

Forum: Environmental Committee

Issue: The Issue of Mercury use in gold mines

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INTRODUCTION

‘Over 100 million people rely on artisan gold mining for their livelihoods, so it is critical that we work with governments to equip miners with the knowledge and tools necessary to phase out mercury use (Ludovic Bernaudat, programme manager of planet GOLD).¹

Gold is one of the most important minerals of our time, used in everything from electronics to dentistry. Since the dawn of time, it has been the ultimate symbol of wealth and status, and since the dawn of time it has been desired and acquired by the entirety of humanity. The methods of acquiring gold have changed through the centuries, from simply heading down to the river and panning for it to digging deep into the earth to find the precious stone. However, gold mining in present times is plagued with one huge problem: Mercury use.

Mercury is used in the purification of gold, meaning the removal of excess metals from the gold ore. The workers surround the gold with mercury, then burn the mercury off. The fumes from that process are not only potentially deadly to humans, but also harmful to the ozone layer, and therefore, to the environment. What is also harmful to the environment is rivers and soil being polluted by mercury waste from the same workers. As much as 38% of the world's anthropogenic mercury emissions come from artisanal gold miners.²

These miners usually operate in small mining communities in countries all over South America, Africa, and Southern Asia in Less Economically Developed Countries (LEDC's) like Ghana, The Philippines, and Venezuela. Artisanal gold mining is more often than not associated with crime and gang activity, which is linked to the fact that most of it is done illegally. Although some countries like the Philippines have adopted methods like retorts to reduce the damage done to the environment by mercury, it is still not enough.

¹ <https://news.un.org/en/story/2023/02/1133587>

² “Reducing Mercury Pollution from Artisanal and Small-Scale Gold Mining.” EPA, Environmental Protection Agency, www.epa.gov/international-cooperation/reducing-mercury-pollution-artisanal-and-small-scale-gold-mining.

What is more, these operations do not only hurt the ozone layer and their workers. The long-term effects of releasing mercury into the environment can mean deforestation, corruption of soil, mercury poisoning across the whole food chain and more.

DEFINITION OF KEY-TERMS

Artisanal³

The word artisanal is used to describe something that is made in a traditional and non-mechanized way.

Retort⁴

A retort is a cheap device often used in artisanal mines to recycle up to 95% of the mercury burned off during the purifying process.

ASGM⁵

Artisanal and small-scale gold mining (ASGM) is the exploitation of smaller gold deposits by individuals, small groups, or small cooperatives.

Tailing⁶

The residue of something, especially ore.

Emissions⁷

The production and discharge of something, especially gas or radiation.

Centrifuge

A scientific device that is used to separate fluids, gasses, or liquids based on the density of the subject.

³ "Artisanal Definition & Meaning." *Dictionary.Com*, Accessed 29 July 2023. www.dictionary.com/browse/artisanal

⁴ *The Mercury Problem in Artisanal and Small-scale Gold Mining*, chemistry-europe.onlinelibrary.wiley.com/doi/10.1002/chem.201704840

⁵ "ASGM 101." *planetGOLD*,. Accessed 31 July 2023. www.planetgold.org/asgm-101

⁶ "Tailing." *Cambridge Dictionary*, dictionary.cambridge.org/dictionary/english/tailing. Accessed 31 July 2023.

⁷ "Emission." *Cambridge Dictionary*, dictionary.cambridge.org/dictionary/english/emission. Accessed 31 July 2023.

BACKGROUND INFORMATION

How gold is extracted

Roughly 20% of the world's gold comes from poverty stricken artisanal gold mining communities in Less Economically Developed Countries (LEDCs) of Africa and Asia.⁸ These communities find gold in the rivers that surround them, take it back to their village, combine it with mercury and then burn the mercury off. This process ensures that the gold is pure and that no other minerals are left on it. This can happen because gold has a higher melting point than mercury and most of the minerals that the workers are trying to get rid of.

