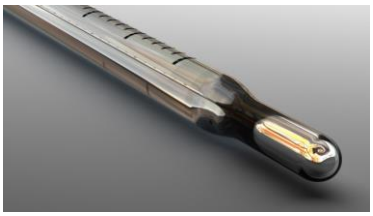


Minamata Initial Assessment Report

Sri Lanka

















July 2019

Introduction



Mercury - A Global Pollutant

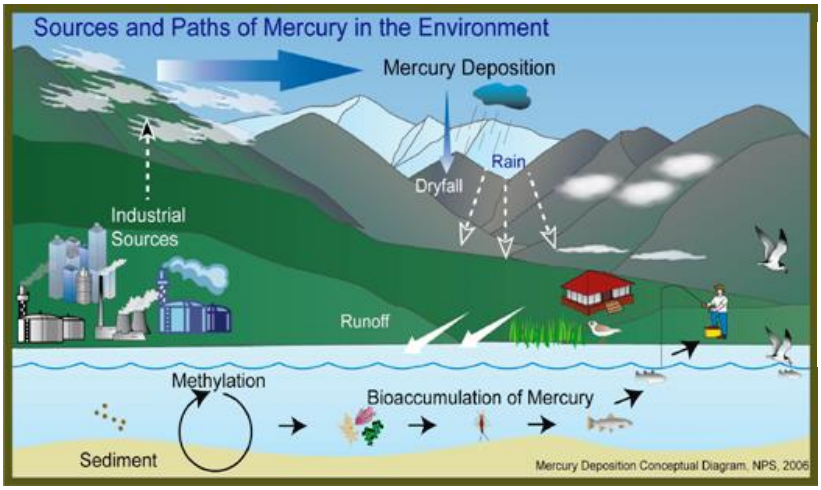
> *"Mercury is a chemical of global concern owing to its long-range atmospheric transport, its persistence in the environment once anthropogenically introduced, its ability to bioaccumulate in ecosystems and its significant negative effects on human health and the environment"*
>
> *(First preamble of the Minamata Convention on Mercury)*

Mercury is a naturally occurring chemical element with symbol Hg and atomic number 80. It is commonly known as quicksilver, a shiny silvery metal and is the only metal that is liquid at room temperature and standard pressure. It is a heavy metal having a very low vapour pressure and slowly evaporates even at ambient temperature.

Mercury exists as;

- *Elemental/metallic mercury*
- *Methyl mercury*
- *Other organic or inorganic compounds*

Mercury occurs in its elemental form in the earth's crust but is more commonly found in the form of cinnabar (mercury sulphide). It may occur with other non-ferrous sulphide minerals (zinc, lead, arsenic, gold, etc) and in trace quantities or as an impurity in many other economically valuable materials including fossil fuels such as coal, gas, and oil. Moreover, mercury combines with most metals to form alloys called amalgams and these decompose on heating with volatilization of the metallic mercury.



Once mercury has been released, it persists in the environment, cycling between air, land and water, and biomagnifies up the food chain.

Sources and Paths of Mercury in the Environment

Mercury and mercuric compounds (particularly methyl mercury) have long been recognized as chemical substances, which have significant adverse health effects on humans and the environment. In spite of its usefulness in thermometers, barometers, sphygmomanometers, float valves, fluorescent lambs and other devices, mercury is considered by the World Health Organization as one of the top ten chemicals or groups of chemicals of major public health concern.

Mercury Exposure

- Most toxic substance known to humans.
- Mercury can pass through skin, blood-brain and placental barrier and can cause devastating effects on the function and growth of brain in the growing fetus.
- It is neuro and nephro-toxicant and can damage kidney and central nervous system.
- Mercury is a trans-boundary pollutant that crosses international borders by pathways like air and water.
- It bio-accumulates and bio-magnifies.
- Likely route of exposure: inhalation or absorption of inorganic mercury vapour after a spill or during a manufacturing process or ingestion of methyl mercury from contaminated fish.
- It can pose significant health threat when spilled in a small and poorly ventilated room

(Source: Mercury Free India, Toxics Link, 2014)

MINAMATA CONVENTION ON MERCURY

Minamata Convention is aimed to protect human health and environment from anthropogenic emissions and releases of mercury and mercury compounds.

Because of its significant negative effects on human health and the environment, mercury has increasingly become the focus of decision-makers. The Minamata Convention on Mercury is the first global agreement specifically designed to address contamination from a heavy metal. Opened for signature on October 10, 2013 and entered into force on August 16, 2017. By this Convention, it is expected to incorporate provisions that, if taken together and accurately implemented over time, will essentially reduce total anthropogenic mercury emissions and releases into the global environment.

Major Focus of the Convention

- Control and regulate mercury supply
- Control demand side, thereby reducing the usage
- Ban on manufacturing of mercury containing products by 2020
- Reduce mercury emissions and releases
- Identify and remediate sites contaminated with mercury
- Safe handling of mercury waste and retiring excess mercury for long-term storage
- Strict reporting mechanism to be in place on mercury movement and the measures adopted for complying with treaty provisions.

(Source: Mercury Free India, Toxics Link, 2014)



In order to assist with preparations for the ratification and implementation of the Convention, the government of Sri Lanka conducted a Minamata Initial Assessment (MIA) in 2017 with financial assistance from the Global Environment Facility (GEF) and was implemented in collaboration with United Nations Industrial Development Organization (UNIDO).

Sri Lanka has signed the Minamata Convention on October 08, 2014 and became a Party to the Convention by ratification on June 19, 2017

Primary Activities of the MIA

- A review of institutional and capacity needs for implementation of the Convention;
- An assessment of national regulations, policies, and legislation to assist with preparations for compliance with the obligations of the Convention; and
- An identification of the primary sources of mercury emissions and releases as part of a detailed National Mercury Profile.

Major Sources of Mercury in Sri Lanka

The estimated total mercury input to society in Sri Lanka is 7,630 kg/year.

Major sources of releases and emissions of mercury are anthropogenic.

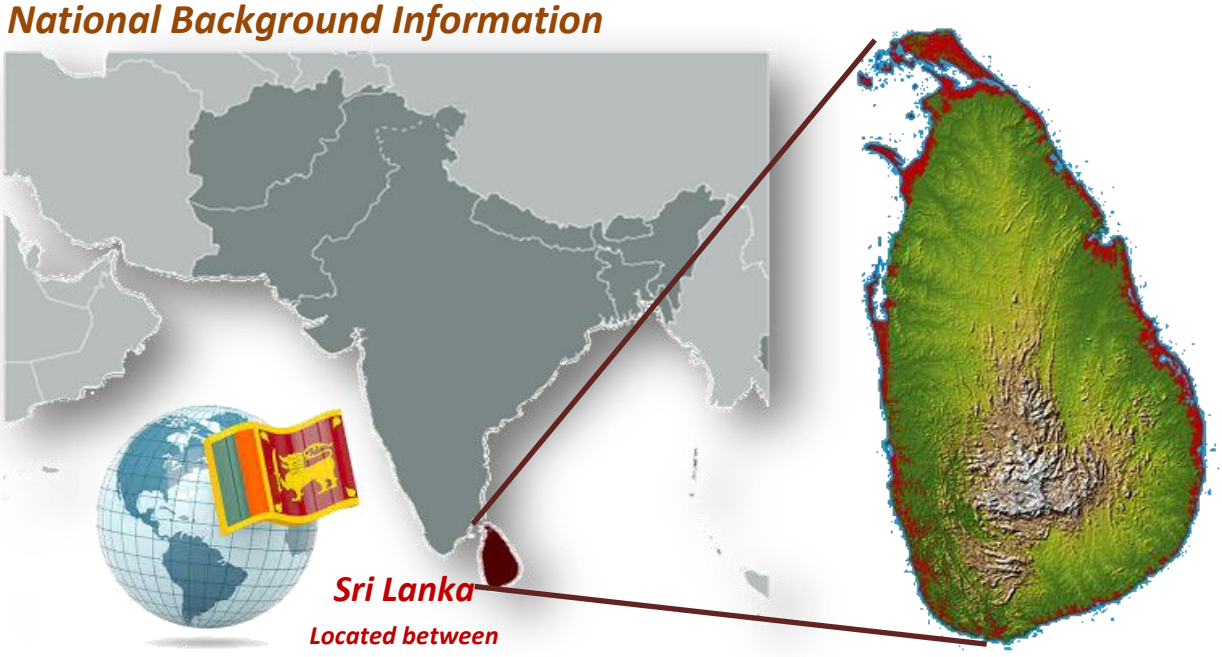
- Use and disposal of mercury-added products (4,418 kg Hg/year or 58%)
- Waste incineration and open waste burning (1,229 kg Hg/year or 16%)
- Combustion of coal, other fossil fuels and biomass (742 kg Hg/year or 10%)
- Informal dumping of general waste (396 kg Hg/year or 5%)
- Application, use and disposal of dental amalgam fillings (331 kg Hg/year or 4%)

(National Mercury Inventory, 2016 - MIA, Sri Lanka)

Findings from the MIA in Sri Lanka indicate that the input of mercury into local ecosystems may be elevated in some areas (e.g., in the vicinity of open waste burning, coal combustion, and waste

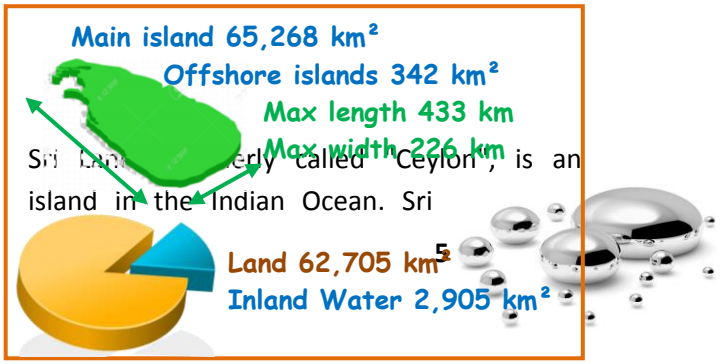
Chapter I

National Background Information



1.1 COUNTRY PROFILE

1.1.1 GEOGRAPHY AND POPULATION



Sri Lanka, formerly called "Ceylon", is an island in the Indian Ocean. Sri

MIA Sri Lanka

Lanka lies on the Indian Plate, a major tectonic plate that was formerly part of the Indo-Australian Plate and located southeast of the Indian Subcontinent, in a strategic location near major Indian Ocean sea lanes.

