Final Report

Technical Study

Guideline for Handling and Storage of Confiscated Mercury

Within the Framework of the Project
'Reducing Mercury Supply and Availability in Indonesia'

Nexus3 Foundation
Center for Regulation, Policy, and Governance (CRPG)
Indonesian Center for Environmental Law
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1. INTRODUCTION

1.1 Background

Mercury is a heavy metal in liquid form that is dangerous for human health and the environment. Mercury exposure to the human body can cause disorders of the nervous system, digestive system, immune system, and disorders of other organs, such as: the lungs, kidneys, eyes and skin. In Indonesia, the use of mercury in daily life can be found in various sectors, such as: medical equipment (thermometers, sphygmomanometers), energy-saving fluorescent lamps, mercury switches, and other electronic devices. Apart from that, mercury can also be used in cosmetics, pesticides, the caustic soda industry, chlorine gas production, dental amalgam materials, batteries and in small-scale gold mining (ASGM).

To obtain the mercury metal, mercury sulfide rock (or what is called "cinnabar") is generally mined. This cinnabar ore is a primary form of mercury and can be found in the environment naturally. Mercury levels in cinnabar stone can reach 80%. In Indonesia, illegal cinnabar mining is often carried out in the Maluku, West Sumatera, and Aceh areas [(2)]. The cinnabar ore is then heated to a temperature above 540ºC. This heating process evaporates the mercury in the cinnabar, which is then captured and cooled to obtain pure mercury metal in liquid form.

Apart from being dangerous and toxic, mercury is also persistent (difficult to decompose) and bio-accumulative in ecosystems. Mercury tends to spread globally from one location to another through the atmosphere and biosphere. Thus, the impact of mercury also crosses regional boundaries and thus becomes a global problem. Therefore, countries in the world have agreed to a convention related to the reduction and elimination of mercury (Minamata Convention), which was signed on October 10, 2013 in Kumamoto, Japan. The Minamata Convention, which was proclaimed on August 16, 2017, is a global commitment which as of October 2023 has been ratified by 147 countries.

The main objective of the Minamata Convention is to protect human health and environmental safety from emissions and releases of mercury and mercury compounds caused by human activities (anthropogenic). The Minamata Convention contains provisions related to the life cycle of mercury, including its control and reduction in various products, processes and industries. Apart from that, the Convention also discusses cinnabar mining and the export/import activities of mercury, including the safe storage and management of mercury.

In Indonesia, the Minamata Convention has been ratified and promulgated through Law No. 11 Year of 2011 concerning Ratification of the Minamata Convention on Mercury. As an implementation of Law Number 11 of 2011, the government then established a National Action Plan through Presidential Regulation Number 21 of 2019 concerning the National Action Plan for the Reduction and Elimination of Mercury (NAP-REM). This

NAP-REM targets the reduction and elimination of Mercury in priority sectors, covering: manufacturing, energy, Small Scale Gold Mining (ASGM) and health, as listed in Table-1 below.

Table-1:
National Action Plan – Reduction and Elimination of Mercury (NAP-REM)
2018-2030

NAP	Sector	Target	Year	Remark
Reduction	Manufacturing	50%	2030	Mercury reduction in the production of batterues and lamps.
	Energy	33,2%	2030	Reduction of mercury emission to the atmosphere
Elimination	Small Scale Gold Mining (ASGM)	100%	2025	Closing down ASGM using mercury (180-220 locations)
	Health	100%	2020	Phasing out of mercury containing equipment on healthcare facilities (21,663 units)

From Table-1 above, it appears that the government is targeting the elimination of mercury use in the ASGM sector at 180 – 220 mining locations (100%) by 2025. To achieve this target in the ASGM sector, one of the strategies for mercury elimination as stated in Article 3 (point h) of Government Regulation Number 21/2019 is strengthening the law enforcement.

The role of the Attorney General's Office in the NAP-REM, as stated in Appendix-II of Government Regulation Number 21 of 2020, for the implementation period of 2019 – 2025 is to support and collaborate with Police agencies for the activities of:

a. Supervising and controling illegal primary mercury mining activities (cinnabar mining)
b. Monitoring the distribution of mercury in the country
c. Controlling illegal ASGM that uses mercury
d. Controlling the illegal Mercury trade system

Meanwhile, the targets for law enforcement from 2019 to 2025 are:

- No illegal cinnabar mining activities
- No use of mercury in ASGM.
- Withdrawal of mercury from illegal trade/use, amounting to 10 tons per year.

From the description above, it appears that the prosecutor's office will be intensively involved in handling confiscated mercury, both in the form of elemental mercury and mercury-contaminated materials/equipment. For this reason, guidelines need to be used by all levels of prosecutors in handling and managing confiscated mercury, in a safe and environmentally sound manner.

The Center for Regulation, Policy and Governance (CRPG) is currently involved in activities with the theme "Reducing Mercury Supply and Availability in Indonesia" which was initiated by the Biodiversity Research Institute and the Nexus3 Foundation. The aim of this activity is to support the Indonesian Government to limit the supply of mercury, especially in Small Scale Gold Mining (ASGM) through amendments to the draft National Action Plan and the storage of confiscated mercury, products containing mercury and mercury produced from the oil and gas industry. This activity aims to:

- promote regulations and policies that can limit the supply of mercury originating from cinnabar mines as well as mercury produced from the oil and gas industry.
- develop and carry out pilots related to the Regional Action Plan (RAP) to reduce and eliminate the use of mercury in ASGM activities, including safe handling, temporary storage and final storage of mercury and cinnabar so that they no longer circulate on the market.
- monitor implementation and fulfillment of national and regional action plans.

1.2 Objective of the Study

This Technical Study is intended to provide a reference to the Attorney General's Office in preparing Guidelines for the Management of Confiscated Mercury, within the framework of the Reducing Mercury Supply and Availability in Indonesia project, as an implementation of the Minamata Convention.

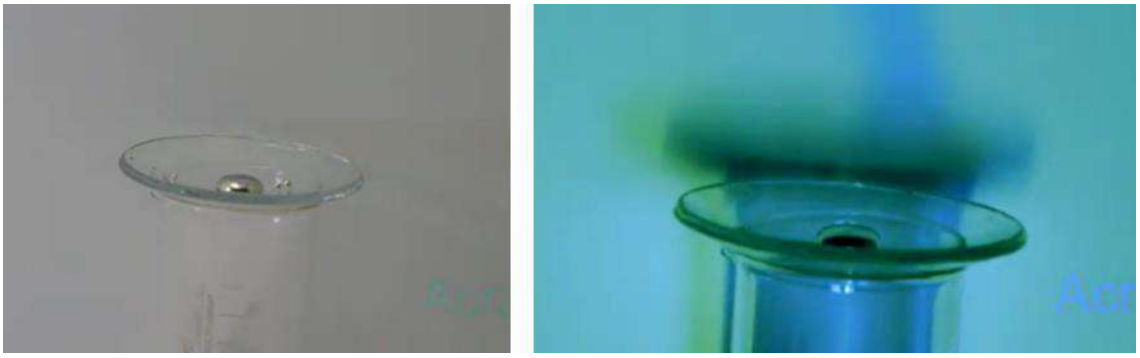
1.3. Mercury Properties and Its Dangers to the Human Health and the Environment

1.3.1. Mercury Properties

Mercury (chemical formula "Hg") is a metal that is liquid at room temperature (25°C). The pure metal is odorless, with a shiny silvery white color. Mercury is also a heavy metal with a specific gravity of 13.6 kg/liter. This high density causes objects such as billiard balls to float when placed on the surface of mercury, with only 20% of their volume submerged. If mercury is packaged in an uncovered container, the mercury metal will

evaporate and this mercury vapor will spread into the environment. The evaporation of mercury is invisible, but if viewed under ultraviolet (UV) light, the mercury will appear to evaporate intensely (Figure-1).

Figure-1:
Appearance of Mercury Vapor under Visible Light and UV Light



Source: https://www.youtube.com/watch?v=aSO3ykbaiM8

The higher the temperature, the more vapor is released from the liquid mercury. Mercury vapor in the atmosphere can last for 3 months to 3 years, meanwhile the mercury that dissolved in water, will only lasts a few weeks. Apart from that, there are also other dangerous properties of mercury such as [3]:

- Very toxic to the nervous system (neurotoxin).
- Persistent (not easily broken down) in the natural environment.
- Bioaccumulation (higher concentrations in aquatic animal and plant tissues than in water).
- Bio-magnifies (the higher the position in the food chain, the higher the concentration of mercury accumulates).
- Various chemical forms in water, sediment, and biota.

1.3.2. Use of Mercury

Mercury has been found in Egyptian tombs as early as 1500 BC, and has been used for centuries in medicine. Although mercury is no longer sold as a skin antiseptic or oral antiseptic, its organic form continues to be used as a vaccine preservative. The ancient Greeks and Romans used mercury in cosmetics and it was also one of the main remedies for syphilis in Europe before modern times. By taking advantage of its properties, mercury is used in various products and production processes because it is very useful (Table 2).

Table-2:
Properties and Uses of Mercury

Properties	Use
Liquid metal	Barometer, sphygmomanometer (blood pressure meter)
Expands/contracts with heat	Thermometer
Conducts electric current	Switches, fluorescent lamps, chlor-alkali process electrodes
Forms amalgam with other metals	Dental fillings, gold mining/refining
Kills bacteria and fungi	Disinfectant, preservative

Mercury is used in various types or forms of compounds, among others are:

- Elemental Mercury (Hg): Elemental Mercury (Hg) is found in thermometers, mercury sfigmomanometer, dental amalgam, electrical devices, batteries and paint. In addition, elemental mercury is also used as a catalyst in the production of caustic soda and disinfectants and for the production of chlorine from sodium chloride.
- Inorganic Mercury: Inorganic mercury in the form of Hg++ (Mercuric) and Hg+ (Mercurous) is widely used in disinfectants, teething powder and laxative (calomel) as well as mercurous fulminate which is flammable.
- Organic Mercury: Organic Mercury is found in several forms, such as: methyl mercury and ethyl mercury, both of which include short chain alkyl forms found as metal contaminants in the environment and mercury in long chain alkyl and aryl forms found as antiseptics and fungicides.

Globally, data on mercury use can be seen in Table-3 below.

Table-3:
Global Consumption of Mercury Based on Sector of Activities

Sector	Cunsumption (ton/year)		
	2005	2010	2015
Small Scale Gold Mining (ASGM)	650 – 1,000	912 – 2,305	872 – 2,598
Preparation of Vynyl Chloride Monomer	600 - 800	860 – 1,030	1,210 – 1,241
Chlor-Alkali Production	450 - 550	300 - 400	233 – 320
Battery	300 - 600	230 - 350	159 – 304
Dental Application	240 - 300	270 - 341	226 – 322
Measuring and Control Tools	150 - 350	219 - 280	267 – 392
Light	100 - 150	105 - 135	112 – 173
Electrical & Electronic Equipment	150 - 350	140 - 170	109 – 185
Etc	30 - 60	222 - 389	215 – 492
Total	3,000 – 3,900	3,258 – 5,400	3,404 – 6,027

From Table-3 above, the use of mercury in the ASGM sector is the highest consumer compared to other sectors. Although this data is a figure of global consumption, it can be used as a reference that the ASGM sector is also the largest user of mercury in Indonesia. This was confirmed by the results of an inventory carried out by Kania Dewi & Yuyun Ismawati[5] using the Level 1 Inventory Toolkit, which showed that the total mercury released into the environment in Indonesia was estimated at around 339,250 kg Hg/year. Of this amount, the ASGM sector accounts for the highest release of mercury into the environment (57.5%). Meanwhile, the highest mercury release pathway is into the atmosphere, namely 59.32% of the total mercury emissions to all pathways.

1.2.3. Dangers of Mercury

a. Impact to The Human Health

As previously explained, the properties of mercury that may give adverse effects are: volatile, highly toxic (neurotoxic), bio-accumulation and bio-magnification. The impact that mercury can have on human health depends on various factors, including:

- Type/compound of mercury
- Dosage (how much)
- Exposure time
- Routes of exposure (food, inhalation, injection/intravenous, touch)
- Individual characteristics (age and health condition)

The pathway for mercury into the human body can be through various media: water, air and land. Apart from this environmental media, exposure to mercury can also be from

animals or plants that have been contaminated with mercury. Airborne exposure from inhaled mercury vapor has the greatest potential to cause poisoning, while ingested mercury metal does not cause toxic effects because of its low absorption, unless there is a fistula or gastrointestinal inflammatory disease or if mercury is stored for a long time in the gastrointestinal tract. Mercury that enters the body intravenously can cause pulmonary embolism [(6)].

Exposure to mercury into the human body will be carried by the bloodstream, and then distributed throughout the body. Mercury carried by the blood to the brain will cause neurotoxicity. In other parts of the body, mercury will be deposited in fat tissue, skin, lungs, heart, kidneys and fetuses. This bioaccumulation of mercury in the body can cause tremors, Parkinson's, gray eye lens disorders, and mild anemia, followed by disorders of the nervous system which is very sensitive to mercury with the first symptoms being paresthesia, ataxia, dysarthria, deafness, and ultimately death. Pregnant women who are exposed to alkyl mercury can cause damage to the fetus' brain, resulting in birth defects. The research results show that the fetal brain is more susceptible to methyl mercury compared to the adult brain.

One of the tragedies related to mercury exposure is the mercury pollution case that occurred in Minamata Bay, Kumamoto Prefecture, Japan. In 1932, the Chisso Factory began discharging wastewater containing organic mercury from a factory producing acetaldehyde into Minamata Bay. In 1949, the bad effects began to appear, where hundreds of people died due to nerve paralysis. Further investigation showed that this death occurred after residents consumed fish contaminated with the heavy metal mercury in Minamata Bay.

In 1968, the Chisso Factory finally closed production of acetaldehyde which produced mercury waste. As of April 30, 1997, the number of people in Kumamoto and Kagoshima who had applied for certification as victims of Minamata disease was more than 17,000. Of this number, the number of victims permitted to receive mercury by the government currently reaches 13,805 people. Despite these figures, it is estimated that there are still hidden patients who have not been accounted for.

Figure-2:
Victim of Minamata Disease Due to Mercury Poisoning

Source: 1972 photograph by W. Eugene Smith & Aileen M. Smith

b. Impact to the Environment

One of the properties of mercury that is dangerous for the environment is that the mercury is volatile. Even if mercury is stored in packaging, mercury vapor can still "penetrate" the walls of the packaging, and then be released into the atmosphere. Mercury vapor in the atmosphere can last for 3 months to 3 years, whereas the mercury that dissolved in water only lasts a few weeks.

In the environmental ecosystem, mercury does not easily undergo decomposition processes, either physically, chemically nor biologically degradable. Eventhough the levels are low, mercury can still be absorbed and accumulate through biological processes through the food chain.

When it enters aquatic media, mercury easily bonds with chlorine in seawater and forms mercury chloride (HgCl) bonds. In this form, mercury easily enters plankton and can move to another marine biota. As inorganic mercury, HgCl will then be transformed into organic mercury by the role of microorganisms that occur in bottom sediments. Organic mercury compounds that can be formed are: dimethylmercury, phenylmercury, ethylmercury, and methylmercury. However, the most common organic mercury compound found in the environment is methylmercury. Like inorganic mercury compounds, both methylmercury and phenylmercury are found in salt form, such as: methylmercury chloride or phenylmercury acetate. Methylmercury is the most dangerous type of mercury compound, because almost 90% of the methylmercury levels that are ingested or enter the body will be absorbed into the blood. This figure is very large compared to other types of mercury which is only absorbed 2–10% into the blood[7].

