AN INTRODUCTION TO ASM GOLD, MERCURY REDUCTION & ASM SUPPORT PROGRAMMES

THE FASHION PACT

THE IMPACT FACILITY

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TDi Sustainability

CONSERVATION INTERNATIONAL

TABLE OF CONTENTS

This report was done as part of the Transforming the Fashion Sector with Nature project that is led by Conservation International and The Fashion Pact and funded by the Global Environment Facility.

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Led by: Conservation International, The Fashion Pact

In partnership with: The Impact Facility, TDi Sustainability

TABLE OF ABBREVIATIONS

AMP	Artisanal Mineral Producer
ARM	Alliance for Responsible Mining
ASGM	Artisanal Small Scale Gold Mining
BGI	Better Gold Initiative
CNCJ-Peru	Coordinadora Nacional de Comercio Justo de Perú
CRAFT	Code of Risk-mitigation for ASM engaging in Formal Trade
CSR	Corporate Social Responsibility
EPRM	The European Partnership for Responsible Minerals
ESG	Environmental Social and Governance
GCT	Genesis Charitable Trust
GEF	Global Environmental Facility
GEF Gold	The Global Opportunities for Long-term Development in ASM Programme
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
IIED	International Institute of Environmental Development
IUCN	International Union for Conservation of Nature
LSM	Large Scale Mining
LV2030	The Lake Victoria 2030 Programme
MRU	Mano River Union
OECD	Organization for Economic Co-operation and Development
OHS	Occupational Health and Safety
PG	planetGOLD
PPE	Personal Protective Equipment
RVO	Rijksdienst voor Ondernemend Nederland – Netherlands Enterprise Agency
SBGA	Swiss Better Gold Association
TDi	TDi Sustainability
TIF	The Impact Facility
UN	United Nations
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organisation
USAID	United States Agency for International Development

INTRODUCTION

About 20% of mined gold originates from so-called artisanal and small-scale mining (ASM) operations across Africa, Asia, and South America. In total, the ASM gold sector is estimated to offer a livelihood to more than 8 million people, with as many as 40 million people relying on the sector either directly or indirectly.

Most artisanal gold miners rely on the application of mercury during the processing and concentration of gold, making ASM gold the largest emitter of mercury into the environment. Given the highly toxic nature of mercury, this poses a threat to human health as well as a negative impact on biodiversity.

To mitigate biodiversity loss and protect the environment, one target of the two year project funded by the Global Environment Facility, Transforming the Fashion Sector with Nature, is the reduction or elimination of 100kg of environmental mercury emissions. Aiming at achieving lasting impact upstream, preference has been given to supply chain-based responsible sourcing interventions, rather than considering stand-alone CSR projects.

OBJECTIVE

This document provides an overview of relevant initiatives The Fashion Pact signatories should be aware of, to make an informed decision on how to achieve their mercury reduction targets.

For purposes of providing relevant context, this report reflects on the structure of the global gold value chain and provides further background on the risks around mercury usage and effective ways of reducing and eliminating mercury emissions through technical interventions. TDi Sustainability (TDi) and The Impact Facility (TIF) recommend considering support of the TIF-run Lake Victoria 2030 Programme (LV2030), given its status and maturity and in-depth understanding by TDI and TIF regarding project specifics.

This said, The Fashion Pact signatories are most welcome to enquire about any of the other projects highlighted in this document.

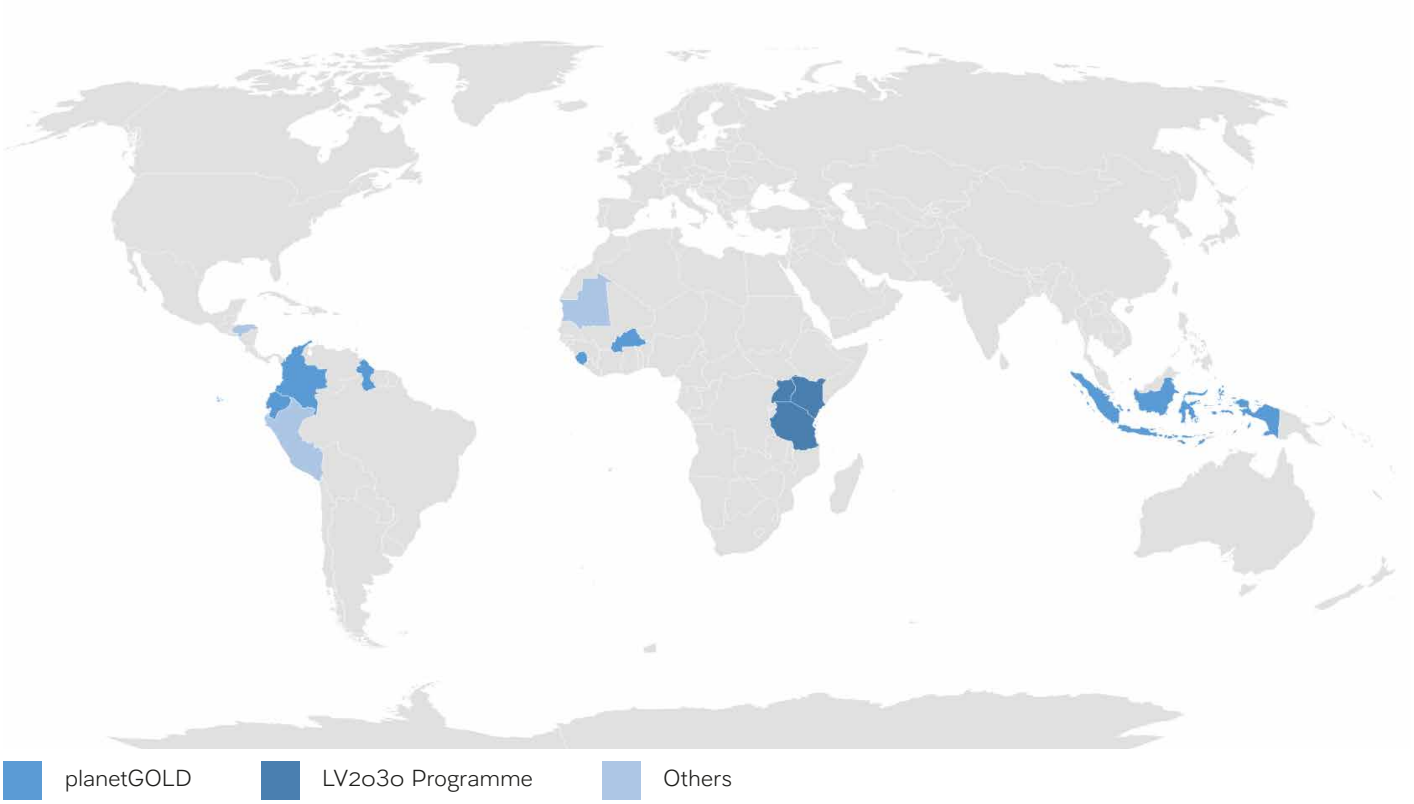
ACTIVE PROGRAMMES DRIVING EFFORTS TO ELIMINATE MERCURY AND PROFESSIONALISE ASGM

Initial hammering of the gold ore into smaller pieces before mechanical crushing

Gold miner searching through the tailings of a leaching plant for potential gold residue

GLOBAL EFFORTS TO ELIMINATE MERCURY IN ASGM

This section provides an overview of select programmes aimed at the reduction of mercury usage in ASGM. The Fashion Pact signatories might want to consider supporting their efforts by either investing financially in their activities or alternatively, if offtake volumes are sufficient and a route to market mechanism is in place, sourcing ASM gold directly from these projects.



Each project has been profiled to allow for easy comparison, taking into account the project runtime, the ESG scope of the project, its geographic focus and the parties involved - based on publicly available data. TDi and TIF maintain active relations with many of the actors involved in these projects and could facilitate introduction if of interest.

planetGOLD

A sister project to The Fashion Pact under the GEF, planetGOLD (PG), finances programmes worldwide focussed on reducing mercury use in line with the commitments made through the Minamata Convention (see info box page 27). An ambition of the PG projects is to integrate mercury-free ASM gold into formal supply chains. Their approach is through raising awareness, providing access to finance and formal markets, and facilitating technical and formalisation support in the following countries. Projects are at various stages in implementation, as indicated by their respective phase.

PROGRAMME STRUCTURE

SUPPORTED BY

gef

UN environment programme

LED BY

CONSERVATION INTERNATIONAL

IMPLEMENTED BY

UN environment programme

- Republic of the Congo
- Cote d'Ivoire
- Guinea
- Mongolia
- Philippines
- Uganda

UNIDO UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

- Bolivia
- Burkina Faso
- Ghana
- Madagascar
- Mali
- Mongolia
- Nicaragua
- Nigeria
- Philippines

UNDP

- Colombia
- Ecuador
- Ghana
- Honduras
- Indonesia
- Kenya
- Peru
- Suriname

CONSERVATION INTERNATIONAL

- Guyana
- Mali
- Sierra Leone
- Zambia

- Phase 1
- Phase 2 (2022)
- Phase 2 (2023)

Find out more about planetGOLD on their official website.

Burkina Faso

The Global Opportunities for the Long-Term Development of the ASGM Sector			
Project runtime	2019-2022	**Project status**	Active
Area of focus	Gnikpière Mine (South-West) - Burkina Faso	**Financed by**	Co-financed by the Artisanal Gold Council, Argor Heraeus and the government of Burkina Faso
Led by	Artisanal Gold Council	**In partnership with**	UN Industrial Development Organization (UNIDO), Argor Heraeus and the government of Burkina Faso.
Official Areas of focus			
Formalisation	Yes - Has provided support in policy review of the sectors legislation, provided a gap analysis and provided recommendations to the government	**Access to finance**	Yes - Conducted a training in the project area to familiarize miners with the lenders' requirements for access to formal loans
Gender Equality	Yes - Strengthened a local women's AMP group and working to provide access to finance and resources and has previously engaged mines led by a woman.	**OHS**	Yes - Working towards improving the availability of mercury-free technologies
Number of AMPs engaged	Not specified - working with one mine	**Is it possible to source gold?**	Not specified. Pilot export yet to be implemented
Project Description			
The Burkina Faso project is implemented by the UN Industrial Development Organization (UNIDO), co-financed by the Artisanal Gold Council, Argor Heraeus and the government of Burkina Faso, and executed by the Artisanal Gold Council. Operating in Gnikpière Mine on the south-western part of the county, the aim is to prevent or eliminate mercury use by 3 tonnes in the country. Launched in early 2017 and ending in 2023, the consortium also supports policy strengthening, formalisation support and has plans to establish a revolving fund that can provide financial incentives with an eventual goal of formal market access for ASM gold. Providing knowledge and the training necessary to operate mercury-free processing systems is one of the project goals and this year, the partners are still in the process of attempting a pilot export of gold from the country.			

Find out more about the programme here.

