

MERCURY MANAGEMENT GUIDELINE FOR HEALTH CARE FACILITIES

HEALTH PROTECTION AGENCY

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FOREWORD

Mercury is a heavy metal which occurs naturally in the environment and exists in various forms. Exposure to mercury is a threat to human health and has various toxic effects on the nervous, digestive and immune systems, lungs, kidneys and eyes.

Health care facilities are marked as one of the main source where mercury can be released to environment, through spills or broken mercury-containing equipment. Exposure to elemental mercury in health care settings is a significant health hazard for employees, patients, visitors, waste handlers and those tasked with repairing and cleaning up such broken equipment. I urge the best use of this guideline by all health care providers and all staffs at health facilities. Mercury Management guideline for health care facilities is intended to assist healthcare providers in proper handling, storage and management of mercury spills. Hence I urge health care providers to play an important role creating a safer environment in the health care facilities and protecting the environment from mercury waste.



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ACRONYMS

EPA	Environment Protection Agency
HCF	Health Care Facilities
Hg	Mercury
HPA	Health Protection Agency
NGO	Non-governmental Organization
WAMCO	Waste Management Corporation
WHO	World Health Organization

Chapter 1

1.1. Introduction

Mercury exists naturally and as a man-made contaminant. The release of processed mercury leads to progressive increase in the amount of atmospheric mercury, entering the soil and water distribution cycles where it remains in circulation for years¹. Exposure to Mercury or mercury compounds results in various toxic effects such neurological and reproductive disorders depending on its toxic form and route of exposure. Mercury exposure is mainly through release of mercury into the environment through spills or incineration and by consumption of contaminated fish, seafood and wildlife. To reduce the potential exposure to mercury proper management of used mercury containing items and elemental mercury out of the trash, and preventing them from going down the drain is essential.

Exposure to mercury is preventable through best management of mercury containing products in the Health care facilities. This best management practices contains a set of recommended guideline designed to reduce the amount of mercury discharged to the environment. Proper implementation of these procedures is intended to protect human health and our natural environment from the discharge of hazardous mercury-containing compounds.

HCF's has a responsibility not only to their patients, but to their communities, and can play an active role in preventing illness. One way is reducing the use of hazardous materials in the facility. When mercury is spilled, it comes into contact with air and evaporates into an invisible, odorless toxic vapor. Acute and chronic exposures to mercury can negatively impact cognition, personality, sensory, and motor functions.

Situational analysis of mercury management in Health Care Facilities of Maldives was done during October 2017. The analysis revealed a total of 155 sphygmomanometers and 175 thermometers were found in the HCFs and approximately 10,945.6gms of mercury was found in these two items. Among all the mercury containing items 83% items were thermometer & sphygmomanometers. The analysis also showed 99% of thermometers were found in the Atolls.

The Minamata Convention on Mercury adopted in (2013) and entered into force on 16 August 2017 has provisions dedicated to health aspects (Article 16), which specifically calls for the implementation of programs to protect populations at risk from exposure to mercury and mercury compounds, including adoption of national guidelines. The Convention also has time-bound targets for phasing out mercury added products (by 2020) specified in the convention including sphygmomanometers and thermometers². Thus to ensure rationale management of mercury waste in Health care facilities, Health Protection Agency (HPA) initiated to develop the mercury management guideline for the HCF's of Maldives.

The primary purpose of the guideline is to provide guidance to health professionals in proper handling of mercury containing items, managing spills, transportation and final disposal of mercury wastes in a manner that does not endanger the lives of Health care providers, supporting staff and community. In addition, guidance is given on practices that offer environmentally preferable practices for HCF and may help waste minimization.

1.2. Objectives of the guideline

1. To set a recommended standard for proper handling of mercury, on site cleanup, storage, transport and disposal methods to be followed by all the HCF's.
2. To replace with alternatives of mercury containing Health care products.
3. To maintain mercury containing equipments and product inventory in all HCF's

Chapter 2

2.1 Types of Mercury

Mercury is categorized into elemental, inorganic and organic mercury. The table 1 below illustrates the different mercury compounds for both categories.

