Global Mercury Project

Report to the UNEP Governing Council Meeting
Nairobi, February 2007

GLOBAL IMPACTS OF MERCURY SUPPLY AND DEMAND IN SMALL-SCALE GOLD MINING

Prepared by UNIDO
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Removal of Barriers to the Introduction of Cleaner Artisanal and Small-Scale Gold Mining and Extraction Technologies

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Executive Summary

I. INTRODUCTION

The Global Mercury Project respectfully submits this report in response to the UNEP Governing Council's request (*decision 23/9 IV*) for information on mercury supply, trade and demand in artisanal and small-scale gold mining (ASM). This report highlights some of the Global Mercury Project's findings 2002-2007 and outlines some major policy implications for nations worldwide — particularly nations exporting, importing and/or using mercury, as well as all countries affected by global pollution and/or involved in providing capacity assistance to populations involved in ASM.

The Global Mercury Project (GMP) is an initiative of the U.N. Industrial Development Organization, launched in 2002 with financial support from the U.N. Development Program and the Global Environment Facility, co-financed by partner countries and civil society. The GMP works with governments, NGOs, industry and community stakeholders, building capacity to monitor factors related to mercury use and pollution in ASM and developing policy and institutional capacities to remove barriers to the adoption of cleaner technologies of mineral extraction. Several countries are participating in this pilot program, with primary field activities during the first phase taking place in Brazil, Indonesia, Lao People's Democratic Republic, Sudan, Tanzania and Zimbabwe.

II. GLOBAL MERCURY USE & POLLUTION IN SMALL-SCALE GOLD MINING

At least 100 million people in over 55 countries depend on ASM for their livelihood, mainly in Africa, Asia and South America. ASM produces 20-30% of the world's gold production, or approximately 500-800 tonnes per annum. It involves an estimated 10-15 million miners, including 4.5 million women and 1 million children. This type of mining relies on rudimentary methods and technologies and is often performed by miners with little or no economic capital who operate in the informal economic sector, often illegally and with little organization. **As mercury amalgamation is an inexpensive, quick and simple way to extract gold particles, it is currently the method most commonly used in ASM.**

As a consequence of poor practices, **mercury amalgamation in ASM results in the discharge of at least 650 to 1000 tonnes of mercury per annum, equivalent to 1/3 (one-third) of all global anthropogenic (human-caused) mercury releases into the environment. This makes ASM the single largest intentional-use source of mercury pollution in the world.** In addition to the severe occupational hazards associated with mercury use, ASM has generated thousands of polluted sites with impacts extending far beyond localized ecological degradation, often presenting serious, long-term environmental health hazards to populations living near and downstream of mining regions. **It is estimated that as much as 300 tonnes of mercury per annum are volatilized directly to the atmosphere, while 700 tonnes are discharged in mine tailings into soil, rivers and lakes. In addition to domestic pollution impacts, both air emissions and tailings discharge contaminate both international waters and air.**

III. ECONOMIC AND SOCIAL DETERMINANTS OF MERCURY CONSUMPTION

Though large-scale gold mine operations have phased out mercury use by adopting alternative technologies, mercury demand in ASM continues to increase. With gold rising from US$260/oz in March 2001 to US$725 in May 2006, a gold rush involving poverty-driven miners is being observed in many countries. This increase in mining activity is compounded by escalating poverty due to factors such the failure of subsistence economies, conflict causing displacement of populations, and diseases such as HIV/AIDS. **Due to the increase in ASM, and based on evidence of mercury use in country-by-country and regional reporting, mercury consumption and demand in ASM may be growing to a historically unprecedented level on the global scale.**

The highest consumption levels are from China (with 200 to 250 tonnes released), followed by Indonesia (100 to 150 tonnes) and between 10 and 30 tonnes in each of Brazil, Bolivia, Colombia, Ecuador, Ghana, Peru, Philippines, Venezuela, Tanzania and Zimbabwe. Mercury may be used in as many as 40 other countries, to varying degrees. Because some mercury used is recycled, the amount of additional mercury demanded is equivalent to the amount of mercury consumed (assuming constant ASM production levels and constant technologies over time). On average, it is conservatively estimated that **at least 1 to 3 grams of mercury is lost to the environment for every gram of gold produced by ASM. Mercury releases primarily depend on the nature of mining technology employed, which is influenced by both social and economic factors.**

While there are numerous social and economic factors that affect technology use, the focus of this report is on how mercury supply and demand relate with respect to available technologies. **Various location-specific GMP training programs and assessments demonstrate that when mercury is less available and/or more expensive, less mercury is consumed due to transfers to more efficient practices, or in some cases, to practices that eliminate mercury use.** GMP assessments emphasize these four critical determinants of mercury reduction:

