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# Best management practices in the use of cyanide in Artisanal and Small-scale Gold Mining

*Online webinar, 25 January 2022*

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# UNEP GLOBAL MERCURY PARTNERSHIP

## Artisanal and small-scale gold mining Area\*



## Agenda

### Opening remarks and scene-setting

- ❖ *Susan Keane, Co-lead of the ASGM Partnership Area, Natural Resources Defense Council (NRDC)*
- ❖ *Richard Gutierrez, Secretariat of the Minamata Convention*

### Presentations

- ❖ *The International Management Code and its Implications for ASGM, by Eric Schwamberger, International Cyanide Management Institute*
- ❖ *Best Management Practices for the Use of Cyanide in ASGM, by Daniel Stapper, PACT*
- ❖ *Best Practices and Recommendations for Management of ASGM tailings, by Malgorzata Stylo, UNEP*
- ❖ *Questions and Answers Session*

### Closure

- ❖ *Kenneth Davis, UNEP*

# The International Cyanide Management Code and Safe Cyanide Management in the ASGM Sector

**Dr. Eric C. Schwamberger**  
**Senior Vice President**  
**International Cyanide Management Institute**

**January 25, 2022**





# Cyanide Code Overview

- Performance driven, voluntary program of best practice for the use and management of cyanide at gold and silver mines
- Recognized as the global benchmark for cyanide management
- Provides step-by-step guidance on how to achieve safer management of cyanide
- Covers use cycle of cyanide: production, transport, handling, use, recycling and disposal at mine site
- Participating operations are periodically audited to determine certification, and summary reports are available online





# Cyanide Code Objectives

- To protect workers, communities and the environment from the adverse effects of cyanide exposure
- To improve management and reduce risk over entire cyanide supply chain: producers – transporters – mining operations
- To be used by large and small gold mining operations, in both developed and developing countries
- To serve as a credible form of assurance for stakeholders



# Example Requirements

- Proper Personal Protective Equipment
- Signage and labelling
- Use of dyed cyanide
- First Aid equipment
- pH controls
- Secure, ventilated storage
- Secondary containments
- Training
- Routine inspections





# Example Requirements

Plans and procedures for:

- Cyanide mixing
- Cyanide addition
- Emergency response
- Spill control
- Leaching
- Tailings management



25 January 2022



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# Best Management Practices for Cyanide Use in the Small-Scale Gold Mining Sector

Daniel Stapper, Pact

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**Pact Mines to Markets**



<https://www.pactworld.org/our-expertise/mining>

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## Background

- ▶ Minamata Convention in force
- ▶ Major focus on mercury-free mineral processing
- ▶ Since ~100 years ago, “cyanidation” produces majority of newly mined gold, by the global mining sector
- ▶ With pressure to eliminate/avoid Hg amalgamation, ASGM actors and investors are seeking alternatives
- ▶ CN also enables small miners to profit from lower grade gold deposits
- ▶ Therefore (obviously) safe use of CN thus warrants special attention in the drive to eliminate mercury amalgamation

# Document Scope

- ▶ Overview of CN practices used in ASGM
- ▶ Guidance on minimum requirements for safe and responsible use of CN in SSM

## *The guidance document does not provide:*

- ▶ Comprehensive review of technical aspects concerning cyanidation
- ▶ Technical specifications (chemical and physical operating parameters; specific protocols or controls)



The image shows the front cover of a report. At the top left is the planetGOLD logo, which consists of a stylized sunburst icon followed by the text 'planetGOLD'. Below the logo is the tagline 'Making a world of difference in small-scale gold mining.' and 'A GEF Initiative'. In the center, the word 'Report' is written above a horizontal line. Below this, the title 'Best Management Practices for Cyanide Use in the Small-Scale Gold Mining Sector' is prominently displayed in a large, bold, dark blue font. Underneath the title, the date 'December 2021' is printed. At the bottom right, there are two logos: 'gef' (Global Environment Facility) and 'UN environment programme'. The text 'Supported by:' is placed to the left of the 'gef' logo, and 'Led by:' is placed to the left of the 'UN environment programme' logo. A small Roman numeral 'i' is located at the bottom right corner of the cover.

