


OPENING THE
BLACK BOX: **LOCAL
INSIGHTS INTO
THE FORMAL AND
INFORMAL GLOBAL
MERCURY TRADE
REVEALED**



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Cover image: Mercury in the bare hand

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A miner washing out soil to extract gold © Bram Ebus/InfoAmazonia

EXECUTIVE SUMMARY

BACKGROUND

Mercury is continually used in the artisanal and small-scale gold mining (ASGM) sector even though it is highly poisonous to both humans and the environment. There are an increasing number of projects, initiatives and conventions, including the Minamata Convention, working on the reduction of mercury use in ASGM. However, a long-lasting change away from mercury is hard to achieve and there seem to be mechanisms in place that prevent a mercury-free ASGM sector. As mercury trade and use is mostly regulated and restricted, a lot of mercury used for ASGM is traded informally. To better understand the factors at play, the mercury supply chain of both formal and informal mercury was investigated in eight countries with large ASGM sectors (Bolivia, Suriname, Guyana, Kenya, Tanzania, Uganda, Burkina Faso and the Philippines). Investigations on formal and informal imports, domestic trade routes, the supply chain and actors involved established a similar picture across the different regions.

IMPORTS, TRADE ROUTES AND SUPPLY CHAIN

Depending on the country, mercury enters via multiple formal and informal pathways. In the case of entrance through formal ports, mercury is either misdeclared and passes customs unnoticed or officials are bribed to look the other way. For informal entrance, similar pathways are used as for other smuggled goods. Large trading hubs are generally the capitals and larger cities. The mercury trading network is multilayered with importers, wholesalers and retailers involved. The networks are well established and generally operate in secret, as most of the trade is informal. High up in the supply chain, trade is based on trust and networks are difficult to

infiltrate or understand. For many mining operations, the mine manager or operation owner is the person who buys mercury. The mercury can be bought at hardware and mining stores in the cities and larger mining towns or directly at the mining sites where local traders offer mercury. These traders are often, but not always, gold traders who also trade with mercury. In some cases, mercury gets supplied in advance and the price gets settled when miners sell the recovered gold to the same trader.

MAIN DRIVERS OF MERCURY TRADE

Miners, their families and surrounding communities are often the most negatively affected by mercury. However, while they are the end users, they are not the driving force behind the trade. Many miners are caught in multiple circuits that cause the continued use of mercury. Firstly, miners are trapped in a poverty cycle in which mercury is the only affordable method to produce gold. Within the second cycle, gold/mercury traders take advantage of the sector's informality and generate trade mechanisms that guarantee the continued use of mercury. Through the trade with both minerals, power imbalance between miners and gold traders can occur. In these cases, traders create dependencies in which the miners have to keep using mercury and cannot easily break ties with the dealer (e.g. by providing mercury up front to be offset with the gold buying price and under the condition that the produced gold can only be sold to the same trader). The gold/mercury traders increase their profits through the trade with both minerals.

The investment necessary for changing to mercury-free extraction methods, are mostly unaffordable for the individual ASGM miners. Generally, the traders or investors of mining operations could afford investments, however, they have no incentive to do

so as the trade with both mercury and gold is very lucrative. Instead, they create trade mechanisms that encourage miners to keep using mercury. Mercury trade is a lucrative business on all levels in the supply chain. It is often linked to the gold trade and in many cases the same actors are involved in both trades. Nonetheless, there are also actors involved that have no such links to gold trade and only trade with mercury.

MAIN RECOMMENDATIONS

A combination of factors is driving the continued use of mercury, including the lucrativeness of the trade, the informality of the ASGM sector, the poverty of many miners and the power imbalance between many traders and miners. Mercury governance within the focus countries has potential for improvement. To tackle the mercury problem, action should be taken that addresses the problem from all angles.

- Reliable data concerning formal mercury trade and the ASGM sectors of the countries is necessary to better understand mercury trade for ASGM.
- As informal trade is hard to tackle, we recommend improving legal trade regulations and monitoring for both mercury and gold within the different countries.
- Laws and regulations concerning mercury imports, domestic trade and use should be clarified.
- Yearly quotas for formal imports should be put in place.
- Licensing and monitoring schemes for domestic trade should be created and enforced.
- Custom agencies should receive training on recognizing, handling and storage of mercury.
- Environmentally sound interim storage facilities need to be created with monitoring schemes in place to guarantee safe keeping of confiscated mercury.
- There is the need for increased regional and international cooperation on informal trade. In many cases, the stricter implementation of regulations in one country led to a shift of imports into a

neighboring country with looser regulations.

- To address the mercury problem at the level of the miners, the ASGM sectors should be formalized to provide miners with access to governmental support.
- Inclusive, long-term institutionalized support that facilitates the transition to mercury-free gold extraction techniques should continue. These should include research on the most affective extraction method for the mining site and include miners in the search for affordable and doable methods.
- Financing schemes that enable miners to access necessary equipment for these mercury-free techniques need to be put in place.
- Markets for mercury-free gold need to be enlarged and a certification scheme for mercury-free gold needs to be supported.

Implementing these recommendations would ensure that the power imbalance between miners and gold/mercury traders would be reduced and miners would have an incentive to change to mercury-free techniques.

Miners, their families and surrounding communities are often the most negatively affected by mercury

LIST OF ACRONYMS AND ABBREVIATIONS

ASGM	Artisanal and Small-Scale Gold Mining
ENSO	Enquête nationale sur le secteur de l'orpaillage (Burkina Faso)
DRC	Democratic Republic of Congo
IGF	Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development
IUCN NL	IUCN National Committee of the Netherlands
NAP	National Action Plan
PH-EITI	The Philippine Extractive Industries Transparency Initiative
SRJS	Shared Resources, Joint Solutions
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization

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1 INTRODUCTION

1.1 PROJECT BACKGROUND AND OBJECTIVE

Mercury is obtained from mercury ore, or cinnabar. To date, only a few primary mines of mercury ore remain in use and these are located in Mexico, China and Indonesia. Mercury was and still is used in a variety of objects and processes, e.g. dental amalgam, laboratory processes and gold mining. Within the last decades, the negative impacts of mercury on both human and environmental health have been widely documented and mercury is considered one of the top ten chemicals of major public health concern (World Health Organization, 2017). Mercury is released into the environment from anthropogenic and natural sources and once entering the atmosphere, it circulates world-wide making mercury pollution a global problem. Mercury concentrations in the atmosphere are already 450% higher than natural levels (AMAP/UN Environment, 2019), and large amounts of additional mercury are emitted through anthropogenic activities each year. With more than 37%, the main contributor to these anthropogenic mercury emissions is the artisanal and small-scale gold mining (ASGM) sector.

Many projects, initiatives and global treaties, such as the Minamata Convention, have been working on reducing mercury use in ASGM. Approaches include introducing small-scale gold miners to mercury-free mining techniques and enhancing mercury-free gold supply chains. However, most projects are struggling to achieve a lasting change, and miners quickly return to using mercury post-project. A key question that remains is thus which forces are constraining mercury-free artisanal gold production?

While official data on exports and imports of mercury is available for most countries, this data does not seem to match with mining realities on the ground. Little information is available on informal pathways of the mercury trade and how these drive the artisanal

gold economies. Where does the mercury used in ASGM originate? How is it transported, through which channels, formal or informal and by whom? And who benefits from this trade?

An insight into the supply routes and value chain of mercury markets with special focus on the informal trade is needed to support the reduction of mercury use in ASGM.

To gain insight into the formal and informal mercury trade, IUCN NL initiated a study on the political ecology of the gold-mercury link to identify informal mercury flows, trade hubs and key players in multiple countries located across three continents, namely Guyana & Suriname, Bolivia, Philippines, Tanzania, Uganda, Kenya and Burkina Faso. The objectives of this study were:

- 1) To improve the understanding of mercury flows, trade hubs and key players.
- 2) To enhance the governance of mercury in the ASGM sectors of the target countries.
- 3) To enhance recognition of the scale and impact of the informal mercury trade.
- 4) To showcase that this is a global problem.

The aim of the study is to support the National Action Plans (NAP) developed by the abovementioned focus countries that are currently developed for the Minamata Convention. The gained insights into the informal mercury trade may enhance the governance in the phasing out of mercury in the ASGM sector. Furthermore, we aim to raise awareness in the global community about the role and influence of the informal mercury trade on ASGM.

This report compiles results from country/regional reports done by local partner CSOs in the target countries and highlights common findings.



Mining landscape in Guyana (Cuyuni) © Bram Ebus/InfoAmazonia

Information refers to the respective country/regional reports if not stated otherwise. The full country/regional reports can be found at (www.iucn.nl/mercury). Within this report, the terms formal and informal mercury trade are commonly used, however, the informal trade also includes illicit mercury trade. The Mercury governance project was initiated by IUCN National Committee of the Netherlands (IUCN NL) under the Shared Resources, Joint Solutions (SRJS) program funded by the Dutch Ministry of Foreign Affairs.


1.2 METHODOLOGY

Work in the selected focus countries, namely Guyana, Suriname, Bolivia, Tanzania, Uganda, Kenya, Burkina Faso and the Philippines was conducted

by local partner organizations supported by globally recognized expert consultants under the coordination of IUCN NL.

Each focus country has a significant ASGM sector and we identified the specific target countries based on countries included in the SRJS programme and in consultation with UN Environmental Programme (UNEP) taking into account already available information to assure our added value.

Information on both formal and informal mercury trade in each focus country was collected through a combination of desk research and field work as well as qualitative stakeholder interviews. Due to the informality of the sector and secrecy around it, different levels of details could be obtained for the various aspects of mercury trade in the different countries.



From its original source to the gold mining sites at the other end of the world, trade routes of informal mercury remain largely elusive to this day.

1.2.1 Desk Research

Desk research was conducted focusing on current mercury and gold trading practices both inside and outside of the countries. Documents included in the research were academic studies, government and research reports, national policies and website articles. Information gathered through desk research, e.g. on trading routes, was later discussed and validated with interview participants. Furthermore, national policies concerning the ASGM sector and mercury were reviewed.

1.2.2 Field work

As many mercury imports and the mercury trade itself are informal in most of the selected countries, little detail on trade routes and mechanisms is available. To get a better picture of the informal mercury market, partner organizations made visits to mine sites, gold buyers and shops selling mining materials.

1.2.3 Stakeholder interviews

To gain further insight, qualitative stakeholder interviews with open-ended questions were conducted. Interviewed stakeholders included miners, mining financiers, gold traders, mercury traders, custom officials and other government officials. Interviews varied in content and length depending on the type of stakeholder. Generally, questions focused on mercury use, information regarding mercury flow into the country and trade routes within the country, quantities and prices of mercury and key players in the mercury trade. Due to the informality of mercury import and trade in many cases, quantitative data on the informal mercury trade is difficult to obtain. However, the results presented here provide an initial insight into the informal mercury supply chain and key players involved. As the topic is sensitive due to its illegality in some countries, this report will not name specific people or companies involved, but rather identify routes and trading hubs, supply chains and groups involved as well as explain power relationships.

2 MINAMATA CONVENTION

The Minamata Convention on Mercury, a global treaty to protect human health and the environment from the adverse effects of mercury, entered into force in August 2017. As of March 2020, 118 countries are Parties to the Convention. Among other things, the convention regulates the international trade of mercury and prohibits the use of mercury from primary mining in the ASGM sector (Article 3). Ratifying parties of the convention are obliged to reduce, and where possible eliminate, the use of mercury in ASGM (Article 7). Parties that have an ASGM sector that is more than insignificant, have

to notify the Minamata secretary and develop and implement a Nation Action Plan to achieve their goals (Minamata Convention, Annex C). Within the NAPs, countries are required to include “strategies for managing trade and preventing the diversion of mercury and mercury compounds from domestic and foreign sources to use in artisanal and small scale gold mining and processing”.

An overview of the status of the Minamata Convention in the different focus countries can be found in table 1

COUNTRY	SIGNED MINAMATA	RATIFIED MINAMATA	NAP	EXPECTED DATE	AIM
Bolivia	10.10.2013	26.01.2016	In progress		
Guyana	10.10.2013	24.09.2014	In progress	No later than 08/2021	75% Hg reduction by 2027
Suriname		02.08.2018	In progress	2021	
Kenya	10.10.2013	x	In progress		
Tanzania	10.10.2013	x	In progress		
Uganda	10.10.2013	01.03.2019	In progress		70% Hg reduction by 2024; providing alternatives\ substitute for mercury use by 2030
Burkina Faso	10.10.2013	10.04.2017	In progress		
Philippines	10.10.2013	x			

Table 1: Overview of the status of the Minamata Convention in the different focus countries

3 MERCURY TRADE

3.1 SMALL-SCALE MINING AND MERCURY

In recent years the ASGM sector has been booming as gold prices have continued to rise. The incentive of making fast money is drawing more people into the ASGM sector. Up to 20% of the global gold supply originates from ASGM (World Bank, 2013) produced by 10-20 million miners in over 70 countries worldwide (planetGOLD, 2019). An estimated 30% of all miners globally were women in 2003, but their involvement may be much higher today (Hinton et al., 2003). Approximately 70-80% of miners operate informally (IGF, 2017), opening doors for corruption and criminality, as well as keeping miners away from legal protection and support services. Therefore, ASGM is often linked to extreme poverty as miners live from hand-to-mouth (World Bank, 2012). This applies especially to women, as cultural barriers and gender-based discrimination often force them to take on lower paid and low-skilled jobs such as ancillary roles, e.g. as cooks or service providers (ibid). This poverty cycle is nearly impossible to break without external support.

Mercury has been used to extract gold for thousands of years. It is still seen as a favorable technique by miners as it is an easy process that does not involve any expensive equipment and mercury is often relatively cheap and easily available. Mercury can be used during various stages of the mining process and depending on the method, different amounts of mercury are needed. Generally, the following steps are involved in the extraction of gold by using mercury. First, gold deposits get extracted by either hard-rock or alluvial mining. The extracted ore gets further processed to liberate gold from other minerals. In many cases, the liberated gold gets concentrated through gravity or other techniques. However, in some cases this concentration is not taking place and mercury is directly added to a

large amount of ore (whole ore amalgamation).

