



a toxics-free future

[www.ipen.org](http://www.ipen.org) | [ipen@ipen.org](mailto:ipen@ipen.org) | @ToxicsFree

## International Mercury Treaty Enabling Activities Program (IMEAP)

Following the signing of the Minamata Convention on Mercury (the 'Mercury Treaty') in 2013 and the release of the IPEN Minamata Declaration on Toxic Metals, IPEN expanded its Mercury-Free Campaign and developed a broad program of treaty-enabling activities to be implemented in conjunction with IPEN Participating Organizations (POs). The International Mercury Treaty Enabling Activities Program (IMEAP) is geared toward raising awareness about the mercury treaty while generating data on key thematic elements of mercury pollution to help enable countries to implement the Minamata Convention.

IPEN launched IMEAP in early 2014 and continues to mobilise resources for IPEN POs to conduct activities that support implementation of the mercury treaty<sup>1</sup>.

The key objectives of the IPEN IMEAP are:

1. *Preparing for Treaty Ratification & Implementation*: Creating synergies between NGOs in developing countries with ongoing UN agency or government-led mercury activities and NGO priority-setting.
2. *Enabling Activities to Prepare Countries for Treaty Ratification & Implementation*: Support to NGOs to carry out national and thematic mercury treaty activities.
3. *Communication of Issues Related to Mercury and Treaty Ratification & Implementation*: Global dissemination of project results & south-south collaboration.

The following project forms part of the overall IMEAP activities and contributes to the greater global understanding of mercury pollution issues while providing information that may contribute to Minamata Initial Assessments (MIA) and raise public awareness in preparation for early ratification of the Minamata Convention on Mercury.

---

<sup>1</sup> IPEN would like to acknowledge the financial contributions from the governments of Germany, Sweden and Switzerland, and the Swedish public development co-operation aid through the Swedish Society for Nature Conservation (SSNC) and other donors. The views herein shall not necessarily be taken to reflect the official opinion of any of these donors, including SSNC or its donors.



a toxics-free future

[www.ipen.org](http://www.ipen.org) | [ipen@ipen.org](mailto:ipen@ipen.org) | @ToxicsFree

## **IPEN Mercury Treaty Enabling project**

Indonesia

NGO: Balifokus Foundation

Date: December 2015 (IMEAP 2014 Phase)

Title of project: Established and strengthened health professionals, community and NGO capacity for prevention, diagnosis, treatment, and monitoring of health risks related to mercury exposure from selected ASGM hotspots of Indonesia and the Philippines

### **Summary**

This comprehensive report by NGO Balifokus (Indonesia) documents a field-based investigation by Balifokus personnel and medical experts into the health impacts of mercury exposure on ASGM miners, their families and communities in selected communities of Indonesia. The report documents the involvement of over 1 million Indonesians in the practice of artisanal small scale gold mining (ASGM) and reveals the growing activity of primary mercury mining that is emerging in parts of Indonesia. This groundbreaking report discusses the conditions of the miners and their communities and the diagnostic methods to determine if mercury intoxication has taken place, and records some of the health impacts among the villagers of Cisitu, Sekotong, Bombana Regency and Wonogiri Regency. Balifokus provides recommendations to address the current crisis of mercury use in small scale gold mining as well as providing important tools for other NGOs to use in their investigations of this environmentally destructive activity.

### **The scale of ASGM in the project area**

Artisanal and Small-scale Gold Mining (ASGM) is practiced in 27 provinces out of 34 provinces of Indonesia, spread out in more than 900 hotspots/sites, and involves more than 1 million miners, women and children. The use of mercury in the field is massive and uncontrolled. The amount of mercury imported to the country has declined since 2014, but local mercury produced by artisanal mercury miners and financiers is now mushrooming. Some of them, when interviewed, claimed that they will export the mercury to other countries.

In Indonesia, in the last five years, the number of artisanal and small-scale gold mining hotspots has almost doubled. Sites are located on public or private land that is managed together by groups of miners or a community. In 2010, there were about 900 hotspots associated with more than 250,000 miners, including women and children, as well as over 1,000,000 people who relied on the sector for their livelihood.<sup>2</sup> From various studies, it was estimated that every miner could produce 5-10 grams of gold per week. The ASGM sector could produce about 65-130 tonnes of gold per year, bigger than the national gold production, which was 46 tonnes in 2013. There is a huge economic potential and benefits for impoverished communities, but it needs to be managed and controlled properly to prevent negative irreversible impacts.

---

<sup>2</sup> Ismawati, Y. 2011.

The UN funded Global Mercury Project (2007) reported that mercury in fish in Central Kalimantan around the ASGM site ranged from 0.09 ppm up to 1.6 ppm. Several studies conducted in Jambi (1977), West Kalimantan (2000), North Sulawesi (2002), West Java (2003) and Palu, Central Sulawesi (2008, 2010) found high mercury concentrations in the river, soil and fish affecting community and miners' health.<sup>3,4,5,6</sup>

A study conducted by BaliFokus and others in several ASGM hotspots found mercury in the air was also considerably high, ranging between 20 nanogram/cubic meter up to 55,000 nanogram/cubic meter<sup>7,8</sup>. Mercury was also found in the food chain, especially rice and fish, risking the downstream population's health as well as the community that lives within the area.<sup>9,10</sup> Mercury in water and sediment in several ASGM sites ranges from 0.6 ppm up to 4 ppm, which is 600-3000 times higher than the World Health Organisation (WHO) standard (0,001 ppm).<sup>11,12,13</sup>

### The recent history of ASGM in the project area

Our project areas and their recent history are as follows:

- a. **Cisitu, Lebak Regency, Banten Province.** The main economic activities in this area are wet-system rice farming, fish ponds, forest-based products, and gold mining. The site is an indigenous peoples' territory, located inside a national park, and has had a history of conflict with a state-owned gold mining company (PT. Aneka Tambang) from the 1990s until 2003. The site is an old site, meaning that the community has done some activities around this area for more than 15 years, and used mercury at a rate of more than 25 tonnes per year. In the last 10 years, the gold extraction process has moved to the village and has been mushrooming in the residential areas. The total population of the Cisitu community is about 7,000 people, consisting of about 1,460 households. Almost 50% of the population is involved in gold mining and relevant processing activities. The Cisitu community is comprised of indigenous people that still respect and value their traditional customary ways, including planting and consuming their own rice. Some rice samples from Cisitu showed high mercury concentrations.
- b. **Sekotong, West Lombok Regency, West Nusa Tenggara Province.** The main economic activities in this area are dry-land rice farming, fisheries and gold mining. The mining sites are spread out in about 10 sites and have a history of conflict with a private gold mining

---

<sup>3</sup> Subanri, 2008. Kajian Beban Pencemaran Merkuri (Hg) Terhadap Air Sungai Menyuke Dan Gangguan Kesehatan Pada Penambang Sebagai Akibat Penambangan Emas Tanpa Izin di Kecamatan Menyuke Kabupaten Landak Kalimantan Barat. Program Pasca Sarjana Magister Kesehatan Lingkungan Universitas Diponegoro. Semarang. Indonesia.

<sup>4</sup> Daniel Limbong et al, 2002. Emissions and environmental implications of mercury from artisanal gold mining in north Sulawesi, Indonesia

<sup>5</sup> Irwan Said, 2008. Tadulako University. Palu, Central Sulawesi.

<sup>6</sup> Halimah Syafrul, 2003. University of Indonesia. Pencemaran merkuri dan strategi penanganan penambangan emas tanpa izin (PETI) di Pongkor, Jawa Barat. Jakarta.

<sup>7</sup> BaliFokus, June 2011. Lumex sampling result in Palu and Poboya ASGM site.

<sup>8</sup> Yuka Serikawa, 2011. Joint research Toyohasi University of Technology, Toyama Prefecture University and Tadulako University.

<sup>9</sup> BaliFokus, 2013. Environmental monitoring in ASGM hotspot in Cisitu Village, Lebak Regency, Banten Province.

<sup>10</sup> Krisnayanti et al, 2012. Mercury assessment in a four-year old ASGM site.

<sup>11</sup> Gajah Mada University. 2010. Press release environmental monitoring study of Sekotong ASGM area.

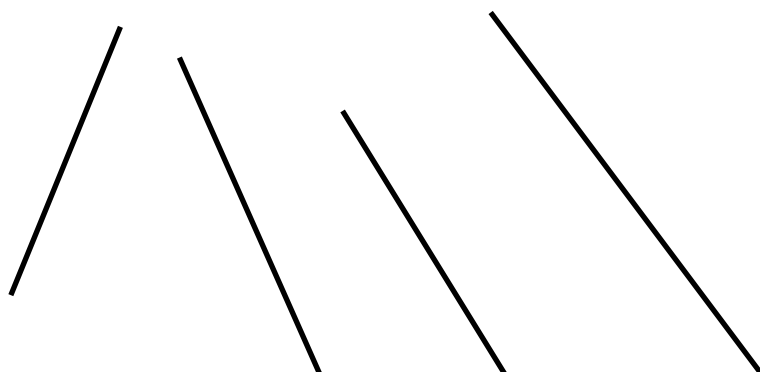
<sup>12</sup> Prof. Mappiratu, Tadulako University. 2010. Laboratory result of Poboya ASGM site.

