# Global Mercury Project

Project EG/GLO/01/G34: Removal of Barriers to Introduction of Cleaner Artisanal Gold Mining and Extraction Technologies

# OVERVIEW OF PROJECT SITE IN INDONESIA TALAWAAN AND GALANGAN AREAS

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# 1. Introduction

This report presents a result of field investigations as well as extraction from reports relating to the first year implementation of Global Mercury Project (Project EG/GLO/01/G34: Removal of Barriers to Introduction of Cleaner Artisanal Gold Mining and Extraction Technologies) at two selected mining site in Indonesia (Talawaan area, North Sulawesi and Galangan area, Central Kalimantan).

# 2. Description of the site

## 2.1. Geographic Information

### 2.1.1. Talawaan Mining Area

The Talawaan mining area, also known as the Tatelu mining site is selected location that presents the most festive illegal gold mining (PETI) in North Sulawesi (N 001$^{o}$ 31' 51.2" – E 124$^{o}$ 58' 53.2"). The area lies within the Talawaan River watershed, between the villages of Talawaan and Tatelu, about 20 km north east from Manado city, (the capital city of North Sulawesi Province. This area can be reached approximately 30 menits by a car from Manado city.

The area has a typical equatorial climate with 2 seasons: rainy (November – March/April) and dry ( May – October) with its highest rainfall in December (3000 mm/annum). The average temperature is about 26 $^{o}$C.

The Talawaan River Watershed drains from the peak of Klabat Mountain into the western coast of Minahasa District and Manado city. The watershed has a highest point of 1995 m and comprises an area of approximately 34,400 hectras. The distance from the peak to the sea is about 20 km. Within this watershed runs three rivers, they are Kima River, Talawaan River and Bailang River. Talawaan River and Bailang River flow through the mining area.

### 2.1.2. Galangan Mining Site

Galangan mining area (N 001$^{o}$ 59' 16.4" – E 113$^{o}$ 17' 19.1"), located at Hampalit village, in Katingan District, is about 107 km from Palangkaraya city , the capital city of Central Kalimantan Province.

The access to the area is by car form Palangkaraya – kasongan : 84 km. Kasongan – Kereng Pangi 16 km and Kereng Pangi – Galangan 7 km. Kereng Pangi is a part of Katingan District, is a jump off town, that provides infrastructure for miners in Galangan.

The same as Talawaan Area, the area has also a typical equatorial climate with 2 seasons: rainy season (November – Mei) and dry season ( June – October) with its highest rainfall in December (3996 mm/annum). The average temperature is about 27.3 $^{o}$C.

This area lays on the right margin of Katingan River which drains into the Java Sea about 200 km to the south. Thera are 3 rivers flow in this area, they area Hampalit River (drains to Kalawanan River) and Kalamanan River flow to the east and drain to Katingan River, and Cempaga Buang River flows to the west and drains to Cempaga River.

The Galangan Mining area is fairly flat, and covered with white sand. It looks like a sandy desert with some trunks and stumps of trees left behind after deforestation of rain forest.on a large scale. No trees remain and the soil is reduced to white, fine sand. Many former pits are left, and filled with water like, they look like deep pools with 5 – 15 m in depth.

## 2.2. History of the Mining Activities

Mining activities in Talawaan area are started in 1998 following the findings of 1997 exploration of PT Tambang Tondano Nusajaya. This joint venture was owned by Aurora Gold Ltd. (85 %) of Australia and PT Austindo Mining Corporation (15 %). This company had been awarded a contract of exploration by the Indonesian Ministry of Mining and Energy, and the entire Dimembe Sub-district is a part of the company's mining concession area.

The mining area is closed to some of the villages, and actually this location is normally an agriculture area of the village communities. When the severe economic crisis struck Indonesia in 1998, local communities in the area started seeking their fortune in gold mining. Acceleration of the mining activities in this area had also been influenced by the delay in the start-up of company operations caused by the unstable relationship between Indonesia – Australia concerning East Timor in 1998 and 1999.

By July 2000, there were about 250 processing units in the area, and this number has continued to increase. The processing units were built around Talawaan and the surrounding villages of Tatelu, and Wasian. The majority of those were constructed near the Talawaan River and its tributaries. In June 2001, the number of processing units was estimated to have reached 400 units. At present, operations in the processing plants also have started to become more sophisticated. Several units of mechanical crushers have been put in place, heavy machinery and related equipment for developing tunnels and even mine car for ore transport have been used. Some mine or processor owners have also temporarily employed engineers and other technical personnel.

