

**A HANDBOOK ON**

# **MERCURY-FREE MINERAL PROCESSING TECHNOLOGY**

**Artisanal Gold Council**

**“Roadmap to Responsible Gold -  
Guyana”**



# Table Of Contents

<b>Introduction</b> .....	<b>4</b>
<b>Overview of Project</b> .....	<b>5</b>
<b>Chapter One: Understanding the Impact of Mercury on Gold Mining</b>	
What is mercury.....	<b>7</b>
Mercury usage in the extraction of gold.....	<b>8</b>
How is mercury released to the environment?.....	<b>9</b>
Harmful effects of mercury on Human Health.....	<b>10</b>
Harmful effects of mercury on the Environment.....	<b>12</b>
Addressing the risks.....	<b>14</b>
<b>Chapter Two: Mercury-Free Technologies and Alternatives</b>	
<b>2.1 Identifying Appropriate Mercury Free Gold Solutions</b>	
Reasons for adopting Mercury Free Gold Solutions.....	<b>15</b>
Two-step approach towards mercury-free processing.....	<b>16</b>
<b>2.2 Methods for Improving Gold Concentration and Reducing Mercury</b>	
Gold liberation.....	<b>17</b>
Gold Screening and Classification.....	<b>19</b>
Gold Recovery .....	<b>21</b>
Mercury Reduction Best Practices .....	<b>23</b>
Zero Mercury Use Methods.....	<b>24</b>
Chemical Processes.....	<b>25</b>
Technology Pricing.....	<b>28</b>
<b>Conclusion</b> .....	<b>32</b>
<b>References</b> .....	<b>33</b>

# Who can use this document?

**Governments** can utilize the mercury free handbook as a resource to educate themselves on technical aspects of intervention programs and policy considerations to reduce mercury use in ASGM. It can also serve as a decision-making tool to understand best practices and provide an explanation of the technical fundamentals to support the formalization of the ASGM sector.

**Civil society organizations** can benefit from the mercury-free handbook in the following ways:

1. Educational tool: The handbook can provide valuable information for civil society to better understand the complexities of ASGM, including the environmental and health impacts of mercury use. It can help them advocate for sustainable mining practices and raise awareness among their members and the public.
2. Explanation of barriers: The handbook can outline the challenges and barriers that mining communities face when trying to improve their mining practices and reduce mercury use. By understanding these obstacles, civil society organizations can work towards addressing them and supporting miners in transitioning to safer and more sustainable methods.

**Miners** can benefit from the mercury-free handbook in the following ways:

1. Graphic introduction of best practices: The handbook can visually present best practices in a clear and accessible way, making it easier for miners to understand and implement sustainable mining techniques that reduce mercury use.
2. Guide on local conditions: The handbook can provide guidance on how local conditions, such as geography and resources, can influence the adoption of improved mining practices. This information can help miners tailor their approaches to suit their specific circumstances.
3. Explanation of barriers: The handbook can outline the various barriers that miners may encounter when trying to improve their practices and reduce mercury use. By understanding these obstacles, miners can develop strategies to overcome challenges and make positive changes in their mining operations.

# Who can use this document?

**Researchers** can use the mercury-free handbook as a resource for gathering information on sustainable mining practices, mercury use in ASGM, and environmental and health impacts. They can also reference the handbook for data and case studies on successful initiatives to reduce mercury use in mining. The handbook can serve as a valuable tool for researchers conducting studies on ASGM and looking for practical solutions to address mercury pollution.

**Students** can use the mercury-free handbook as an educational resource to learn about the environmental and health impacts of mercury use in mining. The handbook can provide age-appropriate information on sustainable mining practices and the importance of reducing mercury pollution. It can also serve as a platform for discussion and project ideas related to environmental conservation and responsible mining practices. **Teachers** can incorporate the handbook into their curriculum to engage students in understanding the complexities of ASGM and the efforts to promote mercury-free mining practices.



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## Introduction

The environmental impact of mercury use in gold mining is a pressing concern that has significant implications for the ecosystems and human health. Mercury, a highly toxic heavy metal, is commonly used in artisanal and small-scale gold mining operations to extract gold from ore. However, the use of mercury in this process has potentially detrimental effects on the environment, leading to widespread pollution of water bodies and soil and posing serious health risks to communities living near mining sites.

This handbook highlights the importance of transitioning to mercury-free practices. Transitioning to mercury-free practices in gold mining is crucial for mitigating environmental and health hazards. Adopting alternative methods such as gravity separation, cyanidation, or non-toxic reagents can significantly reduce mercury pollution and protect the ecosystems and local populations adversely affected by mercury contamination. By promoting mercury-free practices, we can safeguard water quality, preserve biodiversity, and promote sustainable development in gold mining regions.

Additionally, the handbook aims to provide a comprehensive guide for miners, mining communities, policymakers, and stakeholders on the importance and feasibility of eliminating mercury in gold extraction, creating awareness about mercury's environmental and health impacts, and promoting adopting alternative technologies and practices.

Through disseminating information, best practices, and guidelines outlined in the handbook, stakeholders in the gold mining industry can work towards sustainable and responsible mining practices that protect the environment and human well-being.