Methyl mercury is often found in seafood, such as fish and shellfish, which comes from waters contaminated with mercury. The amount of methyl mercury levels in fish bodies can vary. However, several types of fish that have higher levels of mercury include mackerel, shark, tuna, swordfish and marlin.

1.3 Regulatory Overview

he Indonesian government has established a regulatory infrastructure that can serve as a guide for implementing the Minamata Convention. These laws and regulations can be used as a reference by the Attorney General's Office in issuing guidelines for managing confiscated mercury, whether mercury in elemental form or materials/equipment contaminated with mercury. These laws and regulations are summarized below.

a. Law Number 11 of 2017 concerning Ratification of the Minamata Convention on Mercury (Minamata Convention Regarding Mercury)

The Minamata Convention is a global instrument that regulates the use of mercury globally, with the aim of protecting human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds. As one of the countries that ratified the Convention, Indonesia is bound by the provisions contained in the Convention.

One aspect of Indonesia's obligation as a signatory to the convention is to reduce anthropogenic emissions and releases of mercury and mercury compounds into environmental media, through:

- Controlling Sources of Mercury Supply and Trade (Article 3)
- Phase-out and phase-down of mercury use in products and processes (Articles 4, 5 and 6
- Controlling the use of mercury in Small Scale Gold Mining (Article 7)
- Control of emissions and releases of mercury and mercury compounds (Articles 8 and 9)
- Storage, waste and contaminated soil (Articles 10, 11 and 12)

b. Presidential Regulation Number 21 of 2019 concerning the National Action Plan for the Reduction and Elimination of Mercury

1. As an implementation of Law Number 11 of 2017 described above, the government created targets and action plans through Presidential Regulation Number 21 of 2019 concerning the National Action Plan for the Reduction and Elimination of Mercury (NAP-REM). NAP-REM essentially contains priority sectors for mercury reduction and elimination, that are:
   - Mercury reduction: manufacturing sector and energy sector
   - Mercury Elimination: small-scale gold mining (ASGM) sector and health sector

2. One of the strategic implemention to achieve the above target is strengthening the law enforcement activities, where the role of law enforcement, particularly to the Attorney General's office, is listed in Appendix-II of Presidential Regulation Number 21 of 2019, as described below:
   - Supervising and controlling illegal activities of primary mercury mining (cinnabar mining);
   - Monitoring the circulation of mercury in the country
   - Controlling illegal ASGM that uses mercury
   - Controlling the illegal Mercury trade system
3. The targets for law enforcement (Police and Attorney General's Office) from 2019 to 2025, as stated in Appendix-II of Presidential Regulation Number 21 of 2019 are:
   - no illegal activities of cinnabar mining.
   - no use of mercury in ASGM.
   - retraction of illegal trade/use of mercury amounting to 10 tons per year.
4. Based on baseline data in 2018, the ASGM locations spreading across Indonesia were 180-220 ASGM locations, located in 30 provinces or 180 cities/districts,
5. Furthermore, Appendix-II of Presidential Regulation Number 21 of 2019 also mandates the construction of a Mercury Storage Facility (Storage Depo), as part of the ASGM sector NAP-REM. The party responsible for this activity is the Ministry of Environment and Forestry, with support from the Ministry of Research, Technology and Higher Education, as stated in points c.6.4.1 and c.6.4.2.

c. Minister of Environment and Forestry Regulation Number P.81/MENLHK/ SETJEN/KUM.1/10/2019 concerning Implementation of Presidential Regulation Number 21 of 2019 concerning the National Action Plan for Mercury Reduction and Elimination

1. This regulation is a derivative of Presidential Regulation Number 21 of 2019 concerning the National Action Plan for the Reduction and Elimination of Mercury (NAP-REM), which mainly regulates:
   - procedures for preparing the Regional Action Plan for Reduction and Elimination of Mercury (RAD-PPM)
   - monitoring and evaluation of NAP-REM and RAP-REM
   - NAP-REM and RAP-REM reporting
   - integrated monitoring and evaluation system for mercury reduction and elimination.
2. This regulation does not provide further detailed and technical requirements related to Mercury Storage Facilities (Storage Depo)

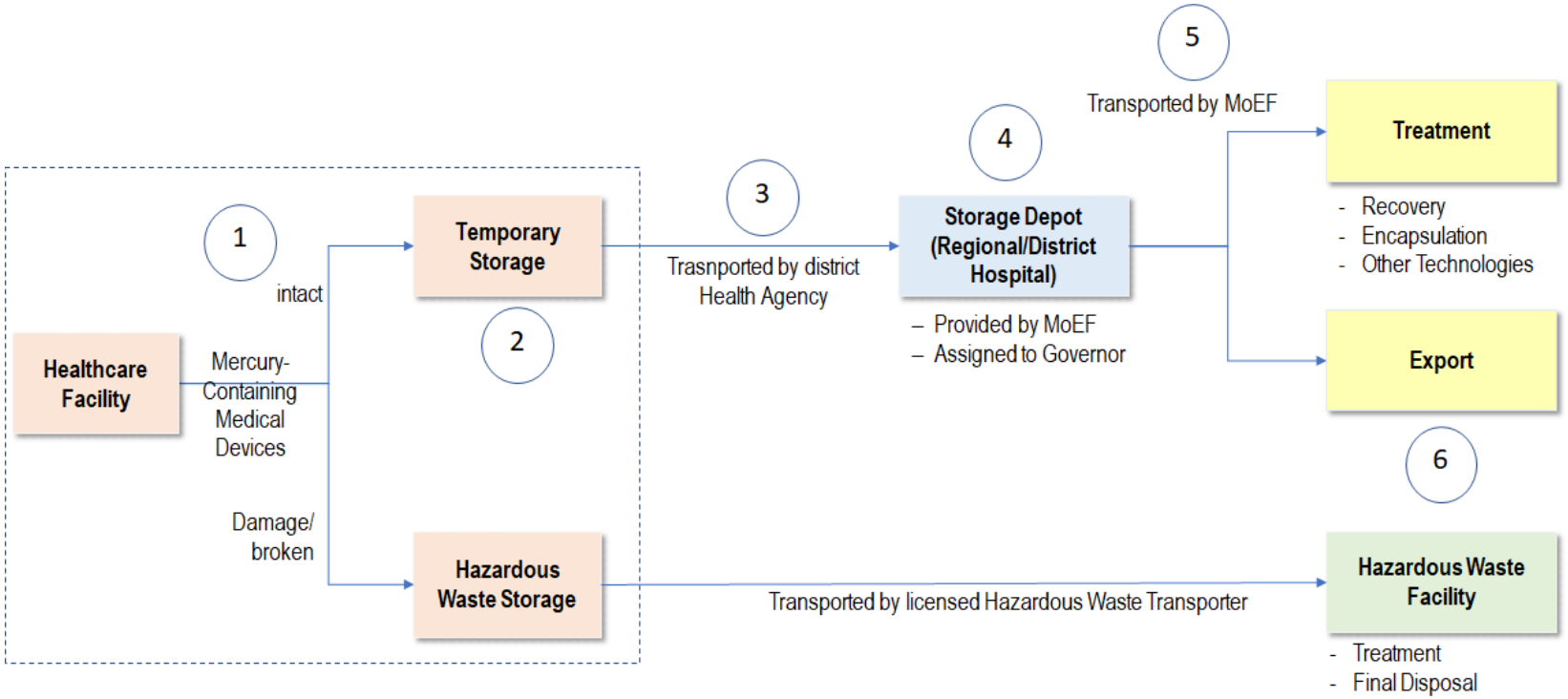
d. Minister of Environment and Forestry Regulation Number P.27/MENLHK/SETJEN/KUM.1/12/2020 concerning Management of Waste Medical Equipment Containing Mercury

1. Medical devices containing mercury regulated in this regulation are intact (not broken/spilled) which include:
   - thermometer;
   - tensimeter/sphygmomanometer; And
   - dental amalgam
2. Medical devices containing mercury that do not meet the above criteria must be managed as hazardous (B3) waste.
3. Flow diagram for the Management of Waste Medical Devices Containing Mercury is shown in Figure-3, with the following description:

   1. Collection:
   - Medical Facilities (Fasyankes) segregate intact medical equipment containing mercury from the damaged/broken equipment.
   - The damaged/broken mercury-containing medical equipment are temporarily stored in Hazardous (B3) Waste Temporary Storage, for further managed in accordance with regulations relating to hazardous (B3) Waste.
   - The intact mercury-containing medical devices are packaged in primary and secondary packaging. Secondary packaging must be equipped with lid, not react with mercury, and provided with hazardous symbol/label.
   - The person in charge in the healthcare facility shall prepare record of the stored mercury-containing medical equipment.

   2. Temporary Storage
   - The person in charge of the healthcare facility stores mercury-containing medical devices in the temporary storage area for mercury-containing medical devices which is under the control of the health facility.
   - If the healthcare facility does not have a temporary storage, the revoked mercury-containing medical equipment shall be stored in storage owned by national or regional hospitals located in the same district/city area (complete with hand-over minute)

Figure-3:
Flow Diagram for the Management of Mercury-Containing Healthcare Devices
Regulation of the Minister of Environment and Forestry Number P.27/MENLHK/SETJEN/KUM.1/12/2020



- Requirements for the Temporary Storage Facility for mercury-containing medical devices:
  a. the area of storage commensurates with the number and volume of mercury-containing medical equipment to be stored;
  b. safe from possible damage and leaks
  c. has adequate lighting and ventilation
  d. separated with other regular hazardous (B3) waste.

3. Transportation from Temporary Storage Facility to Storage Depo

- Transportation from the Temporary Storage Facility to the Storage Depot is carried out by the provincial regional health service, and/or district/city regional health service, in coordination with the provincial and/or district/city regional environmental service.
- Transport can be carried out for medical equipment waste containing mercury which has been carried out: packaging, attaching symbols/labels, and equipped with documents recording medical equipment waste containing mercury (Appendix-II)

4. Storage at Storage Depo

Storage Depots are provided by the Ministry of Environment and Forestry and handed over to the governor to be placed in regional government hospitals or other locations.

5. Transportation from Storage Depot to Processing/Export Facility

- Transportation of mercury-containing medical equipment from the Storage Depo to the Waste Processing Facility or exporting to oyher countries, is carried out by the Ministry of Environment and Forestry.
- Transfer of mercury-containing medical equipment to the waste processing facilty or export, can be carried out if the mercury-containing medical equipment has been: properly packaged, attached with symbols/labels, and equipped with tracking documents

6. Treatment/Disposal & Export.

- Mercury-containing medical equipment must be treated at the Waste Processing Facility, through:
  - mercury recovery
  - encapsulation; and/or
  - other technologies in accordance with scientific developments.
- If the reatment facilities are not available in Indonesia, exports will be made to other countries for further treatment and disposal.

4. The management of Mercury-Containing Medical Equipment as regulated in this Ministerial Regulation shall be implemented no later than 31th December 2025.

e. Minister of Environment and Forestry Regulation Number P.26/MENLHK/SETJEN/KUM.1/4/2017 concerning Handling of Evidence of Environmental and Forestry Crimes

1. This regulation is related to the handling of evidence for Environmental and Forestry Crimes, which are prohibited and considered as crimes or violations as regulated in the Law on the Environment and Forestry.

2. The scope of this regulation includes:
   a. Classification of Evidence
      - movable objects, including: Waste, B3, B3 waste, wood forest products, non-timber forest products, live/dead wild plants, live/dead wild animals
      - immovable objects, including: forest areas, buildings, roads, mining areas.
   b. Procedures for Handling Evidence
      - The process of collecting evidence in the form of waste, B3 and B3 waste shall comply with the provisions of laws and regulations and/or in accordance with the science and technology.
      - The process of collecting evidence in the form of samples of waste and/or B3 waste must be known by the waste owner and/or company representative and witnessed by the local village head.
      - Every transportation activity must be accompanied by a task order containing:
        - the official who give order;
        - name of officer;
        - type, quantity and size of evidence; and
        - origin and destination of transportation.
      - Every activity of transporting evidence must be made into a Minutes of Handover.
   c. Evidence Management
      - Destruction of evidence is carried out on: Waste, B3, B3 waste, forest products, plants, animals, or their parts that contain disease germs and/or are damaged.
      - For investigatiion purposes, before destruction is carried out, setting aside of evidence might be required.
      - Procedures for destruction are carried out in accordance with statutory provisions.

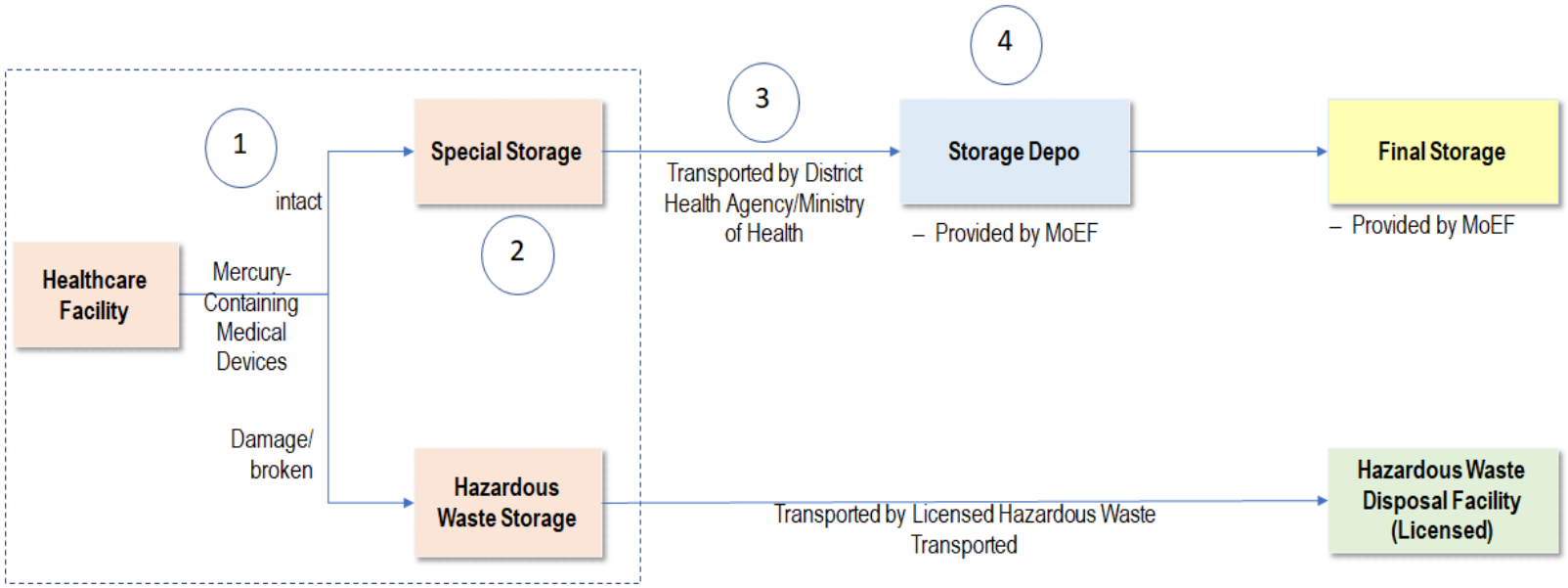
   d. Financing.
      All costs arising from the implementation of this ministerial regulation are borne by:
      - state income and expenditure budget;