In Galangan, the mining activities have been carried out since 1970s at that time simple panning of stream was the main source of artisanal gold mining activities, however by the late of 1980s the use of mercury became popular. In 1986 – 1999 PT Ampalit Mas Perdhana, a big Australia - Indonesia mining Company operated in the area. The area is approximately 200 km2, where about 25 % of the area was persevered from mining damage by the company. However, in 1990s the mining activities were widespread to the preserved area and has been ruined extensively by PETIs. This situation caused a delay of PT Ampalit Mas Perdhana mining closure.

Before more than 5000 miners were working in this area, but today the amount of miners are decreasing, according to the miners some of them moved to another location because the concentration of the gold is very small. At present, approximately 500 units gold processing are operating in the location. Normally, 5 -6 people occupy each unit, therefore the total illegal miners in the area are approximately 2500 people.

Due to the conflicts of interest on the mining locations, fights and drunks between the group of miners are sometimes happened in those areas.

## 2.3. Community Characteristics

Province in Indonesia are divided into districts and the sub-districts, in which most of the sub-district consists of more than 10 villages. The head of village are responsible to community organizations such as cooperation, youth organization etc.

- ***Talawaan Area***

The Talawaan river watershed comprises part of Minahasa District and Manado city, and consists of 4 sub-districts (Wori, Dimembe, Mapanget and Molas). The mining area is located in the villages of Tatelu and Talawaan within the Dimembe sub-district. The gold processing units can be found in six villages, they are Wasian, Rondor, Warukapas, Tatelu, Talawaan and Kalangan.

The population of this area is about 150,000 people or 2000 – 4000 people live in each village. Their main source of in come are dependent on agriculture (dominated by plantations of coconut, cloves and nutmeg), but a number of people involved in gold mining activities has increased since 1998.

Most of miners in this area have come from outside of Dimembe district/ Talawaan River Watershed, such as Minahasa, Gorontalo etc. The miners and the operator of gold processing plant live in the mining location and leave their families in the villages.

The majority, they educated up to the level of secondary school and primary school.

The source water for daily need is different, but mainly they use shallow wells for drinking and cooking water. The rivers in this area, are usually used for washing, bathing and irrigation. For

lighting, the majority of community use electricity but the miners who live in the mining location use generator.

One medical center is available in Tatelu village, which has 4 medical doctor, 1 dentist, 16 nurses and 9 midwifes. They work for the Dimembe district.

The Talawaan mining area is located in Tatelu and Talawaan villages. belongs to Dimembe sub-district, North Sulawesi. This sub-district comprises

- ***Galangan area***

Administratively Galangan mining area or Hampalit village lies in the Katingan Hilir Subdistrict, District of Katingan, Central Kalimantan Province. According to Hampalit Village Office (2003) this village has a population of 8056 people or 2172 household. It is almost a half of the population of Katingan sub-district (17054 people or 4686 households).

Most of people in Hampalit area came from other region of Kalimantan and immigrate from Java and Sulawesi or other part of Indonesia. They live there since the resettlement of local people was carried out in 1988.

Therefore, there are three types of communities found in the Hampalit village, they are :

- Community of Banjar, in general they come from South Kalimantan for business e.g. buying and selling gold, shopkeeper, conducting amalgam smelters, etc. and live in Kereng Pangi. This society represents a biggest outsiders, that is about 50 % from entire outsiders.
- Community of Java Island, consist of Javanese, Sundanese and Maduranese. They come because of they are fascinated with gold. Thereby, they in general work as miners/ gold panning with or without permit. The amount of this society is about 45 % from entire outsiders. Some of them remain as farmers.
- Community of local people represent a minority from the entire population of the Hampalit village (20 %). Generally, they live along the river and work as farmer, gardener, fishermen etc.

The same as in Talawaan area, the majority of inhibitants in this area have completed secondary school and primary school.

In this area, the miners and his families live in the wooden huts or camps close to the water pools, where the mercury is added and the panning process takes place. This water is used for drinking water and washing purposes. For lighting and cooking they use kerosene. Some small food shops are found in Galangan area.

# 3. Mining and Processing Characteristics

## 3.1. Number of Miners in the Country and on the Project Site

There is no data reporting number of artisanal and small-scale miners, but it is estimated approximately 100.000 people are involved in gold small scale mining in Indonesia. Those included miners who works in KUD and WPR.