The main island of Sri Lanka has an area of 65,268 km², which is the twenty-fifth largest island of the world by area. It consists mostly of flat to rolling coastal plains, with mountains rising only in the south-central part. The highest point is Pidurutalagala, reaching 2,525 m above sea level. Sri Lanka's coastline is 1,585 km long and claims an Exclusive Economic Zone extending 200 nautical miles, which is approximately 6.7 times Sri Lanka's land area.

DRAINAGE

Sri Lanka has 103 rivers, most of which are mere wet-season rivulets. These waterways give rise to 51 natural waterfalls of 10 m or more. The highest is Bambarakanda Falls of 263 m height. Twelve major rivers account for about 75 percent of the mean annual river discharge of the country. The longest is the Mahaweli River extending 335 km, where a part of its catchment is within the Wet Zone, hence has a larger and less seasonally varied flow than the other Dry Zone rivers and so is a major asset for irrigation in the drier parts of the country.

CLIMATE

The climate in Sri Lanka is tropical and warm, due to the moderating effects of ocean winds, and consists of very distinctive dry and wet seasons. Mean temperatures range from 17 °C in the central highlands, where frost may occur for several days in the winter, to a maximum of 33 °C in other low-altitude areas. However there are certain areas along the coast that are cooled by the ocean breezes. Average yearly temperatures range from 28 °C to nearly 31 °C, which may differ due to global weather conditions as a whole. The coldest months according to the mean monthly temperature are December and January while the warmest months are April and August.

Rainfall pattern is influenced by monsoon winds from the Indian Ocean and Bay of Bengal. Due to its location in the equatorial and tropical zones, Sri Lanka has been influenced by the four very distinctive monsoon seasons.

Rainfall is of three types; monsoonal, convectional and depressional. Monsoon rain occurs during the two monsoon periods, namely the south-west and north-east, and is responsible for nearly 55% of the annual precipitation. Convectional rain occurs during the inter-monsoon periods, mainly in the afternoon or evening and is likely to be experienced anywhere over the Island. Depressional rain also occurs during the inter-monsoonal periods, particularly during the second inter-monsoon.

Monsoon Seasons of Sri Lanka

1. First Inter-Monsoon (Mar – Apr)
2. Southwest-Monsoon (May – Sep)
3. Second Inter-Monsoon (Oct – Nov)
4. Northeast-Monsoon (Dec – Feb)

The mean annual rainfall is less than 900 mm in the south-eastern and north-western (driest) parts of the island to over 5000 mm in the western slopes and the central highlands. The reported annual average rainfall in 2017 and 2018 was 1,757 mm and 1,944 mm respectively.

Periodic squalls occur and sometimes tropical cyclones bring overcast skies and rains to the southwest, northeast, and eastern parts of the island. Humidity is typically higher in the southwest and mountainous areas and depends on the seasonal patterns of rainfall.

SOIL

Most of the soils of Sri Lanka are potentially suitable for some kind of agricultural use. The climatic influences are reflected in the dominance of red-yellow podzolic soils (leached lateritic soils) in the Wet Zone and of reddish brown earths (nonlateritic loamy soils) in the Dry Zone. In parts of the Central Highlands there are reddish brown latosolic soils (partially laterized soils) or immature brown loams (clayey loams). Among the other important soil types are the alluvials that occur along the lower courses of rivers and the regosols (sandy soils) of the coastal tracts.

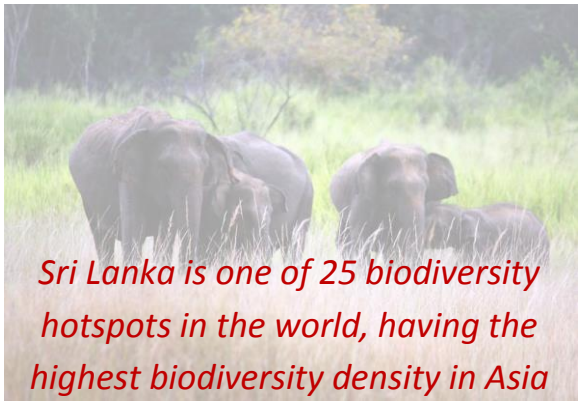
NATURAL RESOURCES

The countries natural resources include limestone, feldspar, graphite, mineral sands including silica, gems, phosphates, clay including kaolin, and hydropower. Existence of petroleum and gas in the Gulf of Mannar has also been confirmed and the extraction of recoverable quantities is under discussion.

ECOSYSTEMS

Sri Lanka's natural vegetation covers about one-third of the total land area. The climax vegetation in most parts of the country is forest.

In the Wet Zone, tropical wet evergreen forest dominates in the lowlands, and submontane and montane evergreen forests prevail in the highlands. The Dry Zone has a climax vegetation of dry evergreen forest and moist deciduous forest, giving way to stunted, shrubby, xerophytic (drought-tolerant) vegetation in its driest parts. In the highest areas of the central highlands, forests tend to be sparse and interspersed with grasslands. Most of Sri Lanka's climax vegetation cover has been heavily depleted by extensive clearing of forests for settlements, extraction of timber, and agriculture. Only the Sinharaja forest and the Peak Wilderness of the southwestern interior remain as significant remnants of the Wet Zone's original evergreen forests. The forests found in most parts of the Dry Zone are secondary vegetation, which probably developed after hundreds of years of repeated clearing and cultivation.



A remarkably high proportion of the species among its flora and fauna; 27% of the flowering plans and 22% of the mammals are endemic. Sri Lanka has declared 24 wildlife reserves, which are home to a wide range of native species such as Asian elephants (The Sri Lankan elephant is one of three recognized subspecies of the Asian elephant), leopards, sloth bears, the unique small loris, a variety of deer, the purple-faced langur, the endangered wild boar, porcupines, and Indian pangolins.

The countries mangrove ecosystem spans over 7,000 hectares and played a vital role in buffering the force of the waves in the 2004 Indian Ocean tsunami. The coastline and adjacent waters support highly productive marine ecosystems such as fringing coral reefs and shallow beds of coastal and

estuarine seagrasses.

HUMAN POPULATION

Sri Lanka is the 58th most populated nation in the world, with mid-year population of 21,670,000 people in 2018 that is equivalent to 0.27% of the total world population.

The reported population density in 2018 is 346 persons per km^2. The most dense areas lying in the urban areas especially in and around the commercial capital, Colombo, and other large cities that are also the industrial and economic hubs of the country.

Crude birth rate of Sri Lanka has decreased from 15.6 in 2016, 15.2 in 2017 to 15.1 births per 1,000 people in 2018. Conversely, number of deaths has increased by 0.2% in 2018 compared to 2016 which lies at 6.4 deaths per 1,000 people. However, Sri Lanka has high life expectancy at birth. According World Health Organization published data; total life expectancy is 75.3 years in 2018 with a male life expectancy at 72.1 years and female life expectancy at 78.5 years, which gives Sri Lanka a World Life Expectancy ranking of 70.

Male to female ratio in the country fell gradually from 106.16 males per 100 females in 1970 to 92.31 males per 100 females in 2018. Sri Lanka hosts a dynamic age structure dominated by 67% youth component (15-64 year people) and less number of aging population of 65 years and over, which in only 8%. The median age is 32.7 years.

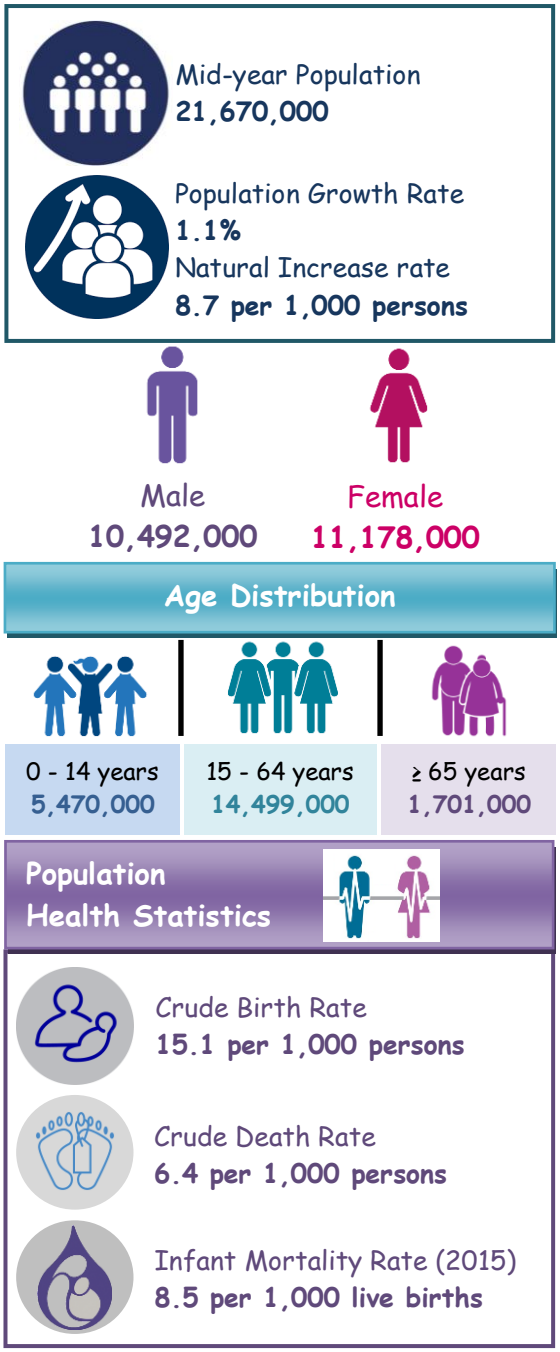


Figure 1.1: Demographic Indicators of Sri Lanka, 2018

Average household size is 3.8 persons. The Colombo Metropolitan Region including the legislative capital, Sri Jayewardenepura Kotte dominates the settlement system of the country. It is also the foremost administrative, commercial, and industrial area and the hub of the transport network of Sri Lanka. Urban settlements outside this area are

much smaller and less diversified in functions. Sri Lanka houses people from many different ethnicities and religions, which give the country a multi-cultural and multi-ethnic identity. Three ethnic groups; Sinhalese, Tamil, and Muslim make up more than 99% of the population. The Sinhalese alone accounting for nearly 75% of the total population. Sri Lankan Tamils are the second major ethnic group with around 11.9% of the total population. Buddhist comprises 70% of the population with the Theravada school being predominant and thus it is the major religion in the country, followed by Hinduism, which is actively practiced by the Tamils. Most Buddhists are of the Sinhalese ethnic group. The next most popular religion is Christianity, especially among the Burgher population.