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Report

**Best Management Practices  
for Cyanide Use in the Small-  
Scale Gold Mining Sector**

December 2021

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# Document Organization

- ▶ **Section 1:** Introduction and Important Considerations
- ▶ **Section 2:** Technical Overview of Cyanidation
- ▶ **Section 3:** Best Practices for CN Management, with reference to the nine Principles of the ICMC.
- ▶ **Section 4:** Conclusion, including risk register tools to analyze and monitor risks and develop risk-mitigation efforts.

Two national case studies are included, from Ecuador and Zimbabwe, to help readers understand typical conditions in the ASGM sector, to contextualize common challenges associated with cyanide management in ASGM.



Figure 5. Workers use wheelbarrows to move and manage dewatered ore and tailings



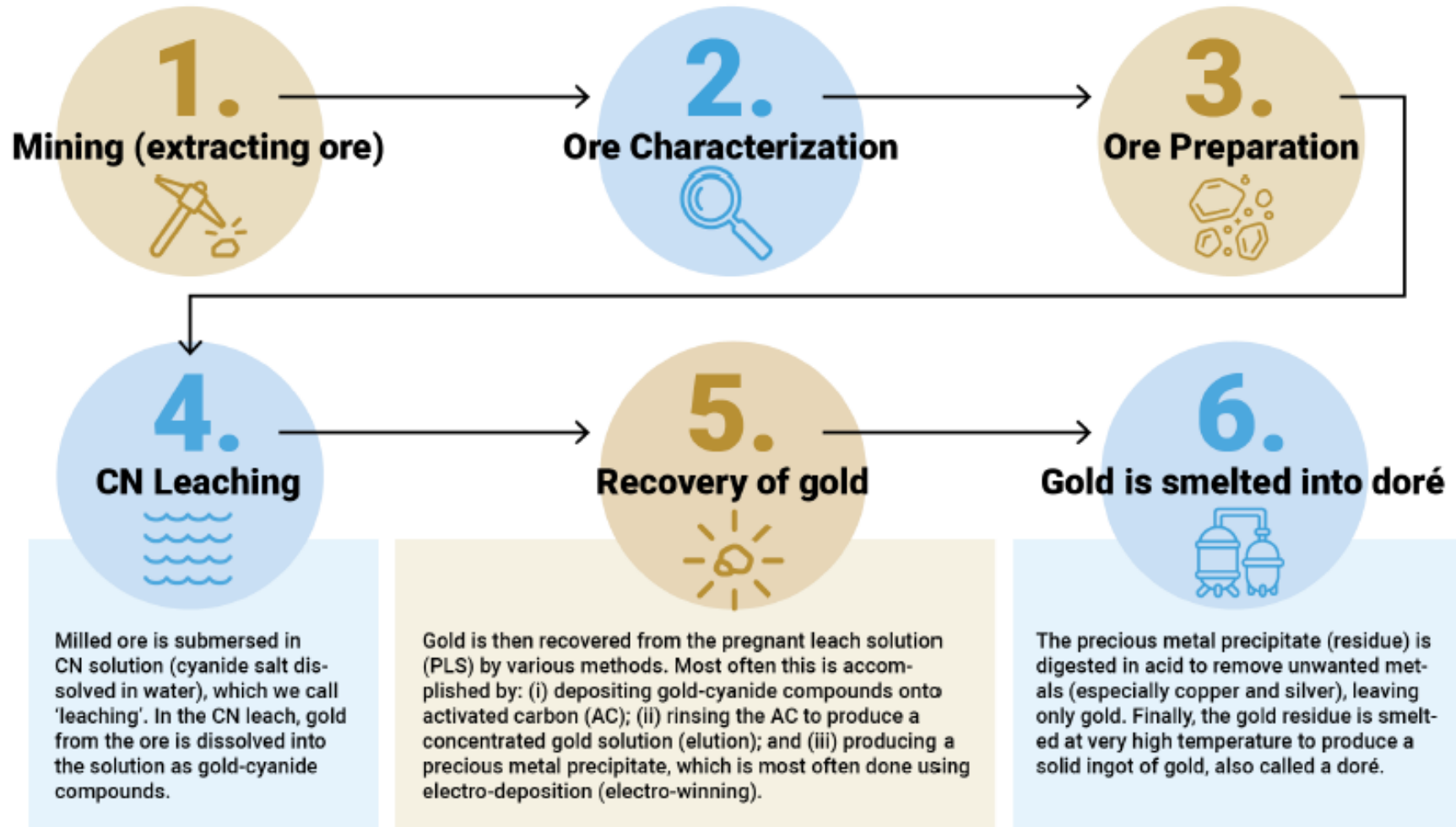
Figure 6. Filtered pregnant leach solution (PLS) flows out from the CIP circuit, and then through columns filled with activated carbon (AC)