In the Talawaan region, there are about 3000 people involved the activities and those in the Galangan area are approximately 2500 people.

## 3.2. Categories of Miners on the Site.

As it mentioned at the previous, in the Talawaan site there about 2700-3000 people involve in the mining activities. They can be categorized and estimated as :

- Mine workers (1250 people or 45.8%)
- Processing workers (1080 people or 40.0%)
- Transporter (250 people or 9.3%)
- Miscellaneous (120 people or 4.9%).

While those in Galangan (2500 miners), they work in a group of 4 – 6 people. The group responsible for ore extraction, processing, amalgamation process etc.

Traditionally, women are not common involve in artisanal mining. Some of them do cooking/preparing food, washing, for the miners. To day, the role of women are changing. Now women are involved in processing of gold ore. They can work at a crushing ore in the plant. Some of them are also the owners or managing the operator.

## 3.3. Gold Production Methods

Basically the method of processing ore was the same at both mining areas, they used an amalgamation process. The difference is on the mining system. It is due to the difference of ore type in the both areas. In Talawaan, they have primary ore type, therefore miners use an under ground mining system, while those at Galangan are alluvial ore type, so they use a open pit mining system. The following is a detail description of mining and processing system apply in each the mining areas.

- ***Talawaan Area***

The artisanal miners/PETIs in the Talawaan mining area apply an underground mining system, which begin with a narrow vertical shafts (dimensions 1.0 m x 1.0 m) and tunnels with the maximum 30 m depth, where the gold veins are mined. These shafts and tunnels are dug by hand. Pit opening is supported with wooden bars and wooden boards.

The ore is excavated manually using traditional tools such as broad hoes, craw bars, etc. The excavated ore is loaded into a container/bucket, drew up to the surface using pulley, and then packed in sacks and transported to a processing plant with a cart drawn by oxen/buffalo. Figure 1 shows a flow chart of gold processing applied in Talawaan Mining Area.

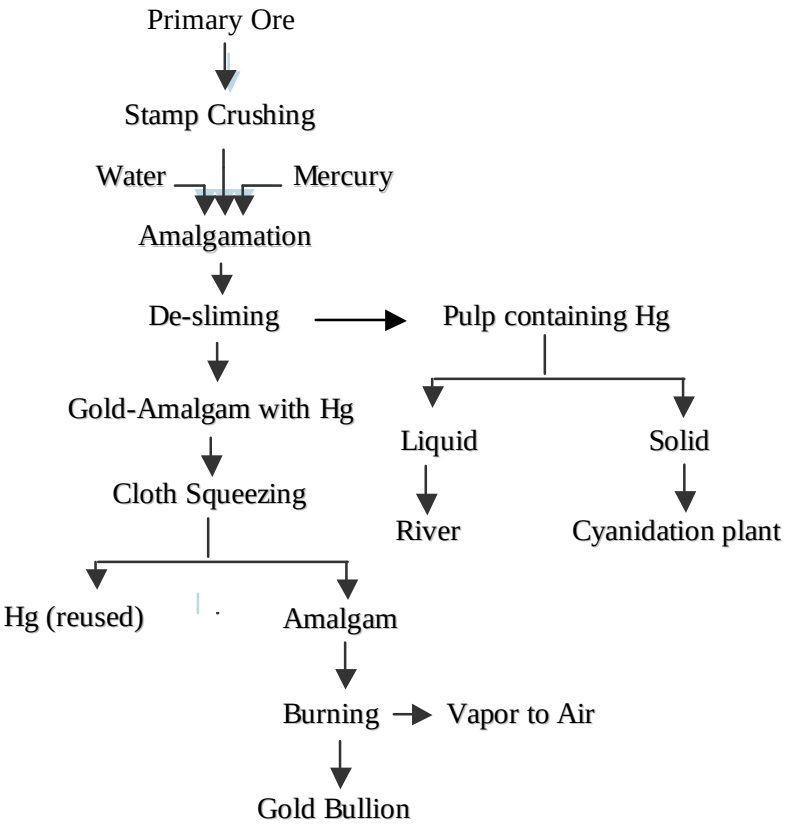


Figure 1 – Flowsheet of the amalgamation practice in Talawaan

In the processing plants, the ore is sun dried, and crushed manually using hammer or other traditional tools in order to reduce the size of ore and the processing time in the mills. Nowadays, some processing plants use a home made mechanically crusher to replace manual workers. After crushing process, approximately 30 – 40 kg of the crushed ore is fed into tromols/ball mills for grinding. Water and had rocks are added into the ball mill and rotated for grinding in order to break down the ore to fine particles and to release the gold. It usually takes about 3 – 4 hours.