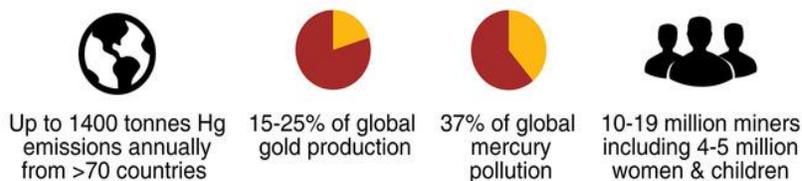
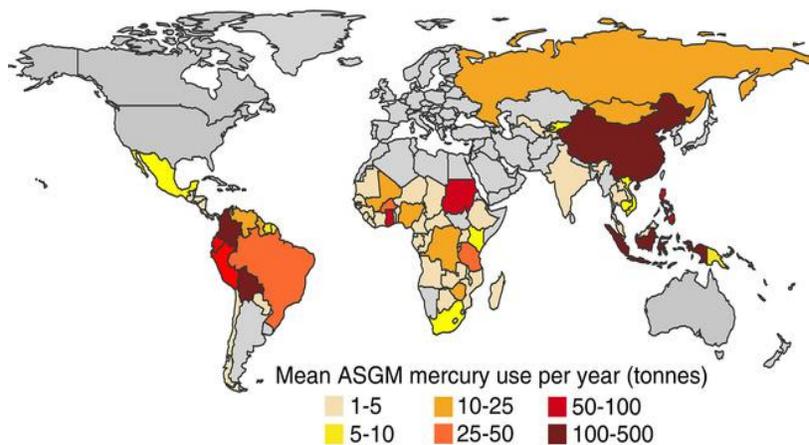
Two main mining techniques, placer, and vein mining, as well as byproducts from the extraction of other metals are used to get gold. When the metal is discovered in loose quantities of sand and gravel, where gold can be readily separated because of its high density, placer mining is used. Moving water suspends the stones and sand while the much weight metal falls to the bottom and must be manually removed. The simplest technique, known as panning, involves swirling the combination in a pan quickly enough to push the majority of the pebbles and sand, as well as the water, over the side, leaving the gold behind on the bottom.

The forty niners' standard technique, known as panning, has been celebrated in literature, fine art, and music. A sluice box, a U-shaped trough with a mild slope and crossing bars tightly fastened to the trough bottom, is far more effective. The horizontal bars stop the heavier particles from being washed downslope by catching them. The lighter stuff is washed down the sluice box and out at the bottom when the heavier stuff is placed in the high end and the opening to the water source is opened. To reclaim the gold, materials captured behind the bars of gold are gathered. Hydraulic mining is yet another placer technique variant. Natural gravel and sand banks are subjected to an incredibly powerful stream of water, which causes them to wash away. In many ways, the suspended substances are handled as though they had been placed in a big sluice box. Dredging is the most significant placer method used today. In this technique, the unorganized sand and gravel are lifted from their resting place and the placer process is initiated using a shovel with a capacity of several cubic meters. The most crucial way of recovering gold is lode mining, also known as vein mining.

⁸ Author links open overlay panel Gerardo Martinez a, et al. "Voluntary Gold Certification Programs: A Viable Mechanism for Improving Artisanal and Small-Scale Mining in Peru?" *Journal of Rural Studies*, Pergamon, 11 June 2022, www.sciencedirect.com/science/article/abs/pii/S0743016722001127.

Why mercury use needs to be stopped.

The aforementioned mercury method is more often than not, unregulated and has many downsides. It is harmful not only to the workers' health and safety, but to the environment as well. Contaminating the water and soil of the surrounding area, this method can also affect neighboring communities. As previously mentioned, it is also the largest source of anthropogenic Mercury emissions, making up 38% of the earth's total.⁹ The fumes are not only detrimental to the environment, but also to the people. The cost on human health is astonishing due to the huge levels of mercury handled directly by the miners and released into the environment. Impaired cognitive function, neurological impairment, kidney damage, and other health issues are brought on by miners inhaling mercury vapor. When amalgams are processed in close proximity to homes or in gold shops in towns or cities, the mercury vapor



released during the process affects residents who are not miners. Mercury pollution exposure is particularly detrimental for children and fetuses because it raises the risk of physical abnormalities, neurological harm, and reduced IQ. The excessive amounts of mercury that build up in fish and other food sources in ASGM populations further exacerbate these dangers of mercury exposure.