1) ***Whole ore amalgamation*** **is the largest point source of mercury pollution in ASM (contributing more than 50% of mercury lost in ASM).** Substantial differences in mercury consumption are observed between whole ore amalgamation (i.e. mercury is added to all ore being processed during crushing, grinding or sluicing) and amalgamation of only heavy mineral concentrates. Although amalgamation of the whole ore is an inexpensive way to quickly extract gold, several cost-efficient alternative mercury-free pre-concentration technologies exist as viable options. However, the practice of whole ore amalgamation often persists in many regions due to factors such as: availability of inexpensive mercury, lack of technical knowledge/expertise, lack of organizational support, and lack of environmental health awareness. **GMP assessments in various locations indicate that a rising mercury price is a significant added incentive to eliminate this hazardous and economically inefficient practice.**

2) ***Burning amalgam in open air*** **is the second largest source of mercury loss to the environment (contributing 20-30% of mercury losses in ASM); however it is the main health problem for miners and nearby communities. The price and availability of mercury also influences whether miners use retorts to contain mercury vapor during the burning stage of amalgamation.** GMP field assessments found that effective retorts could be made cheaply (e.g. as little as US$3.20 in some cases), and that these retorts could contain mercury vapor in such a way that allows over 95% of the mercury to be recycled and re-used. Numerous community training programs and assessments have concluded that the mercury price and economic benefits of re-using mercury have a significant impact on whether miners will adopt the retorts, in addition to health and environmental considerations.

3) ***Loss of mercury in amalgamation of concentrates*** **has also been identified by the GMP as a source of mercury pollution (10-15% of mercury losses).** Amalgamation of only gravity concentrates is an improvement when compared to whole ore amalgamation. However, even amalgamating the gravity concentration, some

mercury is lost. Higher prices of mercury could encourage miners to adopt better techniques to prevent these losses.

4) ***Complete phase-out of mercury use*** **in mining may be a viable option for many miners, though such alternative technologies generally require a higher order of economic investment, organization, and technical expertise.** Assessments indicate that a high price of mercury, coupled with capacity-building, may contribute to the transfer to such technologies. The most promising technology to replace completely the use of mercury in any type of gold ore is cyanidation, but this is not quite affordable and technically available to all artisanal miners. Cyanidation methods must be carefully assessed so that cyanide and mercury are not used in any way together, which can exacerbate pollution. Other gravity separation methods have great potential to reduce and in some specific situations eliminate the use of mercury but many of these cannot be adopted worldwide because ores vary significantly. **In approximately 10% of current ASM cases, gold sources are alluvial ore (free gold) and completely mercury-free-alternatives could be locally available at a very low cost.**

IV. GLOBAL SOURCES OF MERCURY

As mercury is readily available in most countries, it tends to be inexpensive and easily accessible to gold miners. Mercury usually enters developing countries legally, i.e. for use in dental amalgams or the chlor-alkali industry. However, evidence indicates that in many developing countries and countries with economies in transition, by far the majority of mercury imported ends up being used in ASM. Estimates have been undertaken concerning the amount of mercury diverted for use in ASM using import statistics and anticipated consumption for legitimate uses, focussing in the 6 GMP pilot countries and neighbouring countries.

GMP assessments reveal that in 2005, Kenya imported almost 14 tonnes of mercury from German, followed by Georgia (9.5 tonnes) and Japan (4.1 tonnes). **Evidence suggests that most of Kenya's imported mercury is then exported, legally and illegally, to Tanzania, Uganda and the Democratic Republic of Congo, where it is primarily used in ASM. In Tanzania, in 2005, the United States exported approximately 30% of Tanzania's official imports of 3 tonnes, followed by the Netherlands with another 30%.** It is unclear how much of this mercury is used in ASM since the price of imported mercury varies from US$0.18/kg to US$31.2/kg.

Officials noted that differences could be attributed to mercury quality variance as well as reporting-related problems.

OECD countries are the main source of mercury to Sub-Saharan Africa, where mercury imports increased from 34 metric tons in 2000 to 57 tons in 2002. In 2000, the Netherlands shipped 245 tonnes of mercury to at least 18 countries, most in the Latin American-Caribbean region. Indonesia imported in 2000 24 tonnes from Spain, 17 tonnes from the Netherlands, 3 tonnes from Australia and 3 tonnes from Japan.

