BLACKSMITH INSTITUTE
PURE EARTH

INTERIM PROJECT REPORT

Sovetskoe, Kyrgyzstan Lead Health Risk Reduction Project

September-November 2016

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March 2017

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List of Abbreviations

µg/dL micrograms per deciliter
BLL Blood lead level
mg/kg milligrams per kilogram
ppm parts per million
TAB Technical Advisory Board of Pure Earth
UNIDO United Nations Industrial Development Organization
XRF portable X-Ray Fluorescence analyzer

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Project Overview

Sovetskoe (Kan) is a small town in South Kyrgyzstan heavily contaminated with lead and other heavy metals from mining industry. Local residents were not aware of the lead health hazards and were exposed to high lead soil concentrations from using sand from nearby tailings. Sovetskoe is one of the unfortunate legacies of Soviet mining in the region. The area required remediation, and the local population had to be made aware of the dangers they encountered on an everyday basis. The aim of this project was to both clean the site, and educate local citizens and government officials about the health effects of lead.

Project Goals

The main goal of the project is to reduce the lead health risk of children in Sovetskoe

Sponsors and Participants

The program is implemented by the administration of Sovetskoe with the organizational support of Pure Earth/Blacksmith Institute and UNIDO, funded by the European Union.

Budget

The total budget of the project is $85,535. It includes: soil remediation, planting, water filtering equipment, heavy machinery, leadcare test kits, sampling, preparing and printing educational materials. Direct costs - $64850, administrative costs (10%) - $6485, local matching funding $14200.

Program and Action Plan

The present program lists the main project activities.

1. Environmental Assessment

- Assessment of soils near school, kindergarten, and technical boarding school
- Assessment of private gardens and indoor dust
- Assessment of drinking water
- Mapping results of the assessments in order to prepare for remediation.

2. Medical Monitoring

- Blood lead testing of children attending kindergarten, school, and technical boarding school
- Analysis of the blood lead testing results
- Risk assessment for children with high blood lead levels (BLL) and providing consulting to their families

3. Remediation

- Remediation (cleanup) of areas near kindergarten, schools, and other areas considered priority
- Remediation of yards with high contamination of soils
- Planting grass and bushes in public education institutions and other priority areas.
- As feasible conducting actions to solve the issue of water contamination (e.g. installation filters in children education institutions)

4. Education and Awareness

- Consulting local residents about lead health risk issues
- Preparing, printing, and disseminating informational materials
- Introducing education program for children and parents including:
    - for high school – classes, contests, and quizzes;
    - for primary and middle school - interactive lessons, contests, plays
    - for kindergarten - interactive shows, play lessons
    - for parents and teachers – meetings, lectures
- Equipping education institutions with information stands, posters, and education stickers
- Installing warning signs at the tailings

Health Dangers

High concentrations of lead in the environment are dangerous and are especially hazardous to small children. Children are the most susceptible part of population when it comes to lead poisoning. The main risk factors are contaminated soil, dust, water, and local food. Additionally, people put themselves at risk in Sovetskoe by using contaminated sand from tailings for construction purposes. The concentration of lead in that sand is generally 1000-4000 mg/kg.

According to the World Health Organization lead poisoning is the most widespread and dangerous disease related to environmental pollution. Individual susceptibility to lead poisoning varies widely.

Symptoms of lead poisoning vary, and may develop gradually or appear suddenly after chronic exposure in severe clinical lead poisoning cases. The victim usually becomes pallid and irritable and may complain of a metallic taste in mouth. The victim also suffers from upset stomachs, reduced appetite and may have abdominal pain, with spasms of the abdominal muscles ("lead colic") as well as constipation. A black line ("lead line") may appear at the base of the gums in victims. Anemia is often a symptom. In later stages, headache, dizziness, confusion, and visual disturbances may be noted. Peripheral nerve involvement results in a paralysis ("lead palsy") that generally first affects the fingers, hands, and wrists ("wrist drop"). Among children, the brain itself may be affected, resulting in some cases in permanent damage, such as blindness and deafness, or in convulsions and coma ending in death.

Site Description and Background

The town of Sovetskoe (recently renamed Kan) is located in Kyrgyzstan, in Batkensky region, about 70 km west of the district capitol Kadamzhay. The settlement is situated in the foothills of the Alai Mountains at an altitude of 1100 – 1200 m. Distance to the regional center Batken is about 75km, to Osh – Isfana road - 17km.