Figure 1: Estimated annual mercury use in artisanal and small-scale gold mining¹⁰

⁹ "Reducing Mercury Pollution from Artisanal and Small-Scale Gold Mining." EPA, Environmental Protection Agency, www.epa.gov/international-cooperation/reducing-mercury-pollution-artisanal-and-small-scale-gold-mining.

¹⁰ *The Mercury Problem in Artisanal and Small-scale Gold Mining*, chemistry-europe.onlinelibrary.wiley.com/doi/10.1002/chem.201704840.

The dangers of mercury use in gold mining extend far beyond mercury pollution exposure and also include jeopardizing food chains and biodiversity. Mercury emissions, for instance, can have a negative impact on amphibian larval health and survival as well as algae development, fish growth, brain function, and reproduction. Moreover, fish are known to bioaccumulate mercury, which puts any birds or mammals that eat them in danger (including humans). Given that many of the mining sites are situated in geographically diverse areas, such the Amazon rainforest, harm to these avian and mammalian predators is crucial to ASGM. Those who live close to these ASGM sites frequently eat fish as a significant source of protein in their diets, which causes elevated mercury levels even in non-miners. Mercury pollution poses a threat to food security in this way.

Negative effects on the environment

As mentioned before, mercury can be catastrophic for the environment if released without the proper measures taken. Excess mercury, which is more often than now in liquid form, is usually released into rivers. These rivers are now mercury polluted, and therefore their waters damage the flora around them instead of nurturing it. Sadly, the fauna does not stay unharmed either. The fish in said river are mercury polluted, and so are the animals that drink water from that river. The biggest disturbance in the food chain is the effect mercury has on fish, as exposure to mercury can lead to reduced liver function and metabolism, impaired reproduction, altered behavior, damage to the gills, deformity and olfaction organs, and mortality.

Gold miners must be aware that they can easily infect their own, their loved ones, and friends, as well as those living far away from their jobsite, when they use mercury for amalgamating gold. how contamination is done relies on how miners carry out their duties. Mercury will be carried below and scattered over a very wide area, for instance if the whole ore is mixed together and discharged without enough settling ponds or if mercury-contaminated substances are dumped directly into the river from a raft, where it can then change into methyl mercury in the dirt at the bottom of rivers, lakes, or streams.

Fish, particularly piscivorous species (fish that consume other fish), become highly concentrated in methylmercury, which is easily taken by worms, snails, and insects. People who live downstream of mining sites run a significant danger to their health when they consume fish that has been tainted with mercury from ASM activities. Similar to how amalgam burning in an open pan releases mercury vapor into the atmosphere. The majority of the vapor condenses on the surface and can pollute soil as far as two kilometers away from the fire source. However, some vapor disperses over great distances and falls as rain. Mercury tends to concentrate in a

relatively limited region when miners amalgamate concentrate in pools, creating a local "hotspot," or a location with an elevated level of mercury-contaminated material.

Challenges and opportunities

The use and emissions of mercury in ASGM are a genuine issue. It is a problem that has persisted despite numerous well-intended initiatives from governments, environmentalists, and humanitarian assistance organizations. Legally limiting or outlawing the use of mercury is not the easiest way to stop mercury pollution in ASGM, as such policies have already been tried and failed in regions with the greatest mercury use rates. The use of mercury in these situations continues uninterrupted since a ban on its usage could make it more difficult for miners operating outside the law to be engaged and educated.