- regional income and expenditure budget; and/or
- other legal and non-binding sources.

f. Minister of Health Regulation Number 41 of 2019 concerning Elimination and Withdrawal of Mercury-Containing Medical Devices in Health Service Facilities

- Elemination of mercury-containing medical devices is carried out through:
  a. making written policies or commitments from the Health Facilities leadership.
  b. assessment and inventory of mercury-containing medical devices
  c. replacement of mercury-containing medical devices with non-mercury medical devices
  d. temporary storage of mercury-containing medical devices.
- Medical devices containing mercury are not combined with other hazardus (B3) waste and shall not be treated through incineration process.
- Mercury-containing medical devices that have been withdrawn from the heathcare facilities shall be collected by the central government or regional government through the ministry or agency that has duties and responsibilities in the health sector.
- Each health facility is required to record and report the implementation of the removal and withdrawal of mercury-containing medical devices. The reporting is carried out in stages from the health facility to the district/city regional health service, provincial health service and the Ministry of Health.
- Funding for the removal and withdrawal of mercury-containing medical equipment shall be obtained from each healthcare facility's budget, state budget, regional budget, and/or other leggal sources in accordance with statutory provisions.
- The procedure for withdrawing and managing Mercury Medical Devices from healthcare facilities is identical to the procedure as contained in the Minister of Environment and Forestry Regulation Number P.27/MENLHK/SETJEN/KUM.1/12/2020 concerning Management of Medical Equipment Containing Mercury Waste, as can be seen in Figure -4:

Figure-4:
Flow Diagram of Removal and Withdrawl of Mercury-Containing Medical Devices from Healthcare Facilities
Minister of Health Regulation Number 41 of 2019



1. **Sorting and Packaging**
   - Mercury-containing medical equipment from health facilities is segregated between those that are still intact and those that are broken.
   - Mercury-containing medical equipment that has been spilled/ broken is managed as hazardous waste, whereas its storage, transportation, collection, processing and final disposal shall follow applicable laws and regulations pertaining to hazardous waste management.
   - For mercury-containing medical equipment that is still intact, packaging is carried out in containers, with the following requirements:
     - segregated based on the type of mercury-containing medical equipment
     - the container must be strong, not easy to leak or crack, and locked
     - has a good and undamaged lid
     - shall protect mercury-containing medical devices from collisions, so that they do not break when in the container
     - the size of the container is adjusted as needed
     - the container is labeled/marked with information about the type and quantity of mercury-containing medical devices
     - the container is placed in a place that is not easily accessible.
2. **Temporary storage in a special room**
   - The containers of mercury-containg medical equipment, that are still intact, are labeled or marked for identification purpose.
   - After being packed in containers, mercury-containing medical equipment is temporarily stored in a special storage, with the following requirements:
     - has a sufficient space
     - safe from possible damage and leaks that could allow mercury to spill from the mercury-containing medical devices.
     - can be locked and can only be entered by personnel designated by the head of the health facility
     - have adequate lighting and ventilation
     - have a record of the type and amount of mercury medical equipment stored.
3. **Transportation of Mercury-Containing Medical Equipment from the Special Storage to the Storage Depot**
   - The transfer of mercury-containing medical equipment is carried out from the temporary storage area (pecial storage) in the healthcare facility to the Storage Depot provided by the Ministry of Environment and Forestry.
   - Prior to the transfer, it may require to complete the procedure for the write off of the State Property (BMN) for government-owned healthcare facilities.

- The withdrawal of Mercury-containing Medical Devices is carried out by the Ministry of Health or Regional Health Office, in coordination with the Ministry of Environment and Forestry or Provincial/District/City Environmental Agency.
- The implementation of Mercury-containing Medical Device withdrawal is carried out by officers who have the competence and authority in accordance with the provisions of laws and regulations.

4. Final Storage

- Mercury-containing medical devices that have been withdrawn are stored in Final Storage.
- The Ministry of Environment and Forestry is encouraged to carry out planning and development of Final Storage of mercury waste both at the regional and in provincial levels, in accordance with statutory provisions.

- Each healthcare facility is required to record and report the implementation of the Removal and Withdrawal of Mercury-containing Medical Equipment.
- The recording/reporting is carried out in stages starting from the healthcare facility, district/city health office, provincial health office, and the Ministry of Health.
- Recording and reporting the implementation of the Removal and Withdrawal of Mercury-containing Medical Equipment follows a predetermined format.

g. Guidelines of the Attorney General No. 8 of 2022 on the Handling of Criminal Cases of the Environmental Protection and Management

- The public prosecutor manages confiscated objects/evidence in the form of B3, Waste, and/or B3 Waste by considering the characteristics, concentration, and/or quantity of confiscated objects and/or evidence.
- The management of confiscated objects/evidence in the form of B3, Waste, and/or Hazardous Waste is carried out based on the recommendation of the coordination forum by considering the purpose of the evidence at the trial court.
- For evidentiary purposes, samples of confiscated objects/evidence in the form of B3, Waste, and/or Hazardous Waste are taken and an official report is made with the knowledge of the owner of the confiscated objects/evidence and/or company representatives and witnessed by the head of the local environment agency.
- In the event that it is deemed necessary, the taking of test samples is coordinated with the head of the agency that organizes government affairs in the field of environment and forestry.
- Test samples of evidence in the form of B3, Waste, and/or Hazardous Waste as referred to in number 3 are set aside and weighed and an official report is made.

- In the event that confiscated objects/evidence in the form of B3, Waste, and/or B3 Waste are not possible to be stored until the court decision has obtained a permanent legal force, or if the cost of storage will be too high, actions can be taken:
    a. if the case is in the investigation stage, the public prosecutor shall give instructions to the investigator to sell at auction or secure the confiscated object/evidence;
    b. if the case is at the prosecution stage and has not been submitted to the court, the public prosecutor may sell at the auction or secure the confiscated object/evidence, witnessed by the suspect or his/her attorney; or
    c. if the case is in the trial stage, confiscated objects/evidence may be secured or sold at auction by the public prosecutor with the permission of the judge hearing the case and witnessed by the defendant or his attorney.
- By considering the nature, concentration, and/or amount of confiscated objects and/or evidence of B3, Waste, and/or Hazardous Waste, the public prosecutor may give instructions to the investigator to carry out destruction in accordance with the provisions of laws and regulations.
- Consideration to carry out destruction of evidence also involves the fiscal risk that must be borne by the state, if based on a court decision that has obtained permanent legal force, it is declared that the defendant's actions on confiscated objects and / or evidence are not illegal and therefore the defendant files a claim for compensation for the destruction that has been carried out.
- The actions of auctioning, securing, and destroying are carried out based on the recommendations of the coordination forum by considering the interests of evidence at trial court.
- The security of confiscated objects/evidence in the form of hazardous waste can be carried out by depositing it with a party that has a hazardous waste storage permit by making an official report on the examination of hazardous waste in accordance with the provisions of laws and regulations.

From the above regulatory review, it can be concluded that:

a. By the ratification of the Minamata Convention through Law-11/2017, Indonesia is obliged to reduce and eliminate the use of mercury.
b. The National Action Plan on Mercury Reduction and Elimination (NAP-REM), which is implementing actions of the Minamata Convention, targets mercury reduction in the sectors of manufacturing (50%) and energy (33.2%), while mercury elimination in the sectors of ASGM (100%) and Health (100%). The

targeted volume for mercury withdrawal from the ASGM sector is 10 tons per year.

c. The law enforcement process conducted to support the NAP-REM will produce evidence and confiscated mercury, in the forms of elemental and mercury-contaminated materials/equipment, which require further handling and management in accordance with the rules and regulations.

d. The Attorney General's Guideline Number 8 of 2022 pertain9ng to the Handling of Criminal Cases in the Sector of Environmental Protection and Management has not yet adopted Law-11 of 2017, as well as its derivatives, related to the handling of evidence in the form of mercury. Thus, a revision of the guideline or the issuance of a new guideline specifically related to the handling of evidence and confiscated mercury is required.

1.5. Institutional Overview

The National Action Plan - Mercury Reduction and Elimination (NAP-REM) as stipulated in Presidential Regulation No. 21/2019, cobers the activities, targets and success indicators for each person in charge of each activities. The national mercury reduction/elimination targets are as listed in Table-4 below.

Table-4:
Mercury Reduction and Elimination Target

NAP-REM	Priority Sector	Target	Year	Remark
Reduction	Manufacturing	50%	2030	Reduction of mercury in productions of batteries and lamps
	Energy	33,2%	2030	Reduction in mercuri emission to the atmosphere
Elimination	Artisanal and Small-scale Gold Mining (ASGM)	100%	2025	Closing of ASGM using mercury (180-220 locations)
	Health	100%	2020	Phase out and retrieval of mercury-containing medical devices (21,663 unit)

Furthermore, Presidential Regulation No. 21/2019 also targets mercury retreieval as a consequence of mercury elimination in Health and ASGM sectors, as listed in Table-5.

Table-5
Types and Quantity of Mercury Retrieved from Distribution/Use

Priority Sector	Type of Mercury	Quantity	Remarks
Health	Mercury-containing medical devices	21,663 units	Retrieval of Mercury-containing medical devices conducted by Ministry of Health
ASGM	Elemental mercury	70 ton	Evidence/confiscated mercury of police and attorney retrieved from illegal mercury trade.

Mercury retrieved from illegal trade/distribution as listed in Table-5 requires further management, as stipulated in the laws and regulations related to mercury reduction/elimination. This further management basically consists of two stages, namely: interim storge in a Storage Depot and Final Disposal.

The duties and responsibilities of each government agency that plays a role in the implementation of NAP-REM, as stipulated in Presidential Regulation Number 21 of 2019, are as shown in Table-6 below.

The Attorney General's Office, as a law enforcement agency, supports the Police agency in the implementation of the NAP-REM, with tasks/activities as shown in Table-7.

Table-6:
Responsible Institutions for the Executions of NAP-REM

Responsible Institution	Activities	
Ministry of Energy and Mineral Resources	c.1.1.1	Conducting policy socialization to the provincial government
	c.1.2.2	Conducting monitoring and evaluation of the implementation of the KepESDM on the prohibition of gold processing using amalgamation
	c.5.1.6	Improving understanding of good mining practice for people's mining license (IPR) business actors
Ministry of Environment and Forestry	c.1.1.4	Developing guidelines for storage and handling of mercury and mercury-containing waste
	c.1.1.5	Developing guidelines for the recovery of contaminated land
	c.2.2.1	Developing and implement cooperation on mercury reduction/elimination and mercury impact mitigation with non-governmental organizations, NGOs, donor agencies, and other countries.
	c.2.3.1	Conducting environmental quality monitoring
	c.3.1.1	Developing a national mercury research and monitoring laboratory
	c.3.1.2	Conducting mercury research
	c.4.4.1	Mapping the impact of mercury emission and release on the environment around ASGM
	c.4.1.4	Developing a national database system related to the trade, circulation and use of mercury
	c.4.1.5	Developing an information system for the distribution map of cinnabar rock and mercury in Indonesia
	c.4.1.6	Conducting inventory and mapping of sources, supply, circulation and use of mercury
	c.5.1.2	Conducting risk campaigns on the impact of mercury use on vulnerable communities and gender mainstreaming campaigns
	c.5.1.7	Socialization of guidelines for the study of contaminated land
	c.6.2.1	Conducting mercury-contaminated land recovery and land rehabilitation due to gold mining activities
	c.6.3.2	Construction of mercury-free gold processing facilities
	c.6.4.1	Preparation of FS and DED for the provision of Mercury Storage Facilities
	c.6.4.2	Provision of Mercury Storage Depot/Facility
	c.7.1.1	Developing a social assessment of the impact of mercury use on ASGM activities
	c.7.1.2	Developing an economic assessment of the impact of mercury use

Table-6 (continued)

Responsible Institution	Activities	
Ministry of Environment and Forestry	c.7.2.1	Social and economic transformation of mercury-using illegal miners
	d.1.1.2	Developing guidelines for the management of mercury-containing medical device waste in the healthcare facilities
	d.3.1.2	Identifying the content of mercury emissions and releases in incinerator facilities in hospitals
	d.5.2.1	Conducting storage of mercury-containing medical device waste in Storage Depots available in each province
	d.5.2.2	Preparing Storage Depots in Provinces to store mercury medical equipment waste
	d.5.2.2	Providing technical guidance on handling of mercury medical equipment waste for health facilities and for Storage Depots
Ministry of Trade	c.1.1.3	Developing and improving regulations pertaining of: import, export and domestic distribution of mercury commodities.

Table-6 (continued)

Responsible Institution	Activities	
Ministry of Health	c.1.1.6	Developing a standardized method for measuring mercury exposure covering nodes 1-3 (source-media-receptor) consisting of sampling and analysis methods.
	c.1.1.7	Carrying out efforts to protect at-risk populations, especially children and women, and control health impacts due to mercury exposure, through the preparation of guidelines for controlling risk factors, health impacts due to mercury exposure in the environment and guidelines for handling mercury poisoning.
	c.4.1.2	Identifying hotspots, at-risk populations, and vulnerable populations due to mercury exposure through cross-sectoral cooperation.
	c.4.1.3	Identify and improve national standards for the threshold value of mercury exposure to human health
	c.5.1.3	Conducting socialization and capacity building for health workers on health risks due to mercury exposure
	c.5.1.4	Developing a community approach to increase knowledge and awareness of the health hazards of mercury.
	c.5.1.5	Develop participatory approaches to communities in ASGM sites aimed at increasing knowledge about the health impacts of mercury exposure, and sustainable behavior change in the community.
	d.1.1.1	Developing policies or regulations related to the replacement of mercury medical devices in health facilities.
	d.1.3.1	Data collection, processing and analysis (on the implementation of mercury medical equipment elimination policies in the regions)
	d.2.1.1	Coordinating with Ministries/agencies and local governments
	d.3.1.1	Inventory of mercury use in products and processes in mercury-containing medical devices
	d.4.1.1	Developing counseling and socialization programs for medical personnel on the replacement of mercury medical equipment and the risk of mercury exposure in health facilities.
	c.1.1.6	Developing a standardized method for measuring mercury exposure covering nodes 1-3 (source-media-receptor) consisting of sampling and anaAlysis methods.
	d.4.1.2	Conducting socialization and capacity building for medical personnel on the health risks of mercury use and handling.
	d.5.1.1	Implementing the replacement of mercury medical equipment in health facilities
	d.6.1.1	Monitoring the circulation of mercury medical equipment in the country

Table-6 (continued)

Responsible Institution	Activities	
Agency for the Assessment and Application of Technology	c.6.1.1	Developing research and studies on alternative mercury-free gold processing technologies
	c.6.3.1	Preparation of FS and DED for mercury-free gold processing
Police Department	c.8.1.2	Conducting supervision and control of illegal mercury mining activities (cinnabar mining)
	c.8.1.3	Monitoring of domestic mercury circulation
	c.8.2.1	Controlling illegal ASGM that uses mercury
	c.8.2.2	Controlling of illegal mercury trade
	d.6.2.1	Controlling of illegal trade of mercury medical-containing devices

Table-7:
Activities of General Attorney Office as Supporting Institution for the Executions of NAP-REM

Supporting Institution	**Activities**	
General Attorney Office	c.8.1.2	Monitoring and controlling of illegal mercury mining activities (cinnabar mining)
	c.8.1.3	Monitoring of mercury distribution
	c.8.2.1	Controlling illegal ASGM that uses mercury
	c.8.2.2	Controlling of illegal mercury trade
	d.6.1.1	Monitoring of distribution of mercury-containing medical equipment

2. THE SOURCES AND TYPES OF EVIDENCE/CONFISCATED MERCURY FROM ASGM SECTOR

As outlined above, the targets set in the National Action Plan - Reduction and Elimination of Mercury (NAP-REM) are: reduction of mercury in the manufacturing (50%) and energy (33.2%) sectors, and the elimination of mercury in the ASGM (100%) and health (100%) sectors.