<sup>13</sup> Yayasan Tambuhak Sinta. 2010. Scoping Study Report of Poboya, Palu ASGM Site.

company (PT. Indotan Lombok Barat Bangkit). The site is about 8-10 years old; not a young hotspot, but not too old (started around 2000-2002), and has used mercury at a rate of more than 70 tonnes per year. In the last 10 years, the gold extraction process has moved to the village and has been mushrooming in the residential areas. The total population of the Sekotong areas where the ASGM practices is spread out is about 40,000 people. Almost 50% of the population is involved in gold mining and relevant processing activities.

- c. **Bombana Regency, Southeast Sulawesi Province.** The main economic activities in this area are irrigated rice farming, fisheries and gold mining. The mining sites are spread out over more than 10 sites, are mostly alluvial type mining, and have conflicts or overlap within the concession areas of several medium-sized gold mining companies. The site is more than 10 years old, and was started around 2004-2005 when a farmer dug into his soil and found a big chunk of gold in his farmland. Miners at the Bombana site used mercury intensively at a rate of more than 80 tonnes per year during the panning process and through the sluice box. In the last 10 years, the gold extraction process has moved to the village and has been mushrooming in the residential areas. Like at other sites, some processing activities involving mercury and burning the amalgam are handled by women. The total population of the ASGM sites in Bombana is about 50,000 people spread out in several sub-districts. Almost 50% of the population is involved in gold mining and relevant processing activities, but the gold mining activities have been declining since 2010; transferred and formalised to medium-sized companies that obtained permits to mine from the local government. The mineral in some sites in Bombana also contained cinnabar ore.
- d. **Wonogiri Regency, Central Java Province.** The main economic activities in this area are irrigated rice farming, agriculture, non-timber products and gold mining. The mining sites are spread out in 6 sites, are mostly rock type, and have already been mined for more than 25 years. Miners at the Wonogiri ASGM site mined the ore within their own village and the neighbouring village, and then processed the ore at home using ball-mills, using mercury intensively. It is predicted that miners in Wonogiri used mercury at a rate of more than 80 tonnes per year during mining. The ore in Wonogiri also contained high percentages of Au, Cu, Pb, Zn, Ag and Hg.

Figure 1 shows the location of BaliFokus project sites.



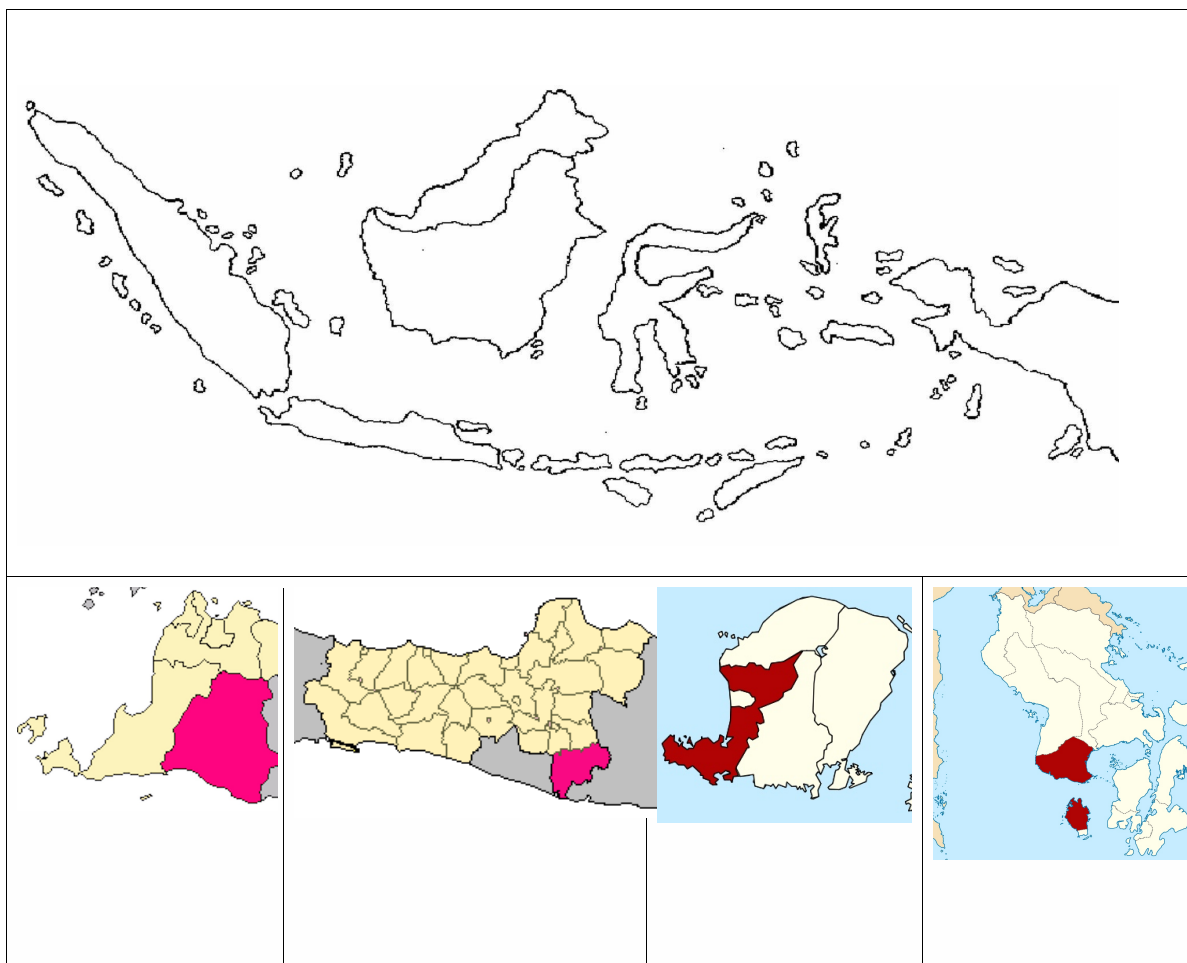


Figure 1. Maps of the ASGM project sites (from left to right): Lebak Regency, Wonogiri Regency, West Lombok Regency and Bombana Regency

### **Describe the methods used to estimate the scale of ASGM activity.**

We used mixed methods to estimate the scale of ASGM activities in Indonesia. We used Tekmira (*Teknologi Mineral*) Journal, *Badan Geologi dan Sumber Daya Mineral* (Geology and Mineral Resources Agency), various scientific papers and journals of Indonesian researchers, local government reports, project reports, publications, mining companies reports and websites, news clippings, interviews with miners and communities, field surveys and information from discussions at meetings.

### **Describe the environmental and human health impact of mercury use in ASGM in the project area.**

The health impact of mercury to humans and the environment is described in a guidance document prepared jointly by the WHO and the United Nations Environmental Programme (UNEP) as the following:

*“The primary targets for toxicity of mercury and mercury compounds are the nervous system, the kidneys, and the cardiovascular system. It is generally accepted that developing organ systems (such as the foetal nervous system) are the most sensitive to toxic effects of*

*mercury. Foetal brain mercury levels appear to be significantly higher than in maternal blood, and the developing central nervous system of the fetus is currently regarded as the main system of concern as it demonstrates the greatest sensitivity. Other systems that may be affected include the respiratory, gastrointestinal, hematologic, immune, and reproductive systems*<sup>14</sup>

Mercury can cause direct or indirect intoxication and this depends on the personal sensitivity and susceptibility. Mercury can be present in the following three different ways:

**a. Elemental mercury.**

- This is mercury in the original form (the most volatile form of mercury), and usually contaminates our body by inhalation or by ingestion of mercury directly through air. When mercury is being burned off amalgam it evaporates to the air, increasing exposure.
- Inhaling elemental mercury vapours causes acute symptoms such as cough, chills, fever, and shortness of breath, and also GIT (gastrointestinal tract) complaints such as nausea, vomiting and diarrhoea accompanied by a metallic taste, dysphagia (difficulty or discomfort in swallowing), hyper salivation, weakness, severe headaches and visual disorders.<sup>15</sup> This type of mercury can be excreted out of our body by our kidney and flows through the urine.<sup>16</sup>

**b. Inorganic mercury compounds.**

- Inorganic mercuric compounds include mercuric sulphide (HgS), mercuric oxide (HgO) and mercuric chloride (HgCl<sub>2</sub>). These types of mercury compounds are also called mercury salts. However, the water solubility and chemical reactivity of these inorganic (ionic) mercury gases lead to much more rapid deposition from the atmosphere than for elemental mercury. This results in significantly shorter atmospheric lifetimes for these ionic (e.g. divalent) mercury gases than for the elemental mercury gas.<sup>17</sup>
- In acute cases ingestion of inorganic mercury salts could cause gastroenteritis. The colour of mucous membranes changes rapidly, along with development of metallic taste, local oropharyngeal pain, nausea, vomiting, bloody diarrhoea, colic abdominal pain and renal dysfunction. Subsequently, stomatitis, haematemesis (the vomiting of blood) and hematochezia (blood excreted through faeces) may be seen. Chronic inorganic mercury salts intoxication may lead to the development of tremor of the lips and tongue, severe salivation, losing teeth, anorexia, and weight loss. This species of mercury also will be excreted out of our body through our kidney through our urine, and will be cleaned out of our body within a 3-month period if the exposure was only in one batch.<sup>18</sup> The reality is different and when people are exposed continuously every day, the kidneys could be affected severely.