It is important to keep in mind that these miners live in some of the world's poorest regions and have few, if any, alternative options for employment and income when addressing the mercury issue in ASGM. While there are 10-19 million ASGM workers at any given time, 80-100 million individuals are believed to be directly dependent on the associated income, making this factor crucial.¹¹

MAJOR COUNTRIES AND ORGANIZATIONS INVOLVED

Colombia

Colombia is a fine example of a country that understands the dangers of mercury use and has taken progressive steps to minimize it. Colombia has had a gold mining culture since the mid-19th century, and mercury use has been a big part of it. The government has been implementing laws on this topic since 2013, and now, in 2023, mercury use is completely prohibited in gold mining operations, and instead the use of centrifuges and other such eco-friendly machines is in place. It is a beacon of hope that we can actually achieve the worldwide total ban of this dangerous procedure.

¹¹ Author links open overlay panel Jennifer J Hinton a b, et al. "Clean Artisanal Gold Mining: A Utopian Approach?" *Journal of Cleaner Production*, Elsevier, 18 Apr. 2002, www.sciencedirect.com/science/article/abs/pii/S0959652602000318?via%3Dihub.

Guyana

Guyana has also had a long history with gold mining, and a tragic one at that. Gold mining in Guyana has been the leading cause of deforestation for decades. Guyana has been the first of eight countries to launch a GOLD¹² program, and also the “El Dorado” programme, backed not only by UN Environment, but also by Conservation International and Global Environment Facility aiming towards a mercury use free Guyana by 2025.

Venezuela

Venezuela has a long history of gold mining and mercury use, as it was first used in 1829. Since then, gold mining has been plagued with crime and associated with mafias and small militias. Government corruption also plays a key role in Venezuela, as gold miners have been bribing the military in order to continue their illegal endeavors. Venezuelan President Nicolás Maduro has launched the Mining Development Plan 2016-2018 in order to kickstart, as he put it, “an effort to start reducing illegal mining and give work to Venezuelan artisanal miners.” However, the Development Plan was not amazingly effective, as it did not tackle the issue directly and instead focused on investments from foreign parties.

Philippines

The Philippines has one of, if not the least safe working environment for artisanal gold miners. Not only are there all the usual risks of working with mercury to purify gold, but there is also the possibility of a deadly landslide due to the climate. Sudden floods and collapse of walls are also a quite common thing in tragedies happening in the gold mining scene of the Philippines. However, the Philippines have joined the International Atomic Energy Agency (IAEA) project, a project launched by the Department of Health, UP National Poisons Control and Information’s Service of the National Institute for Minamata Disease-Japan, aimed at the overall improvement of the situation.

Planet GOLD

Planet GOLD is an organization supported by the Global Environment Facility and led by the United Nations Environment Programme and works in partnership with governments and other NGOs in order to formalize and improve the working conditions of artisanal miners. Apart from this, planet Gold aims to raise awareness about issues their communities face. In addition to that, they work to close the financing gap and promote mercury free mining technology.

¹² “Global Opportunities for Long-Term Development of Artisanal and Small-Scale Gold Mining (ASGM) Sector plus - GEF Gold +.” *Global Environment Facility*, www.thegef.org/projects-operations/projects/10569.

United Nations Development Programme

The UNDP is a UN programme tasked with helping nations achieve human and cultural development, as well as economic growth and the elimination of poverty. They are also in active collaboration with organizations such as Planet GOLD, National Chemicals Programme, Global Environment Facility (GEF) and many others. They have also been a part of the Minamata convention, one of the most important conventions in the history of mercury use. As a key partner in the Global Environment Facility (GEF) funded planet GOLD programme, UNDP is making small-scale gold mining safer, cleaner, and more profitable in Colombia, Ecuador, Ghana, Honduras, Kenya, Indonesia, Peru and Suriname.