# Overview of the “Roadmap to Responsible Gold” Project

The Roadmap to Responsible Gold Project is being implemented by the Artisanal Gold Council (AGC) with funding from the United States Department of State (USDoS). The Project, launched in March 2023, is a 36-month long project designed to develop and test at the field level the tools required to reduce the use of mercury in the artisanal and small-scale gold mining (ASGM) industry in Guyana through the identification of appropriate technologies and business models for mercury-free gold production in the sector.

This handbook outlines mercury - free processing technologies, their potential applications for the Guyana environments, and how they may boost recovery, enhance efficiency, and eliminate the need for mercury in your business.

Chapter One:  
**“Understanding Mercury and its Impact in Gold Mining”**

# WHAT IS MERCURY?

**Mercury** (Hg) (elemental), commonly known as quicksilver, is a heavy, silvery-white metal that is highly toxic and can be hazardous to human health and the environment.

Mercury has long been used in small-scale gold mining operations to extract precious metals from ore. While effective, this process poses significant risks to human health and environmental sustainability.



# MERCURY USAGE IN THE EXTRACTION OF GOLD

Elemental mercury is used in amalgamation, a process for gold extraction, particularly in artisanal and small-scale gold mining (ASGM). In this process, mercury is mixed with gold ore to form an amalgam that is then heated by vaporizing the mercury, leaving only a gold sponge behind.

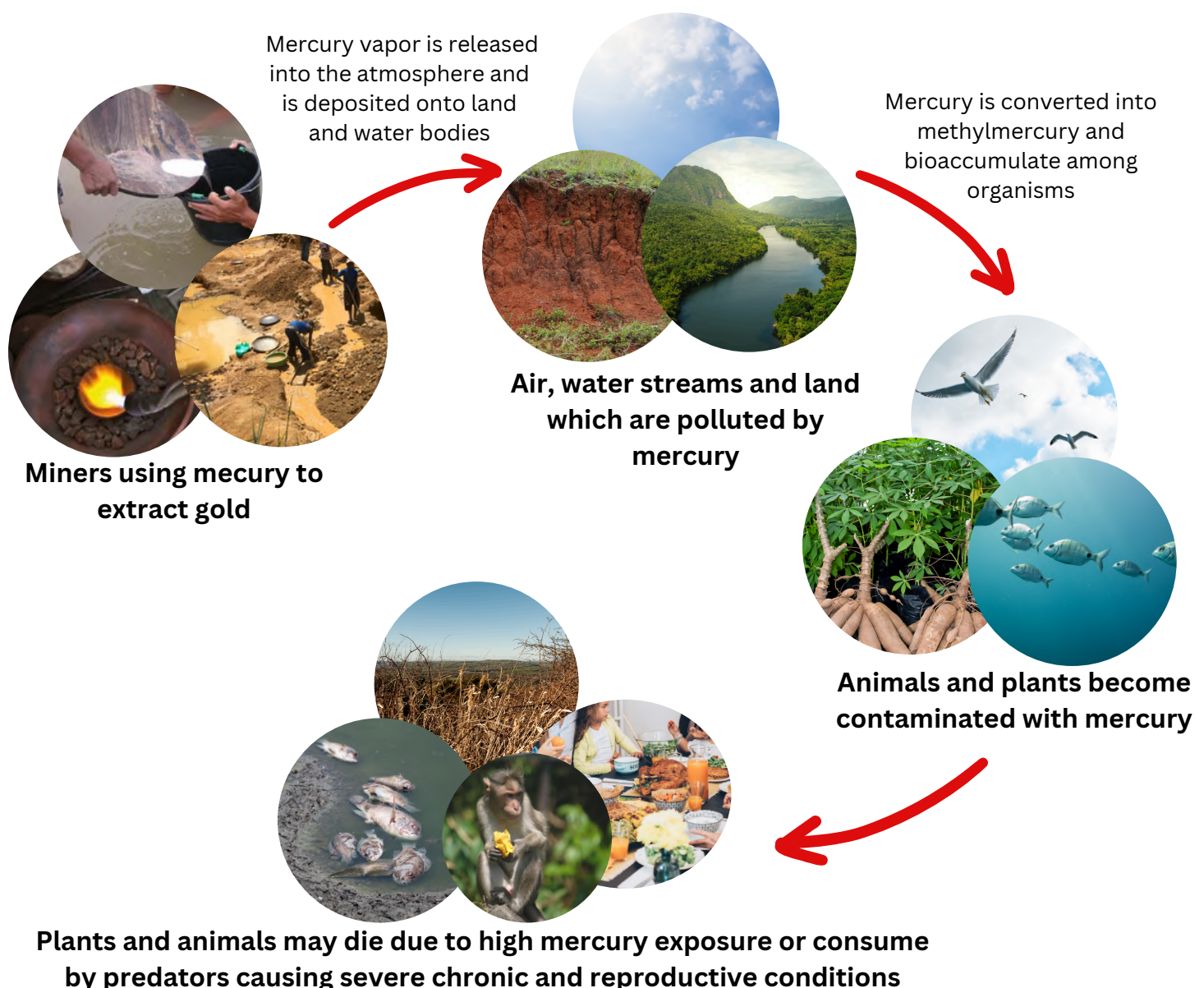
However, this technique releases mercury vapors, which contribute to elevated levels of inorganic mercury in soil, sediment, and water bodies. This creates conditions favorable for microorganisms' methylation of mercury. As a result, methylmercury levels can become elevated in the surrounding aquatic ecosystems, posing risks to human and wildlife health.

