



# ASGM SITES: Matundasi and Makongolosi mining areas in Tanzania



Report by Agenda, Arnika  
Association and IPEN  
January 2013

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## IPEN Mercury-Free Campaign Report

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*Dar es Salaam – 3 January 2013*

### Introduction

In 2009, the Governing Council of the United Nations Environment Programme (UNEP GC) decided to develop a global legally binding instrument on mercury to reduce risks to human health and the environment (UNEP GC25/5). The UNEP GC noted that mercury is a substance of global concern due to its long-range transport, persistence, ability to bioaccumulate, and toxicity. Its conclusions were based in part on the 2002 UNEP Global Mercury Assessment which noted that mercury is present in fish all over the globe at levels that adversely affect humans and wildlife (UNEP 2002). In humans, hair is widely accepted as a matrix for reliable estimations of the body burden of methylmercury, which likely comes from eating fish (Grandjean, Weihe et al. 1998); (Harada, Nakachi et al. 1999); (Knobeloch, Gliori et al. 2007); (Myers, Davidson et al. 2000).

This report focuses on artisanal small-scale gold mining (ASGM) hotspots of the Matundasi and Makongolosi mining areas in Tanzania. We examined levels of mercury in the hair of the population living and working at ASGM sites to confirm whether the use of mercury in the processing of gold can be traced in human hair from these locations. In addition, since local mercury releases become global problems due to long range transport we considered how the draft treaty text will address ASGM sites such as these in Tanzania.

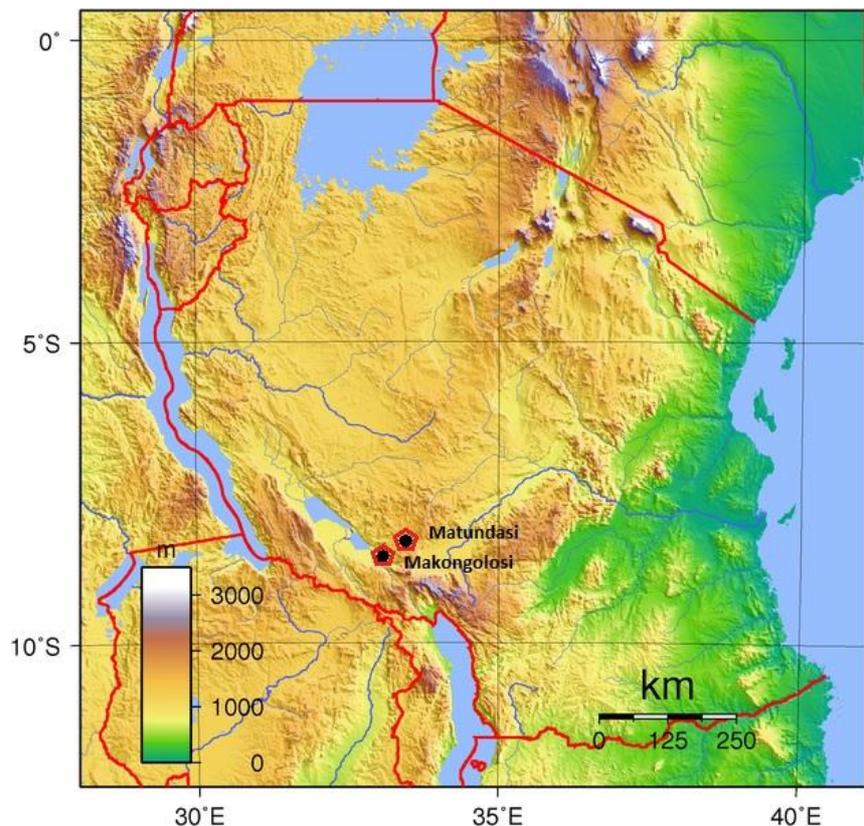


Figure 1: Map of Tanzania with two ASGM hot spots Matundasi and Makongolosi. Map: Wikimedia Commons.

### ASGM hot spots on the Lupa River, Tanzania

The Matundasi and Makongolosi mining areas are located about 20 km and 40 km northwest of Chunya (Chunya district headquarters). The two sites are ASGM areas where non-alluvial

gold is mined and processed and later amalgamated by using mercury. The mercury-gold amalgam is finally burned in the open without recovery systems employed. Most of the water that is used for sluicing and amalgamation finally finds its way to the Lupa River which drains its water into Lake Rukwa located on the southern side of Chunya.