The law enforcement process carried out to achieve the targets set out in the NAP-REM Strategic Plan targets activities involved in the illegal mercury use chain, namely:

- primary production of mercury
- trade/distribution of mercury, and
- use of mercury artisanal and small-scale gold mining (ASGM).

As a result of the investigation, prosecution and litigation during law enforcement, evidence and confiscated mercury will be obtained, both in the form of elemental mercury metal and mercury-contaminated materials/equipment. This mercury evidence and seized property requires safe management for human health and the environment, in accordance with applicable laws and regulations.

In order to safely manage this confiscated mercury, it is necessary to identify the source of the activity and the type of confiscated mercury, which is described below.

2.1. Production of Primary Mercury

Primary mercury is produced from the refining process of naturally occurring cinnabar ore. In Indonesia, cinnabar is mined in the areas of South Sulawesi, Southeast Sulawesi, Central Kalimantan, South Kalimantan and the Maluku Islands.

From these mining sites, the cinnabar ore is shipped to Java Island (Figure 5), mainly to Jakarta and then to Sukabumi in West Java, and Surabaya in East Java, where it is processed into liquid mercury that in turn is used for gold extraction. This primary mercury is mostly sold illegally to the ASGM or exported.

The process of mercury separation from cinnabar ore is performed using simple equipment, as a following:

- the lumpy cinnabar stone is ground into a fine powder (Figure-6).
- the powdered cinnabar is placed in a heating pot and sealed.
- the pot is heated on a stove to vaporize the mercury bound in the cinnabar powder (Figure-7).
- the mercury vapor flows from the pot through a pipe into the cooling water to obtain liquid elemental mercury.

Based on the primary mercury production process described above, as well as the actual results of law enforcement activities that have been conducted, the types of evidence and seizures obtained from the primary mercury production sector are:

- Sinabar ore (raw material for mercury production)
- Mercury refining equipment (teapots, piping, etc.)
- Elemental mercury (product of mercury refining)
- Mercury Contaminated Materials/Wastes

Figure-5:
Distribution Cinnabar for the Raw Matarial of Primary Mercury Production

Source: EXRI Report, 2018

The law enforcement strategy against illegal cinabar mining and mercury production is very effective in reducing and even stopping the supply of primary mercury to illegal ASGM sectors.

Figure-6:
Cinnabar Ores Ground into Powder Form

Figure-7:
Mercury Distillation Process from Cinabar Ores

Source: *Nexus3 Foundation*

Figure-8
Online Illegal Mercury Trade

Source: Tokopedia

Figure-9
Evidence & Confiscated Liquid Mercury Stored in Plastic Jerrycans from Illegal Mercury Production in Sukabumi

Source: Detiknews, 18 Sep 2017

Figure-10
Evidence/Confiscated Teapots and Other Equipment from Illegal Mercury Production in Palangkaraya

Source: https://www.kompas.id/ 3 December 2020

Figure-11:
Evidence/Confiscated Liquid Mercury Stored in Plastic Jerrycans and Flasks Seized from Illegal Mercury Manufacturing Activities in Bogor District

Source: https://www.beritasatu.com, 2 August 2017

2.2. Domestic and Foreign Mercury Trade/Distribution

Illegal small-scale gold mining (ASGM) activities have increased in Indonesia since the early 2000s, partly due to the high global price of gold. According to the Biodiversity Research Institute[7], until 2014 Indonesia was still importing mercury from various countries. However, after adopting the Minamata Convention in 2013, exporters from European Union countries and the United States began to impose a ban on mercury exports out of their countries. Since then, global mercury production and exports have shifted from the Northern Hemisphere to East Asia and South America.

In 2016, Indonesia even became one of the largest mercury producers and exporters in the world, exporting 311 tons of mercury to 11 countries. Almost the entire mercury supply chain in Indonesia is illegal, as the Indonesian Ministry of Trade has banned the import, trade, and use of mercury in the mining sector. Nevertheless, mercury continues to be widely used in the Indonesian ASGM sector and large amounts of mercury are reportedly smuggled out of the country to other gold producing countries[7] .

The law enforcement against domestic/foreign mercury trade yields evidence and confiscated mercury, most of which is elemental mercury in liquid form. For cross-border trade (export), the confiscated mercury is packaged in a special tube for mercury ("mercury flask"), while local mercury trade, generally mercury is packaged in Mercury Flask (Mercury Tube) and also other packaging, such as: plastic jerry cans, bottles used for drinking water packaging. It is this kind of non-standard and "makeshift" mercury packaging that often leads to spill incidents, as the packaging is unable to safely contain the mercury inside. Mercury spills during temporary storage should be avoided, as they can contaminate the room/environment and are difficult to clean up.

Mercury flasks are made of steel/cast iron or polyethylene with threaded caps. Official Mercury Flasks are made to specifications that meet international standards, making them much safer to store and transport, compared to other non-standard packaging. The size of Mercury Tubes varies, but generally those found as confiscated items are 2.5 liters or approximately 34.5 kg.

Figure-12
Evidence/Confiscated Liquid Mercury in Mercury Flasks Seized from Illegal Export Activities

Source: PPLI and Detikews (2 Agustus 2017)

2.3. Mercury Use in Artisanal and Small-Scale Gold Mining (ASGM)

The indicator used in the mercury elimination target in the Small-Scale Gold Mining (ASGM) sector is the number of ASGM sites. Based on the baseline data, as stipulated in Presidential Regulation No. 21/2019 on NAP-REM, ASGM locations spread across Indonesia in 2018 were 180-220 locations, spread across 180 cities/districts with details as shown in Table-8. The massive number of sites and their wide distribution are the main challenges for law enforcement in executing the National Action Plan - Reduction and Elimination on Mercury (NAP-REM).

Illegal ASGM uses simple and traditional equipment to separate gold from gold ore. The principle of gold separation is adding mercury to gold ore, so that gold and mercury will form a combined compound in the form of amalgam. After being cleaned of other impurities, the amalgam is then heated to evaporate the mercury, leaving pure gold as the residue. Mercury that evaporates into the air is the main source of pollution that endangers workers and the surrounding environment.

The steps of the gold refining process using mercury by ASGM is shown below (Figure-13):

Figure-13:
Steps of Gold Refining Process Using Mercury in ASGM

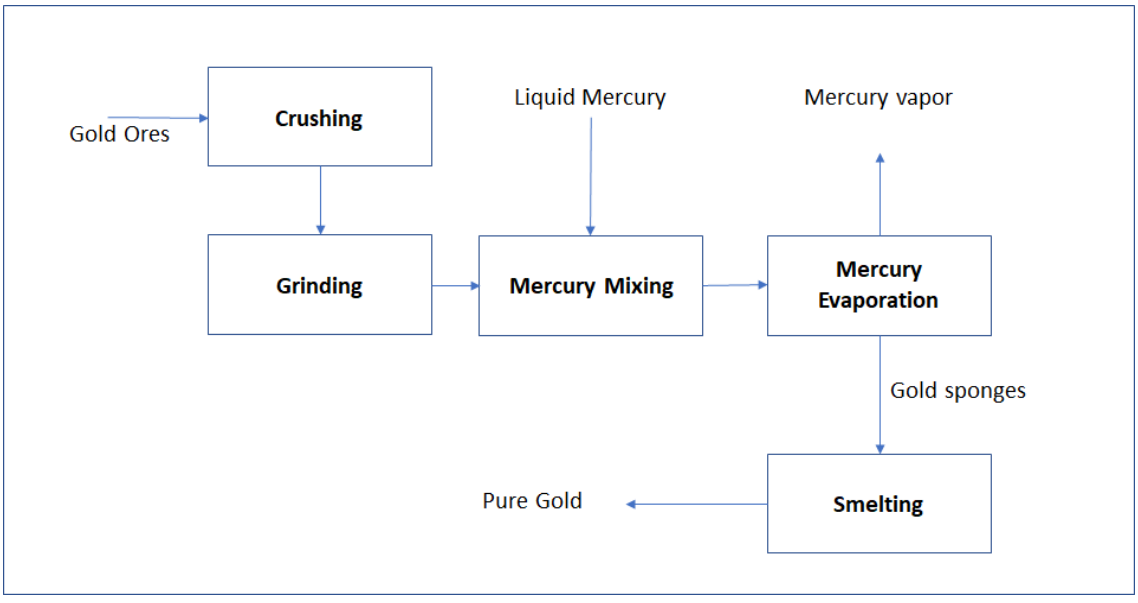


Table-8:

Baseline 2018 – Distribution ASGM Locations in Indonesia

1. Province: Nanggroe Aceh Darussalam	**2. Province: Sumatera Utara**	**3. Province: Sumatera Barat**	**4. Province: Riau**	**5. Province: Kepulauan Riau**
1. Pidie Jaya 2. Aceh Barat 3. Aceh Tengah 4. Nagan Raya 5. Aceh Selatan 6. Aceh Jaya 7. Aceh Besar 8. Kota Subulussalam 9. Pidie	1. Dairi 2. Langkat 3. Tapanuli Selatan 4. Mandailing Natal	1. Tanah Datar 2. Sawah Lunto 3. Solok 4. Solok Selatan 5. Agam 6. Pasaman Barat 7. Pasaman 8. Dharmasraya 9. Pesisir Selatan 10. Sijunjung 11. Lima Puluh Kota 12. Padang	1. Rokan Hulu 2. Kuantan Singingi 3. Kampar 4. Indragiri Hilir	1. Karimun 2. Bintan Island 3. Lingga 4. Tanjung Pinang 5. Kota Tanjung Pinang

6. Province: Bengkulu	**7. Province: Jambi**	**8. Province: Sumatera Selatan**	**9. Province: Lampung**	**10. Province: Banten**
1. Bengkulu Utara 2. Bengkulu Tengah 3. Seluma 4. Kaur	1. Muaro Jambi 2. Tanjung Jabung 3. Sarolangun 4. Tebo 5. Bungo 6. Batang Hari 7. Merangin	1. Ogan Komering Ulu Timur 2. Ogan Komering Ilir 3. Ogan Ilir	1. Way Kanan 2. Tanggamus 3. Lampung Barat 4. Lampung Timur 5. Lampung Selatan 6. Tulang Bawang 7. Pesawaran 8. Pringsewu	1. Lebak 2. Pandeglang 3. Cilegon

Table-8 (continued)

11. Province: Jawa Barat	12. Province: Jawa Tengah	13. Province: Yogyakarta	14. Province: Jawa Timur	15. Province: Kalimantan Barat
1. Tasikmalaya 2. Bogor 3. Sukabumi 4. Cianjur 5. Garut 6. Kuningan	1. Cilacap 2. Kebumen 3. Wonogiri 4. Banyumas 5. Banjarnegara 6. Jepara 7. Grobogan	1. Kulonprogo	1. Pacitan 2. Ponorogo 3. Trenggalek 4. Tulungagung 5. Blitar 6. Lumajang 7. Tuban 8. Lamongan 9. Banyuwangi 10. Malang 11. Mojokerto 12. Pasuruan 13. Jember	1. Sambas 2. Pontianak 3. Sanggau 4. Sintang 5. Kapuas Hulu 6. Bengkayang 7. Landak 8. Sekadau 9. Melawi 10. Ketapang

16. Province: Kalimantan Selatan	17. Province: Kalimantan Tengah	18. Province: Kalimantan Timur	19. Province: Kalimantan Utara	20. Province: Gorontalo
1. Banjar 2. Tabalong 3. Hulu Sungai Selatan 4. Tanah Laut 5. Kota Baru 6. Tanah Bumbu	1. Kapuas 2. Lamandau 3. Barito Timur 4. Barito Utara 5. Barito Selatan 6. Katingan 7. Kotawaringin Barat 8. Pulang Pisau 9. Murung Raya 10. Kotawaringin Timur 11. Gunung Mas 12. Palangkaraya 13. Seruyan	1. Kutai Timur 2. Kutai Barat 3. Paser	1. Nunukan 2. Bulungan 3. Malinau 4. Tana Tidung	1. Pohuwato 2. Gorontalo Utara 3. Boalemo 4. Bone Bolango

Table-8 (continued)

21. Province: Sulawesi Barat	22. Province: Sulawesi Utara	23. Province: Sulawesi Selatan	24. Province: Sulawesi Tengah	25. Province: Sulawesi Tenggara
1. Mamuju Utara 2. Majene 3. Polewali Mandar	1. Minahasa Utara 2. Minahasa Tenggara 3. Bolaang Mongondow 4. Bolaang Mongondow Timur 5. Tomohon 6. Bolaang Mongondow Utara 7. Kepulauan Sangihe 8. Minahasa Selatan 9. Minahasa	1. Luwu Timur 2. Luwu Utara 3. Pangkajene 4. Maros 5. Enrekang 6. Barru 7. Butung 8. Bulukumba 9. Bone	1. Banggai 2. Toli-Toli 3. Kota Palu 4. Parigi Moutong 5. Morowali 6. Tojo Una-Una	1. Konawe 2. Bau-Bau 3. Konawe Selatan 4. Konawe Utara 5. Kolaka 6. Kolaka Utara 7. Bombana

26. Province: Nusa Tenggara Barat	27. Province: Maluku	28. Province: Maluku Utara	29. Province: Papua	30. Province: Papua Barat
1. Bima 2. Lombok Barat 3. Dompu 4. Sumbawa 5. Sumbawa Barat	1. Kepulauan Pulau Buru 2. Seram Bagian Barat 3. Maluku Barat Daya	1. Halmahera Utara 2. Halmahera Tengah 3. Halmahera Timur 4. Kepulauan Obi 5. Kepulauan Sula 6. Halmahera Selatan 7. Halmahera Barat	– Nabire – Yahukimo – Paniai	1. Raja Ampat 2. Manokwari

Source: MoEF Regulation No. P.81/MENLHK/ SETJEN/KUM.1/10/2019 about the Implementation of Presidential Regulation Number 21 of 2019 concerning the National Action Plan for the Reduction and Elimination of Mercury

a. Crushing:
   Gold ore that is still in the form of large chunks is crushed into smaller sizes manually or by machine.

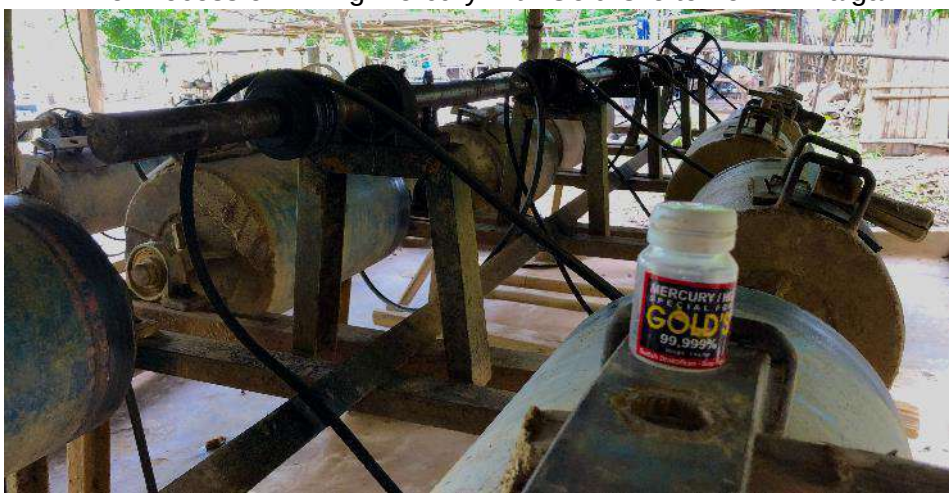
b. Grinding:
   After being crushed into smaller chunks, the gold ore undergoes a further grinding process to produce a smaller size in the form of granules (Figure-14). This is intended to maximize gold recovery, as contact with mercury will be more effective. The grinding tools that are often used are Tromol or Glundungan with varying sizes.

