



**Ministry of Environment
Government of Pakistan**



DRAFT

**NATIONAL MERCURY WASTE
MANAGEMENT PLAN OF PAKISTAN**

**Ministry of Environment
Government of Pakistan**

In collaboration with

**UNITED NATIONS ENVIRONMENT PROGRAM (UNEP) Chemicals Branch,
Geneva, Switzerland**

**© Ministry of Environment,
Islamabad, June, 2010**

DRAFT NATIONAL MERCURY WASTE MANAGEMENT PLAN

GOALS AND OBJECTIVES

The overall goal of the National Waste Management Plan for mercury is to improve the quality of life of people of Pakistan and to conserve aquatic resources by reducing mercury releases to environment through ensuring provision for mercury alternatives at all levels at an affordable cost and in an equitable, efficient and sustainable manner. The objectives of the plan are:

1. Replace mercury products with mercury alternatives in future.
2. Ensure protection and safety of all people working/using mercury for different purposes.
3. Encourage community participation and empowerment in planning, implementation, monitoring and operation of safe disposal of mercury.
4. Promote cost effective and appropriate technological option for proper handling of mercury.
5. Increase public awareness about mercury releases, their toxicity and proper disposal through media and formal education.
6. Promote public-private partnership for enhancing access to Environmentally Sound Management system for mercury disposal.
7. Application of Basel convention technical guidelines on mercury uses sectors like Chlor alkali industry, Health sector (especially dental amalgams) and light sources sector.
8. Up gradation and enforcement of relevant legislation in the country.
9. To encourage NGOs and individual researchers to identify regional mercury hazards and entertains their suggestion.

1. EXISTING NATIONAL FRAME WORK FOR THE MANAGEMENT OF HAZARDOUS WASTE

.1. National Environment Policy

.1.1. Waste Management Plan

According to this plan, pollution caused by liquid and solid waste in the country would be prevented and reduced. For this purpose, the government may;

- a) Strictly enforce the National Environmental Quality Standards (NEQS) and self monitoring and reporting system.
- b) Encourage reduction, recycling and reuse of municipal and industrial solid and liquid wastes.
- c) Develop and enforce rules and regulations for proper management of municipal, industrial, hazardous and hospital waste.
- d) Develop and implement strategy for integrated management of municipal, industrial, hazardous and hospital waste at national, provincial and local level.
- e) Sustainable management of pesticides/agrochemicals.
- f) Coordinate with NGOs and individual researchers to highlight different mercury hazards in country.

.2. Relevant laws

.2.1. Toxic or hazardous substances

- The Pakistan Penal Code (1860)
- The Explosives Act (1884)
- The Factories Act (1934)
- The Agriculture Pesticide Ordinance (1971) Rules (1973)

.2.2. Solid Wastes and Effluents

- The Factories Act (1934)
- The Balochistan, NWFP, Punjab and Sindh local Government ordinance (s) (1979/80).
- Pakistan Environmental Protection Act, 1997.
- Hospital waste management Guidelines 2005.
- Solid waste management Guidelines 2005.

1.3. National Environmental Quality Standards (NEQS) for mercury (mg/L)

1.3.1. For Municipal and Liquid Industrial Effluents (mg/L)

Parameter	Into Land Waters	Into Sewage Treatment	Into Sea
Mercury	0.01	0.01	0.01

1.3.2. For Industrial Gaseous Emission (mg/Nm³)

Parameter	Source of emission	Existing standards	Revised standards
Mercury	0.01	0.01	0.01

1.4. Pakistan Environmental Protection Act, 1997

1.4.1. Prohibition of Import of Hazardous Waste under Section 13

No person shall import hazardous waste into Pakistan and its territorial waters, Exclusive Economic Zone and historic waters.

1.4.2. Handling of Hazardous Substances Section 14

Subject to the provisions of this act, no person shall generate, collect, consigns, transport, treat, dispose off, store, handle or import any hazardous substance except ___

- a) Under a license issued by the Federal Agency and in such manner as may be prescribed; or
- b) In accordance with the provision of any other law for the time being in force or of any international treaty, convention, protocol, code, standard, agreement or other instrument to which Pakistan is a party.