TIMELINE OF EVENTS

DATE	DESCRIPTION OF EVENT
2000	Planet GOLD was founded
October 10th 2013	Minamata convention on mercury was signed
February 18th 2019	New \$180 million Global Environment Facility programme across eight countries ran by planet GOLD
March 23rd 2020	Global Opportunities for Long-term Development of artisanal and small-scale gold mining (ASGM) Sector Plus - GEF GOLD +
September 27th 2022	Philippines signs a country programme with the IAEA

RELEVANT UN RESOLUTIONS, TREATIES AND EVENTS

A/HRC/51/35: Mercury, small scale gold mining and human rights - Report of the special Rapporteur on the implications for human rights of the environmentally sound management and disposal of hazardous substitutes and wastes¹³

In accordance with Human Rights Council resolution 45/17, Marcos Orellana, the Special Rapporteur on the human rights effects of environmentally sound management and disposal of hazardous substances and wastes, submits to the Council his annual thematic report on the negative effects and potential risks of mercury uses in small-scale gold mining. Because of the emission of mercury from mining operations, which is a persistent heavy metal dangerous to both human health and the environment, lands, rivers, and oceans are being contaminated on a large scale, endangering human health. The world's largest source of mercury pollution is small-scale gold mining. Yet, there are gaps and weaknesses in the international agreements for the regulation of mercury in small-scale gold mining. The Special Rapporteur investigates the systemic racism experienced by indigenous peoples as well as the human rights breaches and environmental injustices brought on by the use of mercury in small-scale gold mining.

Phasing out Mercury: The Minamata Convention takes aim at a leading cause of ill health¹⁴

According to the UNDP, phasing away mercury provides advantages beyond just our health. Additionally, it helps to reduce poverty, promote gender equality, safeguard the environment, preserve marine and coastal biodiversity, protect children, and ensure fair working conditions. According to a survey of artisanal and small-scale gold miners in Migori, Kenya, women made up the majority of the mercury users who were not wearing any safety gear, indicating that women and children had the highest mercury exposure. Therefore, just like climate change, mercury is a widespread issue that affects the entire world, which is why the Minamata Convention on Mercury was established. It is the newest international environmental convention, having only entered into force in 2017. It attempts to lessen mercury emissions from all sources, including small gold mines, coal combustion, cement manufacturing, non-ferrous metal production, waste disposal from mercury-containing products, chlor-alkali facilities, among many others.

¹³ "A/HRC/51/35: Mercury, Small-Scale Gold Mining and Human Rights – Report of the Special Rapporteur on the Implications for Human Rights of the Environmentally Sound Management and Disposal of Hazardous Substances and Wastes." *OHCHR*, Accessed 30 June 2023. www.ohchr.org/en/documents/thematic-reports/ahrc5135-mercury-small-scale-gold-mining-and-human-rights-report-special.

¹⁴ Monica Gaba Kapadia Programme Specialist, and Kasper Koefoed-Hansen Programme Advisor. "Phasing out Mercury: United Nations Development Programme." *UNDP*, 18 Mar. 2022, www.undp.org/blog/phasing-out-mercury.

PREVIOUS ATTEMPTS TO SOLVE THE ISSUE

Minamata treaty-convention

The Minamata convention first took place on October 10, 2013, after years of meetings and five intergovernmental sessions, and managed to convince over 140 countries to adopt the text of the Minamata convention, whose goal is to protect the environment and human health from anthropogenic mercury emissions. Conventions continue to take place and are just as active today with their sustainable goals and development. The Minamata Convention Text was very efficient in its solutions and helped countries like Colombia achieve total bans of mercury use, while supporting others in their quest to minimize it.

Global Environment Facility (GEF) GOLD

A cooperative project called the Global Environment Facility (GEF) GOLD program aims to decrease the use of mercury in ASGM (artisanal and small-scale gold mining) and promote environmentally friendly methods in this industry. The program is carried out in collaboration with numerous multinational governments and organizations with an emphasis on addressing the effects of ASGM operations that use mercury on the environment and human health. The goal of the program is to encourage ASGM operations to adopt mercury-free or low-mercury technology and practices. Mercury is frequently employed by small-scale miners to extract gold, although it is extremely hazardous and harms both people and the environment. GEF GOLD supports projects to increase the skills of local communities and miners in safer chemical handling, improved gold extraction techniques, and sustainable mining practices. The initiative promotes the incorporation of environmentally friendly methods into national and regional policies by strengthening governance and policy structures relevant to ASGM. For local communities, GEF GOLD aimed to increase the social and economic advantages of ASGM, such as improved conditions at work, possibilities for earnings, and community development.