**c. Organic mercury or methyl mercury.**

- This form of mercury is the one that has a bond with a living being, such as fish, shell-fish, or other living things. The danger of this kind of mercury is that it will accumulate in the body of

---

<sup>14</sup> UNEP. 2008. Guidance for Identifying Populations at Risk from Mercury Exposure. DTIE. Chemicals Branch and WHO Department of Food Safety, Zoonosis, and Foodborne Diseases,

<sup>15</sup> Mehrdad Rafati-Rahimzadeh et.al. 2014. Current approaches of the management of mercury poisoning: need of the hour. Daru. 2014; 22(1): 46. Published online 2014 Jun 2. doi: 10.1186/2008-2231-22-46.

<sup>16</sup> WHO. 2003. ELEMENTAL MERCURY and INORGANIC MERCURY COMPOUNDS: HUMAN HEALTH ASPECTS. Concise International Chemical Assessment Document 50.

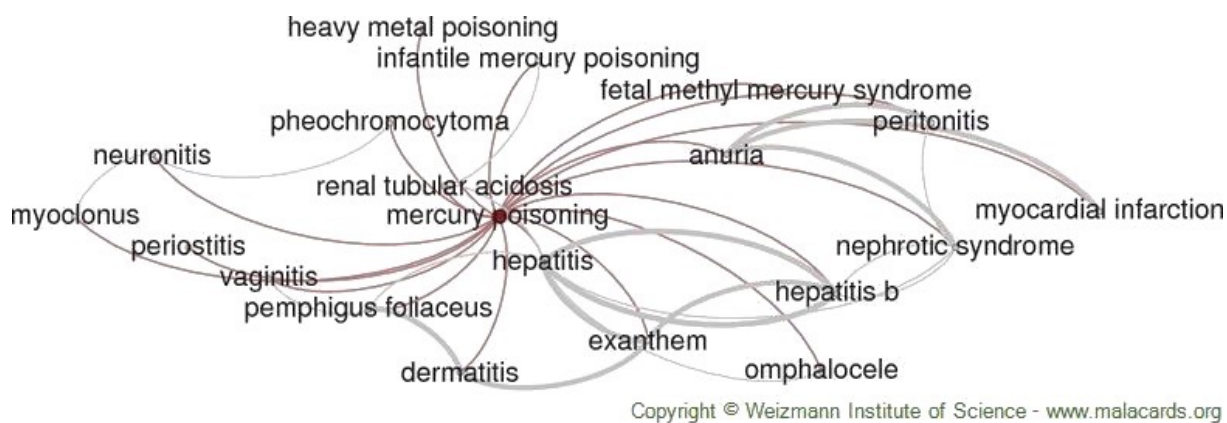
<sup>17</sup> UNEP Mercury Programme.

<sup>18</sup> Mehrdad Rafati-Rahimzadeh et.al. 2014.

the living being and increase in the food chain hierarchy. Methyl mercury is the most dangerous type mercury to our body, because it will be deposited in our body rapidly, and can cause neural disturbances and physical deformity.

- Depending on the susceptibility and the sensitivity of a person, the deformity usually takes place around 5 to 10 years after exposure, rather than a disturbance or illness immediately showing. In the case of mild exposure, organic mercury compounds, especially methyl mercury, do not produce severe symptoms, but high exposure to organic mercury compounds leads to acute Gastro Intestinal Tract symptoms and delayed neurotoxicity and regional destruction of neurones. This type of organic mercury can also cause many health problems, mimicking other disease symptoms, and can be described as “the greatest imitator.”

The map of diseases that possibly arise as an outcome of mercury poisoning can be seen in the MalaCard below.



*Figure 2. Possible diseases related to mercury intoxication.*

Source: Weizman Institute of Science (accessed by 28 October 2014)

[http://www.malacards.org/card/mercury\\_poisoning#disorders](http://www.malacards.org/card/mercury_poisoning#disorders)

Many mercury intoxication cases that occur result in neural deficit-related diseases. If it has deposited in the body of a female, this can result in birth defects for children carried by the women. If the child was exposed at birth, it can create neural deficiencies later in the child’s life. This deficiency develops gradually and increases with the age of the child.

This neural deformity can also have an effect on adults, in those who have direct contact with the mercury and those who consume food or water contaminated by mercury. The worst aspects of the diseases related to mercury are not happening due to direct contact with mercury (except for some skin disorders that are caused by hypersensitivity to the mercury, which can cause direct reactions). This is also a linear relationship with the exposure to mercury, especially to the organic mercury that is ingested with food. People who have been exposed to

mercury for a number of years may take about 10 years to show the clinical symptoms, and it will worsen as time elapses. Depending on individual health conditions and vulnerabilities, some adults can be affected quickly. Unfortunately, babies and children under 6 are the most vulnerable subjects.<sup>19</sup>

### **Describe the supply chain and availability of mercury to workers in the ASGM operations.**

Mercury entered Indonesia through legal and illegal flows via various countries, as shown in Figure 3 and Table 1 below. Mercury is exported to Indonesia under several commodity categories: SITC Rev. 2 - 52216 - mercury; SITC Rev. 3 - 52227 - mercury; and after 1985 as HS 280540.

As mercury is categorised under the hazardous substances for restricted purposes or *Barang Berbahaya* (B2), according to the Ministry of Trade regulation No.75/M-DAG/10/2014, elemental mercury should be imported only by registered B2 importers and the end user of hazardous substances such as CFL manufacturers, thermometer factories, etc. Since 2011, mercury is only permitted to enter Indonesia through 5 ports, and importers have to obtain VPTI certificate or clearance (*Verifikasi Penelusuran Teknis Impor*) or Technical Importation Verification Assessment from several designated companies.

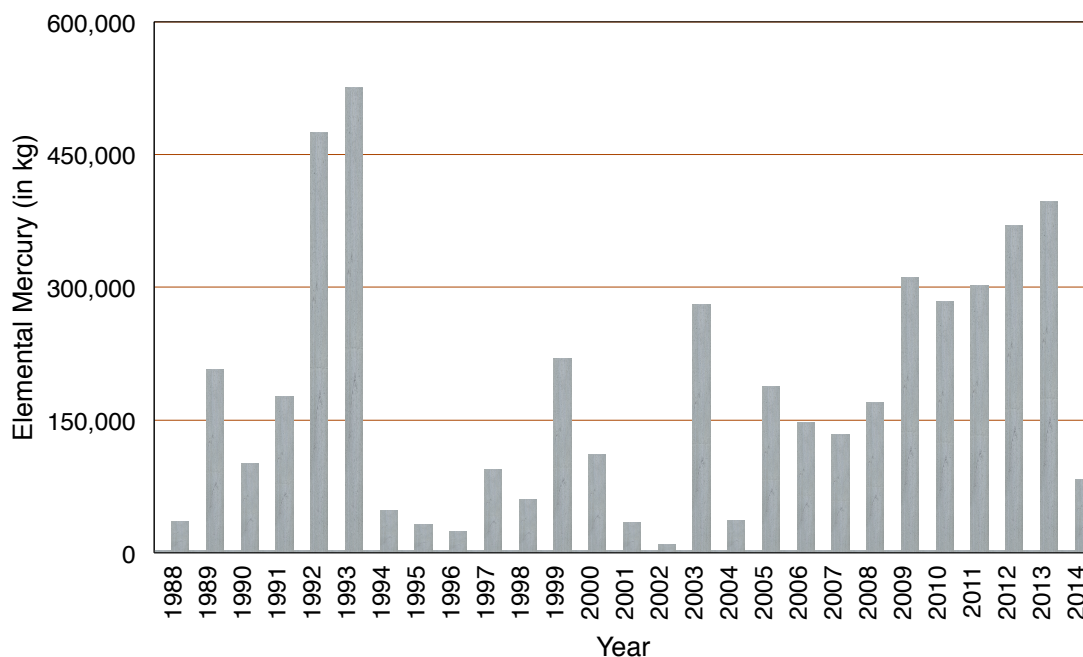
From our observations, mercury is sold freely through various channels and mediums including: shops, kiosks, online, by phone, and door-to-door. The first three approaches are practiced widely in the capital city of Indonesia (Jakarta) and big cities of Indonesia, while the last two approaches are practiced widely at the provincial and local level. Some gold shops in big cities also sell mercury. Traders must obtain permits to sell hazardous substances (B2) from the relevant local government agencies and national agencies. However, many mercury traders do not have such permits; instead they will show a list of military or police officials' phone numbers when asked for their permits.