## Section 1: Introduction & Important Considerations



- ▶ Using cyanidation of **mercury-contaminated ASGM tailings** constitutes a “worst-practice” as defined in the Minamata Convention
- ▶ CN operators should not use cyanide on Hg-contaminated tailings without a clear plan for measuring and removing/addressing the Hg
- ▶ This document should not be construed or interpreted as “advocating” for the adoption of cyanidation
- ▶ The document encourages research into non-toxic / less-toxic alternatives to CN

## Section 2: Technical Overview of CN Leaching in the ASGM Sector



## Section 2 includes discussion of:

- ▶ Ore Characterization
- ▶ Ore Preparation
- ▶ Difference between heap, vat, & agitated (tank) leaching
- ▶ How Activated Carbon (AC) & Zinc are used for elution
- ▶ Smelting of gold doré
- ▶ Managing Cyanide Effluent



## Section 3: Best Practices for CN Management

### 9 Principles of the International Cyanide Management Code

Principle 1: Production and Purchasing

Principle 2: Transport

Principle 3: Handling and Storage

Principle 4: Operations

Principle 5: Decommissioning

Principle 6: Worker Safety

Principle 7: Emergency Response

Principle 8: Training

Principle 9: Dialogue and Disclosure



# (Example Content) ICMC Principle 4: CN Operations

## **Principle 4: Operations - Manage cyanide process solutions and waste streams to protect human health and the environment**

*Principle 4 of the Code presents nine operational standards of practice which are critical to ensure responsible CN use on active mineral processing plants or mine sites (...)*

4.1 Implement management and operating systems designed to protect human health and the environment including contingency planning and inspection and preventive maintenance procedures.

4.2 Introduce management and operating systems to minimize cyanide use, thereby limiting concentrations of cyanide in mill tailings.

4.3 Implement a comprehensive water management program to protect against unintentional releases.

(...)

# (Example Content) ICMC Principle 4: CN Operations

## *Principle 4 - Guidance for ASGM stakeholders*

### *Establishment of standard operating procedures (SOPs)*

- i. Operating plans and SOPs should address activities such as inspections and maintenance, water and effluent management, spill prevention and response, and environmental protection and monitoring.
- ii. Operating plans and SOPs should be specific to the facilities and CN processes at an operation, practical, and written at a level to facilitate understanding & implementation by the workers who will use them.
- iii. Operating plans & SOPs should provide clarity concerning responsibilities of personnel. Workers should be trained to the plans and procedures prior to the worker beginning the activities described.
- iv. (...)

