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Abbreviations

DICAPI  General Directorate of Captaincies and Coast Guard
DIRMEAMB  Directorate of Environment – PNP
EPA  Environmental Protection Agency
FEMA  Special Prosecutor for Environmental Matters
GEF  Global Environment Facility
Hg  Mercury
ASGM  Artisanal and Small-scale Gold Mining
MINAM  Ministry of the Environment
MINEM  Ministry of Energy and Mines
DGFM  General Directorate of Mining Formalization
MTC  Ministry of Transport and Communications
DGASA  General Directorate of Socio-environmental Affairs
WHO  World Health Organization
PNP  National Police of Peru
UNDP  United Nations Development Programme
UNEP  United Nations Environment Programme
SEIA  Environmental Impact Assessment
SUNAT  National Superintendency of Customs and Tax Administration
RCBF  Register for the Control of Auditable Assets
NIOSH  National Institute for Occupational Safety and Health
OSHA  Occupational Safety and Health Administration

Definitions

The Minamata Convention: A multilateral environmental agreement designed to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds. (Minamata Convention on Mercury, Art. 1)

Interim storage: A facility designed to house objects or substances for a predetermined temporary period until they are transferred to another location for final treatment or disposal. (Minamata Convention on Mercury)

Mercury: Elemental mercury Hg (0), which is a silver liquid of high toxicity whose use and distribution is regulated internationally by the Minamata Convention. (Minamata Convention on Mercury)

Mercury compound: Any substance consisting of atoms of mercury and one or more atoms of other chemical elements that can be separated into different components only by chemical reactions. (Minamata Convention on Mercury)

Mercury wastes, substances or objects: (a) Consisting of mercury; (b) Containing mercury; or (c) Contaminated with mercury, in a quantity above the relevant thresholds defined by the Minamata Conference of the Parties, in collaboration with the relevant bodies of the Basel Convention in a harmonized manner, that are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law or the Minamata Convention. This definition excludes overburden, waste rock and tailings from mining, except from primary mercury mining, unless they contain mercury above thresholds defined by the Conference of the Parties. (Minamata Convention on Mercury, Art. 11[2])

Artisanal and small-scale gold mining: Gold mining conducted by individual miners or small enterprises with limited capital investment and production. (Minamata Convention on Mercury, Art. 2)
PURPOSE

This document provides practical guidance for the storage, handling, and transport of liquid elemental mercury and related wastes in Peru, particularly wastes consisting of used elemental mercury, and mercury contaminated objects. According to their competencies, some government entities such as the Peruvian National Police (PNP), National Superintendency of Customs and Tax Administration (SUNAT), General Directorate of Captaincies and Coast Guard (DICAPI) and Special Prosecutor for Environmental Matters (FEMA) must sometimes handle and temporarily store quantities of mercury seized as a result of interventions, operations, inspections, audits and controls on illegal gold mining. The goal of this guide is to establish practical methods for handling, interim storage and transport of mercury and mercury contaminated wastes awaiting final disposal, or long term storage, or recycling for re-use. This guidance provides recommendations adapted to the realities of Peru, which faces particular challenges in its aim to progressively eliminate mercury use in artisanal and small-scale mining and properly manage mercury wastes in compliance with the Minamata and Basel conventions.

AUDIENCE

This document has been designed to provide the aforementioned government entities with detailed practical guidance on the environmentally sound management of elemental mercury and mercury contaminated wastes (PPE, vessels, and other contaminated solids, contaminated liquids such as plastic bottles with water and mercury, and bulk liquid elemental mercury waste such as reused mercury or mercury in plastic bags). It is intended to supplement the guidelines developed under the Basel and Minamata Conventions, the Peruvian regulations and other guidance documents such as U.S. Department of Energy Interim Guidance on Packaging, Transportation, Receipt, Management, and Long-Term Storage of Elemental Mercury, UNEP’s Guidelines on the environmentally sound interim storage of mercury other than waste mercury, among others, that stop short of giving specific recommendations for protocols and products that are needed to ensure environmentally sound transport, handling and storage of mercury waste throughout Peru. It is hoped that this guidance will also be useful or adapted for other countries.

GENERAL CONTENT OF THIS GUIDANCE DOCUMENT

This guidance document is divided into two main sections. The first deals with storage and handling of seized mercury and mercury contaminated waste, and covers storage containers and facilities, emergency planning, personnel training, documentation and reporting. The second section focuses on transport of seized mercury and mercury contaminated waste, including certification, planning, control, emergency management, tracking and transport protocol.

1.1. SITE CHOICE

To the extent possible, the site of the storage facility should be chosen on the basis of various criteria, including but not limited to the following:

- **Geological and meteorological:** Away from geologically unstable areas such as seismically active areas, to prevent damage to the facility, or in an area where the facility can withstand anticipated earthquake loading and expected weather events.
- **Ecological and biological:** Far from environmentally sensitive areas that have sensitive flora or fauna such as threatened or endangered species.
- **Hydrological and hydrogeological:** Adequately removed from sensitive locations such as floodplains, water courses, aquifers and wetlands, rivers or lakes, fisheries.
- **Political:** Outside areas affected by or potentially affected by armed conflict.
- **Societal:** At least 150 meters away from other sensitive facilities including schools, hospitals, homes, food processing facilities, agricultural operations, etc.
- **Security:** Located and constructed in such a way that the personnel, facilities, and contents are secured against theft, violence and vandalism.
- **Public consultations:** Inform the local community in advance about siting criteria and procedures for mitigating potential human health and environmental risks associated with the possible release of mercury or mercury compounds, including emergency response plans in the event of an incident.

(References: 1,4,8)

1.2. ENVIRONMENTAL ASSESSMENT AND PERMITTING

An environmental assessment and management plan must be developed and approved before construction and commissioning activities can begin, according to Law Nº 27446 (SEIA).

In accordance with the provisions of article 6 of the Law of the National System of Environmental Impact Assessment (SEIA), the procedure for the Environmental Certification consists of the following: a) Request for environmental classification of the project; b) Environmental classification of the project and terms of reference (Categories II and III); c) Environmental Impact Assessment review; d) Resolution or Environmental Certification; and e) Monitoring and control.

The evaluation of the Environmental Management Instrument is a technical, administrative, multidisciplinary and participatory process, designed to prevent, minimize, eliminate, correct and/or mitigate, and report on the environmental risks and impacts that projects may cause, as well as to monitor and control them. It is mandatory to obtain environmental certification prior to the execution of public, private or mixed capital investment projects.
The environmental impact assessment serves as both the relevant government authority and the proponent in making decisions regarding the execution of projects in the most efficient and environmentally safe manner according to SEIA Law or other applicable regulations.

The environmental impact assessment must contain at least:

1. Executive summary
2. Introduction
3. Description and analysis of the activity or project
4. Determination and description of the direct and indirect areas of influence or impact
5. Environmental characterization
6. Identification of direct and indirect environmental impacts
7. Evaluation of environmental and social impacts
8. Environmental management plan
9. Closure plan

1.3. BUILDING SPECIFICATIONS

General overview and design criteria:

- This is a storage facility for short to medium-term storage of mercury.
- The facility is only for storage of liquid mercury and small volumes of materials that are heavily contaminated with mercury.
- The mercury storage capacity of the facility should match the anticipated need.
- It is intended that mercury both enter and exit the facility and that new mercury entering the facility not remain for more than five years. The design plan in this guidance is a minimalist approach; if the anticipated storage need is greater than 5 tonne of liquid mercury, then a larger facility should be built.