Table 2.1. Types of Mercury

Elemental		Inorganic Mercury		Organic Mercury	
Elemental Mercury	Hg ⁰	Mercury sulphide	HgS	Ethyl Mercury	C ₂ H ₅ Hg ⁺
		Mercury sulfate	HgSO ₄	Methyl Mercury	(CH ₃ Hg) ⁺
		Mercury oxide	HgO	Oxide Diethyl Mercury	(C ₂ H ₅) ₂ Hg
		Mercury selenide	HgSe	Dimethyl Mercury	(CH ₃) ₂ Hg
		Mercury Iodide	HgI ₂	Dibutyl Mercury	(n-C ₄ H ₉) ₂ Hg
		Mercury chloride	HgCl ₂	Dipropyl Mercury	(n-C ₃ H ₇) ₂ Hg
		Ionic Mercury	Hg ⁺² , Hg ⁺¹	Di-isopropyl Mercury	(iso-C ₃ H ₇) ₂ Hg

2.2 Sources of Mercury

Mercury has been widely used in medical devices (sphygmomanometers, thermometers), switches and relays, batteries and dental filling. Mercury is considered a global hazardous pollutant. Mercury emissions and releases can be anthropogenic and may also come from natural sources such as volcanoes, rocks (granite) and soil and sediments. Once mercury is released to the environment, it persists in the atmosphere in the form of mercury vapour, or in the form of ionic mercury in the soil and in the aquatic environment as methyl mercury. Mercury in the environment has the potential to end up in the food chain due to bioaccumulation and bio magnification and is eventually consumed by humans.

Mercury containing equipment's and products used in HCF are listed in Annex 1

2.3 Pathways of mercury release to the environment

The use of these mercury-containing items in HCF creates many pathways by which mercury may be released into the environment. The following are likely primary pathways of mercury release to the environment:

- a) Release of mercury into the environment by medical waste incinerators due to burning of medical waste mixed with the waste containing mercury and other chemicals used in HCFs;
- b) Land filling of mercury-containing medical waste without any pre-treatment;
- c) Release of mercury into the wastewater stream
- d) Spillage of mercury in HCFs.