2. NATIONAL AGENCIES/DEPARTMENTS RESPONSIBLE FOR HAZARDOUS WASTE

- Ministry of Environment
- Federal & Provincial EPA's
- Ministry of Commerce
- Ministry of Industries and Production
- Federal Board of Revenue
- Ministry of Health
- Ministry of Science and Technology
- Ministry of Food and Agriculture.
- Ministry of Petroleum and Natural Resources.
- City District Governments.

2.1 Regulatory Authorities

Regulatory authorities for all hazardous substances and waste including mercury are EPA's (Federal & Provincial).

3. SECTORAL MANAGEMENT PLAN FOR MERCURY

3.1. Plan for Chlor-alkali Sector

Mercury is used as a catalyst in industrial processes to produce chlorine and caustic soda (in mercury-cell of Chlor-alkali plants). In Pakistan, few industries which were using mercury few years back, have now phased-out mercury from their industrial processes. Currently, Ittehad chemical industry is using mercury for its industrial processes.

Following guidelines can help in proper management of mercury and its uses for different industrial processes.

1. As a start, any Industry that uses mercury in its operation should have a specific written plan for dealing with mercury. This plan ought not only to demonstrate compliance with all government regulation but fulfill environmental standards, as necessary.
2. Industry should have a clear policy for the quantity of mercury used and releases through its practices and products.
3. Each industry using mercury should prepare a mercury balance each year. Reporting how much mercury entered the process and how much was emitted.
4. Industry management should also be generally aware of the movement of its emission into the upper atmosphere or local atmosphere and its deposition respectively.
5. Industry should also know precisely where and how its mercury waste is disposed off.
6. The Workers dealing with transport, storage, use and disposal of mercury containing chemicals must be fully and clearly informed about the possible hazards of mercury at any stage.
7. All mercury containers must be kept tightly closed when not in used. Liquid mercury and mercury containing waste must be stored in a cool place.
8. Mercury collection drums must be protected from rain fall and secured from theft and/ or to protect against unauthorized opening.
9. Post clear visible signs in the mercury storage area. Access to the storage area should be limited.
10. Mercury storage site should have a fire alarm system.

11. Segregate mercury and mercury containing items/waste from all other types of waste.
12. With regard to the mercury-cell process, mercury releases to the air from the cell room. Preventive measures and good management practices can significantly reduce these emissions.
13. Preventing or limiting the use of obsolete technology and/ or requiring the use of the best available technology to reduce or prevent mercury releases.
14. Membrane cell technology being the cost efficient because of lower electricity input required and eliminating the use and emission of mercury during manufacture should be preferred.
15. The primary mercury emissions to air occur during virtually any maintenance procedure that opens the system, as well as from the end-box ventilation system and the hydrogen gas vent. Several control techniques may be employed to reduce mercury levels in the hydrogen streams and in the end box ventilation systems. The most common techniques are (1) gas stream cooling, (2) mist eliminators, (3) scrubbers, and (4) adsorption on activated carbon or molecular sieves.
16. Pollution control measure should consider a wide range of pollutants including mercury, particularly when construction of new facilities.
17. Industry should have a good understanding of its mercury waste situation. how much mercury waste is generated, what type of waste (sludge's, filter cake, tailings, ash, slag, etc.) as generated, what is the approximate mercury content of the different types of waste, as under what conditions may waste be stored?
18. Any mercury containing waste or materials stored on-site by an industry or commercial operation must be in air tight and water proof containers and that the organization must have complete records, and a written and schedule for proper disposal of the materials.
19. There should be a well-ventilated, designated location for the storage of waste mercury collection drums.
20. Establishing schedule for; mercury removal for processing, proper management and disposal.
21. There must be emergency management procedure, such as how to deal with mercury spill and with worker who has been exposed to high levels of mercury.
22. The Industry should have a program for monitoring air concentrations of mercury in the workplace, worker exposure and for dealing quickly with any evidence of harmful exposure.