Storage facilities should have certain containment characteristics to ensure the safe and environmentally sound interim storage of mercury and mercury contaminated wastes. The protection of soil, groundwater and surface water should be carefully considered, particularly in the construction of facilities for the storage of larger quantities (e.g. 10 tonnes or more) of mercury or mercury wastes. Such protection could be achieved through a combination of a geological barrier (e.g., earthen dike, berm, etc.) and other impermeable barriers (e.g., cement wall, epoxy floor and wall coatings, impermeable floor liner, etc.).

The facility must be secured with physical locks, an alarm system and security camera, as appropriate. The facility should also be fire-resistant, for example constructed from non-combustible materials. The maximum temperature inside the mercury storage area should be maintained at 22°C and not exceed 30°C.

Facilities should be designed to facilitate the safe handling of containers and may include separate areas for container shipping and receiving and for repackaging operations, as these are the operations most vulnerable to accidents and spillage of mercury. Storage buildings should be secure and video monitored with intrusion detection alarms, air conditioning, and fire suppression capabilities, along with cheap and reliable mercury monitoring devices. They should also include proper surface coatings and/or impermeable floor liners, plumbing and drains with appropriate traps, a filtered ventilation system, and the size of the facility must match the anticipated storage demand. For example, the design plan for the 10m by 10m facility shown below is suitable for storing up to one tonne of mercury. Each additional tonne would require extra storage space. (References: 1,4,8)

1.3.1. Operations

This guide reflects the standards provided by the U.S. Department of Energy (Reference 8) relating to storage facilities for elemental mercury. There are four main physical areas defined for: 1 - Receipt and Shipping, 2 - Handling, 3 - Storage and 4 - Office Administration:

- **Reception and shipping area:** This area should have a gated enclosure and loading/unloading area that is large enough for the proper delivery vehicles. This area should allow room and equipment for vehicle inspection and transfer of goods. Ideally the vehicle would be able to back right into a covered area with epoxy coated floors and emergency spill management measures. There should also be basic office equipment (esp. chairs and a desk) for administrative tasks like manifest review and custody transfer paperwork.

- **Handling area:** In this area containers with mercury are inspected more closely and prepared for storage. The area may also be used for weighing samples during reception or inventory, or for emergency transfer of the contents of a leaking container. In anticipation of a possible spill, the area should also be designed to retain the anticipated volume of mercury received or in the area at any given time.

- **Storage area:** This area should be closed and have sufficient storage space and passage for careful placement, recovery, inspection and tracking of all containers. The area should have adequate ventilation measures, mercury vapour monitoring, and fire protection.

- **Administration area:** This should ideally be located in a separate building, at a safe distance from the storage area, dedicated to administration, record keeping, training and all other office management functions.
should be placed in a 200L overpacking drum as described in the section on mercury storage containers. 1-tonne containers for liquid mercury are also possible.

The storage area must have personal protective equipment (PPE) available for all staff at the facility. Also, as previously mentioned, the area should be air conditioned.

The building footprint is ~100m² with a roof over the entire area including the driveway and two small rooms built onto the back to house the generator, mercury filter and ventilation systems. To avoid the risk of flooding, it is built on a mound that is raised 0.5 metres above the ground level with a ramp up to the driveway edge. The steel garage security door has a 10 cm floor containment barrier and sand-roughened epoxy painted ramps on either side of the barrier for smooth rolling into and out of storage and handling areas. All floors are epoxy coated with rounded corners where they meet walls or floor containment barriers. Separate floor containment barriers surround the storage area and handling area. The workbench is where mercury is poured into approved 2.5L containers, and there is a round-cornered spill tray on the table in which the mercury transfer is done. Above the workbench there is a filtered fume hood fan that runs regularly. If the storage units are not refrigerated then the storage room should have an air conditioning system that keeps the facility at a temperature of 22 degrees or cooler.

The storage units should all be located within the storage area floor containment barrier. Chest refrigerators are recommended as storage units so that the stored items can be cooled without keeping the entire facility cooled. Also, the refrigerators are fairly air-sealed to a certain extent and should the power fail, the insulated refrigerators will stay cool for a few hours. Inside the chest refrigerators there are round-cornered drip pans that match the maximum Hg volume to be stored in each. Power cords to refrigerators should be wired along the ceilings and walls instead of along the floors, and protected by a metal tube or other conduit.

Once mercury has been transferred to approved 2.5L Hg flasks, there is no need to keep the flasks refrigerated. The flasks should be placed in a 200L overpacking drum as described in the section on mercury storage containers. 1-tonne containers for liquid mercury are also possible.

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The mercury storage area should have a separate low-power (to avoid turbulence) ground level fan (with activated carbon filter) to pump out any heavy vapours so that they cannot accumulate. (Reference 8,11).

1.4. EMERGENCY PLANNING AND RESPONSE

The Emergency Response Plan aims to establish appropriate procedures and actions to be implemented to minimize and/or eliminate losses related to people, warehouse facilities, third party ownership and the negative impact on the environment that may occur due to an emergency. In Peru, the emergency response plan is part of the contingency plan, established in the Environmental Management Instrument, according to Law N° 28551.

The principal elements of an emergency response plan include the identification of potential hazards; legislation governing emergency response plans; actions to be taken in emergency situations, including mitigation measures; personnel training plans; communication targets (fire service, police, neighbouring communities, local government, etc.) methods in case of emergency; and schedules for the testing of emergency response equipment.

In the event of an emergency, site staff must do the following:

1. Notify the authorities (PNP, firefighters, FEMA) and keep the site secured until the appropriate official has deemed the area safe for investigation, or continued operation.
2. Put on PPE – put on old clothes, apron or coveralls, shoe covers, rubber or nitrile gloves, eye protection and respiratory protection.
3. Record the incident noting the circumstantial details.

Emergency response plans or procedures should cover a number of different scenarios, which could include but should not be limited to:

a) Damage to storage containers during handling, including distinctions between minor damage and catastrophic damage (e.g., complete failure of the seal on a container);
b) Discovery of container leakage during routine inspections;
c) Mercury release occurring during repackaging operations; and
d) Damage to the storage facility itself (e.g., owing to flood, fire, earthquake, vandalism, theft, etc.) that compromises the physical integrity of the facility.

1.4.1. Fire protection and risk communication

The storage site should be equipped with all of the tools necessary to address any potential threat to the facility, such as a fire protection system, PPE, smoke alarms, etc. Emergency response plans should be developed in coordination with local agencies responsible for fires, earthquakes, etc., to ensure that personnel are sufficiently informed, trained, equipped and otherwise prepared to safely handle any fires or other emergencies that may occur at the facility. To reduce the risk of fires in particular, pallets, storage racks and other interior furnishings – as well as the facilities themselves – should be constructed of non-combustible materials. To further minimize the risk of fire, it is suggested that a battery-powered electric forklift be used, when necessary, to transport the mercury or mercury contaminated wastes inside the storage facility.

In case of fire, workers should first put on personal protective equipment. Then, use an extinguishing agent suitable for the type of fire. Equipping the storage facility with a dry-pipe (water supply) fire suppression system and emergency response equipment is recommended. If the fire is confined to a given space, the mercury and mercury contaminated waste storage containers should be moved away from the fire, using utmost caution. After the fire is extinguished, the containers may need to be treated with a water spray until they are sufficiently cooled.

It is critical that all facilities develop risk communication protocols that detail procedures for notifying management, authorities, communities, and emergency services, that establish conditions that dictate when to notify each stakeholder, and how communications should be carried out at the time of the spill, during clean-up, and post-spill. (References 1,3,6)

1.5. PERSONNEL TRAINING AND CERTIFICATION

All personnel working with mercury must receive adequate training to work in the storage facility, handle mercury containers, respond to emergencies, or transport mercury or contaminated materials. The training may include general hazardous material management, as well as training specific to mercury management. Prior to starting their assignment, new personnel should be trained and have a minimum competency consistent with their responsibilities. This requirement should be stipulated in local regulations.