Climate

The dry climate and dominating winds create conditions for contamination of the settlement with lead containing dust from the tailings. In addition to this, the sand from the tailings is frequently used by the local residents for construction purposes, including for the interior of their homes.

Topography of the area is mountainous. The hydrological network is weak and represented by small streams and springs with. The climate is moderate continental.

The average annual rainfall ranges from 300 to 400 mm. Westerly flow is predominant.

Mining History

The Adrasman lead and zinc factory was built in Sovetskoe in 1950, and operated continuously until 1971. Lead and zinc ores were produced from open mines and refined at the factory. The ore processing facility functioned in the southeastern part of the town. The tailings are present right near the eastern edge of town. The area of tailings is about 11 hectares and the volume of stored materials is about 2.8 million cubic meters.

Open mining and processing of lead and zinc ores was held in the village for a long time and led to the disruption of the natural landscape. It caused erosion of non-cultivated dumps and tailings; pollution of soil, surface water and atmosphere. There is no sanitary protection zone between the residential area.

The precarious ecological situation in the region is caused by the long-term open-pit mining and processing of lead and zinc deposit. The development of the deposit started in the 1940. Currently, the deposit is conserved.

Fig. 1. Tailings near the town

The area of tailings in the region is 175 ths. m2 with a total capacity of 2800 ths. m3, with high content of lead and heavy metal salts. The area of tailings is easily accessible to local residents and only partially capped. The local population uses sand as a building material for plastering inside and outside their homes.

Fig. 2. Sand from tailings local population uses as a building material

Fig. 3. View of the tailings

Fig. 4. Even though the tailings do not contain radioactive materials the signs have the radiation symbol in order to scare the people away

Local Involvement and Impact

Head of Sovetskoe Aiyl District, Kalbubu Osmonova and Speaker of Village council, Zamirbek Mamasadykovich Dosatov reported chronic salt deposits in the kidneys of all villagers (the population annually undergoes medical examination). He also reported tooth loss among villagers older than 30 years old (the reason for this is unknown).

Currently, the population of the village is about 1,300 people. These citizens are exposed to the negative impact of production waste. Tailings are situated directly next to the village. In the summer, the population of the village, especially the children go through the tailings to get to a pit filled with groundwater.

Preparing for Remediation

Dr Deborah Havens (TAB member) conducted training of Ochulkhan Zhalilova (local medical personnel), Indira Zhakipova (Country Coordinator), Olga Kuzminova (Consultant), and Alena Temnikova (Program Associate) on proper handling and use of LeadCare II blood lead analyzer. The trainees were taught how to prepare the equipment for blood lead testing, perform quality control operations, and conduct analyses. This knowledge is particularly important for future blood-lead testing in other projects in the region.

Petr Sharov (Regional Director of the Former Soviet Union Program) held a training for Olga Kuzminova (Investigator) and Alena Temnikova (Program Associate) on using Niton XRF portable analyzer. The training was conducted on October 27th in Sovetskoe during the ongoing soil remediation activities in order to assure quality of remediation. At the end of the training both trainees were able to conduct field sampling using portable XRF.

Initial Area Tests and Screenings

The initial screening assessment was conducted by Blacksmith Institute in 2012. Six samples of soil and sand were taken from the area near Sovetskoe together with the aid of the Head of the Sanitary and Hygienic Laboratory of Kadamjai Center of State Sanitary and Epidemiology, Makhmud Israilov. Samples analysis were done in the lab, Alex Stewart in Bishkek. The results of analyses revealed soil lead concentrations up to 4,000 mg/kg (ppm)

This is significantly higher than 32 mg/kg, the Maximum Allowable Concentration (MAC) for lead in Kyrgyzstan and 400 mg/kg, the United Stated Environmental Protection Agency cleanup trigger level.

In May 2016 by invitation of the town administration the group of Blacksmith Institute specialist led by Dr. Petr Sharov conducted a more detailed assessment using a potable X-ray fluorescent spectrometer. In all after examining 77 collected soil samples the concentrations of lead exceeded the MAC levels. Local gardens, yards, streets, playgrounds of Sovetskoe are contaminated with lead concentrations reaching 4169 mg/kg (Fig.5).