Mercury use in the ASGM sector started many years ago within the Lupa gold field area; hence exposure to mercury contamination is high within the area. It is estimated that the anthropogenic mercury released annually into the atmosphere is approximately 1-3 metric tonnes in the Lupa gold fields of Tanzania. Water, streams, and rivers that pass through Matundasi and Makongolosi feed into the Lupa River that drains its water into Lake Rukwa which supports the livelihood of the southern highland part of Tanzania.

## Materials and methods

AGENDA conducted sampling of human hair using protocols developed by IPEN (2011). Fifteen hair samples were taken in total for this study at the Matundasi and Makongolosi mining areas. Biodiversity Research Institute (BRI) measured mercury levels (total mercury content = THg) in hair samples in their laboratory in Gorham, Maine, USA. AGENDA characterized the site and provided information about its history and presumptive mercury sources.

## Results and discussion

Mercury contamination of the two sites (Makongolosi and Matundasi) is derived from the gold ore amalgamation process using elemental mercury as well as panning and burning of mercury-gold amalgam in an open air without recovery systems. Most of the water used in mineral processing activities ends up in streams and rivers that eventually send their water into the Lupa River that forms one of the major tributaries of Lake Rukwa. Due to high potential exposure to mercury through consumption of fish from lakes and rivers that feed into Lake Rukwa, it is feared that most of the population is exposed to mercury.

It is estimated that between 150 and 200 miners are working at the two project sites. The amount of mercury that is used by one miner per month is estimated to be 1 kg hence the area could be consuming about 2 to 4 tonnes of mercury per year (the amount varies with gold rushes). Currently, there is no exact data on the number of miners in the two sites as some miners move to new locations depending on gold rushes.<sup>1</sup> There are no existing landfills within the two sites. Open burning of mercury-gold amalgam is the likely air pollution pathway that can affect the surrounding area with mercury releases.

Table 1 shows that the mean mercury level in all 15 hair samples from the Matundasi and Makongolosi mining areas is more than 17-times higher than the US EPA reference dose of 1 ppm. Two-thirds of the hair samples exceeded the reference dose. The maximum mercury value observed in a hair sample from Chunya District, Tanzania exceeded the US EPA reference dose by more than 236-fold.

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<sup>1</sup> Agenda's consultation with Chunya Resident mines officer

Table 1: Mercury content in hair samples from Matundasi and Makongolosi mining areas

	Sample Size	Hg Mean (ppm)	St Dev	Min Hg (ppm)	Max Hg (ppm)	Reference dose (ppm) <sup>2</sup>	Fraction of samples over Reference Dose
All hair samples	15	18.318	60.425	0.373	236.412	1.00	67%

Abbreviations: Hg, mercury; ppm, parts per million or mg/kg; st dev, std deviation; min, minimum; max, maximum

The Rwamagasa mining area near Lake Victoria was assessed by Baeuml, Bose-O'Reilly et al. (2011) in comparison with other ASGM sites in several different countries. They analyzed the hair of 160 individuals from the Tanzanian site and found a mean mercury level of 1.80 ppm with a maximum level 48.7 ppm, which is still below the maximum value observed in this study. However the maximum value of 236 ppm observed in the hair of one individual in this study is comparable to one of the highest values found in seriously polluted ASGM sites in Indonesia-Sulawesi in the Baeuml, Bose O'Reilly et al. study. Another study looked at mercury levels in the breast milk of mothers living at ASGM sites and emphasized that „Twenty-two of the 46 children from these gold mining areas had a higher calculated total mercury uptake. The highest calculated daily mercury uptake of 127 ug exceeds by far the recommended maximum uptake of inorganic mercury.“ (Bose-O'Reilly, Lettmeier et al. 2008).

A very broad study on human exposure to mercury carried out in the vicinity of Lake Victoria emphasized that “Some occupationally exposed gold mine workers showed very high hair THg concentrations exceeding the threshold criteria. They also showed symptoms of organic Hg poisoning (Harada, Nakachi et al. 1999), emphasizing the extreme occupational hazards of gold mining in Tanzania.” (Campbell, Dixon et al. 2003).