Figure-14:
Gold Ore Grinding Process in Ballmills

Source: Nexus3 Foundation

c. Mercury Mixing:
   To separate gold from other minerals, mercury is mixed with the crushed ore in the Mixing Unit (Figure-15). Mercury in contact with gold particles in the ore will then form amalgam, a soft metal mixture of mercury (about 50%) and gold (50%). This mercury mixing process also uses water, which is generally discharged directly into the environment as wastewater, which contains very high mercury content. In addition, excess mercury that does not react with gold is also discharged into the environment (Figure-16).

Figure-15
The Process of Mixing Mercury with Gold Ore to Form Amalgam



Source: Nexus3 Foundation

Figure-16:
Excess Mercury Discharged to the Environment

Source: Nexus3 Foundation

d. Mercury Evaporization:
To separate the gold, the amalgam is heated so that the mercury evaporates, forming "sponge gold" (sponge-like texture). This mercury vaporization process is generally done in the open, so mercury vapor is released directly into the air, which can poison workers and the surrounding community. Sometimes the mercury vaporization process is carried out in a building or closed room. In these cases, the mercury vapor will stick to the walls or roof, which in turn will evaporate back into the air over time and cause long-term exposure.

e. Smelting:
Raw spongy gold ("sponge gold") is separated from other impurities by melting it by heating, forming "solid gold dore". The purity of the dore varies depending on the nature of the gold deposit.

Gambar-17:
Proses Peleburan Untuk Menghasilkan Emas Padat Dore

Sumber: Nexus3 Foundation

From the above description, it can be concluded that evidence/confiscated materials that may be obtained from law enforcement activities against the ASGM sector include:

- Gold refining equipment (contaminated with mercury)
- Liquid mercury (raw material for gold refining)
- Mercury-contaminated materials/waste

Based on the knowledge of the types of mercury evidence/confiscations, a guideline can be developed pertaining to the safe handling of each type of evidence and confiscation.

3. PROCEDURE FOR HANDLING EVIDENCE/CONFISCATED MERCURY

3.1. Current Procedures for the Handling of Evidence/Confiscated Mercury

The procedure for handling evidence and confiscation in the form of Waste, Hazardous Materials and Wastes currently implemented in the prosecutor's office, refers to the Attorney General's Guidelines Number 8 year 2022 concerning Handling of Criminal Cases in the Sector of Environmental Protection and Management. This guideline regulates the handling of evidence/confiscation of hazardous waste in general. However, it does not specifically regulate evidence/confiscation of mercury materials/wastes.

In this guideline, the management of evidence/confiscated objects related to hazardous materials/wastes is stipulated in Chapter-V point C, which is basically carried out in refer to the recommendations of the coordinating forum, by considering the interests of evidence at trial process.

This guideline stipulates that, if the evidence/confiscated object in the form of hazardous materials/waste is not possible to be stored until the court decision on the case concerned has obtained permanent legal force, or if the cost of storage will be too high, the following actions can be taken:

a. if the case is in the investigation stage: the public prosecutor gives instructions to the investigator to **sell** at auction or **secure** the evidence/confiscated objects;
b. if the case is at the prosecution stage and has not yet been submitted to the court: the public prosecutor may **sell** by auction or **secure** the evidence/confiscated objects, witnessed by the suspect or his/her attorney; or
c. if the case is in the trial stage: evidence/confiscated objects may be **secured** or **sold** at auction by the public prosecutor with the permission of the judge hearing the case and witnessed by the accused or his/her attorney.

In addition, by considering the nature, concentration, and/or amount of evidence/ confiscated hazardous materials/waste, the public prosecutor can provide instructions to the investigator to destroy evidence/confiscated hazardous waste in accordance with statutory provisions.

In summary, there are 3 options for further management of evidence/confiscated objects in the form of hazardous waste, that are:

- selling auction of evidence/confiscated hazardous materials/waste
- securing the evidence/confiscated hazardous materials/waste
- destroy the evidence/confiscated hazardous materials/waste

The auction, security and destruction activities as stipulated in this guideline are carried out based on the recommendations of the coordination forum by considering the interests of evidence in the trial.

Nevertheless, the provision of selling auctions the evidence/confiscated B3 waste as stipulated in the guideline, is contrary to the laws and regulations related to the reduction and elimination of mercury, whereas confiscated mercury is prohibited from being re-used and must be withdrawn and collected from circulation.

Furthermore, this guideline also provides direction that the security of evidence/ confiscated objects in the form of hazardous waste, can be carried out by depositing it with a party that has a permit for storage of hazardous waste. The problem is that there are no or very rare companies that have licenses to store mercury or hazardous waste containing mercury.

The Attorney General's Guideline Number 8 year 2022 also contains provisions regarding the provision of instructions to investigators for the destruction of evidence/ confiscated B3 waste in accordance with statutory provisions. The act of destroying evidence/confiscated goods is vulnerable to fiscal risks that must be borne by the state if based on a court decision, that has obtained permanent legal force, it is declared that the defendant's actions are not guilty and therefore the defendant files a claim for compensation for the destruction of evidence/confiscated objects that has been carried out. Considering to the NAP-REM, this fiscal risk does not apply to evidence/confiscated mercury retrieved from the ASGM sector, since the NAP-REM clearly targets that mercury must be withdrawn from circulation and prohibited from re-use.

To execute a court decision with the ruling that evidence/confiscated objects in the form of hazardous materials/waste to be destroyed, the public prosecutor can hands over the evidence/confiscated hazardous materials/waste to a business entity that has facilities for storage, treatment and disposal of hazardous waste.

3.2. Proposed Procedures for Handling Evidence/Confiscated Mercury

Procedures implemented by the law enforcers (attorney/police) for handling evidence/confiscated mercury retrieved from the ASGM sector, shall be consistent with the procedures established in the laws and regulations related to mercury elimination in Indonesia. These include: recording, temporary storage and treatment/disposal of confiscated mercury.

The treatment/disposal for each type of evidence/confiscated mercury is different. Therefore, its preliminary handling will also be different. Likewise, the nature of the hazards of each evidence/confiscated mercury is different from one another, whereas the security requirements of liquid elemental mercury is stricter than the other evidence/confiscated mercury. This is to protect the law enforcers from mercury exposure, either through direct or indirect contact, during handling illegal ASGM cases,

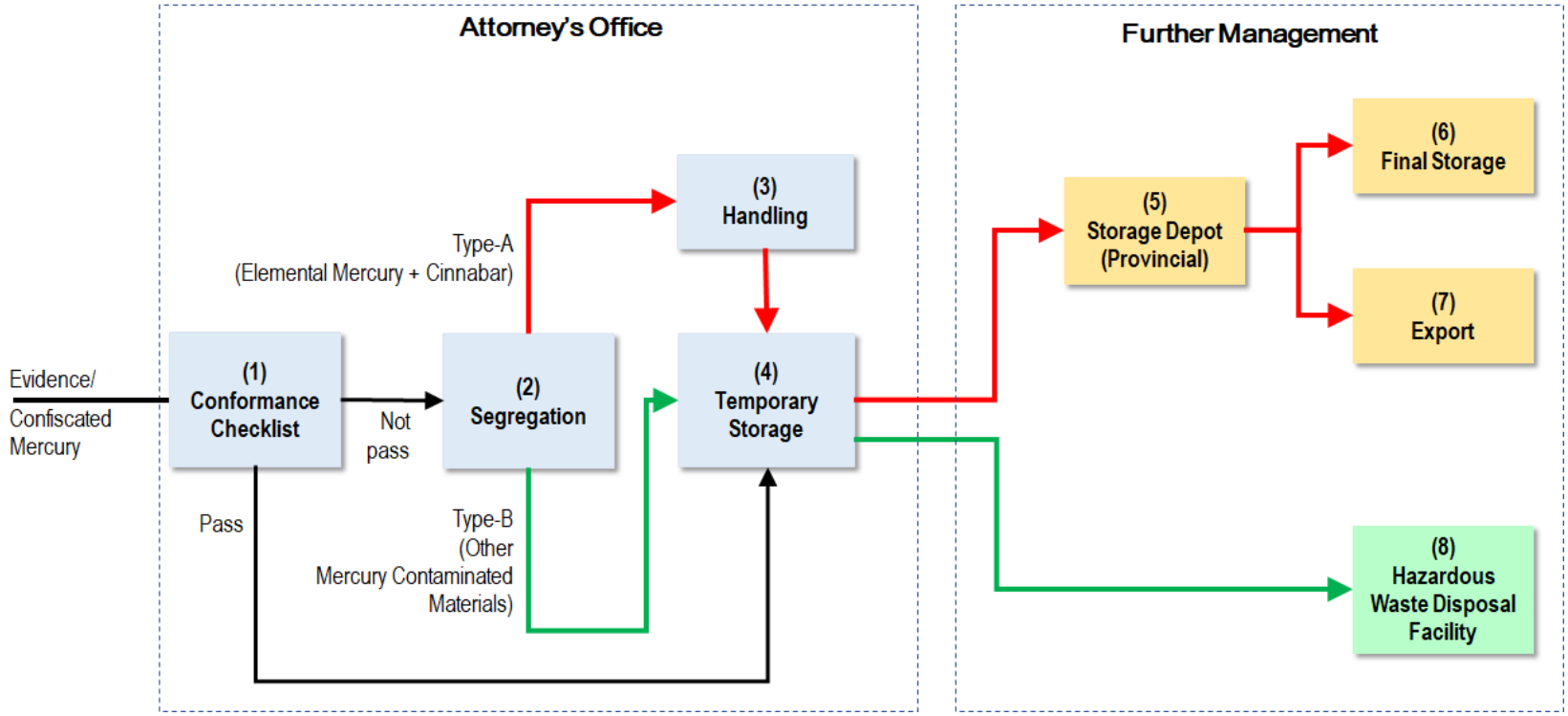
As described earlier, the types of mercury evidence and confiscations obtained from illegal ASGM law enforcement are as follows (Table-9).

Table-9:
Types Evidence/Confiscated Mercury Retrieved from ASGM Sector

Mercury Production	Mercury Trade/Distribution	Mercury Use (ASGM)
• Elemental mercury (liquid) • Cinnabar • Mercury Production Equipment • Mercury-Contamineted Materials/Waste	• Elemental mercury (liquid)	• Elemental mercury (liquid) • Gold production Equiopment contaminated with mercury • Mercury-Contamineted Materials/Waste

Guided by the rules and regulations related to the reduction and elimination of mercury as previously described, the procedure for the management of evidence/confiscated mercury for the prosecutor's office is prepared as shown in Figure-17. This flow diagram of the procedure for handling conviscated mercury is identical to the handling of mercury-containing medical devices retrieved from healthcare facilities, as stipulated in the Regulation of the Minister of Environment and Forestry Number P.27/MENLHK/ SETJEN/KUM.1/12/2020 concerning Waste Management of Mercury-Containing Medical Devices and Regulation of the Minister of Health Number 41 of 2019 concerning the Elimination and Retrieval of Mercury-Containing Medical Devices in Healthcare Facilities.

Figure-18:
Flowchart of Porposed Procedure for Managing Evidence/Confiscated Mercury



3.2.1. Conformance Checklist

For the safety of personnel involved in law enforcement, ideally the sorting/segregation and handling of evidence/conviscated mercury shall be performed at earliest stage, i.e. right after the collection of evidence/confiscated objects by investigators. However, the Prosecutor's Office needs to verify the conformity of the conviscated mercury to the requirements, using the checklist form as listed in Table-10.

If the verification results indicate that the conviscated mercury, received from investigators, meets the requirements as required in the checklist, the Prosecutor's Office may immediately place the conviscated mercury in dedicated temporary storage for conviscated mercury. If the inspection results show that the requirements for temporary storage are not met, then the evidence/confiscated items received need to be sorted and/or handled before temporary storage is carried out.

Table-10
Conformance Checklist Form for Conviscated Mercury Storage Requirements

No	Requirements	Result	
1	Sorting of conviscated mercury types (Type-A/Type-B)	□ Yes	□ Tidak
2	Primary packaging Conviscated mercury is over-packaged in secondary packaging	□ Yes	□ No
3	Primary/secondary packaging is in good condition (no leaks or potential leaks)	□ Yes	□ No
4	Primary packaging is tightly sealed with structural stability (leak-proof) to avoid Mercury spillage due to brittleness or breakage that may occur and prevent Mercury vaporization.	□ Yes	□ No
5	Primary packaging is able to withstand the heavy pressure of mercury and does not react with mercury.	□ Yes	□ No
6	Primary packaging is made of materials that do not react with Mercury or are made of materials compatible with the contents, for example: steel or polyethylene.	□ Yes	□ No
7	Secondary packaging is hermetically sealed and structurally stable (leak-proof)	□ Yes	□ No
8	Secondary packaging made of materials that do not react with Mercury or made of materials compatible with the contents, for example: steel or polyethylene	□ Yes	□ No
9	Secondary packaging is equipped with a symbol	□ Yes	□ No

3.2.2. Segregation of Evidence/Confiscated Mercury Types

Segregtion of conviscated mercury is necessary prior to temporary storage for the following reasons:

1. Liquid elemental mercury evidence/ confiscations are far more dangerous than other conviscated mercury (e.g. contaminated equipment/materials) and therefore require preliminary handling before storage. This includes one or more of the following handling: inspection/evaluation, repackaging, over-packing and symbol/labeling.
2. The final management (treatment/disposal) by the government for confiscated elemental mercury and cinnabar will be different from other forms of conviscated mercury. Elemental mercury and cinnabar are supposed to be permanently stored in Permanent Storage Facility and/or exported to other countries, where trans-boundary movement is still possible.

Once the conviscated mercury is received from the investigators, the prosecutor's office sorted the evidence/confiscated mercury into 2 main types, namely (see Figure-18 and Figure-20):

a. Type-A confiscated mercury: Elemental Mercury and Sinabar
b. Type-B confiscated mercury: Other confiscated mercury, including:
   - Mercury refining equipment from cinnabar (contaminated with mercury)
   - Gold refining equipment (contaminated with mercury)
   - Mercury-contaminated materials/waste
   - and other similar goods

Figure-19:
Segregation of Type-A Confiscated Mercury

Source: https://www.liputan6.com/ and https://tniad.mil.id/

Figure-20:
Segregation of Type-B Confiscated Mercury

Source: https://regional.kompas.com/

The segregation of conviscated mercury should ideally be conducted upstream (at the seizure stage by investigators), for the safety of all law enforcers (police and prosecutors) handling evidence/confiscated objects from mercury exposure.

