Mercury Sources: Products and Hotspots in Bangladesh

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Abstract

This booklet describes Mercury sources, products and hotspots in Bangladesh. A study was conducted in Dhaka and its adjoining areas to find out Hg sources, Hg containing products and its hotspots in Bangladesh. Primary information was collected from different sectors namely; health care, electronics and electrical equipments, battery industry, cement, chemical, and jewelry and beauty product's consumer based on purposive sampling. Secondary information was collected from online sources. It was found from study that there is no effective treatment facility in surveyed sectors due to absence of policy on Hg. Therefore, it is crying need to formulate a national policy on Hg use and disposal for reducing Hg pollution and hence to improve environmental conditions and lessen human health hazards.

This booklet has been produced to help encourage and enable organizations of global civil society to engage in local, national, and international activities aimed at controlling mercury pollution. It includes information that can be used in programs and campaigns aimed at raising mercury awareness among professionals, media and the public at large. It identifies sources of mercury pollution and suggests what can be done to control those sources.

Shahriar Hossain, Ph.D.
Secretary General
ESDO

Acronyms and abbreviation

CFL	Compact Fluorescent Lamps
ESDO	Environment and Social Development Organization
g	Gram
Hg	Mercury
Kg	Kilogram
Kwh	Kilowatt Hours
LCD	Liquid Crystal Display
MT	Metric ton
mg	Milligram
ppm	parts per million
UNEP	United Nations Environment Programme
%	Percent

Declaration

This study has been conducted and report prepared by ESDO and it has not been submitted in any previous application. The work reported within was executed by ESDO, unless otherwise state.

Let's move for Mercury free world

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1. Introduction

1.1. Why should be concerned about Mercury?

Mercury (Hg), a potential contaminant of the environment is of global concern because of its toxic nature, trans-boundary movement and its ability of bioaccumulation etc. Mercury has been used in a vast range of products over the years. Mercury is used in a wide variety of household products. These items release mercury into the environment and home when broken, mishandled or disposed of.

1.2. List of Mercury products

Product	Amount of Mercury
Fluorescent light bulbs	0 – 50 mg
Button-cell batteries	0 – 100 mg
Thermostats	10 – 1000 mg
Electrical Switches	10 – 1000 mg
Dental amalgam	100 – 1000 mg
Thermometers	0 – 3000 mg
Older pressure gauges	3000 – 10000 mg
Manometers and barometers	50000 mg - several pounds
Plumbing traps	100000 mg - several pounds
Consumer fever thermometers	0.5 g - 1.5 g
Hospital laboratory thermometers	3 g - 4 g
Wall blood pressure	110 - 200 g
Pocket Calculator	0 – 50 mg
LCDs	0 – 50 mg

2. Regional situation of Hg uses

Source	Estimated global Hg consumption (in MT)	Estimated global Hg atmospheric emissions (in MT)
Artisanal and small-scale gold mining	806	350
Vinyl chloride monomer manufacture	770	00
Chlor-alkali plants	492	60
Batteries	370	20
Dental amalgam	362	26
Measuring and control device	350	33
Lighting	135	13
Electrical devices	200	26
Others	313	29
Total	3798	557

Statistics indicates that approximately 35.2 tons of mercury was used in amalgam fillings in the U.S.

In 2006, U.S. coal-fired power plants produced 1,971 billion kilowatt hours (kwh) of electricity, emitting 50.7

tons of mercury into the air—the equivalent amount of mercury contained in more than 9 billion CFLs.

According to UNEP's "Global Atmospheric Mercury Assessment," cement kilns annually release an estimated 189 metric tons of mercury into the atmosphere. This is approximately 10 percent of UNEP's estimated total of global anthropogenic mercury emissions to the atmosphere.

3. Hg products in Bangladesh

3.1. Mercury in Medical Devices

Mercury usages in health care equipments and products in Bangladesh are about 24.28 tons per year.

- Annual Hg released by healthcare instruments is 6.9 tons,
- Per capita Hg usage in medical instruments is154.76 mg.
- Per capita Hg release 43.98 mg

3.1.1. Thermometer

The share of mercury released from thermometers is 1.37 tons

3.1.2. Sphygmomanometer

The share of mercury released from sphygmomanometer is 0.71 tons per year.

The contribution of Hg released from

- Thermometers 20%,
- Sphygmomanometer 10%,
- Laboratory usages 30%
- Other medical equipments 40%.
- Home blood pressure gauges contain almost 1.5 pounds of mercury.

Mercury is used to this very day to make dental amalgams, tooth fillings made with a mixture of mercury and zinc

3.2. Mercury in electrical Switches

Several kinds of electrical switches contain mercury. These include

- Tilt switches,
- Float switches,
- Thermostats,
- Relays that control electronic circuits

- Tilt switches in industrial applications contain as much as 3.6 kg of elemental mercury.
- An individual float switch may contain as little as 100 mg of mercury or as much as 67 g.