During amalgamation, mercury is added to capture the gold particles. When added to the whole ore, a large quantity of mercury is needed (3-50:1 Hg: Au) and a lot of it is released into the environment.

In concentrate amalgamation mercury is added to the concentrated ore and much lower mercury amounts are needed. The mercury gets separated from the gold by burning the amalgam. Mercury evaporates, leaving the gold behind. Exposure to the vapors is harmful and mercury gets released into the atmosphere. The release of mercury at this stage can be reduced and health-risks mitigated by burning mercury with a capturing system for example retorts. Globally, an average of three grams of mercury is used to produce one gram of gold (Telmer, 2011), resulting in an estimated release of 1220 tonnes of mercury into the environment in 2015 (UN Environment, 2019). Currently, the ASGM sector is the major contributor of anthropogenic mercury emissions to the air contributing 37.7% globally and up to 70-75% in the regional emissions of South America and Sub-Saharan Africa (AMAP/UN Environment, 2019).

3.2 GLOBAL MERCURY TRADE

Information on the formal global mercury trade can be found in various publications, including UN Environment (2017, 2018). Information on the informal trade is less readily available and this report attempts to address this. Mercury trade, both formal and informal, has been affected by the mercury export ban of the European Union in 2011 and the US in 2013 as both regions were mercury exporters. Since the bans, trade flows have shifted and prices have increased (Fig.1). This report will focus on data after the export bans to reveal the current situation in the mercury trade.

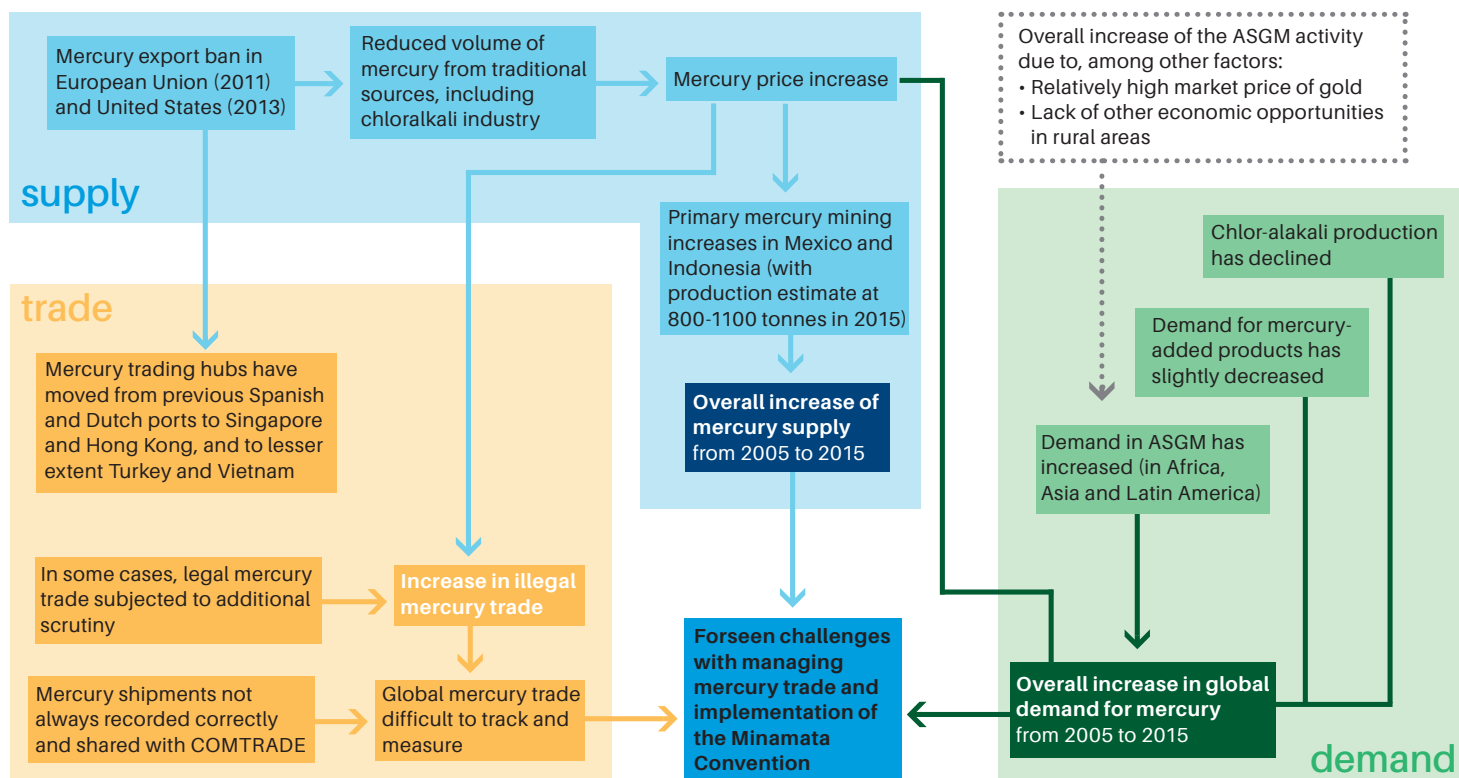


Figure 1: Global trends and causality in mercury supply, trade and demand, Source: UN Environment (2018) based on UN Environment (2017)

An overview of the officially recorded data of mercury trade reveals the main official flows and trading countries (within this report, official data refers to data obtained from either the UN Comtrade database or national agencies). However, comparison of data from exporting countries and importing countries show discrepancies. In addition to this, gold trading data is also problematic. Official gold production figures from ASGM are often unreliable as a large proportion of the sector works informally and the extracted gold leaves the country through informal channels. However, estimates for ASGM production exist for most countries.

Furthermore, official mercury imports into some countries are significantly smaller than what would be required to support the large ASGM communities in these countries. In other cases, mercury imports are significantly higher than amounts required for the

country's ASGM sector. Mercury is used in a certain ratio to gold (Hg:Au) during the mining process and both global as well as regional estimates of these ratios exist. Using the ratios and the declared/estimated gold production by ASGM, it is therefore possible to estimate the amounts of mercury needed to support the ASGM sectors in the countries. Mercury imports and gold production never add up to 100% as mercury is also used for other activities, e.g. in laboratories, and mining can also be done without mercury. However, major misalignment of mercury imports and ASGM gold production can indicate that a black market exists. Based on this, the questions arise where all the mercury used in ASGM originates.

This report will not go into detail of the estimations, but rather highlight the conclusions drawn by these. For more details, please see the regional reports.

3.3 MERCURY TRADE IN THE SELECTED COUNTRIES

Bolivia

Most miners in Bolivia are organized into cooperatives in which a group of miners become partners and work together. Of a total of ca. 30 tonnes of officially produced gold in 2018, most was extracted by cooperatives (89%), so basically the ASGM sector (Ministerio de Minería y Metalurgia, 2019). In 2018, more than 136 thousand people relied directly on ASGM for their livelihood in Bolivia. The organizational structure of cooperatives was initially put in place for social purposes. Over time, it gained a more permissive regulatory framework compared to other mining entities with looser labor and environmental regulations, a preferential tax regime and direct state support. Due to the size and economic importance, the cooperative mining sector has immense political power, influencing regulations and policies. Unfortunately, this importance also creates a power imbalance between cooperative leaders and employed miners and it is common that leaders take advantage of their employees in the form of long working hours, low wages and unsafe working conditions.

In Bolivia, mercury imports fall under a legal gap in regulations. The mercury import ban from the neighboring country Peru in 2015 led to a significant change in Bolivian imports. Bolivia experienced a leap in imports with a 12-fold increase and a historic peak of 152 tonnes from 2014 to 2015. Imports since have stayed high and made Bolivia the second largest importer of mercury in the world. Before 2015, mercury imports were lower than estimates needed for the declared gold creating a “deficit”. In contrast, imports since 2015 are well above what is required for the cooperative gold extraction sector, creating a significant “surplus”. The deficit is an indication of possible informal imports of mercury before 2015. On the other hand, the surplus is an indication of a higher

ASGM gold extraction than recorded, stockpiling of mercury within the country, informal exports of mercury to neighboring countries or a combination of these.

Most imports originate from Mexico (93%), where mercury is produced from mercury ore (Instituto Nacional de Estadística, 2018). These imports alone represent 25% of all commercial flows of mercury globally. Imports enter Bolivia mainly by land (98%) after arriving on the continent by ship to Arica, Chile (Instituto Nacional de Estadística, 2018) (Fig.2). Small portions are imported by air (1%) and via land from Peru (1%). The majority of imports are registered in the city of La Paz (393 t, 61%), followed by the city of El Alto (191 t, 30%). However, La Paz and El Alto border each other making this differentiation negligible. Following this, more than 90% of the imported mercury arrives in the trading hub La Paz-El Alto.

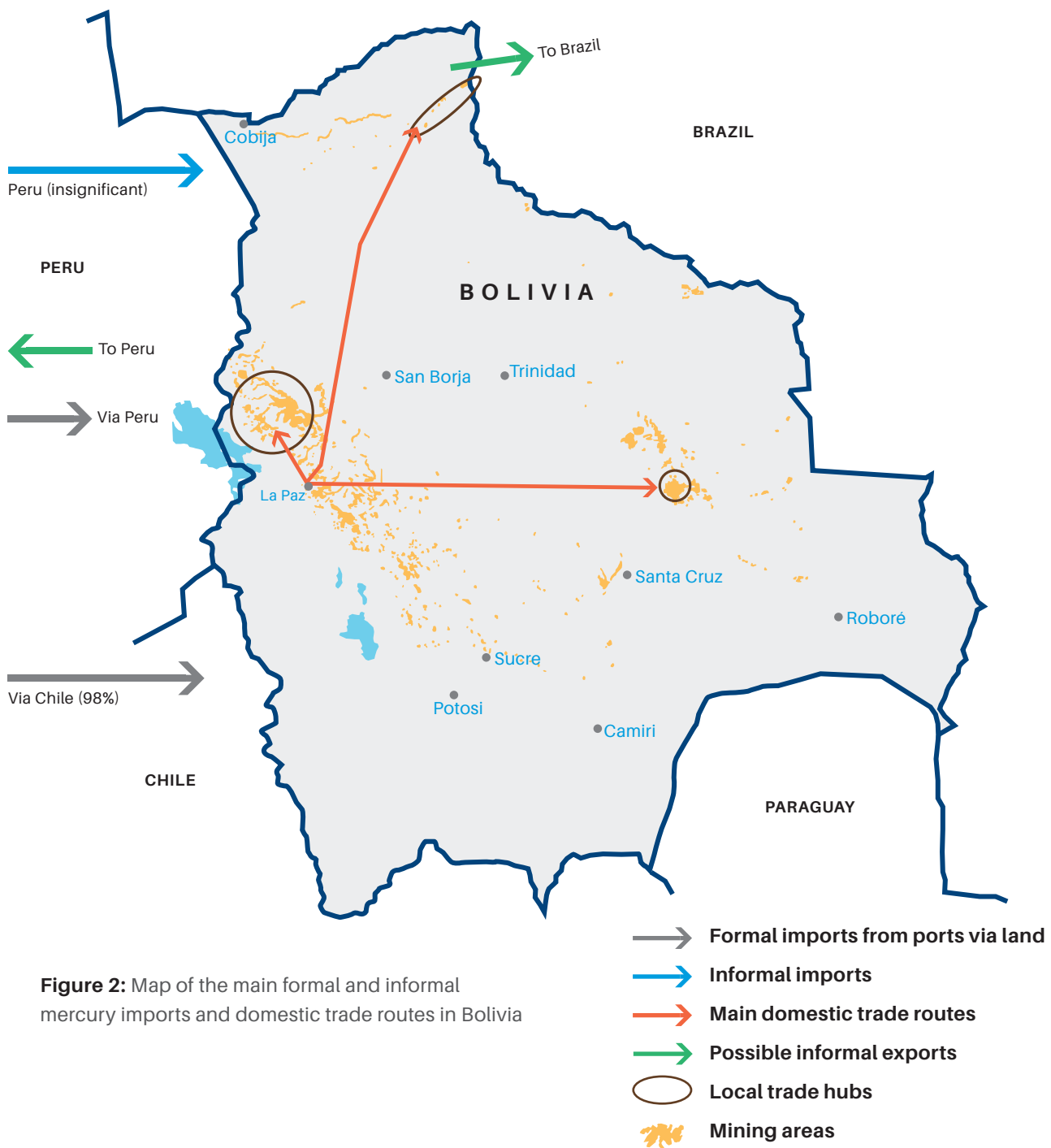


Figure 2: Map of the main formal and informal mercury imports and domestic trade routes in Bolivia

Information on the amount and value of these mercury imports are based on two different sources (Great Export Import, 2018; Penta-Transaction, 2018) as Bolivian customs denied access to information. As in most other cases, the accessible sources did not align perfectly, however, imports of mercury in the timeframe 2014-2018 seem to range from a minimum of 647 tonnes to a maximum of 1,366 tonnes. The majority of imports were imported by mining-related market entities (84%), followed by importers without information regarding their sector (9.2%),

the hardware and household appliances sector (6%) and the chemical, textile and cosmetic sector (0.6%). Informal imports into Bolivia seem negligible during the last years as volumes are small. Only in the region bordering Madre de Dios in Peru, small quantities of mercury are informally acquired from traders in Peru (Fig.2). This seems to be a matter of accessibility as Madre de Dios (Peru), a region in which ASGM is booming, is located a lot closer than the main trading hubs in Bolivia.