For Type-A Conviscated Mercury, preliminary handling is required prior to temporary storage, to prevent spillage and/or release of mercury to the environment. Meanwhile, Type-B Conviscated Mercury does not require special handling prior to temporary storage, but simply packaging and marking with appropriate symbols and labels, and ensuring that it is properly packaged.

3.2.3. Handling

Handling of conviscated mercury is particularly carried out on elemental mercury, in order to ensure that the mercury is stored safely and to prevent incidents of spills or other releases of mercury into the environment. The handling includes: re-packing, double-packing and marking (symbol/label). For other type of evidence/confiscated mercury, direct storage in a Conviscated mercury Temporary Storage Area (TPS) is possible.

a. Re-packing:

Elemental mercury must be placed in primary container that meets the following terms and conditions:

- Properly sealed:
  Primary container shall be tightly closed and structurally stable (leak proof) to avoid any spillage of mercury due to brittleness or breakage that may occur, and to prevent any vaporization of mercury.
- Strong against the heavy pressure and does not react with mercury.
  Primary container is made of materials that do not react with Mercury or are made of materials compatible with the contents, for example: steel or polyethylene.

If the primary container of evidence in the form of elemental mercury received from investigators does not meet the above requirements, or there are indications or potential for leakage, then re-packing must be carried out immediately. Mercury leakage generally occurs due to non-standard packaging or packaging that is not strong enough to withstand the weight of mercury (for example: PET plastic bottles used for bottled drinking water).

Repackaging should be done carefully in the following manner (Figure-21):

- Conduct repackaging in an open or well-ventilated room.
- Use appropriate personal protective equipment (PPE) for handling mercury.
- Lay down plastic sheeting in the work area to prevent the spread of mercury in case of spilled/scattered.
- Prepare a new container for elemental (liquid) mercury, either metal or polyethylene mercury flask.
- Transfer the mercury into the new container using a funnel slowly and carefully.
- Put on and tighten the lid of the new package.

Note that this re-packing must be performed by trained personnel, due to the high risk of mercury exposure.

For evidence/confiscated cinnabar, repackaging is required if it is in powder form, such that it is susceptible to spillage and scattering, if the packaging is damaged/leaked.

Figure-21:
Re-packing of Liquid Elemental Mercury into Mercury Flask

Source: PT PPLI

b. Over-packing:

'Over-packing' is an effective spill prevention, where liquid mercury packed in its original packaging, or re-packed packaging, is put into a larger secondary container. These secondary containers can be made of metal or polyethylene plastic with sizes: 200 ltr, 100 ltr, 50 ltr or 25 ltr.

The container requirements for this mercury over-packing are:

- Packaging made of metal or polyethylene plastic
- packaging is capable of confining hazardous waste to remain inside the packaging;
- has a strong lid to prevent spillage during transfer and/or transportation;
- the condition of the packaging does not leak, does not rust, and is not damaged.

The double packaging procedure can be carried out as follows (see Figure-22 and Figure-23):

- Place the secondary container on a pallet.
- Place a plastic liner/bag into the drum to prevent direct contact between the mercury and the container in the event of a leak/spill.
- Place cushioning material (stirofoam granules) that also serves as a dampening mat at the bottom of the drum.
- Put the packaged elemental mercury (liquid) in its original packaging or re-packed into the drum. For elemental mercury packed in 34 kg mercury flasks, one drum can be filled with 6 (six) mercury flasks, resulting in a total weight of approximately 204 kg.

- Insert sponge rubber or tight cardboard dividers between the packs, and between the mercury packs and the inner wall of the drum.
- Secure the inner plastic bag and put on the drum lid.
- Install the drum locking ring and tighten the bolts.

Over-packing is not required for solid materials such as cinnabar, as there is no risk of scattered/spillage.

Figure-22:
Over-packing of Evidence/Confiscated Elemental Mercury

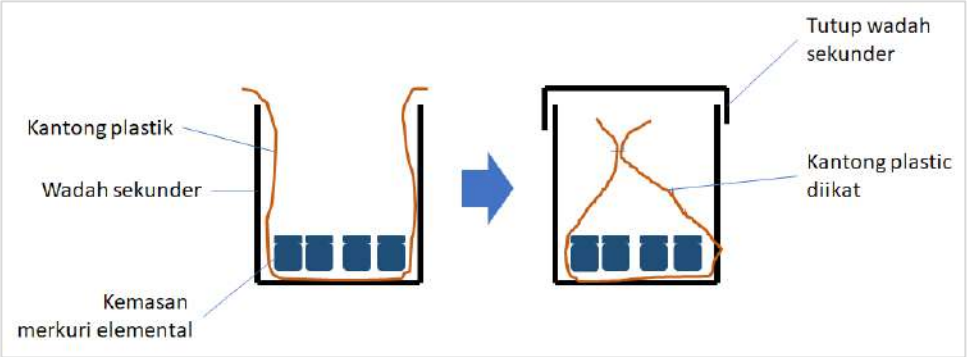


Figure-23:
Over-packing of Evidence/Confiscated Elemental Mercury in Metal Drums

Source: PT PPLI

c. Symbol and Label Markings

Refering to to the current standard police procedures, evidence and confiscated items that will be used in the trial process, are marked with tags/labels, which contain information about:

- Place and Date of Seizure
- Police Report Number

- Name
- Place/Date of Birth
- Occupation
- Address

Nevertheless, for evidence/conviscated mercury, additional identification or marking is required related to the communication of mercury hazards to humans and the environment, in the form of symbols and labels. Symbols and labels for evidence/confiscated items in the form of elemental mercury (liquid) refer to the Regulation of the Minister of Environment No. 03/2008 on the Procedures for Providing Symbols and Labels for Hazardous and Toxic Substances as well as the Global Harmonized System of Classification and Labelling of Chemicals (GHS).

- Symbol:
  Symbol is a rhombus-shaped figure with a white base color and a red border. The symbol is attached to the conviscated mercury packaging, with the size generally measuring 10 cm x 10 cm. Referring to the Safety Data Sheet (SDS), elemental mercury has hazard characteristics: corrosive, toxic and harmful to the environment. Therefore, the symbol applied to elemental mercury packaging is as shown in Figure-24.

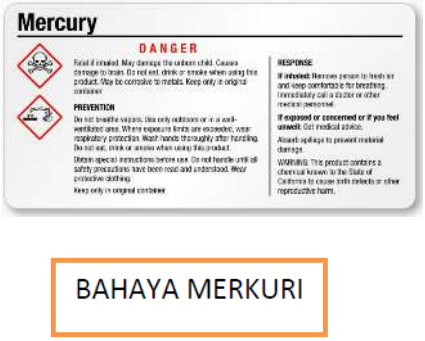
Figure-24:
Symbol for Packaging of Elemental Mercury

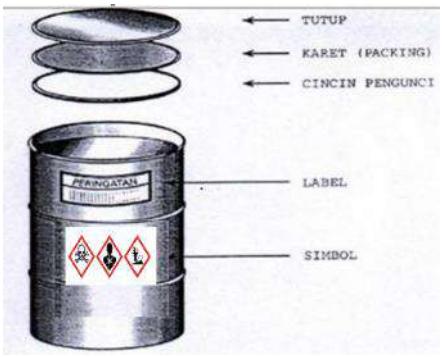
For innabar, the symbols used on the packaging are shown in Figure-25.

Figure-25:
Symbol for Packaging of Cinnabar

- Label:
  Labels are Signal Words, such as "Danger" or "Warning" to emphasize the hazard and indicate the relative severity of the hazard. Hazard Statements, phrases that define the nature of the hazard, including: prevention, storage, response and disposal methods.

Figure-26:
Label for Packaging of Elemental Mercury





3.2.4. Temporary Storage of Conviscated Mercury

Temporary storage of confiscated mercury in the Prosecutor's Office must be carried out in a dedicated storage that is safe and preferably separate from other evidence/ confiscated storage. In this storage, the conviscated mercury is temporarily stored until the court decision is legally binding (*inkracht*). If the amount of conviscated mercury is big to be stored for a relatively long time, some of the conviscated mercury can be set aside for treatment/disposal through an approval process in accordance with applicable laws and regulations.

a. Requirements for Temporary Storage of Confiscated Mercury

Temporary storage for evidence/confiscated mercury shall be a dedicaed area that is separate from other activities, to prevent the spread of mercury vapor. This dediated area can be permanent or non-permanent (movable/mobile) space. For non-permanent storage, a 20ft container can be used, with minor modifications to add a ventilation system, lighting and installation of a containment system.

The requirements for this temporary storage space are as follows:

- located in a location that is easily monitored, and away from heat sources and/or potential fires.
- has sufficient area to accommodate conviscated mercury;
- safe from possible leakage to the outside of the storage in the event of a mercury spill/spill (the room is able to contain the spill/spill).
- the storage can be locked and can only be entered by designated personnel (not easily accessible to the public);
- has sufficient lighting and ventilation that is separate from other rooms;
- on the outside of the storage, place a sign showing a mercury hazard symbol and a signboard "Stoarge of Conviscated Mercury".

Figure-27:
Example of Confiscated Mercury Storage

Source: https://mediak3.com/persyaratan-tempat-penyimpanan-sementara-limbah-b3

Source: https://www.container-xchange.com/blog/ventilated-container/

b. Procedure for Storage of Confiscated Mercury

For relatively small/light packaging, storage of Confiscated mercury may use shelves for efficient use of storage space. For relatively heavy packaging (e.g. 200-litre dum packaging containing mercury flask), placement of packaging can be conducted on the floor of the storage using pallets. If the storage is a mobile container, drums can be stacked in a maximum of 2 stacks. Whereas in the case of a building, the drums can be stacked in a maximum of 3 stacks.

During the storage of confiscated mercur, inspections must be carried out, to ensure that all conviscated mercury is stored safely and there is no potential for leaks or spills. The inspection is conducted periodically, at least once a week.

If leakage or potential leakage is found during the inspection, then repackaging must be performed immediately, before mercury spillage occurs. If there has been a leak/spill of mercury in the storage, immediately take emergency response measures.

c. Recording & Weighing

Each type of conviscated mercury stored in the storage must be recorded, including information related to: date, type of evidence/confiscation, source, packaging and size, weight, and other necessary information. Weight data of confiscated mercury can be obtained through weighing, that is conducted prior to storage.

Particularly for evidence/confiscated elemental mercury, the weight data shall be reported and consolidated nationally through tiered reporting (both manually and online) to measure the achievement of mercury withdrawal national targets as specified in the NAP-REM.

3.2.5. Personal Protective Equipment (PPE)

Personnel involved in the management of conviscated mercury, especially those who directly handling mercury re-packaging, will have a potential risk of exposure to mercury vapor. Exposure over long periods of time can pose health hazards, which must be controlled and minimized. Therefore, while working in the storage, personnel should be equipped with appropriate Personal Protective Equipment (PPE).

Hazard risk assessment/evaluation shall be conducted before determining the type of PPE to be used. However, the general PPE required for personnel working in a Evidence/Confiscated Mercury storage are (Figure-27):

Figure-28:
Personal Protective Equipment (PPE) for Handling of Conviscated Mercury

1. Half-face respirator, with mercury cartridge
   Notes: Respirator cartridges have a service life, depending on the period of use and the mercury concentration in the air. Cartridges should be replaced before they are saturated, according to the manufacturer's recommendations.
2. Protective clothing (tyvex)
3. Safety hat
4. Latex/nitrile gloves
5. Safety shoes
6. Safety glasses or goggles with side shields

It should be noted that the use of PPE should consider the following:

- properly assessed before use to ensure its suitability for the hazards present;
- be provided with instructions and training on how to use it safely;
- worn in the correct manner.
- properly maintained and stored;
- replaced when they become worn or damaged

All PPE must remain in the workplace area after working hours, and workers must not remove PPE from the mercury storage area. It is recommended that workers take a shower or at least wash their hands before leaving the workplace.

All PPE used must meet standard types and government requirements. Used PPE should be placed in plastic bags, sealed and labeled "Mercury Contaminated PPE - Type B". The PPE waste shall be managed as hazardous waste along with other Type-B conviscated mercury.

3.2.6. Emergency Response & First Aid for Mercury Spills

Emergencies that may occur during the storage of conviscated mercury in a Prosecutor's Office include:

- elemental mercury spills
- fire
- natural disaster: flood, earthquake.

Emergency response to mercury spills shall be performed immediately to prevent mercury from evaporation and release to the atmosphere. Therefore, all personnel involved in mercury storage shall be aware of emergency spill response measures and be able to use a mercury spill kit, before professional mercury response team arrive to clean up the spill. The following sections will describe the procedures related to the emergency response resulted from mercury spill and first aid for mercury exposure accidents.

a. Emergency Response to Mercury Spills

Emergency Response Procedures for mercury spills need to be developed and socialized within the law enforcement agencies (attorney’s office and police), who involved directly with conviscated mercury. A common emergency situation is an elemental mercury spill/spill during the handling of Type-A conviscated mercury.

Spill incidents of elemental mercury are caused by, among others:

- mercury packaging leaking/breaking/closing off
- mercury packaging broken due to dropping/bumping
- other reasons.

Referring to the Regulation of the Minister of Environment and Forestry Number P.74 /MENLHK/SETJEN/KUM.1/10/2019 concerning the Emergency Program for the Management of Hazardous and Toxic Materials and Hazardous and Toxic Waste, the emergency program consists of 3 aspects, that are:

a. Prevention:
   Emergency prevention is carried out through the preparation of an emergency program, which includes the provision of emergency infrastructure and the preparation of countermeasure functions. Emergency infrastructure includes: preparation of emergency countermeasures and preparation of necessary equipment/resources.
b. Preparedness:
   To remain alert to emergencies, it is necessary to conduct periodic training for personnel involved in emergencies, as well as emergency drills.
c. Countermeasures and Recovery
   Emergency countermeasures are actions taken to overcome emergencies. Meanwhile, recovery is restoring the environment back to its original state.

As part of the emergency infrastructure preparation, mercury spill handling procedures must be written and clear. Meanwhile, equipment preparation can be done by preparing adequate Mercury Spill Kit and trained personnel. Mercury Spill Kit can be obtained in the market as a package with various brands and sizes, adjusted to the needs (Figure-29).

Figure-28:
Mercury Spill Kit

Source: https://www.absorbentsonline.com/

In addition, emergency response equipment for mercury spill can also be purchased separately, with the following details:

1. Self-adhesive plastic bag
2. Garbage bags
3. Polyethylene plastic bottle with tight lid
4. Latex/nitrile gloves
5. Tissue paper
6. Business card paperboard
7. Syringe (without needle) or eye drop bottle
8. Safety mask with special mercury cartridge
9. Adhesive tape or duct tape
10. Flashlight
11. Sulfur (sulphur) or zinc powder
12. Work procedure/instruction.