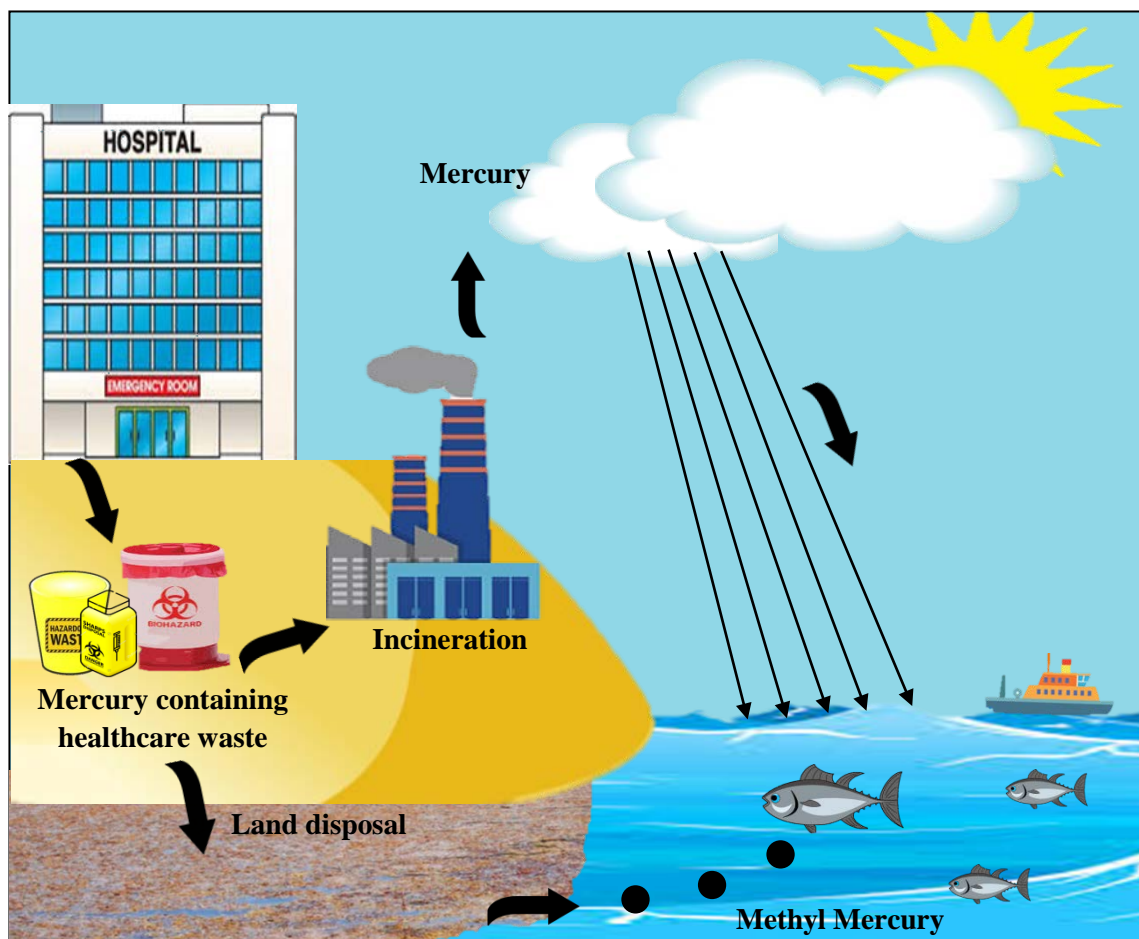


Figure 2.3 Pathways of mercury release to the environment

2.4. Alternatives to mercury based products in HCFs

Hospitals can solve their mercury waste and acute mercury exposure problems by replacing mercury based products with the appropriate alternatives. Considering the toxic nature of the mercury, all the HCFs are required to gradually phase out mercury containing products (thermometer, BP instruments etc.) and replace them with good quality non-mercury based products. Once mercury products are been replaced to mercury free alternatives mercury containing products or mercury wastes should be transported to an atoll/regional hospital and to a designated area allocated by MoE.

Some of the suggested non-mercury alternatives that can be used at HCFs are listed in Annex 2

Chapter 3

3.1. Mercury Inventory

HCF's should complete mercury products inventory including the equipment's and products directly used, as well as those that need repairs or are stored.

Maintaining an inventory will identify all the equipment's and products that contain mercury, the quantity and their location in HCF. All HCF's shall maintain mercury inventory as per the mercury tool attached in Annex 3.

3.2. Mercury Spill Management

All HCF should manage spills in any area where mercury-containing devices are used. Each HCF should follow the standard procedures to clean up spills according to what is practical and available while maximizing protection for patients and HCF staffs.

The institution with proper procedures and staff training, along with the availability of mercury spill kits can prepare a facility for mercury spill management.

3.3. Spill kit:

If mercury spill kits are commercially unavailable, a spill kit can be made by putting together a number of inexpensive items such as:

1. 4 or 5 hermetic Ziploc bags
2. Trash bags (at least 2 mm thick)
3. Rubber, nitrile or latex gloves
4. Face mask
5. Paper towels
6. Cardboard
7. Dropper or syringe (without needle)
8. Sticky tape (around 30 cm)
9. Flashlight
10. Sulfur or zinc powder

3.4. Mercury spill clean-up procedure

Mercury spill should be managed by a trained Nurse

3.4.1. Personnel Protective equipment:

- Wear Personal Protective Equipment (facemask, overall or a disposable apron, gloves)

Note: Remove metal items like jewelry and watches as it can be permanently damaged by mercury.

3.4.2. Evacuate area:

- Ask everyone to immediately leave the contaminated area and close the door of the affected area.
- Shut down the inside ventilation system to prevent dispersal of mercury vapors.
- Switch off heaters or blowers in use.
- Put up Warning signs.

3.4.3. Removal of broken glass or sharp objects:

- If there are any broken pieces of glass or sharp objects, carefully pick them up by using cardboard.
- Place all broken objects in a zip locking bag.
- Secure the bag and label it.

3.4.4. Locate mercury beads:

- Locate all visible mercury beads. Use cardboard to gather mercury beads into small mercury balls. Make slow sweeping movements to keep mercury controllable.
- With the room darkened, take a flashlight and shine it at a low angle as close as possible to the floor and look for the reflection of the any beads of mercury that may remain stuck to the surface or in small depressions.

Note: Mercury can move a surprisingly long distance on hard, flat surfaces, so be sure to inspect the entire room when doing this job.

- Use the dropper or syringe (without needle) to collect or draw up the mercury beads.

- Slowly and carefully squeeze the mercury onto a damp paper towel or use two pieces of cardboard to roll the mercury beads onto the paper towel and carefully place it into the zip locking bag, secure and label the bag.
- After cleaning up the larger beads, use sticky tape to pick up the smaller, hard-to-see beads.
- Place the sticky tape in an airtight zip locking bag, secure and label the bag.