After this period the mill is turned off and 1 kg of mercury is added to the ball mill and the mill is rotated again for half an hour for amalgamation process. In this phase fine gold will react with mercury to produced Au-amalgam. Afterwards, water is passed through the ball mill, in order to pour

out the slurry. The whole milled ore is then dumped into a tailing pond and the heavy metal alloy will settle down to the bottom.

The amalgamated mercury is separated from the slurry through the panning process. The clean amalgamated mercury is then collected and placed in a fine woven cloth and squeezed to separate the excess of mercury from the amalgam. The residue, which remains in the cloth, is the Au-amalgam. This Au-amalgam is burned in a clay crucible to vaporize the mercury. Sometimes borax is added, to remove the impurities in the final products, which is gold bullion.

Currently some of the miners in Talawan store their amalgamation tailing in sacks and sold to the cyanidation plants (Figure 2).

In this plant the tailing is put into an agitation tank and water is added to give a slurry with 40 % solid, agitated for a certain and then it remains to settle the excess of mercury. According to the owner, for 20 tones of tailing, about 300 – 500 gram of mercury can be separated with this method. After this separation, the tailing is leached in a leaching tank with 100 – 200 mg/l NaCN at pH 10 – 11 adjusted with lime. Aeration of the slurry is carried out using a simple a compressor. After 3 batches, 100 – 150 kg of charcoal is added to the leaching tank, the charcoal will adsorbed gold. This Au-charcoal is separated by filtering, then to get gold the charcoal containing of gold is burned in open air.

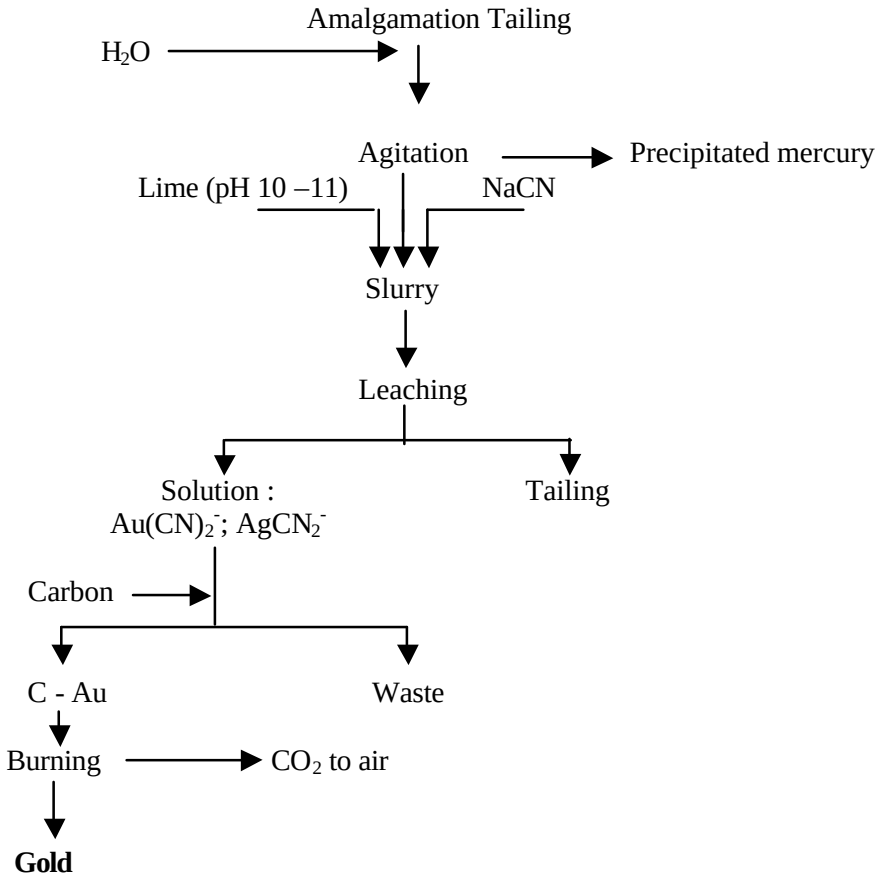


**Figure 2. Flowsheet of the cyanidation process used in Talawaan.**

The PETIs live around the pits in wooden huts or camps. They work in a group of 4 – 10 people in one site, 10 hours a day, during 6 days a week (They do not work on Friday). At the moment more than 200 groups of PETIs work in this area.