Colombia

Integrated Sound Management of Mercury in Colombia's ASGM sector			
Project runtime	2019-2023	**Project status**	In operation
Area of focus	11 cities in the regions of Cauca, Antioquia and Sur de bolivar, Colombia	**Financed by**	GEF Gold
Led by	United Nations Development Programme (UNDP)	**In partnership with**	Ministry of Environment of Colombia
Official Areas of focus			
Formalisation	Yes - Provide institutional and regulatory framework support	**Access to finance**	Yes - Working to improve AMP's access to financing for the acquisition of mercury-free technologies
Gender Equality	Yes - In 2021, held a „Gender Equality Learning Cycle" webinar to provide training and knowledge management on gender issues, gender-based violence, and policies for the prevention of sexual exploitation and abuse.	**OHS**	Yes - Trained miners on technology transfer for an alluvial mobile plant in Cauca and Antioquia, to help avoid the use of at least 200 kilograms of mercury per year.
Number of AMPs engaged	Not specified	**Is it possible to source gold?**	Not specified
Project Description			
This Planet Gold programme aims to support ASGM communities in 11 cities in the regions of Cauca, Antioquia, and Sur de bolivar in the country. The project is implemented by the UNDP and the Ministry of Mines and Energy in partnership with the Health and Environment Ministries. The five-year project is currently organising the first commercial pilot of responsible gold from the country in partnership with ARM that includes a traceability strategy. Starting in 2019 and ending in 2023, the project is working to reduce and, where possible, eliminate mercury use in the ASGM sector by 20 tonnes at the end of 2023. The approach is to strengthen institutions and regulatory frameworks; increase mining communities' access to the financing needed to purchase mercury-free processing technologies; provide technical assistance, aid in technology transfer to the AMPs, and offer formalisation support for the ASGM sector in the country.			

Find out more about the programme here.

Ecuador

The National Program for Sound Management and Life Cycle Management of Chemical Substances			
Project runtime	2019-ongoing	**Project status**	In operation
Area of focus	Camilo Ponce Enríquez, Zaruma-Portovelo and Chinapintza communities in Ecuador	**Financed by**	GEF Gold
Led by	United Nations Development Authority	**In partnership with**	The Ministry of Environment and Water
Official Areas of focus			
Formalisation	Yes - Has supported 3 mining groups to formalise and submitted for consideration improvements for the mining legislation	**Access to finance**	Yes - Supported in the improvement of financial products one of whichh is in partnership with National Bank of Ecuador and Central Bank to enable access to finance.
Gender Equality	Yes - Implemented a garden project and goldsmithing as alternative livelihoods for some women miners	**OHS**	Yes - Initiated clean-up/remediation processes for and Supported research on mitigating mercury contaminated sites.
Number of AMPs engaged	Target to reach 350 AMPs	**Is it possible to source gold?**	Not specified
Project Description			
Starting in 2019, the Planet gold programme is implemented by the UNDP in collaboration with the Ministry of Environment. Supporting ASGM communities in Camilo Ponce Enríquez, Zaruma-Portovelo, and Chinapintza regions, the programme has developed formalisation guidelines for the country and has since supported 3 mining groups to formalise. The Ecuador programme aims to reduce the use and release of mercury from ASGM by 2 tonnes, train at least 350 miners, improve the selling price for responsibly-produced gold, and create industrial incentives and competitive fund mechanisms to increase access to financing for miners. The program also seeks to change cultural patterns linked to the ASGM sector that negatively affect women. The team has implemented a family vegetable garden project that allows women mineral selectors that sort through ore discarded by mines, also known as jancheras, to have an alternative livelihood source given the increased efficiency of mine internal processes reducing the amount of gold-bearing residue in the dumps.			

Find out more about the programme here.

Guyana

Supply Chain Approach to Eliminating Mercury in Guyana's ASGM Sector: El Dorado Gold Jewellery Made in Guyana			
Project runtime	2017 - present	**Project status**	In operation
Area of focus	Barima Waini, Cuyuni Mazaruni, and Potaro Siparun regions of Guyana	**Financed by**	GEF Gold
Led by	Conservation International Guyana	**In partnership with**	The Guyana Environmental Protection Agency, the Ministry of Natural Resources, the Guyana Women Miners Organisation, The Guyana Geology and Mines Commission and the National Toshaos Council
Official Areas of focus			
Formalisation	Yes - Contributed to the Guyana National Action Plan, including the assessment of Guyana's legal framework	**Access to finance**	Yes - Finalized a yet to be operationalised report on potential financial mechanisms including: lending through geological information as collateral; launching a support fund; establishment of mining development bank and new green loans (equipment-focused)
Gender Equality	Yes - Published a blog, "Humanizing Gender Dynamics within Guyana's ASGM Sub-Sector." describing how the experiences of women in the ASGM sector are vastly different from those of men	**OHS**	Yes - Identified equipment for set-up of the first circuit to be utilized for mercury-free processing of ore for gold production
Number of AMPs engaged	Not specified	**Is it possible to source gold?**	Potentially - Working towards ‚El Dorado Gold'
Project Description			
CI Guyana is supporting the country achieve its mercury elimination aim by 2025 by mainstreaming appropriate mercury-free technologies in Guyana's ASGM sector, establishing a functional mechanism for financing capital investments for mercury-free technologies and assist in the establishment of a market for branded mercury-free gold produced in Guyana and branded El Dorado Gold. The programme's goal is to prevent or eliminate mercury use of mercury by 15 tonnes, here working with a consultant to provide a national baseline for mercury use. Part of its achievement has been contributing to the national action plan, which includes the assessment of the country's legal framework.			

Find out more about the programme here.

Sierra Leone

Enabling and Growing Artisanal Gold Enterprises (EnGAGE)			
Project runtime	2020-2022	**Project status**	In operation
Area of focus	Sierra-Leone	**Financed by**	Co-funded by the European Union and the German Development Council
Led by	Artisanal Gold Council	**In partnership with**	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and Mano River Union (MRU)
Official Areas of focus			
Formalisation	No	**Access to finance**	Yes - Plans to establish an ASGM Investment fund
Gender Equality	Not specified	**OHS**	Yes - Plans to install a mercury-free processing plant
Number of AMPs engaged	Not specified	**Is it possible to source gold?**	Not specified
Project Description			
This Sierra Leone project aims to promote responsible ASGM practices amongst stakeholders at the national level, while adhering to international best practices relating to legality, environment, gender equality, occupational health, safety and human rights. A mercury-free gold processing facility will be installed and training provided to AMPs and the government. Outside of facilitating increased market access, the project also seeks to provide access to formal finance, develop an investment fund and establish a traceable supply chain.			

Find out more about the programme here.

Indonesia

GOLD ISMIA			
Project runtime	2019 - 2023	**Project status**	Active
Area of focus	Kuantan Singingi District, Kulonprogo District, West Lombok District, North Gorontalo District, North Minahasa District and South Halmahera District in Indonesia	**Financed by**	GEF Gold
Led by	Ministry of Environment and Forestry and National Agency for Technology Assessment and Application (KLHK and BPPT)	**In partnership with**	United Nations Development Programme (UNDP)
Official Areas of focus			
Formalisation	Yes - Supported 17 mining groups to establish a miners' cooperative and obtain mining permit and facilitated several formalization "training of trainers" at four project sites.	**Access to finance**	Yes - Assisted with the lending of micro loans, disseminated through financial mechanisms developed by the team in the amount of USD 28,485, to 35 individual miners
Gender Equality	Yes - Conducted a training on gender inclusion in the ASGM sector for government staff and miners.	**OHS**	Established a micro-scale mercury-free gold processing prototype with capacity to process 150 - 250 kg of ore and conducted a field testing of this prototype
Number of AMPs engaged	Over 500 AMPs engaged across different programme activities	**Is it possible to source gold?**	Yes - Possible through BPPT and KLHK support

Project Description

Operationalised in 2019, the programme has engaged over 500 AMPs across different activities under the areas of facilitating mercury-free processing, formalisation support and access to market. Under market facilitation, the project has supported the transaction of 754 g of mercury-free gold from one project-assisted cooperative in Minahasa Utara to a local ethical jeweller called the Garden of the Sun.

The project has also established two financial mechanisms: one Low Value Grant Agreement with seven mining cooperatives and one mechanism with a commercial bank using micro loan for small-medium enterprises. They have also authored a financial management guidebook for a mining cooperative with 214 miners to enable proper mine management.

The team has also supported ASGM miners in three project sites to shift their technology from mercury to mercury-free processing plants, leading to avoidance of 11.6 MT mercury release per year and producing 2.23 MT of mercury-free gold. Additionally, the team has been successful in establishing a micro-scale mercury-free gold processing prototype with capacity to process 150 - 250 kg of ore was able to conduct field testing of the prototype.

In 2022, the team plans on putting up five mobile plants and one permanent plant, to be established at six project sit having developed a detailed engineering design. They have in the past been able to train 77 miners at existing mercury-free processing plant and laboratory installations on non-mercury gold processing techniques and also built a laboratory-scale for reprocessing mercury containing tailings.

A major achievement for the team has been developing a mobile application and web dashboard to systematically and regularly monitor mercury avoided from the mercury-free processing units within the project locations.

Find out more about the programme here.

Active ASGM development initiatives/projects

The below projects fall outside the scope of global planetGOLD projects and are implemented by a range of civil society organisations and private sector actors listed in alphabetical order by the name of the initiative.

Honduras

Honduras: Land of Shining Gold			
Project runtime	2019 - 2022	**Project status**	Active
Area of focus	Municipality of Macuelizo, Department of Santa Barbara in Honduras	**Financed by**	The European Partnership for Responsible Minerals (EPRM)
Led by	Alliance for Responsible Mining (ARM)	**In partnership with**	Heimerle + Meule, Samlerhuset the International Institute for Environment and Development (IIED) and the Centro de Negocios Hondureño Alemán (Honduran-German Business Centre)
Official Areas of focus			
Formalisation	Yes - provides legalisation and formalisation support for pre-selected mine sites	**Access to finance**	Yes - The cooperative is prefinanced by the refinery to enable gold aggregation
Gender Equality	Not specified	**OHS**	AMPs have beneffited from the provision of PPE
Number of AMPs engaged	1 cooperative - number of miners not specified.	**Is it possible to source gold?**	Yes - Likely possible through offtake from Heimerle + Meule refinery
Project Description			
ARM is the lead implementing partner in the Honduran project to improve the working conditions and strengthen the livelihoods of miners at Minas y Cuevas, a legally-registered Honduran mining cooperative located in the municipality of Macuelizo that is already compliant with the CRAFT standard as of 2019 with the expectation to be fully Fairmined compliant by the end of 2022 as per ARM's assessments. This includes support from the programme to assist the cooperative in mercury reduction and eventual elimination. The EPRM-financed project started in January 2019 and will run all the way until December 2022 and consists of a consortium of partners working with ARM that include Heimerle + Meule, a german refinery, Samlerhuset - coin company headquartered in Norway, IIED and the Centro de Negocios Hondureño Alemán (Honduran-German Business Centre). The cooperative currently sells its produce to Heimerle + Meule which has a direct relationship with the AMP and prefinances their activities through supplier contracts to enable gold aggregation and facilitate operational costs. Other forms of support are provided in the form of provision of PPEs and on-site camera provision. The Honduran Mining Authority also does periodic assessments, inspecting and reporting back to the consortium on the results.			

Find out more about the programme here.

Mauritania

The Business Pilot for Responsible ASM Gold			
Project runtime	2019-2022	**Project status**	Active
Area of focus	Chami and Zouerat regions in Mauritania	**Financed by**	The European Partnership for Responsible Minerals (EPRM)
Led by	Alliance for Responsible Mining	**In partnership with**	PACT, Magma Group and Aurum Monaco
Official Areas of focus			
Formalisation	Yes - AMPs engaged will be supported to be in compliance with national regulations and international standards	**Access to finance**	Not specified
Gender Equality	Not specified	**OHS**	Yes - The project supports the miners and forgerons adopt improved methods for processing, smelting and jewellery-making with reduced environmental and health impacts.
Number of AMPs engaged	Not specified	**Is it possible to source gold?**	Not specified at the moment - Sahel clean gold initiative has not been specified to be active
Project Description			

The 3-year EPRM-funded project in Mauritania, started in January 2021 and will last all the way until December of 2023 and is focused in the regions of Chami and Zouerat.