3.4.5. Cleaning of the floor and room surfaces contaminated with mercury:

- Sprinkle sulfur or zinc powder over the area. Either of the powder will quickly bind any remaining mercury.
- Use cardboard to pick up the powder and place it in a plastic bag.
- Use a damp paper towel to pick up the remaining powder and place the towel in a plastic bag and
- Seal all the bags that were used and store in a designated area.
- After the mercury spill cleanup, remember to keep the spill area well ventilated (open windows and keep fans on) for 24 to 48 hours.

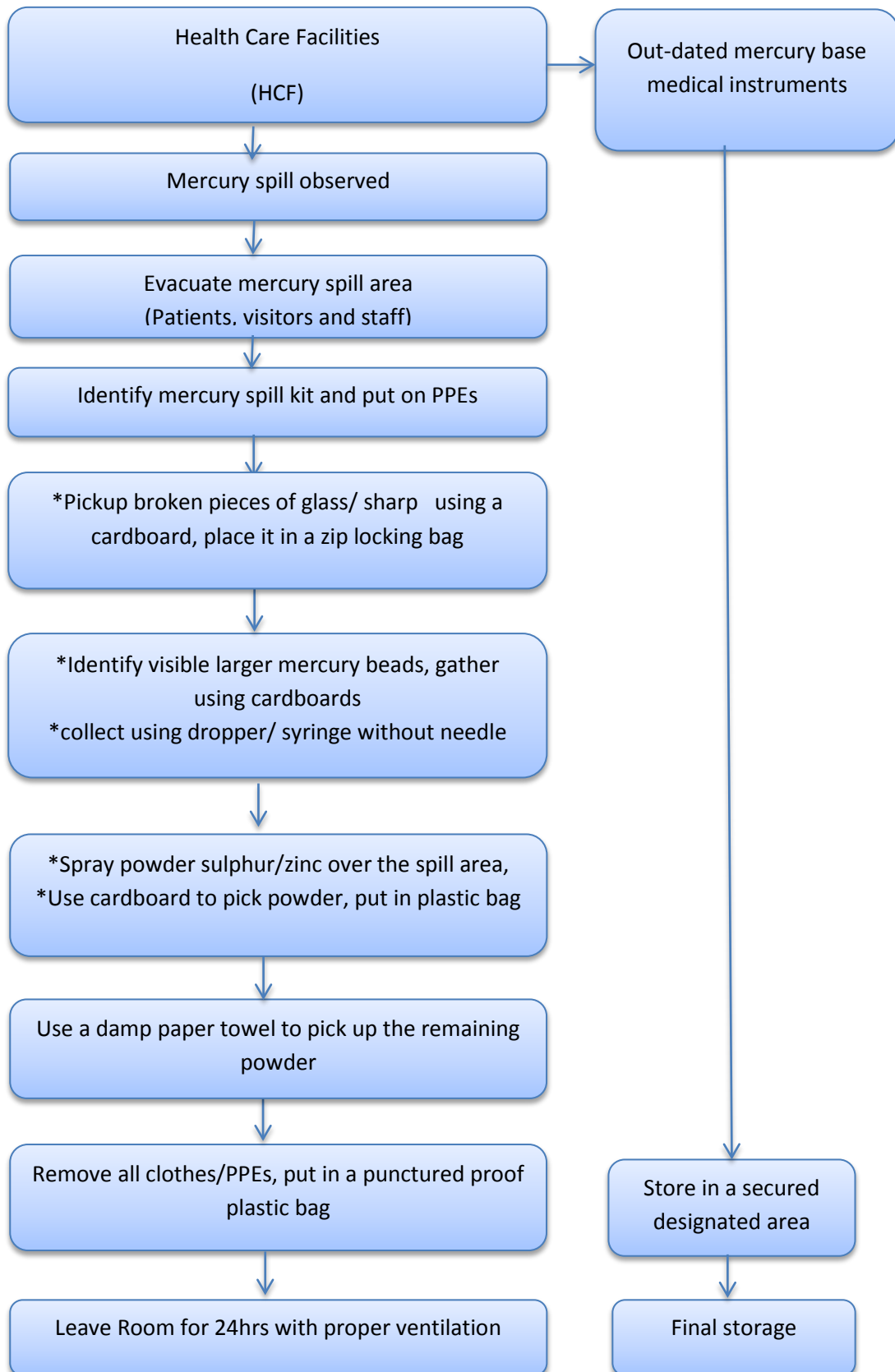
3.4.6. Collection and storage of all mercury contaminated items:

- Put all items that were used in the clean-up procedure (cardboard, eyedropper/syringe including the gloves, etc) into a leak proof plastic bag or container with lid and seal properly.

