The planetGOLD Philippines Project is a five-year project with the objectives of addressing key issues linked to continued use of mercury in artisanal and small-scale gold mining (ASGM) in the country, implemented by the United Nations Environment Programme and the United Nations Industrial Development Organization. Funded by the Global Environment Facility, the Project is executed by the Artisanal Gold Council in partnership with the Department of Environment and Natural Resources and the Mines and Geosciences Bureau.

#MakeMercuryHistory

@planetgoldphilippines  planetgoldph@artisanalgold.org  planetgold.org/philippines

MERCURY-FREE PROCESSING SYSTEM

of the planetGOLD Philippines Project in Paracale, Camarines Norte
third-class municipality has been recognized as a “gold town” as it is one of the largest historical gold-producing regions in the Philippines hosts four large-scale mining companies and several small-scale mining operations that provide for the majority of its population

**Minahang Bayan of Barangay Casalugan, Paracale**

- **Declaration date:** August 8, 2019
- **Petitioner:** Provincial Government of Camarines Norte
- **Location:** Brgy. Casalugan, Paracale, Camarines Norte
- **Area:** 26.43 hectares

**Current Gold Mining Methods**

- 26 active underground workings in Paracale Minahang Bayan.
- Underground mining method is employed through the use of shafts

**Current Gold Processing Methods**

- Average daily ore production of around 2,500 kgs or 2.5 metric tons per shaft
- Ores are subjected to manual crushing and rod mill grinding.
- Ores are subjected to amalgamation to recover free gold.
- Amalgamation tailings are subjected to cyanidation to recover the remaining gold.
Annual gold recovered in Paracale Minahang Bayan is estimated to be around 150 kg.

Amalgamation is proven to be a less efficient gold processing method with an estimated 30-50% recovery.

Cyanide leaching of amalgamation tailings is one of the worst practices contributing to mercury pollution, according to Minamata Convention.

150 kg of annual gold recovered is equivalent to 222 bottles (250 mL each) of mercury.

* data from planetGOLD Philippines 2021 Contextual Study

Mercury Use in ASGM

- There are probably more than five ball mill or amalgamation plants inside the Minahang Bayan area, but these are being used intermittently.

- Though there is also no official inventory of the amalgamation plants outside the Minahang Bayan, the planetGOLD Philippines Contextual Study estimates that there are more than 30 plants outside the Minahang Bayan but within the Paracale municipality. Most of these plants process ores coming from the Minahang Bayan operations.

- These plants’ annual mercury use is around a half metric ton.

The Mercury-Free Processing System (MFPS) of the planetGOLD Philippines Project is:

- a centralized gold ore processing facility within Casalugan Minahang Bayan
- with a capacity of 2-5 metric tons of ores per day
- aims to recover gold by at least 80%
- to use combined metallurgical methods of improved gravity concentration and chemical leaching using cyanide-amino acid mixture as an alternative to mercury amalgamation

Features include:

- Inside the Minahang Bayan area
  - >5
- Outside the Minahang Bayan area, within the municipality
  - >30

Estimated annual mercury use 500 kg

Cyanide Leaching of Gold

- Most dominant gold extraction method since the 1970s
- Uses a dilute solution of cyanide
- Has superior economic and environmental qualities to recover precious metals particularly gold
- Non-toxic
- Found in high protein foods such as meat
- High leaching efficiency similar to cyanide
- Best paired with cyanide to reduce cyanide consumption or dosage during gold leaching

Use of Amino Acid in the Cyanide Leaching of Gold
Paracale Process Flow Sheet

STEP 1
Ore Extraction

STEP 2
Crushing and Screening

STEP 3
Grinding

A. Wet Milling
- Water Tanks
  - Raw or fresh water
  - Recycled or Process

B. Classification
- Hydrocyclone
  - Underflow or coarser materials return back to ball mill
  - Overflow or finer materials feed to gravity circuit

Roll Crusher
- 12mm to f.o.b.

Rolling Screen
- Single-deck
- 12mm screen
- 12mm feed to roller crusher
- 12mm goes to fine ore bin

Jaw Crusher
- About 120mm of ores reduced to 20-50mm in size

Ball Mill

Fine Ore Bin

STEP 4
Gravity Concentration

Gravity Circuit for Free Gold Recovery

STEP 5
Leaching

Batch Type Carbon-In-Leach (CIL)

A. Thickening to >35% solids
B. Leaching and absorption (36hrs)
C. Harvest of gold-loaded carbon
D. Cyanide Detoxification

STEP 6
Carbon Ashing and Gold Smelting

STEP 7
Tailings Pond

Water is recycled as process water

Gold Product

3D Design: The MFPS took advantage of the terrain of the area, minimizing the use of pumps for material transfer.