- Total amount of mercury in a residential analog thermostat is approximately 4 g.

3.3. Mercury in Batteries

3.3.1. Why does mercury uses in *Battery?*

Mercury in batteries used to prevent a buildup of hydrogen gas that can cause the battery to bulge and leak. Mercury has also been used as an electrode in mercuric oxide batteries.

3.3.2. Global consumption of Hg in battery

Global battery production still accounts for about a third of total global demand for mercury

- A button cell battery contains 0-25 mg of mercury.
- Highest mercury content is in mercuric oxide batteries, which is 40 percent mercury by weight.
- Zinc air, silver oxide, and alkaline manganese button batteries typically contain from 0.1% to 2.0% mercury by weight.

3.4. Mercury Containing Lamps

3.4.1. Fluorescent Lamps

Fluorescent lamps represent approximately 80 percent of the total mercury used in lighting.

A CFL bulb contains >5 mg of mercury

The average mercury content of size T12 fluorescent tubes manufactured in China is between 25 mg and 45 mg, for size T5 tubes it is 20 mg, and for CFLs it is 10 mg. In India, the most popular CFLs contain between 3.5 mg and 6 mg of mercury.

3.4.2. Metal halide lamps

The amount of mercury used in individual metal halide lamp lamps ranges from more than 10 mg to 1,000 mg.

3.4.3. Ceramic metal halide lamps:

Contain less than 50 mg of mercury

3.4.4. High-pressure sodium lamps:

Contain between 10 mg and 50 mg of mercury

3.4.5. Neon lights

Contain between approximately 250 mg and 600 mg of mercury per bulb

3.5. Mercury in Measuring Devices

3.5.1. Barometers

- Measure atmospheric pressure.
- Each may contain 400 g to 620 g of mercury.

3.5.2. Manometers

- Measure differences in gas pressure. Each may contain 30 g to 75 g of mercury.

3.5.3. Psychrometers

- Measure humidity.Each may contain 5 g to 6 g of mercury.

3.5.4. Flow meters

- Measure the flow of gas, water, air, and steam.
- Each may contain 2 g to 4 g of mercury

3.5.5. Hydrometers

- Measure the specific gravity of liquids.
- Each may contain < 5 g of mercury.

3.6. Mercury in cement industry

According to UNEP's "Global Atmospheric Mercury Assessment," cement kilns annually release an estimated 189 metric tons of mercury into the atmosphere. This is approximately 10 percent of UNEP's estimated total of global anthropogenic mercury emissions to the atmosphere.

- Total production of cement in 5 industries is 2054511 tons
- Hg release fromv5 industries is 0.13588 tons per year
- Hg release from 18 cement industries of Bangladesh is 0.489178 ton

3.7. Mercury in Dental Amalgam

- Mixture of liquid mercury, silver, tin and copper
- Used in filling dental cavity caused by tooth decay
- Consists of 50% mercury, 35% silver and 13% tin, approx. 2% copper and <0.1% zinc.

Harmful effects of dental amalgam on human health

- Reduction of body's diseases defensive capacity
- Damage the brain, kidneys, and immune system of children
- Memory disturbances
- Effects on reproduction
- Weakening of tooth structure
- Neurological Problems
- Reduction of vision and hearing capacity
- Hair falling
- Skin cancer and kidney damage
- Damage in health tissue cell
- Gastrointestinal Problems

3.8. Mercury-Containing Pesticides and Biocides

3.8.1. Paint additives

Phenyl mercuric compounds and mercuric acetate are sometimes added to paints as fungicides to prevent the growth of mold and mildew.

3.8.2. Pulp and paper mills

Phenyl mercury acetate is sometimes added to pulp in the paper-making process as a fungicide.

3.9. Mercury in Laboratories and Schools

Elemental mercury as well as mercury compounds, mercury-containing reagents, and mercury-containing devices are frequently found in both school and professional laboratories

3.10. Mercury in Cosmetics

3.10.1. Skin lightening cream

Some of the creams contain mercury levels 20,000 to 56,000 parts per million.

Skin lightening creams are popular cosmetic agents typically used to undo sun damage to the skin, even-out skin tones and remove age spots.

In Bangladesh, the following skin lightening creams are popular which content high level of Hg content.