A total of 37 companies formally imported mercury into Bolivia within the period of 2015-2018. Of these, the top nine are responsible for 84%, and even more striking the top 3 for more than 50%, of all imports. Four of the large importers have ties to the Peruvian mining sector and could be linked to both formal and informal imports in Peru. The importers are selling mercury to wholesalers but also acting as wholesalers themselves (Fig. 3). Most large transactions are organized in La Paz and most stores involved are located in El Alto. The wholesalers in turn sell mercury to retailers, mining cooperatives and companies and individual miners. Transport to the larger mining towns or towns located near mining areas where most retailers are located is done via land, involving passenger transport companies, cargo fleets and sometimes the buyers' private vehicles. Retailers sell mercury mostly in small quantities to cooperatives, companies and individual miners (Fig. 3). Only one official export of 212 kg to Peru in 2017 has been registered in the last years. However, the amount of excess mercury and the abovementioned ties of importers to Peru suggest that large quantities of mercury are leaving the country informally towards

Peru. Different levels in the supply chain seem to be the source of these informal exports. Mercury might be directly diverted by importers or by mercury retailers, especially the ones based in areas close to the borders to Peru and Brazil.

At the import level, costs of mercury are rather low ranging from 10 to 31 USD/kg. Importers however, sell the mercury to intermediate retailers for prices ranging from 166 to 217 USD/kg while the final retail price that the end user pays ranges from 200 to 240 USD/kg. Of this multi-million dollar business, the importers who sell the mercury for 5 to 20 times the purchased price make the greatest profit within the value chain.

The investigations in Bolivia were rather difficult. While investigating in the field, our informants received multiple threats and were warned to drop further investigations. However, they were able to identify that networks supplying Bolivia with mercury are partially connected to networks of large transnational crime organizations involved in illegal activities such as drug and human trafficking.

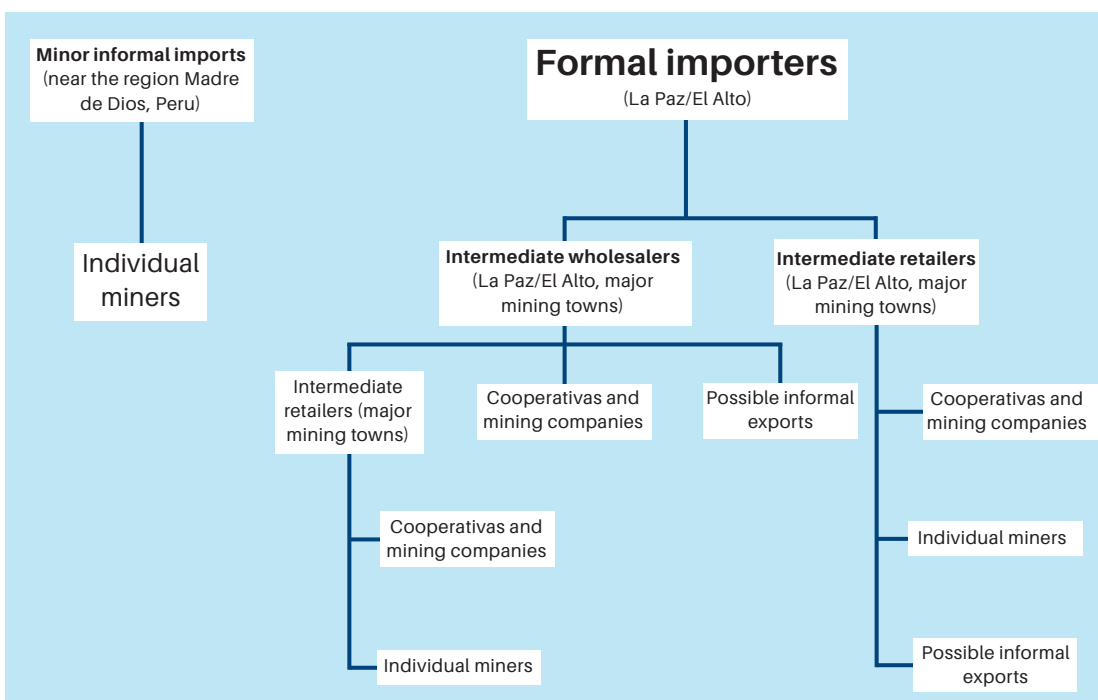


Figure 3: Actors within the mercury value chain in Bolivia

Guyana

In Guyana, the ASGM sector is fully legalized, however both legal and illegal mining operations exist. Around 19 t of gold were declared in 2018 (Ministry of Finance, 2019). Estimates of the contribution of the ASGM sector to the production range from 59% to 70% (Ministry of Finance (2019) and Pasha et al. (2017), respectively). However, these numbers need to be taken cautiously as there is concern that a significant part of gold is not declared but smuggled to Suriname (30-60%) where royalty payment is less (Stabroek News, 2018 and Stabroek News, 2016, respectively).

In the region, Guyana is the only country where mercury can be imported relatively easily. While no restrictions were in place concerning import amounts in previous years, since 2019, no more than 1,000 flasks/year or 34,500 kg per year can be imported. After a peak of mercury imports in 2012 and 2013, imports decreased in 2014 to approximately 5 t. Since then, imports have risen again with fluctuations reaching nearly 22 t in 2018. Over the past five years, the average amount of mercury imported per year is 20.46 t. Up until 2013, Guyana imported double the amount of mercury needed for its ASGM sector.

It can therefore be assumed that additional mercury was either stockpiled and/or exported informally to neighboring countries. Evidence suggests that both stockpiling and informal exports occur.

The main entry point for mercury is the Georgetown seaport (Fig.4). Another point of entrance is the Cheddi Jagan International Airport. Since the EU and US trade bans on mercury, India is the main supplier of mercury supplying 25% of all formal mercury, followed by Russia, Turkey and Singapore. While Mexico is a minor supplier, one shipment of 3 tonnes was declined entry by Guyanese officials and had this shipment been approved, it would have replaced India as the main supplier.

No informal imports have ever been intercepted by officials. However, multiple informants reported that mercury enters the country informally from China in container ships. It is believed that Chinese-operated businesses are allowed to import containers that are not being subject to customs checks. Under-invoicing and under- or mis-declarations seem to be common practice as reported by informants. Furthermore, mercury might also be transported through the porous borders from neighboring countries like many other smuggled goods.



Extracted gold in the hands of a miner © Bram Ebus/InfoAmazonia



Figure 4: Map of main trading routes in Guyana

Since the drop in mercury imports in 2014, the number of importers also decreased. As of 2015, only three official importers have been registered, one businessman and miner from Georgetown and two businessmen from Corriverton (close to the Suriname border). One of the latter stopped importing mercury due to new requirements for mercury storage. After arriving in the Georgetown port, a significant amount of mercury is transported to Corriverton on the Corentyne coast where two of Guyana’s major importers of mercury are based (Fig.4). The rest of the mercury is sold to mining companies, suppliers of mining equipment, general stores and gold dealers who retail the mercury further (Fig.5). Most of these transactions are done in Georgetown making it the major trading hub. Trade is done both openly and more secretly depending on the shop and the

origin of the traded mercury. It was suggested by informants that mercury sold in a secretive manner originates from the informal trade. Interviewees indicated that Chinese mercury can be obtained cheaply from Chinese businesses. Mercury is either sold in bulk in its original flask to bigger secondary retailers or re-packaged into plastic bottles for sale to miners. Many miners buy mercury directly in Georgetown in small amounts and transport it openly to the mining sites. Domestic transport is via land, water and air in small quantities and usually transport goes unhindered by the authorities. Retailers who buy mercury in Georgetown also transport mercury in the original flasks of 34.5 kg to the main mining towns (Fig.4). In the main mining hubs of Bartica, Port Kaituma and Mahdia, the retailers who are commonly suppliers of mining material, sell the mercury to

miners. Some smaller shop owners also have smaller quantities of mercury available for sale.

Mercury imported and taken to Corriverton, is sold to miners directly at the wharf in Georgetown or from a warehouse in Corriverton. (Fig. 5). However, the east of Guyana has rather few gold mining sites and interviewees from multiple different stakeholder groups, including government officials, reported that mercury is believed to be smuggled into Suriname. None of the interviewees could state with any certainty what quantities were likely to be smuggled. Another country that has been reported to receive

smuggled mercury from Guyana is Brazil. Sources identified a well-known operator who transports mercury via the Georgetown-Lethem road. This route was also confirmed by a bus driver who transports mercury to the border from where it is taken over the informal river crossing via boat and further transported to Boa Vista (Brazil) by bus or taxi. From there, it might be brought to Venezuela. Mercury also leaves the country directly towards Venezuela via different routes. Transport can be done via the river to Ethingbang, via plane or boat along the coast, however information on the latter is sparse. Guyana recorded no formal exports since 2008.

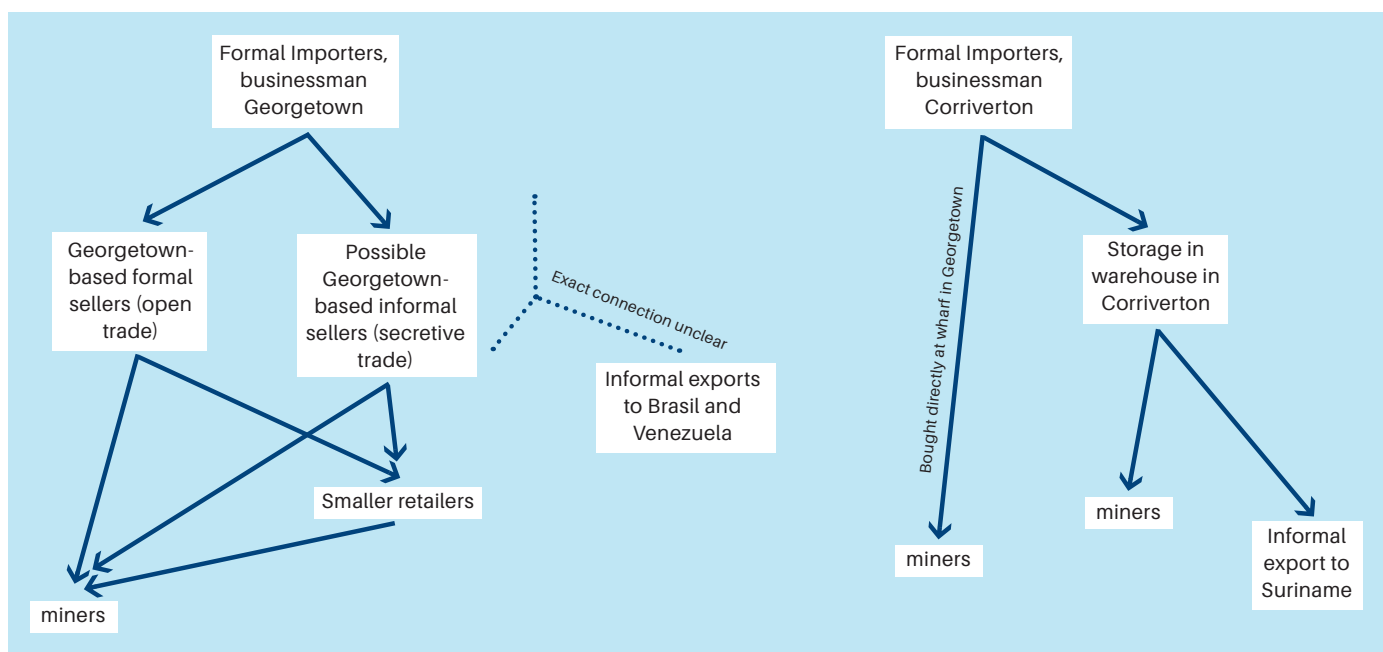


Figure 5: Mercury supply chain with main actors and flows in Guyana

Prices of mercury are higher further down the supply chain. Importers purchase mercury for as little as 17.4 USD/kg and sell it for up to 126 USD/kg, making a more than three-fold profit. Retailers in turn sell the mercury for at least 159 USD/kg to miners, but prices go up to 234 USD/kg in the city. Outside the city,

prices might be even higher, 300 USD/kg depending on difficulty of transport to the smaller mining towns. Profits for retailers are at least 33 USD/kg, even for those using the lower price ranges. Similar to Bolivia, the largest profit lays with the importers.

Suriname

Most mining in Suriname takes place in the Greenstone Belt and is carried out by Brazilians and Maroons, indigenous people of African descent, who dominate the work force in the ASGM sector (Heemskerk et al., 2016). Mining generally takes place in official mining concessions, however under illegal circumstances. Many exploration title-holders let informal miners mine at their sites and receive a percentage of their earnings in return. In total, 17 t of gold were declared in 2018 in Suriname¹ and estimates from 2014 suggest that about 65% of the country's gold originates from ASGM (Centrale Bank van Suriname, 2016). While some undeclared gold might exist, figures seem to be smaller than in other countries.

Since Suriname placed mercury on a list of goods that need a special license for import in 2003, no official mercury imports have been documented. As Suriname has quite a large ASGM sector and nearly all miners use mercury, it can be assumed that all mercury enters the country informally. All informants noted that most mercury enters the country via Guyana. The routes involve transport via land and water using the same routes as used for other smuggled goods. Via land, mercury is transported in 34.5kg-flasks or in repackaged 1- 1.5 l bottles by Surinamese or Guyanese citizens, often taxi drivers. The border is porous and the Suriname border control can be bypassed by using small-motorized boats instead of the official ferry to cross the Corantijn River. Initiatives to increase patrols on the border are being implemented, however, the "backtrack" route into Suriname connects with a sand road that can be taken to avoid authorities close to the border. It seems likely that mercury is also informally imported from China via container ships. While these shipments have never been officially intercepted, informants mentioned that customs officials are commonly bribed to let other goods enter the country informally.