3.4.7. Labeling:

All the bags or containers with mercury contaminated items should be marked according to the Waste Management Regulation R-58/2013 as attached in Annex 4.

Flow chart 3.4 Mercury spill clean-up procedure



3.5. What NEVER to do after a Mercury Spills

- **Never** use a vacuum cleaner to clean up mercury. The vacuum will put mercury vapor into the air and increase exposure.
- **Never** use a broom to clean up mercury. It will break the mercury into smaller beads and spread them around.
- **Never** pour or allow mercury to go down a drain. If discharged it may cause environmental health problems.
- **Never** walk around if your shoes are contaminated with mercury. It may spread mercury around

3.6. Incidence Report:

All HCF should maintain a record of accidental mercury spill

Chapter 4

4.1. Storage of Mercury products and mercury waste

4.1.1. Storage room

- A designated place should be made available in all HCF's to site the storage according to the Waste Management Regulation R-58/2013 (page 35-36) in Annex 4. ONLY personnel's involved in mercury storage should have access to the designated place.
- In addition to the requirements in Waste Management Regulation R-58/2013, below mentioned requirements should be followed:
 1. Based on the volume of mercury products or mercury waste to be stored, HCF manager should decide if an old room will be used or make a partition in a used room or store the minimal quantity in a locked shelf/ safety cabinet etc.
 2. If a locked cupboard / locked shelf / safety cabinet is used, mercury waste should be kept in a spill containment tray to prevent spills from spreading.
 3. The entrance and exit doors of the storage room and the waste containers should be marked with warning signs in accordance with the Waste Management Regulation R-58/2013 as attached in Annex 4
 4. The entrance should be marked with no smoking or eating sign
 5. Personnel protective equipments, a spill kit, and wash areas should be located near (but not in) the storage space for easy access by authorized personnel.

4.1.2. Storage of mercury devices

- Unbroken mercury devices such as thermometers and sphygmomanometers are fragile and should be stored in a manner that reduces the chance of breakage.
- The primary container must be puncture-resistant and air-tight unless they are placed in their original cases or individual boxes used during shipment to prevent breakage during storage or transport.

- The primary container should be marked with the type of mercury device, the quantities inside the container, the initial date of storage, and any additional information if necessary.
- As a safety measure, the primary container should be placed in a secondary container that is leak proof which prevents release of mercury vapor in case the mercury devices break. A label should be placed outside the secondary container with necessary information.

4.1.3. Storage of Mercury waste

- The containers which elemental mercury is stored should have the following characteristics:
 - Easy to open and re-seal
 - Air tight and leak proof
 - Made of a material that does not react with mercury, and is not brittle and corrosion resistant
- The primary container (zip locking bag) should be marked with the type of mercury waste and the date mercury was placed in the container.
- When mercury is stored, storage should include a secondary container that further prevents the release of mercury vapor as a safety measure. If the secondary container is not transparent or the label on the primary container cannot be seen, a label should also be placed outside the secondary container.
- The mercury waste containers should be kept in a spill-control tray to prevent mercury spill.

4.1.4. Storage of Mercury Contaminated Wastes

- Mercury-contaminated wastes that include broken glass or other items with sharp edges or points (e.g. broken thermometers) should be placed in a primary container that is puncture-resistant and air-tight. As a safety measure, the primary container should be placed in a secondary container that further prevents the release of mercury vapor.

- Mercury-contaminated wastes such as contaminated rags, paper towels, or pieces of carpet etc. should be placed in an airtight primary container. As a safety measure, the primary container should be placed in a secondary container that further prevents the release of mercury vapor.
- The primary container should be marked with:
 - Mercury waste type,
 - Estimated amount,
 - Date the material was placed in the container,
 - Additional description if necessary.
- A label should also be placed on the secondary container.