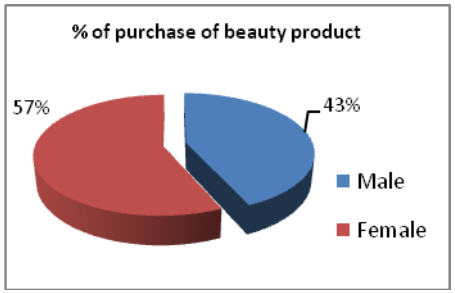
Table: List of harmful skin fairness cream in Bangladesh

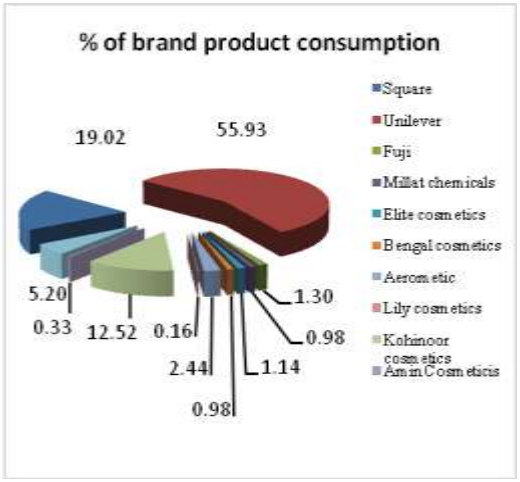
Sl. No.	Sample name	Hg content (ppm)
1.	PONDS	3450
2.	Shumons Aiura	3361
3.	Olay	3604
4.	Fair & Handsome	3567
5.	Fair & lovely Ayurvedic	4005
6.	Fair & lovely Max fairness	4174
7.	Modern	3931
8.	Garnier	4643
9.	Botanic	3930
10.	Modern	4152
11.	Tibbat	3753
12.	Fair &Handsome (Emami)	4134

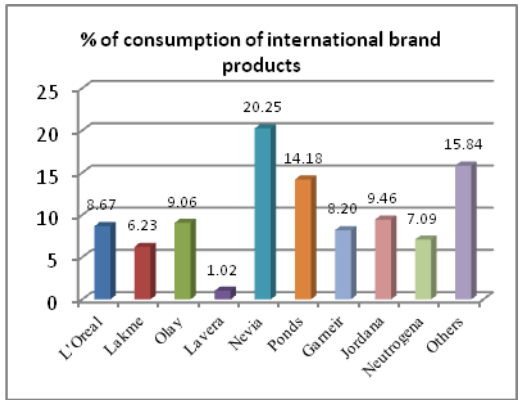
** All the samples were analyzed in Atomic Absorption Spectrometer using Cold Vapor Unit.*

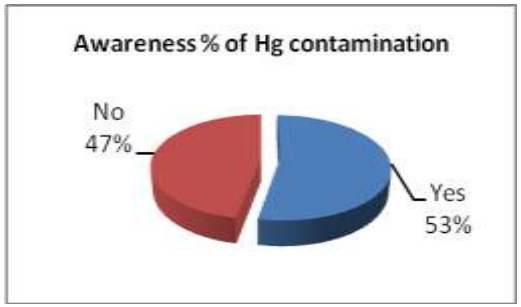
Figure: Mercury containing beauty cream in Bangladesh

Moreover, some other creams namely; Fasco, Ruengium and Quaemae contain 4600, 16700 and 3540 ppm of Hg.









Harmful effects of Hg containing beauty cream

People who use skin products containing mercury have been found to have elevated mercury levels in their hair, blood, and urine. Mercury can damage the kidneys; affect the nervous system, or cause pain or rashes and even affect personality.

Pregnant women and women of child-bearing age should avoid exposure to mercury. Unborn babies, infants, and children are very sensitive to mercury.

3.11. Mercury in Medicine

3.11.1. Calomel

3.11.2. Mercurochrome

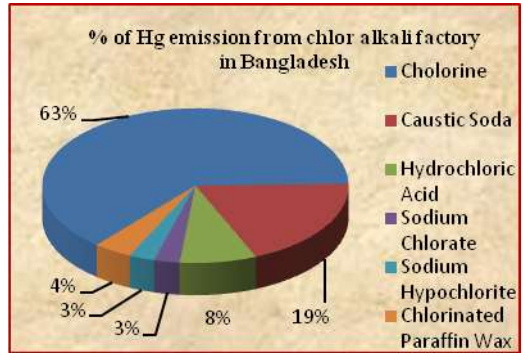
3.11.3. Thiomersal

3.12. Mercury in Cultural Products, and Jewelry

3.13. Mercury in Chlor-alkali Production

Chlor-alkali plants use mercury-cell process, which releases large quantities of mercury into the environment.

- 5 chlor alkali factory exist in Bangladesh
- 1.4445 tons (0.2889 tons Hg/year) of Hg released to environment in every year in Bangladesh.