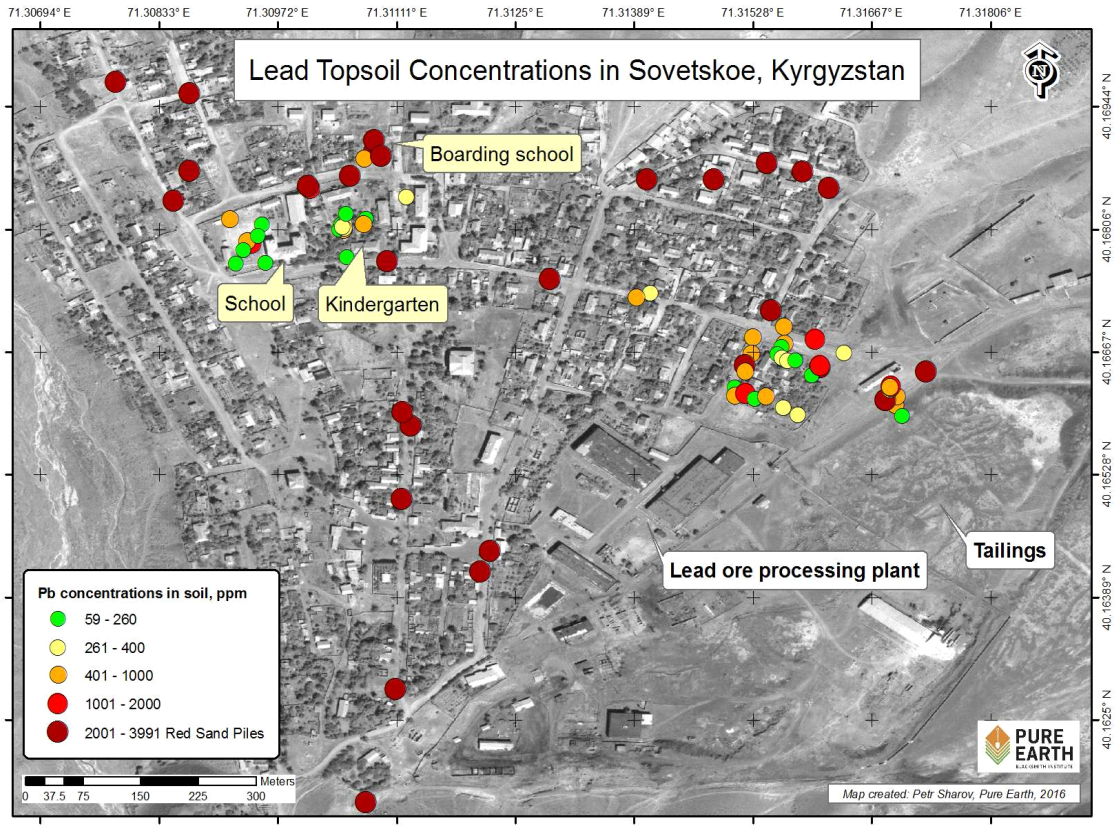

Fig. 5. Results of the assessment in 2016

Blood Tests

An individual's health risk from exposure is assessed by measuring the concentration of lead in the blood. Today, the United States has adopted a standard

that labels blood-Lead concentration below 5 µg/dl as "safe" for a child, in many other countries the standard is 10 µg/dl. Blood-Lead concentrations above 5-10 µg/dl but below 20 µg/dl are considered elevated and denote elevated risk of lead poisoning.

Levels above 20 µg/dl indicated even higher risk of lead poisoning leading to serious health problems. Blood lead concentrations of 45 µg/dl and higher may result in permanent brain damage and death, so immediate treatment is necessary. Because of variation in individual susceptibility to lead poisoning, some children may have worse than average effects at lower blood lead concentrations and some may become sick only at higher blood-lead levels.

Fig. 6. Blood lead testing of children in Sovetskoe hospital

Blood-Lead testing in Sovetskoe was successfully conducted by the local medical personnel with the support of the project team. In all, 260 people were tested. According to the law of Kyrgyzstan Republic for each tested person an informed consent form was signed. For children, the consent forms were signed by their parents.

- One group of adults (21) and children 15-17 years old (17) had the lowest blood-Lead levels. Only 45% tested above 5 mcg/dl and 5% above 10 mcg/dl.

- Another group of 222 children at the age of 8 months to 12 years had much higher blood-Lead levels: 88% of them were above 5 mcg/dl, 41% above 10 mcg/dl, 12 children (5%) had blood lead concentrations 20-39.9 mcg/dl.