4.1.5. Storage of other products:

a. Dental Amalgam

- When dental amalgam is stored, storage should include:
 - Primary container that is easy to open, re-sealable, leak-proof and air-tight
 - Vapor suppression agent or water in the primary container
 - A label with the type of mercury waste and the date mercury was first placed in the container.
 - A secondary container with labeling that further prevents the release of mercury vapor as a safety measure.

b. Fluorescent lamps

- When unbroken fluorescent lamps are stored, storage should include:
 - A primary container that prevents breakage, preferably the original box in which the lamps were shipped. (If available, a box with a well-sealed vapor resistant liner, such as a plastic-foil liner, is recommended. Otherwise a long box or other box that fits the shape of the lamp can be used.)
 - A secondary container, such as taped plastic sheet, that prevents the release of mercury vapor as a safety measure. The container should be labeled.
 - If the fluorescent lamps are stored in their original shipping cases, a secondary container is NOT required.
- Broken fluorescent lamps should be stored as mercury-containing waste.

4.2. Important measures:

- All personnel involved in collection, storage, transport, and supervision of mercury waste should receive special training on mercury waste management including spill cleanup
- The storage space should be inspected every month to check for leaks, corroded or broken containers and proper ventilation. Special attention should be given to waste that has the potential to generate the highest vapor concentrations (e.g. elemental mercury, sphygmomanometers, etc.)
- The condition of the spill kit and wash areas should be inspected every month
- Inventory records should be kept on the types of mercury waste, descriptions, quantities in storage, and initial dates of storage.

