow on top of treatment facilities. We will have to accept it or reject this idea altogether (it's not realistic to heat several kilometers of stream). Then, as an option we can consider constructing a treatment plant and collection (by pumping) of contaminated water from various sources into one (we'll have to heat the pipes.)

Naturally, we'll have to further study and calculate various options.

### **Olga Smirnova's Recommendations:**

Additional suggestions (comments) of Olga Smirnova – in continuation of the necessary scientific research in support of technical solutions of liquidation of negative impact of waste material of mining on the environment in Zakamensk.

A) Matt's research (University of New Mexico) – impact of inhaled fractions of dust from the territory of Zakamensk and waste tailings on live organisms (mice) has shown toxicity of dust. He offered to continue this line of research (to conduct various types of analysis that he is able to do). I believe, that we need to support this line of research because the data will be required to prove the necessity of projects of isolation of the dust surface of the tailings. It is necessary to publish the results in the unrestricted publication (so the data can be cited).

B) To continue research in order to find technical solutions for safe storage of tailings from the enrichment plant by selecting effective geochemical barriers (Plusnin, Smirnova, Dabaeva).

C) To continue research of forms of migration of potentially toxic chemical elements in geotechnogenic landscapes (Smirnova) in order to determine factors and conditions of prevention of the possible formation of their migrating forms.

D) To continue the search of ways of secondary use of waste of mining industry (study ways of how to use tailing as possible fertilizers) – laboratory hydro-geology and geology of Geological Institute (Doroshkevich Svetlana)

Taking into consideration Mehdi's proposal for collaboration in the analysis of elements, his interest in our research and in Matt's research, I suggest that it is necessary to finish formatting of our Agreement of Scientific Collaboration of our organizations (SRIC, UNM, GIN SB RAS).

I am absolutely against the idea of transporting tailing of sulfate ore to the basin of the river Dzhida. I also do not favor the idea of closing Western adit, since such attempts have been already made in the past with failed results (but I can be wrong, because I do not fully understand this method of solving the problem).

***V.F. Belogolovov's Recommendations, see Appendix***

## **II. Holodninskoje Mine of Polymetals**

### ***1.1. Short history, status and implementation of the project of the neutralization of mine water***

Holodninskoje is a pyritic lead-zink deposit, which is located in the north of Baikal in the watershed of the rivers Tii and Holodnaja, which flow into the Lake Baikal. It is part of the territory designated as Central ecological zone of Baikal natural territory ((ЦЭЗ БИТ)), which is within the limits of the world heritage site of Lake Baikal. In the 70-80ss of last century, the geological work was carried out, which resulted in the construction of 2 adits; currently, there is insignificant drainage of mining water from 2 adits, which flows into the river Holodnaja.

Majority of researchers conclude that Holodninskii is a type of hydrothermal-sadimentary deposit. Development of Holodninskii was prohibited back in the Soviet period in 1990. (Regulation of Ministry of RFSR 4.14.1990) due to the complex hydrogeological structure of subsoil, high seismicity and permafrost, which all create high risks of contamination of Lake Baikal via the rivers Tia and Holodnaja in the case of underground mining. A large scale mining-enrichment facility can lead to intensification of oxidizing processes in the deposit and transportation of the highly toxic elements to the surface.

However, in 2004 investment-financial corporation (IFC) “Metropol” obtained the rights for the development of the deposit because of the existing loopholes in the federal laws at the time. Since 2006, after the borders of the territory ИЭЗ БИТ, the development of the deposit is prohibited by the federal law.

Any attempts of the company “Metropol” to make amendments in the existing law, in order to carry out the development of the deposit caused protests of the ecologists (BroBaikal, BAV, Greenpeace of Russia). This caused a committee of the world heritage UNESCO as well as the International Union of the Preservation of the Environment (MCOП/IUCN) to take under their control the protection of the status of this site.