23. Industry should construct waste water treatment plant to control industrial mercury effluents.
24. Primary use of the receiving water body (drinking, fishing etc.) must not be disturbed in addition to meet National Environmental Quality Standards (NEQs) of 0.01 mg/l for wastewater discharge.
25. Industry should check regularly the health of their workers from hospitals regarding the toxicity/exposure.
26. Industrial management should ensure the handling and storage of mercury/mercury waste as per capacity and ability. Extra quantity should be informed immediately.
27. Emergency team should be established and trained by experts.
28. Industry should focus on recovery system in which the sludge containing mercury should be processed properly.
29. Strict rules for implementation of OSHA (Occupational Safety and Health Administration) rules, regulation/requirements/SOPs regarding handling of mercury.
30. Awareness is a must at the very basic level and amongst the working class.
31. Social surveys must be carried out in communities which are either directly affective by or located in and around industrial units using mercury products.
32. All PPE's must be easy and cheap to acquire as this will encourage proper maintenance over a longer period of time. This will also prevent the poor workers from selling of their assigned PPE's in exchange for money.
33. Disposal of mercury waste must again be according to the strictest of OSHA regulations and must be classified as hazardous waste in any form.
34. Treat the waste water system stream containing mercury separately and do not allow it to mix with other wastewater streams on industry.
35. Equipments containing mercury should be disposed off after complete removal mercury.
36. Industries using mercury should be strictly monitored monthly for implementation of national environmental quality standards.
37. Effluents should also be included for the NMWMP.
38. Control techniques should be employed to reduce mercury emissions.

39. Industrial solid waste should be disposed off in engineered land fills in very safe manner.
40. People residing near industries should be aware and check regularly toxicity of mercury in water and soil.
41. Industry should focus on recovery system in which the sludge containing mercury should be processed properly.
42. While arranging for health checkup of their workers, the industry should compulsorily check the blood /urine mercury levels of the workers. Those workers with levels reaching near the upper normal limit should be removed from that site and placed some where else. This will help to identify the high risk group and workers can be protected before develop frank poisoning. A single standardized test should be followed for this purpose through out the country.
43. Females should be categorically barred from handling mercury and thus should not be placed in such departments in order to avoid mercury related birth defects.
44. Due to the risk of contamination Chlor-alkali industry should not be established near "Wetlands" to preserve its wildlife. Fish farming and consumption of fish, caught from natural sources in the areas contaminated with mercury should be discouraged.

3.2. Plan for Health Sector

In Health sector, mercury is used in different ways; in hospitals, clinics and doctor's offices. Mercury is also used in many common medical measuring devices like thermometers, sphygmometers and a number of gastro-intestinal devices, such as esophageal dilators & feeding tubes. In 2005, approximately 240-300 tones of mercury were used through out the world by dentists as an ingredient in dental amalgam. Dental amalgam comprises of 50% of elemental mercury, 30% silver and 20% other metals such as copper, tin and zinc.

The Guideline listed below can significantly help in ensuring proper handling and disposal of mercury in Health sector.

1. There are safe and cost-effective non-mercury alternatives for all uses of mercury in health care. This can help in reduction of mercury pollution. Replacing mercury thermometers may be a more appropriate first step. In this regard, workers should work with administration to promote training, to implement policies for reducing mercury use and to procure mercury-free products.

2. Awareness regarding mercury and its toxicity must be raised at all levels. This also include that all those students who are currently studying in dental colleges must knows about the toxicity of mercury and mercury alternatives.
3. Mercury containing medicines should be avoided and if they are essential then these medicines must be labeled. Beside the manufacture, import and sale of unlabeled and mercury-containing health care products must be regulated.
4. Workers should strictly follow practical steps in their work environment to manage mercury products carefully and dispose off it properly when broken.
5. Broken mercury and/ or obsolete mercury medical devices along with mercury from clean up operations may be placed in separate drums.
6. Spilled mercury should never be put in a sharps containers as these are usually incinerated, which would spread mercury through the air.
7. On-site spill management kits should be assembled and provided for use in areas susceptible to spills. In case of mercury spills, people from the contaminated areas must be removed.
8. Segregate mercury and mercury containing items/waste from all other types of waste.
9. Post clear visible signs in the mercury storage area . Access to the storage area should be limited.
10. Mercury should be disposed of at off-site hazardous waste warehouse. If now such storage facility exists locally or within a distance that is safe and economically feasible, then it can store the mercury waste on sight. However, mercury should only be stored there for a short period of time until it can be transported to mercury recycling facility or a safe large-scale storage facility.
11. Mercury storage site should have a fire alarm system.
12. Regarding dental filling, promotion of good dental hygiene reduces the need for dental filling.
13. Install amalgam separator at dental clinics to reduce most of the emission from wastewater.
14. Dentists should prefer to use alternatives to traditional dental amalgam, such as composite.
15. There must be a sound collection system to store safely surplus mercury from dental clinics.