# HOW IS MERCURY RELEASED TO THE ENVIRONMENT?

Mercury from gold mining can be released into the environment when used irresponsibly through various pathways, including:

1. **Atmospheric Emissions:** Mercury vapor is released into the air during amalgam burning.
2. **Water Contamination:** Mercury enters water bodies through runoff and leaching from mining activities, contaminating rivers, lakes, and groundwater.
3. **Soil and Sediment Pollution:** Mercury from mining activities contaminates soil and sediment, posing risks to plant and animal life.

Below is a representation of how mercury is released and impacts on human health and the environment:

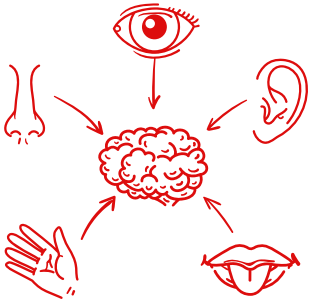


# POSSIBLE HARMFUL EFFECTS OF MERCURY ON HUMAN HEALTH

Mercury can accumulate and concentrate in organisms through the food chain. This process, known as **bioaccumulation**, can lead to higher levels of mercury in predators at the top of the food chain, such as fish, birds, and mammals. This can result in serious health issues for these organisms and those higher up in the food chain, including humans.

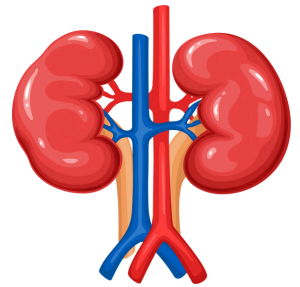
## Damage to the Nervous System

Mercury can damage the nervous system, particularly in developing fetuses and young children. Prenatal mercury exposure can result in developmental delays, cognitive impairment, and learning disabilities. In adults, mercury exposure can cause tremors, memory loss, ability to feel and taste and difficulty with coordination and balance.



## Damage to the Kidneys

Mercury is known to accumulate in the kidneys and can cause kidney damage over time, leading to kidney dysfunction and failure.



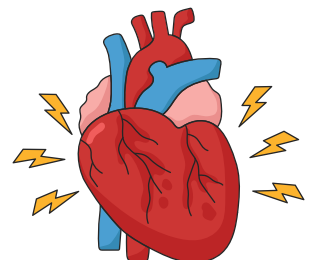
## Difficulty Breathing

Inhalation of mercury vapor can irritate the respiratory system and cause symptoms such as coughing, shortness of breath, and chest tightness.



## Cardiovascular Diseases

Increase the risk of cardiovascular diseases, including heart attacks and hypertension.



# POSSIBLE HARMFUL EFFECTS OF MERCURY ON HUMAN HEALTH

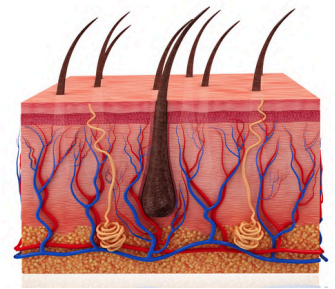
## Stomach Illness



Ingestion of mercury-contaminated food or water can lead to gastrointestinal issues such as nausea, vomiting, abdominal pain, and diarrhea.

## Damage to the Skin

Direct contact with elemental mercury or mercury compounds can cause skin irritation, rashes, and dermatitis.



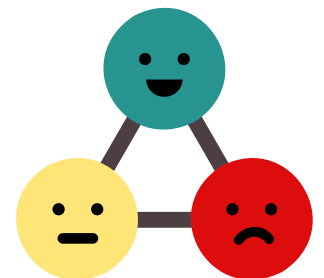
## Reproductive Challenges

Mercury exposure has been associated with reproductive problems, including infertility, miscarriage, and developmental abnormalities in offspring.



## Behavioral and Mood Changes

Chronic exposure to mercury vapor can affect mood and behavior, leading to irritability, anxiety, depression, and other psychological symptoms.



# POSSIBLE HARMFUL EFFECTS OF MERCURY ON THE ENVIRONMENT

## Toxicity to Aquatic Life

Mercury contamination in water ways can be toxic to aquatic organisms, including fish, amphibians, and invertebrates. Exposure to even low concentrations of mercury can impair growth, reproduction, and behavior in aquatic species, leading to population declines and ecosystem disruptions.



## Loss of Biodiversity

Mercury pollution can contribute to the decline of vulnerable species and biodiversity loss in affected ecosystems. Species that are particularly sensitive to mercury toxicity may be unable to thrive or reproduce in contaminated environments, leading to shifts in community structure and ecosystem dynamics.

## Contamination of Soil and Sediments

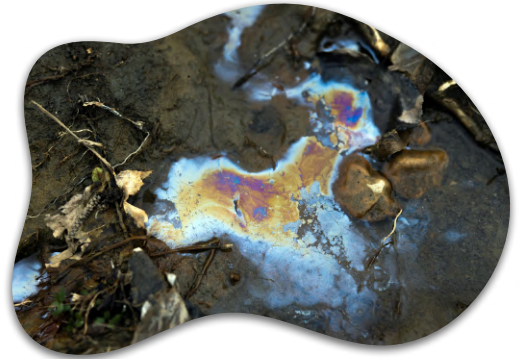
Mercury released into the environment can accumulate in soils and sediments, where it may remain for long periods. Contaminated soils can pose risks to terrestrial organisms and may serve as a source of mercury exposure for plants, animals, and humans.