Mercury is sold in various packaging. In Jakarta and some big cities, the traders sold mercury in flasks as well as in smaller containers or bottle sizes of 1 kilogram. At the local level, the packaging could be even smaller, placed in a simple plastic bag or small bottle, usually sold as a 100 gram package. Various packaging of mercury sold in Indonesia is shown in Figure 4.

---

<sup>19</sup> Philippe Grandjean. 2013. *Only One Chance*. Oxford University Press.





**Table 1. Mercury exporting countries to Indonesia between 1988 to 2014**

Country	Amount (kg)	Country	Amount (kg)
Areas, nes	1,369	Malaysia	4,876
Algeria	22,437	Netherlands	61,192
Australia	62,113	Not specified	35
Austria	10,769	Other Asia, nes	195,986
Belgium	157	Poland	1,562
Brazil	359	Singapore	1,803,713
China	228,419	Spain	534,262
Czech Rep	17,250	Sudan (former)	0
France	72,380	Sweden	40,000
Germany	126,267	Thailand	3,477
Hungary	98	Turkey	3,562
India	4,126	UK	14,398
Italy	28	USA	442,336
Japan	125,517	World	970,848

Source: UN Comtrade database HS280540, SITC Rev.2-52216, SITC Rev.3-52227, Indonesia Trade Statistic (BPS) reports.



Figure 4. Various packaging of mercury sold in Indonesia.

Mercury is sold at various prices, depending on the source or origin of mercury, as in Table 2. Mercury sales are also advertised freely on social media platforms, especially on Facebook. By the third quarter of 2014, there were more than 60 mercury traders listed on various websites and trading platforms and more than 30 Facebook accounts specifically selling mercury to be used in the ASGM sector.

**Table 2. Mercury price sold in several Indonesia’s ASGM hotspots**

Claimed country or origin	Retail price (IDR/kg)	Remark
Germany	1,500,000 - 1,600,000	Claimed to have 99.99% purity but certificate only displayed on the websites
USA		
Spain		
China	700,000 - 1,000,000	Claimed to have 70 to 99.99% purity but certificate only displayed on the websites or email
Recycled hg		

**Table 2. Mercury price sold in several Indonesia’s ASGM hotspots**

Local	150,000 - 250,000	No information about purity
-------	-------------------	-----------------------------

Source: Observation and field survey, 2014

**Describe how is mercury utilised in the ASGM activity.**

Mercury is used or added mostly in the panning process, whole ore amalgamation, and concentrate amalgamation process. Depending on the quality of the ore and type of the ore, miners used mercury at a rate of between 50 grams per pan and up to 500 grams per ball-mill unit. In one ASGM site in Sulawesi, a ball-mill operator claimed to use about 7 kg of mercury per day to process 10 ball-mills within 24 hours.

Mercury will be poured into the pan or ore inside the ball-mill directly from its packaging and is then mixed barehanded. Some miners put their bare hands into the ball-mills to mix the mercury evenly. After 4-5 hours, the mixture inside the ball-mills will be discharged and settled in a smaller bowl or bucket and then mixed again by hands. The sediment that settles in the bowl will be screened in a cloth and then squeezed to form amalgam. After collecting several nuggets of amalgam, miners will burn it and get the gold (mostly between 20% and 60% purity) and cash it in at the gold kiosk.

Several observations in the field in Indonesia show that miners used up to 60 grams of mercury per gram of gold produced. This is considered very high, as the common knowledge found in several studies stated the comparison was 5-10 grams of mercury per gram gold produced.

**Describe the techniques used to minimise mercury exposure to workers and their families and /or recycle mercury (retorts, fume hoods, etc).**

Retorts and fume hoods were introduced from 2006-2009 in Central Kalimantan through a UNIDO Global Mercury Project in several countries including Indonesia. The project introduced the application and modification of fume hoods and retorts in some gold shops and mining sites. However, the retorts are never utilised anymore. Some miners are not in favour of using them due to their small capacity, some miners do not like retorts because they could not see the gold appearing during the process, and some others said that there is no regulation, enforcement or incentive to use them.

In 2013, a quick sampling in three Palangkaraya gold markets was conducted by the BaliFokus team, where most of the gold shops have already installed the fume hoods introduced by the UNIDO-GMP project. BaliFokus detected mercury vapour above 41,000 nanogram/m<sup>3</sup> in several corners of the market.

Miners in the project area have started to use non-mercury gold extraction processes, ranging from other chemical-based processes to the physical-mechanical concentration processes. Cyanide is widely used in the conventional cyanide leaching plants as well as 'new' leaching technique in a shallow tank covered by tarpaulin.

**Describe the level of awareness of mercury toxicity among ASGM workers and their families in your project area.**



a toxics-free future

[www.ipen.org](http://www.ipen.org) | [ipen@ipen.org](mailto:ipen@ipen.org) | @ToxicsFree

Some miners are aware of the harmful effects of mercury but do not care or do not have any plan to evacuate or move their families from the village. Some young and educated miners moved their families and pregnant wives to another town. Some others are aware but claimed that they have no other choice but to use mercury because they are just following orders from their bosses.

### **Describe the demographic of ASGM workers in your project area.**

a. **Cisitu, Lebak Regency, Banten Province.** Cisitu is located in the Cibeber Sub-district, Lebak Regency. The total population of the Cisitu community is about 7,000 people, consisting of about 1,460 households, spread out into two villages (Situ Mulya and Kujang Sari) within a 7,226 hectare of land inside the Halimun-Salak Mountain National Park. The Situ Mulya's population in 2012 was 2,537 people, consisting of 1,252 men and 1,285 women distributed into 848 Households (HHs). Kujang Sari's population in 2012 was 1,985 people, consisting of 1,030 men and 955 women in 666 HHs. Almost all households are involved in ASGM-related activities and at the same time continue their work as rice farmers.

Almost 50% of the population is involved in gold mining and processing relevant activities such as mercury selling, metals workshop, crushing, grinding, milling, amalgam burning, and gold buying.

After finishing their rice farming or agriculture-related activities, they will be involved in either crushing the ore at home, in a communal space, or operating the ball-mills in the backyard or at someone's facility. There are only a handful of gold buyers in Cisitu. All of these gold buyers have a burning unit in front of or beside their houses.

In the last 6 years, most miners are local villagers from Cisitu, no migrant miners. They received daily wages plus the profit sharing from the sales of gold produced collectively. Children as young as 12 joined the group and went to the mining shafts for 2 weeks or so until they collected enough ore to be split between the owner/the boss and the workers. Usually the owner will retain 50-70% of the ore and the rest will be split equally among the workers (5-10 people in one group).

Most miners suffered from severe headache, TB, skin diseases, hernia, back pain, and sight problems. Some of them have had to undergo hernia operations and show mercury intoxication symptoms. In a health assessment conducted in October 2014 for 130 people (men and women, young people and adults) of Cisitu, about 27% showed severe mercury poisoning. Some children are suspected to have severe congenital mercury intoxication.

b. **Sekotong, West Lombok Regency, West Nusa Tenggara Province.** Sekotong is one of the sub-districts of West Lombok Regency with a total population of 57,500 people spread out in 16,200 households. One in five households along the road in Sekotong and Pelangan areas are involved in ASGM-related activities and owned 2-10 ball-mill units beside or in the front yard of their houses, near the water wells.

Almost 30% of the population is involved in gold mining and processing, as well as relevant activities such as mercury selling, metal workshops, crushing, grinding, milling, amalgam burning, and gold buying.

After finishing their rice farming or agriculture-related activities, they will be involved in either crushing the ore at home, in a communal space, or operating the ball-mills in the backyard, front yard, or at someone's facility. The gold buyers in Sekotong can be found along the main street and identified by the gold burning unit in front of their shops or kiosks.



a toxics-free future

[www.ipen.org](http://www.ipen.org) | [ipen@ipen.org](mailto:ipen@ipen.org) | @ToxicsFree

In the last 4 years, Sekotong and Pelangan ASGM activities are declining, and less and less migrant miners are found in the area. Some mining activities are conducted or operated by a small group, only by a pair of husband and wife. Some others, like in many ASGM sites, operated in a group of 10 or 20, depending on the size and potential of the minerals.

Like in other sites, most miners suffered from severe headache, TB, skin diseases, hernia, back pain, and sight problems. Some miners, adults and children in Sekotong and Pelangan areas had severe mercury intoxication symptoms.

- c. ***Bombana Regency, Southeast Sulawesi Province.*** In Bombana Regency, most ASGM activities are spread out in about 5-6 sub-districts involving a population of about 15,000. Almost 50% of the population is involved in gold mining, processing, and relevant activities, but the gold mining activities have been declining since 2010.

As the gold deposits in Bombana are mostly alluvial and available along the riverbank and in the soil, many women and children are involved in ASGM activities from the upstream level to the downstream level (in the form of gold nuggets).