Mercury is transported within the country mainly via road. The main trading route goes along the coast, transporting mercury from the border river between Guyana and Suriname in the west to Paramaribo, the major trading hub (Fig.6). It is first taken by boat to Nickerie, then further in cars and trucks over land to Paramaribo. In some cases, miners themselves travel to Guyana, in other cases, Nickerie-based middleman bring the mercury across the border and sell it directly in Nickerie to miners who do not want to transport it themselves (Fig. 7). Vendors from Paramaribo also cross the borders to buy mercury in Guyana. Along the road a police checkpoint mainly checks for drugs, weapons and illegal immigrants. At times, seizures of mercury seem to happen at this checkpoint as reported by news articles. However, no mercury has been confiscated at the site since 2014 according to the Chief Inspector responsible for the checkpoint. Once mercury reaches Paramaribo, it is sold by informal vendors, who are also often taxi drivers. The main trading is done in the neighborhood of Little Belem, where many mining shops are located. Most miners stock up on mercury on trips to Paramaribo. From there, smaller amounts seem to be transported to mining areas where it is sold. Informally imported Chinese mercury can be bought both in Paramaribo and in mining cities where it was reported that nearly all Chinese supermarkets sell mercury. Some mercury gets further transported to the east to Albina, where many Brazilian miners working in French Guiana buy mercury.

NOTE

¹ Deviezencommissie, pers. com. 23/05/2019, see regional report

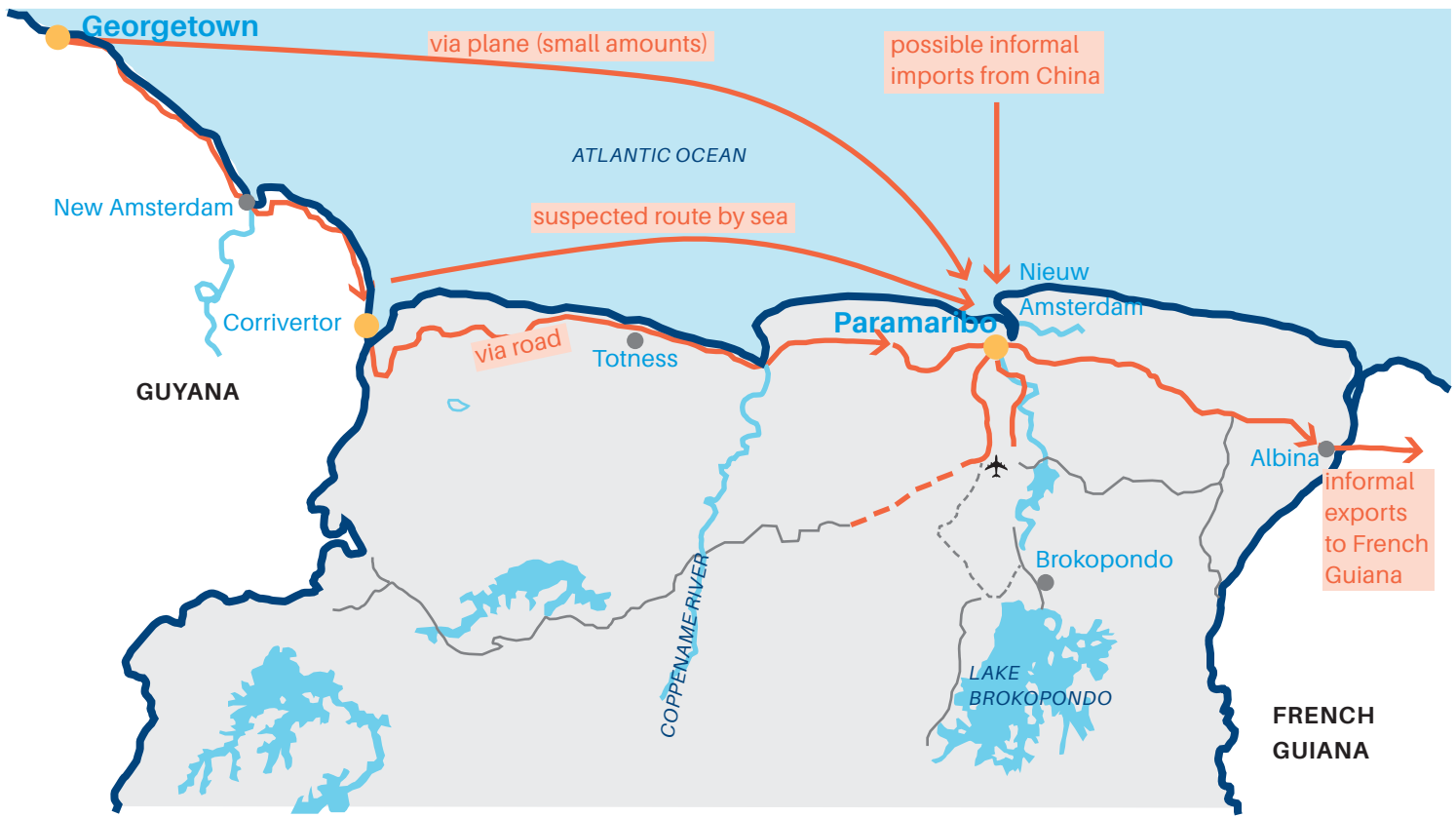


Figure 6: Map of main mercury trade routes in Suriname

- Main trading hub
- Main transport route
- - - Transport distributing mercury to ASGM areas

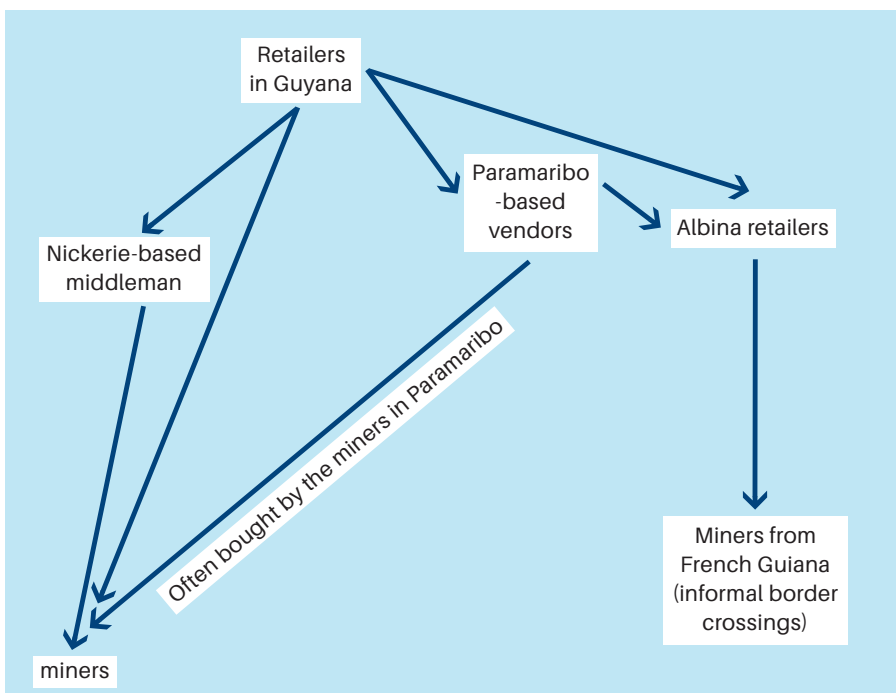


Figure 7: Mercury supply chain with main actors and flows in Suriname.

Suriname officially exported mercury for two years within the last decade, 1.300 kg to the Netherlands in 2010, and 102 kg of mercury to the United States in 2016 (UN Comtrade, 2019). No further exports have been recorded since then. Nonetheless, it is thought that mercury is being informally exported to French Guiana. Most miners from French Guiana buy mining equipment, including mercury, in Suriname. However, mercury has never been seized at the police control post on the route to Albina and French Guiana². Furthermore, Guyanese informants noted that there might be smuggling from Suriname to Guyana, contrary to the aforementioned route in which most mercury is transported from Guyana to Suriname. This is thought to be due to the cheaper retail price of mercury in Suriname compared to Guyana. Sources indicated that mercury commonly traded in Suriname is of lower quality and might be recycled mercury. Retail sellers purchase mercury from Guyanese wholesalers for 58-72 USD/kg and resell it in Paramaribo for 100-130 USD/kg (retail price in Guyana is 159 - 234 USD/kg). Prices in the border towns to French Guiana are higher with ca. 210-350 USD/kg. However this is still cheaper than mercury prices in French Guiana itself which have been reported to be 350-525 USD/kg.³

East Africa

The East African countries Kenya, Tanzania and Uganda are closely connected when it comes to networks of mercury trade. Therefore, they are discussed together and in relation to each other. In Kenya, small-scale mining is the main source of income for many people and more people search for daily income within the ASGM sector. An estimated 140 thousand people are directly employed by the small-scale mining sector and over 800 thousand people depend indirectly on it (Barreto et al., 2018). Most mining endeavors are run informally with a legal framework for ASGM only being put into place in 2016.

Estimates for the scale of the Tanzanian ASGM sector vary greatly with numbers ranging from 500 thousand to one million people relying directly on the sector and millions indirectly (World Bank, 2015; Kinyondo & Huggins, 2019). These quoted numbers of people involved in ASGM makes the estimation that around 10% of the national gold supply originate from ASGM seem rather low (UN Environment, 2012). While ASGM regulations have been in place since 1998 including efforts to formalize the sector, many registered mining sites still are sub-leased to unregistered miners for a share of their produce and/or earnings.

The Ugandan ASGM sector has expanded substantially in the past decade and estimates are that around 50 thousand people work within the ASGM sector, though numbers could be larger (Schipper et al., 2016). A large portion of miners operates informally, extracting an estimated quantity of 1.2 tonnes of gold per year (UN Environment, 2012).

All three countries have formal mercury imports which are mainly registered for industrial use by chemical companies based in Kenya (16), Tanzania (9) and Uganda (6). Official data from the Kenya National Bureau of Statistics, the Tanzania National Bureau of Statistics (NBS), the Uganda Bureau of Statistics (UBOS) and UN Comtrade on import statistics shows that Kenyan imports (average 12 t/year) are substantially higher than imports of Tanzania (average 3 t/year) and Uganda (average 0.3 t/year). Kenyan imports are more than double to 15-fold of the imports of Tanzania and more than 100- to 1000-fold of Ugandan imports in the last five years.

NOTES

² Regional Police Commander East, pers. com. March 22, 2019, see regional report

³ F.M. Le Tourneau, geographer. Pers. com. 21/03/2019, see regional report

Kenya's official imports come mainly from China, Mexico, India, Singapore, Germany and the US. Imports to Tanzania arrive mainly from China, India and Switzerland and imports to Uganda from Kenya, Malaysia and India (UN Comtrade, 2019). For all three countries information can be found that mercury was imported from EU countries or the US, which would be illegal due to the export bans in place. This information however, needs to be taken with caution. As explained in the "Global mercury supply, trade and demand" by UN Environment (2017) origins of mercury in transit are often unclear. Mercury that gets repackaged in transit at an EU or US port is sometimes incorrectly assigned an EU or US origin at its final destination. This might be the reason that EU countries and the US are listed as exporters by the importing countries even though it is assumed that there are no real exports from these countries to the importing country.

The sheer amount of officially imported mercury, especially at the port of Mombasa in Kenya, gives rise to doubts that all the mercury is used by chemical companies. When researchers tried to contact

"Previously my workmates used to import mercury covertly amongst other mining chemicals and equipment that the company imported from China. They would then sell it to ASGM operations and gold dealers. They had developed some sort of informal business partnership with ASGM miners that the company's management was not aware of."

*Worker at a Chinese mining equipment company,
Dar-es-Salaam*

the importing companies, most of the companies remained unresponsive and the one company that replied claimed not to be involved in mercury trade. A reason for the high imports might be that the mercury gets informally redirected to the ASGM sector once it has entered the country legally. While the countries vary drastically in size and also in size of their ASGM sector, estimates suggest that Kenya imports more mercury than is needed for its ASGM sector, while Tanzania and Uganda import too little. Most of the official imports in Tanzania seem to be imported for other sectors than ASGM. Therefore, there are only small quantities of formally imported mercury available for the ASGM sector, suggesting that most mercury used in ASGM comes from informally traded mercury. Data on official imports from the different Ugandan Ministries and agencies vary significantly. All these findings together, indicate that a lot of Kenya's officially imported mercury is used in Kenyan ASGM but also informally exported to Tanzania, Uganda and even further afield.

Regional mercury trade is not uni-directional from trade hub to mining sites, but multi-directional across borders. Mercury dealers in Kenya, Tanzania and Uganda import and export mercury informally between each other depending on supply and price. This goes to a degree that traders might even pass each other at the porous borders that are difficult to control by officials. As trade routes are not just one-directional, but create a network of pathways, flows have been categorized as primary and secondary flows (Fig. 8). Primary flows are routes through which mercury is transported from one big mercury hub to another area. Secondary flows are characterized as going in the opposite direction to primary flows. As an example, mercury flows are mainly from Kenya to Tanzania and Uganda (primary flows), however, in some cases mercury is transported the other way, from Tanzania and Uganda to Kenya (secondary flow). These changes in direction are mainly due to supply, demand and price.



Figure 8: Domestic mercury trade within the East African countries of Kenya, Tanzania and Uganda. Primary flows are defined as flows from major trading hubs to other areas, secondary flows as flows of the opposite direction that may appear due to variation in mercury supply and price.

Formally imported mercury arrives in Kenya, mainly at the port of Mombasa, in sealed metal jars of 34.5 kg or in bottles of 1 or 2 kg. Large quantities of this mercury are thought to be diverted into informally traded mercury used for ASGM, both within Kenya and in neighboring countries. For further transportation, mercury is re-packaged into smaller quantities of 2 kg, 1 kg, 500 g and 250 g bottles. Mercury is transported to Nairobi from where it reaches mining areas both within Kenya as well as in Tanzania and Uganda. Primary flows of mercury to Tanzania go through the bordering towns of Sirari and Namanga and through the borders at Busia and

Malaba for Uganda (Fig. 8). Mercury might further be transported to DRC, Burundi and South Sudan. Miners prefer Tanzanian mercury as it is regarded as elemental mercury. This has led to the reporting of secondary flow transportation from Tanzania to Kenya, close to Migori.