# POSSIBLE HARMFUL EFFECTS OF MERCURY ON THE ENVIRONMENT

## Degradation of Water Quality

Mercury contamination can degrade water quality and impair the use of water resources for drinking, irrigation, and recreation. High levels of mercury in water bodies may lead to fish consumption advisories and restrictions on fishing activities to protect human health.

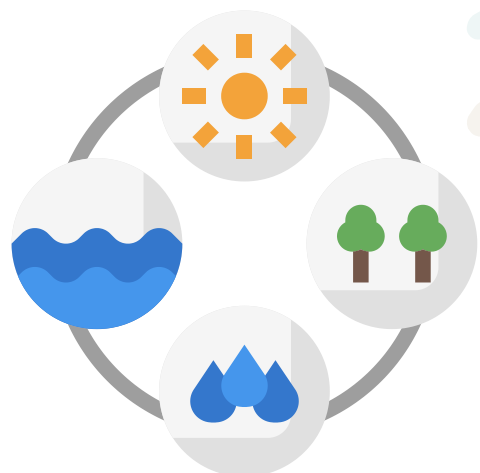


## Damage to Terrestrial Ecosystems

Mercury can also impact terrestrial ecosystems through atmospheric deposition and runoff from contaminated water sources. Plants and soil organisms may be affected by mercury pollution, with potential consequences for ecosystem functioning and nutrient cycling.

## Global Dispersion

Mercury pollution is a global issue, with mercury emissions from sources such as artisanal gold mining contributing to atmospheric deposition and long-range transport of mercury to remote regions. This global dispersion can result in widespread contamination of ecosystems far from the sources of mercury emissions.



# ADDRESSING THE RISKS

Mercury is a long-lasting environmental pollutant that does not degrade, presenting risks even after mining activities cease.

Therefore, transitioning to safer extraction methods and promoting responsible mining practices are essential to reduce the long-term risks associated with mercury contamination.

By addressing these challenges, we can work towards sustainable and environmentally conscious mining practices.

Chapter Two:  
**“Mercury-Free Technologies and Alternatives”**

# Mercury-Free Technologies and Alternatives

## 2.1 Identifying Appropriate Mercury Free Gold Solutions

- Reasons for adopting Mercury Free Gold Solutions

1. **Innovation and Efficiency:** Mercury-free gold processing technologies and methods offer innovative alternatives to traditional mercury-based practices. These technologies often utilize cleaner and more efficient processes, leading to higher gold recovery rates, reduced water and energy consumption, and improved overall operational efficiency.
2. **Human Health Protection:** Mercury is highly toxic and can pose serious health risks to miners, workers, and local communities involved in gold mining and processing activities. By adopting mercury-free solutions, exposure to harmful mercury vapor and contaminated water sources can be minimized, protecting human health and reducing the incidence of mercury-related illnesses.
3. **Environmental Preservation:** Mercury pollution from gold mining operations can have devastating effects on ecosystems, wildlife, and water quality. Mercury-free gold solutions help mitigate these environmental impacts by reducing the release of mercury into the environment and preventing contamination of soil, water bodies, and food chains.
4. **Market Access and Reputation:** Increasingly, consumers, investors, and regulatory bodies are demanding responsible and sustainable practices in the mining industry. Companies that adopt mercury-free gold solutions demonstrate their commitment to environmental stewardship and social responsibility, enhancing their reputation and market access in an increasingly conscious marketplace.

# Mercury-Free Technologies and Alternatives

- **Two-step approach towards mercury-free processing**

The following two stages/steps are recommended for mercury reduction in gold recovery:

## **Step 1: Improved gold recovery methods**

Utilizing improved alternative ore processing techniques that do not involve the use of mercury is crucial in promoting mercury-free processing. This benefits miners by increasing revenue, raising awareness, reducing exposures, and fostering positive connections, paving the way for the next phase.

## **Step 2: Mercury-free technology**

Using mercury-free technology to process concentrate results in a cleaner product as it reduces or removes the harmful by-product of mercury while benefiting health and the environment.

# Mercury-Free Technologies and Alternatives

## 2.2 Methods for Improving Gold Concentration and Reducing Mercury

- **Gold liberation**

**Liberation** in gold mining is extracting gold from its host rock or ore using methods like crushing, grinding, and chemical treatment. It separates gold particles from the surrounding rock or mineral matrix, thereby increasing the probability of recovery and concentration. Liberation is a crucial step in gold mining, impacting the efficiency and success of extraction.

**Methods of liberation:**

1. **Crushing** - this is done using a jaw or hammer crusher.

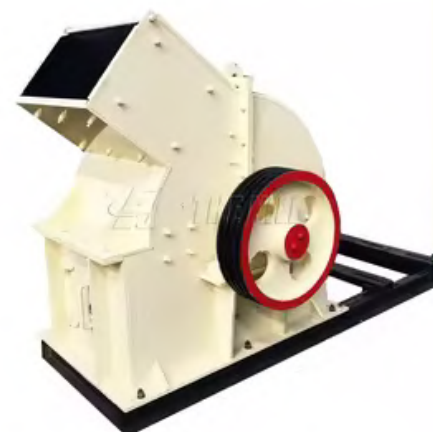


### JAW CRUSHER

Jaw crushers are machinery used to break large rocks or ore into smaller pieces for processing. They work by moving a fixed jaw and a movable jaw to compress the material against the fixed jaw. These crushers are typically used for primary crushing tasks and are effective in breaking down tough materials like rock or ore.