The training may consist of two main categories: Basic Safety Training and Operations Training. All training received by the mercury handling, storage, and transport personnel shall be documented and the records shall be easily accessed for audit purposes. Refresher training is required for all personnel at least once a year.

Basic training objectives (UNEP 2015 and Basel Guidelines):

- Understand mercury and its adverse health and environmental effects;
- Understand adverse impacts of mercury on women and children;
- Understand occupational safety standards relevant to mercury, including the use of personal protective equipment such as body coverings, eye and face protectors, gloves and respiratory protectors;
- Ensure that relevant information on the emergency management of mercury spills and waste is provided to those responsible;
- Instruct responsible persons that mercury must be collected and managed separately from other substances;
- Provide practical guidance on how to deal with mercury wastes (covering identification, collection, handling, labelling, storage, disposal operations etc.); and
• Develop, document and distribute concepts and solutions that are appropriately adapted to domestic circumstances.

Employees should have basic knowledge of the following:

a) The chemical properties and adverse effects of mercury.
b) How to identify mercury and segregate it from other hazardous substances.
c) Occupational safety standards relevant to mercury and mercury contaminated waste.
d) How to use personal protective equipment provided, such as body coverings, eye and face protectors, gloves and respiratory protectors, including how to properly handle and dispose of such equipment.
e) Labelling and storage standards considered appropriate for the facility, container compatibility and dating requirements and closed-container requirements.
f) How to safely handle mercury and mercury contaminated waste using the equipment available at the facility.
g) How to use engineering controls to minimize exposure.
h) How to deal with accidental spills of mercury or mercury contaminated waste.
i) How to use mercury vapour monitoring devices to identify possible sources of elevated mercury levels in the facility (whether by routine monitoring or focused monitoring aimed at spill response execution and verification) and provide workers with the information they require to ensure safety (e.g., when respiratory protection may be warranted).


Employers should ensure the health and safety of all employees while they are at work. An exposure assessment can be undertaken for any employees who are directly exposed to mercury or mercury contaminated waste and appropriate monitoring and industrial hygiene practices adopted. Colorimetric badges and/or personal monitoring equipment (vapour sampling devices) are needed for this kind of comprehensive exposure assessment and monitoring programme. Pre-employment physical examinations may be carried out to establish a baseline for determining an individual’s background mercury level and help to ensure that the employee has appropriate body chemistry for subsequent mercury removal, if necessary. Personnel may have other considerations that should be handled on a case-specific basis. Medical monitoring programmes may also include periodic physical exams (e.g., every one to three years), regular blood tests and regular urinalysis. Consideration should be given to offering alternative job opportunities to workers who become pregnant or who are breastfeeding. It is important to have worker insurance and employer liability insurance as required under national law.

### 1.6. MERCURY STORAGE CONTAINERS

Different types of mercury (e.g., elemental mercury in steel flasks and mercury wastes) should be stored separately. Avoid mixing different wastes. Contaminated solids (PPE, contaminated containers, rags and others), contaminated liquids (water + mercury and others), and bulk elemental mercury waste (reused mercury and mercury in plastic bags) should each be stored in separate containers.

Waste elemental mercury in bulk form should be carefully packaged in appropriate containers, such as those identified in the United Nations Recommendations on the Transport of Dangerous Goods: Model Regulations (United Nations, 2017), as described below. Solid mercury waste should be stored in sealed containers such as barrels or pails with well-fitting lids or in specially constructed containers that do not release mercury vapour. Also, comply with the provisions of D.L 1278 and its D.S. Nr 014-2017-MINAM, for cases of hazardous waste that includes mercury.

There are two main types of internationally approved mercury storage and transport containers: 34.5 kg (~2.5L) flasks and one-metric-ton containers (see images 15 and 16). The design of the container should pass the drop test and the leakproof test as described in chapters 6.1.5.3 and 6.1.5.4 of the United Nations Recommendations on the Transport of Dangerous Goods: Manual of Tests and Criteria. For transporting smaller quantities of mercury, other sizes (e.g., up to 7 kg) and types (e.g., polyethylene) of containers are often used; however, the level of protection such containers provide should be taken into account.

When storing elemental mercury in containers, it is important to leave some “head space” to allow for thermal expansion of the elemental mercury. The maximum filling ratio of a container is 80 per cent by volume, and the head space is therefore at least 20 per cent (References: 4,8,9).

Elemental mercury can only be stored safely in durable containers with the following properties:

- Strong enough to support the mass of mercury contained
- Unreactive to mercury (e.g., no aluminum)
- They should not be damaged by any materials previously stored in them or contain traces of materials that could adversely react with mercury
- Their structural integrity should be intact
- They should not be corroded to the point where leaks may be possible if the corroded area is struck with a hammer
- They should have a protective coating (preferably epoxy paint) to prevent corrosion
- They should be gas- and liquid-tight
1.6.1. Temporary storage containers

Mercury seized or surrendered may not be contained in vessels appropriate for transport or storage. To avoid spills, smaller quantities of mercury and contaminated wastes should not be transferred from the containers in which they are found in the field. Instead they should be sealed inside two sealable bags (Ziploc or similar), one inside the other, and then submerged under water or placed in airtight containers that are filled with enough sorbent granules and/or padded with enough sorbent pads to absorb all of the mercury stored in the container, in the event of a leak.

These temporary containers should be tamper-proof and marked with unique identifying codes that are recorded in an official manifest to enable verification and prevent tampering. (References: 1,4,8)

Overpacking is intended to provide a secondary containment for the mercury flasks. The proposed overpacking procedure is as follows:

- Place on a pallet an open UN-approved drum.
- Put an inner liner plastic bag into the drum.
- Place a cushioning material, which also functions as an absorbent mat, at the bottom of the drum.
- Put the mercury flasks into the drum. One drum can be filled with six 34.5 kg flasks, giving the total weight of approximately 220 kg including the weight of the flasks.
- Insert tightly sponge rubber or cardboard dividers between the flasks, as well as between the flasks and the inner side of the drum.
- Seal the inner plastic bag and place the drum lid over top.
- Place the rubber gasket and sealing ring on the drum and tighten the bolt.

The stability of the pallets must be considered when stacking drums containing mercury flasks. For metal drums (200 litre capacity), the maximum stack height should be two pallets, where each pallet supports four drums. Metal containers holding one tonne of mercury should not be stacked.

No protective coating is needed for the inner surface of steel flasks as long as the mercury to be stored in them meets the purity standards for storage as elemental mercury, and no water is present inside the flask. The distance between the opening of the flask and the bottom of the vessel should be no more than 0.7 m because a vacuum pump can lift mercury only 0.76 metres.

Steel storage flasks must meet the following criteria:

- Metal flasks should have as few welds as possible.
- Teflon® tape provides excellent and low cost sealing for metal screw top seals.
- Carbon steel (ASTM A36 minimum) or stainless steel (AISI 304 or 316L) is recommended.
- Epoxy paint on the outside of the flask will prevent corrosion and increase flask life.

1.6.2. Longer term storage containers

When mercury is to be stored for longer periods in facilities that have a greater capacity (and forklifts available to move heavy containers), it is appropriate to store standard 34.5 kg flasks inside plastic lined overpacking UN-approved steel 200-litre drums sealed with rubber gaskets - with 6 flasks per drum. The drums should be clearly labeled and stored in groups of 4 on non-flammable spill catching pallets (see image 11).