Three main routes have been identified in Tanzania, a northern, a southern and an eastern flow (Fig. 8). The northern flow originates from Kenya where mercury is transported from Nairobi mainly via Sirari (less frequently via Namanga) to the main towns of the Lake Victoria Gold Fields, in particular Mwanza, Geita,

A strong relationship exists between the gold and the mercury supply chain

and Kahama, which further supply the mining areas in the area. Mercury from the southern route enters the continent via South Africa, where trade is legal and is transported via Zimbabwe through Malawi or Zambia to Tanzania. It enters the country at Tunduma from Zambia or Songwe-Kasumulu from Malawi from where it is taken to Mbeya, a regional trading hub, and further supplied to the mining sites through a combination of primary and secondary flows. The eastern route supplies mercury that enters Tanzania at the port of Dar es Salaam. The mercury entering the port flows towards smaller ASGM sites, e.g. in the region of Tanga, but also into both the northern and southern route, supplying Mbeya and the Lake Victoria Gold Fields.

Mercury used in Ugandan ASGM is reported to come through Kenya across the border at Busia and Karamoja. From these two areas, it is distributed to the ASGM sites in the whole country. The border between Uganda and Kenya is porous with many informal entry routes, making illegal crossings hard to control. In addition, mercury traders have informants who monitor the movements of officials along the border so that traders can avoid the controlled pathways. Both custom officials and mining informants reported that mercury trade seems to be higher along the border to DRC and Kenya compared to the border with Tanzania. Trade at the Tanzanian border is probably lower as most mercury arrives straight from Kenya. Transport of mercury is done in multiple ways, often with a combination of vehicles,

e.g. by public busses from major cities to smaller trading hubs and further by motorbikes, bicycles or on foot across the borders. Generally, transport and trade are kept secret and people transporting mercury are kept in the dark about its origin and destination as a precaution in case the person gets caught. Local transport within the mining areas is mainly done via motorbike by young adult men who are well connected within the ASGM sector of the area. Informants reported that sometimes people with disabilities are hired by large wholesalers to transport mercury across the borders as custom officials check them less frequently.

Besides the main trade routes, mercury is sometimes distributed through indirect sources. Informants mentioned that mercury can –at times- get purchased from individuals working in hospitals, medical laboratories and pharmacies, licensed shops selling other mining chemicals and individuals working within military camps.

Within East Africa, the mercury trade is secretive and the supply chain is built on trust between different actors, making it hard to enter the business as a newcomer. A strong relationship exists between the gold and the mercury supply chain, however, many non-gold actors are also involved in the mercury supply chain. Formal mercury importers and large-scale informal importers as well as gold smiths import the mercury into the region (Fig. 9). Wholesalers order mercury from these large-scale traders and act

as intermediaries supplying retailers, gold brokers/dealers, gold processors and ASGM miners. However, both wholesalers and retailers are mostly based in the large cities and act through agents in the local mining areas. To transport the mercury into the mining areas, it is repackaged from the original 34.5 kg flasks into smaller 1 kg bottles. Agents do not always own the mercury themselves, but sometimes sell it for the traders, receiving a commission for the amounts sold. Similar to wholesalers, retailers also supply both gold brokers/dealers and ASGM miners directly. The amounts sold directly to the miners can be small, e.g. as low as 1 g in Kenya and

Uganda. Most ASGM miners sell their gold to gold dealers and it used to be common practice that mercury was provided to miners in advance and the recipient settled the debt upon selling gold to the same dealer. Smaller retailers were reported to often be jewelry shop owners that sold directly to miners. Mining pit owners - while often not directly involved in the mercury trade- create trade networks to facilitate miners with mercury and increase gold extraction. The role of actors within the supply chain is not clearly defined and delineated and some actors might overlap, for example, in the case of agents who are also gold traders themselves.

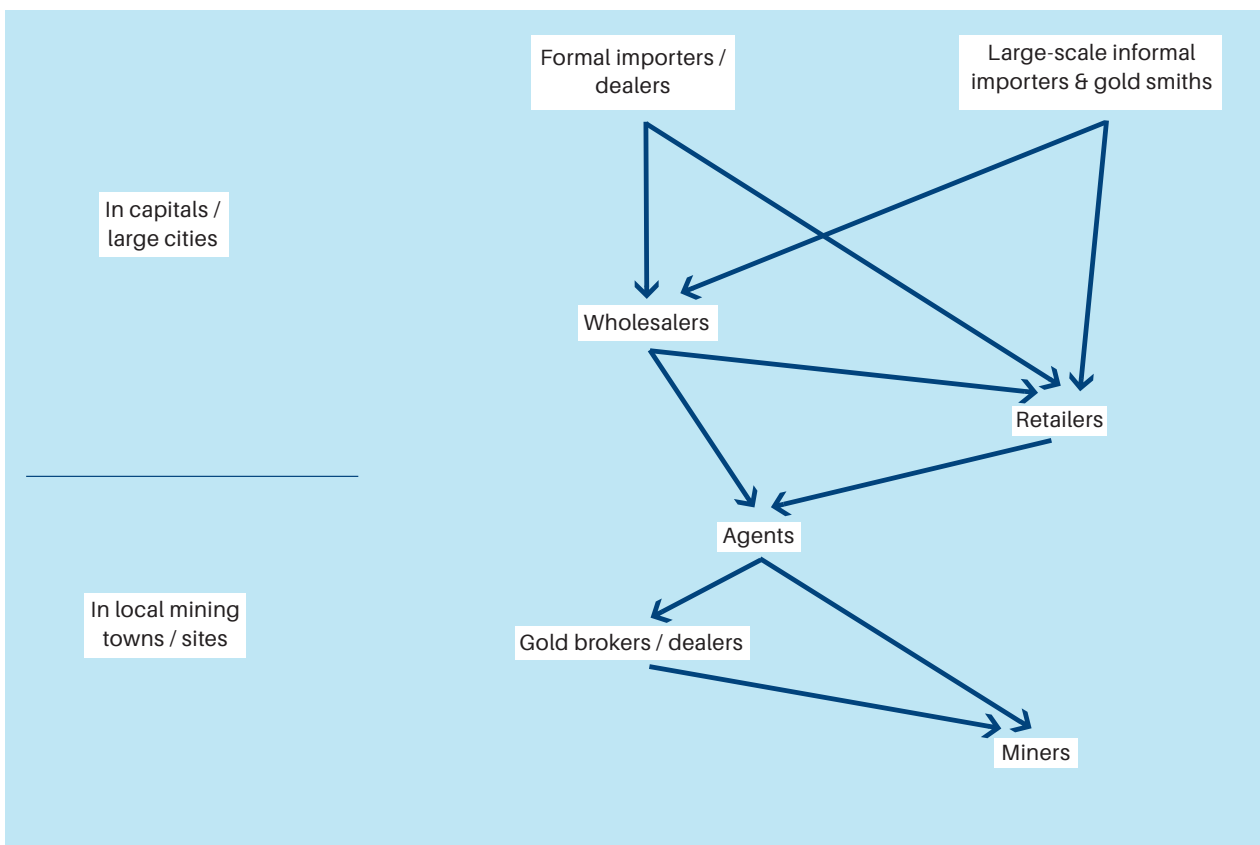


Figure 9: The supply chain of mercury in the East African countries of Kenya, Tanzania and Uganda

The trade operates in secrecy and is controlled by gold dealers and mercury suppliers since they have financial capital and connections to the mercury supply chain outside the region. At lower levels, the trade is primarily controlled by local gold dealers, mine pit holders and owners of gold concentration and extraction operations.

Import prices of mercury are not known for East Africa. However, similar to other countries, prices increase with decreasing mercury amounts and further down in the supply chain. On average, the wholesale price ranges from 113 to 202 USD/kg while the retail price is up to 150 to 391 USD/kg. In Kenya, average wholesale prices range from 113 to 148 USD/kg while retail prices range from 150 to 180 USD/kg. Tanzanian prices are higher, with an average wholesale price of 130 to 202 USD/kg and retail prices from 150 to 391 USD/kg, when quantities are small. In Uganda, average wholesale prices range from 175 to 202 USD/kg while retail prices range from 250 to 270 USD/kg. However, prices seem to vary a lot depending on time and other factors

"... in 2014, I was called by a friend of mine who is a police officer. He told me that he had some 10kgs of mercury that he hoped I could buy. We agreed on a place to meet close to the police post. When I reached there, we negotiated the price per kg. He wanted USD 120 per kg. But I insisted that I could only pay him USD 80 per kg. Since he wanted to sell and we knew each other well, I insisted on my offer. Eventually he agreed, I paid and brought the mercury home. I think he had confiscated them from someone they had arrested, and he wanted to make money out of it. He was my friend and he trusted me..."

Mercury trader, Bondo, Kenya

such as distance and remoteness of the ASGM site, seasonality, stage in the supply chain and fear of political turmoil.

While Tanzania and Uganda have had no formal mercury exports in the last decade, Kenya reported a total of 32,292 kg in the period 2009-2018. Official data stated that mercury was traded with the Democratic Republic of Congo (DRC), Tanzania and Uganda. However, exports have decreased since 2014 and exporting partners vary with only one reported export to Tanzania and one to Uganda since 2014. The main trading partner still remains DRC, however, no exports to DRC have been recorded in 2017 and 2018.

Burkina Faso

Burkina Faso's gold sector is large considering the size of the country. Approximately 700 thousand miners work in ASGM (UNIDO, 2019), making it the second largest source of income after agriculture. The recent report on initial estimates of the artisanal and small-scale gold extraction sector in Burkina Faso done for the Minamata Convention, extrapolates the national gold production to ca. 126 tonnes per year (Kaboré, 2019). While estimates of the annual gold production by ASGM from other sources vary greatly, most estimates lay around 25 tonnes per year (Hunter, 2019). However, official exports of gold are small with only 236 kg reported in 2017, so most gold is thought to leave the country undeclared (Hunter, 2019). Nearly half of the reported gold originated from the region "Sud-Ouest", followed by the region "Nord" which accounted for about a quarter, the mining sites in the region "Centre-Nord" reported small production (ENSO, 2017). Like in many of the other countries, the ASGM sector is poorly organized and miners have no access to financial, social and health support from the state. As a result of the poverty many miners face, child labor is a commonly reported problem as many miners' children drop out of school to support their parents in the gold mining

activity. Mercury use in ASGM has been banned since 2015, nonetheless, nearly all ASGM miners report using mercury.

Mercury enters Burkina Faso mostly through its neighboring countries, while Burkina Faso itself only imports small amounts (less than 100kg/year in the last 5 years (UN Comtrade, 2019)). The main importer in the region is Togo where mercury enters through the port of Lomé (Hilson et al., 2018) (Fig.10). Togo receives formally traded mercury mainly from China, Hong Kong, India, Indonesia, Singapore, Vietnam and Turkey. While Togo has almost no ASGM sector, large amounts of mercury enter the region through Togo each year. Some of it is probably used for other sectors (e.g. dental amalgam), however, an estimated 80% of the mercury demand in the Economic Community of West African States (ECOWAS) region is for ASGM (Lassen et al., 2016).

Official imports of ECOWAS countries, including Togo and Burkina Faso, are a fraction of what would

be needed to support the countries ASGM (several hundred tonnes)(Lassen et al., 2016). Due to this and the informality of the sector, most mercury is thought to arrive in the region informally. Informants reported that informal mercury enters Burkina Faso via Lomé seaport from China. From Togo, mercury is informally transported to Burkina Faso and Ghana. Mercury arrives in Burkina Faso mainly by land from Togo, but also in smaller amounts from Ghana, Côte d'Ivoire, Mali and Niger (Fig.10). Interviewed miners further mentioned two countries, Angola and South Africa, from which mercury enters Burkina Faso by plane. Once inside the country, mercury is transported to the different regions. The central region seems to be a main hub from where mercury is distributed. Exchanges between regions are based on geographic proximity and the availability of the product. Burkina Faso is a trading hub for both mercury and gold in the region and a lot of mercury leaves the country to its direct neighbors from where it is transported further.

The mercury and gold supply chains in Burkina Faso are strongly interlinked creating a cycle that is difficult to break



Measuring gold returns © Bram Ebus/InfoAmazonia

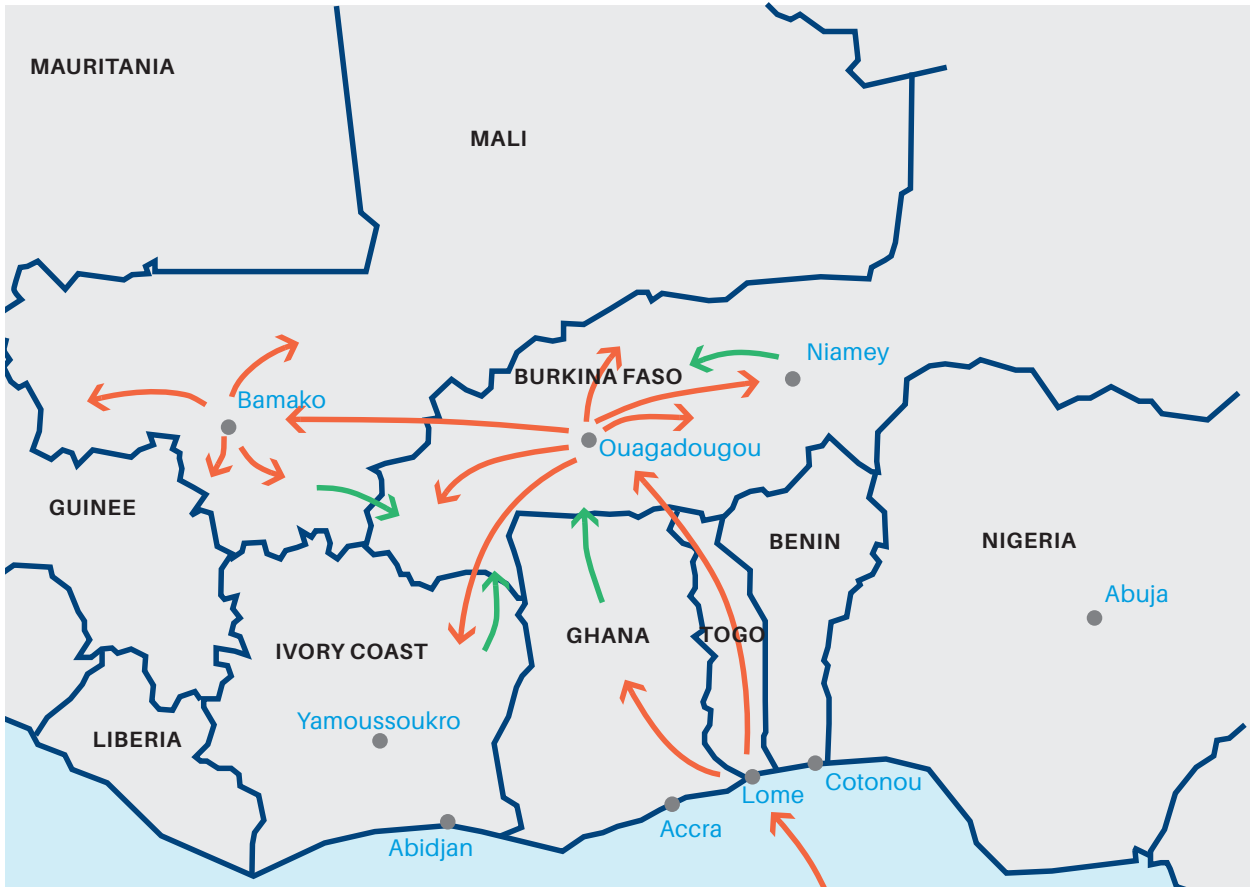


Figure 10: Regional mercury trade within West Africa with main focus on Burkina Faso as a trading hub. Primary flows are defined as flows from major trading hubs to other areas, secondary flows as flows in the opposite direction that may appear due to variation in mercury supply and price.