## Section 4: Summary and Risk Registry Tool

- ▶ Summary of Stakeholder Responsibilities
- ▶ ‘Risk register’ for ASGM cyanidation operator/processing site
- ▶ ‘Control hierarchy’ for evaluating risk control and mitigation

**Table 2. Risk register for ASGM cyanidation operator/processing site**

Risk	Severity of Risk	Mitigation Measure
<b>Manufacturing and Sourcing</b>		
CN was not produced by a Code-certified producer and lacks MSDSs.	High	Mine operators should implement a policy to only purchase from Code-certified or, at a minimum, registered CN suppliers.
<b>Transport</b>		
Transport vehicles carrying sodium cyanide from supplier are poorly regulated and drivers are unaware of the risks hazardous	High	Invest in secure truck transport with dedicated driver, purchase from responsible, Code-certified CN suppliers with proper labelling of containers, certificates of origin, and responsible transport tendering.

Thank you.



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# Best practices and recommendations for management of ASGM tailings

**Malgorzata Stylo, UNEP**

# TAILINGS

The **waste material** left over after a portion of the valuable components have been removed from the ore (dependant of the processing technology).



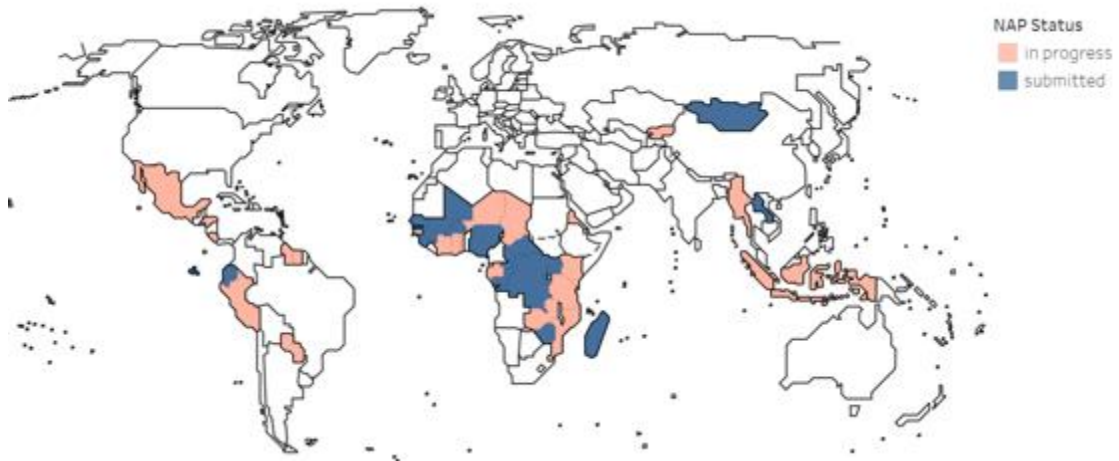
Due to inefficiencies in ore processing, some **ASGM tailings** contain **significant amounts of unrecovered gold**.

**Cyanide leaching of tailings to which mercury** has been added without first removing the mercury is one of the **worst practices** as defined by Annex C of the Minamata Convention.



It leads to generation of **mercury-cyanide complexes** that are highly mobile in the environment and bioavailable.