Sinhala and Tamil are the two official languages of Sri Lanka. The Constitution defines English as the link language that is widely used for education, scientific and commercial purposes. The Sri Lanka's population has an average literacy rate of 92.6% with male literacy at 93.6% and female literacy at 91.7% in 2017. It has the second highest literacy rate in South Asia and overall, one of the highest literacy rates in Asia. Computer literacy, phone user and website user percentages in 2017 were recorded at 28.3%, 105% and 32% respectively.

1.1.2 POLITICAL, LEGAL AND ECONOMIC PROFILE

GOVERNMENT

Democratic Socialist Republic of Sri Lanka is a democratic republic and a unitary state. In fact it is the oldest democracy in Asia. The country is governed by a mixture of a presidential system and a parliamentary system. Most provisions of the constitution can be amended by a two-thirds majority in parliament. The amendment of certain basic features such as the clauses on language, religion, and reference to Sri Lanka as a unitary state require both a two-thirds majority and approval in a nationwide referendum.

In common with many democracies, the Sri Lankan government has three branches.

1. **Executive** (the President of Sri Lanka is the head of state, the commander in chief of the armed forces, head of government, and is popularly elected for a five-year term.)
2. **Legislative** (the Parliament of Sri Lanka for which members are elected by universal suffrage for a five-year term. The parliament reserves the power to make all laws. The Prime Minister leads the ruling party in parliament and shares many executive responsibilities, mainly in domestic affairs.)
3. **Judicial** (consists of a Supreme Court, which is the highest and final superior court of record, a Court of Appeal, High Courts and a number of subordinate courts. The President appoints judges to the Supreme Court, the Court of Appeal, and the High Courts. A judicial service commission, composed of the Chief Justice and two Supreme Court judges, appoints, transfers, and dismisses lower court judges. The common law of Sri Lanka is based largely on Roman-Dutch law.)

ADMINISTRATIVE DIVISIONS

For administrative purposes, Sri Lanka is divided into nine provinces and twenty-five districts. The 13th Amendment to the 1978 constitution established provincial councils for a decentralization of the Government of Sri Lanka.





Figure 1.2: District Map of Sri Lanka

Each provincial council is an autonomous body not under the authority of any Ministry. Some of its functions had been undertaken by central government ministries, departments, corporations, and statutory authorities, but authority over land and police is not as a rule given to provincial councils. Each district is administered under a District Secretariat.

The districts are further subdivided into 256 divisional secretariats, and these, in turn, to approximately 14,008 Grama Niladhari (village level) divisions. There are three other types of local authorities; namely Municipal Councils (18 Nos.), Urban councils (13 Nos.) and Pradeshiya Sabha (256 Nos.).

ECONOMY

Sri Lanka is favorably located in the most dynamic region of the world. Sri Lankan economic history clearly demonstrates that well-designed international economic integration has resulted in dividends for the country. The development of modern ports under British rule raised the strategic importance of the island as a centre of trade. From 1948 to 1977, socialism strongly influenced the government's economic policies. Colonial plantations were dismantled, industries were nationalized, and a welfare state established. In 1977, the free market economy was introduced to the country incorporating privatization, deregulation, and the promotion of private enterprise.

Sri Lanka's main economic sectors are tourism, tea export, clothing, rice production, and other agricultural products. In the 19th and 20th centuries, plantation economy became famous for its production and export of cinnamon, rubber and Ceylon tea, which remains a trademark national export.





In addition to these economic sectors, overseas employment, especially in the Middle East, contributes substantially in foreign exchange.

Following 30 years of civil war that ended in 2009, Sri Lanka's economy grew at an average 5.8 percent during the period of 2010-2017, reflecting a peace dividend and a determined policy thrust towards reconstruction and growth. The economy is transitioning from a predominantly rural-based economy towards a more urbanized economy oriented around manufacturing and services. The country has made significant progress in its socio-economic and human development indicators. Social indicators rank among the highest in South Asia and compare favorably with those in middle-income countries.

The economic activities of GDP in Sri Lanka are divided in to three major sectors; Agriculture, Industry and Services. Contribution for annual GDP growth rate from these sectors during last five years (2014-2018) is graphically presented in Figure 1.3.

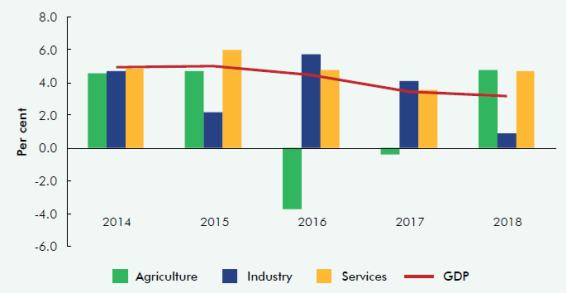


Figure 1.3: Annual GDP Growth Rate
(Central Bank Annual report, 2018)

The vulnerability of the Sri Lankan economy to global and domestic disturbances became increasingly visible in 2018, with a modest expansion in real economic activity amidst a low inflation environment during the year.

Real GDP growth was recorded at 3.2% in 2018, compared to 3.4% in the previous year. This growth was largely supported by services activities that expanded by 4.7% and the recovery in agriculture activities, which recorded a growth of 4.8%. Industry activities slowed down significantly to 0.9% during the year, mainly as a result of the contraction in construction.

According to the expenditure approach, both consumption and investment expenditure supported growth. Investment as a percentage of GDP stood at 28.6% in 2018 compared to 28.8% in the previous year, while the savings-investment gap widened during the year indicating increased dependence on external resources to fill the shortfall.

The total size of the Sri Lankan economy was estimated at US dollars 88.9 billion, while the per capita GDP was recorded at US dollars 4,102 (LKR 666,817) in 2018, which was marginally lower than in the previous year.



The Global Competitive Report, published by the World economic Forum, has described Sri Lanka's economy as transitioning from the factor-driven stage to the efficiency-driven stage and that it ranks 52nd in global competitiveness.

1.1.3 PROFILES OF ECONOMIC SECTORS

Profiles of potentially important economic sectors where mercury use, trade, disposal, emissions or releases may be/is relevant are discussed under this topic.

AGRICULTURE

Agriculture is the most important sector of the Sri Lankan economy, having a rich history dating back more than 2500 years. The primary form of agriculture in Sri Lanka is rice production. For centuries, paddy cultivation was not just an economic activity, but also a way of life that shaped the society, culture, religion and economy. The sustainable and organic agricultural practices of both the near past and the ancient people of Sri Lanka, exemplify the interconnectedness of nature and human life.

Even though its contribution to the GDP declined substantially during the past five decades (from 30% in 1970, 21% in 2000, 11.9% in 2010 to 7% in 2018), agriculture is an important source of employment for the majority of the Sri Lankan workforce. In 2018, agriculture sector provided one-fourth of the countries' employment. It also a major source of foreign exchange earnings and local food production. The agriculture production index, which measures the output of the agriculture and Fisheries sectors, recorded a growth of 10.7% in 2018, compared to a decline of 10.7% in 2017.

Fisheries

The fisheries sector plays a key role in Sri Lanka's social and economic life. Fish products are an important source of animal protein for the population. Exports of fish and fishery products accounts for considerable foreign exchange. In fact, fisheries is the largest contributor for GDP from the agriculture sector with 1.2% share from total GDP in 2018. The fisheries sector of Sri Lanka consists of three main subsectors, namely coastal; offshore and deep sea; and inland and aquaculture. These three subsectors employ around 250,000 active fishers and another 100,000 in support services.

Being island nation seafood is an important protein source in Sri Lanka, which can be a major source of methylmercury. Marine fish production, which accounts for around 83% of total fish production, witnessed a decline of 2.2% to 439,370 tonnes in 2018, largely due to the drop in coastal and lagoon fish production. Meanwhile, offshore fish production increased marginally.

Inland fish production contributed around 17% to the total fish production. It showed an increase of 7.1% to 87,690 tonnes in 2018 compared to the previous year. Inland surface water pollution due to discharge of industrial effluents, agricultural runoff, and leachate from contaminated landfills/waste dump sites may result in an accumulation of the pollutants (specifically heavy metals including mercury) in inland aquatic organisms and even fish kills.

Agrochemical Use

With the global technological advancement, traditional Sri Lankan pest control and soil conditioning practices have been replaced by agrochemical use to optimize the agriculture output.

All agro-pesticides used in the country are imported either as finished products or as technical material, which are then formulated locally. Registrar of Pesticide (ROP) is the legal authority for enforcement of the Control of Pesticides Act No. 33 of 1980, it's amendments and regulations. The Act provides provisions to control, import, packing, labeling, storage, formulation, transport, sale and use of pesticides through registration of individual products. Registration of following pesticides with the following mercury compounds as the active ingredient were legally banded in 2011 by the act.

Banned pesticides with mercury compounds as the active ingredient, and the respective Chemical Abstracts Service (CAS) registry number

- Mercuric(II) chloride: 7487-94-7
- Mercuric oxide:21908-53-2
- Mercury: 7439-97-6
- Mercurous(I) chloride: 7546-30-7

Other pesticides are controlled by the ROP during pesticide imports with strict quality assurance based on sample analysis and authentic foreign quality certificates.