Mnali (2001) observed high levels of mercury in stream sediments and tailings in the Lupa gold field. No other measurements data on mercury in environmental compartments is available from the Lupa gold field, however a more complex picture about the scope of burden caused by the ASGM is visible in the studies focused on such sites near Lake Victoria (Ikingura, Mutakyahwa et al. 1997).

### ASGM sites and the mercury treaty

The ASGM sites in Tanzania researched in this report as well as in other reports confirmed levels of mercury in human hair (Baeuml, Bose-O'Reilly et al. 2011); (Harada, Nakachi et al. 1999) are elevated to extremely high. This provokes questions about how the mercury treaty might mandate actions to eliminate mercury pollution of the environment and its harmful effects on human health at ASGM sites.

ASGM is the largest current intentional use of mercury and causes extreme mercury pollution. In areas where ASGM is practiced, it is a source of significant human exposure to mercury, and contributes to high levels of methyl mercury pollution of fish in waterways nearby and downstream of ASGM sites (Castilhos, Rodrigues-Filho et al. 2006); (Eisler 2004). Mercury

<sup>2</sup> U.S. EPA's RfD is associated with a blood mercury concentration of 4-5 µg/L and a hair mercury concentration of approximately 1µg/g.” US EPA (1997). Mercury study report to Congress, Volume IV, An assessment of exposure to mercury in the United States. EPA-452/R-97-006: 293.

emissions from ASGM are the second largest source of global mercury pollution (UNEP Chemicals Branch 2008).

The current treaty text (UNEP (DTIE) 2012) does not require a country to address ASGM if it does not admit it has ASGM or determines that it is not “more than insignificant”. Since there are no guidelines to determine “significance”, application of Article 9 becomes complicated.<sup>3</sup> There is also no ban on the import or use of mercury in ASGM in the current proposed treaty text (UNEP (DTIE) 2012).<sup>4</sup> Finally, to address the mercury pollution caused by ASGM in such sites as Matundasi or Mangokolosi, funding and technical assistance will be needed by developing and transition countries to shift from mercury to non-mercury methods and clean up the contaminated hotspots. However, since the treaty links compliance with funding and since action on contaminated sites is not obligatory, it is likely that no funding will be available through the treaty’s financial mechanism to address contaminated sites left by ASGM.

To prevent continuous mercury pollution caused by using mercury in ASGM and to stop harm to communities settled around ASGM sites such as the Lupa gold field it is necessary to prevent further use and releases of mercury from the ASGM. Until this problem is addressed, mercury will continue to harm people and ecosystems at both local and global level.

## Acknowledgements

AGENDA, Arnika Association and IPEN gratefully acknowledges the financial support the governments of Sweden and Switzerland, and others, as well as the technical support provide by the Biodiversity Research Institute (BRI) to analyze the data. The content and views expressed in this report, however, are those of the authors and IPEN and not necessarily the views of the institutions providing financial and/or technical support.

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<sup>3</sup>UNEP(DTIE)/Hg/INC.5/3; Article 9 para 3 “Each Party shall report to the Secretariat if at any time it determines that artisanal and small-scale gold mining and processing in its territory is more than insignificant. If it so determines the Party shall:”

<sup>4</sup>UNEP(DTIE)/Hg/INC.5/3; Article 9 para 5 “Each Party that is subject to the provisions of paragraph 3 of this Article and determines that domestic sources of mercury are not available: a. May import mercury for use in artisanal and small-scale mining consistent with its action plan developed in accordance with paragraph 3 of this Article; and”

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Photos



Fig 1. Individual miner re-slucing tailings



Fig 2. Gold ore sluicing by using constant flow employing the siphon method at Katente mining center, Shinyanga Region



Fig 3. Gold ore sluicing by using constant flow employing the siphon method at Makongolosi mining center, Mbeya Region



Fig 4. Gold ore amalgamation in ore processing pond



Fig 5. Finalizing gold ore amalgamation on the side of ore processing pond



Fig 6. Ore processing area (*Mwalo*) at Nyarugusu mining center, Geita Region



Fig 7. Open burning of gold – mercury amalgam



Fig 8. One of the ore processing area (*Mwalo*)



Fig 9. Glass retort that were distributed during Global Mercury project in Lake Victoria zone



Fig 10 and Fig 11. Locally made metal retorts that owned by artisanal and small scale miners

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