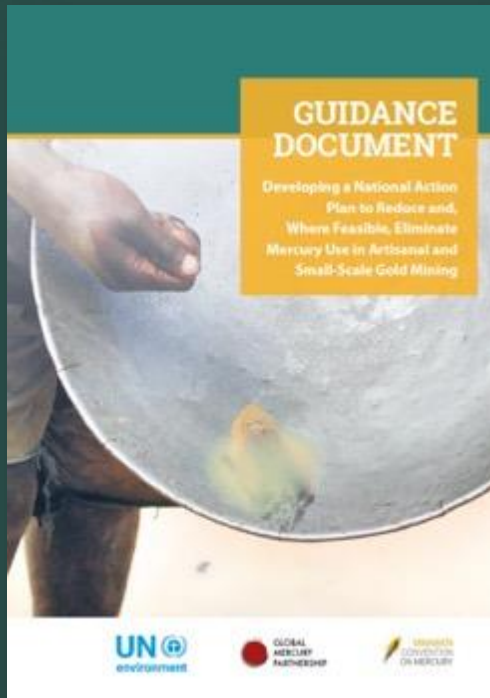




## ASGM Worst Practices

Worst practice reported    No information in NAP    Worst practice not present

Country	Open air burning	Cyanide + mercury	Burning in residential areas	Whole ore amalgamation
Burkina Faso	●	●	●	●
Burundi	●	●	●	●
Central African Republic	●	●	●	●
Congo	●	●	●	●
DRC	●	●	●	●
Ecuador	●	●	●	●
Guinea	●	●	●	●
Lao PDR	●	●	●	●
Madagascar	●	●	●	●
Mali	●	●	●	●
Mongolia	●	●	●	●
Nigeria	●	●	●	●
Senegal	●	●	●	●
Sierra Leone	●	●	●	●
Uganda	●	●	●	●
Zimbabwe	●	●	●	●



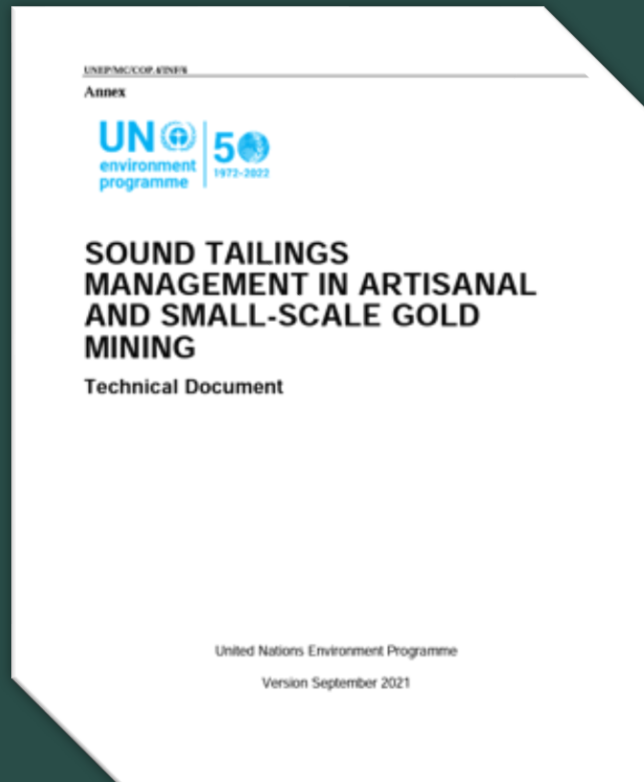
The Third Conference of the Parties of the Minamata Convention requested the Secretariat, in cooperation with the Global Mercury Partnership, to **improve the guidance on the preparation of national action plans for ASGM regarding management of tailings** from such mining.

Updates to NAP guidance document submitted for COP 4 consideration (COP.4/6)

Available at:

<https://www.mercuryconvention.org/en/documents/article-7-artisanal-and-small-scale-gold-mining-update-guidance-document-preparation>





To further guide the Parties in their efforts to soundly manage ASGM tailings, UNEP in collaboration with the Minamata Secretariat and Global Mercury Partnership developed a **complementary technical document**, highlighting best practices for ASGM tailings management (COP.4/INF/6).

Available at:

<https://www.mercuryconvention.org/en/documents/guidance-document-management-artisanal-and-small-scale-gold-mining-tailings>

# Best practices and recommendations for management of ASGM tailings



**BASICS OF TAILINGS MANAGEMENT**



**MERCURY AND GOLD RECOVERY FROM TAILINGS**



**DISPOSAL, ECOLOGICAL RESTORATION AND MONITORING OF MERCURY CONTAINING TAILINGS**



**LEGAL ASPECTS AND GOVERNANCE**



**PROVIDING INFORMATION AND ENGAGING COMMUNITIES**

## BASICS OF TAILINGS MANAGEMENT

The best way to manage mercury-containing tailings is **not to generate them in the first place**

**Understand** the local political, socio-economic, and environmental **context**



Keep mercury-contaminated tailings **separate**

Measure **mercury content** and perform additional **chemical and mineralogical characterization** of tailings