INDUSTRY

Industry sector significantly contributes to the Sri Lankan economy with one fourth share of both the GDP and the total employment.

Power Generation

Electricity in Sri Lanka is generated using three primary sources; thermal power, hydropower and other non-conventional renewable energy sources such as solar power and wind power.

Ceylon Electricity Board (CEB) is the largest electricity company in Sri Lanka that controls all major functions of electricity generation, transmission, distribution and retailing in Sri Lanka. Independent Power Producer (IPP) companies also contribute to electricity generation by adding to national grid.

Thermal power plants of the country run primarily on coal, furnace oil, naptha, diesel and biomass. By February 2019, 80% of the national grid is powered by coal and oil based thermal power plants (Table 1.1).

Table 1.1: Thermal Power Share of Sri Lanka

Energy Source	Generation (GWH)	Contribution to National Grid (%)
Thermal Coal (CEB)	17.65	38.98
Thermal Oil (CEB)	07.25	16.01
Thermal Oil (IPP)	11.20	24.78
Total Thermal	**36.12**	**79.77**

(CEB)

The Lakvijaya Power Station, located in Norochcholai, North Western Province is the only coal fired power plant in the country. It consists of three power generation units of similar capacity (300 MW each), where the first unit was commissioned and synchronized to the national grid in 22nd March 2011.

Oil Refining

There is only one crude oil refining plant in Sri Lanka, which is located in Sapugaskanda, Colombo District, Western Province. This refinery was commissioned in August 1969 to process 38,000 barrels per steam day (BPSD) of Iranian light crude oil, equivalent to 5,200 tonnes per day capacity. Currently, the crude Distiller unit was de-bottlenecked to increase the refining capacity to 50,000 BPSD (6,900 tonnes per day) and is able to process crude oils similar to Iranian light meeting the required specifications. In this refinery, the imported crude oil is refined into Petrol (Octane No. 90 and 95), Auto Diesel, Kerosene, Jet fuel A-1, Heavy Fuel Oil (maximum viscosity 800, 1500 and 3500), Naphtha, Special Boiling Point Liquid, Liquefied Petroleum Gas (LPG) and Asphalt.

Small-scale Gold Mining

Even though Artisanal and Small-scale Gold Mining (ASGM) is not present in Sri Lanka, some isolated incidences of separating gold from river sand were recorded during the recent past, whereas the related mercury usage was not clear.

Cement Production

Puttalam Cement Kiln is the only integrated cement plant in Sri Lanka, located at Puttalam District, North Western Province. The average production rate is 640,000 t of clinker/year.

The main raw material, limestone, is obtained from the Limestone Mine in Aruwakkalu, Puttalam District, which is owned by the cement plant itself. Other raw materials, such as clay, are also supplied locally. The primary kiln fuel is coal imported from Indonesia. Coal fly ash plays an important role in cement manufacturing as a raw material for manufacturing chemically resistant cement. Presently, fly ash is obtained from the Norochcholei Coal Power Plant and a considerable amount is also imported from India. These virgin raw materials (limestone, clay), fossil fuels (coal) and fly ash may naturally contain trace concentrations of mercury.

This cement kiln is also the single facility available in Sri Lanka for thermal destruction of liquid, semi-solid and solid hazardous waste. Even though hazardous wastes are incinerated in the cement kiln, it is not considered as a hazardous waste incinerator as they are co-processed in the kiln as alternative fuels and raw materials (AFR).

Metal Production

Sri Lanka does not produce mercury; hence its domestic requirements are completely met through imports. Primary metal production by extractive metallurgy or production of metal oxides, specifically alumina (aluminum oxide) by refining bauxite via Bayer process is also not done in Sri Lanka. However, metal production from imported billets and metal scrap recycling is widely practiced in the country.

Production of Chemicals

Sri Lanka had a Chlor-Alkali Production Plant at Paranthan in the Northern Province, which ceased manufacturing activities in 1985. In this plant, caustic soda was produced from the solar salt (the main raw material) in the De-Nora type diaphragm cells consisted of a graphite anode and perforated double steel cathode on either side of the anode (Diaphragam process), and the production capacity was about 3,000 tonnes per annum. Recommencement of the Chloro-alkali plant at Paranthan, it is still at the discussion stage.

Therefore, basic chemical manufacturing facilities are currently not available in Sri Lanka. The existing chemical industries involve in formulation of chemical products by use of imported chemicals and active ingredients.

Production of Products with Mercury Content

Sri Lanka has never been involved in the production of mercury containing or mercury added products, thus the total requirement is met through imports. There are only a few florescent lamp assembling plants, for which mercury added light sources and parts are imported.

Metal Recycling

Mercury recycling is not done in Sri Lanka due to the absence of such technology in the country. Only mercury and phosphor powder recovered during fluorescent lights recycling are stored until exporting to Germany for refining.

Metal scrap recycling is a well established industry sub-sector in the country. However, end of life vehicle (ELV) recycling process is not yet established in Sri Lanka.

Iron and steel recycling industry, starting from scrap collection to final smelting,

contributes to the national economy through profit making and providing several direct and indirect job opportunities in both the formal and informal sector. Due to the high demand for iron and steel scrap, it was one of the fastest moving waste streams in the country before 2015. There were 42 registered steel millers, most located Colombo and Gampaha Districts in the Western Province. Annual steel production in 2015 was 1,400,000 tonnes with a 40% share from ferrous scrap. However, in January 2015, global steel billet prices fell to below the cost of melting scrap to make billet and a local tax concession has been given by the 2016 budget proposal for imported billets. Under this situation, steel billet imports have been increased by 35% in 2016 compared to the previous year, and most of the steel industries have ceased their primary scrap smelting operations and shifted to run the operations with imported iron and steel billets.

Among non-ferrous metal recycling industries, aluminum smelting is leading in Sri Lanka. Most of the aluminum recycling plants are of small-scale in which used oil is the crucible fuel. With regard to other metals, four lead acid battery recycling plants are in operation, where two of them are located in industrial zones. The copper recycling industries located in industrial zones governed by the Board of Investment of Sri Lanka (BOI), involve in processing of copper imported mainly from India. According to the requirements of the Basel Convention, all imported scrap copper consignments shall produce a certificate indicating purity level, whereas only the consignments achieving purity level above 95% is released for processing. Also all residues generated from the process shall be re-exported to the country of origin of the scrap.

Metal scraps such as aluminium, copper, brass, pewter, aluminium alloys, special kind of iron, cast iron and steel scraps are being suspended for export with a view to support the local recyclers.

Electrical and Electronic Waste (e-waste) Recycling

The formal e-waste recycling sector is still small and most of them only do partial processing and recycling. Among the 10 registered e-waste recyclers; one is registered for compact fluorescent lamp (CFL) and fluorescence tubes, two for toner cartridges, and the remaining seven for other e-wastes.

Recycling of fluorescent lights is performed by a leading bulb company having a local market share of 48% in CFLs. The collected bulbs are sent to the company-owned recycling plant, which is the first fluorescent lamp recycling company in South Asia. The plant has been operated since 2011. It has capacity to recycle up to 30 million bulbs annually, nearly three times the annual CFL and fluorescent bulb usage in Sri Lanka.

Only one recycling company holds formal approval for the export of cathode ray tubes (CRT), who has recently granted environmental clearance to establish a facility at an industrial zone in Western Province to process e-waste to recover precious metals. Nineteen companies have signed agreements with registered e-waste recyclers as partner companies to manage e-waste generated by the corporate sector in an effective and responsible manner. Other formal recyclers generally collect e-waste through their existing informal network and dismantle to extract metals and plastics, which are sold to local recyclers. Printed circuit boards are exported for recycling while the residuals from dismantling are stocked.

Gold Waste Recovery

Gold craftsmanship is a well-established industry sector in Sri Lanka, whereas traditional gold craftsmen are famous for designer jewellery and jewellery with traditional designs. The National Gem and Jewellery Authority database shows that 2,649 jewellery shops (with or without gold craftsmen shops) are in operation over the country under its purview. However, significant numbers of gold craftsman shops are believed to be un-registered domestic cottage type units, thus the actual number of jewellery craftsmen in the country is likely much higher than this. In Sri Lanka, recovery of gold waste is usually done as an annual practice either by acid treatment or mercury amalgamation where the latter is practiced by most of the traditional gold craftsmen.

Waste Incineration

Incineration of municipal or general waste is not practiced in Sri Lanka (Karunaratne, 2015).

With the approval of relevant authorities, thermal destruction of hazardous waste by means of co-processing in the Puttalam Cement Kiln was started by incinerating the first load of pharmaceutical waste in 2005. In October 2008, the cement kiln demonstrated its ability to thermally destruct hazardous waste to a Thermal Destruction Efficiency exceeding 99.9999%, which is considered to be the acceptable global standard. Thereafter, the first Environmental Protection License for hazardous waste co-processing in the cement kiln was obtained in the same year for a list of hazardous wastes, enabling it to accept a large range of hazardous waste. By 2010, the total customer base consisted of 194 industries where more than 40,000 tonnes of waste was able to be co-processed in the kilns.

Wastewater Treatment

Sewer connections are only available for restricted areas in the Colombo city and for a few other major cities. The Colombo Sewerage System was first built in 1906-1916 with 100 km of sewers, which is currently expanded to 320 km of sewers and 18 pumping stations in north and south catchments. The current system has no treatment plant for sludge and wastewater. A greater Colombo Wastewater Management Project was started in 2010 with financial assistance of Asian Development Bank (ADB) for upgrading the sewerage infrastructure. Under this project, wastewater is presently screened for removal of solidified waste at each pump station and then discharged directly into the Indian Ocean through two long sea-outfalls located at Wellawatte and Mutwal. Piped sewerage facilities managed by the National Water Supply and Drainage Board are available in Rathmalana/Moratuwa, Ja-Ela/Ekala, Hikkaduwa, Kataragama, and Kandy as well as in major housing complexes, located mostly in the Colombo and greater Colombo areas.

In Sri Lanka, twelve BOI administered Industrial Zones are currently in operation from which piped sewerage and sanitation services including the central/common wastewater treatment plant facility is available in ten zones. In addition, there is a specialized, sector-specific, privately-owned industry having a piped sewerage and CWWTP facility.