The results of the blood-Lead testing were provided by the medical personnel individually to each family. Olga Kuzminova interviewed and provided additional

counseling to parents with children with levels over 15 mcg/dl. She was able to talk to 38 families. Medical personnel were provided dietary supplement "Detoxal" to give to the families in order to speed up removing heavy metals from the body. It ought to be administered to children with blood-lead levels above 15 mcg/dl.

Affected Population

The current population of Sovetskoe is 1300 people. There are three public education and childcare institutions: a kindergarten, a school, and a technical boarding school. All are located in the western part of the town. About 350 children attend these institutions. Some older children come to study to the boarding school from out of town. The analyses of soil at yards and playgrounds of all those institutions showed high level of contamination up to 2000 mg/kg.

Fig. 7. The mayor of the town helping to translate the lecture on lead health dangers at the boarding school

Cleanup Process

Almaz Baymyrzaev was appointed by the mayor to organize and lead the remediation crew of local workers. Almaz Kyrgyzbaev and Petr Sharov supervised the soil cleanup. Almaz Kyrgyzbaev and Indira Zhakipova handled contracts and payments to workers and heavy machinery operators.

The main activities occurred in October and beginning of November 2016. Local government representatives helped organize the project and educational activities in the town, and helped parents with small children come to the meeting. They set up the assemblies for school and pre-school children. The officials also spoke to the local residents about the need to transport soil out of their back gardens, and have their children tested. Local government leaders also provided housing and meals for the cleanup workers.

- The main cleanup was done with heavy machinery and took about two weeks and cost $11000. Water filtering equipment and transportation/installation cost $8000.

Special water filters were installed in the school, kindergarten, and boarding school. The newly cleaned water is used for drinking and cooking, and not only in the schools, but also by other residents in the area. There is a noticeable difference in the water before and after filtering. The filters that were installed are not difficult to maintain. They look like removable cartridges. There is an extra filter in the kit. Each filter lasts for 1 million liters of water, so it will last a long time. One cartridge costs about $45. After installation, the project team took water samples for further analysis of lead concentrations in the regional lab and in Bishkek.

Fig. 8. Soil remediation process

Piles of sand from tailings were in almost every yard in town. Most of the piles of sand were on the side of the street. All of them were removed and the sand returned to the tailings using heavy machinery. In 3 yards closest to the tailings the soil was highly contaminated with lead. Those yards were cleaned by removing the most contaminated layer of soil, usually about 40cm from the top. At the school, there was an area in the sport yard filled with sand from tailings. In this area the top 30cm were removed. The layer was replaced with clean sand. At the boarding school, the volleyball field was similarly filled with red sand from tailings. In this location, about the top 40cm of soil were removed. At the kindergarten, the contamination was uneven in the play area, so about 20cm of top-soil was removed in this area. All places with lead concentrations over 400 ppm were cleaned up manually, because heavy machinery could not operate in a narrow area. The contaminated soil was removed and replaced with clean soil, mostly using an excavator. About 400 metric tons of soil were removed from the area. About 40 tons of clean soil and 45 tons of sand were brought in. The new soil came from the Village Chon, 20 km from Sovetskoe. The soil and sand were tested by the team.

The autumn weather was damp, and there was no need for additional dust control. After all the cleanup efforts some contamination is still present in the town, mostly as minor leftovers from the piles of red sand, so the work is continued to remove manually all red sand from the streets and yards.

Educational Activities

Education activities in the form of lectures, meetings, classes, and games were conducted with children of all ages and their parents according to the project plan. The project team even brought a children's book that explained the dangers of lead to young kids.

Fig. 8. Children's book on the dangers of lead poisoning

Most of the local residents positively responded to the education program and eagerly participated in the project by bringing their children for testing, helping cleanup, reading and distributing provided printed education materials.

Overview

Getting support from central government is difficult. The country is poor and does not have state programs on remediation. The project became possible because of the initiative of the Pure Earth team and support and enthusiasm of the local authorities.

The level of awareness of local people about lead health risks was extremely low. Only blood-Lead testing showed local residents that exposure of children to lead was real. Only then did most of them started cooperating in removing the contaminated sand from their yards. Printed materials developed for the project have great value as they could be used in other places in Kyrgyzstan and Central Asia

Next Steps

In the future the Ministry of Emergencies is planning to cap the tailings. This should block easy access to highly contaminated materials. But it is not know when this work will be done.

The project team plans to help organizing another blood lead testing and education sessions once again in May or September 2017 in order to monitor the lead health risk and finalize the project activities in the area.