- ***Galangan Area***

Simple processing technique is applied by PETIs in Galangan area, they use an open pit mining system. Sand-containing gold is sprayed with water jet. Pulp is then pumped into a sluice box to get rougher concentrate. The length of sluice box is approximately 4 m and such equipment is provided with some riffles. The baffles are covered with carpet to maximize gold particle catching. The rougher, concentrate gold-sand from the sluice box, is cleaned up by panning to obtain cleaner gold concentrate. Pulp containing 20 kg of cleaner gold concentrate is put into a pail and 200 g mercury is added into the pail to be steered with hand. After several minutes, pulp is sieved using

cotton cloth to produce gold amalgam. The product of amalgam is then sold to gold shop in either in Galangan or Kereng Pangi. So miners do not conduct smelting activities for themselves.
Figure 3 shows the flow of gold processing used in Galangan

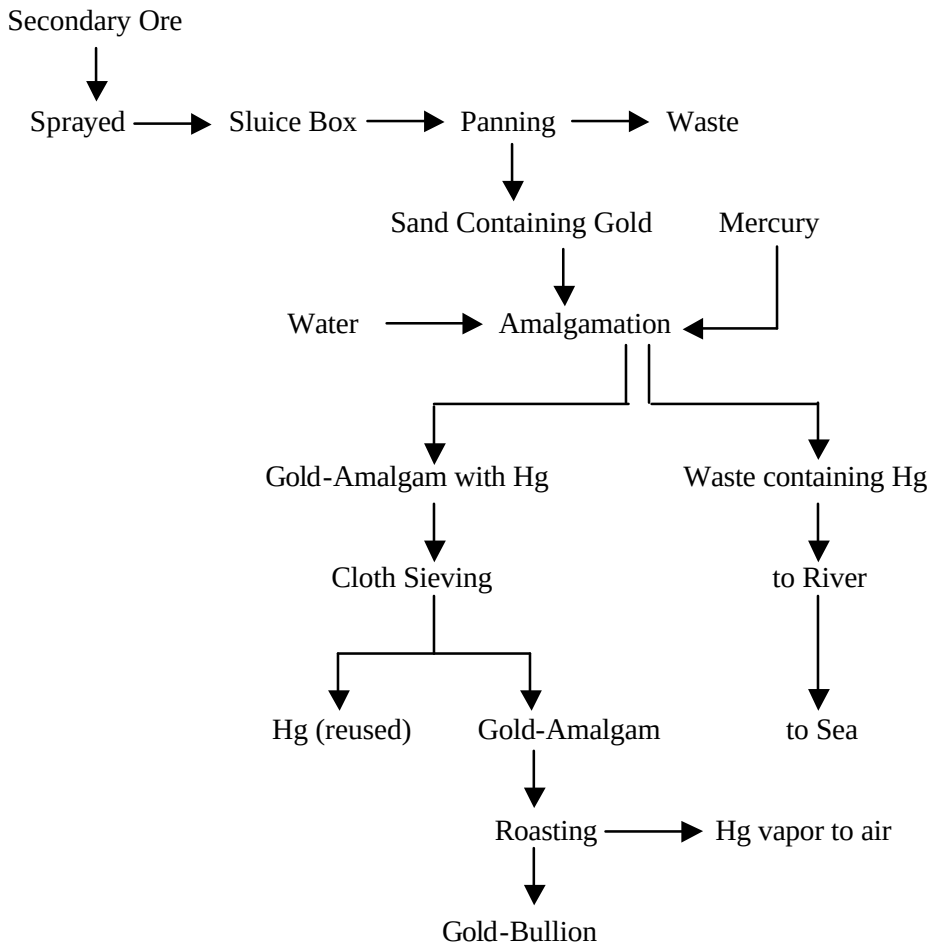


Figure 3 - Flowsheet of gold processing used in Galangan

## 3.4. Use of Mercury

As it was mentioned at the previous, that mining process and the use of mercury depending of the ore type . The miners in the Talawaan area do not use mercury. They just excavate the ore using the underground system and transport them to the processing plant.