The storage containers should be placed in larger spill-proof storage cases, and chest refrigerators are a useful and widely available option for extended storage. The refrigerators themselves are fairly well air-sealed and if the power fails the refrigerator insulation should keep the stored elements cool for up to 12 hours. Industrial refrigerators can be found that have durable stainless steel liners which are ideal for mercury storage. These refrigerator boxes should be lined with sorbent pads to add another layer of spill protection.
1.7. STORAGE AREAS

Flasks containing elemental mercury should be stored upright on pallets. If not on a pallet, the flasks could be placed in protective outer packaging such as a box or drum. The use of wood or other porous materials for pallets should be avoided as such materials are difficult to decontaminate. The same is true for corrosion or rust. Elemental mercury in flasks should be placed on containment trays or in a leak-proof area of the storage facility that ideally has curved edges to limit the potential accumulation of elemental mercury in any corner in the event of a spill. The volume of the containment area should be at least 125 per cent of the maximum stored liquid volume, taking into account the space taken up by various other items that may be stored in the containment area.

To facilitate the organization of small containers of mercury waste, steel shelves capable of withstanding the load may be considered. The shelf surfaces should be epoxy coated to facilitate any decontamination that may be necessary.

1.8. LABELING

Proper and durable labelling is absolutely essential! Unlabeled containers are serious and expensive hazards. Never neglect or delay labelling.

The guidance provided by “Globally Harmonized System (GHS) of Classification and Labeling of Chemicals” addresses classification of chemicals by types of hazard and proposes harmonized hazard communication elements, including labels and safety data sheets. The objective of the system is to ensure that information on physical hazards and toxicity from chemicals is available, so as to protect human health and the environment during handling, transport and use.

Where feasible, use international standard hazardous materials labeling on all containers carrying mercury and substances contaminated with mercury.

At the very least, each flask or other container should indicate that it contains mercury and warn of toxic hazards. Additionally, it should be recorded, both on the container and in separate documentation, the amount of mercury or material, the nature of the material (liquid mercury or contaminated solids), the date received, and identification and chain of custody information.

Other important information may include the name of the supplier of the mercury, the origin of the mercury (if known), the level and purity of the mercury, the container number and batch number, etc.

Finally, the gross and net weight and the date when the container was sealed should be affixed to each container, along with an appropriate label indicating the corrosive hazard (US DOE, 2009).

1.9. MONITORING

Indoor air monitoring at interim mercury storage facilities should be done regularly to check for leaks and protect workers on site, especially before and after handling mercury. Although expensive and technically challenging, it is ideal to have a continuous indoor air monitoring system to detect leaks as early as possible, with sensors positioned at ground and head levels, and with visual and acoustic alarms. A number of continuous mercury monitoring systems (such as Tekran)
are commercially available. A first alternative that achieves acceptable results, is cheaper and easier to use are manually operated instantaneous monitoring devices such as Lumex or Jerome. If leaks above threshold are detected, the operator should immediately take all necessary actions to stop any releases of mercury.

For limited budget and technical knowhow scenarios, passive monitoring devices such as dosimeter badges are adequate for a relatively small facility. Personnel should store their dosimeter badges in a separate building along with a "control" badge that is always stored in the place where the active duty badge is stored when not in use. Individual doses should never exceed occupational health norms.

The information obtained from routine monitoring can be used to determine whether the stored mercury wastes are being properly managed, to identify potential issues relating to possible releases or emissions of, or exposure to mercury, and to help assess whether amendments to the management system might be needed. A monitoring programme will help facility managers be confident that they are not at risk, to identify problems, and to take appropriate measures to remedy them. All equipment, including monitoring equipment, should be subject to routine pre-scheduled maintenance, including testing to ensure proper calibration and function. Monitoring should also be carried out in peripheral areas to detect any unexpected releases. If the results show that safe limits have been exceeded, action should be taken and/or remedial measures applied.

Regular scheduled inspections should be undertaken to ensure that the facility, including all equipment, is in good condition. A clear record of the results of inspections should be produced and kept. It is critical to regularly monitor the condition of the mercury containers to detect any degradation over time. Such inspections should include examination of the spill collection areas, floors and walls to ensure that there are no mercury releases and that the equipment and any coatings are intact. The site security system should be inspected. The inspection schedule may be determined by national regulations or guidelines, or by the facility manager. A clear plan and budget for a regular monitoring and maintenance schedule should be in place before the facility starts operating.

(References: 1,4,8)

1.10. DOCUMENTATION

It is essential that hard copies be kept of all manifests, custody and transfer papers, Safety Data Sheets, inventory management records, etc. Documentation should also be kept on routine inspection and audits of storage areas, focusing especially on damages, spills and deterioration. Clean-up and decontamination records should also be kept, but not without also alerting the authorities concerned.

Monitoring results should be reported to the relevant government authorities as necessary. This should include an annual report containing the results of the monitoring programme, an assessment of those results, any corrective actions and the relative success of the corrective actions. Monitoring data and related reports should be retained for at least 3 years.

All documents on mercury transfers, including the certificate accompanying the container and records concerning the destocking and dispatch of the mercury after its temporary storage, its destination and its intended use, should also be kept for at least 3 years. (References: 1,4,7)

1.11. INVENTORY

According to D.L 1103, each user (natural or legal person) must register with SUNAT RCBF. There is no exclusive regulation for custody of mercury, but in Perú SUNAT and FEMA have custody of seized mercury. An inventory of the mercury wastes kept at a storage site should be created and updated as mercury wastes are added to or removed from the facility, such as for disposal in accordance with Article 11 of the Minamata Convention and Article 4 of the Basel Convention. The inventory sheet should be checked periodically against the containers stored at the facility to ensure its accuracy. (References: 1,4)

1.12. CLOSURE

A closure plan should be prepared during the design phase for the interim storage facility, as it is an integral component of the environmental impact assessment. This should include the implementation of financial instruments (i.e., dedicated closure funds and insurance in case of disaster) that are sufficient to pay for the closure of the facility and potential decontamination work that may be necessary. The closure plan should be updated regularly to reflect any changes in site conditions from the design phase to the closure phase. At the end of a facility's life, all mercury, wastes and mercury-contaminated materials should be removed. Air, equipment and soil measurements should be taken to confirm that the site has not been contaminated. If contamination is present, the site should be remediated according to relevant regulations.

Guidelines for Interim Storage, Handling and Transportation of Mercury

It is critical that mercury is handled safely and in a manner that ensures traceability and security. The first layer of security is the design of the storage facility itself, as described in the previous section. This section describes the equipment and procedures that can ensure safe operation, protect workers, prevent spills and losses during collection, reception, and transfer of mercury to appropriate containers.
2.1 PERSONAL PROTECTIVE EQUIPMENT

The mercury storage location must have a closet containing personal protective equipment (PPE) (References 10,5). This should include:

- Impermeable rubber or nitrile gloves. N-Dex gloves are often used for protection against skin contact with mercury. Thick rubber is best. If only thin disposable gloves are available, use three layers of gloves.
- Safety goggles or other protective eyewear. Eye and face protection in the form of goggles will reduce exposure in cases of splash hazards.
- Coveralls, aprons, and other protective clothing such as Tyvek coveralls.
- Disposable shoe covers or rubber boots, ideally with steel toe. Pant leg of coveralls, suit, or apron should cover the boot tops so that liquid cannot enter boot.
- Respiratory protection. Air purifying respiratory protection may be required in cases where other masks do not adequately reduce exposures. For air purifying respirators, specific mercury cartridges are available. It is recommended to use a respirator in the following situations:
  a) During emergencies, and during entry into areas of unknown mercury concentration.
  b) During evaluation or installation of other control equipment and/or modification of work practices to achieve compliance with exposure limits.
  c) In work situations where existing controls are not yet capable of reducing employee mercury exposure to or below the exposure limits.
  d) During cleaning, maintenance, repair and other work where existing controls are not feasible.
  e) For elemental mercury vapor concentrations up to 0.5 mg/m³, a half-face air purifying respirator with a cartridge that removes up to 1 mg Hg/m³ provides adequate protection. Only hazard-specific NIOSH-approved cartridges provide air-purifying protection against low-level mercury vapor.
  f) For concentrations between 0.5 and 2.5 mg Hg/m³ a full-face chemical cartridge respirator should be used, with cartridge(s) providing protection against mercury compounds with Assigned Protection Factor (APF) = 10.
  g) Above 2.5 mg Hg/m³ a self-contained breathing apparatus (SCBA) is required (APF = 40).