In one area of Bombana, many divorcee women and widows were recruited to work for a particular boss. He provided them with the shelters, the mining sites to work, or the tailings to be processed, and assurance to buy their gold processed with mercury supplied by the boss.

Like in other ASGM sites, most miners settled down in the hotspots with the whole family (and some babies were born in those areas). A couple of children and babies were born with birth defects and other health problems.

- d. ***Wonogiri Regency, Central Java Province.*** Mining activities in Wonogiri spread out in 6-8 sub-districts and villages. Most miners are men but in some sites we can find women also involved in digging the ore, and a noticeable number of old women (age between 60s-70s) also found digging the ore occasionally.

Some women established their own small group and operated 2 ball-mills shared with other women miners.

Only a few children were involved in mining activities, but some of the children live in the houses where ball-mill units operated and use mercury intensively.

### **Describe the driving factors of ASGM in the project area.**

The factors driving ASGM in the project areas are mostly poverty, legacy and opportunities to mine or to get some gold from the tailings. West Nusa Tenggara, for example, is among the poorest regencies in Indonesia. The increased price of diesel fuel reduced the number of fishing boats, as well as the frequency of fishing in some areas. Selling gold from the ASGM site is the easiest way to get quick cash, and can be done as a family business.

Mineral deposit potential and lack of law enforcement made the gold exploration and processing much easier.

### **Project Outcomes:**

Activities conducted that were supported by the IMEAP funds were:

1. Health impact assessment in Csitu village; and



a toxics-free future

[www.ipen.org](http://www.ipen.org) | [ipen@ipen.org](mailto:ipen@ipen.org) | @ToxicsFree

2. Capacity-building to identify mercury intoxication symptoms for health workers, government officials, academia and NGOs from several cities of Indonesia and the Philippines (conducted in Jakarta).

1. **Health impact assessment in Cisitu village.**

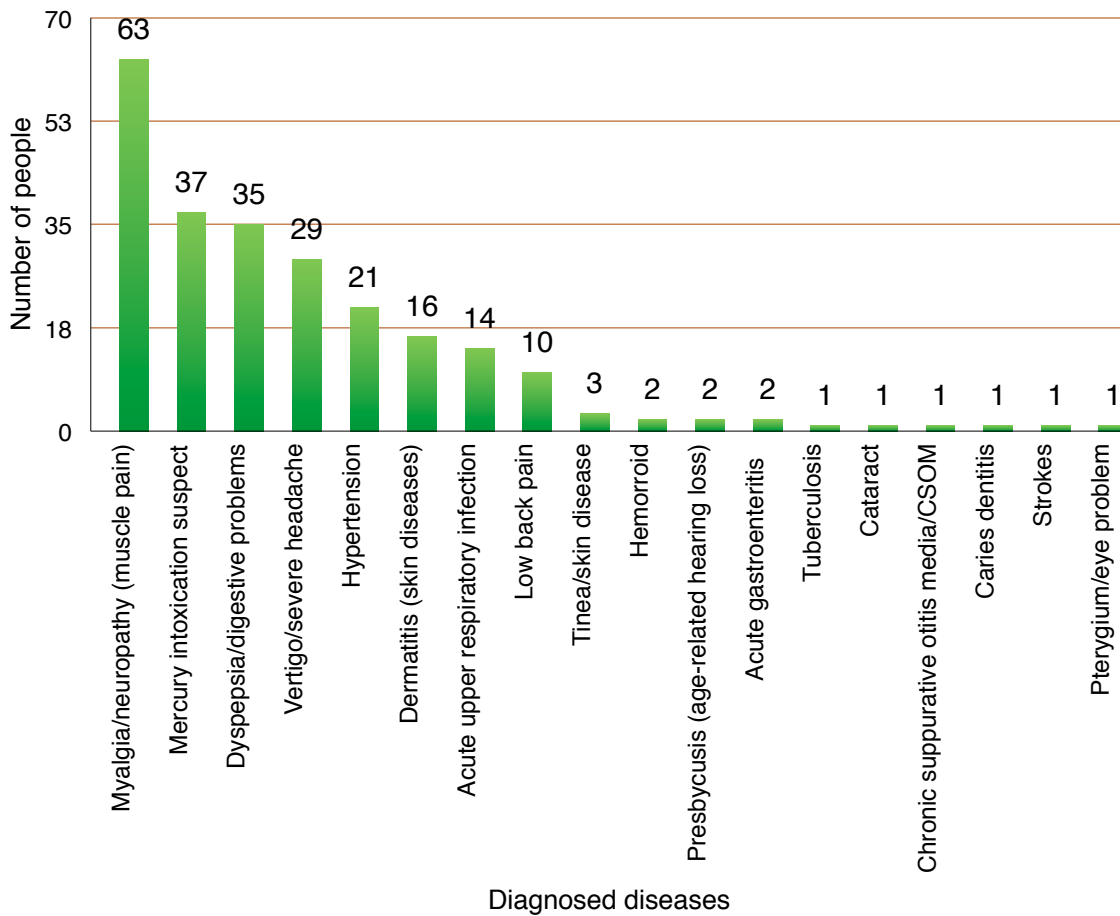
The health impact assessment was conducted jointly with 3 doctors from the Medicuss Foundation (Dr. Jossep William, Dr. Fradico and Dr. Panji), and a German pediatrician and mercury intoxication expert, Dr. Stephan Bose-O'Reilly, PD.

The assessment was conducted in two approaches: home visits and a free health check service at the community hall. We managed to visit about 20 people with severe diseases and undiagnosed illnesses, and from the health service the three doctors managed to serve and scan about 140 patients. Of those examined, 26.4% of them are suspected to have severe mercury intoxication. Figure 5 provides the results of the assessment.

The main complaints were myalgia or neuropathy (nerve system disorder), hypertension, upper pulmonary infection diseases and dyspepsia (upset stomach or indigestion, hard or difficult digestion).

The list of home visit patients are provided in Table 4 and the summary of health complaints from the free health service are provided in Table 5 (tables at page 18-19 below).

Further health and medical examinations are needed and treatment or medication for several curable/treatable diseases need to be conducted and provided by the Health Agency of Lebak Regency.



In addition to the health assessment, we also conducted mercury vapour measurements in Kasepuhan Adat Cisitu areas, covering some spots in the two villages (Kujang Sari and Situ Mulya villages). Figure 6 shows the distribution of Hg vapour, while Figure 7 shows the mercury vapour concentration and the houses of some mercury intoxication suspects from the house visits.



Fig. 6 Mercury vapour measurement (green, yellow and big red dots) in Kasepuhan Adat Cisitu areas



Fig. 7 Mercury vapour measurement (green, yellow and big red dots) and mercury intoxication suspects' houses (smaller red dots) of the Kasepuhan Adat Cisitu ASGM areas (October 2014)



**Table 3. Mercury emission and mercury gaseous dispersion in Cisitu**

Sampling point	Location	Mercury in the air (nanogram/m <sup>3</sup> )
1	SDN 1 Situ Mulya (elementary school)	262,14
2	Ball-mills Pak Apen	29.472,92
3	Ball-mills Pak Encup	6.495,50
4	Ball-mills Pak Adhi	2.318,35
5	Ball-mills Pak Uad	993,20
6	Ball-mills Pak Um Hatta	3.856,46
7	Amalgam burning corner Pak Um Hatta	38.143,68
8	Gold kiosk Ibu Tiamah	55.817,47
9	Ball-mills Pak Enur	38.107,95
10	Ball-mills Pak Oleh	35.745,62
11	Soaking pond Pak Jamaludin	15.438,70
12	Ball-mills Pak Udin	24.367,69
13	Ball-mills A	19.579,74
14	Village intersection to Kujangsari	779,93
15	Accessories shop	9.146,93
16	Food stall Bunda	409,13
17	In the middle of a rice field	594,38
18	In the centre point of the foot ball field	591,67
19	Mosque Jami' Nurul Iman	600,08
20	Fish pond with lotus	76,90
21	Car wash	728,42
22	Motor cycle repair shop	222,14
23	Lumbung Padi/rice barn	219,28
24	Ball-mills below the Adat house	2.480,69
25	The Adat House - community hall	76,43
26	Ball-mills Encup	4.990,61
27	Intersection Toko Bangunan	263,68

28	Warung Ukaja	724,37
29	Rice field near ball-mills	1.473,19
30	Ball-mills green house	3.398,22
	Mean	9.912,52

According to the direction of the United States Department of Health and Human Services,<sup>20</sup> actions to be taken based on indoor mercury concentrations are presented in Table 3 below.

Table 3. Action Benchmark for Indoor Mercury Concentration	
Hg Concentration	Action
< 1,000 nanogram/m <sup>3</sup>	Safe
1.000 – 10,000 nanogram/m <sup>3</sup>	Get ready for evacuation
> 10,000 nanogram/m <sup>3</sup>	Evacuate/isolate
<i>Source: Department of Health and Human Services, USA. (2012)</i>	

According to the WHO guidelines<sup>21</sup> and United States Department of Labor,<sup>22</sup> permitted level of mercury exposure in the work environment is 10.000 ng/m<sup>3</sup> mercury in the form of alkyl compounds within 8 working hours, and 100.000 ng/m<sup>3</sup> mercury in form of aryl and inorganic compounds within 8 working hours.