SERVICES

This is a vital sector to the Sri Lankan economy that accounts for the highest share in terms of GDP (57.7% in 2018) and employment (46.6% in 2018).

Mercury Supply and Trade

Elemental mercury, chemical compounds of mercury and all mercury containing or mercury-added products are imported to the country. The respective import/export figures are recorded in the Sri Lanka Customs database.

Heath Sector

Sri Lanka has a free and universal health care system. It scores higher than the regional average in healthcare having high life expectancy and a lower maternal and infant death rate than its neighbors. It is known for having one of the world's earliest known healthcare systems and has its own indigenous medicine system. By 2018, there are 613 government hospitals with total number of 76, 774 beds that practice western medicine and 109 hospitals with 4,365 beds treating according to the Ayurvedic System (indigenous medicine). The state sector operates the largest number of hospitals in Sri Lanka. In addition, a large number of private hospitals have appeared in Sri Lanka, due to the rising income of people and demand for private healthcare services.

Use of dental amalgam, mercury-added medication and mercury-containing medical devices are the major concerns with respect to mercury use in health care sector.

Majority of dental professionals in Sri Lanka are in the view that mercury amalgams are the best method for tooth filling due to simple techniques, high strength, long durability and less breakage. However, usage of mercury containing dental amalgams in the government sector have been reduced since 2013 and replaced with composite fillings with the intention of banning mercury amalgam usage by the year 2020. Major private hospitals with dental clinics also have taken initiatives to limit usage of dental amalgams. Medical Supplies Division is the main supplier of dental amalgam for government dental health institutions.

Heavy metals, including mercury, are used for 35-40% of all Ayurveda (indigenous medicines). Sri Lanka Ayurvedic Drugs Corporation is the main manufacturer of mercury containing drug preparations. It follows the ayurvedic pharmacopoeia for preparation of ayurvedic drugs by use of a special process for mercury purification that enhances medicinal value of prepared drugs. After this process, mercury is used for drug manufacturing and a special mixture, called Kajjali, is prepared using treated mercury and treated sulphur. In addition, few other government manufacturing institutions and two private manufacturers are involved such drug preparations at present. The indigenous medical institutions obtain drugs from these manufacturers. Presently, the demand for these drugs is higher than the current production/supply.

Manufacturing of homeopathy drugs are not carried out in Sri Lanka, and all homeopathy drugs are imported from India. According to Government Homeopathy Hospital, there are twenty homeopathic preparations containing mercury in trace quantities (nano level), which is undetectable. Homeopathy drugs required by government sector are supplied through State Pharmaceuticals Corporation, while private Homeopathic practitioners shall obtain a drug list registration from Homeopathic Medical Council before import.

Though some bigger hospitals have shifted to digital alternatives, Medical Thermometers and Medical Blood Pressure Gauges (Mercury Sphygmomanometers) containing mercury are still used in most of the

hospitals.

Education Sector

Sri Lanka is one of the few countries in the world that provide universal free education from primary to tertiary stage. The free education system was established in 1945 and schooling is compulsory for nine years from 5^{+} to 13 years of age for every child is in place.

There are 10,174 government schools in the country, where 55% of them have computer facilities for students. In addition, 106 private and special schools and 759 Pirivenas (monastic colleges for the education of buddhist monks) are in operation. To provide tertiary education, Sri Lanka has 15 public universities. A number of private, degree awarding institutions of higher education including medical schools, engineering schools, schools of law, and technical and vocational training schools and National Colleges of Education have emerged in recent times, yet their participation at tertiary level education remains at 5.1%.

Science laboratories in both government and private sector universities, education institutions and schools use metallic mercury mainly as a reference metal to study the physical characteristics. In universities, metallic mercury is also used in experimental apparatus. Other uses of mercury in the education sector include mercury-containing laboratory thermometers and chemical compounds of mercury.

Laboratory Services

There are number of public and private scientific and medical laboratory services in the country. These institutions use metallic mercury, chemical compounds of mercury as well as mercury-containing laboratory thermometers and experimental apparatus.

1.1.4 ENVIRONMENTAL OVERVIEW

GENERAL ENVIRONMENTAL CONDITION

Forest Cover

The current forest cover of Sri Lanka is about 29.7%, which is around 2,088,000 hectares out of which dense forest cover is 23 percent (1,656,000 hectares). Out of the 6,730 assessed wildlife species, 1,751 species have been identified as threatened species according to the National Red List 2012 (Public Investment Programme 2017-2020).

Air Quality

Air pollution has been identified as a growing problem in Sri Lanka mainly due to rapid motorization and industrialization. Also the general trends in energy consumption show increase in petroleum consumption compared with other renewable sources such as bio-fuels and hydropower. Main air pollutants in Sri Lanka include ground-level ozone, carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2) and particle pollution. Recent studies reveal that indoor air quality, open burning of waste and related impacts needs more and more attention.

The industrial emissions are regulated by national ambient air quality standards and source emission standards, while vehicular emissions are controlled by vehicular exhaust emission standards.

Air quality monitoring in Sri Lanka has focused mainly to the Colombo City where most of the economic and urbanization activities are centred. Air quality monitoring in other regional cities and indoor air quality monitoring are very limited or has been carried out for specific reasons, research purposes etc.

The atmospheric pollution in the Greater Colombo area is high, where a significant proportion of the country's population resides and most of the industrialization has occurred. Kandy City, which is located in a valley in the Central Province, has been revealed to have worse air quality than Colombo due to its topography.

The ambient air quality status in Colombo Fort in 2015 and the expected target by 2025 is presented in Table 1.2.

Table 1.2: Ambient Air Quality Targets for Colombo Fort

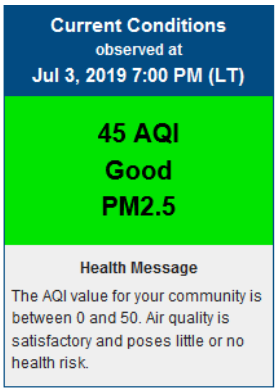
Air Pollutant	Annual Average (2015)	Target (2025)
PM_{10}	63 µg/m^3	50 µg/m^3
SO_2	0.007 ppm (Max. 1-hr Avg. 0.135 ppm)	Further reduce
NO_2	0.018 ppm (Max. 1-hr Avg. 0.085 ppm)	Further reduce

(Clean Air Action Plan 2025)

As per Clean Air Asia Global Satellite-Derived Map of fine particulate matter of 2.5 microns or less ($PM_{2.5}$) averaged over 2001-2006 (µg/m^3), ambient $PM_{2.5}$ of Sri Lanka was below 20 µg/m^3.

The highest SO_2 and NO_2 exposure levels are recorded in Colombo, Gampaha, Kandy and Galle urban areas compared to other areas. Average levels of SO_2 and NO_2 in each location are within the 24 hour average of national ambient air quality standard levels. However, the average NO_2 exposure levels in Colombo, Gampaha, Galle and Kandy areas exceeded the annual WHO Guideline levels and the average SO_2 exposure levels of almost all areas exceeded the 24 hour WHO Guideline levels (NBRO).

The U.S. Department of State and the U.S. Environmental Protection Agency (EPA) are working together to record air quality at U.S. Embassies and Consulates around the globe. As part of this initiative, Colombo U.S. Embassy installed an air quality monitor in central Colombo. The data is available at the 'EPA AirNow' website. The air quality monitoring station is using high-tech laser particle sensors to measure in real-time $PM_{2.5}$ pollution, which is one of the most harmful air pollutants.



US Real-time AQI in Colombo

The US AQI at Colombo is reported to be less than 50 and hence condition of the ambient air is "Good".

The Sri Lanka Air Quality Index (AQI) values were also formulated by Clean Air Asia to help the public understand what local air quality means to their health (Table 1.3). It is proposed to measure O_3, $PM_{2.5}$, PM_{10}, CO, SO_2 and NO_2 under this programme to estimate the Sri Lanka AQI. However, the project implementation is still in progress.

Table 1.3: Sri Lanka AQI

Sri Lanka AQI	Interpretation	Colour Code
0-50	Good	Green
51-100	Moderate	Yellow
101-150	Unhealthy for Sensitive Groups	Pink
151-200	Unhealthy	Red
201-300	Very Unhealthy	Dark Red
301-500	Hazadous	Maroon

(Country Synthesis Report on Urban Air Quality Management, Sri Lanka, ADB, 2006)

Water Quality

Public water bodies of Sri Lanka include rivers, impounded reservoirs, manmade irrigation canals and ground water. There are 103 natural river basins, significant number of reservoirs including ancient irrigation reservoirs and recently constructed multi-purpose reservoirs with a total area of 169,941 hectares and groundwater resources of about 7,800 million m^3 per year. Groundwater is the major source of water especially in rural areas. Based on the available information, about 72% of the rural population relies on groundwater for domestic uses.

Sanitation coverage in Sri Lanka is the best in South Asia. Several water supply development projects were implemented in 2018, while increasing the level of access to safe drinking water. Accordingly, access to safe drinking water has increased to 90.6% of the population and accessibility to pipe borne water also increased to 50.5% by the end of the year.

By 2018, drinking-water coverage is 94%. The remaining 6% of the population consume water by purchasing it from vendors who transport water in very unsanitary plastic containers, by walking more than two km, or from rivers, streams or unprotected wells. Efforts are being made to identify these communities to provide them with improved water supply facilities.

It is difficult to comprehend the trend of water quality in public water bodies due to lack of monitoring data. The Sri Lanka National Water Development Report (2006) pointed out several water quality concerns; contamination by nitrate and bacteria in underground and surface waters mainly due to poor sanitation and untreated wastewater or insufficient wastewater treatment, toxic chemicals from industrial and agricultural activities, and eutrophication in lakes and reservoirs. Microbial contamination caused by poor sanitation systems such as pit latrines is a common groundwater quality problem in the country. Nitrate is also identified in coastal aquifers such as in Jaffna (north coast) and Kalptiya (western coast) due to excessive fertilizer use and untreated wastewater. Contamination due to naturally occurring fluoride and arsenic was identified in some areas of the country. High salinity is also an issue especially in coastal zones, which is exacerbated by excessive groundwater extraction.