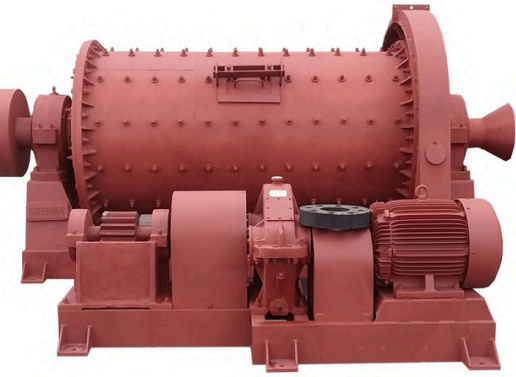
### HAMMER CRUSHER

Hammer crushers, or hammer mills, utilize rotating hammers to crush materials like limestone, coal, and gypsum. They are ideal for softer, less abrasive materials. In gold mining, they are used for secondary and tertiary crushing after a jaw crusher's initial crushing. The hammers impact the material to break it into smaller particles, aiding in gold extraction.



2. **Grinding**- this is done using Ball mill and Rod mill.

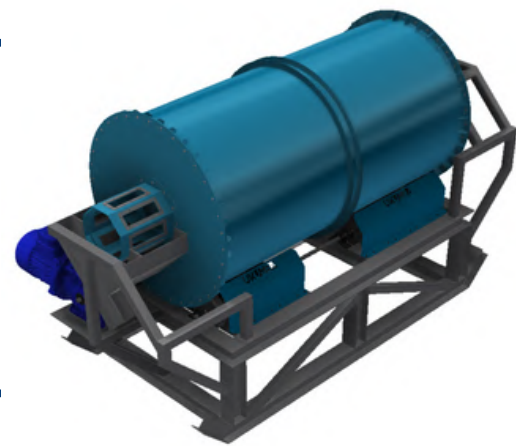
## BALL MILL



A ball mill is a cylindrical machine that rotates on its axis and uses steel balls as grinding media. It grinds the material, typically alongside a liquid like water or solvent, into a fine powder as the steel balls crush and grind the ore. Ball mills are widely used in the mineral processing industry, such as in gold mining, for efficient wet and dry grinding operations.

## ROD MILL

A rod mill is a machine similar to a ball mill but uses long steel rods instead of steel balls for grinding. The rods cascade and break down the ore as the mill rotates, producing fine particles. Rod mills are effective for processing coarse or hard-to-grind materials. In gold mining, they are commonly used in secondary grinding to decrease particle size before further processing.



## • Screening and Classification

Gold concentration can be improved by screening or classifying the ore. Various methods of classification are as follows, from simple to more improved versions:

## GRIZZLIES



A grizzly is a grid or set of parallel bars that separates coarse materials like rocks and large ore pieces from finer materials. Oversized stones and debris that can't pass through the openings are redirected using a crusher or other processing machine for further size reduction.

# Mercury-Free Technologies and Alternatives

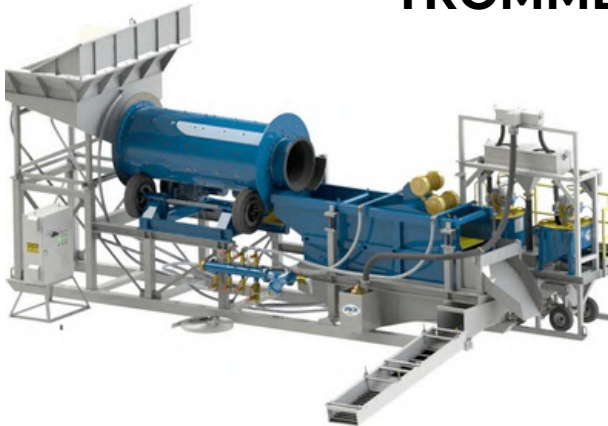
## TROMMEL

A trommel is a rotating cylindrical drum made of metal mesh or plates used to screen and classify materials like ore or gravel. Smaller particles pass through the holes or mesh while larger particles are retained inside the drum. Trommels are often used in gold mining to separate and classify materials by size before further processing.



## TROMMEL SCRUBBER

A trommel scrubber is a type of trommel with scrubbing pads or brushes on the inner surface used to wash and clean material, removing clay, mud, or other contaminants that could impede gold extraction. The scrubbing action helps break down material for better separation and processing. Trommel scrubbers are beneficial in gold mining for dealing with highly contaminated or clay-rich ores.



## VIBRATING DECKS/SCREENS

Vibrating decks/screens in gold mining are essential for separating and classifying different sizes of gold particles from the mining material. They consist of a perforated metal plate or wire mesh with vibrating mechanisms that shake and separate the gold particles by size. This process increases mining efficiency by removing oversized and undersized material, ensuring only the desired gold particles are retained for further processing.



# Mercury-Free Technologies and Alternatives

## Recovery Methods

Recovery of the concentrate after screening and classifying. Various methods are used to recover the gold concentrate- from simple to more complex and expensive methods are as follows:

- **Simple Concentration**

### SLUICING (SLUICE BOX)

A sluice box is commonly used and is the primary system used in gold mining. Its design ranges from simple ground systems that use the slope of the land to elevated boxes that can be manufactured from wood or metal, as shown in the picture. Best practices are recorded to use a “Z” box design with mats and carpets. These boxes can be improved by ensuring optimum angle, material feed speed, solid-to-liquid ratio, or slurry density combination.