## MERCURY AND GOLD RECOVERY FROM TAILINGS

Never apply cyanide to mercury-contaminated tailings

Ensure safe disposal of the recovered mercury



Prior to reprocessing of mercury-contaminated tailings, **mercury must first be removed**

Cyanide should only be used by **organized and trained miners** that can comply with chemical management

## DISPOSAL OF MERCURY CONTAINING TAILINGS



Use **impermeable lining** systems or concrete and cover tailings

Do **not use mercury contaminated material** to construct tailings structures

**Mark and fence** the tailings' structures

Ensure **safe transport** of tailings

Ensure tailings structures are constructed **away from human settlements**, grazing and farming areas, rivers and outside flood areas

Do **not to dump the tailings** that contain mercury back into streams or in flood-prone areas

## ECOLOGICAL RESTORATION OF MERCURY CONTAINING TAILINGS

Restore the surface grading and **revegetate** the land to reduce erosion

Engage **ASGM communities** in the restoration plans

Consult Art 12 of the Minamata Convention if the land is **contaminated** with mercury

Organize **educational sessions** focused on the benefits of restoration and future restored land use possibilities

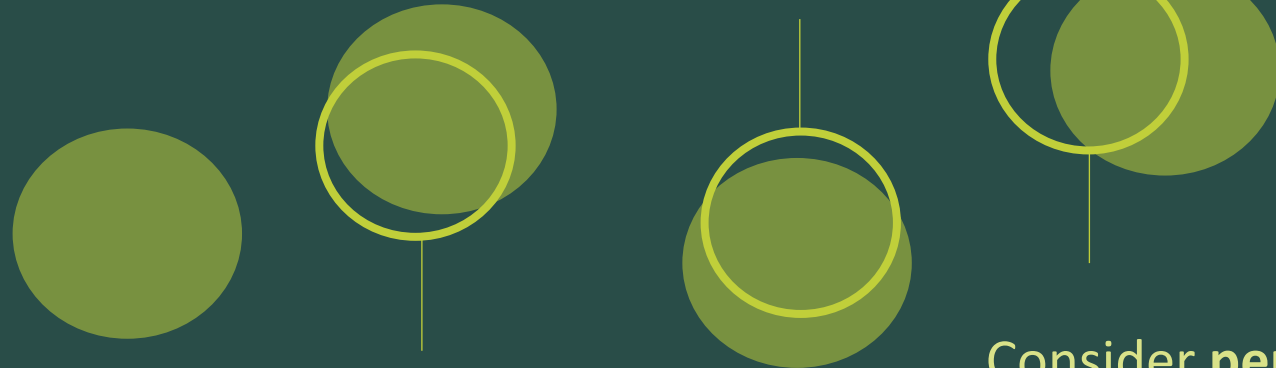
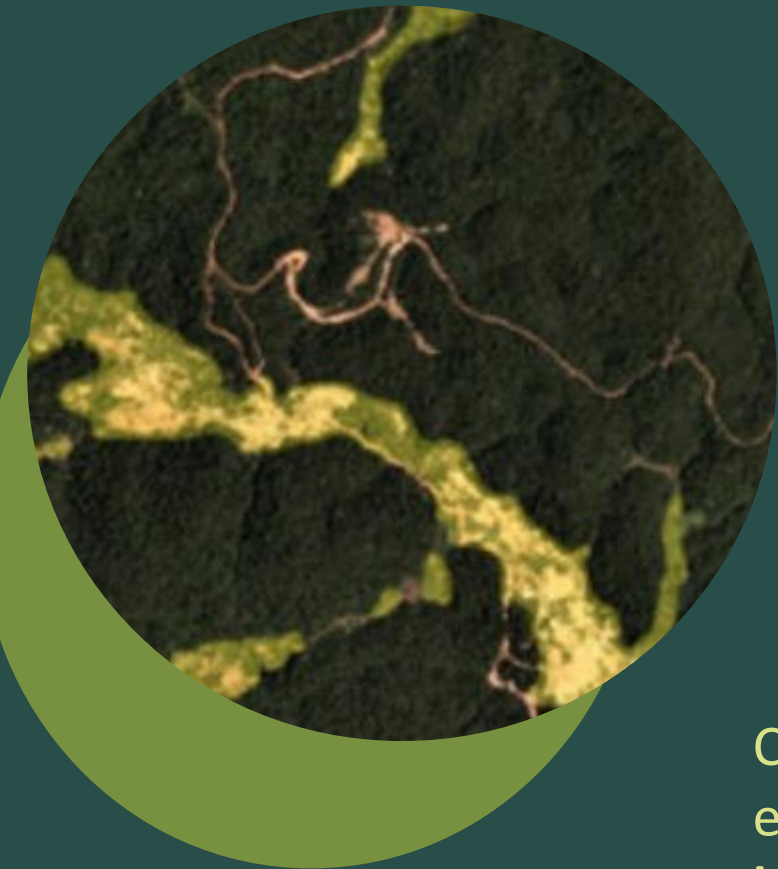