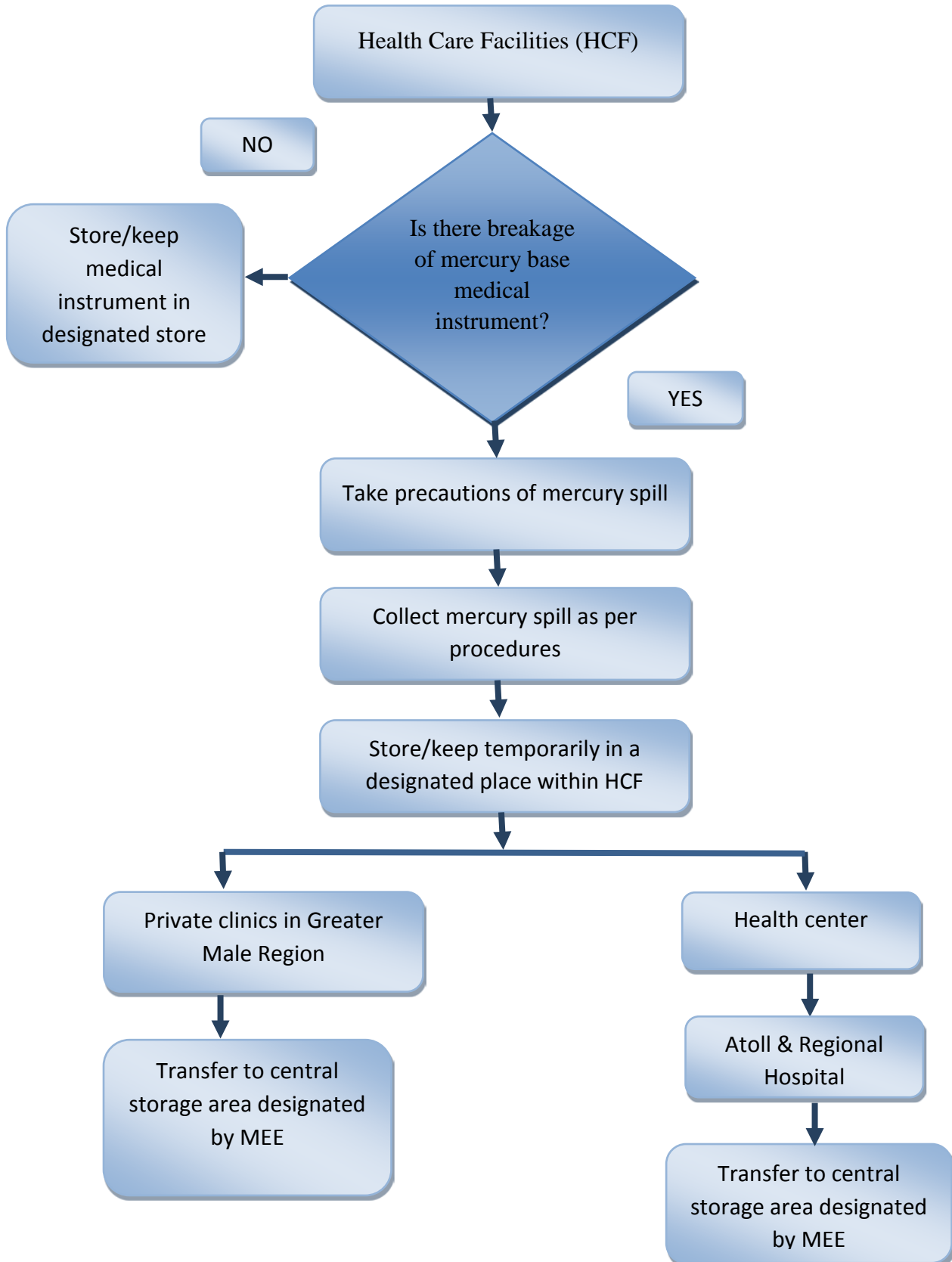
Chapter 5

5.1. Packaging, labelling and off-site transport

- Mercury waste should be transported in a container that is closed, structurally sound, compatible with the contents, and designed to prevent release of mercury. If the original transport case or box in which devices were shipped is still in good condition, it can be used for shipment of **unbroken** devices.
- The mercury waste should be packed carefully with packing material such as plastic bubble wrap or plastic packing foam to prevent breakage inside the container.
- The transport container should be tightly sealed to prevent release of mercury if breakage occurs.
- The outside of the container used for transport should have a clear label “Hazardous Mercury Waste” with all the toxic symbols
- The waste containers should also be labeled with warning signs in accordance with the Waste Management Regulation R-58/2013 as attached in Annex 4
- The label should also include content (chemical composition or description of the waste), warnings, special handling procedures if necessary, emergency contact numbers, and the name and contact information of the generator.
- Mercury waste should be transported to a designated area (refer to flow chart 2) in accordance with the Waste Management Regulation R-58/2013

5.2. Mercury Storage

Flow chart 5.2 Mercury Storage



Chapter 6

6.1. Record keeping, monitoring and evaluation

- Records of mercury containing products and equipments and mercury waste should be maintained in all HCFs.
- Records of mercury related accidents, spills, workers injuries should be maintained and informed to the focal points appointed in HCFs.
- Health centers should report to atoll/regional hospital monthly.
- All the HCF's in Male' Region and all atoll/regional hospital's should report to Health Protection Agency

6.2. First aid if exposed to mercury

6.2.1. Skin Contact

- Immediately remove contaminated clothing, jewelry and shoes.
- Wash affected area with soap or mild detergent and water for 15 to 20 minutes until no evidence of chemical remain
- Wash clothing before reuse and contaminated shoes should be discarded accordingly.

6.2.2. Eye Contact

- Immediately rinse eyeball and inner surface of eyelid with running water for 15 minutes by holding the eye open.

6.2.3. Inhalation

- Move to fresh air immediately
- If breathing is difficult, give oxygen
- Do Not use mouth to mouth resuscitation

6.2.4. Ingestion

- Do not induce vomiting
- If victim is conscious and alert, give 2-4 cups of water. Wash mouth with water.

6.3. Training and Education

Training of Health care personnel's and creating awareness is an essential component when phasing out mercury in the HCFs. Managers of HCFs should take pro-active role in maintaining the safe management of mercury waste in a HCF with an objective to minimize exposure to patients, health workers, waste handlers, and the community. In order to accomplish these objectives, a mercury waste management plan is essential in all HCFs focusing on educating and training of staff and community, periodic training on mercury management and simulation (response to mock spills). As a part of periodic awareness/training programme, following aspects should be emphasized:

- (i) Health impacts
- (ii) Proper maintenance of mercury devices
- (iii) Appropriate labeling
- (iv) Mercury spill management
- (v) Mercury waste collection and storage

ANNEXES

Annex 1: List of mercury containing equipment's and products

The following is a list of mercury containing equipment's and products that usually contain mercury in a Health Care Facilities