Led by PACT UK, the project also involves the partnership provided by the Magma Group, a geotechnical company, and Aurum Monaco, a precious-metals refiner. The project aims to provide ASM gold miners and forgerons - a traditionally marginalised group of blacksmiths in Mauritania with training and support to adopt improved methods for processing, smelting, and jewellery-making, as well as access to finance and markets.

The partners have established an exporting company under Magma's Sahel Clean Gold initiative, with the aim to establish a transparent and 'clean' supply chain from Mauritania's gold mines to Aurum's refinery in Monaco – providing miners with access to the global market.

This will pilot both CRAFT-compliant and traceability schemes from the mine site to export, including increased production volumes with an emphasis on mercury reduction.

Find out more about the programme here.

Peru

Responsible Peruvian Gold			
Project runtime	2019-2022	**Project status**	Active
Area of focus	Puno region, Peru	**Financed by**	The European Partnership for Responsible Minerals (EPRM)
Led by	Fairtrade	**In partnership with**	FairCapital, Valcambi, Coordinadora Nacional de Comercio Justo de Perú (CNCJ-Peru) and Fairphone
Official Areas of focus			
Formalisation	Yes - The AMPs will be supported to achieve Fairtrade Certification	**Access to finance**	Yes - The programme intents to provide capacity support to enable AMPs' access to formal lenders
Gender Equality	Not specified	**OHS**	YES - To achieve the certification, AMPs are provided with technical support to improve mine practices
Number of AMPs engaged	10 mine operators within four AMPs'	**Is it possible to source gold?**	Yes - Likely possible through offtake from Valcambi refinery
Project Description			
In partnership with the lender FairCapital, metal refiner Valcambi, Peru's national network of Fairtrade producers CNCJ-Peru and Fairphone, Fairtrade is implementing the Responsible Peruvian Gold project to support ASMOs to obtain the Fairtrade certification and export Fairtrade certified gold through training and improved management systems. The EPRM-funded project aims to support AMPs to operate legally and formally, and uptake more responsible and productive mining practices that include the reduction and elimination of mercury. The intention is to enable the entry of gold into premium international markets and encourage good practice in mines outside the programme. Focused in the region of Puno in Peru, the project started in January 2021 and is estimated to come to a close in January 2024, and is currently engaging four AMPs by the names Untuka, a community mining set-up, and Comig, Oro Sur, and Limata AMPs' currently registered as existing cooperatives. The programme also intends to provide the AMPs with access to formal lenders.			

Find out more about the programme here.

ASGM 3rd-party certification schemes

Fairmined and Fairtrade
Next to ASGM development initiatives listed above, there are some established ASGM assurance programmes that have a declared focus on mercury reduction as well. The Fairtrade and Fairmined Gold certification has been active since 2012, with a current footprint in Bolivia, Peru and Colombia as well as in Mongolia. Both schemes assure producers a minimum price share of the international price and consider a range of environmental, social and governance related risks in their assessment.

To date, the amount of Artisanal Mineral Producers (AMPs) holding certified status remains small and concentrated in South America. Next to their standard 'Fairtrade' and 'Fairmined' gold label, both schemes offer eco-gold, which has been produced without the use of mercury. For Eco gold this premium is even higher at 15%. These costs are exclusive of potential costs for supply chain integration and certification of actors along the supply chain to ensure the integrity of the sourcing claim.

Better Gold
Equally focused on South America, the Swiss Better Gold Association (SBGA), has developed a different approach promoting continuous improvement of conditions on the ground of mine sites that operate at sub-certification levels. The SBGA runs its programme that also offers a producer-premium with the backing of a number of Swiss refiners, under the umbrella of the Better Gold Initiative (BGI).

Code of Risk mitigation for Artisanal and small-scale miners engaging in Formal Trade (CRAFT)
The Code of Risk mitigation for Artisanal and small-scale miners engaging in Formal Trade (CRAFT) is an open source tool and the product of a multi-stakeholder consultation designed to bridge the gap between legitimate artisanal producers and refiners, jewelers, electronics companies, banks, and other supply chain actors.

The code helps both buyers and miners to assess critical social and environmental risks – such as child labour, illicit trade, and uncontrolled use of chemicals, among others – in artisanal supply chains. The code is progressive, defining clear criteria for critical risks while assessing opportunities for – and making commitments to – mitigate risks and improve on other social, environmental and safety practices.

TIF's LV2030 Programme

Professionalising ASGM in Kenya, Uganda and Tanzania

Mine Your Own Business
LV2030

The LV2030 Programme			
Project runtime	2018 - ongoing	**Project status**	In operation
Area of focus	Kenya, Uganda, and Tanzania	**Financed by**	The European Partnership for Responsible Minerals (EPRM), Genesis Charitable Trust and Private Social Investors
Led by	The Impact Facility	**In partnership with**	Solidaridad, Chambers Federation, the Fairtrade Foundation, Fairphone and Aunexum Precious metals
Official Areas of focus			
Formalisation	Yes - Provides financial literacy training to AMPs to bridge the gap to access to formal finance	**Access to finance**	Yes - The leasing facility provided the AMPs' with access to finance on fair terms to increase mine efficiency
Gender Equality	Yes - Retort training and provision to women groups done in 2020 to enable mercury reduction through recycling	**OHS**	Yes - The equipment leasing facility prioritises production equipment to increase the efficiency and productivity of AMPs' activities enabling the safe extraction of the commodity
Number of AMPs engaged	26 mining organisations	**Is it possible to source gold?**	Yes - This can be through direct offtake of the East African Gold or through Gold credits starting at the end of 2022.

Project Description

Comprising the totality of TIF's work across Kenya, Uganda, and Tanzania, the Lake Victoria 2030 Gold Programmes 'Project Access', as well as the project 'Realising the Potential of ASGM Trade' in Tanzania led by TIF strategic partner Solidaridad. Comprising a consortium of partners with expertise all along the gold supply chain, the programme takes on a business-led, productivity-first approach, having engaged miners in East Africa since 2012.

Having launched an equipment leasing venture committed to expanding across the region, TIF is bridging the gap between AMPs and formal finance institutions by providing AMPs' with access to capital and equipment, access to capacity development, and access to markets. The project aims to provide equipment investment into 25 - 30 mines in Kenya and Uganda before the finalisation of the project in 2024. In Tanzania, 10 mines have already been engaged and assessed and are set to receive investment pending the Dutch government's approval of phase B of the Tanzania project.

The eligibility for investments is determined based on an AMP's ESG performance while incentivising continuous improvement in order to unlock additional investments. In partnership with Solidaridad, a Book & Claim mechanism is in development developed in partnership with TIF's strategic partner Solidaridad aims to increase the amount of responsibly sourced gold into the formal supply chain without allowing for physical integration into specific supply chains.

Scope of the programme
The LV2030 comprises the totality of TIF's work across Kenya, Uganda, and Tanzania. At its core, this constitutes 'Project Access', the consortium programme financed by the European Partnership for Responsible Minerals (EPRM) focused on the professionalisation of ASGM across Kenya and Uganda, running until the end of 2024; as well as 'Realising the Potential of ASGM Trade' in Tanzania led by TIF strategic partner Solidaridad with financing from the Dutch government.

Approach
Investments in higher productivity and more efficient processing technology are key to unlocking the economic potential of AMPs. Most mines that receive external investment do so under often questionable terms. Offering miners transparent and market-rate-based financing options, TIF aims to retain more value with the AMPs and enable machine ownership over time.

The eligibility for investments is determined based on an AMPs ESG performance that incentivizes continuous improvement in order to unlock additional investments. The terms of the Lease-to-Purchase agreements have been designed to accommodate the realities on the ground, offering grace periods, market-rate interest rates, and optional payment breaks to ensure that AMPs successfully pay off their leases and attain ownership over the machines.

Activities under the LV2030
- Aside from equipment provision, TIF and its partners also provide miners with capacity building by engaging miners on a wider range of topics, including gender in mining, child labour, record-keeping, and formalisation support in acquiring business licences to enable their compliance with local legislation.
- A Book & Claim mechanism developed in partnership with TIF's strategic partner Solidaridad aims to increase the amount of responsibly sourced gold into the formal supply chain without allowing for physical integration into specific supply chains.[1]

Partnerships and collaborations
Comprising a consortium of partners with expertise all along the gold supply chain, the programme takes on a business-led, productivity-first approach, having engaged miners in East Africa since 2012.

Expected outcomes
Having launched an equipment leasing venture committed to expanding across the region, TIF is bridging the gap between AMPs and formal finance institutions by taking a multifaceted approach to enable the sustainable development through access to capital and equipment, access to capacity development, and access to markets.

The project aims to provide equipment investment to 25 - 30 mines in Kenya and Uganda before the finalisation of the project in 2024. In Tanzania, 10 mines have already been engaged and assessed and are set to receive investment pending the Dutch government's approval of the second phase of the Tanzania project.

Equipment leasing for AMPs

TIF promotes the gradual roll out of its leasing services factoring in the ASM operators' performance against the Impact Escalator - a progressive Due Diligence and ESG improvement framework designed to incentivise and guide AMPs' committed to adopting improved mining and business management practices. TIF leverages a blended finance model tailored to AMPs' and the following resources provide more insight into the model.

1. An introduction to TIF's equipment leasing services to AMPs - This miner-facing presentation has been developed to raise the awareness of the leasing solution to AMPs keen on accessing finance to improve operational efficiency.
→ Find the presentation here.

2. Equipment leasing services to artisanal mines in East Africa - This white paper demonstrates the rationale behind the leasing solution based on TIF's experience with pilot equipment projects and the lack of formal finance options tailored to the complexity of ASM.
→ Find the white paper here.

[1] See Annex 1 to learn more about different sourcing models where the Book & Claim mechanism is one of several options that we believe enables most effective resource fund to meet the ambition of mercury reduction.

MERCURY USE IN ASGM

Gold miner displaying bottled mercury used in gold concentration

Gold miners initially concentrate the crushed ore using the panning method

UNDERSTANDING THE GOLD SUPPLY CHAIN

There are various set ups possible to get ASM gold to formal market. Depending on the national legislative context, the value added to the gold by AMPs may differ as illustrated in the graphic below.