## MONITORING OF MERCURY CONTAINING TAILINGS

Consider using **remote sensing** to identify and **track progress** of the existing tailings

Consider **periodic sampling** and characterization of the tailings to monitor changes

Consider using **geospatial tools**, e.g. GIS, to keep **track of the locations and characteristics** of mercury containing tailings



## LEGAL ASPECTS AND GOVERNANCE



Ensure **miners participation** and build interventions on the formalization efforts

Review **legal and regulatory frameworks** to identify gaps and propose improvements in respect to tailings management

Allocate **financial mechanisms and responsibilities** to ensure the sound management of tailings



## PROVIDING INFORMATION AND ENGAGING COMMUNITIES

**Inform the community** about the presence of mercury-contaminated tailings and the associated risk

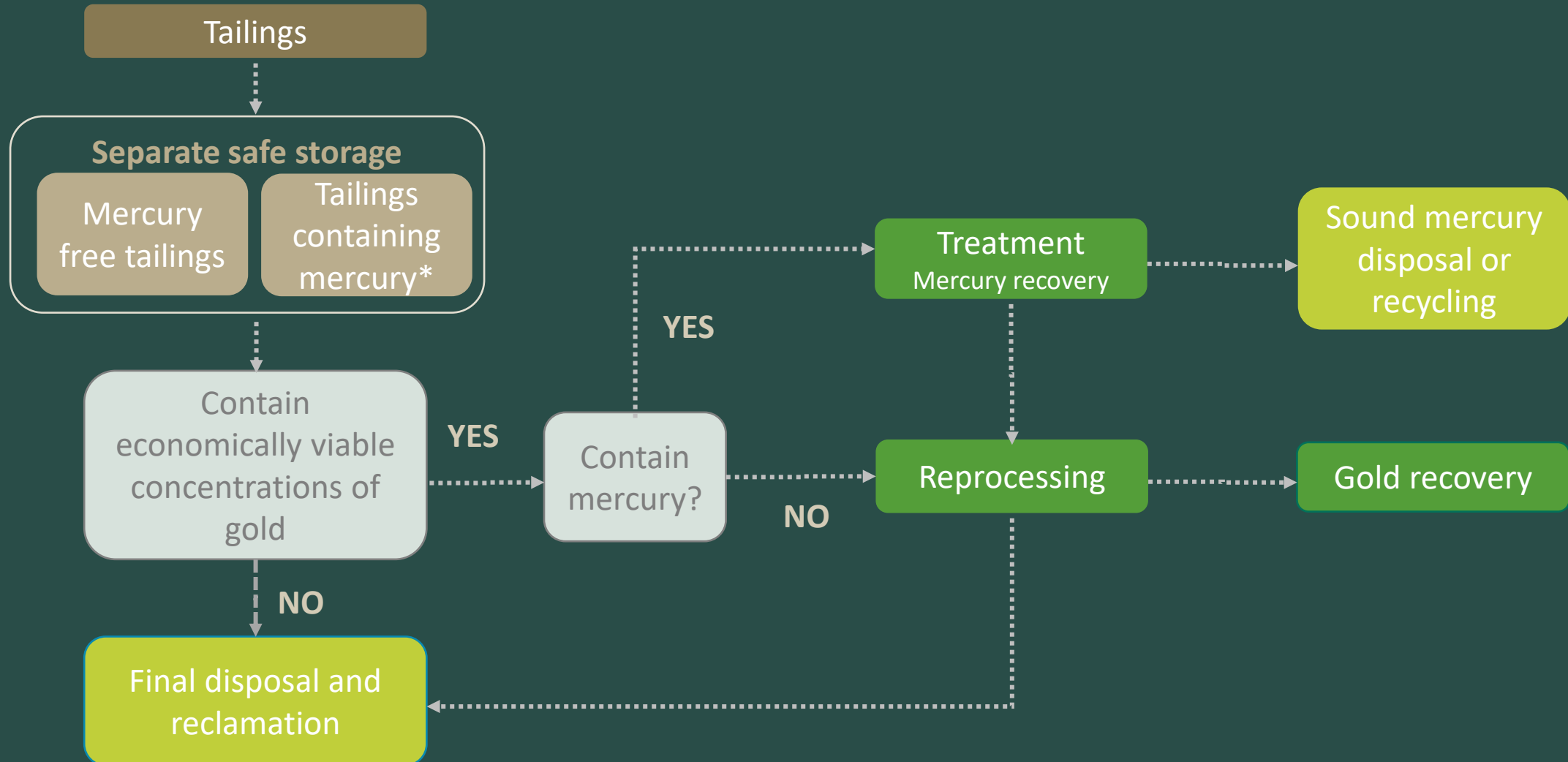


Design and conduct **educational programs**

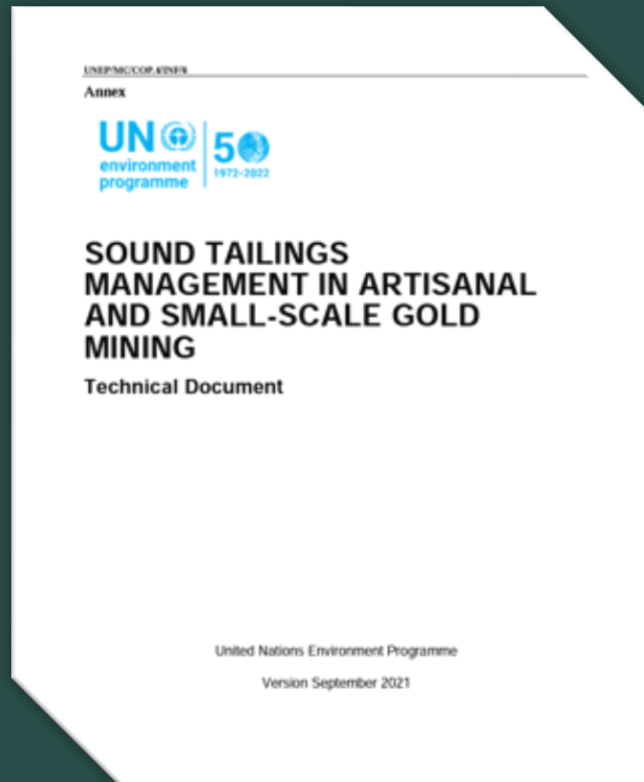
Disseminate information about mercury pollution and **mitigation programs** in affected communities

Ensure the engagement of indigenous populations

## LEGAL ASPECTS AND GOVERNANCE



## PROVIDING INFORMATION AND ENGAGING COMMUNITIES



Available at:

<https://www.mercuryconvention.org/en/documents/guidance-document-management-artisanal-and-small-scale-gold-mining-tailings>

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