In 2005, official import data from Zimbabwe indicated 21.8 tonnes of mercury imported in which South Africa contributes with 13.8 tonnes, the Netherlands with 2.7 tonnes, Switzerland with 4.6 tonnes, and Germany with 0.7 tonnes. However, results from interviewing in 2003 indicated that one single mercury dealer in Zimbabwe unofficially declared importing 20 tonnes of mercury. In the same year, the Zimbabwe official data indicated that the Netherlands accounted for 15.7 tonnes. Given these facts, **it is unlikely that import statistics adequately capture the cross-border trafficking of mercury and the extent of diversion from legal sectors.**

In 2005, Brazil officially imported 43.3 tonnes of mercury, in which 26.9 tonnes came from Spain, 6.9 from UK, 3.4 from Hong Kong, and 3.3 from Kazakhstan, among others. Most of the mercury used in ASM in Brazil is labelled for use in dentistry.

The unregulated trading of mercury from industrialized countries to developing countries makes mercury easily available at the mine sites. **In most countries with ASM, mercury is readily available to miners at ASM sites. In some cases it is given for free, contingent on gold being sold to the mercury provider. Stockpiling of mercury by gold dealers has been identified as a concern. GMP assessments find that monitoring and regulating imports and domestic trade in many developing countries and countries with economies in transition is generally significantly more difficult than regulating mercury supply at the export stage, particularly exports from developed countries.**

V. HEALTH AND ENVIRONMENTAL IMPACTS

The misuse of mercury in ASM produces severe health and environmental hazards. The mobilization of **mercury from mine sites into aquatic systems presents a major**

risk. The major effects of mercury in aquatic life, soils and sediments, were found in Brazil, Zimbabwe and Indonesia. This was attributed to excessive use of mercury (whole ore amalgamation) as well as combined use of mercury with cyanidation. This combined use exacerbates the methylation of mercury. Once methylated, mercury can rapidly move through the food chain, leading to impacts downstream.

Inhalation of mercury during handling, as a result of spills and during amalgamation, which is often undertaken by women and children, also represents a major health concern. Typically, this is conducted with **no protection and often takes place in the home.** Results of the health surveys have been alarmingly similar across GMP sites. Symptoms of mercury intoxication are widespread, with some people experiencing **levels of intoxication that exceed 50 times the WHO maximum public exposure limit.** Neurological disturbances such as ataxia, tremors and coordination problems are common. At one project site, almost 50 percent of miners showed an unintentional tremor, which is a typical symptom for mercury-induced damage of the central nervous system. With extremely high mercury concentrations in breast-milk of nursing mothers in GMP communities, infants are especially at risk.

VI. IMPLICATIONS FOR POLICY AND GOVERNANCE

The Global Mercury Project has been working mainly in six countries, and has acquired key lessons in its *Policy and Governance Initiative*. This initiative recognizes that effectively addressing mercury problems in ASM requires an integrated approach that targets capacities of local institutions in the removal of technical, social, economic and political barriers to the improvement in ASM practices. The GMP emphasizes that local participation and locally-driven processes of policy development are of critical value. **Since 2005, the GMP has been working with governments and communities on developing and implementing various new policies such as: mercury trade and management laws in Indonesia, national mercury and mining labour laws in Zimbabwe, policies to legalize and assist indigenous miners in Sudan, and microfinance policy in Tanzania.**

In selected sites, the GMP has been focussing on capacity-building pilot programs to remove barriers to the adoption of cleaner technologies. These programs involve **mobile training units that can reach miners in rural areas to engage local priorities. This community assistance model is receiving widespread support, and the GMP has already certified teams of local trainers.** Yet, the regions benefiting from the GMP

constitute only a fraction of the global population impacted by ASM. **Further commitment is needed in these and other regions, including additional resources.**

Global commitments are critically needed, from community-level issues such as technologies and gender inequities, to broader policies such as international mercury export controls and policies to improve regulation and assistance in the ASM sector. **The GMP asserts that it could be possible to achieve at least a 50% reduction of mercury consumption (demand) in ASM by 2017. As called for by the GMP, this goal must be achieved by fostering commitments of diverse stakeholders** to development strategies that will empower populations to:

1. **eliminate amalgamation of whole ore** by replacing by introducing mercury-free concentration process prior to amalgamation
2. **reduce mercury use in the amalgamation of concentrates** through closed circuit process (mercury is always recycled)
3. **eliminate the burning of mercury without the use of a retort** to contain emissions and thereby allow recycling
4. **introduce completely mercury free techniques where feasible**, particularly for ores which preclude the use of mercury.

The 10-year goal of reducing mercury consumption in ASM by over 50% is ambitious but achievable. Given the urgency of the mercury problem in ASM, such an effort cannot be considered a choice – rather it must be seen as a global obligation. The GMP calls on nations around the world to achieve the above goal by reducing mercury supply through export controls and other mechanisms that will encourage the transition to alternative technologies, as well as by pledging commitments to programs to help build community capacities. Further information on the activities of the Global Mercury Project can be obtained at the project website: www.globalmercuryproject.org