The steps for handling mercury spills/spills are as follows:

1. Evacuate and make adequate air ventilation to remove accumulated mercury vapor in the room.
2. Wear a mercury-specific safety mask: to prevent inhalation of mercury vapor
3. Wear hazmat clothes: used clothing and shoes should be discarded (not to be cleaned)
4. Remove all jewelry: mercury vapor will stick to metal jewelry to form amalgam.
5. Wear safety gloves: use rubber or latex gloves. Watch out for broken glass or other sharp objects. Place broken glass on tissue paper, fold and place in a plastic bag with adhesive. Label with "Mercury Contaminated Glass Shards".
6. Observe the floor surface where the mercury spill occurred: Wood, ceramic, concrete and similar floors can be cleaned of mercury. Carpeted and similar floors cannot be cleaned of mercury, but must be cut up, packed and labeled "Mercury Contaminated Garbage".
7. Combine the scattered mercury grains using cardboard. Collect the mercury grains slowly to prevent the mercury from spreading. Caution: Mercury grains can roll quickly on a flat, hard surface.
8. Use a syringe (without a needle) to suck out the mercury grains. Transfer the mercury into a polyethylene bottle with a tight-fitting lid. Place the bottle in a plastic bag with adhesive. Label and symbolize as described earlier.
9. For very small mercury granules, use sticky tape to pull the mercury granules.
10. If it is quite difficult to see the mercury grains, sprinkle sulfur powder or zinc powder, so that the mercury grains will appear dark in color and easy to collect.
11. Combine all waste generated from emergency response activities (except bottled elemental mercury) into one container and label it "Mercury Contaminated Material - Type B)".

12. Perform over-packing of mercury collected in plastic bottles, labeled "Elemental Mercury-Type A)".

It should be noted that the implementation of this emergency response for mercury spill shall be carried out by personnel who have received adequate training.
Some do's and don'ts when handling a mercury spills:

- Do not use a vacuum cleaner to clean up mercury. Using a vacuum cleaner will increase the evaporation of mercury, thus increasing the risk of exposure.
- Do not use a broom to collect scattered mercury granules, as it will break the mercury granules into smaller ones, making decontamination more difficult.
- Do not spill/dump mercury into drainage.
- Do not wash mercury-contaminated items, as this will spread the mercury into the water medium.
- Do not reuse clothing or footwear that has been used for mercury spill response, it will increase mercury exposure to the body.
- Do not burn mercury-contaminated materials/equipment, as it will spread mercury into the air.

b. First Aid for Mercury Spills

Mercury is a metal that may enter the human body through the skin. If a personnel is exposed to mercury spills, first aid must be given as soon as possible. Referring to the Minister of Health Regulation Number 41 of 2019 concerning the Removal and Retrieval of Mercury-Containing Medical Devices in Healthcare Facilities, the following first aid procedures need to be carried out:

- body parts that are directly exposed to liquid mercury should be cleaned as soon as possible with running water. Use soap and running water to scrub all skin exposed to mercury and rinse thoroughly;
- clothing or anything worn by personnel suspected of being splashed with mercury should be removed immediately and packed for collection.
- personnel should immediately report the mercury exposure incident to the authorized work unit;
- pesonnels who are exposed to mercury must fill out the occupational accident incident form clearly and completely, in accordance with the applicable procedures in the agency/work unit.
- The authorized agency will verify the report and immediately follow up with the designated doctor to handle cases of occupational accidents/illnesses;
- doctor will conduct medical monitoring;
- if the incident results in acute exposure to patients or personnel, blood and urine tests shall be conducted.

3.2.7. Training

The Minister of Environment and Forestry Regulation No. P.74/MENLHK/ SETJEN/KUM.1/10/2019 also mandates adequate training for emergency responders. For conviscated mercury handling, this training includes not only to the emergency responders, but also to other personnel handling conviscated mercury (including for activities: re-sorting and storage). Training should be conducted periodically or at least once a year, covering the aspects of:

- Introduction to mercury and its hazards
- Personal Protective Equipment (PPE)
- Procedures for packaging, repackaging, over-packing, labeling
- Sorting and temporary storage procedures
- Mercury spill/spill emergency response.

In addition to classroom training, the storage manager or persin in charge are also required to conduct regular emergency response drills or simulations. Training and drill/simulation can be conducted internally or in collaboration with other business entities or hazardous waste management facilities (e.g. PT Prasadha Pamunah Limbah Industri) that already has trained personnel related to hazardous waste emergency response.

3.2.8. Monitoring and Reporting

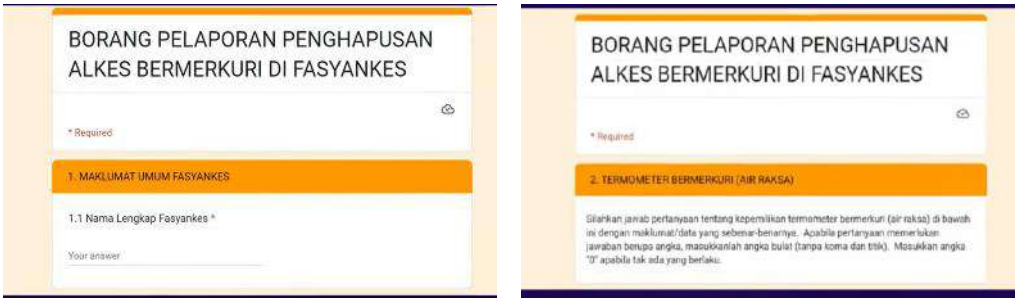
As stated in Annex-II of Presidential Regulation Number 21 of 2019 concerning the National Action Plan - Mercury Reduction and Elimination, the Police and Prosecutor's Office agencies play a role in law enforcement as stated in points c.8.1.2, c.8.2.1 and c.8.2.2, with success indicators as follows:

- No unlicensed cinnabar mining activities
- No use of mercury in ASGM.
- Control of illegal mercury trade/use of 10 tons per year.

Therefore, to monitor the level of the achievement of mercury retrieval, the weight and volume of all conviscated mercury shall be recorded, either by weighing or other means. For evidence in the form of elemental (liquid) mercury, the weight data is consolidated nationally by the Attorney General's Office, and then reported to the Minamata Convention focal point, in this case the Ministry of Environment and Forestry.

Recording and reporting of the weight of confiscated elemental mercury can also be performed online, by filling the form specifically made for reporting/recording conviscated mercury within the Attorney General's Office. The online reporting has been carried out by the Ministry of Health in the context of withdrawing mercury-containing medical devices from healthcare facilities, through the Directorate of Health Environment Letter Number KL.03.01/4/3541/2020 dated June 8, 2020 regarding the submission of the Online Form for Reporting the Retrieval of Mercury-Containing Medical Devices in Indonesia (Figure-30).

Figure-29:
Screenshoot of the Reporting Form for the Elimination of Mercury-Containing Medical Equipment in Healthcare Facilities



4. FURTHER MANAGEMENT OF EVIDENCE/CONFISCATED MERCURY

4.1. Further Management of Type-A Conviscated Mercury

Further management of Type-A conviscated mercury, whether during the investigation, prosecution, court or after the issuance of an legally binding verdict, is carried out in accordance with the rules and regulations related to the reduction/elimination of mercury in Indonesia.

4.1.1. Transportation of Type-A Confiscated Mercury

Type-A conviscated mercury is a liquid elemental mercury and cinnabar (mercury sulfide). The final disposal for this type shall be a permanent storage, where the cinnabar and mercury that has been processed by stabilization/solidification, is stored in a special storage permanently. Since there is no permanent storage facility available in Indonesia, final disposal (stabilization/solidification and permanent storage) shall be done in facilities in other countries (export).

For elemental mercury originating from medical devices, referring to the Regulation of the Minister of Environment and Forestry Number P.27/MENLHK/SETJEN/KUM.1/ 12/2020, before being transported to the final storage facility or export, mercury medical devices are first collected at the Storage Depo. This Storage Depot facility is a facility for temporary storage of mercury medical devices, which is prepared by Ministry of Environmentand Forestry (MoEF), and assigned in a location determined by the Governor.

For elemental mercury originated from evidence/confiscated items, there is currently no government policy that clearly regulates the procedures for its further management. However, for efficiency reasons, the Storage Depots provided by MoEF can also be used to accommodate and temporarily store Type-A confiscated mercury from the Attorney and/or Police. Therefore, the transportation of Type-A confiscated mercury from the Temporary Storage is carried out by officials of the Prosecutor's Office to the Storage Depot, after coordination with the DLH Province.

Transportation of Type-A conviscated mercury from the Temporary Storage to the Storage Depot is carried out using a van or truck with a closed box and equipped with a "toxic" placard. Before loading into the truck, ensure that the packaging of the evidence/confiscated elemental mercury is in good condition, stored in double containers (over-packing) and equipped with symbols and labels.

The movement of Type-A confiscated mercury from Temporary Storage to Storage Depot shall be accompanied by a Tracking Document, as shown in Figure-30. This Tracking Document refers to the document as applied for the withdrawal and further management of mercury-containing medical devices, as stipulated in the Minister of Environment and Forestry Regulation No. P.27/MENLHK/SETJEN/KUM.1/ 12/2020.

The Confiscated mercury Tracking Document basically consists of 4 (four) sections, namely:

- Section-1: filled in and signed by the person in charge of the confiscated mercury Temprary Storage at the Prosecutor's Office
- Section-2: filled in by the confiscated mercury transporter from the Temporary Storage to the Storage Depot and signed by the transporter, representative of the Prosecutor's Office, and representative of the district/city agency responsible for the environment;
- Section-3: filled and signed in by the Storage Depot manager, representative of the prosecutor's office, and representative of the agency in charge of the environment in the provincial level;
- Section-4: filled and signed in by the transporter of the confiscated mercury from the Storage Depot to the Final Disposal Facility or export activities, a representative of the Ministry responsible for the environment, and a representative of the Attorney General's Office.

Figure-31:
Tracking Form for Confiscated Mercury Movement

DOKUMEN PENCATATAN (TRACKING FORM)
BARANG BUKTI/SITAAN BERMERKURI

I. BAGIAN YANG HARUS DILENGKAPI PADA SAAT PENYIMPANAN BARANG BUKTI/SITAAN BERMERKURI DI TPS BARANG BUKTI/SITAAN BERMERKURI		
1	Nomor ID Barang Bukti/Sitaan Bermerkuri	
2	Nama Instansi dan Alamat	
3	Status	
4	Penanggung jawab	
5	Tanggal pemeriksaan	
6	Tujuan	
7	Tanda tangan penanggung jawab	
8	Jenis Barang Bukti/Sitaan Bermerkuri:	Berat/Volume/Jumlah
	Tipe-A: - Merkuri Elemental - Sinabar	 ... ...
	Tipe-B: - ..... -	 ... ...
II. BAGIAN YANG HARUS DILENGKAPI PADA SAAT PENGANGKUTAN BARANG BUKTI/SITAAN BERMERKURI DARI TPS BARANG BUKTI/SITAAN BERMERKURI KE STORAGE DEPO		
9.	Tujuan pengangkutan dan Alamat	
10	Nama dan Alamat pengangkut	
11	Nomor telepon pengangkut	
12	Identitas kendaraan	
13	Penanggung jawab	
14	Tanda tangan pengangkut	
15	Tanggal pengangkutan	
16	Tanda tangan perwakilan kejaksaan negri	
17	Tanda tangan instansi penanggung jawab di bidang LH kabupaten/kota	
III. BAGIAN YANG HARUS DILENGKAPI PADA SAAT PENYIMPANAN BARANG BUKTI/SITAAN BERMERKURI DI STORAGE DEPO		
18	Lokasi Storage Depo dan Alamat	
19	Penanggung jawab	
20	Tanggal pemeriksaan	
21	Tanda tangan pengelola	
22	Tanda angan Kejaksaan Tinggi	
23	Tanda tangan instansi penanggung jawab di bidang LH provinsi	
24	Nama dan Alamat pengangkut	
25	Nomor telepon pengangkut	
26	Identitas kendaraan	
	a. Nomor kendaraan	
	b. Nama kendaraan	
	c. Izin pengangkutan	
27	Penanggung jawab	
28	Tanda tangan pengangkut	
29	Tanggal pengangkutan	
30	Tujuan pengangkutan	
31	Tanda tangan kejaksaan tinggi	
32	Tanda tangan kementerian LHK	
IV. BAGIAN YANG HARUS DILENGKAPI PADA SAAT PENGOLAHAN AKHIR ATAU EKSPOR BARANG BUKTI/SITAAN BERMERKURI		
33	Lokasi pengolahan akhir/eksportir dan Alamat	
34	Nomor telepon pengolahan akhir/eksportir	
35	Penanggung jawab	
36	Tanda tangan pengolahan akhir/eksportir	
37	Tanggal pengolahan akhir/ekspor	
38	Tujuan ekspor (diisi jika dilakukan ekspor)	
39	Tanda tangan Kejaksaan Agung	
40	Tanda tangan kementerian LHK	

4.1.2. Temporary Storage at Regional Storage Depot

Mercury Storage Facility (or Mercury Depot) is facility built to collect mercury withdrawn from circulation in the framework of the National Action Plan - Reduction and Elimination on Mercury (NAP-REM). Referring to point c.6.4 in Annex-II of Presidential Regulation No. 21/2019, the provision Mercury Storage Facility is responsibility of the Ministry of Environment and Forestry (MoEF), with support from the Ministry of Research, Technology and Higher Education.

Furthermore, article 19 of the Minister of Environment and Forestry Regulation No. P.27/MENLHK/ SETJEN/KUM.1/12/2020 on the Management of Mercury-Containing Medical Devices, stipulates that the Mercury Storage Depot is provided by the MoEF and handed over to the Governor to be placed in hospitals owned by local governments or other locations in accordance with the designation of storage of Mercury-Containing Medical Devices. This regulation does not explicitly state that the Storage Depot is intended for mercury derived from evidence/confiscated objects. However, it can also be used as a collection storage for evidence/cconfiscated mercury, with the following considerations:

- the technical requirements for storage of mercury withdrawn from medical devices and from ASGM/illegal mercury trade are not different.
- cost efficiency and management of mercury that has been withdrawn from circulation.

Therefore, additional regulations are needed for management of evidence/confiscated mercury obtained from the law enforcement activities. Referring to the Regulation of the Minister of Environment and Forestry Number P.27/MENLHK/ SETJEN/KUM.1/12/2020, the requirements related to the Storage Depot are:

- the building/room must be enclosed;
- has an adequate space area to store volume of Mercury-containing medical device waste collected;
- must be maintained at room temperature;
- located in a safe location;
- not placed in disaster-prone areas.

4.1.3. Permanent Storage Facility

Unlike persistent organic pollutants (POPs) that shall also be phased out in accordance with the Stockholm Convention, mercury is a toxic metal element that cannot be decomposed into other less toxic compounds or elements. Since mercury cannot be decomposed/destroyed, either physically, chemically or biologically, the only method to secure mercury is to store it permanently.

Storing mercury permanently is performed in a facility specifically designed for mercury long-term storage. To reduce the risk of exposure to human health and the environment

during permanent storage, mercury and mercury-containing compounds shall be converted to mercury sulfide salts (HgS or cinnabar) through a stabilization process, prior to permanent storage. The stabilization mercury is commonly applied by European countries and the United States.

a. Stabilization/Solidification Treatment

The purpose of this stabilization treatment is to chemically convert elemental mercury into a compound that is more thermodynamically stable, solid, and lower volatility and solubility. As such, these mercury compounds pose less risk to human health and the environment.

Although there are generally various technologies to stabilize mercury, including: stabilization as amalgam, stabilization as mercury sulfide and stabilization with insoluble matrix, the technology that is currently rapidly developing and widely used is the stabilization of mercury into mercury sulfide. The stabilization process into mercury sulfide (HgS or cinnabar) is the reverse reaction of the process of making mercury (Hg) from cinnabar (HgS). In this stabilization process, liquid elemental mercury is reacted with elemental sulfur or sulfur salts, such as: thiosulphate or pyrite (FeS_2), to eventually form mercury sulfide.

$$Hg_{(l)} + S \rightarrow HgS$$

At room temperature, solid mercury sulfide may exist in 2 types of kinetically stable modifications, namely:

- α-HgS cinnabar (red); and
- β-HgS cinnabar (black)

To determine the extent of the solubility of mercury that has been stabilized into mercury sulfide, the Toxicity Characteristic Leaching Procedure (TCLP) test shall be conducted. Referring to the Minister of Environment and Forestry Regulation Number 6 of 2021 concerning Procedures and Requirements for Hazardous Waste Management, the TCLP standard for mercury prior to dispose off at the Final Disposal Facility is 0.05 mg/L, as stated in Appendix-XII of Government Regulation Number 22 of 2021 concerning the Implementation of Environmental Protection and Management.