- **Improved Concentration - Centrifugal Concentrators**

There are a variety of centrifugal concentrators ranging in different brands and capacities. each with its advantages and disadvantages. The most common are as follows:

### FALCON

A Falcon concentrator is a gravity separation device used in gold mining to recover fine gold particles efficiently. It works by spinning a bowl at high speeds, creating a centrifugal force that separates fine gold particles based on density. Heavier particles move to the outer edge of the bowl, while lighter particles move toward the center, allowing for efficient gold concentration. The Falcon concentrator is valuable in gold mining for recovering fine gold.



# Mercury-Free Technologies and Alternatives

## ICON

The ICON i150 Gravity Concentrator is a centrifugal gold recovery equipment used in mining. It uses gravity separation to recover fine gold particles by spinning a bowl at high speeds, causing heavier gold particles to move to the bowl's edge and lighter particles toward the center. This concentrator efficiently concentrates gold particles, making it valuable for recovery in gold mining. Additionally, the ICON is designed to be portable and easily transportable to remote mining sites.



## KNELSON

The Knelson Concentrator is a high-speed centrifuge used in gold mining to recover fine gold particles from a slurry or ore feed. It spins a bowl at high speeds, creating a centrifugal force that separates heavier gold particles to the outer edge of the bowl while lighter particles are pushed toward the center. This allows for the concentration and recovery of fine gold based on its density, making it a valuable tool in the gold mining process.



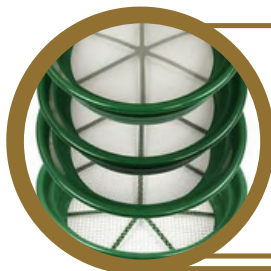
## GOLD KACHA

The Gold Kacha is a cost-effective gravity concentrator used in gold mining to recover fine gold particles from a slurry or ore feed. It operates on the principle of gravity separation, using centrifugal force to separate heavier gold particles to the outer edge of a spinning bowl or drum while pushing lighter particles toward the center. This allows for the concentration and recovery of gold particles based on density.



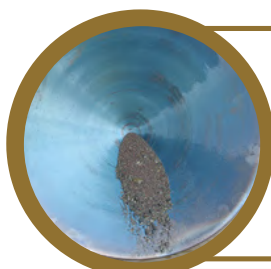
## Mercury Reduction Best Practices

Below are the best practices for reducing mercury application and safety tips to ensure the recapture and recycling of mercury. Reducing the concentrate to its purest form is the fundamental step in reducing the use of mercury in the final stage of gold recovery.



**Screen** concentrate using sieves such as a **Brazilian sieve stack**.

Use **magnets** to remove magnetite.



**Pan** concentrate to reduce oversize and less denser particles.

**Mercury Application:** When using mercury, it should be handled carefully to avoid spills.



Always use **personal protective gear** such as hand gloves and an approved mask.

While the goal is always to eliminate the use of mercury, where "feasible" and as a temporary measure during the transition to mercury-free processing, use a retort to recapture the mercury, which can be reused.



## Zero Mercury Use Methods

After recovering the concentrate and screening, here are some methods that can be used to recover the gold without mercury. The concentrate must be screened to remove oversized and denser materials.

Below are three technologies that can be used to recover gold without the use of mercury:

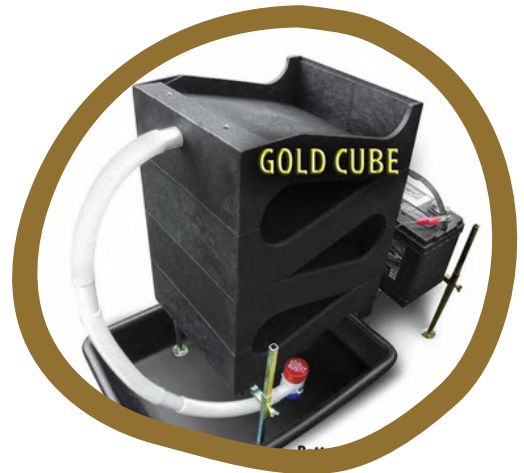
### Spiral Wheel

The Spiral Wheel Mercury Free Technology uses a spiral wheel to extract gold and other precious metals from ore without mercury. It separates heavy gold particles from lighter materials using centrifugal force. This environmentally friendly process is a sustainable alternative to traditional methods that rely on mercury, a toxic substance harmful to humans and the environment.



### Gold Cube/Warrior Box

The Gold Cube/Warrior Box is a mercury-free technology used in gold mining, featuring a cube-shaped device with trays and screens for separating and capturing gold from ore efficiently. It uses a fluidized material bed to separate heavy gold particles from lighter materials. This environmentally friendly and safe technology is used as an alternative to traditional mercury-based gold mining methods.



### Helicoid Concentrator

The Helicoid Concentrator is a mercury-free technology used in gold mining to extract gold from ore. It uses a spiral-like design to create a helical flow of water that separates heavier gold particles from lighter materials in the ore. This process does not involve mercury, making it an environmentally friendly and safer alternative to traditional gold extraction methods.