Water pollution in coastal water bodies has grown over the past few decades due to rapid development activities and human settlements both in and outside coastal areas. However, studies on coastal water quality are lacking in the country. The Coastal Resource Management Project (CRMP) implemented by the Ministry of Fisheries and Ocean Resources reported organic pollution in sea water of the Beruwala and Unawatuna areas.

Drinking water quality is regulated by Specifications for Potable Water published by Sri Lanka Standards Institution, while three tolerance limits for disposal of wastewater are stipulated by the National Environmental (Protection & Quality) Regulations.

1. Tolerance limits for discharge of industrial waste into to inland surface waters
2. Tolerance limits for industrial waste discharge on land for irrigation purpose
3. Tolerance limits for discharge of industrial and domestic waste into marine coastal areas

Waste Management

The seriousness of waste problems is on the rise due to a surge in the amount of waste generated, attributed mainly to economic development in Sri Lanka. This is one of the top priority issues for most of the Local Authorities (LAs) because they are responsible for executing solid waste management. Generation of MSW is now beyond the capacities of the local authorities.

Total municipal solid waste (MSW) generation in Sri Lanka was about 10,000 tonnes/day in 2016, from which 26% is generated from the Western Province (3 Districts). The average quantity of MSW generated (excluding e-waste) in Colombo Municipal Council area during last five years, was 775 tonnes/day. However, only 38% from the total MSW generation was formally collected by the LAs due to a considerable amount of MSW burning at the point of generation and poor collection systems. Based on avilable literature, MSW in Sri Lanka contains approximately 60% of biodegradable wastes (Figure 1.4).

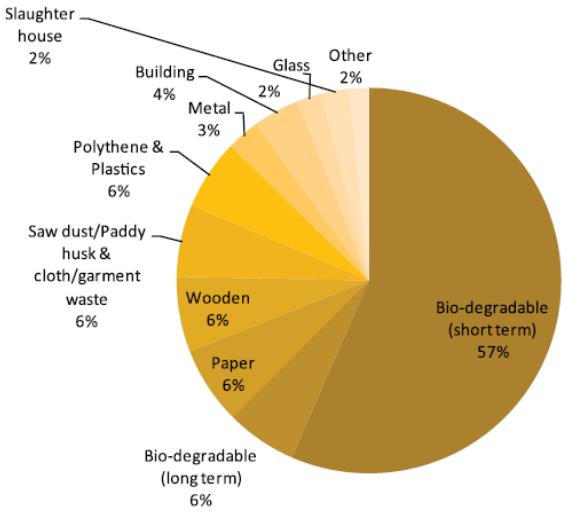


Figure 1.4: Composition of MSW in Sri Lanka

(Public Investment Programme 2017-2020)

Less than 10% of the generated MSW is recycled and only 6% is used for composting and biogas generation. The rest is disposed in sanitary landfills or open dump yards. According to Department of Census and Statistics in 2012, 46.9% of the generated MSW is burned. It can be attributed to poor collection of systems in the peripheral LAs of major towns. Sometimes even within the major cities, garden wastes are set on fire by the generators or the LA workers to get rid of the heaps collected (MMDE, 2016).

Segregation of metal scrap at the source is commonly practiced in Sri Lanka due to its economic value within institutional, industrial and even household levels. Metal scrap collection is well established in Si Lanka and performed by both formal and informal collectors. Other recyclable wastes (plastic and paper) are also directed to waste recycling facilities by both formal and informal collectors.

Hazardous waste including e-waste and clinical waste is currently managed with very limited facilities in the country.

Extreme Climate and Disaster Management

Sri Lanka is a negligible contributor to the global warming with per capita CO_2 emission is 0.25-0.5 tonnes in 2010 (Accessing Asia: Air Pollution and Greenhouse Gas Emissions Indicators for Road Transport and Electricity, Clean Air Asia, 2012). However, being an island, it is highly vulnerable to adverse impacts of climate change. It mainly includes increase in the frequency and intensity of disasters such as prolonged droughts, flash floods and landslides, variability and unpredictability of rainfall patterns, increase in temperature and sea level rise (Public

Investment Programme 2017-2020).

In 2004, almost two-thirds of the Sri Lankan coast was affected by the Indian Ocean Tsunami killing 35,000 people and left 900,000 homeless, highlighting the countries vulnerability to low frequency but high impact events. During the past three years many people lost their lives and shelter due to higher number of intense/heavy rainfall incidents that cause flash floods and landslides. On 14th April 2017, part of the garbage mountain was collapsed; burying more than 20 people alive and displacing 180 families. It was a pseudo-rotational slip that has formed a very steep back scar.

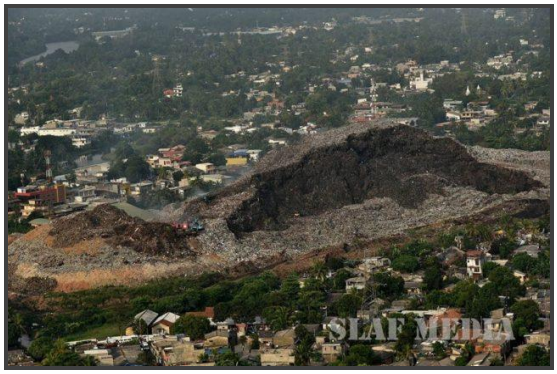


Figure 1.5: Meethotamulla Garbage Dump Site Indicating the Failed Side of the Dump

(Sir Lanka Air Force Image)

Attempts are being made by the relevant authorities on following to minimize vulnerability to disastrous events.

- Protect river bunds and coastal area
- Manage uncontrolled waste dumping
- Establish results based monitoring and evaluation, multi-hazard early warning system and effective dissemination of timely needed information
- Undertake hazard, vulnerability and risk assessment
- Increase the climate resilience of the infrastructure

ENVIRONMENTAL PRIORITIES

The Public Investment Programme 2017-2020 of Sri Lanka, gave high priority to the environment sector in the Government's policy framework in line with the United Nations Sustainable Development Goals (SDGs).

Relevant SDGs

- **Goal 12**: Ensure sustainable consumption and production patterns
- **Goal 13**: Take urgent action to combat climate change and its impact
- **Goal 14**: Conserve and sustainably use the oceans, seas and marine resources for sustainable development
- **Goal 15**: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

The National Mercury Inventory, 2016 of Sri Lanka identified use and disposal of mercury-added products, waste incineration and open waste burning, combustion of coal, other fossil fuels and biomass, informal dumping of general waste and application, use and disposal of dental amalgam fillings as the major mercury sources.

Hence, with regard to the relevant SDGs, there are two key environmental concerns with mercury priorities.

1. Air pollution due to combustion of fossil fuels, waste incineration and open waste burning
2. Land and water contamination due to disposal of mercury-added products, informal waste dumping and disposal of dental amalgam

Chapter II

Mercury Inventory and Identification of Emissions and Resources

The Ministry of Mahaweli Development and Environment of Sri Lanka has initiated work to develop a National Mercury Release Inventory with the aim of identifying mercury sources and quantifying mercury releases. The purpose of this work is to provide national information as a basis for prioritizing measures to reduce mercury releases.

This inventory was performed in 2017 in accordance with UNEnvironment's "Toolkit for Identification and Quantification of Mercury Releases", Guideline for Inventory Level 1 (Version 2.0, January 2017), which is based on mass balances for each mercury release source type. Data for the year 2016 have been used in the inventory, when available. Existing data for the most recent year were taken in to consideration for some mercury source sub-categories, when data from this inventory year was not been available.

2.1 SUMMARY OF MERCURY RELEASES, STOCKPILES, AND SUPPLY AND TRADE

2.1.1 MERCURY RELEASE SOURCE TYPES PRESENT

MAJOR MERCURY RELEASE SOURCE TYPES PRESENT IN SRI LANKA

The mercury release sources identified as present (Y), absent (N) or possible, but not positively identified (?) in Sri Lanka is stated in Table 2.1. Among them, the source types identified as present are included in the quantitative assessment.

Table 0.1: Identification of Mercury Release Sources in the Country

Source Category	Source Present?
Energy Consumption	
Coal combustion in large power plants	Y
Coal combustion in coal fired industrial boilers	Y
Other coal uses	Y
Combustion/use of petroleum coke and heavy oil	Y
Combustion/use of diesel, gasoil, petroleum, kerosene, LPG and other light to medium distillates	Y
Use of raw or pre-cleaned natural gas	N
Use of pipeline gas (consumer quality)	N
Biomass fired power and heat production	Y
Charcoal combustion	Y
Fuel Production	
Oil extraction	N
Oil refining	Y
Extraction and processing of natural gas	N
Primary Metal Production	
Mercury (primary) extraction and initial processing	N
Production of zinc from concentrates	N
Production of copper from concentrates	N
Production of lead from concentrates	N
Gold extraction by methods other than mercury amalgamation	N
Alumina production from bauxite (aluminium production)	N
Primary ferrous metal production (pig iron production)	N
Gold extraction with mercury amalgamation - from whole ore	N
Gold extraction with mercury amalgamation - from concentrate	N

Table 0.2…

Source Category	Source Present?
Other Materials Production	
Cement production	Y
Pulp and paper production	N
Production of chemicals	
Chlor-alkali production with mercury-cells	N
VCM production with mercury catalyst	N
Acetaldehyde production with mercury catalyst	N
Production Of Products with Mercury Content	
Hg thermometers (medical, air, lab, industrial etc.)	N
Electrical switches and relays with mercury	N
Light sources with mercury (fluorescent, compact, others: see guideline)	N
Batteries with mercury	N
Manometers and gauges with mercury	N
Biocides and pesticides with mercury	N
Paints with mercury	N
Skin lightening creams and soaps with mercury chemicals	N
Use and Disposal of Products with Mercury Content	
Dental amalgam fillings ("silver" fillings)	Y
Thermometers	Y
Electrical switches and relays with mercury	?
Light sources with mercury	Y
Batteries with mercury	Y
Polyurethane (PU, PUR) produced with mercury catalyst	N
Paints with mercury preservatives	N
Skin lightening creams and soaps with mercury chemicals	?
Medical blood pressure gauges (mercury sphygmomanometers)	Y
Other manometers and gauges with mercury	Y
Laboratory chemicals	Y
Other laboratory and medical equipment with mercury	Y

Table 0.3…

Source Category	Source Present?
Production of Recycled of Metals	
Production of recycled mercury ("secondary production")	N
Production of recycled ferrous metals (iron and steel)	Y
Waste Incineration	
Incineration of municipal/general waste	N
Incineration of hazardous waste	Y
Incineration / burning of medical waste	Y
Sewage sludge incineration	Y
Open fire waste burning (on landfills and informally)	Y
Waste Deposition/Landfilling and Waste Water Treatment	
Controlled landfills/deposits	Y
Informal dumping of general waste *1	Y
Waste water system/treatment	Y
Crematoria and Cemeteries	
Crematoria	Y
Cemeteries	Y

MINOR MERCURY RELEASE SOURCE TYPES PRESENT IN SRI LANKA

Minor mercury release source types present in the county include following. Evidences for preliminary indication of the possible presence of these minor mercury sources are summarized in Table 2.2.