One example of stabilization technology as mercury sulfide is offered by Econ Industries, as shown in Figure-31.

Figure-32:
Stabilization Elemental Mercury into Mercury Sulfide

Source: https://www.econindustries.com/mercury-waste/mmcu-traceable-economic-solution-for-mercury-disposal

The advantages of the mercury stabilization process prior to permanent storage are:

- mercury sulfide (or cinnabar, HgS) form is the most stable, solid, non-degradable and non-volatile form of the mercury compound, making it much safer for humans and the environment during permanent storage;
- storage of mercury in elemental form, without conversion to mercury sulfide (cinnabar), would pose a risk of theft for reuse in illegal ASGM activities.
- elemental mercury is corrosive to its metal container, so there is a risk of leakage during permanent storage, such that periodic repackaging will be required;
- mercury sulfide is a solid, so that its packaging is much simpler and space-saving, compared to the packaging of original elemental mercury, which requires over-packing.

The disadvantages of the mercury stabilization process prior to permanent storage are:

- Additional investment and operational costs are required to perform the stabilization process for the conversion of elemental mercury into mercury sulfide.
- The stabilization process needs to be carried out by skilled and trained operational personnel.

b. Permanent Storage Facility

Permanent Storage Facility is the final storage of mercury which has been stabilized into mercury sulfide. In the context of hazardous (B3) waste management, this facility can be categorized as B3 waste disposal activities. Referring to Article 171 of the Minister of Environment and Forestry Regulation Number 6 of 2021 concerning Procedures and Requirements for Hazardous and Toxic Waste Management, waste disposal consists of:

- landfill facilities (class I, II and III);
- injection wells;
- re-placement in ex-mining areas;
- containment dams for mining waste; and/or
- other B3 waste disposal facilities in accordance with the development of science and technology.

Although Permanent Storage Facility is not specifically mentioned in this regulation, it may be classified as other B3 waste disposal facilities in accordance with the development of science and technology.

The requirements for facilities and procedures for permanently store stabilized mercury shall refer to the provisions for hazardous waste storage, as stipulated in the Minister of Environment and Forestry Regulation Number 6 of 2021 concerning Procedures and Requirements for Hazardous Waste Management as follows.

1. **Requirement for the Location**
   The requirements for the location of the Permanent/Sustainable Storage Facility for mercury that has been processed by stabilization are as follows:
   - flood-free
   - not prone to natural disasters, such as: landslides, volcanic hazards, earthquakes, faults. sink holes, land subsidence, tsunamis; and/or mud volcanoes.

   In the event that the Permanent/Sustainable Storage location is not flood-free and prone to natural disasters, the B3 Waste Storage location must be able to be engineered with technology for environmental protection and management.

2. **Requirement for the Facility**
   The building of Permanent Storage Facility shall fulfill the following requirements:
   - design according to the characteristics and amount of stored mercury sulfide
   - storage space area in accordance with the amount of mercury sulfide stored;
   - capable of protecting the stabilized mercury sulfide from rain and covered;
   - roof is made from non-combustible materials;
   - has a ventilation system for air circulation;
   - adequate lighting system;

- the floor is impermeable and not bumpy;
- the outer floor of the building is designed such that rainwater does not enter the building of Permanent Storage;
- equipped with hazardous (B3) Waste symbol in accordance with the provisions of laws and regulations.

3. Procedure for Storage

The procedure for storing the stabilized mercury in the Permanent Storage is as follows:

- Packaging

  Mercury sulfide, as a stabilization product of elemental mercury, is a relatively inert/stable compound. Packaging requirements for mercury sulfide containers are as follows:

  - made of metal or plastic, preferably drums with the size of 200 liters complete with lid and locking ring.
  - able to confine the mercury sulfide to remain in the packaging;
  - has a strong lid to prevent spillage during storage, transfer, and/or transportation; and
  - non-leaking, non-rusting, and non-damaged condition.

  Lining the inner side of the drum with a plastic bag will prevent direct contact between mercury sulfide and the packaging, thus extending the lifetime of the packaging. Ensure the lid is in place and the ring bolts are locked, to prevent mercury sulfide from spilling out if the container is dropped/overturned.

- Labeling

  Referring to its Safety Data Sheet, mercury sulfide has toxic characteristics, so that it should be labeled accordingly. The outer side of the packaging is marked with symbols and label, as shown in Figure-33.

Figure-33:
Symbol and Label for Mercury Sulfide Packaging

- Storage Procedure

  Packing in the form of 200-liter drums are placed on pallets, with maximum 4 drums/pallet. For space efficiency, the drums can be stacked with a maximum height of 3 stacks, where the pallet is inserted between the stack. If more than 3 stacks of drums are desired, racks must be used.

  The minimum distance between pallets is 60 cm, which is required for regular inspection. If aisles are required for forklift movement, the distance between pallets can be made wider.

Figure-34:
Stacking of Drums in Permanent Storage Facility

4.1.4. Trans-boundary Movement (Export)

In refer to the Regulation of the Minister of Environment and Forestry Number P.27/MENLHK/ SETJEN/KUM.1/12/2020 concerning Waste Management of Mercury-Containing Medical Devices, there are 2 options in managing mercury-containing medical devices, that are: processing and export. Export means that the treatment/disposal of mercury is performed in other country's facilities. The mercury

export is performed because there are no facilities in Indonesia, which are capable of treatment/disposal of mercury retrieved from the healthcare and ASGM sectors. Countries that have received mercury exports from Indonesia for treatment/disposal in their facilities, are among other: Netherlands, Switzerland and Japan.

Trans-boundary movement of mercury shall go through procedures as stipulated in the Basel Convention. The Basel Convention establishes a detailed Prior Informed Consent (PIC) procedure with strict requirements for transboundary movement of hazardous wastes and other wastes.

The trans-boundary movement procedure consists of four main stages, as described as following:

a. Notification.
   Notification is performed based on government-to-government (G to G) communication, where the authorities of the exporting country notify the destination country (and transit countries). This notification is related to the plan to export hazardous waste to the destination country, using a standardized form.

b. Approval and issuance of transfer documents.
   After the destination country verified the facilities that will treat hazardous waste in their country, the destination country gives written approval. Similarly, countries that will be transitted by ships transporting hazardous waste, are required to give approval prior to the shipment of hazardous waste.

c. Trans-boundari movement.
   After concent is obtained from the destination and transit countries, the authority of the exporting country will issue an approval for trans-boundary movement of hazardous waste, and then shipment of hazardous waste may be commenced. This trans-boundary movement must be completed with a movement document (manifest). This document must be signed by the authorities of the exporting country, transit country and destination country.

d. Confirmation of treatment/disposal.
   Once the treatment hazardous waste is completed, the treatment facility shall issue a certificate/confirmation of treatment/disposal.

Figure-35:
Packaging and Loading Activities of Mercury Waste for Export

Source: PT PPLI

4.2. Further Management of Type-B Confiscated Mercury

Type-B evidence/confiscated mercury is confiscated mercury in the form of equipment/materials contaminated with hazardous (B3) waste. Referring to Government Regulation No. 22 of 2021 concerning the Implementation of Environmental Protection and Management, Type-B confiscated mercury is categorized as B3 waste with a waste code of **A105d** (if the mercury content is greater than 10 ppm) or **B101d** (if mercury content is less than 10 ppm but greater than 0.3 ppm). As a consequence, the further management of Type-B confiscated mercury shall be performed at a hazardous waste management facility, licensed for the management of hazardous wastes with waste codes of A105d and B101d, as shown in Figure-17. This management of Type-B confiscated mercury may include: decontamination, stabilization/solidification, incineration and/or landfill.

4.2.1. Transportation to the Licensed Hazardous Waste Management

Transportation of Type-B confiscated mercury from Temporary Storage to the hazardous waste management facility shall be carried out by either the investigator/prosecutor or by another party appointed by the investigator/prosecutor.

Prior to transportation to to the licensed final disposal facility, ensure that the Type-B confiscated mercury packagings are in good condition. The packaging shall also be marked with label and symbol, as shown in Figure-36 below.

Figure-36:
Symbol and Label of Type-B Confiscated mercury

4.2.2. Treatment of Type-B Conviscated Mercury

In general, the treatment of mercury-contaminated waste in integrated hazardous waste management facilities, such as PT PPLI, is conducted through stabilization/solidification and/or encapsulation processes. PT PPLI's internal policy for the stabilization/ solidification process requires the mercury content in the waste mixture to be 260 mg/kg maximum. The mercury content may exceed 260 mg/kg, provided that the mercury is bound to other compounds, for example: mercury bound to sulphur impregnated activated carbon (SIAC).

Prior to treatment, laboratory tests and treatability tests are usually conducted to determine the optimum recipe. These tests include, including: on-waste and Toxicity Characteristic Leaching Procedure (TCLP) tests. If the TCLP test results exceed the quality standards as stated in Appendix-XII of Government Regulation No. 22 of 2021 on the Implementation of Environmental Protection and Management, the waste shall undergo a stabilization/encapsulation process prior to disposal in a licensed hazardous waste landfill facility. In addition to the TCLP test requirements, other requirements that must be met before the mercury waste is placed in the landfill facility are:

- compressive strength test with soil penetrometer test with a minimum pressure value of 10 tons/m2
- paint filter test, i.e. a sample with a size of 1 cm does not pass the fiter with a mesh size of 60 after and 10 minutes of observation.

The stabilization process is carried out in a steel lined pit (Figure-37), where the mercury-containing waste is mixed with cement and other reagents, according to the formula (recipe) determined in the pre-acceptance process.

Figure-37:
Hazardous Waste Treatment Process by Stabilization and Encapsulation.

Source: PT PPLI

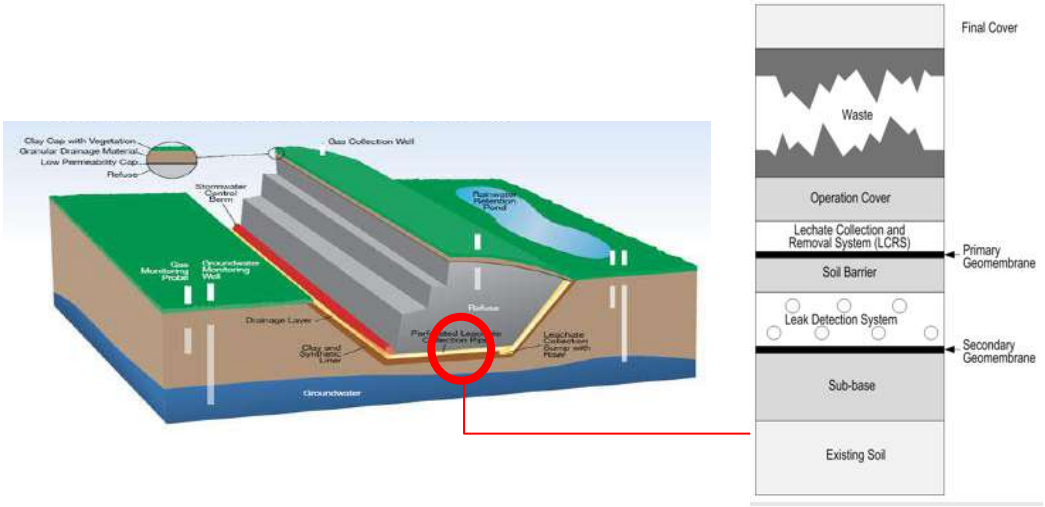
4.2.3. Final Disposal at Hazardous Waste Landfill

After the mixing in the stabilization pit is complete, samples of the stabilized waste are tested. If the results of the TCLP test, bearing strength test and paint filter test meet the required quality standards, then the treated mercury-containing waste is disposed off in a category-1 landfill facility, whichis specifically designed and licensed for the disposal of hazardous and toxic waste.

The design and lining system of the hazardous (B3) waste landfill refers to the Minister of Environment and Forestry Regulation No. 6 of 2021 pertining to the Procedures and Requirements for Hazardous (B3) Waste Management, which is also equivalent to the US-EPA's requirements. The hazardous waste landfill base liner system consists of (shown in Figure-38 from bottom to top):

- base layer;
- a second HDPE geomembrane layer;
- layer for leak detection system;
- barrier soil layer (Geo-synthetic Clay Liner, GCL);
- the first HDPE geomembrane layer;
- lining for leachate collection and transfer system; and
- protective layer for operation.

Figure-38
Base Liner System of Class-1 Hazardous Waste Landfill Facility



Meanwhile, an illustration of the hazardous waste landfill location is shown in Figure-39 below.

Figure-39:
Hazardous (B3) Waste Landfill Facility of PT PPLI - Bogor

Source: PT PPLI

5. CONCLUSION & RECOMMENDATION

1. The management of evidence/conviscated mercury as stipulated in the Attorney General's Guideline Number 8 of 2022 concerning the Handling of Criminal Cases in the Field of Environmental Protection and Management, shall be harmonized with the National Action Plan related to Mercury Reduction and Elimination, as stipulated in Presidential Regulation Number 21 of 2019 concerning the National Action Plan for Mercury Reduction and Elimination.
2. Revised guidelines related to the handling of evidence/conviscated mercury include:
    - Sorting of conviscated mercury (Type-A and Type-B)
    - Handling of Type-A conviscated mercury (repackaging, over-packing, labeling)
    - Temporary Storage of Evidence/Conviscated Mercury in Temporary Storage.
    - Delivery of Type-A Conviscated mercury to a Storage Depot managed by the Provincial Environment Agency and/or Ministry of Environment and Forestry.
    - Delivery of Type-B Conviscated mercury to Hazardous Waste Managers licensed in the management of mercury-containing hazardous waste.
    - Recording and Reporting
3. Regulation of the Minister of Environment and Forestry Number P.27/MENLHK/ SETJEN/KUM.1/12/2020 on the Management of Mercury-Containing Medical Device Waste, explains that Storage Depos, i.e. Mercury Storage Facilities are provided by MoEF and handed over to the Governor to be placed in hospitals owned by local governments or other locations.This regulation does not mention that the Storage Depot is intended for confiscated mercury retrieved from illegal use/distribution. Basically, the Storage Depot can also be used as a Storage Place for Mercury obtained from evidence/ confiscated by law enforcement, with consideration:
    - the technical requirements for storage of mercury withdrawn from medical devices and from ASGM/illegal mercury trade are not different.
    - cost efficiency and management of mercury that has been withdrawn from circulation.

    For this reason, regulations are needed related to Storage Depots for the storage of mercury obtained as evidence/ confiscated from law enforcement activities.
4. Considering the limited number of countries willing to accept mercury imports, it is necessary to immediately execute the export of mercury and mercury-containing compounds that have been withdrawn and collected. This is necessary to minimize health risks due to mercury exposure.
5. Regulatory infrastructure and related facilities are needed for the management of elemental mercury and mercury compounds in the country. These mercury

management facilities include stabilization treatment facilities and permanent storage facilities.

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