# Alternatives to Mercury

## Direct Smelting

Alternatives to Mercury	Advantages	Disadvantages
<p>1. <b>Borax</b> - is a mineral compound commonly used in small-scale gold mining as an alternative to mercury for extracting gold from ore. It acts as a flux, reducing the melting point of gold, allowing it to be easily separated from the ore.</p>	<ul style="list-style-type: none"><li>• Direct Smelting is a less toxic substance compared to mercury and does not have the same harmful effects on humans and the environment.</li><li>• Direct Smelting is safer for miners to handle and reduces the risk of health issues associated with mercury exposure.</li><li>• Direct Smelting is relatively cheaper and readily available, making it a cost-effective alternative to mercury.</li></ul>	<ul style="list-style-type: none"><li>• Direct Smelting may not be as effective as mercury in extracting gold from ore, resulting in lower gold recovery rates.</li><li>• Slower processing times</li><li>• Direct Smelting may not be suitable for all types of gold ore, and its effectiveness can vary depending on the ore's characteristics.</li></ul>

## Chemical Processes

The chemical process of refining gold is the most effective. However, each chemical has advantages and disadvantages, and their use and application must be considered.

<p style="text-align: center;"><b>Chemical Alternatives to Mercury</b></p>	<p style="text-align: center;"><b>Advantages</b></p>	<p style="text-align: center;"><b>Disadvantages</b></p>
<p><b>1. Cyanide</b> - is a toxic chemical used in gold mining to dissolve and separate gold from ore. The process involves spraying or pouring cyanide solution over finely ground gold ore, which dissolves the gold into the solution. The cyanide-gold solution is then separated from the ore, and gold is extracted using methods like absorption onto activated carbon or precipitation with zinc.</p>	<ul style="list-style-type: none"> <li>• Cyanide is highly effective in dissolving gold from the ore, allowing for efficient extraction of the precious metal.</li> <li>• Cyanide allows for high recovery rates of gold from ore, making it a popular choice in the gold mining industry.</li> <li>• Cyanide can be used to extract gold from various types of ore deposits.</li> <li>• Cyanide can be degraded and used as fertilizer</li> </ul>	<ul style="list-style-type: none"> <li>• Cyanide is highly toxic and poses serious risks to the environment if not managed properly. Accidental spills or leaks can lead to contamination of water sources and harm to aquatic life.</li> <li>• Cyanide exposure can be hazardous to human health, causing respiratory issues, skin irritation, and potentially fatal outcomes if ingested or inhaled.</li> <li>• The use of cyanide in gold mining is heavily regulated due to its environmental and health risk leading to strict compliance requirements and increased operational costs.</li> </ul>

<p style="text-align: center;"><b>Chemical Alternatives to Mercury</b></p>	<p style="text-align: center;"><b>Advantages</b></p>	<p style="text-align: center;"><b>Disadvantages</b></p>
<p><b>2. Glycine</b> - is an amino acid that is being researched as an alternative to cyanide for gold extraction in the mining industry.</p>	<ul style="list-style-type: none"> <li>• Glycine is considered non-toxic to humans and the environment, unlike cyanide which is highly toxic.</li> <li>• Glycine is biodegradable and does not pose the same environmental risks as cyanide.</li> <li>• Glycine can selectively extract gold from different ores without affecting other metals.</li> <li>• Glycine is cheaper than cyanide and can potentially reduce overall operational costs</li> </ul>	<ul style="list-style-type: none"> <li>• Glycine may offer slower gold extraction rates compared to cyanide, which can impact the efficiency of the mining process.</li> <li>• Using glycine requires process optimization and testing to ensure its effectiveness in gold extraction.</li> </ul>

## Technology Pricing

Mercury-free technologies represent a significant advancement in sustainable and environmentally conscious industrial practices. While the initial investment in mercury-free alternatives may appear higher than their traditional mercury-containing counterparts, the long-term economic benefits—including reduced environmental compliance costs, lower maintenance requirements, and enhanced operational efficiency—often result in substantial cost savings over the technology's lifecycle. The table below provides a guide on the cost price of some mercury free technology. **Note:** Prices can vary widely based on several factors such as size, manufacturer, features and specifications.

Item	Image	Price (Guyanese Dollars)	Source
<b>Jaw Crusher</b>		<b>\$220,000 - \$880,000</b>	<a href="https://hze-beneficiation.en.made-in-china.com/product-group/obiQhyKDbYRp/Gold-Ore-Crushers-1.html">https://hze-beneficiation.en.made-in-china.com/product-group/obiQhyKDbYRp/Gold-Ore-Crushers-1.html</a>
<b>Hammer Crusher</b>		<b>\$120,000 - \$440,000</b>	<a href="https://www.alibaba.com/showroom/gold-hammer-mill.html">https://www.alibaba.com/showroom/gold-hammer-mill.html</a>
<b>Ball Mill</b>		<b>\$1,320,000 - \$4,400,000</b>	<a href="https://www.alibaba.com/showroom/gold-mining-ball-mill.html">https://www.alibaba.com/showroom/gold-mining-ball-mill.html</a>
<b>Rod Mill</b>		<b>\$1,540,000 - \$3,740,000</b>	<a href="https://www.alibaba.com/showroom/rod-mill-price.html">https://www.alibaba.com/showroom/rod-mill-price.html</a>
<b>Grizzlies</b>		<b>\$660,000 - \$2,200,000</b>	<a href="https://www.alibaba.com/showroom/gold-grizzly-mining-equipment.html">https://www.alibaba.com/showroom/gold-grizzly-mining-equipment.html</a>
<b>Trommel</b>		<b>\$440,000 - \$1,200,000</b>	<a href="https://www.alibaba.com/premium/trommel_gold_wash_plant.html">https://www.alibaba.com/premium/trommel_gold_wash_plant.html</a>