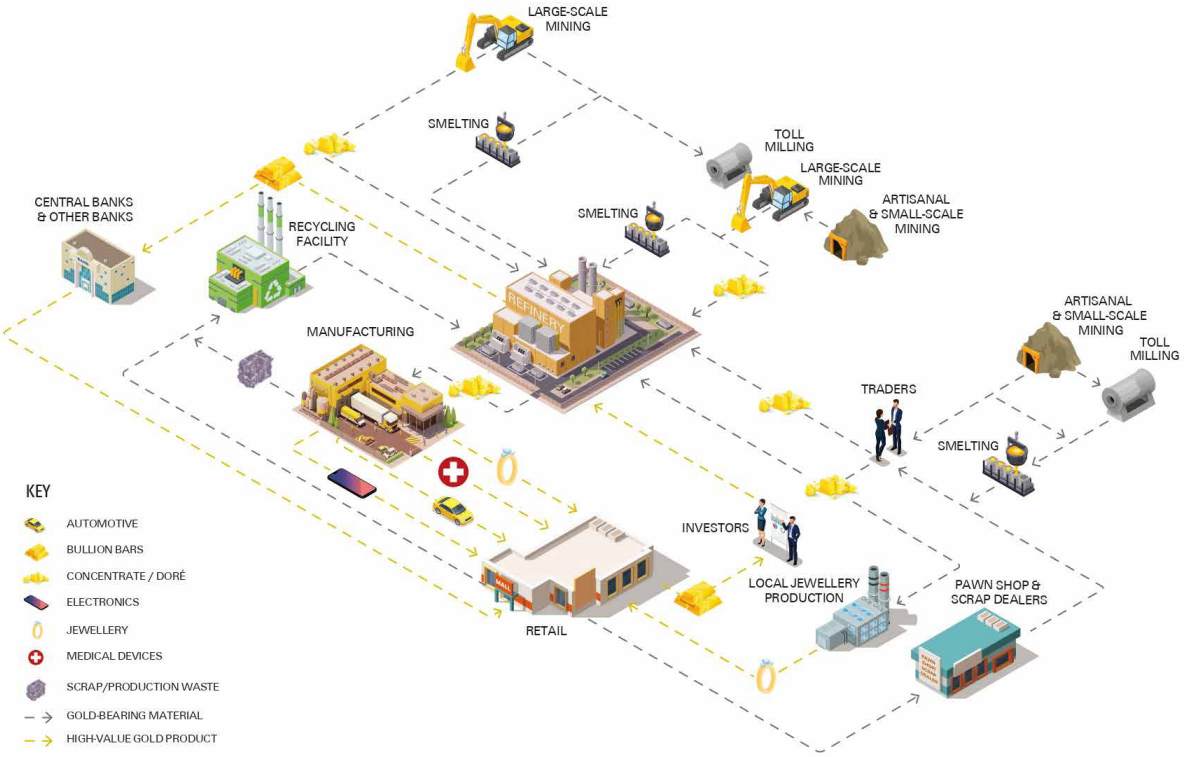


Figure 1: A model of the global gold value chain, highlighting the diversity of possible value chain set-ups (TDI/RMI, 2021)

The degree of forward integration within the value chain, in other words, how many steps of value addition are executed by the AMP, depends on a range of factors. These include the mine's physical location, volumes produced on-site, the operation's level of mechanisation and technical capacity, as well as the state of infrastructure leading up to the mine site. AMPs might sell their ore to toll millers or execute processing up to the point of smelting within their own operations. They might sell gold directly to traders operating on-site, or decide to travel to the nearest buying centres, which sometimes can mean hours of travel. Some AMPs might even prefer to export their gold directly to an international buyer, facilitating everything from processing of ore to the application for prerequisite licenses and permits. As gold is being moved from point A to B, it might be carried by motorcycles, through public transport, or private vehicles cars, or, in rare cases, also through secure third-party logistics providers.

Gold is predominantly used by three sectors including:

1. **The jewellery sector** – presenting the greatest demand for gold taking up in 2021 – 52% of all gold in accounted circulation according to the World Gold Council.
2. **The finance sector** – acting as a liquid asset in times of distress, providing a financial buffer to individuals and countries alike; and
3. **The electronics sector** – due to its good conductivity, gold is used in the manufacture of semi-conductors that are found across a range of devices including smart phones and life support equipment.

Across all stages of industrial and cosmetic use of gold, recycling occurs as can be seen in the graphic above.

Across the value chain, risks can occur - not only limited to artisanal mining but also at the stages of industrial mining or recycling, both during the trade and transport of the commodity. Annex 2 provides a comprehensive overview of prevalent issues as featured on TDi's Material Insights platform.

What are the sources of responsible gold?

The growing consumer-conscious market of this century has considerably demonstrated a willingness to pay a premium on responsibly produced gold. This is gold that has not only been extracted and sourced in consideration of the human rights of the actors across the supply chain but also done in consideration of their health and safety and in the process giving fair compensation to the producers. Responsibly sourced gold notably acts as a force for good, with the benefits from its extraction rightfully flowing to the communities where it came from.

The majority of gold (about 55%) originate from large-scale mining (LSM) operations. For a long time the LSM sector applied a do-no-harm approach to running their operations. Increasingly, LSM is now looking to demonstrate the positive impact that they have at both a national and a regional level. With the right risk management systems, environmental and social risks can be addressed and mitigated. A number of voluntary sustainability schemes have come up to ensure that this is done credibly, giving trust to both material offtakers and investor. This said, LSM offers a comparatively small number of jobs, limiting the economic impact on local communities to the tax payments made to governments and jobs for an educated and skilled workforce. While not seen as intrinsically bad, LSM gold is usually not talked about when discussing responsible or ethical gold sourcing.

The attention lies clearly on both recycled and artisanlly mined gold.

Recycling
Recycled gold currently provides around 30% of the annual gold consumption. Given the substantial value of the mineral, gold recycling has been the norm throughout, but has recently been recognised as a potentially more sustainable source of gold and branded accordingly. Recycling offers a lower carbon footprint as the processes of extraction and processing of the gold are absent, providing a circular solution to the high-demand metal. While the individuals purchasing recycled gold might stand to benefit from a lower carbon footprint for their product compared to newly mined gold and less risks along the supply chain, their choice to purchase recycled gold does not decrease the global demand for gold. Realising the development potential that ASGM could have, compared to recycled gold, a number of high street brands have committed to using ASM or recycled gold to achieve both environmental and social sustainability.

Further reading material

Is recycled gold ethical? Find out more about the complexity of recycling in the gold industry as Authored by Patrick Schein and published by the Alliance of Responsible Mining (ARM).

→ Find the article here.

Artisanal and small-scale mining
Providing a livelihood to an estimated 8 million people worldwide, this number is set to increase due to the ever-growing demand for the commodity, coupled with its increasing financial value. The low barrier to entry into the extraction, processing, and trade of the commodity makes artisanal mining even more attractive as an alternative livelihood option. Artisanal miners rely on the most rudimentary tools, oftentimes unable to achieve safe working conditions and effective production processes.

Despite the obvious environmental health and safety risks – made even more prominent by mercury – a harmful neurotoxin primarily used for gold processing that speaks to both these risks, ASM has continuously proven to potentially be a huge economic driver.

The key to harnessing the development potential of the sector is enabling access to the financing and investment necessary to professionalize their working environments despite the small-scale nature of their operations.

Rather than disengaging from the sector, active engagement with ASM is the answer. Limiting environmental degradation, improving the health & safety of the miners, and providing decent working conditions, while concurrently providing formalisation support in complex environments will significantly increase the amount of responsibly sourced gold in formal markets.

WORKING TOWARDS MERCURY-FREE ASGM

The ASGM sector is one of the largest emitters of mercury globally and is estimated to release over 2,000 tonnes per year into the environment. Despite growing awareness within the ASGM community of the toxic nature of this material, the lack of practical, viable alternatives means that many miners continue to use the chemical in their effort of extracting gold.

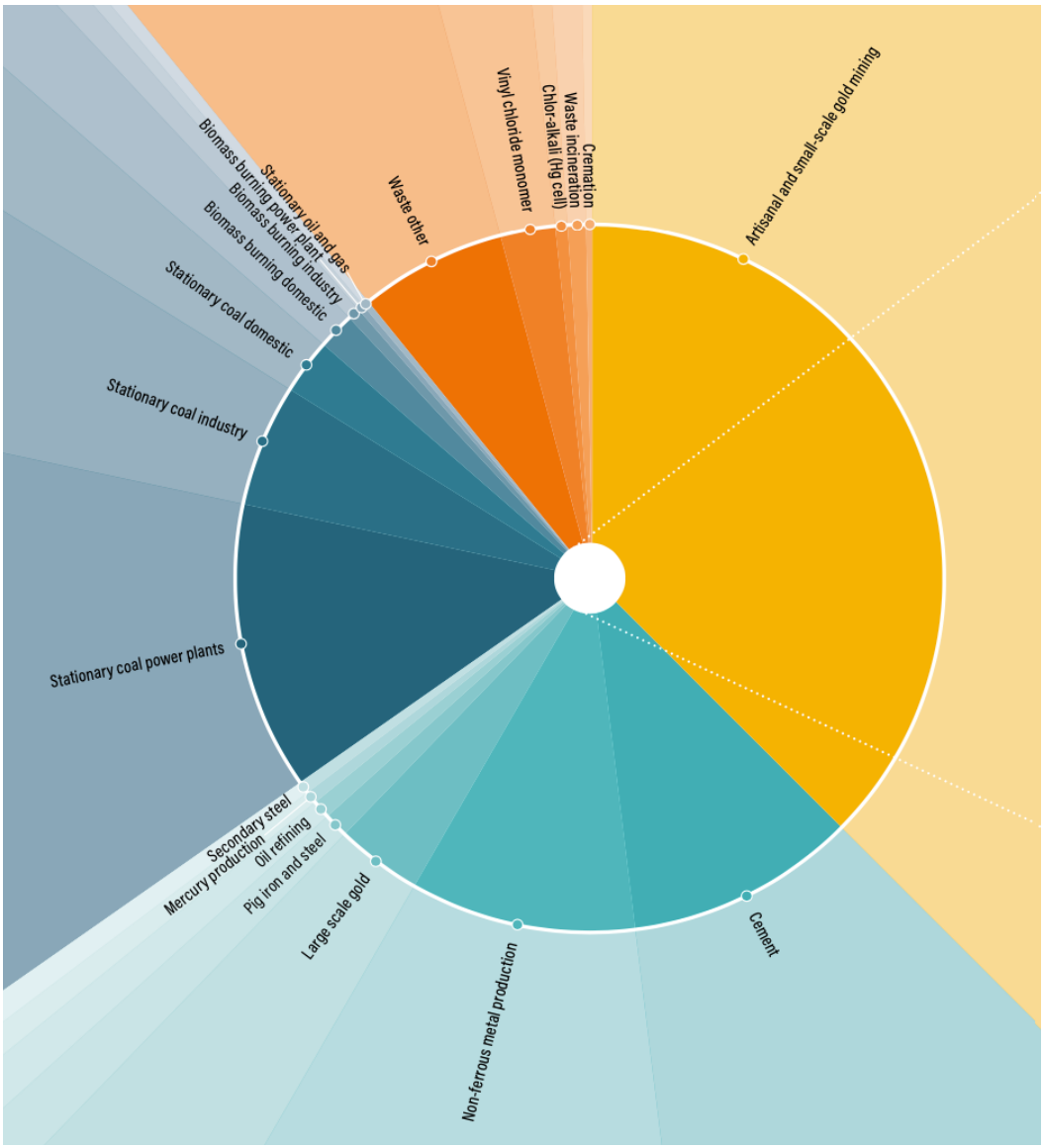


Figure 2: Mercury emissions from different sectors where the chemical finds applicability (Global Mercury Assessment, 2018)[2]

[2] The visual in this chapter originated from: https://www.unep.org/resources/publication/global-mercury- assessment-2018

How mercury is used in ASGM

The ASGM value chain starts with gold-bearing material being extracted from alluvial or primary deposits. Alluvial gold is found in river sediments or soil from shallow earth deposits that contain small particles or nuggets of gold—sometimes known as 'free' gold as the gold particles have been released from the host rock after millennia of natural weathering. Primary deposits of gold are those in which the gold is still embedded in the ore (i.e., the gold is not 'free') and are mostly found underground in quartz seams. To separate the gold from the ore, the rock is first crushed (Step 1), milled into powder (Step 2), and then the gold powder is concentrated.

Step 1:
Crushing bigger stones
(here done manually)

Step 2.1:
Ore milling to powder

Step 2.2:
Ground ore, ready for further concentration

Figure 3: ASGM production steps: ore crushing and milling at ASGM site in Tanzania

Usually, the powdered ore goes through at least one round of concentration; mines with a higher level of mechanization might apply two stages of concentration. At most ASM sites, miners concentrate ore by washing minerals down a sluice box (Step 3). Due to differences in density and weight, gold particles are more likely to be captured by the sluice mat. In very many sites, the concentrate goes through mercury amalgamation (Step 4). This is the application of mercury to the concentrate where it fuses with gold, separating the gold from other materials. The mercury is then burned off (Step 5), and the AMPs are left with so-called "sponge gold," ready to be sold to local traders.