1. Production of other recycled metals
2. Production of lime
3. Production of light weight aggregates (burnt clay nuts for building purposes)
4. Bougie tubes and Cantor tubes (medical)
5. Educational uses
6. Mercury used in traditional medicines and homeopathic medicine
7. Light houses (leveling bearings in marine navigation lights)
8. Explosives (mercury-fulminate)

Table 0.2: Potential Mercury Sources with Preliminary Indication of Possible Presence in the Country (Not Included in the Quantitative Inventory)

Source Category	Preliminary Indication Of Possible Presence
1. Production of other recycled metals	Al, Pb, Cu, brass recycling plants are available.
2. Production of lime	Biomass is used as the fuel for lime kilns. (Biomass fired power and heat production).
3. Production of light weight aggregates (burnt clay nuts for building purposes)	Roof tiles, brick and pottery industry use biomass fired kilns. (Biomass fired power and heat production)
4. Bougie tubes and Cantor tubes (medical)	During the survey, only 1 Institution was found using Cantor tube.
5. Educational uses	Mercury metal is used as a reference material for following purposes. i. Determination of the atmospheric pressure using quill tube ii. Investigation of the relationship between the pressure and temperature of a gas at constant volume iii. Investigation of the relationship between the volume and temperature of a gas at constant pressure iv. Determination of thermal conductivity of Hg
6. Mercury used in traditional medicines (ayurvedic and others) and homeopathic medicine	Some ayurvedic drugs contain mercury in small quantities. The sole production is carried out by Ayurvedic Corporation, Siddha Hospital and two private manufacturers. In addition, some homeopahy drugs contain undetectable amounts of Hg.
7. Light houses (levelling bearings in marine navigation lights)	Three (3) mechanical rotating equipment were used in light houses under the Sri Lanka Ports Authority (SLPA). Each of these containing 5 kg of mercury.
8. Explosives (mercury-fulminate a.o.)	As per information provided by the Ministry of Defense, aluminium capsules with mercury-fulminate (<0.2 mg in each capsule), Lead azide and Pentaerythritol tetranitrate (PETN, 20 mg in each capsule) imported from India and China is used in metal quarries. The annual requirement of such blasting capsules for metal quarries is 2,500,000 Nos.

2.1.2 SUMMARY OF MERCURY INPUTS TO SOCIETY

Mercury inputs to society (Table 2.3) should be understood here as the mercury amounts made available for potential releases through economic activity in the country. This includes mercury intentionally used in products such as thermometers, blood pressure gauges, fluorescent light bulbs, etc. It also includes mercury mobilized via extraction and use of raw materials which contain mercury in trace concentrations.

The estimated mercury inputs are automatically corrected in the inventory calculation spreadsheet to avoid double counting of mercury inputs (consider the notes given for Table 2.3) and are illustrated in Figure 2.1.

Main Source Groups Contribute with the Major Mercury Inputs

(except waste and wastewater categories)

1. Use and disposal of other products
2. Other fossil fuel and biomass combustion
3. Application, use and disposal of dental amalgam fillings
4. Coal combustion and other coal use
5. Other materials production
6. Crematoria and cemeteries



Table 2.3: Summary of Mercury Inputs to Society

Source Category	Activity Rate	Unit	Estimated Hg Input (kg Hg/y)
Energy Consumption			
Coal combustion in large power plants	2,004,021	Coal combusted, t/y	301
Coal combustion in coal fired industrial boilers	24,000	Coal combusted, t/y	3
Other coal uses	64,300	Coal used, t/y	9
Combustion/use of petroleum coke and heavy oil	598,740	Oil product combusted, t/y	33
Combustion/use of diesel, gasoil, petroleum, kerosene, LPG and other light to medium distillates	4,414,140	Oil product combusted, t/y	24
Biomass fired power and heat production	12,401,590	Biomass combusted, t/y	372
Charcoal combustion	4,060	Charcoal combusted, t/y	0
Fuel Production			
Oil refining	1,746,180	Crude oil refined, t/y	6
Other Materials Production			
Cement production*4	1,103,096	Cement produced, t/y	173
Use and Disposal of Products with Mercury Content			
Dental amalgam fillings ("silver" fillings)	21,203,000	Number of inhabitants	331
Thermometers	244,907	Items sold/y	290
Electrical switches and relays with mercury	21,203,000	Number of inhabitants	?
Light sources with mercury	15,550,436	Items sold/y	184
Batteries with mercury	447	t batteries sold/y	137
Skin lightening creams and soaps with mercury chemicals	0	Cream or soap sold, t/y	?
Medical blood pressure gauges (mercury sphygmomanometers)	36,406	Items sold/y	2,912
Other manometers and gauges with mercury	21,203,000	Number of inhabitants	81
Laboratory chemicals	21,203,000	Number of inhabitants	162
Other laboratory and medical equipment with mercury	21,203,000	Number of inhabitants	650
Production of Recycled of Metals			
Production of recycled ferrous metals (iron and steel)	186,500	Number of vehicles recycled/y	205
Incineration of hazardous waste*1	14,262	Waste incinerated, t/y	342
Incineration/burning of medical waste*1	7,200	Waste incinerated, t/y	173
Sewage sludge incineration*1	129	Waste incinerated, t/y	0
Open fire waste burning (on landfills and informally)*1	2,354,365	Waste burned, t/y	11,772
Waste Deposition/Landfilling and Waste Water Treatment			
Controlled landfills/deposits*1	11,160	Waste landfilled, t/y	56
Informal dumping of general waste *1*2	792,080	Waste dumped, t/y	3,960
Wastewater system/treatment*3	710,088,536	Waste water, m^3/y	3,728
Crematoria and Cemeteries			
Crematoria	38,660	Corpses cremated/y	97
Cemeteries	12,033	Corpses buried/y	30
TOTAL of Quantified Inputs*1*2*3*4			**7,620**



Notes to Table 2.3

*1: To avoid double counting of mercury inputs from waste and products in the input TOTAL, only 10% of the mercury input to waste incineration sources, waste deposition and informal dumping is included in the total for mercury inputs. These 10% represent approximately the mercury input to waste from materials which were not quantified individually in Inventory Level 1 of this Toolkit.

*2: The estimated quantities include mercury in products which has also been accounted for under each product category. To avoid double counting, the release to land from informal dumping of general waste has been subtracted automatically in the TOTALS.

*3: The estimated input and release to water include mercury amounts which have also been accounted for under each source category. To avoid double counting, input to, and release to water from, waste water system/treatment have been subtracted automatically in the TOTALS.

*4: To avoid double counting, fossil fuel mercury contributions to cement production was subtracted automatically in the TOTALS.

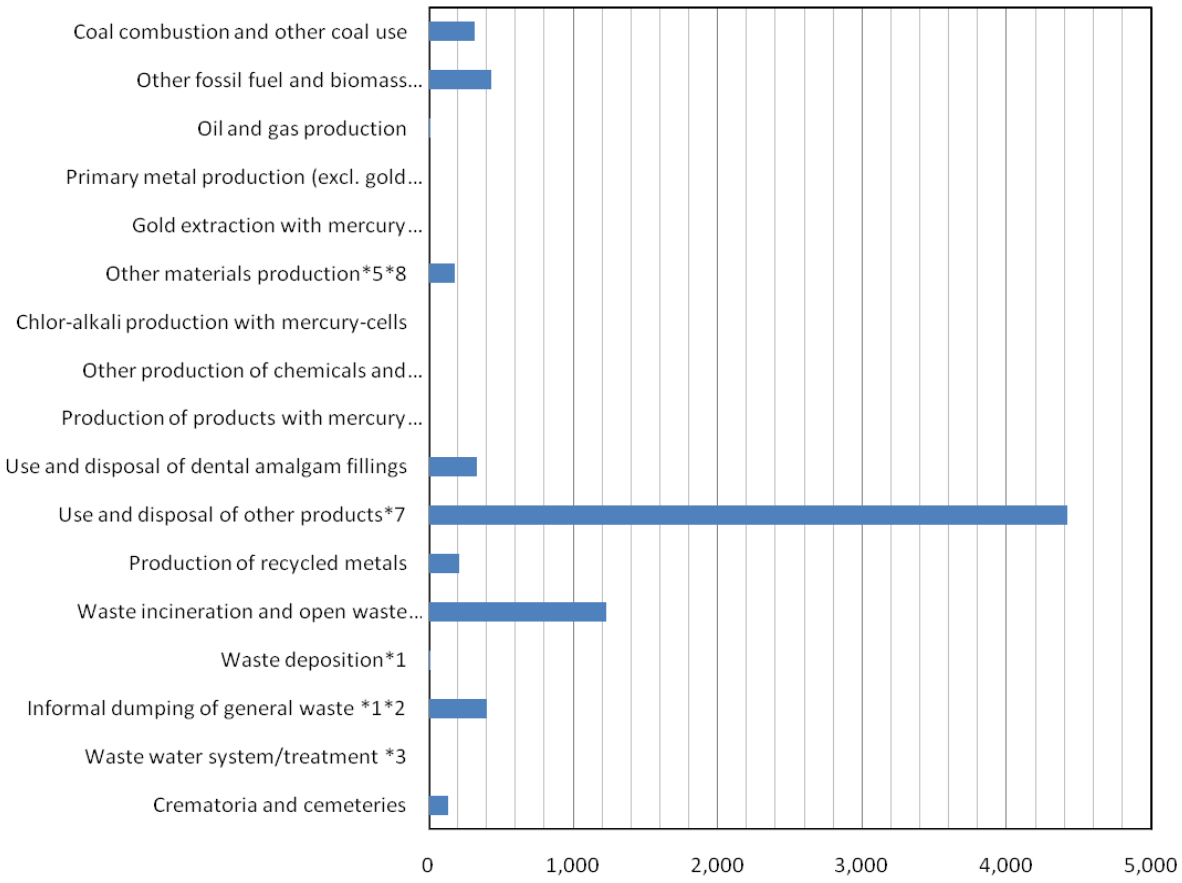


Figure 2.1: Estimated Mercury Inputs (kg Hg/y)