Items	
Thermometers	
	Clerget sugar test thermometers.
	Heating and cooling system thermometers.
	Incubator/water bath thermometers.
	Minimum/maximum temperature thermometers.
	Calibration Thermometers.
	Tapered bulb thermometers.
Sphygmomanometers.	
Dental amalgam.	
Pharmaceutical supplies.	
Contact lens solutions and other ophthalmic products containing thimerosal, phenylmercuric nitrate.	
Diuretics with mersalyl and mercury salts.	
Early pregnancy test kits with mercury-containing preservative.	
Merbromin/water solution.	
Nasal spray with thimerosal, phenylmercuric acetate or phenylmercuric nitrate.	
Cleaners and degreasers with mercury-contaminated caustic soda or chlorine.	
Batteries (medical use):	
	Alarms.
	Blood analyzers.
	Defibrillators.
	Hearing aids.
	Meters.
	Monitors.
	Pacemakers.
	Pumps

	Scales.
	Telemetry transmitters.
	Ultrasound.
	Ventilators
Lamps:	
	Fluorescent.
	Germicidal.
	High-intensity discharge (high pressure sodium, mercury vapor, metal halide).
	Ultraviolet.
Thermostats (non-digital)	
Pressure gauges:	
	Barometers.
	Manometers.
Vacuum gauges	
Laboratory chemicals	
	Acetic acid
	Ammonium reagent/Stone analysis kit
	Antibody test kits
	Antigens
	Antiserums
	Buffers
	Calibration kits
	Calibrators
	Chloride
	Diluents
	Enzyme Immunoassay test kits
	Enzyme tracers
	Ethanol
	Extraction enzymes
	Fixatives
	Hematology reagents
	Hormones
	Immunoelectrophoresis reagents
	Immunofixationphoresis reagents
	Immu-sal
	Liquid substrate con
	Negative control kits
	Phenobarbital reagent
	Phenytoin reagent
	Positive control kits
	Potassium hydroxide
	Pregnancy test kits

	Sodium hypochlorite
	Stains
	Standards
	Sulfuric acid
	Thimerosal
	Tracer kits
	Urine analysis reagents
	Wash solutions

Annex 2: Alternative list

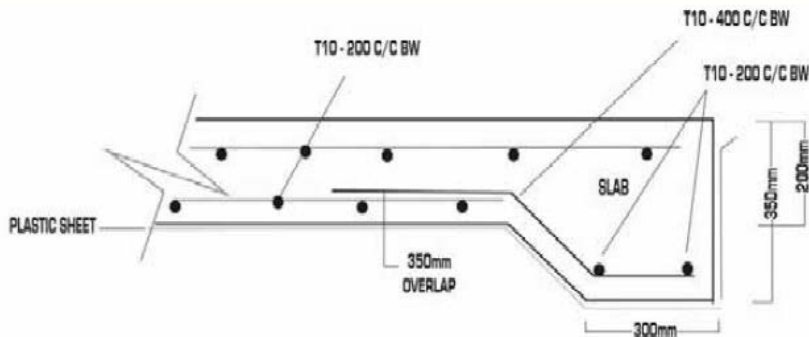
The following is an alternative list to mercury containing equipment's

#	Contains mercury	Alternatives
1	Thermometers	Electronic, digital
2	Blood pressure monitors	Aneroid, Digital/mechanical dial
3	Thermostat	Electronic
4	Fluorescent tubes	Bulbs with low Hg content
5	Batter	Mercury-free/rechargeable batteries
6	Amalgam dental fillings	Composite/resin fillings/Glass ionomer

Annex 4: Minimum criteria of the storage site as mentioned in Waste Management Regulation R-58/2013

1. Minimum criteria for the storage site as mentioned in Waste Management Regulation R-58/2013

1. The site must be a concrete slab, 150mm thick, with a 300mm wide concrete curb on all sides.
2. The site must be a concrete slab, 150mm thick, with a 300mm wide concrete curb on all sides.



2. Minimum criteria for the storage site as mentioned in Waste Management Regulation R-58/2013

3. The site must be a concrete slab, 150mm thick, with a 300mm wide concrete curb on all sides.
4. The site must be a concrete slab, 150mm thick, with a 300mm wide concrete curb on all sides.



3. Minimum criteria for the storage site as mentioned in Waste Management Regulation R-58/2013



نمونه‌های دیگر از علائم ایمنی

5. علائم ایمنی مربوط به خطر انفجار و آتش در محیط کار.
6. علائم ایمنی مربوط به خطر انفجار و آتش در محیط کار.

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