Step 3:
Washing ground gold ore (powder) over a sluice box

Step 4:
Panning to further concentrate and adding mercury to form mercury-gold amalgam.
➝ Exposure to mercury
➝ Water contamination

Step 5:
Burning mercury-gold amalgam to vaporize mercury
➝ Highest exposure during open burning process through inhalation

Figure 4: ASGM production steps: concentration and mercury amalgamation at ASGM site in Kenya

Additional resource

→ A day in the life of a gold miner – Artisanal miners from Kenya explain the different stages of the gold mining process.

Why is mercury use so persistent?

Mercury use in ASM has persisted for decades due to several reasons. These include the availability of the chemical to miners - often provided by informal traders in the market who either sell it to the miners or leverage its provision to guarantee gold offtake at a discount. Furthermore, mercury is often relatively affordable for miners in the short-term as compared to the investment finance needed to purchase alternative technologies.

Other reasons are that the burning of mercury amalgam takes a considerably shorter time than the use of mercury reduction and elimination technologies listed above. In a sector where cash-is-king, delays in gold processing translate to revenue delays for miners, making it difficult to encourage the transition to safer alternatives. The lack of immediate health effects as a result of mercury use often makes it challenging to convince mining communities of the danger it poses. The side effects of mercury use such as physical tremors, deformations at birth, miscarriages, or memory lag are often as a result of consistent and prolonged use and/or exposure to mercury.

Mercury trade - the informal, global mercury market

Falling outside of this topic, but an interesting topic in itself, is the illicit mercury trade that is getting increase attention from journalists and academics alike. The resources below provide an insight into this trade.

1. **IUCN NL sheds light on the formal and informal mercury trade:** Here, the International Union for Conservation of Nature (IUCN) has conducted research on the flows of mercury in the informal market where The Impact Facility has provided input on their East African Study.

   → Find more information here.

2. **Poisoned by the gold rush:** A 15-minute video published by Vice Media investigating the unprecedented surge in health problems that experts are attributing to mercury, an essential component of cheap gold mining in Colombia.

   → Find the video here.

Managing, reducing and eliminating mercury use in ASGM

There is a range of approaches to mitigate the damage caused by mercury, which when used in concert can encourage the gradual reduction in mercury use by addressing the issue from multiple perspectives. In the subsequent section of this report, we discuss the various approaches to mercury management as falling into one of three broad categories:

Managing exposure and behavioural sensitisation
One group of techniques is employed to alter the ways in which mercury is currently used to help reduce harmful emissions and minimise human exposure. This can be achieved either through the use of a device known as a mercury retort that prevents mercury emissions into the air by capturing fumes and turning them back into a liquid, allowing miners to re-use mercury after the captured material is re-activated, or with the use of personal protective equipment (PPE) to safeguard operators.

Reducing mercury use with more efficient techniques
Secondly, the adoption of more advanced gold processing methods such that less mercury is required by virtue of applying mercury only to gold concentrates, for example by using equipment such as centrifugal separators.

Mercury alternatives
Ultimately desirable is the entire replacement of mercury by adopting techniques that make it obsolete. Next to cyanidation, which is costly to establish and requires high production volumes, direct smelting is the most promising alternative, using a chemical agent called borax as a substitute for mercury. To pivot from mercury use to direct smelting, even higher-grade concentrates are needed, which can be achieved by using so-called secondary concentrators such as shaking tables and magnets that allow gold to be concentrated gravitationally.

Using a range of mitigation strategies to progressively reduce risks related to mercury is key to achieving not only improved technical performance but also encouraging behavioural change as summarised below:

Figure 5: Strategies to enable mercury reduction in ASGM (UNEP, 2016)[3]

[3] The visual in this chapter originated from: https://wedocs.unep.org/bitstream/handle/20.500.11822/12186/Infographic_Gold.pdf?sequence=1&isAllowed=y

The Minamata Convention—a global commitment to phase out mercury

Most initiatives in the ASGM development space make reference to the Minamata Convention. The signing of the Minamata Convention on Mercury in 2013 was a major milestone in global efforts to mitigate the negative impacts of mercury, with more than 120 signatories to date.

As part of this treaty governments have committed to phasing out and reducing the use of mercury as part of a greater transition to reduce the dependency of a range of different sectors on this versatile yet toxic metal. The ASGM sector remains one of the largest consumers of mercury. Despite growing awareness within the ASGM community of the hazardous nature of this material, the lack of practical, viable alternatives means that many miners are forced to discount long-term health risks in return for short-term financial gain to make ends meet.

While government pledges to phase out the use of mercury are an important step in the global effort of protecting human health and the environment from the adverse effects of mercury, it remains unclear how millions of artisanal gold miners can be weaned off the toxic chemical that is so easy to access and use in their effort to make a living.

→ Find out more about the Minamata Convention on their official website.

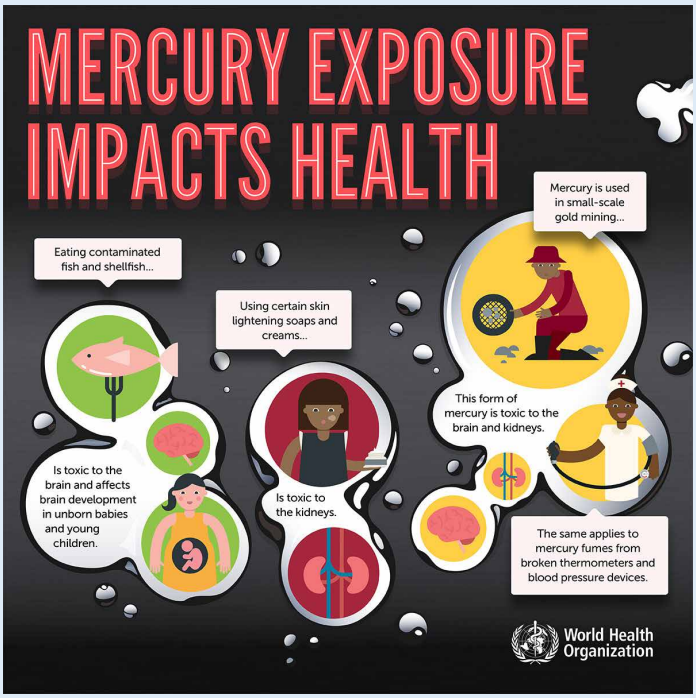


Figure 6: Heath implications of mercury exposure (PAHO, 2017)[4]

[4] The visual in this chapter originated from: https://www.paho.org/en/documents/infographic-mercury-exposure- impacts-health-2017

Managing exposure and behavioural sensitisation

To avoid direct skin contact and inhalation of mercury vapour, AMPs are encouraged to adopt the continuous used of the following personal protective equipment (PPE) some of which are highlighted below.

Promoting the use of personal protective equipment (PPE)

As a first approach, preventing human exposure to the direct health hazards of mercury is an important measure as the exposure to fumes and skin contact needs to be avoided. This can be achieved through the use of personal protective equipment (PPE), such as gloves or masks, but requires sustained effort to affect behavioural change.

Gloves

A number of gold processing techniques require the use of large amounts of water, which leads to the presence of washing ponds, where the runoff from such methods is allowed to collect, which often maintains salvageable concentrations of gold. Miners who work in washing ponds often run the risk of mercury exposure through cuts that form on their skin. The amalgamation process involves pouring mercury in a pan of concentrate (research shows that for every 1gm of Gold recovered 1.5gms of mercury is used) and thoroughly mixing the concentrate by hand. As miners carry out this panning process, in which they thoroughly mix gold concentrate with liquid mercury, they are running a significant risk of exposing their skin.

Figure 7: A mine worker wearing latex gloves while washing gold into a washing pond

Sluicing ponds are predominantly operated by women, where they often use their bare hands. As such, gloves will help prevent exposure of mercury to blood capillaries, which are the entry point for mercury into the body. To help ensure that miners adopt the use of gloves in washing ponds, ideally they should be quite flexible for use during the washing process, as in the past the gloves that were used were too rigid to allow workers to nimbly wash materials, or conversely, very thin and thus easily get worn through during washing. Examples of different kinds of gloves can be seen in Figure 8.

Masks

At the stage of burning of amalgam, the risk of exposure to mercury fumes is most imminent. A proper mask could help mitigate toxic fumes from being inhaled, but mask use is basically unheard of in the ASGM community. Despite a few miners being seen regularly wearing masks in the mines, it is more common that they are exposing themselves to harmful particles, oblivious of the real danger of mercury fumes in the mines and other particulate matter.

Sensitising Miner Behaviour

In principles, gloves and masks are relatively inexpensive and easy to use, however achieving widespread uptake of glove use at an artisanal or small-scale mine site often requires time. As with many workplaces, improving technical performance also requires certain psychological and behavioural considerations. Experience has shown that the following points are informative in encouraging the greater use of PPE:

1. Repeated, consistent training of the miners and demonstrating the use of PPE often.
2. Setting mine leaders as examples and holding them accountable.
3. Supporting the miners who need gloves or masks without simply handing them out for free to everyone, highlighting that safety is also an investment.

It is also advisable to select one lead miner who can be a role model to the rest of the washing team that uses gloves at all times during washing, to slowly influence the rest of the miners.

Figure 8.1: 5 grams of gold amalgam held by a miner in Tanzania wearing a woven glove

Figure 8.2: A miner in Tanzania demonstrates the panning process with makeshift gloves

Reducing emissions: mercury vapour capture with a retort

In January 2020, TIF was able to take an important step in mercury management by providing mercury retorts to AMPs in Kenya, while raising awareness of the hazards associated with mercury.

A mercury retort (see Figure 10) is a small device designed to safely burn mercury-gold amalgam such that mercury does not evaporate in the open air – this not only prevents harmful exposure to those people nearby, but also prevents the passage of mercury into the natural environment.

The retorts were fabricated in Kenya and were supplemented by a guide instructing other stakeholders how they could manufacture retorts themselves. Additionally, training materials were prepared to be administered at the mine sites to ensure adequate on-site demonstration.

Figure 9: Fully fabricated mercury retort in a workshop in Nairobi

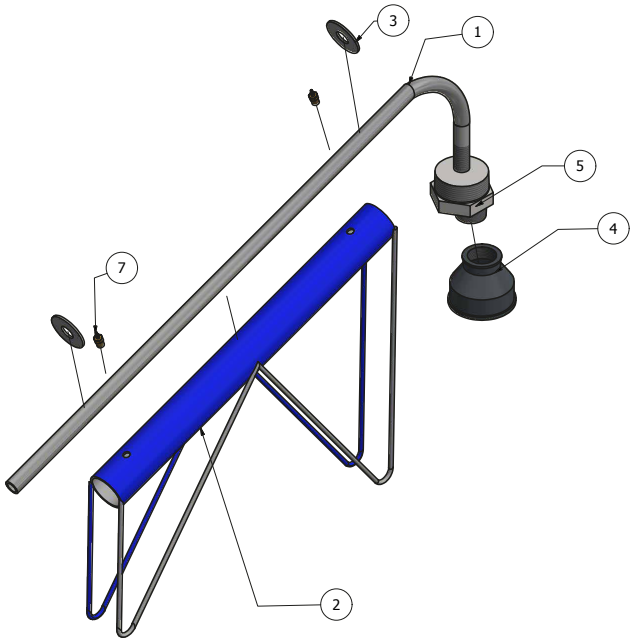
Capturing and recycling mercury can be an effective first step on the journey towards mercury-free processing. TIF, together with a third-party service provider, Maxius Engineering, was able to create a design where the components, assembly process and design, as well as the materials for the retort, were considerately and unanimously agreed upon. The next step was to design a blueprint for fabricating a mercury retort, which was then created in a workshop in Nairobi, resulting in the fabrication of eight mercury retort systems, with a spare to be kept for future use in demonstrations and training.