- ➔ **Primary flows**
- ➔ **Secondary flows**

Wholesalers in Burkina Faso re-package mercury in steel cans and bottles which are placed in wooden cases and stored out of sight in gold panning equipment shops. To show that mercury is available for sale, shops place a blue canister, a black canister and a zinc bar in front of the shop. Mercury is further repackaged into plastic bags and cans and transported to mining sites via motorbike, public transport, trucks and private vehicles. It is sold to miners at gold buying stations or through retailers (Fig. 11). Retailers repackage the mercury again into small, transparent plastic bags and store them in larger plastic wrappings or in cans and drawers. It is

not uncommon for mercury to be kept in residential houses and stores. For retailers, two indicators that mercury is available for sale were reported by interviewees: a small transparent bag in front of the shop and the combination of a small drawer table, a watch post's chair and a small bench in front of a shed.

In many cases, mercury wholesalers and retailers are also gold traders and mercury is supplied to guarantee a flow of gold. The gold buyers sell mercury to miners linking the price they will pay for the recovered gold directly to the supply of mercury.

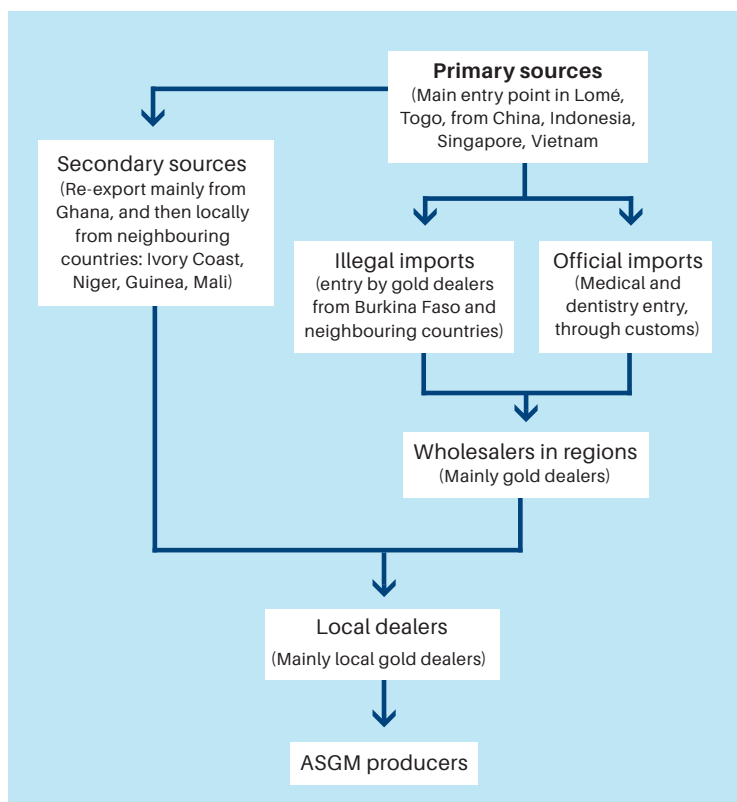


Figure 11: Mercury supply chain in Burkina Faso

Retail prices for mercury vary greatly between regions with a range of 170 to 670 USD/kg, with an average of 501 USD/kg. The higher end of the range in particular, is way above global market price and even higher than mercury in most of the other investigated countries. Prices seem to fluctuate without obvious reasons. It was difficult to obtain information on how many times mercury is re-sold at the different levels. While no prices through the entire value chain could be obtained, it was clear that mercury sellers at all levels profit from the trade. Some traders even reported that they make a profit of 100%. The mercury and gold supply chains in Burkina Faso are strongly interlinked creating a cycle that is difficult to break. Actors that could step into action to work against illegal trade such as the police, agents of the Ministry of the environment or local politicians,

are often either bribed, occupied with other topics or benefit in some way from ASGM. A large proportion of the population is somehow involved in, or benefits from, ASGM and the sector has a strong political lobby at local and national levels.

Burkina Faso reports no formal mercury exports. Nonetheless, the country seems to be a major trading hub for informal mercury in the region. Mercury passing through Burkina Faso is transported on into neighboring Mali, Ivory Coast and Niger. It has been reported that mercury is transported as far as Senegal passing further through Mali and Guinea (Lassen et al., 2016).

Philippines

Approximately 70% of the Philippines gold is produced by ASGM (Seccatore et al., 2014), making it one of the largest ASGM gold producers in the world (Ban Toxics, 2016). Therefore, it is not surprising that up to 500 thousand miners and indirectly millions of people are relying on small scale mining for an income (PH-EITI, 2018). ASGM is illegal in the Philippines and therefore no regulations for safety or minimum wage exist, wherefore it is heavily linked to extreme poverty. Miners often face bad working conditions and child labor has been reported. A large percentage of the produced gold seems to exit the country illegally with estimates up to 95% (Lucas, 2012). Therefore, official figures of declared gold, such as 23 tonnes in 2017 (PH-EITI, 2018), do not represent actual production numbers.

Since the EU and the US banned mercury exports in 2011 and 2013, the Philippines officially imported only very small amounts of mercury, namely 428 kg in 2016, 189 kg in 2017 and 34 kg in 2018, all of which came from Japan (UN Comtrade, 2019). The country's ASGM sector is estimated to use significantly more than these amounts per year, suggesting that most mercury used in ASGM enters the country informally. Informants stated that most mercury arrives from China, Indonesia and Malaysia (Fig.12). Indonesian mercury seems to provide the

majority of mercury used in ASGM and is preferred by miners instead of Chinese mercury as it is thought to be of better quality. It was also reported that mercury enters the country informally through either formal or informal ports (Fig.13). Mercury entering informally through formal ports, especially on the island of Mindanao (Davao City, Cagayan de Oro City, Zamboanga City, and Saranggani Province), is either mis-declared or passes officials through bribing. Mercury entering at formal ports is often shipped from China directly. The majority of mercury imported from Malaysia seems to be Indonesian mercury that was imported to Malaysia formally and then informally shipped to the Philippines. Another way of entry for informal mercury is via

informal ports. Mercury is often smuggled by fishing vessels from neighboring countries that transport their cargo to fishing areas such as Balut Island. There, they either dock at informal ports or throw the loaded mercury overboard without docking. Mercury entering this way is mostly from Malaysia and Indonesia (Fig.12). Some mercury also seems to originate from other sources, such as confiscated mercury sold by government officials or recycled mercury sold by miners. Furthermore, some formally imported mercury may be deviated to informal use in ASGM, however, the amount seems rather small compared to the informally imported mercury.

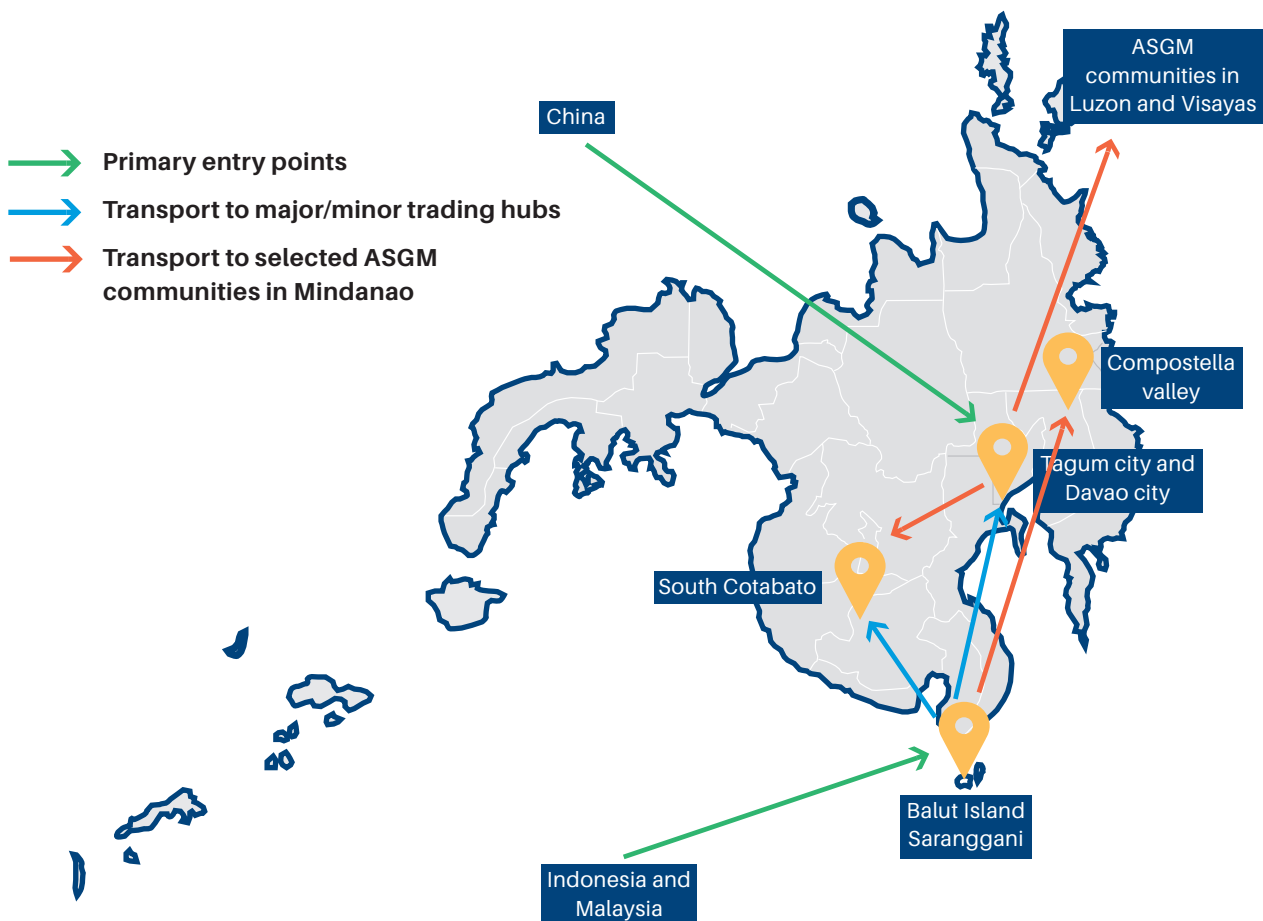


Figure 12: Primary entry points, trade hubs and trade routes in Mindanao, Philippines

Once mercury has entered the country it moves relatively freely due to a lack of regulations. From the entry points at official and unofficial ports, it is brought to the cities in Mindanao, e.g. Marawi City, Zamboanga City and Cagayan de Oro City. From there, mercury is transported to Tagum City and Davao City, the major trade hubs due to their proximity to the ASGM sites. To facilitate transportation, mercury is repackaged into smaller amounts and is placed in plastic bags wrapped with paper and masking tape. The repackaged mercury gets sold all over the country, not just on Mindanao but also the other islands. It is transported via land and sea concealed inside vehicle parts and compartments to hide it from potential inspections.

No formal exports of mercury are recorded for the Philippines. Informal exports were not indicated by informant interviews, so it seems that none or insignificant amounts of mercury leave the country.

Mercury prices range from 135 to 230 USD/kilogram at the retail seller. No information could be obtained about the prices through the value chain as all imports are informal. However, it should be noted that prices have increased, they are now 10-times higher than 15 years ago.