Meanwhile, the standards set by the Ministry of Labour of the Republic of Indonesia through the Circulation Letter No. SE-01/MENAKER/1997 on Threshold Values of Chemical Factors in the Workplace, including mercury exposure (Table 5 in the Appendix of the Circular Letter), do not present any threshold values reference for alkyl mercury; whereas in the form of aryl compounds amount to 100,000 ng/m<sup>3</sup> and as Hg is 25,000 ng/m<sup>3</sup>. For the purposes of this baseline study, the threshold value as alkyl mercury used is the U.S. Department of Labor figures (10,000 ng/m<sup>3</sup>).

## 2. Capacity-building to identify mercury intoxication symptoms for health workers, government officials, academia and NGOs from several cities of Indonesia and the Philippines (conducted in Jakarta)

<sup>20</sup> Department of Health and Human Services, USA. (2012). Action Levels For Elemental Mercury Spills. Chemical-Specific Health Consultation for Joint EPA/ATSDR National Mercury Cleanup Policy Workgroup. March 22, [http://www.atsdr.cdc.gov/emergency\\_response/Action\\_Levels\\_for\\_Elemental\\_Mercury\\_Spills\\_2012.pdf](http://www.atsdr.cdc.gov/emergency_response/Action_Levels_for_Elemental_Mercury_Spills_2012.pdf)

<sup>21</sup> [http://www.euro.who.int/\\_data/assets/pdf\\_file/0005/74732/E71922.pdf?ua=1](http://www.euro.who.int/_data/assets/pdf_file/0005/74732/E71922.pdf?ua=1)

<sup>22</sup> Occupational Safety and Health Administration, Department of Labor, USA. [http://www.osha.gov/SLTC/mercury/exposure\\_limits.html](http://www.osha.gov/SLTC/mercury/exposure_limits.html)

The training was conducted in English and Bahasa Indonesian and held for three days in Jakarta. It was attended by 28 participants from Jakarta, Lebak Regency, West Lombok Regency, Denpasar, Mataram, Surakarta, and the Philippines.

Participants attending the training represented different institutions such as the Ministry of Health, local health agencies, academia and NGOs (as shown in Table 6).

**Table 4. List of home visits at Kasepuhan Adat Cisitu (Oct 2014)**

No.	Name	Gender	Age	Profession	Remarks
1	Ab Oh	M	70	Farmer	TB, bone infection, diabetic, blood vomit, was dying when we visited him (he died the day after we visited him)
2	D	M	23	Miner	TB, high fever, already sick for 1 year
3	N	F	78	Housewife	Mature cataract, hypertension
4	Uwa Sbk	M	60	Miner	Very sick since 2007, complaints about digestive problems, nervous hands, legs paralysed, defecates once in 5 days or 12 times a day, left foot and right hand sometimes had seizures/tremors
5	Skmn	F	60	Farmer, housewife	Live across Uwa Sbk, next to the fish pond with Hg bubbles, limp leg, aching arms, been sick for 2 years and getting worse.
6	Emak Uw	F	53	Farmer, housewife	Paralysed for 7 years, hypertension
7	Yn	F	54	Farmer, housewife	Stroke 3 years ago, could not move around, sleeping in the kitchen, defecated only 2 times during the month we visited her
8	Abah Jmhr	M	70	Farmer	Fallen sick in the last 2 years, aching legs, swollen, difficult to walk, tremors, weak legs
9	Abah Nmg	M	82	Farmer	Stopped going to the rice field 3 years ago, tremors, arms and leg cramps, severe headache, immature cataract, hypertension
10	Suh	M	100	Farmer	Stroke for 7 months, carcinoma (skin cancer) stage 2
11	Prys	F	37	Farmer	Arms and legs numbness for 7 years
12	Nnh	F	40	Farmer	Nausea, bloating, tremors in the last 4 months, restless sleep
13	Nem	F	40	Farmer	Severe headache, aching arms, hypertension

14	At	M	45	Farmer, miner	Tremor, Hg intoxicated, severe headache
15	Oc	F	60	Housewife	Most severe tremor, difficult to walk for more than 7 years, hypertension
16	Thnd	M	35	Farmer	Most severe tremor, ataxia in the last 2 years
17	Uhd	M	50	Miner	Stoke 1 years ago hypertension, tremor, left leg paralysed
18	Hst	F	11	Children	Cerebral palsy
19	Rf	M	3	Infant	Microcephalie
20	Mm	F	22	Housewife	Mother of Rf, healthy

**Table 5. List of complaints and diseases**

Table 5. List of complaints and diseases		
No.	Diseases	No. of people complaints
1	Myalgia/neuropathy (muscle pain)	63
2	Mercury intoxication suspect	37
3	Dyspepsia (upset stomach or indigestion, hard or difficult digestion)	35
4	Vertigo/severe headache	29
5	Hypertension	21
6	Dermatitis (skin diseases)	16
7	Acute upper respiratory infection	14
8	Low back pain	10
9	Tinea/skin disease	3
10	Hemorroid	2
11	Presbycusis (age-related hearing loss)	2
12	Acute gastroenteritis	2
13	Tuberculosis	1
14	Cataract	1
15	Chronic suppurative otitis media/CSOM (a chronic inflammation of the middle ear)	1
16	Caries dentitis	1



a toxics-free future

[www.ipen.org](http://www.ipen.org) | [ipen@ipen.org](mailto:ipen@ipen.org) | @ToxicsFree

17	Strokes	1
18	Pterygium (a fleshy mass that grows over part of the cornea)	1

**Table 6. Trainers & Participants**

No	Name	Institution/Organisation
1	Stephan Böse-O'Reilly	LMU
2	Yuyun Ismawati	BaliFokus
3	Krishna Zaki	BaliFokus
4	Dr. Arni Maharani	BaliFokus intern staff
5	Dr. Jossep F William	Medicuss Group
6	Dr. Fradico Teorgi Owi	Medicuss Group
7	Arlene Galvez	Ban Toxics! Philippines
8	Dr. Antonio C. Furlong	Municipal Health Jose Panganban, Camarines Norte, The Philippines
9	Dr. Carolina Rusdy Akib	Ministry of Health of Indonesia
10	Dr. Frides Susanty	Ministry of Health of Indonesia
11	Dr. Inne N	Ministry of Health of Indonesia
12	Adhy Prasetyo	Ministry of Health of Indonesia
13	Mugi Wahidin, SKM, M. Epid	Ministry of Health of Indonesia
14	Firman Rachmatullah	Health Agency of Lebak Regency, Banten Province
15	Dr. Erwan Susanto	Health Clinic/Puskesmas Cibeber, Lebak Regency
16	Ns Zulkipli, MM	Health Agency of West Lombok Regency, West Nusa Tenggara Province
17	Dr. Erick Gunawan	Health Agency of West Lombok Regency, West Nusa Tenggara Province
18	Asti Pramudiani	Gita Pertiwi Foundation
19	Rita Hastuti	KAKAK Foundation
20	Budi Susilorini	Blacksmith Institute
21	Nickolaus Hariojati	Blacksmith Institute
22	Sumali Agrawal	Yayasan Tambuhak Sinta
23	Siti Nur Alliah	Yayasan Tambuhak Sinta
24	Ardiana Ekawanti	Faculty of Medicine Mataram University
25	Hitapertiwi Suryadhi	Faculty of Public Health, Udayana University
<b>Journalists</b>		
No	Name	Media
1	Gabriel Yoga	Tempo
2	Lariza Oky Adisty	Kompas

3	Charlen	Metro TV
4	Uyung	Detik
5	Indra Nugraha	Mongabay

The training materials have been compiled separately as guidebook for the next program. Materials are provided separately from this report.

### **Describe the intentional information / message to be transmitted**

The messages aimed to be transmitted to the target audience are as follows:

1. In ASGM hotspots areas mercury is a clear and present danger.
2. Mercury concentrations in the environment of Cisit village and other hotspots are already above the safe level and increasing.
3. There are many undiagnosed and uncommon diseases suffered by the communities, especially elderly people and children.
4. Mercury poisoning is irreversible and at the moment there is no affordable and safe medical treatment available.
5. Mercury should not be used any more for gold processing. There are many safer alternatives already available in the market.
6. Health workers and community leaders should be able to identify some early symptoms of mercury intoxication to prevent further health problems.

The set of activities as the follow-up of the capacity-building activities were:

- Sent the report from Cisit health assessment and alerted the Ministry of Health to take immediate action to assess the situation and develop a plan of actions, including the development of a National Action Plan for the Health Sector to curb the impact of mercury exposures to the population, especially children and women;
- Maintain the contact and communication with the local health agencies in ASGM hotspots and recommended several activities related to health assessment in ASGM hotspots.