Figure 10: A miner demonstrating to his colleagues how to operate a retort after training conducted by TIF

Making the case for the use of mercury retorts

A schematic of a mercury retort is shown in Figure 11, which details the individual components that comprise its design. The small number of parts and simplistic design of the retort mean that it is simple and cheap to produce, which means that it is affordable for even smaller ASGM operations with low profits.

Total cost to get a locally manufactured mercury retort system is approximately $120.



PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	0.5 inch stainless steel	
2	1	Black pipe 2 inches	
3	2	PIPE CAP	
4	1	Reducing Socket -	Stainless steel reducing socket 1 1/2 to 1/2
5	1	ISO 4144 Reducing bushes	Stainless steel reducing bush. 1/2-1/4
7	2	Parker Barb-to-Pipe Adapter 28 28-4-5/32-2	Barb-to-Pipe Adapter
9	1	GB/T 14383 2 1/2 HHP NPT	Stainless steel

Figure 11: Extrapolated design for a retort, which is primarily made from stainless steel

Reasons for using mercury retorts

- Mercury emission is reduced by 90-95% and based on the principle that a retort has a closed- loop mercury recycling system, capturing mercury fumes, and channeling them into cooler water instead of emitting them into the air, they present a great way to prevent miners from inhaling the fumes and also from contaminating the environment.
- The retort ensures recovering mercury that would otherwise have been lost in the air and the miners operating costs are reduced as they do not have to buy nearly as much mercury.
- Mercury retort use is now becoming obligatory and miners who use the device have the benefits of getting more support from the government and organisations that support responsible mining.

Barriers to the use of mercury retorts

- Upfront investment costs can be high for miners.
- The process is slower than the open burning process.
- Miners are skeptical that they cannot see the amalgam during the process as one has to cover it in a closed cap.
- Gas needs to periodically be replaced, creating the risk that miners stop using the retort when the gas depletes and they resort back to working without it.

Further reading materials and resources

TIF has created a number of blogs and videos detailing its work relating to mercury risk management in the ASGM sector of East Africa.

1. **Mercury retort training in Kakamega County, Kenya**: Detailed demonstration of the work TIF undertook with four ASGM groups in Kakamega to demonstrate and train miners on how to use a mercury retort in 2020.

   → Find the article here.

2. **Miner testimonial**: A woman from a gold mine from Mwangaza Mining Group in Kakamega County, Kenya, speaks about how her experience learning how to use a mercury retort and the benefit that it brings.

   → Find the video here.

Mercury reduction through improved concentration techniques

Taking mitigation a step further, moving beyond the need for mercury entirely can provide better health and environmental outcomes than managing its use more responsibly. A range of equipment can be used to increase the rate at which miners can recover gold from gold-bearing material to the point where the use of mercury is no longer necessary.

TIF has showcased and provided access to this technology to artisanal miners which allowed them to process their ore without the use of mercury. Specifically, a centrifugal concentrator (one popular model is known as the "Gold Kacha"), a sluice mat and a shaking table were provided to a mine group in Kenya, a hub of mines in Uganda (see Figures 7 and 8) and three mine groups in Tanzania. On top of this, efforts were made with the mining groups in Uganda to trial the use of shared processing facilities.

The initial cost for any of these sets of equipment started at USD 55,000, including installation and training the miners. The equipment comprised of a Gold Kacha, a shaking table, a water pump, 1000 L plastic tank and a 30 kVA generator. These technological improvements were expected to achieve processing efficiencies that allowed for up to 90% recovery rate in perfect conditions, which is a significant increase compared to the conventional methods in place prior to installation, which typically only yielded a 40% recovery rate.

The initial plan was to establish a processing hub where miners would easily process their ore within the shortest time possible, particularly in that it would allow for smelting, which would circumvent the need for mercury use.

Centrifugal Concentration Technology

The Gold Kacha system consists of a centrifugal machine, inside of which is a ribbed bowl that rotates such that increased centrifugal force casts lighter concentrates off to the side, leaving heavier gold concentrate remaining in the bowl for further processing. Beneath the end of the Gold Kacha, a sluice mat table traps the concentrates that escape from the machine to ensure that any heavy gold particulate matter is captured before it finds its way to the waste ponds.

Figure 12: Gold Kacha without a sluice box located in Busia, Uganda, installed and operated by TIF throughout 2019 and 2020

Figure 13: Busia Miners gathers with project partners to compare efficiency of the gold Kacha and classical sluicing, Busia Uganda

Advantages of a Gold Kacha

- A 95% gold recovery rate, which is much higher than the classical sluicing method, which only achieves around 40% recovery.
- Gold Kacha is significantly faster than sluicing.
- Bulk processing that enables faster, less cumbersome gold processing.

Disadvantages of a Gold Kacha

- Lack of support to ASGM operations from equipment manufacturers and suppliers, without which it is hard for miners to achieve full benefit for the equipment.
- Upfront investment costs are high, which can only be justified by high-capacity operations that mine higher-grade ores.

Comparative test between Gold Kacha and classic sluicing

A Gold Kacha was installed in a mining community in Busia, Uganda on 11th March 2020 as part of a trial to assure the AMPs of the increased efficiency of the technology compared to conventional sluicing methods commonly in use. Equal amounts of ore taken from the same gold reef were fed into the sluice and the Gold Kacha to ensure an objective test, with the gold recovered from each system weighed in order to compare their gold recovery efficiency.

From 45 kg of gold ore, the Gold Kacha yielded 3.26 g of gold and 2.76 g was produced from the traditional method in the nearby sluicing pond—a difference of 0.5g (18%), with the former only requiring 20 minutes to complete processing. This was an effective demonstration of not only the superior recovery efficiency of the new method, but also demonstrating the subsequent reduced amount of mercury required to amalgamate the gold concentrate after this processing stage.

Advantages of centrifugal concentration

- Yields a higher amount of gold from the same quantity of ore concentrate.
- The small volume of concentrate remaining in the Gold Kacha helps minimise the amount of mercury used to amalgamate when compared with sluicing.

Further resources

TIF in collaboration with its partners facilitated a competition in the gold mining community of Busia, Uganda to compare and demostrate the efficiency of the centrifugal concentrator, otherwise known as the gold kacha to the sluice box – a slanting device predominantly used in gold concentration in ASM communities worldwide.

Video: gold processing competition in Uganda: An up-close look at the comparison between the Gold Kacha and the sluice box setup clearly demonstrating the higher efficiency of the gold kacha compared to traditional sluice boxes.

→ Find the video here.

Eliminating mercury usage through the introduction of alternatives

While mercury management and emissions reductions are crucial steps for safeguarding both people and environment, the goal should be mercury elimination. Mercury-free gold production stands to benefit not only the health of miners and their communities but holds the promise of enhanced efficiency and thus, increased profitability of mining activities - although conditional to a significant up front investment.

Mercury-free gold processing in ASGM can be achieved through either direct smelting or through a chemical process called leaching, as explained below, which has been adopted at scale in the context of industrially mined gold.

Direct smelting
The above described methods of more sophisticated ways of concentration do not only lead to a reduction in mercury usage but also allow AMPs to go into direct smelting - the process of using heat and the addition of a catalyst such as borax to separate gold from other non-precious metals. Direct smelting requires a steady supply of heat which is usually dependent on steady power supply but could also be done by a fire-heated furnace. Smelting comes at a cost for consumables such as crucibles and the catalyst that is being added, making it costly in the context of small volumes of gold - as in just a few grammes of gold.
This means, direct smelting becomes an option if mines have access to advanced concentration methods, appropriate machinery, stable power supply and sufficient volume to justify the cost associated with this process.

Once smetled, gold is referred to as doré, boasting a gold purity of anywhere between 60% - 95%.

Leaching
In addition to using mercury, some artisanal miners have adopted the use of other chemical processes, most prominently the practice of cyanide leaching. During this process, mined material with lower gold content is typically used – known as tailings, that have been separated from the more gold-rich material, can be treated with a cyanide solution in order to extract a portion of the gold that still remains in the material. In principle, cyanide could be used to treat not only tailings, but primary material extracted from the ground, which would forego the need for mercury. Cyanide leaching has the potential to be a clean alternative to mercury when managed appropriately, however, it poses an environmental risk when used in conjunction with mercury as this can mean that the tailings are contaminated with mercury, creating another route for the poisonous metal to enter into soil and water.

In many countries, local environmental protection agencies are yet to catch up with the emergence of leaching plants in the sector leading to often times poorly managed and hazardous facilities that result in ground water contamination or, as in the case of Kenya, the death of domestic livestock. The process also necessitates the need for the availability of working capital to cover mine operations as cyanidation takes between 2 - 4 weeks to complete, a factor that does not favor ASM operations that depend on the reliability of daily offtake.

Lessons learnt working on phasing out mercury

Addressing the issue of mercury can be a sensitive topic given its significant role in artisanal and small- scale gold mining, and even with the existence of mitigation strategies and substitutes, it is difficult to motivate people to change their habits – not only specific to mercury but in all aspects of mining operations. Initiatives to improve mercury management are larger than any one mining group and the entity that is pushing to change practice must hold the burden of creating sustained changes in behaviour.

Financial commitments with conditions relating to improved mine management are a compelling way to do this, but performing pilot training sessions to showcase the potential of improved equipment also has value and can be a catalyst for future change and even sectoral shift. One example of this is TIF's work with the Nsangano gold mine in Nyarugusu, Tanzania which received processing equipment but due to a lack of confidence in the use of the equipment, they have remained inactive. Hopefully, by doing more trial tests it can help gain

the miners' faith in change over time.
Reflecting on our experience with mining organisations across the three broad areas of managing exposure, vapour capture, and improved concentration techniques, we have summarised some important takeaways for future work:

Improved mercury handling by PPE sensitisation
- Facilitate the procurement of appropriate PPE for mines covering initial costs, to help demonstrate their purpose
- Practical trainings in PPE use and regular follow up checks on usage helps miners develop the behavioural pattern to use them.
- Communication needs to stress inefficiencies as much as negative health impacts.

Mercury vapour capture using retorts
- Procure retorts locally to support local manufacturers.
- Make the use of retorts an obligatory prerequisite for a mine to qualify for investment.
- Follow up with miners, either via phone or in person, in order to facilitate change.

Mercury reduction through improved concentration techniques
- Involve miners at every stage of equipment provision, allowing them the space to clearly communicate their wants and needs.
- Conduct thorough feasibility assessments regarding mine productivity are required before investing
- Certain equipment such as shaking table or smelting apparatus will not be financially viable at the beginning of a mine partnership, due to the high costs and considerable site preparation required.
- Invest in technical training and support of miners on the ground during the introductory period to ensure skilled operation.

ABOUT US

About TDi Sustainability

TDi Sustainability is a consulting firm specialised in business strategy and risk management helping businesses along any stage in the value chain, from mining through to retail, achieve their sustainability objectives, whether they pertain to a specific product or collection or encompass the entire value chain.

TDi's expertise covers key environmental, social, and governance issues, from climate change to human rights, and is constantly enriched by TDi's specialist teams of researchers, consultants, and practitioners on the ground. The firm has experience covering multiple geographies, jurisdictions, industries, and materials, including but not limited to minerals, such ascoloured gemstones and diamonds, precious metals, textiles, fragrances and cosmetics ingredients.

Feel free to contact us at: acarter@tdi-sustainability.com
Visit our website to learn more.