Suitable materials for mercury handling include: butyl rubber, natural rubber, neoprene rubber, nitrile rubber, polyvinyl chloride (PVC), Viton®, Viton®/butyl rubber, Silver Shield® - PE/EVAL/PE, Tychem® BR/LV, Tychem® Responder® CSM, Tychem® TK. Rubber "Wellington" boots may be used for ease of cleaning. Very thin natural rubber, neoprene rubber, nitrile rubber, and PVC gloves (0.3 mm or less) are not recommended. Isolate contaminated clothing by sealing it in a bag or other container. Employees must not take mercury-contaminated materials, clothing, or equipment home.

Test all rubber or synthetic gloves for pin-holes or other leaks by inflating them before putting them on (see figures below).

Any employees working in a mercury storage facility should wear a clip-on Mercury Vapor Badge (also known as a personal air monitor or dosimeter). The badge will not only detect the presence of mercury vapor, but can also be sent to a lab for analysis. This provides an exact reading of the concentration level in the work area during the time of exposure. Any mercury-contaminated PPE or clothing must be disposed of as mercury-contaminated waste.

For reference, the relevant worker exposure limits are given below:

Mercury vapor exposure limits:

- NIOSH (National Institute for Occupational Safety and Health) – mercury vapor:
  - REL (Recommended exposure limit) = TWA (Time-weighted average) 0.05 mg/m³
- OSHA (Occupational Safety and Health Administration) – mercury vapor:
  - PEL (Permissible exposure limit) = TWA 0.1 mg/m³
  - IDLH (Immediate danger to life or health) = 10 mg/m³

2.1.1. PPE donning procedure

Inspect all PPE for damage and replace if the protection is compromised. Don equipment in pairs so that each person can check the proper use and fit of the other person’s equipment.

1. Put on protective suit, placing feet carefully in the leg/foot part of suit so as not to rupture the suit.
2. Put on boots and pull suit legs over the boot tops.
3. Put on appropriate respirator, ensuring a tight seal over nose and mouth.
4. Put on safety glasses.
5. Put on gloves, ensuring that the gloves are pulled up over the sleeves of the suit arms.
6. Inspect PPE to ensure integrity, proper application, and fit of the equipment. This is best done in pairs.

2.1.2. PPE doffing procedure

Inspect all PPE for damage or contamination and replace if the protection is compromised. Remove equipment in pairs to assist and ensure that proper removal procedures are observed.
1. Remove apron (if applicable).
2. Remove safety glasses.
3. Remove respirator.
4. Remove boots.
5. Remove gloves.
6. Remove suit, coveralls and/or apron by carefully grabbing them by the inside surfaces so as to avoid touching the outer surfaces with hands.
7. Wash hands thoroughly.

2.2 SPILL RESPONSE

Spills should be reported to management and the date, time, inspector, location and approximate amount of mercury or mercury wastes should be documented, and the records of such incidences maintained. The type of mercury or mercury wastes spilled, the spill’s size and dispersal, proximity of the spill to human habitations and environmentally sensitive areas should be evaluated. Assessing the availability of the necessary clean-up resources and expertise is critical to determining the appropriate type of response for a mercury or mercury waste spill. If the spill is small and on a non-porous surface (such as linoleum or an epoxy painted floor), it can be readily cleaned up by facility employees and disposed of in an environmentally sound manner. If the spill is large or in cracks or crevices, it may be necessary to hire someone with suitable professional training, should such personnel not be available at the facility. Spills involving more than a few millilitres of mercury should be reported to the relevant authorities. If there is any uncertainty as to whether a spill should be classified as “large”, the relevant authorities should be contacted. Under certain circumstances outlined in the emergency response plan, it may be advisable to obtain the assistance of qualified professional clean-up or air monitoring personnel regardless of spill size (References 1,8,4).

2.3 SPILL KIT

Any spillage of mercury or mercury contaminated waste, even small droplets, should be considered hazardous and cleaned up with caution. Prepare for clean-up by getting the mercury spill kit (see below) and removing your jewelry, watch, mobile phone and other metallic items that could amalgamate with mercury; also cover any metal frames on eyeglasses.

![Image 15: Main PPE for mercury](image15)

![Image 16: Mercury spill response](image16)

![Image 17: Spill cleanup materials (reference illustration)](image17)
used. Facilities should also have the capacity to appropriately contain and manage any contaminated waste water or solid wastes that may be generated.

The basic mercury spill kit should include as many as possible wastes that may be generated.

- Flashlight
- Small plastic scoop and dustpan
- 2 silicone spatulas
- Tweezers
- Eyedropper or syringe (without the needle)
- Duct tape or sticky tape
- “Danger: Mercury Waste” labels to put on waste containers
- Air-tight, sealable plastic bags (small and large sizes, thickness: 2 to 6 mils, or 50 to 150 microns, such as Ziploc freezer bags)
- Air-tight, puncture-resistant, rigid plastic or steel jar or other container with a wide opening
- Empty 2.5L steel mercury storage flask
- Regular plastic waste bags (thickness: 2 to 6 mils, or 50 to 150 microns)
- Plastic tray or wash basin with round corners and edges.
- Spill and vapor suppression agents:
  - Sulfur powder or
  - Zinc or copper flakes or
  - Commercial absorbent pads or vapor suppressants, and
  - Brush to remove powder or flakes
- Alcohol, vinegar, or peroxide-soaked swabs

In the event of a spill, the following procedure should be followed:

1. Keep the site secured until the site manager has deemed the area safe for investigation.
2. Investigate the site to ensure that all those who were near the spill are safe and receive any needed medical treatment.
3. Remove watch and jewelry from hands. (Mercury combines with metals).
4. Put on PPE – apron or coveralls, shoe covers, rubber or nitrile gloves, eye protection and respiratory protection.
5. Turn on fume hoods and fans.
6. Approach cautiously from upwind, secure the scene and identify the extent and distribution of the spill.
7. Assess the need to evacuate; the availability of human resources and equipment, and possible immediate actions.
8. If the site is deemed safe and if the clean-up is within the capabilities of the on-site team, then proceed to clean up the spill. If not, follow the emergency management plan.
9. Bring the spill kit to the edge of the affected area.
10. Place the wide mouth jar on the plastic tray.
11. Begin at the outer edge of the spill and clean inward towards the center of the spill.
12. Use the tweezers to pick up broken glass or contaminated loose material and place in Ziploc bags.
13. Remove visible balls and pools of mercury using spatulas to slide mercury balls into the dustpan and then into the jar.
14. Use the eye-dropper or syringe to capture small mercury beads.
15. Shine the flashlight at a low angle to see reflections of tiny mercury droplets.
16. Use sticky tape to pick up tiny droplets and place the tape with the mercury in a sealable plastic bag.
17. Sprinkle sulfur powder, zinc or copper flakes on cracks, floor crevices and hard surfaces that have come in contact with mercury.
18. Use a brush to collect the powder or flakes and put them in a sealable plastic bag.
19. Wipe areas with vinegar-soaked or peroxide-soaked swabs.
20. Remove contaminated soft material – use a knife to cut out loose material and place in Ziploc bags.
21. Clean out contaminated drains – carefully transfer any mercury in the J or S or P trap and transfer to an air-tight container; replace the trap.
22. Place all contaminated material in leak-proof, sealable plastic bags and dispose as mercury waste.
23. Label and seal all contaminated material.
24. Wash hands and all exposed skin with soap and water.
25. Ventilate the spill area.
26. Place heaters and fans to volatilize residual mercury and to blow contaminated air to the outside for at least 48 hours.
27. For facilities with central ventilation, increase air exchange rates for several days.