### **Describe the engagement of and impact on Target Groups**

- Engagement with the target group in Cisit village was conducted through several visits. Information and explanations were given about the results of their hair samples and their sicknesses. The recommendation was to stay away from mercury exposure, but this is not easy, and the commitment of the whole village to stop the use of mercury immediately is needed. Some community members have already moved out to other villages. A discussion and plan to develop a community action plan to eliminate mercury and find safer alternatives is currently underway.
- Engagement with the health officials conducted in the form of meetings and report submissions. The health agency of West Lombok Regency agreed to have a joint health survey and assessment in ASGM hotspots.

### **Describe the impact on Target Policies**



a toxics-free future

[www.ipen.org](http://www.ipen.org) | [ipen@ipen.org](mailto:ipen@ipen.org) | @ToxicsFree

- The Ministry of Health accepted the recommendation to develop a national action plan for the health sector.
- The Ministry of Health also plans to develop a guidance to identify mercury intoxication symptoms to be distributed nation-wide.

### **Describe the outreach to Stakeholders**

Stakeholders included the Ministry of Health and the health sector. Some activities and outreach already explained above.

### **Describe the deliverables, outputs and/or products**

- Mercury booklet
- Mercury intoxication assessment form (HBM/Human Bio-Monitoring test) (Please see Annex 3)
- Training materials
- Health assessment of Cisitu village report
- Training report

### **Describe communication efforts:**

- News clippings provided in the Annex

### **Provide the name of your National Minamata Convention Focal Point:**

The Indonesian National Focal Point for the Minamata Convention is the Deputy IV Ministry of Environment.

### **List NGO Recommendations for next steps**

1. A systematic health assessment in ASGM hotspots should be developed and conducted;
2. Training for national and local health workers (as well as midwives) on mercury related health issues and mercury intoxication symptoms needs to be developed and organised to prevent further severe health problems;
3. Health monitoring for women and children in ASGM hotspots need to be prioritised to prevent increased numbers of still-births and babies born with birth defects, and to reduce infant mortality rates.



**Annex 1**  
Health assessment in Cisitu village  
15-18 October 2014



Figure 1. One of the patients from the Cisitu home visit. He died one day after our visit.



Figure 2. Young miner, 23, suffered from TB in the last 12 months.



Figure 3. Mercury bubbles in a fish pond by the side of the house of sick people.



Figure 4. At Cisitu, ball-mills units are spread out between houses, fish ponds and rice fields.



Figure 5. The free health services conducted in 2 days, from morning until evening, served about 270 people.



Figure 6. The major complaints were myalgia or neuropathy, hypertension, upper pulmonary infection diseases and dyspepsia.

### Annex 2

Capacity-building to identify mercury intoxication symptoms for health workers, government officials, academia and NGOs from several cities of Indonesia and the Philippines

Jakarta, 20-22 October 2014



Figure 9. Dr. Stephan Bose-O'Reilly delivered the training as the main resource person, translated by Dr. Jossep William from the Medicuss Foundation



Figure 10. Arlene Galvez, Ban Toxics, and Dr. Antonio Furlong, from Municipal Health Jose Panganban, Camarines Norte, The Philippines



Figure 11. Representatives from the Ministry of Health participated in the training and practicing the HBM test



Figure 12. Participants from Lebak Regency's Health Agency



Figure 13. Participants from Mataram University and Yayasan Tambuhak Sinta



Figure 14. Ban Toxics and Dr. Furlong shared their experiences in the health program in the Philippines' ASGM site, Camarina Norte



Figure 15. Group photo



a toxics-free future

[www.ipen.org](http://www.ipen.org) | [ipen@ipen.org](mailto:ipen@ipen.org) | @ToxicsFree

### Annex 3.

### Human Bio-Monitoring Questionnaire

ID Number: .....

Tgl.pemeriksaan/Date of examination : .....

Nama pemeriksa/Name of the examiner : .....

#### Informasi Tambahan/Additional study information

**Keracunan inorganik merkuri kronik - kuesioner dan skema pemeriksaan (10-15 menit) /Chronic inorganic mercury intoxication – questionnaire and examination scheme (10-15 minutes)**

Lokasi studi/Study location: .....

Nama kelg/Family Name: ..... Nama/Surname.....

Tgl.lahir/Date of Birth: ..... Umur/Age: ..... (tahun/years)

Kelamin/Gender: Perempuan/Female Laki-laki/Male (circle it)

Alamat/Address, HP: .....  
.....

#### **A. Paparan di Tempat Kerja/Work Exposure**

1. Berapa lama sudah **tinggal** di daerah ini?/ *How long have you been **living** in this area? \_\_\_\_\_ tahun/year(s)*
2. Berapa lama sudah **bekerja** dengan merkuri di daerah ini? *How long have you been **working** with mercury in this area? \_\_\_\_\_ year(s)*
3. Apa pekerjaan bapak/ibu beberapa tahun terakhir ini? *What has been your work in the last year?*
  - Membakar amalgam untuk ekstraksi emas/ *Smelting amalgam to recover the gold*
  - Menggunakan merkuri untuk mengekstrak emas tapi tidak membakarnya / *Handling mercury to extract the gold from the ore, but no smelting*
  - Membakar emas/ toko/kios emas / *Smelting gold ! / gold buyer*
  - Pekerjaan lain atau tidak bekerja /*Any other job or no job .....*
4. Seberapa sering makan ikan? / *How frequently do you eat fish?*
  - Tidak pernah atau kurang dari sekali seminggu / *Never or less then once a week*
  - Paling tidak sekali seminggu / *At least once a week*
  - Paling tidak sekali sehari / *At least once a day*
5. Apakah merasa sehat saat ini? / *Are you healthy at the moment?*
  - Ya / Yes
  - Tidak, kenapa tidak ? / No, why not? \_\_\_\_\_
6. Apakah pernah merasakan kelainan syaraf (epilepsy, stroke, polio etc.) atau kelainan serius lainnya? / *Have you ever had any neurological disorders (epilepsy, stroke, polio etc.) or other serious disorder?*
  - Tidak / No
  - Ya. Apa masalah atau penyakitnya? Yes, if yes which disease (problem)?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

#### **B. Uji Biomonitoring / Biomonitoring Tests**

##### **#1 Apakah anda mengalami produksi ludah berlebihan? / Do you suffer from excessive salivation?**

- Tidak pernah atau kurang dari sekali seminggu / *Never or less then once a week (score 0)*
- Paling tidak sekali seminggu / *At least once a week (score 1)*
- Paling tidak sekali sehari / *At least once a day (score 1)*

**#2 Apakah anda mengalami tremor (gemetar)? / Do you have any problems with tremor (shaking)?**

(Skala Rating Tremor Klinis / Clinical Tremor Rating Scale) [1]

- Saya tidak punya tremor ATAU tremor tapi tidak mengganggu kegiatan atau pekerjaan saya / *I have no tremor OR tremor does not interfere with my job (score 0)*
- Saya bisa bekerja, tetapi harus lebih berhati-hati dibandingkan orang lain / *I am able to work, but I need to be more careful than the average person (score 1)*
- Saya bisa melakukan apapun, tetapi dengan beberapa kesalahan; lebih buruk daripada biasanya karena tremor ATAU lebih buruk / *I am able to do everything, but with errors; poorer than usual performance because of tremor OR more (score 1)*

**#3 Bagaimana perasaan anda saat tidur di malam hari ? Apakah ada gangguan tidur? / How do you feel after a usual night of sleep? (Sleep disturbances)**

- OK (score 0)
- Sedang / Medium (score 1)
- Buruk / Bad (score 1)

**#4 Apakah gusi menunjukkan warna yang memudar ? Do the gums show signs of bluish discoloration?**

- Tidak / No (score 0)
- Ya / Yes (score 1)

**#5 Apakah ada tanda-tanda ataxia ? / Are there signs of ataxia of gait**

Minta yang bersangkutan untuk jalan tanpa sepatu dan berjalan lurus ke satu arah dan kembali ke titik awal. Lalu ulang sekali lagi dengan mata tertutup. Pemeriksa harus memperhatikan tanda-tanda ataxia (Klockgether Score) / *Person is asked to walk with no shoes and straight, then with eyes closed. Examiner is watching for signs of ataxia (Klockgether Score) [1]*

- Tidak ada / *Absent (score 0)*
- Sedikit (ataxia hanya terlihat saat berjalan bersama tanpa dibimbing / *Slight (ataxia only visible when walking on tandem or without visual feedback) (score 1)*
- Sedang (ataxia terlihat saat berjalan normal; kesulitan-kesulitan saat jalan bersama) ATAU lebih / *Moderate (ataxia visible in normal walking; difficulties, when walking on tandem) OR more (score 1)*

**#6 Apakah gejala-gejala yang ada mengganggu koordinasi gerakan ? Are there signs of disturbed coordination of movements? (Dysdiadochokinesia)**

Minta yang bersangkutan untuk menggerakkan pergelangan tangannya perlahan secara bersamaan atau simetris, lalu bergerak lebih cepat, dengan mata tertutup (gerak pergelangan tangan bergantian (Klockgether Score)[1]. Pemeriksa harus meneliti gerak asimetri, terganggu, dan ketidak-seimbangan.