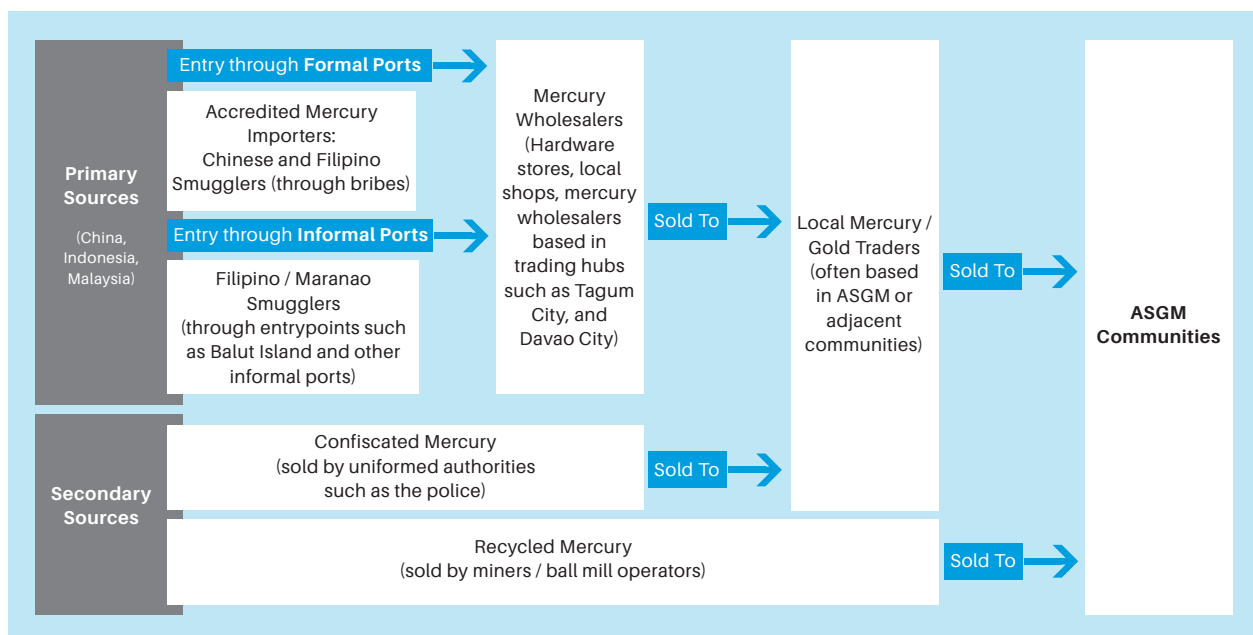


Figure 13: Mercury supply chain in Mindanao, Philippines

4 COMMON FINDINGS ACROSS REGIONS

4.1 USE OF MERCURY IN ASGM

- Mercury use in ASGM in most of the focus countries is prohibited or at least regulated
 - For some countries, where estimates are available, more than 95% of gold miners use mercury
 - Mercury is used during different stages of the mining process, resulting in varying amounts of mercury used. Mercury can be used for concentrate amalgamation, resulting in smaller mercury to gold ratios or whole ore amalgamation, resulting in high mercury-gold ratios
 - Mercury to gold ratios (Hg:Au) vary widely, not only between countries but also within (e.g. 1.3:1 in Burkina Faso, 3.3:1 in Suriname, 10.6:1 to 48.1:1 in the Philippines). These differences are mainly due to miners using either concentrate amalgamation (small ratios) or whole ore amalgamation (high ratios)
 - While some miners recycle mercury during the extraction process, many miners do not, which results in high losses of mercury to the environment
- Philippines: Many miners seem unaware or do not believe that mercury is bad for their health when educated on the topic
 - Some miners who are aware of the risks put certain measures in place to mitigate the risks (e.g. by burning the amalgam in open air)
 - Even if educated about the risks of mercury usage, miners might not take measures as (1) mercury poisoning takes a long time to show symptoms and therefore is difficult to connect directly to the use of mercury and (2) miners face a multitude of other risks every day such as mining accidents, high noise levels, dust inhalation, etc.
 - Gender dynamics: within some regions (e.g. the Philippines), women are at a disadvantage concerning exposure to mercury. Women are believed to be more honest, thus, they are assigned to watch over amalgam burning, resulting in the direct inhalation of mercury fumes

4.2 KNOWLEDGE OF THE NEGATIVE HEALTH EFFECTS OF MERCURY AMONG SMALL-SCALE GOLD MINERS

- Bolivia, Suriname, Guyana & Burkina Faso: miners seem to be well aware of the negative impact of mercury on human health and the environment, but do not know of or have any other way of extracting gold and therefore keep using mercury
- East Africa: some miners are unaware of health risks, others are aware but choose to run a calculated risk or mitigate this risk (not through retorts but through standing at a distance at the opposite of the wind direction while burning)

"I have had joint pain, insomnia for almost five years and I am constantly tired. I also have a persistent cough despite taking antitussives. This cough is more severe at night. I can't sexually satisfy my wife so much that she ends up leaving me. I also have tremors in my limbs when my blood pressure is normal. I can't walk straight. I have worked with mercury for ten years. I buy the gold and burn it under the unprotected hangar. I was rather concerned about the amount of gold I could recover. I even kept mercury at home because I am a retailer, and I handled it with my bare hands. I didn't know mercury could cause me so much trouble. I really regret everything that happened to me."

Artisanal gold miner at the Solhan site in Sebba, Burkina Faso

4.3 MERCURY IMPORTS

Formal mercury imports

- Officially available data shows discrepancies between exporting and importing countries & between different entities inside some countries
- China and Mexico are the main global mercury suppliers
- There is a discrepancy between the estimated mercury use (by taking into account the (estimated) ASGM gold production of the country and the mercury to gold ratio used in the region) and formal imports:
 - ➔ Some countries import more mercury than needed for their estimated national gold production by ASGM, other countries import less than what is needed for their ASGM sector, hinting towards:

- High informal ASGM gold extraction
- Informal mercury trade between neighboring countries
- Combination of both

Informal mercury imports

- Informally traded mercury arriving at official entry points (e.g. ports) is rarely seized due to mislabeling and bribing of officials as reported by informants from multiple countries (including custom officers)
- Mercury entering through unofficial entry points (e.g. at porous borders) often gets transported in the same ways as other illegal goods as reported through informants

4.4 DOMESTIC TRADING ROUTES

- Mercury is transported to large trading hubs from where it gets distributed throughout the country
- Mercury gets repackaged into smaller amounts for transport and resale
- Domestic transport is mainly via land, hidden in vehicles
- Most transport is unhindered by officials
- Routes are not always one-directional, depending on supply, demand and prices

4.5 ACQUISITION OF MERCURY BY GOLD MINERS

- In large cities and mining towns, mercury can be purchased in hardware and mining supply stores
- Mining operation owners or managers buy mercury for the mining team
- Mercury is supplied/sold by gold traders in the mining areas
- In Suriname and Guyana, many miners buy mercury in larger cities as it is cheaper in the trading hubs

4.6 MERCURY SUPPLY CHAIN & ACTORS INVOLVED

- The mercury supply chain is multi-layered including mercury importers, wholesalers and retailers
- The networks are well connected and trade is often done in secret, making it difficult to understand them
- Gender dynamics within the trade depend on the region (e.g. in East Africa, more men are involved in the mercury trade as they are owners of mines, while women are usually workers at the mines. Depending on the region within the Philippines, women are known sellers and gold buyers who also burn mercury)
- Mercury trading networks are often linked to gold trading networks, however, mercury trade in itself is lucrative and a stand-alone business for some actors
- Many mercury traders are also gold traders, profiting from both trades. This can create a power imbalance between traders and miners:

- ➔ Some gold traders provide mercury to miners for free under the condition that the miners sell their gold only to them for a reduced price
- ➔ Traders threaten to not buy gold from miners who are not also buying mercury from them
- ✪ Some miners don't have a choice in who they trade with once inside the trade circle and need to keep using mercury

4.7 MERCURY PRICES THROUGH THE VALUE CHAIN

- Mercury gets more expensive in smaller amounts and further down the supply chain (Table 2)
- Mercury is generally cheaper in the big trading hubs than in remote mining areas
- Mercury trade is a profitable business, providing profit on all levels
- For the countries where full information on prices through the value chain could be obtained, importers are making the largest profits (Table 2)



Mercury as transported in large flasks
© Bram Ebus/InfoAmazonia



Mercury in smaller quantity as often found at the mining sites
© Bram Ebus/InfoAmazonia

COUNTRY	DISTRIBUTION LEVEL	AVERAGE PRICE (USD/KG)	VALUE INCREASE FROM ONE STEP TO THE NEXT IN THE VALUE CHAIN
Bolivia	Import	10-31	
	Wholesale	166-217	5-22 fold
	Retail	200-240	1.1-1.4 fold
Guyana	Import	17.4	
	Wholesale	126	7.2 fold
	Retail	159-234	1.3-1.8 fold
Suriname	Import	NA	
	Wholesale	58-72	
	Retail	100-130	1.3-2.2 fold
Kenya	Import	NA	
	Wholesale	113-148	
	Retail	150-180	1-1.5 fold
Tanzania	Import	NA	
	Wholesale	130-202	
	Retail	150-391	1-3 fold
Uganda	Import	NA	
	Wholesale	175-202	
	Retail	250-270	1.2-1.5 fold
Burkina Faso	Import	NA	
	Wholesale	NA	
	Retail	170-670	
Philippines	Import	NA	
	Wholesale	NA	
	Retail	135-230	

Table 2: Reported price ranges of mercury bound for ASGM at various distribution levels in the different focus countries.

4.8 MERCURY EXPORTS

- While some countries seem to have no or negligible mercury exports (either formal and informal), other countries seem to re-export most of the imported mercury
- Countries with looser regulations on mercury imports often supply mercury informally to neighboring countries who have stricter import regulations

- A change in import regulations from one country immediately affects imports and informal exports in neighboring countries

For more details on some of the abovementioned topics in the different countries, please see Annex 1.

5 ANALYSIS OF FINDINGS

5.1 FACTORS HINDERING THE UNDERSTANDING OF THE INFORMAL MERCURY TRADE

During the research period (2018-2020), various factors aggravated the understanding of mercury trade and its supply chain. As the official data on formal global mercury trade is not reliable, it is difficult to draw a base line of formal imports into the different countries. Furthermore, the size and scale of the ASGM sector in the different countries rely on estimates. As most ASGM miners operate informally, there is no exact data on the number of miners, the production of gold or the amounts of mercury used. Basing estimates of mercury use within a country on estimates of the number of miners creates further vagueness.

In addition, the informality of the trade hinders access to information. A difference in attitude towards interviews along the supply chain was recognized. Generally, miners were open to being interviewed and explained freely how and where they got mercury from. The further up in the supply chain, the more difficult it became to get information. On multiple occasions in Bolivia, informants were warned to leave and not ask questions about mercury. Even government officials advised field agents to leave the area for their own safety.

5.2 FACTORS CONTRIBUTING TO MERCURY USE

The continued use of mercury in ASGM is due to a combination of interconnected social, economic, and political factors. First of all mercury is deeply embedded in the ASGM tradition. Mercury has been used in the communities for decades as it is easy to use, readily available and cheap to obtain. The fact

that most miners grew up with mercury makes it difficult to change their perspective on it. As mercury poisoning often only shows symptoms after years of exposure, it is often hard for miners to link symptoms directly to the use of mercury. Furthermore, many cases of mercury poisoning are never officially recorded as miners often lack access to basic health services. The cultural factor is therefore, one of the reasons why many miners continue to use mercury even after being informed about its negative health effects.

The role of women within mining communities varies per region, yet in some of the investigated countries, women were over-proportionally exposed to mercury due to fixed gender roles. Women within ASGM communities generally do not share equal ownership of resources and are often not involved in decision making processes (World Bank, 2012). As women often occupy secondary roles within mining communities (e.g. as cooks or service providers) (World Bank, 2012), they are generally not in direct skin contact with mercury through panning. Panning is often a male's role, but women are frequently exposed to mercury vapor in cases where amalgam is burned in residential areas. In addition, women are assigned to watch over amalgam burning in some regions, resulting in the direct inhalation of mercury vapor. Women are most vulnerable to the effects of mercury particularly when pregnant. In pregnancy, mercury exposure can have severe effects on the unborn child. Yet women may be the ones in the community that are more receptive to raising awareness about the negative health effects of mercury.

Another major point related to mercury use is poverty. Most ASGM mining takes place informally and most miners live in poverty. Miners and their

families live from hand-to-mouth and therefore need a processing technique that is fast, cheap and easy, which is exactly what mercury provides. Operating in informality also means that miners have no access to governmental support such as training or financial support. Poverty and lack of financial support, prevent miners from working with mercury-free techniques or leaving the ASGM sector and earning their livelihood elsewhere. Most mercury-free gold processing methods need an initial start-up investment as they involve expensive equipment. In addition, many of these methods take more time and require extensive training. For miners that rely on their daily earnings to live, this is unachievable. This problem is aggravated as mercury prices have increased in many countries over the last few years,

leaving miners with less income and less money to invest. Looking at the base level of miners and not connecting them to any other actors in the supply chain, it is obvious that all these factors combined are causing miners to be stuck in a cycle of continued mercury use.

Market and supply chain factors are an additional force driving the continued use of mercury. In some cases, there is a power imbalance between miners and gold traders who also often trade with mercury. Due to the profits from both trades, traders involved in mercury and gold trade have no incentive to stop the use of mercury. Miners are often caught in another cycle of mercury use as they cannot afford to sever ties with the local gold traders. Many miners



Gold panning in Guyana © Bram Ebus/InfoAmazonia

have to sell their gold locally to traders as most formal channels for selling gold are inaccessible to individual miners. These official stations are usually located in larger cities and miners do not only use significant working time to travel there, but also cannot afford to pay the tax placed on the gold. This economic gap and the power imbalance between miners and local gold/mercury traders further widens as mercury prices increase.

At the local level, gold traders are the ones that could afford investment into mercury-free techniques. However, as they profit from this lucrative parallel trade of gold and mercury, they have no incentive to do so. Instead, they keep miners in a circuit that allows them to get a steady supply of gold through the use of mercury.

The continued use of mercury in ASGM is due to a combination of interconnected social, economic, and political factors

5.3 DRIVING FORCES

Generally, mercury trade is a lucrative business on all levels. Information on the price of mercury through the value chain was not available for all countries.

In the cases where prices on all levels are known (Bolivia and Guyana), profits are highest for importers. From there, profits get smaller, however the trade is still lucrative for both wholesalers and retailers. This is especially true for traders who are also trading with gold. The informal mercury trade follows the opposite route to the informal gold trade. Gold is transported from the mining sites via retailers and wholesalers to the trading hubs and finally exported. Mercury is imported, and distributed - via mostly the same routes and actors - to the miners. This double trade adds profits for actors involved in both trades and attracts new contacts in both the mercury and gold value chain. Within the gold trade in particular, markets are controlled by "cartel" like structures. These networks are well established and entering the markets as a newcomer brings certain risks. As the trade is profitable for many involved actors, there is a driving force in place that keeps the use of mercury in ASGM ongoing. These actors do not support the change to mercury-free mining techniques and create trade mechanisms that force miners to keep using mercury. In these cases, the miners, as end consumers, have little impact on the market due to power imbalances and the poverty they are caught in. Miners that do not experience the power imbalance often still do not have a choice as they cannot afford the change to mercury-free techniques. However, miners, their families and the surrounding communities are often the ones that are most negatively affected by mercury.