<http://whc.unesco.org/en/sessions/39com/documents/>

<http://whc.unesco.org/archive/2016/whc16-40com-7BAdd-en.pdf>

Currently, the project of the neutralization of draining water from adits #1 and #2 are being considered based on the funds of the program “Protection of Lake Baikal and the rational use of its resources”. Current project proposals, which include involvement of Geological Institute CO RAN can be found here:

[http://sric.org/mine\\_water/docs/Plusnin\\_2\\_%202016\\_Holodnitski\\_ru.pdf](http://sric.org/mine_water/docs/Plusnin_2_%202016_Holodnitski_ru.pdf)

#### *Recommendations:*

- It is possible to treat adit water draining from adit #2 and from technogenic pool formed due to the seepage of water from adit #1; utilize the experience of the Empire mine for passive treatment.

-To create geological monument and polygon for educational purposes; utilize experience of State Part Grass Valley and Empire mine (recommendation for the creation of the geological monument at the site was made by Evgeni Kislov, a PhD geologist, who is a senior scientist at Geological Institute of CO RAN as part of the public ecological expertise of the Development Project at Holodninsky mine, 2007).

### **III. Holbodzhinsky coal fault**

#### **3.1. Implementation Stage**

Name of the project



“Liquidation of negative impact of coal mining on the environment of Holbodzhensky coal fault and waste from the mine of Gusinozerskaja-reclamation of disturbed land, protection of surface and ground water.”

***Public hearings took place and the preparation for state and public expertise is in progress.***

## ***2.2. Problems/Specifics***

### *A) Applied Legal practices*

This project is focused on the assessment and liquidation of the impact of contamination of Gusinoe Lake by the contaminated water; the budget of the project is 2 billion rubles.

Previous research revealed that Gusinoe Lake is contaminated with nitrogen, phosphorus, and organic material. The following substances accede PDK (maximum allowable concentration): phenol, oil products, copper, iron, BPK5 and HPK (organic material).

Some of the previous research and recommendations have not been fully utilized. This research includes studies by Kremenskii (2003), which were ordered and funded by the Ministry of natural resources of the Republic of Burjatia, Report of FCP (2011) “Preservation of Lake Baikal and rational use of its natural resources”, which received a negative **review** of ecological expertise, and recommendations of Paul Robinson.

### *B) Legal*

Research has been conducted only on the territory of impact next to Gusinoe Lake since the use of federal resources is prohibited on the territory of the currently active company “Bain-Zuhre”.

## ***2.3. Recommendations***

### *A) Technological*

It is necessary to conduct additional **engineering-ecological** assessment of the impact of contamination of underground water, which flows into Gusinoe Lake.

After technical reclamation of the territory of mining waste, the restored land can be used for the wind and solar power stations.

#### *B) Legal*

Prepare amendments to federal law, which will encourage the company “Bain-Zurhe” to develop and implement a project of reclamation of the **disturbed** land on the territory of mountainous region.

### **IV. Tugnuisky Coal Faul**

#### ***3.1 Stage of Implementation***

Conceptual development of the project for the construction of water treatment facilities, which can contaminate the river Tugnuika due to the development of the new mine “Nikolskoje”.

#### *3.2. Problems/Specifics*

##### *A) Applied legal practices*

There is a flow of draining water from the developed coal deposit Olon-Shibirki along the upper portion of the river Tugnuika, which meets eco-protection norms of the current law.

However, in 2015 Angaro-Baikalskii Management of Fishery (i.e. USA federal agency of Game and Fish) raised the status of the river Tugnuika to the first category and therefore raised the standards quality of draining water. As the result, the company will be forced to treat the draining water up to the standards of natural conditions prior to the development of Olon-Shibirsky coal mine. At the present moment, the natural conditions are elevated compared to the original prior state.

### **3.3. Recommendations**

#### *A) Technological*

It is advisable to take into consideration the USA experience in realization of such projects (Empire Mine and Pecos Mine)

It is advisable to find a data base of hydro-biological studies, engineering-ecological findings, which were conducted at the river Tunguika during the years prior to the beginning of coal mining at Olon-Shibirski coal deposit as well as during the development of the deposit

#### *B) Legal*

It is necessary to study the experience of similar legal situations in the USA and in Russia

#### **/ Appendix 2**

Reports of prior research

Materials provided by Paul Robinson

[http://sric.org/mine\\_water/index.php](http://sric.org/mine_water/index.php)