*Person is asked to twist hands first slowly symmetrically, then very quickly, plus eyes closed (alternating movements of the wrists (Klockgether Score) [1]. Examiner is looking for asymmetric, disturbed, unbalanced movements.*

- Tidak ada / *Absent (score 0)*
- Ringan / *Slight (minimal slowness of alternating movements) (score 1)*
- Sedang (tanda marked slowness of alternating movements) ATAU lebih / *Moderate (marked slowness of alternating movements) OR more (score 1)*

**#7 Apakah ada tanda-tanda ataxia - tes telunjuk-ke-hidung ? *Are there signs of ataxia - index finger-to-nose test***

Minta yang bersangkutan untuk menyentuh ujung hidung dengan jari telunjuk. Kedua tangan direntangkan/terbuka di samping tubuh. Lakukan bergantian angkat telunjuk kanan dan kiri mengarah ujung hidung tanpa menyentuhnya, berhenti sekitar 1-2 cm di depan hidung. Amati dari samping, apakah yang bersangkutan tremor saat akan menyentuh hidung. Pertama lakukan dengan mata terbuka, lalu minta lakukan dengan mata tertutup. Beri nilai ataxia (Klockgether Score) [1].

*Ask the person to touch the tip of the nose with their index finger. Both arms stretched / open beside the body. Do alternately lifting the right and left index finger leads without touching the tip of the nose, stopping about 1-2 cm in front of the nose. Observe any tremors from the side of the patient. First, ask the person to do it with eyes open, then ask to do it with closed eyes. Rate ataxia (Klockgether Score) [1].*

- Tidak ada / Absent (score 0)
- Ringan (hypermetria ringan saat lakukan tes telunjuk-ke-hidung) / *Slight (slight hypermetria in finger-to-nose test) (score 1)*
- Sedang (hypermetria dan mendemonstrasikan ataxic dengan tes tes telunjuk-ke-hidung) ATAU lebih / *Moderate (hypermetria and slight ataxic performance of finger-to-nose test) OR more (score 1)*

**#8 Apakah ada protein di dalam urin (Proteinuria) ? / *Is there protein in the urine ? (Proteinuria)***

Gunakan alat tes komersial untuk periksa protein dalam urin / *Use a commercial kit to test for protein in urine*

- Negatif bila tidak ada protein trace / *Negative for protein or traces of protein (score 0)*
- Positif bila ada trace protein / *Positive for protein (score 1)*

**#9 Tes kotak korek api / *Match Box Test***

Minta yang bersangkutan untuk duduk dekat meja. Taruh 20 batang korek api di meja, letakkan dengan jumlah batang korek api yang sama di kedua sisi kotak korek api terbuka, masing-masing berjarak sekitar 15 cm dari kotak korek api. Gunakan tangan kanan dan kiri bergantian. Beri waktu yang cukup, sampai semua batang korek api masuk ke dalam kotak. Catat waktu dengan stop watch.

*Person is sitting at a table. Put 20 matches on a table, half of each on one side of an open matchbox, approx. 15 cm away. Use left and right hand alternatively. Take the time until all matches are put into the box. \_\_\_\_\_ seconds [2]*

- $\leq 17$  detik /  $\leq 17$  seconds (score 0)\*
- $> 17$  detik /  $> 17$  seconds (score 1)

\* Skor di bawah 17 detik berarti normal/baik. *Score under 17 seconds means normal/good.*

**#10 Tes Pinsil / *Pencil Tapping Test***

Minta yang bersangkutan duduk dekat meja. Taruh siku di meja. Coba buat titik sebanyak mungkin di sehelai kertas dengan pinsil selama 10 detik. Hitung jumlah titik yang dibuat selama 10 detik. \_\_\_\_\_ titik [2]

*Ask the person to sit by the table. Elbows should be placed on the table. Try to do as many points as possible on a piece of paper with a pencil within 10 seconds. Count the amount of points within these 10 seconds. \_\_\_\_\_ points [2]*

- $\leq 45$  titik /  $\leq 45$  taps (score 0)
- $> 45$  titik /  $> 45$  taps (score 1)

**Total Skor Medis / Medical score sum**



a toxics-free future

[www.ipen.org](http://www.ipen.org) | [ipen@ipen.org](mailto:ipen@ipen.org) | @ToxicsFree

Test	Enter Score
<b>Anamnestic data</b>	
#1 Air liur berlebihan / <i>Excessive salivation</i>	
#2 Tremor di tempat kerja / <i>Tremor at work</i>	
#3 Gangguan tidur malam hari / <i>Sleeping problem at night</i>	
<b>Clinical data</b>	
#4 Perubahan warna gusi / <i>Bluish coloration of gingiva</i>	
#5 Ataxia / <i>Ataxia of gait</i>	
#6 Gangguan koordinasi / <i>Dysdiadochokinesia</i>	
#7 Telunjuk-ke-hidung / <i>Finger-to-nose ataxia</i>	
#8 <i>Proteinuria</i>	
<b>Neuropsychological test</b>	
#9 Tes kotak korek api / <i>Matchbox test</i>	
#10 Tes pensil / <i>Pencil tapping test</i>	
<b>Medical score sum (add the single scores)</b>	

**Medical score sum:**

- **medical score sum 0-2 → low score sum**
- **medical score sum 3-5 → medium score sum\***
- **medical score sum 6-10 → high score sum\***

\* Lanjutkan dengan pengambilan sampel rambut dan urin/ *Continue to take hair, urine and blood samples*





a toxics-free future

**Urine**

Sampel urin spontan sekitar 10 ml, harus disimpan dalam kotak pendingin 4 derajat celcius dan ditetesi HNO3 bila tidak dianalisa dalam waktu 3 jam.

*Spontaneous urine sample 10 ml, to be stored at 4 degree Celsius and acidified to pH 2 with nitric acid, if not analysed within three hours*

- Tidak ada sampel / No sample available
- Ya, ada sample / Yes, sample available

**Hasil / Result** \_\_\_\_\_ **µg/l**

- normal level (< HBM I) 0-7 µg/l
- alert level (HBM I-II) 7-25 µg/l
- high level (>HBM II) over 25 µg/l

**Urine/creatinine**

- No sample available
- Yes, sample available

**Creatinine result** \_\_\_\_\_ **µg/l**

**Urine/creatinine result** \_\_\_\_\_ **µg/g crea**

- normal level (< HBM I) 0-5 µg/g crea
- alert level (HBM I-II) 5-20 µg/g crea
- high level (>HBM II) over 20 µg/g crea

**Darah / Blood**

Darah EDTA, 10 ml, disimpan dalam kotak 4C, bila tidak dianalisa dalam waktu 3 jam.

*EDTA blood, 10 ml, to be stored at 4 degree Celsius, if not analysed within three hours*

- No sample available
- Yes, sample available

**Result** \_\_\_\_\_ **µg/l**

- normal level (< HBM I) 0-5 µg/l
- alert level (HBM I-II) 5-15 µg/l
- high level (>HBM II) over 15 µg/l

**Rambut / Hair**

Beberapa lembar rambut Rambut A strain of hair, close to the scalp, is cut off and stored

- No sample available
- Yes, sample available

**Result** \_\_\_\_\_ **µg/g**

- normal level 0-1 µg/g
- alert level 1-5 µg/g
- high level over 5 µg/g

**All biomarkers (urine, urine/crea, blood, hair)**

- Check all biomarkers if any is above HBM II (high level)
- Check all biomarkers if any is above HBM I (alert level) and none above HBM II (high level)
- Check all biomarkers if all are below HBM I (low level)

**Decision for the diagnosis of a “chronic mercury intoxication”**

		<b>Medical Score Sum</b>		
		0 - 2	3 - 4	5 - 10

Hg in all specimens	< HBM I	-	-	-
Hg at least in one specimen	> HBM I	-	-	+
	> HBM II	-	+	+
Algorithm for the diagnosis “chronic mercury intoxication” [3]				
HBM = Human Biomonitoring value				
Decision: - = no intoxication, + = intoxication				

### Intoxication

- No (-)
- Yes (+)

If yes, consequences: \_\_\_\_\_

### References

1. Masur H, Papke K, Althoff S, Oberwittler C, Heil U, Hundenborn S, Nedjat S, Papke H, Speight I, Sträter R, Vollmer-Haase J (Eds.): [Scales and Scores in Neurology], 2. edition. Stuttgart: Georg Thieme Verlag; 2000.
2. Zimmer R, Volkamer M: [Motor function test for children aged four to six]. 2 edn. Weinheim: Beltz Test Gesellschaft; 1987.
3. Drasch G, Bose-O'Reilly S, Beinhoff C, Roider G, Maydl S: The Mt. Diwata study on the Philippines 1999 - assessing mercury intoxication of the population by small scale gold mining. Science of the Total Environment 2001, 267:151-168.