In the processing plant, the operator add mercury to the tromol However, in Galangan area miners add mercury to the cleaner concentrate (yield of panning process) to form an amalgam with alluvial gold particles. The miners in Galangan and the gold processing people in Talawaan are very careful to recover mercury as much as possible by squeezing the amalgam containing mercury with a

cotton cloth and reuse them. Even though, the loss of mercury still occurs during amalgamation process, panning and roasting process.

In the Galangan area, the lost of mercury is estimated about 150 – 300 g of mercury per month per unit with the lost ratio of $Hg_{lost}$ : $Au_{produced}$ is about 2.4. This means that about 1 – 2 tong of mercury is released annually in this area. And the lost of mercury in Talawaan area is estimated to be between 20 – 90 tons annually.

# 4. Environmental and Health Impacts

Environmental and health impacts of artisanal mining in both areas are being observed include erosion, loss of vegetation, water quality degradation and so on.

## 4.1. Visible Environmental Impacts

Visible environmental impacts caused by PETIs in both areas are very significant, especially in Galangan area. For examples, at the present the Galangan Mining area is fairly flat, and covered with white sand. It looks like a sandy desert with some trunks and stumps of trees left behind after deforestation of rain forest. on a large scale. No trees remain and the soil is reduced to white, fine sand. Many former pits are left, and filled with water like, they look like deep pools with 5 – 15 m in depth (Figure 10 and 11).

Those in Talwaan area are not visible, because the miners use the underground system to excavate the primary ore. They need only a very small area for digging a pit.

In Galangan mining area, the miners add mercury and do a panning process beside the huts or camps in water pools, but mercury contamination are not visible impact. When the amalgam is burned in open pans, the emission of mercury can be noticeable clearly. There is no data available about mercury concentration in biota in Galangan area.

In Talawaan area, tailings containing mercury from the gold processing are discharged to the tailing ponds, before they flow to the river. It is also noticeable, the silvery layer was found on the wall of the tailing pond. It could be particles of mercury.

## 4.2. Visible Health Impacts

Due to poor sanitary conditions diarrhea and malaria are very common in the Talawaan mining area as well as in Galangan. Asthma, pneumonia, skin diseases , upper respiratory infectious are other important diseases in the both areas. There is no data of health impacts directly attributed to the artisanal mining acitivities.

Mining accidents (tunnel or slope collapse) happen approximately 2 – 5 time each year.

Awareness of mercury impacts are low in the both areas.

From the field investigation, characteristics of the mining community of the two places (Talawaan and Galangan) are distinctly different. The mining community at Talawaan are living in groups at the mining area without family members being involved while those at Galangan are living in the mining area with their family in the hut or camps close to the water pool.

Concerning with the use of mercury, the miners in Talawaan primary tasks are digging and excavating ores from underground. They do not directly work with mercury, since amalgamation process takes place in processing unit operated by gold-collectors. On the other hand, the miners in Galangan operate sluice-boxes in the mining (dredging) sites and they work directly with mercury. More over, the families of the miners in Galangan are potentially exposed to mercury due to the storage of mercury at their homes.

## 4.3. Main Problems and Bottlenecks to Introduce Cleaner Techniques

Since the artisanal mining in both areas are illegal, and the majority of the miners have no technical skills and lack of adequate working tools. Awareness to the health effect of mercury among the miners are very low. Also the environmental effect of mercury is not popular in the areas.

The miner's budget for investing a new techniques are very limited.

Attitude of miners toward Improvement of mining technology. Some miners will accept the improvement of new technology issues, but some them will not.

## 4.4. How Stakeholders Are Seeing the Global Mercury Project

Since the goal of the Global Mercury Project is to reduce mercury pollution caused by the artisanal mining in Indonesia. The project will also assist Indonesian Government in bridging the technological gap and introducing environmental management and cleaner production which currently the artisanal mining do not known.

One of the aim of Indonesian Government in controlling the artisanal mining activities is safety and reduce the use of mercury.

In this case, all the stakeholders (Indonesian Government cq. Ministry of Energy and Mineral Resources, Local Office of Mines and Energy, NGO, private mining company etc) are very concern to the goal of the project.

The project came to the public attention since the Environmental and Health assessment was carried out.

Due to Indonesia has a very large area and the artisanal mining is widespread through out the country, hopely the above assessment can be conducted at other locations and the stakeholders involvement can be intensified.