About The Impact Facility

The Impact Facility for Sustainable Mining Communities (TIF) is a UK-registered charity with the mission of 'Turning Minerals Wealth into Community Prosperity'. With active programmes across East and Central Africa, TIF has specialised in the engagement with and investment into the professionalisation of artisanal and small-scale mining communities. TIF takes an incentive-based and investment-led approach to SME development, leveraging blended finance by responding to the growing demand for responsibly produced metals and minerals of downstream users and the impact investment community.

TIF promotes an inclusive approach to value chain development in resource-rich areas situated in challenging sourcing environments, in an effort to enable a just transition from a fossil fuel-based to a green, mineral-based economy. Working in partnership with actors across and along complex mineral supply chains, TIF seeks to enable equitable access to finance and equipment, capacity development, and fair and formalised markets for their products.

Feel free to contact us at: david.sturmes@theimpactfacility.com
Visit our website to learn more.

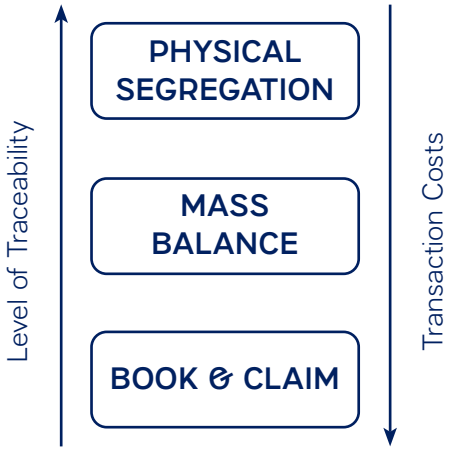
ANNEXES

Annex 1: Different sourcing models explained

This chapter provides an overview of the different models that exist[5], starting with a model of physical segregation and direct integration into the supply chain, up to a Book & Claim model, where the physical traceability is detached from the sustainability claims.

Different programmes and certification schemes utilise different ways of integrating material. Each brand should determine for themselves, what level of traceability and what level of ESG assurance and sourcing claim is right for their company.

As a rule of thumb: the higher the level of traceability and control, the higher the cost of engagement.



Model 1: Identity preservation

In this comprehensive Chain of Custody model, the physical product can be traced back to its sustainable source. Throughout the supply chain the production of each identifiable source is kept separate from the products of other sources, even if the latter were produced according to the same standards. At the point-of-sale consumers can be informed about this unique source. This level of traceability is something that finds its application in specialty coffee or single origin cocoa supply chains in the food and agriculture sector, where intrinsic and measurable quality (in this case taste) is the result of maintaining the identity of the origin until the end. Identity preservation also adds to value perception in the trade of precious stones of higher value, e.g., diamonds that might be assessed and indexed individually. Here the concern is not an intrinsic quality of the product, but the associated Environmental, Social and Governance (ESG) claim of not being a 'blood diamond'. Only by being able to prove the origin, can the consumer be assured that the diamond on their wedding ring or necklace has not been associated with human rights abuses.

The high value of the gold commodity makes it possible to cover the costs linked to maintaining segregation throughout the chain. This mechanism lends itself to products/materials that require little or no (bulk) processing; materials that usually are not mixed, and where processing costs develop linearly, meaning that economies of scale are difficult to achieve. Refined gold usually does not fall into this category.[6]

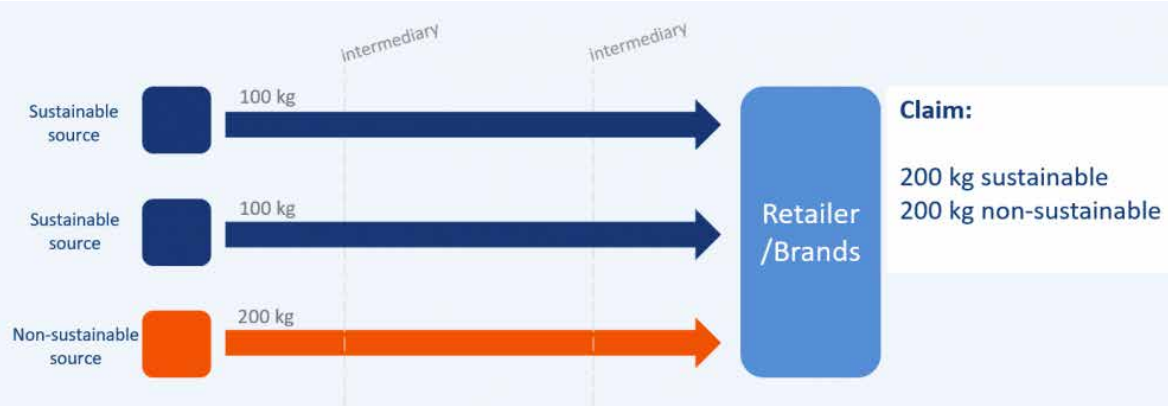


Figure 14: Identity preservation

[5] The visual in this chapter originated from: https://www.chainpoint.com/solutions/supply-chain-traceability/

[6] Adapted from OECD (2016), OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict- Affected and High-Risk Areas: Third Edition, OECD Publishing, Paris.

Model 2: Segregation

If an aggregated flow of products that was produced according to the same sustainability standard is kept strictly separated from other products as they traverse through the supply chain, this is in line with a segregation model. The product a consumer holds may not be traced back to a single source, but they will be guaranteed 100% sustainable. An example for such a claim would be cocoa or tea that is certified organic, a trait that would be lost as the product gets mixed with material originating from foreign, uncontrolled sources. For gold in the context of ASM projects, a segregated claim should be maintained up to the level of refining, to ensure the integrity around sustainability claims.

In a system maintaining full segregation from mine to market, the final user/consumer buying a piece of jewellery, or an electronic device can trace the origin of each component or mineral back to a group of mines, which are being monitored and assessed against a credible ESG framework, such as PlanetGOLD. Segregation of the gold only works or makes sense if the origin is verified. Once traceability is lost, or materials are physically mixed with other non-traced materials, full-segregation status cannot be regained.

When talking about a verified origin, this could refer to either a specific mine site (allowing identity preservation as described above) or a selection of mines, but also could refer to an entire area that is effectively controlled and monitored. Examples of segregated supply chains can be found in the textile and food sectors. One such example would be food items or cotton fabrics that are certified as organic. In a fully segregated system, consumers are expecting to receive uncontaminated products originating from a group of producers that all meet the standards stipulated by the relevant certification system. In the case of organic food, the resulting claim can be verified by checking for (traces of) banned pesticides and chemicals. To maintain (contamination-free) organic status, processing facilities must either exclusively utilise certified material or, alternatively, halt production to clean all processing facilities to a degree that contamination cannot occur when switching between certified and non-certified production.

Maintaining traceability in the gold sector through full segregation comes at a significant cost once ore reaches industrial refining. Gold refining to bullion grade (99.99% purity) is a complex (chemical) industrial process, based on continuous throughput of material. Consequently, to maintain physical segregation of gold from a specific group of mines, refineries would either need to invest in an additional production circuit used exclusively for the project at hand (this option will usually be cost prohibitive), or stop production, clean their facilities, and swap all chemicals that contain gold (which also would incur significant additional costs). As a closing thought, segregation down to the final processing step or sale to consumers only makes sense if it affects intrinsic product properties (such as organic 'non-contamination') or is legally required or expected by the consumer (as seen in the diamond sector). Refined gold is a globally traded commodity that cannot be distinguished from gold from elsewhere. Accordingly, the preliminary recommendation is to either avoid refining (and instead using smelted material for jewellery production) or alternatively operate using a mass-balance claim.

Model 3: Mass-Balance

For efficiency, production process, or cost reasons, it is not always feasible to segregate sustainable and non-sustainable products, especially when there is no physical difference between the two. In the mass- balance traceability model, products from both sustainable and

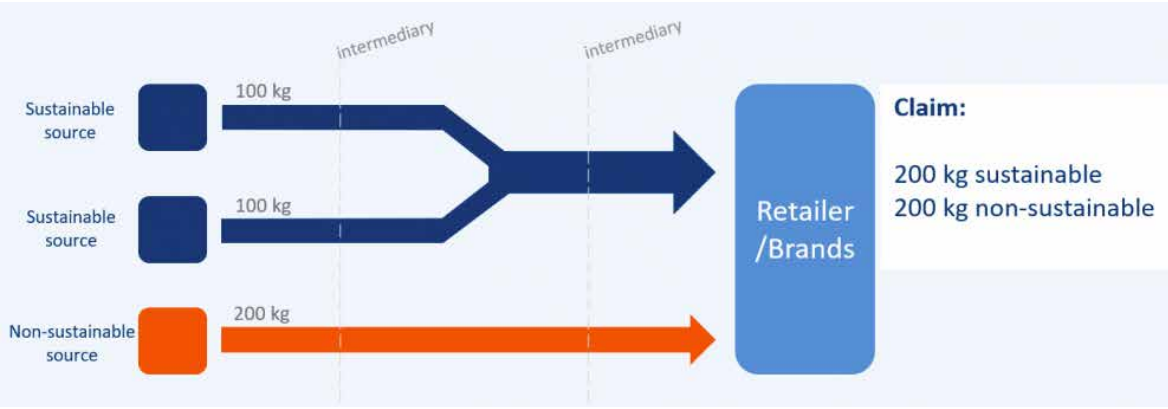


Figure 15: Physical segregation

non-sustainable sources are mixed, but as they move through the supply chain an exact account of volume ratios is maintained. Keeping track of the mass balance, ensures that the amount of sustainable product sold to consumers (after it has been mixed with non-sustainable material) equals the amount (or volume ratios) of sustainable product originally produced.

Mass-balance is adequate or reasonable to consider for a commodity such as gold, as buyers want assurances that the gold they buy meets international due diligence criteria. In practice, mass balance means that the sustainable material is mixed with other non-certified/ foreign material, but at the end of processing, no more than the original volume is sold on to the next actor. The point is that this tracing system should preclude the sale of products with illegitimate claims to sustainability.

This means that if an AMP were to provide 1 kg of gold doré, at 95% purity to a refinery, the refinery would later provide 950g of pure gold back to the organisation (or a designated buyer) – gold that is physically mixed with gold from other sources. Non-mineral examples of mass-balance systems can be found in a palm oil certification system (Roundtable for Responsible Palm Oil), where producers gradually increase the content of certified material without segregating the palm oil in the process. In ASM gold production, mass balance accounting is currently allowed and used by both Fairtrade and Fairmined certification systems due to the difficulty of maintaining full traceability throughout the refining process.

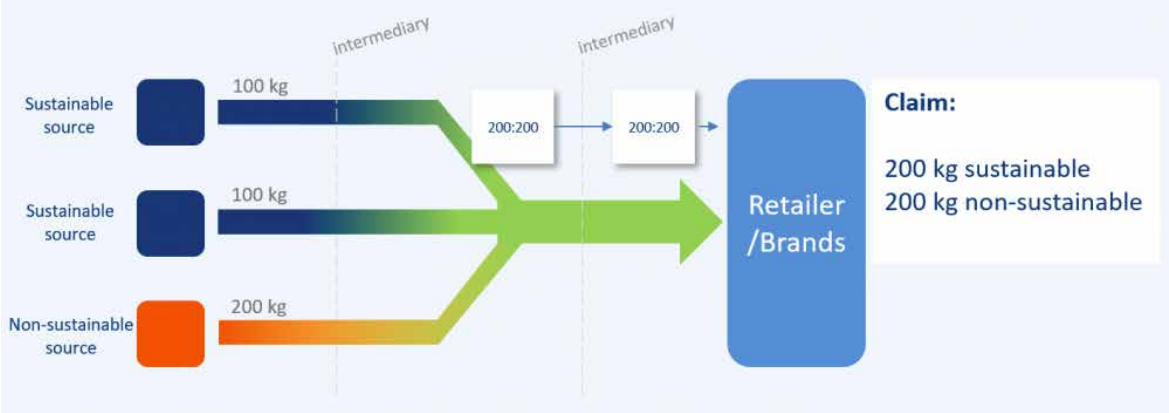


Figure 16: Mass-balance

Model 4: Book & Claim

In supply chains that are not yet thoroughly organised, it may not be possible to segregate or carefully account for the volume ratios of sustainable and non-sustainable products. In this case, a Book & Claim model can be applied. Where physical products are mixed and traded as conventional, the "right to claim sustainable sourcing" is traded separately in the form of sustainability certificates. The sustainability claim as such, is not tied to the physical product, but to the production volume reported through the creation of certificates.