16. Amalgam should be removed in chunk rather than dust.
17. Mercury amalgam chunks should be removed with the low speed suction (the vacuum line).
18. A finer mesh on your traps (100 versus 40) should be used provided the suction system can handle it. This will allow less pollution to go through.
19. Dental offices should collect, store safely and forward for recycling as much of the amalgam waste as possible, regardless of whether or not it has been in contact with a patient. Such waste includes used amalgam capsules excess amalgam that is not used in placing a restoration and amalgam waste retained in vacuum pump filters in amalgam separators.
20. Extracted teeth restored with amalgam can also be recycled with other types of amalgam waste.
21. Use of alternatives to mercury containing chemicals in medical settings especially dental waste management in all dental clinics throughout the country.
22. Simply ban mercury thermometers and introduce and make available alternative thermometers, forcing thermometers manufacturing industry to replace technology to manufacture alternatives.
23. Mercury waste should be treated as hazardous waste.
24. Health workers should be well versed in the proper handling of mercury waste and accidents like mercury spills and use of Spill Kit.
25. Spill Kits must be maintained on regular basis.
26. Proper risk assessment audits should be done of facilities using mercury and producing mercurial waste.
27. Awareness regarding mercury and its toxicity in the hospitals and in clinics to use alternatives drugs, chemicals and its safely disposals should be adopted.
28. Waste water of the hospitals should be analyzed for mercury and other toxic chemicals.
29. Solid waste of the hospitals should be used for the recycled of the mercury in order to reduce the mercury level.
30. The hospital may develop their procurement guidelines adjusted in respect of replacing mercury containing devices e.g. thermometers and sphygmomanometers, with electronic devices.

31. The curriculum for medical and health sciences may include syllabi on mercury usage and its hazards, including alternates. The same may also be addressed at school level curriculum for children.
32. This should address not only the allopathic medicine but also the traditional, homeopathic and other alternate medicines and pharmaceuticals.
33. The ministry of environment should arrange training programs in collaboration with ministry of health, regarding mercury hazards among the health care providers.
34. Dentistry departments in the hospitals should dissociate mercuric compounds in both public and private sectors. e.g. Silver-tin can be use in place of mercury.
35. The ministry of health should be made partner for the said project especially in research and planning in order to identify the possible health risk factors due to mercury among the population and to device policy.
36. Mercury waste management should be incorporated in the curriculum of nurses and Para medical staff as well.
37. Ministry of Health should make a rule not to register any skin whitening product unless it has been checked for mercury.

3.3. PLAN FOR LIGHT PRODUCTS SECTOR

In Pakistan, light sources/products containing mercury are of the following three categories;

- Conventional tube lights /fluorescent lamps (mercury quantity per item : (approx 10 mg)
- High Compact Fluorescent Lamps(HCFL)/energy saver (mercury quantity per item: approx 4 mg)
- Low Compact Fluorescent Lamps(LCFL)/energy saver (mercury quantity per item: approx 2 mg)

These products are not only manufactured in Pakistan but also imported from countries like China, Japan, etc. mercury exposure is possible in case of break down of these light source

Plan for this sector is general and focuses on individual roles and responsibilities:

1. Light products/sources importers should appreciate alternatives instead of light sources containing mercury.

2. All shipments containing mercury light sources/products must have clear visible signs e.g. mercury included products or dangerous.
3. Shipments (containing light sources) must be unloaded carefully and carried towards the destination in special vehicles.
4. The storage containers of mercury light products should be free of cracks or opening of any kinds and must be placed at cool places. Only trained persons should be allowed for storage and handling mercury containing light sources. Workers must have Personal Protective Equipments (PPE).
5. Mercury storage site should have a fire alarm system.
6. Light sources (especially mercury) distributors should follow the take-back services policy. Distributors should provide light products to client on the condition that he or she will return the light products after expiry or in case of fuse off light products.
7. Distributors should install collection points for mercury light products in the close vicinity to customer's area.
8. Main distribution centre must have storage facility for all expired/non working light products collected from clients. However, mercury light products should only be stored there for a short period of time until it can be transported to mercury recycling facility or a safe large scale facility. It is necessary that all these storage facilities must comply with Environmental Sound Management system (ESM).
9. All mercury light products, accidentally broken should not be mixed with any other waste or discharge into the Environment until they are dealt with in Environmentally Sound Management.
10. Marketing companies' should launch awareness programs for handling of mercury products on print/mass media regularly. For example print on the product envelope.. "MERCURY PRODUCT – HANDLE WITH CARE."
11. Programs or animated clips should be run on national and private channels to spread awareness among people on the proper disposal of old used and broken tube lights and energy savers.
12. Use of yellow light energy savers should be encouraged and the industrial sector should be given incentives on the manufacture of yellow light energy savers like reduced GST.
13. If the alternative sources of light are not adoptable the use of lights containing less mercury may be preferred.

14. Lighting is a diffused activity taking place at every house and commercial center and it is difficult to apply a control on diffused activities. So the preference should be given to reduction of mercury use in manufacturing.
15. Take back service may work more efficiently with the responsibility of distributors to effectively convey this concept through electronic or print media.
16. Installation of treatment plant for the mercury and use alternative for mercury in these products.
17. The factories manufacturing batteries products should install treatment plant for its safe disposal.
18. After expiry, there should be a common collecting point for safe disposal.
19. A warning should be clearly mentioned on their packing (like cigarettes) regarding release of mercury if the item is broken.

GENERAL SUGGESTIONS

1. Since mercury enter to the environment if waste is incinerated or land filled, it is important to keep mercury containing devices out of the municipal waste stream.
2. Mercury containing batteries should be handled with care.
3. Waste reduction and proper waste management of products containing mercury
 - Waste management options-household
 - Waste management options-Business and industry
 - Regulations regarding recycling and disposal
 - Hierarchy of disposal options
 - Managing mercury spills
4. Several mercury free alternatives are available, mercury is one of the most easily recovered metals, and many mercury compounds will convert to metal at 300 °C. Also as mercury is substantially more volatile than other metals, separation during recycling is easier. In the recycling process, mercury is vaporized in a retort and collected by condensation. So recycling industry of mercury should be encouraged.
5. In order to regulate mercury at consumer level, all purchasers of mercury containing products should be registered and proper mercury/chemical regulation unit should be established in all provincial EPA's.

6. Replacement of mercury products with mercury alternatives must begin at the production level in industrial processes and also for making of products for direct use by consumers.
7. The plan is focused only on three sectors, namely Chlor-alkali, health and light products, whereas many other sectors/sources of mercury e.g. Dry mercury cells of all types having high concentration of mercury needs to be included in sectors focused in the plan. In addition pressure measuring devices new and old (came with scrap e.g. ship breaking) are also need to pay consideration
8. The present draft of National Mercury Waste Management Plan has almost covered all the important aspects and control measures. Change should be brought from the grass-root level; the best way to achieve this is by introducing these vital topics to students. It should be made a part their syllabus.
9. The plan mostly addresses collection and storage related issues, but it does not address the recovery of the mercury from the discarded mercury based fluorescent bulbs, tube lights, dry cells and sludge of waste water treatment plants of such categories
10. Mercury poisoning should be included in environmental awareness campaigns. It should be a part of pollution plus poisoning campaigns.