



# SQUEEZING GOLD FROM A STONE

***Addressing the Toxic  
Health Risks and  
Pollution Caused by  
Mercury Use in the Small  
Scale and Artisanal Gold  
Mining Sector***

UNITED NATIONS ENVIRONMENT PROGRAMME

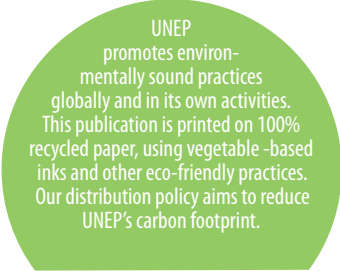


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# ***Squeezing gold from a stone:***

## How to Reduce Toxic Health Risks and Pollution Caused by Mercury Use in the Small-Scale & Artisanal Gold Mining Sector

Chasing today's higher gold prices, as many as 20 million people in more than 70 countries are being lured to small-scale and artisanal gold mining (ASGM) to try to escape from poverty.

But this gamble has high stakes. Many small-scale and artisanal miners are using mercury, a persistent and toxic chemical, to extract gold from ore. During the process mercury escapes into the environment, posing grave, and often irreversible, health threats not only to miners but also to some of the world's most vulnerable populations—women and children. And this invisible threat is reaching well beyond the mining camps as the mercury travels through the world's air and waterways and into fish globally.

Fortunately, low-cost technologies available now have the potential to reduce mercury pollution in the sector dramatically. By supporting miners with knowledge and resources to adopt these new technologies and with the right policies in place at the local, national and global level, we can stem a significant source of global mercury pollution now.

Swift action by UNEP member states will have an immediate impact in reducing the amount of mercury released by ASGM and dramatically benefit health and economic well being of miners, part of a global agreement to control mercury pollution.



## There is nothing small scale about mercury pollution produced by artisanal and small-scale gold mining (ASGM).

ASGM refers to gold mining by individuals or small groups using basic equipment and/or light machinery. Producing about 12 percent of the world's gold (330 tonnes), the artisanal and small-scale mining (ASGM) sector is directly supporting an estimated 10 to 20 million miners and indirectly supporting an estimated 50 to 100 million more people around the globe—the biggest gold rush in history.<sup>1</sup>

The rapid growth in the sector is fueled largely by swelling gold prices, which have risen from US\$10 per gram in 1997 to more than US\$30 per gram in 2009<sup>2</sup>. For the miners, the record gold prices offer an opportunity for bringing new wealth into impoverished communities that often fail to attract other industries.

One of the by-products of a booming ASGM sector is mercury pollution. Mercury is used to bind with gold particles in ore to create an amalgam. When the gold-mercury amalgam is heated to burn off the mercury, leaving the gold behind, the vapors are directly inhaled by miners, exposing them and others in the mining communities to grave health risks.<sup>3</sup>

Mercury is a potent neurological toxicant that interferes with brain functions and the nervous system. It is particularly harmful to babies and young children. Low-level exposure to infants during gestation is associated with reduced attention span, fine-motor function, language, visual-spatial abilities (such as drawing) and verbal memory.<sup>4</sup> In adults, mercury can cause numbness and tingling, vision abnormalities, and memory problems.<sup>5</sup>

## Marginalized people and communities are disproportionately affected by mercury pollution in ASGM.

ASGM cuts across many development issues, including poverty, economic deelopment, gender, and biodiversity. Programmes focussed on reducing mercury use can serve as a positive entry point for broader engagement in development and act as a mechanism to encourage poverty alleviation and rural economic growth while improving health and the environment.

**Women:** Gender issues are prominent in ASGM: Women of child-bearing age have high risk from mercury's effects, yet are often marginalized from the benefits of wealth created by mining.<sup>6</sup>



**Children:** One to two million children may be involved in ASGM, starting with children as young as 3-year-olds and working within or outside of a family unit. Not only does this work expose them to hazardous conditions, but it also can divert them from education.<sup>7</sup>

**Marginalized communities:** In many countries, ASGM is practiced by small, dispersed groups, acting outside a formal legal framework. The mining communities are often underserved by governments, often receiving no government assistance, leading to poor social conditions.<sup>8</sup>

In addition, when gold reserves are exhausted, the community must deal with the environmental degradation and increasing poverty. Gold mining's dispersed and transitory nature and the difficult conditions in these communities present challenges for dealing with the environmental and socio-economic problems they face, particularly mercury.

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*One study of Peruvian children of ASGM miners found that nearly 85 percent of the sampled children had dangerous levels of mercury in their bodies.<sup>9</sup>*

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## Case Study: Zimbabwe

Zimbabwe's Kadoma-Chakari region is one of the country's largest gold belts, but mining activities release a significant amount of mercury into the environment and, according to the Global Mercury Project (GMP), "Urgent action is required to significantly reduce exposure of workers, their families and the local environment to mercury." This is an extremely poor area, with no adequate health care facilities and little access to drinkable water. Poverty "is the main reason for the region's disastrous health and environmental problems." The GMP team found high mercury levels close to processing areas, and noted that one village was using tailings material to build roads, raising mercury concentrations all through the village. Although mercury in fish is often the main pathway for human exposure, however, in this case mercury vapor was the cause of illness. The report calls for region to be given access to alternative technologies and best-practices education, as well as basic healthcare.