This system makes sense if the product attributes are indistinguishable from other products. Maintaining any level of traceability would neither increase the intrinsic nor the attributed value, and often the transport costs or feasibility of logistics for these products are cost prohibitive. Two examples for this are 'green energy' on the consumer market (as all energy is fed into one grid) and the second is carbon certificates, traded internationally for carbon offtake.

In reference to gold, this would mean that the organisation implementing gold exports track production volumes of mercury-free gold, for which certificates are created and sold separately from the physical gold.

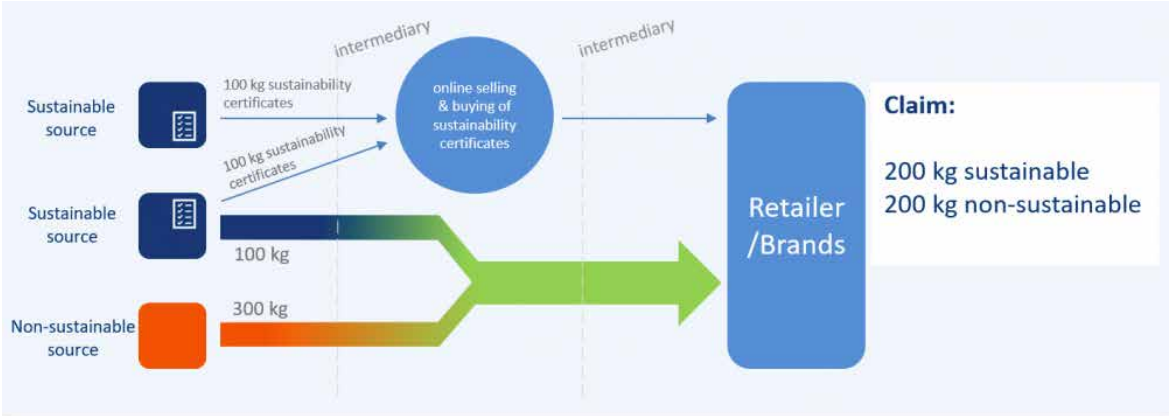
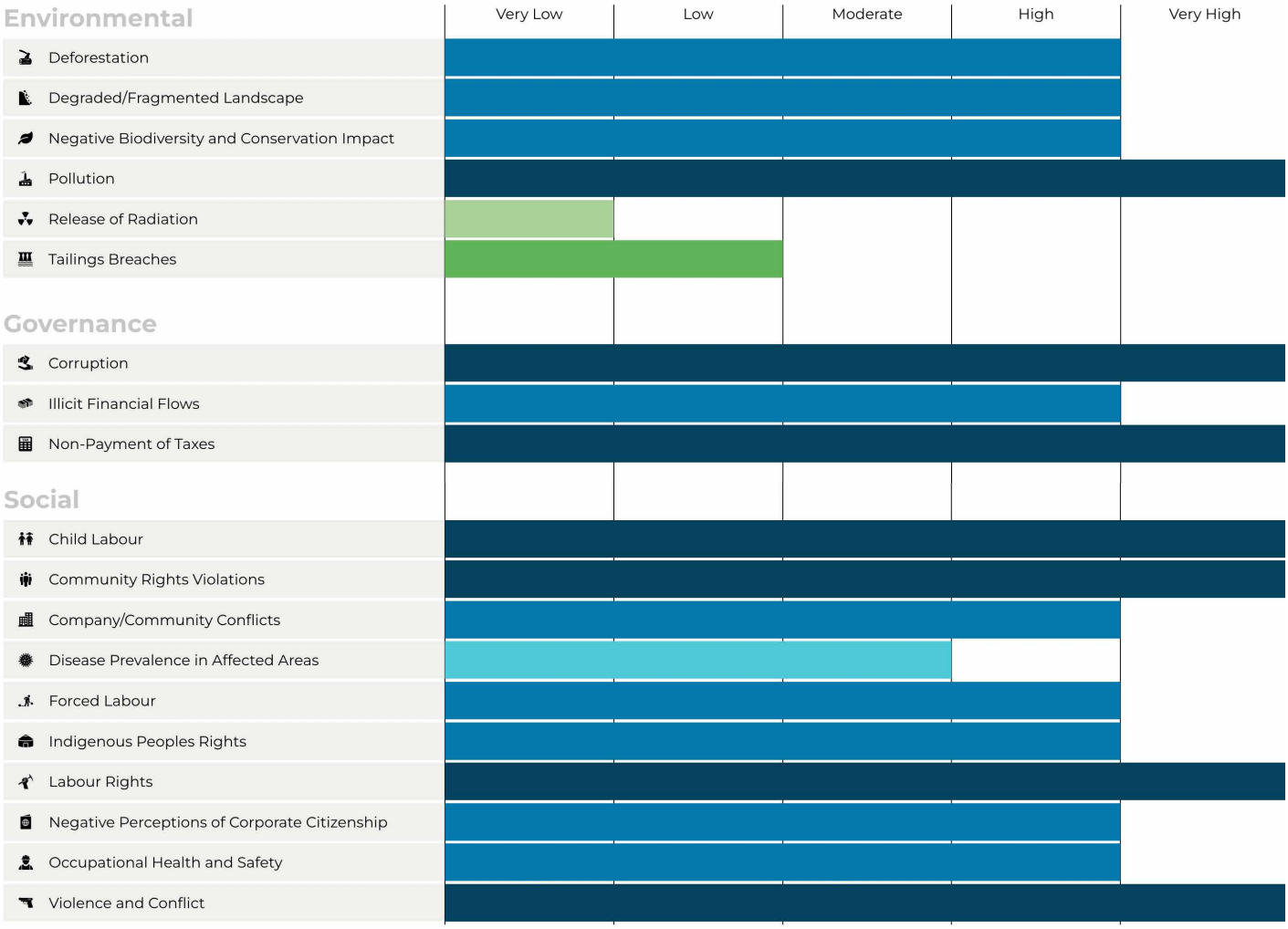


Figure 17: Book & Claim

Annex 2: Global ESG risks associated with gold extraction, processing and trade

The following section provides an overview of the ESG risks associated with gold supply chain - looking at both ASM and LSM - based on TDi Sustainability's Material Insights[7] platform.



The rating for each ESG issue category is based on published reports relating to the supply chain of the material, according to English-language reporting since 1 January 2017. Data on published reports is collected using TDi Search360, TDi Sustainability's web data collection tool. TDi then grades each reported issue to determine the severity of any allegations and the prominence and credibility of the source. The rating for each ESG issue is calculated by aggregating the data on each reported issue.

The ratings are a measure of the importance of the issue for the people or environment that it affects, and the reputation of the businesses using the material in their products. It should be noted, however, that the data is based on allegations contained in public reports, rather than established fact. The actual effects can therefore be more or less severe than reported.

Fast-growing mining economies, such as China, present significant risk as they often develop without adequate infrastructure in place. This lack of proper infrastructure also poses a health and safety risk. Occupational health and safety is a major issue for gold. While safety issues are reported all around the world, such issues are particularly prominent in China. In January 2021, for example, a report by The Guardian notes how a blast within a large-scale gold mine left 22 workers trapped for days.

Environmental issues are also reported as being an issue in ASGM. In South Africa, for instance, ASGM is associated with toxic water and soil contamination.

[7] https://www.material-insights.org/material/gold/

In 2020, major reports of deforestation due to ASGM in Indonesia surfaced. TDi identified a large number of reports of gold being associated with pollution. The use of mercury, prevalent amongst ASGM operations, is a primary reason for this high score. Mercury is a toxic element that allows ASGM operators to extract and concentrate gold. Use of mercury by ASGM operators accounts for approximately 37 percent of global mercury emissions, exposing artisanal miners to toxic fumes with detrimental health impacts. Mercury use in ASGM operations is an issue across the globe where the practice occurs. For example, in Ghana, ASGM is associated with mercury usage, which creates widespread water and soil contamination.

In Peru, TDi also identified a number of reports linking ASGM operations to mercury use.

TDi identified a large number of reports regarding violence and conflict being associated with large-scale gold mining and ASGM across the world. Gold is designated by the US Dodd Frank Act and the EU Conflict Mineral Regulation as a 'conflict mineral' in DR Congo (although the country is currently only a minor source of gold). The ASGM and illegal mining sector is associated with violence and conflict at the hands of criminal groups partly because many geographical areas rich with gold also suffer from poverty, corruption and weak regulatory frameworks.

In Sudan, for example, paramilitary organisations have been accused of widespread abuses committed in attempts to gain control of the country's gold production. Venezuela is also noted as a country wherein the gold sector is generally associated with violence and conflict in a similar manner. In 2020, the United Nations publicly urged Venezuelan authorities to dismantle criminal gangs running gold mines.

In Venezuela, groups of gangs reportedly fight each other for control of gold mining territory, where they charge the miners for the gold they extract.

Several reports indicate indigenous peoples' rights violations and company-community conflict occur in association with large-scale gold mining projects in Brazil.

This is because many indigenous communities live in resource-rich regions that have revenue- generating potential for extracting resources, including gold. These issues may involve large-scale gold mining companies commencing project activity without the permission of indigenous communities, or they may involve ASGM, wherein small groups of gold miners invade indigenous areas when there is a discovery of gold. These types of issues are also recorded in Australia, Canada, Argentina, Peru and Venezuela.

Company-community conflict and community rights violations are commonly reported during both large-scale gold mining projects and ASGM across the world. For example, a 2020 report states that a large-scale gold mine in Tanzania, which sells its gold to one of the world's biggest gold refineries, has been accused of beating, shooting and sometimes killing local community members. A report by USAID notes that informal ASGM in Peru often causes community conflict.

TDi identified a large number of reports of gold being associated with ESG issues regarding corruption and non-payment of taxes. These issues are reported in multiple jurisdictions and across large-scale and ASGM operations. Corruption in the gold mining sector takes many forms. It often involves bribery in the form of facilitation payments in exchange for mineral tenure licenses/permits, or to bypass other bureaucratic hurdles. For example, a large-scale Canadian-owned



Environmental degradation and armed conflict: OHS risks that often result from mining activities worldwide

mining company paid a $950,000 fine in 2018 to settle charges from the US Securities and Exchange Commission that it had made facilitation payments to officials in Ghana and Mauritania.

A 2020 report notes how corruption in Peru can exacerbate environmental damage through such mechanisms as the bribing of environmental inspectors at the micro-level, and the rollback of regulations to benefit big business interests at the macro level.

Non-payment of taxes is often automatically associated with informal ASGM activity, which is partially why such a large number of these reports were identified by TDi. It is worth noting that in many jurisdictions, it is impractical, infeasible, or even impossible for ASGM operators to mine in a legal manner and thus pay taxes. This is sometimes due to the complex regulatory systems in many resource-rich countries.

Sluicing, the first concentrating process to trap gold on the inclined ore before the panning method in artisanal mining