The following measures should also be taken:

- Place spill kits in readily accessible locations. Spill kit, PPE and wash area should be near (but not in) the storage area.
- Train staff on the use of the spill kits.
- Replace spill kit contents that have been used after every spill.
- Spill kits should be accompanied by a signed sheet indicating when materials were used and replenished.

### 2.4 SPILL RESPONSE PROTOCOL

What NOT to do during a mercury spill:

- Do NOT use a vacuum cleaner – it will spread more mercury vapours and will contaminate the vacuum cleaner.
- Do NOT wash contaminated clothing or fabrics in a washing machine – it will contaminate the machine and wastewater.
A very useful video on spill preparedness and response may be seen at https://www.youtube.com/watch?v=RySSbkKv96o.

The storage space should be inspected every month to check for leaks, corroded or broken containers, improper methods of storage, ventilation, the condition of the PPE and wash area, spill kit contents, and to ensure that records are updated. Inventory records should be kept of the types of mercury waste, descriptions, quantities in storage, and initial dates of storage. Smoking or eating should not be permitted in the storage facility. (Reference 9).

2.5 FIELD COLLECTION PROTOCOL

As described in the section on “temporary storage containers,” it is best simply to repackage inadequate or substandard containers in the field in double sealable plastic bags inside a sealable plastic or metal container filled with sorbent material. This should prevent spills during transport from the field to the storage facility, and would also be appropriate for interim storage of the received material if there is any concern about safely transferring liquid mercury to more secure containers. This protocol outlines a process for safely collecting mercury in the field and bringing it safely to a storage facility.

1. Upon arrival at a mercury collection site in the field, a mercury receiving area should be prepared in a well ventilated, covered area where a thick plastic liner with seams taped closed is placed on the ground. Sandbags under the outer edge of the plastic will create low walls over which mercury droplets cannot drain. The receiving area shall have caution tape and signage instructing that only authorized personnel are permitted. Ideally personnel entering the receiving area should have full PPE (masks, tyvek suits, boots, safety glasses, etc.), however, if these materials are not available, careful and informed behaviour to minimize exposures may suffice. All personnel entering the receiving area should have full PPE (masks, tyvek suits, boots, safety glasses, etc.).
2. The receiving area will have a sturdy plastic covered table in the middle of it, with a plastic wash basin (with round corners and smooth bottom with no scratches or grooves) in which seized mercury containers are placed. Adjacent to this, clean and empty wide-mouthed containers shall be placed, as well as Ziploc bags.
3. Collection must be done in teams of at least two people so that one can serve as monitor for spills and errors that might warrant cleanup and documentation.
4. Place absorbent pads on the bottom and along the sides of the wide-mouth containers as padding and added spill prevention.
5. Label all reception containers with a unique identifying number and empty weight.
6. Fill out the registration manifest forms; the weights of mercury and container identification are to be logged as well as the names and signatures of all parties involved in the registration.
7. The mercury should be photographed in the wash basin in the containers in which it was found or confiscated. The photograph should be uploaded to the database or emailed, along with a photo of the manifest, to the next recipient of the mercury.
8. The mercury must be weighed on a dedicated scale placed inside the plastic wash basin.
9. Mercury should be kept in the vessels in which it is found, whether it is a Ziploc bag or a plastic bottle or otherwise. Place the vessel inside two Ziploc bags; one inside the other, and then place this into the absorbent pad lined container. Many items can be put into the same container, but don’t fill the container more than 80%.
10. Separate items in the container with absorbent pads and pour sorbent granules around them to fill voids. This will keep them from moving around during transport and will contain any possible spills.
11. Close the containers tightly and seal them with a tamper-proof security tag.
12. Workers involved in the transfer must sign the registration manifest to guarantee the accuracy of its contents. The manifest must state the weight of mercury in each bottle along with the identifying code on each bottle, along with the number and kind of contaminated containers that the mercury was seized in (and which are also being shipped with the mercury.) The registration manifest must also have the location, date and time of the transfer, as well as the date and identifying code of the collection or seizure operation. The manifest must be made in duplicate so that one copy remains with the arm force personnel (PNP, DICAPI) or FEMA (seizing organization) and the other (Chain of custody) will remain with the mercury until its final disposal.

Place the containers in a crate that is securely fastened to the transport vehicle. Make sure to pad the sides and bottom of the crate with absorbent pads and fill voids between the containers to stop them from moving during transport.

2.6 RECEIVING AND VESSEL TRANSFER PROTOCOL

The following protocol was designed to guide personnel in situations in which mercury contained in substandard containers or vessels is being delivered to the storage facility. As described in the section on “temporary storage containers,” it is best simply to repackage substandard containers in the field in double sealable plastic bags inside a sealable plastic or metal container filled with sorbent granules. This would prevent spills during transport from the field to the storage facility, and would also be appropriate for interim storage of the received material. This would, however, increase the stored volume problematically in cases where storage space is limited, so it may be advantageous to transfer the mercury into a more secure vessel that has a longer usable life and greater resilience. This protocol outlines a process for safely transferring mercury from one vessel to another at an interim storage facility.

In anticipation of gathering a significant quantity of mercury during a seizure operation, for example, a dedicated mercury transfer site will be prepared in a well ventilated, covered area. If the area has not already been prepared with epoxy flooring and ground barriers, one must be prepared by enclosing a
small space with sandbags and covered with a thick plastic liner with seams taped closed. Sandbags under the outer edge of the plastic will create low walls over which mercury droplets cannot escape. The mercury transfer site shall have caution tape and signage instructing that only authorized personnel are permitted. All personnel entering the site should have full PPE (masks, tyvek suits, boots, safety glasses, etc.).

1. The mercury transfer site will have a sturdy plastic covered table in the middle of it, with a plastic wash basin (with round corners and smooth bottom with no scratches or grooves) in which seized mercury containers are placed. Adjacent to this, clean and empty mercury flasks (seamless steel bottles as per international standards) shall be placed, ready for filling.

2. The mercury transfer site will have registration manifest forms at the ready, in which all weights of mercury and containers are to be logged as well as the names and signatures of all parties involved in the registration.

3. A dedicated stainless steel funnel, to be always stored in the wash basin, shall be used to transfer the mercury from the vessel in which it arrives and into the mercury flasks. These flasks should be labeled with a unique identifying number and empty weight.

4. The mercury should be photographed in the wash basin in the containers in which it was found or confiscated. The photograph should be uploaded to the database or emailed, along with a photo of the manifest, to the next recipient of the mercury.

5. The mercury must be weighed on a dedicated scale placed inside the plastic wash basin, and subsequently the empty vessel must be weighed afterwards.

6. Careful transfer of the liquid mercury must be done in teams of at least two persons so that one can serve as monitor for spills and errors that might warrant cleanup and documentation.

7. Plastic bags, bottles, and other containers in which the mercury was found must be placed in a sealed garbage bag, labeled as toxic waste and shipped with the mercury itself.