Source: Global Mercury Project, *Environmental and Health Assessment Report/Removal of barriers to the introduction of cleaner artisanal gold mining and extraction technologies* (Vienna, Austria: 2006), 6, 8, 10, 18.

## Mercury pollution spills far beyond mining communities to affect biodiversity and our global environment.



### Case Study: Mozambique

A pilot project in Mozambique by the Global Mercury Project and Mozambican government promoted safer and better use of mercury in ASGM. Open-air burning of amalgams had been a major problem, but the project, supported by the Blacksmith Institute, taught miners and their families about ways to cut mercury emissions, including retort technologies. The retorts were home-made from salad bowls and showed that mercury emissions could be lowered to allow 95 percent of mercury to be used again. The retort technology's low cost—under US\$4—appealed to miners, particularly given the savings derived from reusing costly mercury.

Source: Samuel J. Spiegel and Marcello M. Veiga, 2006 Strategic Plan on Policy and Governance, (Global Mercury Project, 2006), 50f

Despite the small scale of individual operations, ASGM is a major source of global mercury pollution. Recently, UNEP estimated that ASGM uses 640 to 1,350 tonnes of mercury a year, averaging 1,000 tonnes a year—roughly one-third of total global use.<sup>10</sup> Unlike other industrial uses of mercury, all of what is used by ASGM ends up in the environment. Approximately 40 percent is released into the air, with most of the remaining 60 percent making its way into waterways and onto the land.<sup>11</sup> In many countries, ASGM is the largest single source of mercury emissions. Because mercury can travel globally, mercury released by ASGM ends up polluting air, water and fish all around the world.<sup>12</sup>

ASGM can also threaten biodiversity through deforestation and water pollution that destroys ecosystems and habitat for local wildlife. Miners sometimes work in protected biodiversity areas because these areas are typically remote, and are not otherwise exploited for minerals.<sup>13</sup>

## Challenges to eliminating mercury use

Governments have agreed through the UNEP Governing Council to develop a legally binding instrument on mercury to reduce risks to human health and the environment, taking into account the circumstances of countries. The intergovernmental negotiating committee is to develop a comprehensive and suitable approach to mercury to reduce the demand and releases of mercury from all sources, including ASGM.

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*Governments have requested UNEP to continue and enhance, work to conduct awareness-raising and **pilot projects** in key countries to reduce mercury use in artisanal and small-scale gold mining through the Global Mercury Partnership.*

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Cost effective alternative methods exist that can eliminate or greatly reduce the quantity of mercury used in ASGM, however, due to the imminent threat to ASGM to miners and their families, as well as the significant and growing emissions to the global environment, adoption of these methods must urgently be accelerated now.

There are compelling reasons why mercury is currently favored by miners over other methods of gold extraction, including ease of use, ready accessibility and relatively low cost. Because mercury techniques yield gold rapidly, mercury puts cash in miner's pockets quickly. Further, mercury amalgamation allows for a completely independent processing: the entire mining process can be accomplished by just one miner, unlike more expensive and technically sophisticated methods.<sup>14</sup>

Though other methods may be more effective in theory, mercury amalgamation is generally a practical and efficient method under the conditions typically found at ASGM sites.<sup>15</sup> For miners to implement replacement technologies, the replacement needs to produce as much gold or more for similar financial and time investments for the miner. As well these replacement technologies need to initially fit into a similar labor structure.

## Reducing mercury emissions and exposures through ready-to-go technical solutions

### **Use non-mercury methods**

In some cases, it may be possible for miners to transition away from mercury-based extraction processes altogether. Gold from certain types of ores can be extracted effectively by non-mercury methods alone. Specially designed equipment may be effective in particular settings, such as the use of magnets to enhance gold recovery in ores that are associated with magnetite, a mineral commonly found in gold deposits. Centrifuges can also be used and shaker tables can enhance separation. Although these methods can be effective with particular ores, they often require special knowledge, equipment and skilled operators to maximize gold recovery and minimize losses due to inefficiencies in the process.<sup>16</sup>

### **Stop the practice of whole ore amalgamation by replacing it with gravity and other methods.**

One of the worst and most wasteful uses of mercury in small scale gold mining is whole-ore amalgamation, where mercury is mixed with all of the ore mined. One alternative is to pre-concentrate the ores, using gravity-based separation methods such as sluices and centrifuges, before using mercury. By doing so, the miners can mix mercury with a much smaller amount of ore that contains a higher concentration of gold. Amalgamating concentrates, rather than the whole ore, greatly decreases the overall amount of mercury required to extract the same amount of gold.

### **Reduce emissions by using retorts in the field and by using mercury vapor capture systems in shops that refine local gold.**

Emissions from burning amalgam can be reduced using a device called a retort, which captures the mercury vapor without dissipating it into the air. The recovered mercury can be reused preventing purchase of new mercury, and its capture dramatically reduces the exposure of miners and their families to mercury. Various types of retorts are available, both manufactured

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