According to UNEP Technical Background Report mercury-cell chlor-alkali plants consumed 492 metric tons of mercury in 2005. This reported total listed as follows:

Region	Hg Consumption (in MT)
European Union	175
CIS and Other European Countries	105
North America	60
Middle Eastern Countries	53
South Asia	36
South America	30
Others listed	33
Total	492

3.14. Mercury Use in Artisanal and Small-Scale Gold Mining

Artisanal and small-scale gold mining (ASGM) is practiced in at least 70 countries globally.

ASGM is the largest demand sector for mercury globally, and there is increased global attention on the issue because of the current negotiation of a global mercury treaty.

- Estimated consumption in 2005 is 650-1000 tons

3.15. Mercury Catalysts Used for Chemical Production

- In 2008 it was estimated that 300-350 metric tons/year of mercury catalyst was used globally in polyurethane applications.

3.16. Coal-Fired Power Plants

4. List of Priority Products and Sectors

4.1. The priority products are

- Dental Amalgam
- Thermostats
- Switches, Relays, and Measurement and Control Devices
- Lamps
- Fever Thermometers
- Skin fairness cream

4.2. The priority sectors are

- Health Care
- Households, consumer goods
- Electrical and electronics
- Manufacturing and Industry
- Steel Manufacturing and Processing

4.3. Acceptable limit of Mercury in human body

Institution	Acceptable level of Hg in hair (ppm)	Amount of Methyl-mercury that can safely be consumed every day over a lifetime without effect
U.S. EPA Reference Dose (RfD)	12	0.1 mg/kg/d
ATSDR Minimal Risk Level (MRL)	15.3	0.3 mg/kg/d
Canada Provisional Tolerable Daily Intake (pTDI)	10	0.2 mg/kg/d
Joint FAO/WHO Expert Committee on Food Additives	14	0.23 mg/kg/d

5. Hg contamination

5.1. Signs and Symptoms of Mercury Poisoning

- Irritability
- Shyness
- Tremors
- Changes in vision or hearing
- Memory problems
- Depression
- Numbness and tingling in hands, feet or around mouth
- Growth retardation of children
- Mental disorder of new born baby

The picture is from a person who stepped onto a broken CFL bulb whose foot was subsequently infected with mercury poisoning.

5.2. Cause of Hg pollution

- Emissions and wastes generated during the production of the mercury (whether mined, by-product, recycled, etc.) used in the product;
- Emissions during the product manufacturing phase
- Release through normal product use, as in the case of dental amalgam, cosmetics containing mercury, etc.
- Release due to breakage during use (e.g., fluorescent lamps and glass thermometers)
- Release due to breakage in the waste stream (e.g., fluorescent lamps) or through dumping;

- Releases during the recycling process
- Releases associated with treatment and final disposal of mercury waste (whether through burial, incineration or reuse of waste materials (e.g., in cement).

5.3. What is the concern with mercury in products and processes?

- When products containing mercury are discarded into the general waste stream, they often end up in the environment – in waterways, wetlands, roadside litter, landfills or open dumps, where they may be burned. The mercury they contain is ultimately released into the air, water, and soil.

5.4. How Hg enter into human body

- Through vapor
- Consumption of Hg contaminated fish and other food

6. How Do You Manage Mercury?

6.1. For the Public

- Seek out mercury-free products.
- Dispose of mercury-containing products separately, not with other trash.

- Do not dispose of mercury-containing products in trash that will be burned, since the mercury will vaporize and pollute the air.
- Bring the issue of the need for proper waste management to the attention of the leaders in your community and government authorities.
- Educate people about the risks of mercury poisoning, the mercury-containing products they use, and proper spill handling procedures.

6.2. For Governments

- Promote public awareness about what products contain mercury.
- Encourage government agencies, institutions, hospitals, industry and retailers to choose and procure mercury-free products.
- Encourage municipalities to establish controlled disposal systems for mercury-containing waste. Establish national or regional safe containment facilities for mercury-contaminated waste.
- Regulate and monitor industries using mercury.
- Regulate the export/import of mercury and mercury-containing products.

Mercury from your home can be emitted from various ways:

- Broken electronics equipment
- Fairness cream
- Paint products
- Jewelry ornaments
- Chemicals
- Medical equipments
- Mercury contaminated fish
- Battery

7. Global Mercury Assessment Report

UNEP prepared its "Global Mercury Assessment" report which was released in December 2002. Among the report's key findings were the following:

- ☆ Mercury is widely present in the environment
- ☆ Mercury is persistent and cycles globally
- ☆ Mercury exposure has serious effects.
- ☆ Interventions to control mercury pollution can be successful.
- ☆ Global action is needed because local and regional actions, by themselves, are not sufficient.
- ☆ Mercury may be an especially important problem in less-developed regions.

8. Acknowledgement

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Please raise your voice to stop production of Hg containing products

Say no to Mercury

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