



Short title: Mercury Exposure in Mozambique

Short problem: 50x the recommended levels

Short solution: Community education about simple mercury-capture tools and techniques

Quote: Local empowerment protected the health of miners, gold traders, and the aquatic environment

- Project Details:**

Location:	Manica, Mozambique
Contaminant:	Mercury, Elemental Mercury
Project Duration:	2005--
Project Cost:	\$30,000
Implementing Partners	Centre for Sustainable Development for Natural Resources Management, Chimoio; Ministry for the Coordination of Environmental Affairs (MICOA); the United Nations Industrial Development Organization (UNIDO); the Global Environmental Facility (GEF) and the United Nations Development Programme (UNDP)

- **Problem:**

Manica is a district of Mozambique in the Manica Province with a population of 155,731 people. Manica District borders with the Republic of Zimbabwe in the west, the District of Gondola in the east, the District of Barué to the north through the Pungué River, and the District of Sussundenga in the south, which is bounded by the Revué and the Zonué Rivers.

In the Manica District of Mozambique, more than 10,000 people are directly and indirectly involved in artisanal (small-scale) gold mining activities (garimpagem) that are a source of income for them. Most of “garimpeiros” (artisanal miners) use mercury to extract gold from the mineral ore; the amalgamation process recovers very little of that mercury, which pollutes the nearby environment. The majority of the mercury used pollutes local waterways and soil as well as threatens the livelihood of plant and animal species in the area. Mercury amalgamation results in the discharge of an estimated 1000 tons of mercury per annum, representing about 30 percent of the world’s anthropogenic mercury releases.

The process of amalgamation transforms elemental mercury into methylmercury—one of the most toxic organic compound and a powerful neurotoxin that works its way up the food chain through bioaccumulation. According to the Ban Mercury Group, as much as 95 percent of all mercury used in small-scale gold mining is released into the environment, constituting a dangers on all fronts—economic, environmental and human health. It is estimated that over 13 million people work as artisanal miners worldwide.

- **Solution:**

Blacksmith Institute, MICOA, and technical experts from UNIDO implemented a pilot program in 2005 in an effort to reduce the negative mercury-related impacts of gold mining operations in the region. The objective of this pilot project was to contribute to the reduction of occupational health hazards of artisanal gold miners by promoting a safer, healthier and most cost-effective use of mercury in their mining operations.

First, field visits were conducted to assess health and technological needs in Manica, with particular emphasis on the chosen pilot areas for community training. The program was carried out by a team of four international experts from the GEF/UNDP/UNIDO Global Mercury Project, in collaboration with five locally-based practitioners who were selected and trained in Manica under the coordination of the Centre for Sustainable Development for Natural Resources Management (in Chimoio). Studies and breath test samples revealed that the average level of mercury in the miners in Munhena, the main training site, was 8.23 $\mu\text{g}/\text{m}^3$. Some burners had above 50 $\mu\text{g}/\text{m}^3$ (50 times higher than the WHO guideline for maximum public exposure to mercury vapour). Second, a training protocol is developed in the pilot project area to introduce miners and their families to mercury retort technologies and related ways of reducing mercury emissions. Tests performed with homemade retorts (made of salad bowls) showed that mercury emissions can be reduced significantly and cheaply, thus decreasing the exposure to humans and the surrounding environment. Retorts allow for the efficient capture and reuse of mercury. Following the training

sessions, preliminary use monitoring of these systems showed that the miners were using the retorts successfully. Adopting a community participatory approach, the implementing organizations devised follow-up plans including the establishment of a Community Amalgamation Centre and other opportunities for future collaboration..

- **Results:**

Mercury breath-tests are a quick and accurate method to determine the severity of mercury exposure. In this process, miners are asked to blow for 10 seconds into a plastic hose connected to the LUMEX spectrometer. The readings are shown every second and the maximum is registered. The average level of mercury in the miners in Munhena was $8.23\mu\text{g}/\text{m}^3$. The WHO guideline for maximum public exposure to mercury vapor is $1\mu\text{g}/\text{m}^3$ and the TWA is $25\mu\text{g}/\text{m}^3$. Without the three most affected people (who identified themselves as mercury burners), this average was $3.12\mu\text{g}/\text{m}^3$. Breath test results were shared immediately with the miners as they requested. Air in the village contained an average mercury contamination level of $0.4\mu\text{g}/\text{m}^3$.

The introduction of bowl- and pipe-shaped retorts was successful and well-received by the communities in Munhena, Manica District, Mozambique. Continued monitoring is necessary to ensure successful operation of the retorts left with the workers. The miners were also shown how to make their own retorts and further monitoring should ensure that they were able to do so successfully. Further fieldwork is also necessary to train more people in the community and develop their capacity to implement the solutions that were introduced in this pilot project. Given the rapid increase in artisanal gold mining activities in many African countries, the success of this project suggests that this model should be replicated on a larger scale in other communities as well.

- **Follow-up:**

In order to continue the effectiveness of the pilot project, an Amalgamation Centre in Munhena will be built with specifications including a cement tank to store amalgamation tailings, a small mill (as they use) made of gas tanks with a coarse chain inside or rubber balls to amalgamate their concentrates, avoiding manual amalgamation, a PVC filter that can be attached to a bicycle wheel to remove excess mercury from amalgams avoiding manual contact with mercury, and other waste management features.

Our intervention here has also helped us uncover new potential avenues for mercury exposure as well as make recommendations to solve these problems. Mine tailings containing mercury are washed off into large rivers in the area, particularly during seasonal flood events. Therefore, the mercury load of local fish stocks must be analyzed to determine if they pose a health threat to human consumers.

Since mining activities make up a major source of income in the area, technicians at the Provincial Direction of Mineral Resources who buy gold from artisanal miners are also exposed to high levels of mercury vapor. Studies show that these technicians are exposed to what could be 35 times higher of mercury levels compare to the WHO safety guidelines. One of the solutions for the employees is to receive

the gold in the lab, i.e. under the fume hood, and dissolve residual mercury with nitric acid, instead of receiving the gold in the confined office space where contamination is more likely.



Women panning ore using tanks in the valley



Miners excavating and transporting waste rock along the hilltop in Munhena



Uphill from Munhena Village, a polluted stream converges with a clear stream

Additional links:

<http://www.blacksmithinstitute.org/projects/display/2>