Ban of mercury use in Colombia.

According to law 1658 of 2013, which was put into effect on July 16, 2018, mercury use in mining was formally outlawed in Colombia. The law specified that, by 2023, a complete prohibition on the industrial use of mercury would go into force, and that within five years, the use of this component would be forbidden in all mining operations, particularly gold mining, which utilizes mercury the most. One of the first steps taken, according to Willer Guevara, Vice Minister of Policies and Normalization at the Ministry of Environment and Sustainable Development, was to limit the import of mercury, which was formerly 100 metric tons per year on average. The Colombian criminal justice system goes through a number of processes to

ensure that mercury is never used. The Ministry of Transport devised a strategy for controlling mercury disposal while the Ministry of the Superintendence of Industry and Commerce (SIC) produced a form to regulate mercury imports. Environmental authorities are implementing a strategy to monitor and regulate the introduction of mercury into the country and enforce fines on individuals who import it illegally now that the law has taken effect. The Ministry of Mining will also check to see if the mines have revised their mining plans, where it needs to be made clear that mercury is not included in any of their operations.

Mining Development Plan 2016-2018 Venezuela

Under pressure from NGOs and Venezuelan activists, president Nicolás Maduro launched the Mining Development Plan 2016-2018 as an effort to reduce illegal mining operations. The initiative, according to Maduro, is "an effort to start reducing illegal mining and give work to Venezuelan artisanal miners." However, it is anticipated that the plan will concentrate on regulating artisanal mining and encourage corporate inversion in the mining industry. Because there are numerous potentials for the extraction of other metals as well as gold and diamonds.

Therefore, it is deemed unsuccessful.

POSSIBLE SOLUTIONS

Gold Katcho- Gold Cube

The gold Katcho is a pump-based gold concentrator made from plastic, meaning it does not rust. It uses a 220 Volt connection and a water source in order to process one to three tons of material in the span of an hour and can collect gold as fine as powdered. However, there is one downside to the gold Katcha: it requires training to be used correctly. The gold cube is the katcha's smaller and cheaper alternative: it requires a 12-volt connection and a small water source to operate. It also requires training.

Retort

A retort is a relatively cheap device often used in artisanal mines to recycle up to 95% of the mercury burned off during the purifying process. Countries like the Philippines have adopted retorts fully and reduced their mercury emissions drastically. However, the retort shares the same downside as the gold Cube-Katcha: it is difficult to operate and requires training.

Water repurposing

Areas of ASGM place a lot of importance on various aspects of water cleanup. Tailings are frequently discharged into rivers and streams, which provide water for cultivation and drinking. Hence, removing the mercury from this water may aid in preventing direct mercury consumption as well as uptake by aquatic life and crops. Mercury removal or immobilization may be crucial in situations where tailing ponds are used to avoid discharge into the environment. For instance, it has been demonstrated in field tests that adding a small amount of calcium hydroxide to ASGM tailing ponds will help remove suspended particles from the water and stop mercury from becoming methylated.

Soil remediation

Remediating mercury-contaminated soil is a significant issue in ASGM regions. Any approach for soil remediation must have low-capital outlay and simple protocols for remediation, keeping in mind the limited financial resources of ASGM populations and the governments in these jurisdictions. Large-scale excavation and capping, off-site disposal, and soil washing, or thermal treatment are all likely unfeasible options for soil remediation in ASGM. These actions were all conducted in wealthy nations. Instead, it is necessary to create soil amendments that can capture and immobilize distinct types of mercury. For these soil additives to have any hope of having an effect on contaminated areas covering many square kilometers, they must be very affordable and scalable.

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