Generally, there seem to be few obstacles in informal mercury trade. Mercury entering countries formally as declared for other purposes such as industry or dental amalgam, is easily diverted to informal use in ASGM. Informal imports are rarely checked and seized. Domestic transport goes mostly unhindered.

This lack of risk and hindrance, in combination with the lucratively of the trade, drives the continued use of mercury.

5.4 MERCURY GOVERNANCE ISSUES

Mercury governance varies greatly between countries. In some of the investigated countries, there are no specific laws on mercury. In these cases, mercury often falls under broader regulations, for example the ones for hazardous substances or even under multiple different frameworks. When there are restrictions on the import of poisonous substances, but no mention of mercury on the list that defines these substance, loop holes and legal windows for mercury imports open up.

Even in cases with clearer regulations on mercury trade, imports and use fall under multiple laws and acts and are often ambiguous and difficult to understand. In some cases, governing bodies are trying to tackle the mercury problem by banning it completely from ASGM without any gradual phase out. This approach is driving the mercury trade further into the black market. The profits made by actors higher in the supply chain are too big to lose and many miners have no other choice than to use mercury. Therefore, miners are further criminalized making it even harder to break the cycle they are caught in and the mercury market persists.

Overall, in most of the countries investigated, there was a general lack of enforcement concerning mercury. Informal mercury enters countries easily and domestic trade goes mostly unhindered. This is partly due to corruption issues, but also due to the lack of knowledge of custom agencies. Most custom agents are trained to search for particular items such as guns or drugs. Furthermore, many might not be aware of the issues related to mercury and might not be able to identify mercury. If mercury is seized, there is often a lack of knowledge on how to handle and store it correctly. In addition, many countries do not



Mining landscape in Guyana © Bram Ebus/InfoAmazonia

have facilities that are designed for the safe storage of mercury. It was reported for multiple countries, that mercury that had been confiscated re-entered the market. This might be due to a combination of lack of proper storage facilities which facilitates the disappearance of seized mercury (as no data recording and monitoring systems are in place) and the profit that can be made by re-selling the mercury.

In addition, communication and cooperation between national institutions including ministries and customs is lacking. This in turn contributes to problems around seized mercury and facilitates the return of it to the black market. Looking at a regional level, we encountered many cases where the stricter regulations on mercury imports in one country directly affected the imports in neighboring countries.

6 CONCLUSIONS & RECOMMENDATIONS

6.1 CONCLUSION

The mercury trade is a lucrative business and many actors profit from it. Networks of informal mercury are well established and often linked to the gold trade, operating in a counter direction. At a higher level, the trade mainly operates in secret and is difficult to access for outsiders. The systems in place take advantage of miners and their circumstances and miners themselves have little power to change the mercury market. To discourage mercury trade, regulative frameworks should therefore focus on mercury importers and traders rather than miners.

6.2 RECOMMENDATIONS

To reduce mercury use in ASGM and tackle the informal trade, actions should be taken to address the mercury trade on multiple levels and from different angles.

The availability of and access to data allow understanding of formal mercury supply and mercury demand. To **increase accuracy of data**, we suggest that governments put efforts into the following:

- increase **monitoring and data recording** for formal mercury imports and exports
- make **trade data** more transparent by reporting formal gold and mercury imports and exports to international trade statistic databases
- assess the informal ASGM sector and create **better estimates** for the number of miners, gold production and mercury use

Mercury governance plays an important role in addressing the problem. Governments should therefore:

- **formalize the ASGM sector** accompanied by a regulative framework and monitoring mechanisms that include gender responsive legislation/policies
- **clarify laws and regulations** concerning mercury
- put **yearly quotas** for formal mercury imports
- create a **licensing and monitoring scheme** for domestic mercury trade (with easy application procedures and quick response time)
- increase **enforcement** of these regulations
- **ratify** the Minamata Convention
- increase regional, national and international **cooperation**

To **reduce the power imbalance between miners and gold traders** and in combination with a formalization of the ASGM sector, governments and CSOs should:

- **raise awareness** of miners and mining communities about the negative impacts of mercury
- **provide (gender sensitive) training** for correct handling, use and storage of mercury (for the short-term)
- **strengthen linkages with formal gold and mercury markets**
- improve **economic opportunities for miners** and their communities (with special attention to women) and **access to low interest loans**
- **include ASGM miners** and their communities (also with focus on women) in finding other solutions and how to reduce the power imbalance further
- support the **transition to mercury-free technologies** with institutionalized, long-term support by
 - ➔ **involving ASGM miners** in the process of finding alternative methods that are feasible

- ➔ supporting **research** on most suitable mercury-free techniques in different regions
- ➔ continuing to encourage the **shift to mercury-free technologies** by incentivizing it
- ➔ providing **financing schemes** for mining equipment needed for mercury-free gold
- ➔ **improving markets** for mercury-free gold
- ➔ facilitating **certification schemes** for mercury-free gold

Concerning the **informal trade**, governments should:

- **strengthen border** controls through capacity building by providing training on recognizing mercury and improve knowledge on handling and storage
- create **appropriate, environmentally sound interim storage facilities** for confiscated mercury
- **improve monitoring and data-records** on confiscated mercury to prevent mercury re-appearing on markets
- increase **collaboration** between regional, national and international agencies

To further increase **understanding** of the mercury trade, there is need for:

- coordination between different projects and initiatives
- implementation of more research focused on:
 - ➔ informal mercury trade in other countries
 - ➔ key players up-stream
 - ➔ financial flows related to mercury trade

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ANNEXES

Annex 1: Additional information per country

BOLIVIA

Mercury, its trade and use are not specifically regulated within Bolivia, but standards are in place as mercury is a toxic substance. However, these standards are covered under different regulations and show significant gaps. Generally, harmful substances cannot be imported into Bolivia, however, mercury is not on the list of these substances, creating a legal window. Mercury use within ASGM is allowed under the condition that recovery equipment, such as retorts, are used. Gold extraction within the country has quadrupled in the last nine years. While large mining companies were the main producers in the past, the cooperative sector is the responsible for most extracted gold in the recent years. Most miners from cooperatives in Bolivia seem to be aware of the toxicity of mercury. However, the exact impact and the scale of toxicity might not be clear to many miners. In addition, many do not know of or have any other forms of concentrating gold and therefore keep using mercury. Some miners use mitigating mechanisms, such as retorts. Retorts reduce inhalation while burning and recover mercury that would otherwise be released into the environment. Nevertheless, small producers in particular find the recycling of mercury not efficient enough and would rather buy larger quantities. Other miners do not seem to know much about recycling and the possible mitigation of health effects. In addition, miners mentioned their interest in mercury free techniques as long as they are affordable.

GUYANA

Regulations concerning mercury fall under several laws and regulations. Importing mercury into

Guyana is relatively easy and does not involve any complicated administrative work. Up until 2019, no restrictions existed upon the amounts that could be imported. Since then, a maximum of 1,000 flasks per year or 34,500 kg per year can be imported. Trade within the country is unlicensed and mercury usually moves freely. While regulations for trade and storage do exist, little enforcement has taken place in the past; however, efforts to increase compliance checks have been taken. Regulations concerning the use of mercury in ASGM also exist and include health risk mitigations such as burning of amalgam in open air only and the use of retorts to recover mercury.

Calculations from the regional report of Guyana on the amounts of mercury used to recover gold have yielded ratios of 2.01:1 to 2.71:1 for the period 2008 to 2015. These are in line with previously published ratios, e.g. 3:1 (Legg et al., 2015). However, Legg et al. (2015) mentioned that mercury to gold ratios have increased over the last years and were as low as 1.5:1 in 2008.

Most interviewed miners reported that they purchase mercury in Georgetown.

SURINAME

While Suriname has placed restrictions on the import of mercury, few regulations exist concerning the trade, use and export of the mineral. For imports, a special license has been necessary since 2003, however, no such license has ever been issued and no formal imports have been registered since 2014. This implies that all mercury entering the country is informally traded.

Other than this regulation, no legal instrument specifically mentions mercury. However, as mercury is not entering the country formally, domestic trade and use in ASGM can also be seen as informal.

Nonetheless, nearly all miners in Suriname (97.8%) use mercury and there are no regular controls on either possession or use of mercury. Within the mining community, the equipment owner or site manager decided how much and at which stage mercury is used and how to burn the amalgam. Commonly it is also the mine owner or manager who buys mercury for the mining team. As mercury is a lot cheaper in the city, most mercury is bought in Paramaribo by miners or mine managers and transported by themselves to the mining areas. Within the city of Paramaribo, mercury is known to be sold in the neighborhood of "Little Belem" by informal sales persons who are often cab drivers. Most of the sellers are Surinamese nationals. Some Chinese mining equipment stores in the same neighborhood are also said to sell mercury as well as Chinese shops in the mining areas. Some miners also travel to Guyana to buy mercury directly. Concerning the amounts of mercury used, an average mercury to gold ratio of 3.3:1 could be calculated based on interviews with miners (Heemskerk et al., 2016). From this in turn, mercury emissions for 2018 were estimated to be at 56 t mercury per year, with a minimum of 17 t per year.

Compared to other counties, gold miners in Suriname are aware of the effects of mercury on health (Heemskerk & Oliveira, 2004; Duijves & Heemkerk, 2014). More than 80% could name behaviors that expose oneself to the risk of mercury poisoning and 80% knew that breathing in mercury vapor that gets released while burning the mercury-gold amalgam is dangerous (Heemskerk & Oliveira, 2004). Fewer miners however knew about the danger of eating mercury-polluted fish and handling mercury bare-handed. Furthermore, the symptoms of mercury poisoning were not well known. The knowledge

of miners about mercury and its health effects has improved very little in the last few years (Duijves & Heemskerk, 2014).

EAST AFRICA

The policy frameworks concerning mercury in Kenya, Tanzania and Uganda are generally broad based and cut across multiple sectors. Mercury imports in all three countries are allowed, but bound to clearance protocols for mercury imports associated with certain industries such as ASGM, agriculture and cosmetics. The regulations on mercury use in ASGM within the different countries are rather difficult to understand. Multiple acts include mercury, such as mining acts and environmental management acts and many remain ambiguous. In Kenya, the use of mercury in ASGM is not allowed. Tanzania's most recent Mining Act (2018) does not include any information on mercury, but the older version included the use of retorts while burning amalgam. For Uganda, mercury use in ASGM is neither allowed nor restricted, as artisanal miners are not recognized under the 2003 Mining Act. However, the Mining and Minerals Policy of 2018 aims towards a formalization of the sector and includes regulations on mercury use.

There seems to be a balance between miners who are and miners who are not aware of negative health effects of mercury. Miners who have worked in the sector for a long time have probably received training or participated in some kind of awareness raising initiatives. However, younger miners or new comers to the sector might be unaware. Similar to the situation in other countries, most miners do not know of feasible alternatives and some try to mitigate negative effects by taking some precautions, e.g. burning of the amalgam in open air. Another aspect to consider is that working within the ASGM sector comes with various risks besides mercury use, e.g. mining accidents or dust exposure, wherefore the risk of mercury poisoning might be seen as neglectable by some miners.

BURKINA FASO

With the 2015 mining code came a ban of mercury use in ASGM. However, as the sector has no real alternative, this ban is not realistic at this moment and most miners use mercury to extract gold. The estimates for a gold to mercury ratio for Burkina Faso are in the range of 1.3:1 (Hg:Au) (Persaud and Telmer, 2015) and most recently calculated as 1.5:1 (Hg:Au) (Kaboré, 2019).

Miners are often not aware of the mercury's origin. They acquire it from gold traders and gold buying counters and often the price of gold is linked to the previous supply of mercury.

Within Burkina Faso, there seems to be a certain awareness concerning the negative health effects of mercury among miners, however, many miners do not have an accessible alternative to the use of mercury. Some interviewed miners stated that they are using measures to reduce the health risks of mercury such as the usage of masks while burning the mercury-gold mixture. Nonetheless, this is not always the case and many miners handle mercury without any precautions including the burning of mercury in their homes.

PHILIPPINES

Mercury can be formally imported and used in certain industries and sectors. Mercury use within the ASGM sector, however, is officially not allowed in the Philippines. However, the majority of miners use mercury and amounts used vary greatly depending on the region and technique used. Depending on the method chosen, mercury gets used at different stages of the extraction process and different quantities of mercury are needed. Due to this, the mercury to gold ratio varies significantly with e.g. 10.61 g of mercury for 1 g of gold in Agusan del Sur to 48.1 g mercury for 1 g of gold in South Cotabato. Miners often do not measure the amounts of mercury

but rely on personal estimates, which results in large differences of the amounts of mercury used even under the same processing technique. Furthermore, the volumes used depend how easily mercury is available. In areas with a steady supply, miners use mercury as early as during the panning stages, whereas mercury is only used during the gold processing stages in areas with a less steady supply.

Miners access mercury in different ways. Most miners report that they get mercury from their financiers or gold traders. Some of these gold traders also finance mining operations and force miners to buy mercury by threatening to stop financing the mines. Other gold traders provide miners with mercury for free under the condition that they only sell the obtained gold to the same trader. Another way to access mercury is through mining supply stores, goldsmiths and private gold buying stations. In most cases, mercury is sold discreetly and only people who know the sellers will be offered mercury.

Miners and mining communities in the Philippines are often unaware of the negative health impacts of mercury. Many miners reported playing with mercury as children and claim not to have any health problems. However, many miners do not have access to health care, so many mercury-related health issues probably go undiscovered and are not linked to the chemical by the miners themselves. Those who are aware of the toxicity often simply ignore the risks as they lack an alternative to mercury use.



As the trade is profitable for many involved actors, there is a driving force in place that keeps the use of mercury in ASGM going

