

## TECHNICAL SUMMARY – REMEDIATION OF HIGH PRIORITY HOTSPOTS IN WESTERN BALKANS

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COUNTRY : FYR MACEDONIA

SITE: 1 Radovis Municipality: Bucim reopened copper mine

SITE: 2 Lojane Municipality: Chromium & Antimony Beneficiation Plant

### ENVIRONMENTAL/HUMAN HEALTH PROBLEM

Bucim is an open cut copper mine with several sources of waste water and dust that can impact harmfully on human health and the environment. There is currently contaminated water with high levels of harmful metals (i.e. cadmium) leaving the site and moving where they would impact on humans and environmental health for many kilometers down stream. There are a number of sources of dust from the tailings ponds, the active mine activities and a number of other sources that can be carried onto the surrounding country side and nearby villages where the heavy metals again pose a risk of harm to human and environmental health and the growing of agricultural products.

Lojane is a relatively small underground mine with associated metals processing for Chromium and Antimony. The nature of the ore and the subsequent processing residues produced from past activities has left the site highly contaminated with toxic heavy metals including Arsenic, Cadmium, Mercury etc. The very close proximity of the school to the uncovered process wastes, tailings and contaminated waters presents an extreme risk of harm to human health and the environment.

### INTERVENTION & WORKS

For Bucim the proposed intervention aims to reduce heavy metal impacts from dust and drainage waters through constructing a waste water collection and treatment system for the mine, tailings and waste rock drainage, re-vegetation of stabilized tailings, and stabilization of temporary sources of dust with **“barrier sprays”**. **Monitoring of the current situation and the improvements for both air and water quality** is proposed.

For Lojane removal of the concentrate and containment of the mining, process and tailing wastes are proposed with concurrent monitoring of air quality with a particular emphasis on the improvement of air quality in the school.

### BASELINE AND EXISTING INFORMATION

For Bucim baseline data is available on the metal levels within the primary ore, waste rock, dry tailings wastes, waste water and metal levels in tributaries leaving the site. At the time of this report however the available reports it had not been translated into English and cannot therefore be fully commented on. It is not known at this point if there has been air or soil monitoring conducted for the surrounding area. Reported levels show very high metal loads present in the tributaries collecting the waste rock drainage. The ore level however is relatively low bearing only 0.2% copper with similar concentrations of other heavy metals.

For Lojane there has been considerable baseline collected in a 2007 feasibility study detailing the extent and degree of contamination present in the waste, dust, water and in the surrounding

environment given the concern placed on the site through ENV SEC. While no quantified information on the local health effects or heavy metal body burden have been undertaken the information provided shows extremely high metal levels (Arsenic, Cadmium, Antimony, Nickel) were present on the surfaces present in the school grounds, the river sediments also carry high loads as do the surface waters in some of the rivers (i.e. the Suva) and wells. Heavy metal contours for the surrounding country side show landscape levels of contamination. The information provided for uncovered process wastes show significant quantities of high concentration (greater than 50% Arsenic) wastes across the site (concentrate, open stockyard, drums).

SITE VISIT – 23 April

"Bucim - Industrial Water Treatment Plant"

An inspection of the open cut mine, waste rock stockpiles, tailings dam and mineral processing plant was conducted. In general it showed a well run facility of moderate size with standard environmental mitigation measures carried out on much of the site. From an environmental and human health perspective the features of highest focus are the sources of dust and the waters emanating from the waste rock stockpile. Drainage water from the waste rock stockpile is lime blue in color indicating high levels of copper. The current cadmium load in this water is 200 times higher than the acceptable category for category 1 waters under National laws and approx 700 times higher than contemporary WHO drinking water limits. The water remains this colour for several kilometers and would be a source of heavy metal pollution for humans, livestock for many kilometers downstream. The mines site itself being open cut and approx 500m in depth is largely self contained.

There is an extensive tailings dam present which captures atmospheric rain, receives all tailings from the onsite process and potentially some other drainage waters. The walls of the tailing dam are still under construction and are made up of the tailings material which is deposited on the top as slurry through movable pipe-work. Drainage water from this process is recaptured and pumped back into the tailings dam. Areas of the tailings wall already constructed have been or are undergoing re-vegetation with trees and an under story of grasses. The vegetation appears to be in reasonable conditions. Given the low starting concentration of the ore the metal content of the tailings is low for copper and well within human health limits and would appear to be suitable for constructing the dam wall. The heavy metal content for more harmful metals (Lead, Cadmium, Arsenic, Mercury) still needs to be considered in quantifying the risk though dust abatement measures are being implemented. A village is in direct line of site immediately below the tailings dam wall and would receive any dusts blown from the tailings dam as would the surrounding country side.

**"Lojane-Chromium & Antimony Beneficiation Plant"**

The Lojane mining and mineral processing site is a relatively small and extremely disturbed site with visible stockpiles of red ore concentrate, tailings wastes and stockpiles with prevalent rubbish, mining rubble remains of demolished buildings and site structures scattered across the area. There are considerable quantities of ore concentrate less than 100 meters of the school. School children at the time of the visit and were seen to have free access to the mine site and processing areas. There are no barriers present and no warning signs. The proximity of these concentrated sources of arsenic, antimony, cadmium and chromium to the school presents an extreme high risk of harm to the occupants of the school. Swab sampling undertaken in the feasibility study show that the school is heavily contaminated and would likely result in high metal loads in the occupants through food to mouth activities (eating, drinking, smoking) and through inhalation of dust particles. The highest point sources of contamination are likely to be from the concentrates and process wastes within proximity to the school and nearby villages. Heavy metal contours conducted in the feasibility study also indicate a likely impact on livestock and crops grown in the area.

## RECOMMENDATIONS

For Bucim the site dust control measures are robust and the re-vegetation of the dam slope provides for long term dust control. Though it was noted that the grass understory was patchy in places, and that topsoil cover, it was not always used. For long term effectiveness the vegetation must be maintained. It is recommended that a topsoil cover be utilized in future stabilization areas both as a barrier and to provide a better growth media and that contracts, covenants, bank bonds or other economic instruments is providing for long term vegetation maintenance. The background of heavy metals of human and environmental concern in the surrounding community, agricultural products and tailings wastes should be quantified to allow the impact of the mine both currently and previously to be quantified. In relation to wastewaters based on the information viewed at the timing of this report the waste rock drainage represented the highest source of contamination coming from the mine site and should be addressed as a priority. As a minimum measures should be made to incorporate the waste rock drainage into the flotation treatment process or tailings dam.

For Lojane based on the information present in the feasibility study and collected from the site visit it was recommended that a hierarchy of priority actions be established that identify where the most immediate gains can be made with available resources that will produce the greatest improvement for human health and the environment. An immediate action would be to educate the community on the risk from the mining wastes, fence off the most dangerous sources of contamination and post perimeter warning signs. This should be followed by early actions to either remove or cap and contain the arsenic concentrate near the school, the drum wastes, the open stockyard, the ore stockpile. Secondary actions would be to target other high concentration sources close to human habitation and water sources and plan the next level of actions to be carried out. It is also recommended that a comprehensive community education program be conducted based on the studies conducted on areas and crops which are more likely to represent a risk to the community and education be conducted on minimize the effects of heavy metal intact through surface dusts(i.e. living with lead approaches).