8. Once the mercury has been transferred to secure flasks, they must be sealed with a tamper-proof security tag such as is used to secure flasks in the formal mining industry.

9. The mercury flasks must then be crated for transport and the crate marked with the number and identifying codes of all contents. The manifests must be sealed in the crate with the mercury and tamper-proof tags that must be intact at the time of delivery.

### 2.5.1. Traceability and mass balance

A mass balance of the mercury wastes held, transferred, transported, and received must be performed and recorded at each change of custody (taking into account any emissions or losses, with justifications when significant). This involves weighing each vessel and ensuring that it matches the weight when shipped. Weighing should take place in the handling area of the storage facility, on the workbench under the fume hood. Tamper-proof seals should be inspected to ensure that the vessel was not opened and the contents disturbed. The tracking records are kept by each of the involved actors to allow the local and/or national authorities to inspect the chain of custody from the initial holder to the final destination.

Standard transport manifests list all the important information required for tracking shipments. When mercury is packaged for storage at the same site, the contents of the package should be recorded and copies kept with the package itself as well as in the administrative files of the facility. If there is no standard recordkeeping method specified, the following shows the minimum records that should be kept.

<table>
<thead>
<tr>
<th>Date</th>
<th>Collection location</th>
<th>Name of collector and organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 December 2020</td>
<td>Puerto Maldonado</td>
<td>Alvaro Sanchez</td>
</tr>
</tbody>
</table>

**Comments:**

<table>
<thead>
<tr>
<th>Security tag number</th>
<th>Weight</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>90304456</td>
<td>24 kg</td>
<td>Three small bottles of mercury</td>
</tr>
<tr>
<td>90304457</td>
<td>15 kg</td>
<td>Bags of mercury, mercury contaminated objects</td>
</tr>
</tbody>
</table>

Mercury is often transported in small packages due to its density, and standard paper manifest forms have a limited number of rows in which to list each package. Therefore, multiple manifest forms may have to be used, in which case the total number of manifest forms in the shipment must be listed on each form.

### Transportation

Only authorized vehicles should be used to transport hazardous materials and wastes (includes elemental mercury and mercury wastes), based on Peru’s Law No. 28256 and its regulation DS 021-2008-MTC. Such movements are therefore registered in the National Registry of Hazardous Materials and/or Waste Transportation. Different types of authorized vehicles can be used, depending on how the materials are packed and the amount to be transported. Properly packaged mercury must be transported in a closed van equipped with a GPS tracking system to record the location of the vehicle. Mercury transport must also meet regulatory requirements such as having a Contingency Plan approved by the Ministry of Transport and Communications, and a Special Operating Permit to Provide Land Transport Service of Hazardous Materials and/or Wastes by Road, granted by the General Directorate of Land Transport (DGTT).

### 3.1 UN REGULATIONS REGARDING TRANSPORT OF MERCURY

UN regulations (UN # 2809 Class 8, Subsidiary risk 6.1, Packing group III) impose the following restrictions on the transport of mercury:

- **Bags of mercury:**
  - Fingered 15 kg
  - Fingered 24 kg
  - Three small bottles of mercury
  - Bags of mercury, mercury contaminated objects

- **Security tag:**
  - Number and identifying codes
  - Date
  - Collection location
  - Name of collector and organization

- **Manifests:**
  - Number and empty weight.
  - Form number
  - Total number of manifest forms in the shipment must be listed.

- **Vehicles:**
  - Properly packaged mercury must be transported in a closed van equipped with a GPS tracking system to record the location of the vehicle.

- **Regulatory requirements:**
  - Contingency Plan approved by the Ministry of Transport and Communications.
  - Special Operating Permit to Provide Land Transport Service of Hazardous Materials and/or Wastes by Road, granted by the General Directorate of Land Transport (DGTT).
Maximum capacity for inner containers is 15 kg, and the maximum cumulative mass of the complete packaging is between 60 and 400 kg depending on the material. Liquid goods of Class 8, packing group III in glass, porcelain or stoneware inner packaging shall be enclosed in a compatible and rigid intermediate packaging.

Limited (<5 kg) quantities of mercury can be transported with a lower standard of packaging safety. This guide recommends all mercury should be packaged and protected in the same manner as for quantities >5kg. Special Provision #365 applies in the case of manufactured instruments and articles containing mercury; see UN 3506.

3.2 PLANNING

Elemental mercury and mercury wastes should be transported in a safe and environmentally sound manner in order to avoid accidental spills; they should also be tracked during transport until they have reached their final destination. Prior to transport, contingency plans should be prepared to minimize environmental impacts associated with vehicle accidents, spills, fires and other potential emergencies. Mercury wastes should be identified, packaged and transported in accordance with the relevant national regulations on the transport of dangerous goods, which are generally based on the model regulations in the United Nations recommendations on the transport of dangerous goods (United Nations, 2017).

According to the regulatory framework in force in Peru, mercury is on the list of hazardous materials and is a controlled product; therefore any company that transports it must be registered in the Register of Control of Fiscalized Assets (RCBF) that is administered by the National Superintendency of Customs and Tax Administration (SUNAT). The sender must provide the transport company with a Reference Guide prepared in accordance with the standards issued by the SUNAT, as well as the Material Safety Data Sheet-MSDS in Spanish. The DS 021-2008-MTC mandates that vehicles transporting mercury must display the risk labels and safety panels identifying the hazardous material and / or waste, and the must be visible on 4 sides.

The contingency plan approved by MTC details all the procedures required to transport hazardous materials such as mercury, to minimize the environmental impacts associated with vehicle accidents, spills, fires and other possible emergencies. An insurance policy is mandatory and must cover potential personal, material and environmental damages in the event of accidents during transport of mercury. Mercury waste must be identified, packaged in accordance with DS 021-2008-MTC, which is based on the United Nations recommendations on the transport of dangerous goods (Orange Book). They must also carry and follow a designated route during transport, and have good communications equipment and GPS tracking from source to destination.

3.3 LICENSING OF TRANSPORT COMPANIES BY SUNAT AND MTC

Transport companies shipping mercury must be registered in RCBF in SUNAT and be registered with the MTC in the National Registry of Land Transportation of Hazardous Materials and / or Waste as well as a Directorial Authorization Resolution and Special Operating Permit to provide Land Transportation Service for each vehicle for a period of 5 years. Before starting operations, the transport company must have the Contingency Plan approved by the General Directorate of Socio-Environmental Affairs-DGASA of the MTC.

3.4 VEHICLE SPECIFICATIONS

Any vehicle destined to be used for the transport of mercury must display UN 2809 and risk warning placards, and it must meet all requirements indicated in the National Vehicle Regulations and its amendments. Vehicles used for transport of mercury must also be equipped with basic elements for emergency response, such as a fire extinguisher, protective clothing, flashlight, first-aid kit, spill kit, collection and cleaning equipment, absorbent material, among other things, in addition to the special provisions under Peruvian law regarding transport of hazardous substances. One fire extinguisher must be located in the cab, and a second fire extinguisher should be placed near the mercury cargo.

Specific requirements for the transport vehicle include:

- Proper registration.
- Passed inspection or equivalent periodic control.
- Closed design, correct size for the intended load.
- Bulkhead between driver cabin and body.
- System to keep load secure during transport.
- Spill kit, first-aid kit, fire extinguishers.
- Appropriate hazardous materials transport signage.
- Route plan, contingency plan, emergency phone, etc.
- Vehicles must have devices that allow permanent control and monitoring of the vehicle en route, and effective communication with the carrier base.
- Tamper-proof seals should be used to ensure that the transport vehicle was not opened and the contents changed or disturbed.