# Technology Pricing

Item	Image	Price (Guyanese Dollars)	Source
<b>Trommel Scrubber</b>		<b>\$660,000 - \$2,200,000</b>	<a href="https://www.alibaba.com/showroom/gold-trommel-scrubber.html">https://www.alibaba.com/showroom/gold-trommel-scrubber.html</a>
<b>Vibrating Screen/Desk</b>		<b>\$330,000 - \$1,200,000</b>	<a href="https://www.alibaba.com/showroom/gold-vibrating-screen.html">https://www.alibaba.com/showroom/gold-vibrating-screen.html</a>
<b>Sluice Box</b>		<b>\$120,000 - \$330,000</b>	<a href="https://www.alibaba.com/premium/gold_miniing_sluice_box_equipment.html">https://www.alibaba.com/premium/gold_miniing_sluice_box_equipment.html</a>
<b>Falcon</b>		<b>\$1,200,000 - \$4,400,000</b>	<a href="https://www.alibaba.com/showroom/falcon-gold-concentrator.html">https://www.alibaba.com/showroom/falcon-gold-concentrator.html</a>
<b>Icon</b>		<b>\$440,000 - \$2,200,000</b>	<a href="https://www.alibaba.com/product-detail/Icon-150-Concentration-Fine-Gold-Selection_1600174876049.html">https://www.alibaba.com/product-detail/Icon-150-Concentration-Fine-Gold-Selection_1600174876049.html</a>
<b>Knelson</b>		<b>\$220,000 - \$1,200,000</b>	<a href="https://www.alibaba.com/premium/knelson_concentrator.html">https://www.alibaba.com/premium/knelson_concentrator.html</a>

# Technology Pricing

Item	Image	Price (Guyanese Dollars)	Source
<b>Gold Kacha</b>		<b>\$330,000 - \$550,000</b>	<a href="https://www.alibaba.com/showroom/gold-kacha-concentrator.html">https://www.alibaba.com/showroom/gold-kacha-concentrator.html</a>
<b>Screen (Brazilian sieve stack)</b>		<b>\$5,500 - \$22,000</b>	<a href="https://www.ebay.com/b/Gold-Sieve-Indiana-Collectible-Mining-Equipment/15913/bn_7022267450">https://www.ebay.com/b/Gold-Sieve-Indiana-Collectible-Mining-Equipment/15913/bn_7022267450</a>
<b>Gold Magnet</b>		<b>\$3,300</b>	<a href="https://www.ebay.com/itm/150555523821?_skw=gold+magnet&amp;itmmeta">https://www.ebay.com/itm/150555523821?_skw=gold+magnet&amp;itmmeta</a>
<b>Pan</b>		<b>\$4,400</b>	<a href="https://www.amazon.com/gold-pan/s?k=gold+pan">https://www.amazon.com/gold-pan/s?k=gold+pan</a>
<b>Personal Protective Gears</b>		<b>Boots - \$10,000 \$60,000 Helmets - \$4,500 - \$30,000 Gloves - \$3,300 - \$10,000</b>	<a href="https://www.amazon.com">https://www.amazon.com</a>
<b>Retort</b>		<b>\$55,000 - \$110,000</b>	<a href="https://www.alibaba.com/product-detail/Gold-refining-machinery-mercury-distiller-stainless_1600588538667.html">alibaba.com/product-detail/Gold-refining-machinery-mercury-distiller-stainless_1600588538667.html</a>

# Technology Pricing

Item	Image	Price (Guyanese Dollars)	Source
<b>Spiral Wheel</b>		<b>\$88,000 - \$110,000</b>	<a href="https://www.ebay.com/b/gold-spiral-wheel/bn_7024870981">https://www.ebay.com/b/gold-spiral-wheel/bn_7024870981</a>
<b>Gold Cube/ Warrior Box</b>		<b>\$110,000 - \$330,000</b>	<a href="https://www.ebay.com/shop/gold-cube?_nkw=gold%2Bcube">https://www.ebay.com/shop/gold-cube?_nkw=gold%2Bcube</a>
<b>Helicoid Concentrator</b>		<b>\$7,700,000</b>	<a href="https://www.savonaequipment.com/en/goldlands-goldblaster-gh1500-helicoid-concentrator-p228524">https://www.savonaequipment.com/en/goldlands-goldblaster-gh1500-helicoid-concentrator-p228524</a>

# CONCLUSION



In conclusion, developing a content guide focused on mercury-free practices in gold mining is paramount for promoting sustainability and environmentally friendly mining practices. The proposed outline for the "Mercury-Free Mineral Processing Technology Handbook" aims to educate and empower stakeholders in the industry to transition to safer and more responsible methods of gold extraction. By understanding the impact of mercury, embracing alternative technologies, implementing mercury-free practices, and fostering collaboration and partnerships, we can work towards a future where responsible and mercury-free mining practices are the standard. Through informed decision-making, continuous monitoring, and collective action, we can collectively strive to protect human health, preserve the environment, and drive positive change in the gold mining sector.

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