3.5 TRANSPORTATION PLAN

Before starting the journey, the driver must have a transportation plan that includes the following:

- Time of departure from origin.
- Expected Arrival time at the destination.
- Route plan authorized by the regulators.
- Material safety information for mercury, in Spanish.
List of emergency phone numbers of the recipient and regional committees and/or local emergency care, located on the route to follow during transport.

List of checkpoints along mandated routes, where SUNAT and other agencies check documentation.

The driver must comply with the schedules established for the transport of dangerous cargo, and speeds will also be controlled in high-risk places. The vehicle and load must be inspected at mandatory stops indicated on the route plan, as well as the driver’s fitness (esp. to ensure lack of fatigue). The progress of the transport units on route must be reported periodically with supporting images, in addition to any incidents or events occurring en route. In case of emergencies, the situation must be evaluated and actions taken according to the contingency plan. The MTC will indicate the routes by which the transportation of hazardous materials and waste shall be carried out. The provincial municipalities will establish alternate roads in urban areas, as well as places for parking on the municipal road network.

### 3.6 TRANSPORT EMERGENCY MANAGEMENT

According to government regulations the transport company needs to develop an emergency management plan, which includes predictive, preventive and reactive elements to deal with any foreseeable incident in the transport chain. The emergency management plan is intended to mitigate the consequences of any incident for the population and the environment. It is made up of a set of specific pre-established operational procedures intended to coordinate, alert, mobilize and respond to all possible emergency situations that may occur during loading, unloading, and transportation. The Contingency Plan includes a matrix for the identification of hazards and potential risks en route and for the evaluation and control of risks. If an accident occurs during transport, the carrier and, where appropriate, the sender of the hazardous materials and/or waste are responsible to carry out the following actions.

a. Execute the provisions of the contingency plan.

b. Report the incident to the DGAAM of the MTC who will coordinate the response with the relevant authorities, and present a written report of the emergency and of the measures adopted to reduce the damage within 2 days of the occurrence of the emergency.

c. Within 7 business days of the accident, send the DGASA of the MTC a report on the measures adopted to remedy the damage caused, using the pre-established form. Depending on the severity of the incident, the incident should be classified as either an incident, emergency, or crisis.

The latest version of the GRE Emergency Response Guide (2020) will be used by firefighters, police and other emergency services who are usually the first to arrive at the scene of a hazardous materials transportation incident.

### 3.7 LABELING

The corresponding label for mercury is corrosive Class 8 and Class 6.1 Toxic. The panels must be made with reflective material, black and white, with a size of 25 cm by 25 cm minimum and pictograms appropriate to:

- Class 8: Two test tubes dripping onto a metal plate and a hand, including the word CORROSIVE and the number 8 corresponding to the hazard class.
- Class 6: Skull and crossbones, the word TOXIC and number 6 in the bottom corner. This label must be installed on all visible sides of the transport vehicle.

**Image 20:** Panels to be displayed on a Class 8 (6.1) vehicle

The second label required is the sign of the UN, i.e., number 2809 corresponding to mercury in reflective paint, with orange background, black numbers and black borders. This label must be installed on the front and back of the vehicle.

**Image 21:** Vehicle class identification label

### 3.8 TRACKING

#### 3.8.1. Check-list

Before setting out, all vehicles must be inspected by the safety or emergency teams to ensure that PPE, personnel and vehicles are in adequate working condition and have sufficient equipment and resources to address possible emergencies. A checklist must be provided and the inspection team must document the inspection results according to the checklist. There must be an inspection and maintenance schedule for emergency equipment. Generally, the PPE equipment must be inspected every 30 days to ensure that there is sufficient equipment available.

#### 3.8.2. Records

Keeping accurate records of the quantity of mercury at the storage facility is very important. Prior to transport to the mercury storage facility, containers should have been weighed at the sender’s facility. Transport of mercury requires the documentation described below, which should be recorded at both departure and arrival to enable verification and periodic reporting. A manifest form or consignment note must accompany the movement of mercury waste. The manifest or consignment note should identify the source of the waste, the
transporter and the storage facility. The generator, transporter, and storage facility should each have copies of the manifest or consignment note. Each copy should show the signatures of the persons handling the waste from the generator to the storage facility, as well as the names of the responsible persons representing the generator, transporter, and storage facility. Copies of the manifest or consignment note should be kept by the generator, transporter, and storage facility. The chain of custody should show the signatures of the individuals who handled the hazardous materials and/or waste from the shipper to the storage facility, as well as the names of the responsible individuals representing the shipper, transporter, and storage facility. Copies of the manifest or shipping note, among other documents, should be kept by the generator, carrier, and storage facility, including:

- Vehicle: vehicle registration, vehicle type and body. Report whether own vehicle or belonging to a third party.
- Load: type of merchandise, name of merchandise, UN number, quantity, weight, name of the submitting party, municipality of origin and destination municipality of cargo.
- The shipping papers should include an emergency response telephone number and a certification that the shipment is in compliance with all regulations.


A mass balance of the mercury wastes held, transported, and received must be performed and recorded at each change of custody, carefully justifying any changes or variations. This involves weighing each vessel and ensuring that it matches the weight when shipped. Tamper-proof seals should be inspected to ensure that the vessel was not opened and the contents disturbed. Tracking records are kept by each of the involved parties to allow the local and/or national authorities to inspect the traceability chain from the initial holder to the final destination.

Upon arrival, the transport vehicle should be visually inspected for any obvious leaks, spills, droplets or other signs of elemental mercury, and all suspected mercury leaks should be documented and reported to management.

### 3.9 TRANSPORTATION PROTOCOL

1. Verify that the mercury and mercury wastes to be transported meet the requirements for acceptance at the designated mercury storage facility.
2. Verify the quantity (mass) of elemental mercury and wastes to be transported.
3. Verify the type and number of packages to be shipped.
4. Ensure all national transportation authority requirements for the type of packaging selected are met. This includes, but is not limited to, mass requirements, filling level requirements, and closure requirements.
5. Mark and label the loaded package(s) as follows:
   - RQ (reportable quantity).
   - UN2809.
   - Shipper and receiver names and addresses.
   - The “Corrosive” label should be applied near these markings, if package dimensions are adequate.
   - For hazardous waste the following label must be applied, and should be visible after the waste is palletized:
     - HAZARDOUS WASTE National Law Prohibits Improper Disposal. If found, contact the nearest police or public safety authority.
6. Place marked/labeled containers in appropriate pallets.
7. Verify that the information on the manifest and all other administrative forms are complete and copies kept by all parties.
8. Notify the mercury storage facility of impending shipment per the facility’s schedule. To minimize corporate liability for the shipment, ensure the carrier is aware of the hazardous waste nature of the material to be shipped, is qualified for such transport operations, and has the appropriate signage for the vehicle.
9. Ship mercury to the designated mercury storage facility. The point of arrival is specified in the sender and carrier’s manifest, and under no circumstances may the route or the final destination vary, EXCEPT with prior communication and approval from the SUNAT.

### References

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   https://www.mvotma.gub.uy/component/k2/item/10009842-guia-para-el-almacenamiento-de-residuos-con-mercurio
3. Guidance for Short-Term Storage of Elemental Mercury by Ore Processors
4. Minamata Guidelines on the environmentally sound interim storage of mercury other than waste mercury
5. UNEP Practical sourcebook on mercury waste storage and disposal
6. UNEP Training Video on Cleanup and Temporary Storage of Mercury Waste for Health Care Facilities
   https://www.mvotma.gub.uy/component/k2/item/10009842-guia-para-el-almacenamiento-de-residuos-con-mercurio
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Guidelines for interim storage, handling and transportation of mercury

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