2.1.3 SUMMARY OF MERCURY RELEASES

Summary of mercury releases from all source categories present is given in Table 2.4. The key mercury releases considered here are releases to air (the atmosphere), to water (marine and freshwater bodies, including via waste water systems), to land, to general waste, and to sectors specific waste treatment. An additional output pathway is considered as "by-products and impurities", which designate mercury flows back into the market with by-products and products where mercury does not play an intentional role.

The origin of mercury in waste and wastewater produced in the country is mercury in products and materials. Waste fractions and wastewater do therefore not represent original mercury inputs to society (except imported waste). Waste and wastewater may however represent substantial flows of mercury through society.

Estimated mercury releases to air, water, land, by-products and impurities, general waste, sector specific waste treatment and disposal from the electronic calculation spreadsheet is depicted in Figures 2.2 -2.7 respectively.

Table 2.4: Summary of Mercury Releases

Source Category	Estimated Hg Releases (kg Hg/y)					
	Air	Water	Land	By-products and Impurities	General waste	Sector Specific Waste Treatment /Disposal
Energy Consumption						
Coal combustion in large power plants	174.3	0.0	0.0	0.0	0.0	126.3
Coal combustion in coal fired industrial boilers	2.2	0.0	0.0	0.0	0.0	1.0
Other coal uses	8.6	0.0	0.0	0.0	0.0	0.0
Combustion/use of petroleum coke and heavy oil	32.9	0.0	0.0	0.0	0.0	0.0
Combustion/use of diesel, gasoil, petroleum, kerosene, LPG and other light to medium distillates	24.3	0.0	0.0	0.0	0.0	0.0
Biomass fired power and heat production	372.0	0.0	0.0	0.0	0.0	0.0
Charcoal combustion	0.5	0.0	0.0	0.0	0.0	0.0
Fuel Production						
Oil refining	1.5	0.1	0.0	0.0	0.0	0.9
Other Materials Production						
Cement production*4	120.8	0.0	0.0	51.8	0.0	0.0

Table 2.4…

Source Category	Estimated Hg Releases (kg Hg/y)					
	Air	Water	Land	By-products and Impurities	General waste	Sector Specific Waste Treatment /Disposal
Use and Disposal of Products with Mercury Content…						
Dental amalgam fillings ("silver" fillings)	6.6	145.8	26.5	19.9	66.3	66.3
Thermometers	58.0	87.1	58.0	0.0	87.1	0.0
Electrical switches and relays with mercury	?	?	?	?	?	?
Light sources with mercury	55.3	0.0	55.3	0.0	73.8	0.0
Batteries with mercury	34.3	0.0	34.3	0.0	68.6	0.0
Skin lightening creams and soaps with mercury chemicals	?	?	?	?	?	?
Medical blood pressure gauges (mercury sphygmomanometers)	582.5	873.7	582.5	0.0	873.7	0.0
Other manometers and gauges with mercury	16.2	24.4	16.2	0.0	24.4	0.0
Laboratory chemicals	0.0	53.6	0.0	0.0	53.6	55.2
Other laboratory and medical equipment with mercury	0.0	214.4	0.0	0.0	214.4	220.9
Production of Recycled of Metals						
Production of recycled ferrous metals (iron and steel)	67.7	0.0	69.8	0.0	67.7	0.0
Waste Incineration						
Incineration of hazardous waste	308.1	0.0	0.0	0.0	0.0	34.2
Incineration/burning of medical waste	165.7	0.0	0.0	0.0	0.0	7.1
Sewage sludge incineration	0.2	0.0	0.0	0.0	0.0	0.0
Open fire waste burning (on landfills and informally)	11,771.8	0.0	0.0	0.0	0.0	0.0
Waste Deposition/ Landfilling and Waste Water Treatment						
Controlled landfills/deposits	0.6	0.0	0.0	-	-	-
Informal dumping of general waste *2	396.0	396.0	3,168.3	-	-	-
Wastewater system/treatment *3	0.0	3,728.0	0.0	0.0	0.0	0.0
Crematoria and Cemeteries						
Crematoria	96.7	0.0	0.0	-	0.0	0.0
Cemeteries	0.0	0.0	30.1	-	0.0	0.0
TOTAL of Quantified Releases 2*3*4	**14,290.0**	**1,800.0**	**1,090.0**	**70.0**	**1,700.0**	**680.0**

Note: Mass balance error was identified. However since the Level 1 mercury inventory is entirely based on default settings of the UNEP TOOLKIT Calculation Spreadsheet, it is expected to submit a review paper in this regard.



RELEASES TO AIR

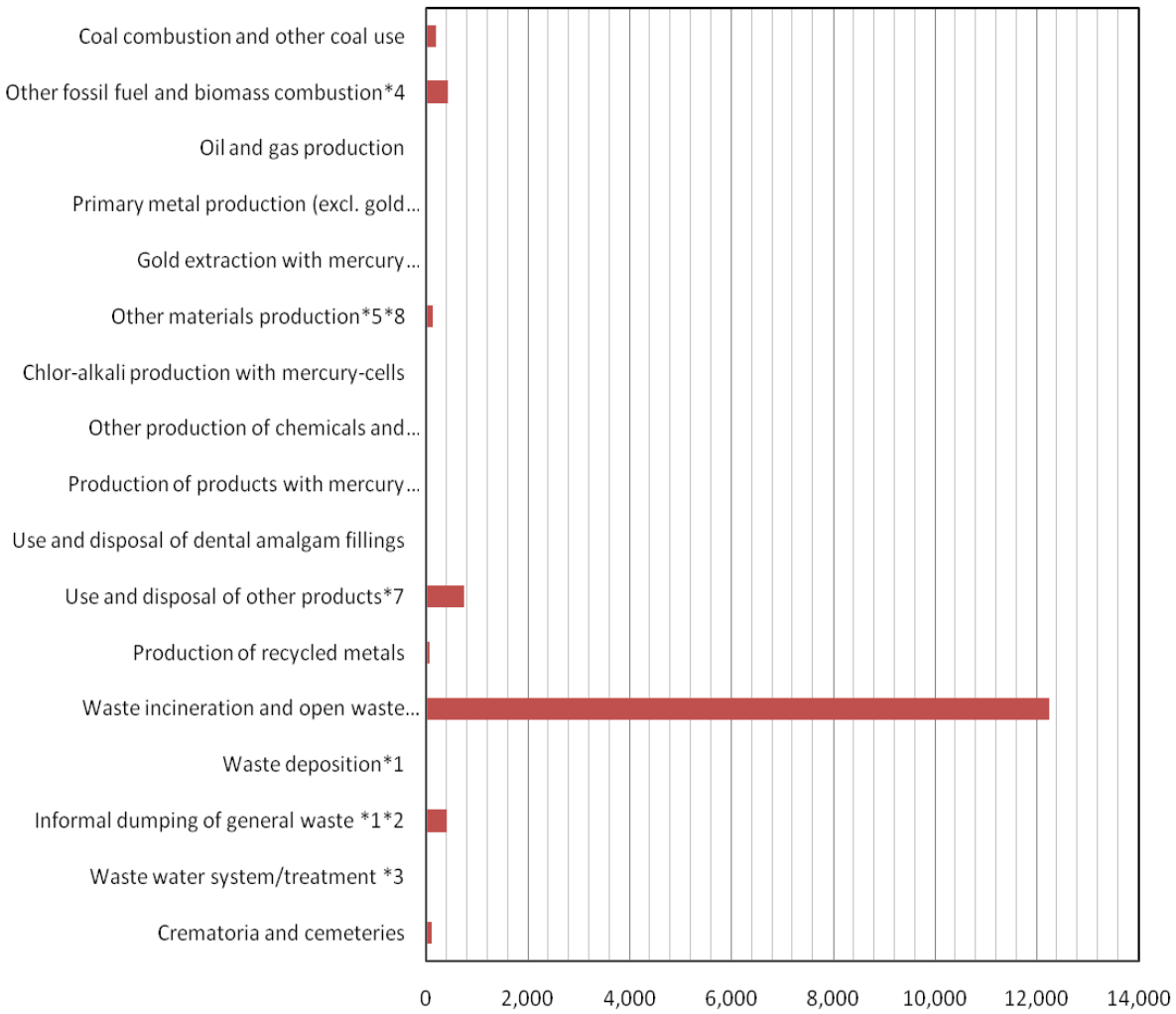


Figure 2.2: Estimated Mercury Release to Air (kg Hg/y)

Sources of the Highest Mercury Releases to the Atmosphere

(Including waste and wastewater categories)

1. Open fire waste burning (on landfills and informally); (11,771.8 kg Hg/y)
2. Medical blood pressure gauges (mercury sphygmomanometers); (582.5 kg Hg/y)
3. Informal dumping of general waste; (396 kg Hg/y)
4. Biomass fired power and heat production; (372 kg Hg/y)
5. Incineration of hazardous waste; (308.1 kg Hg/y)

RELEASES TO WATER

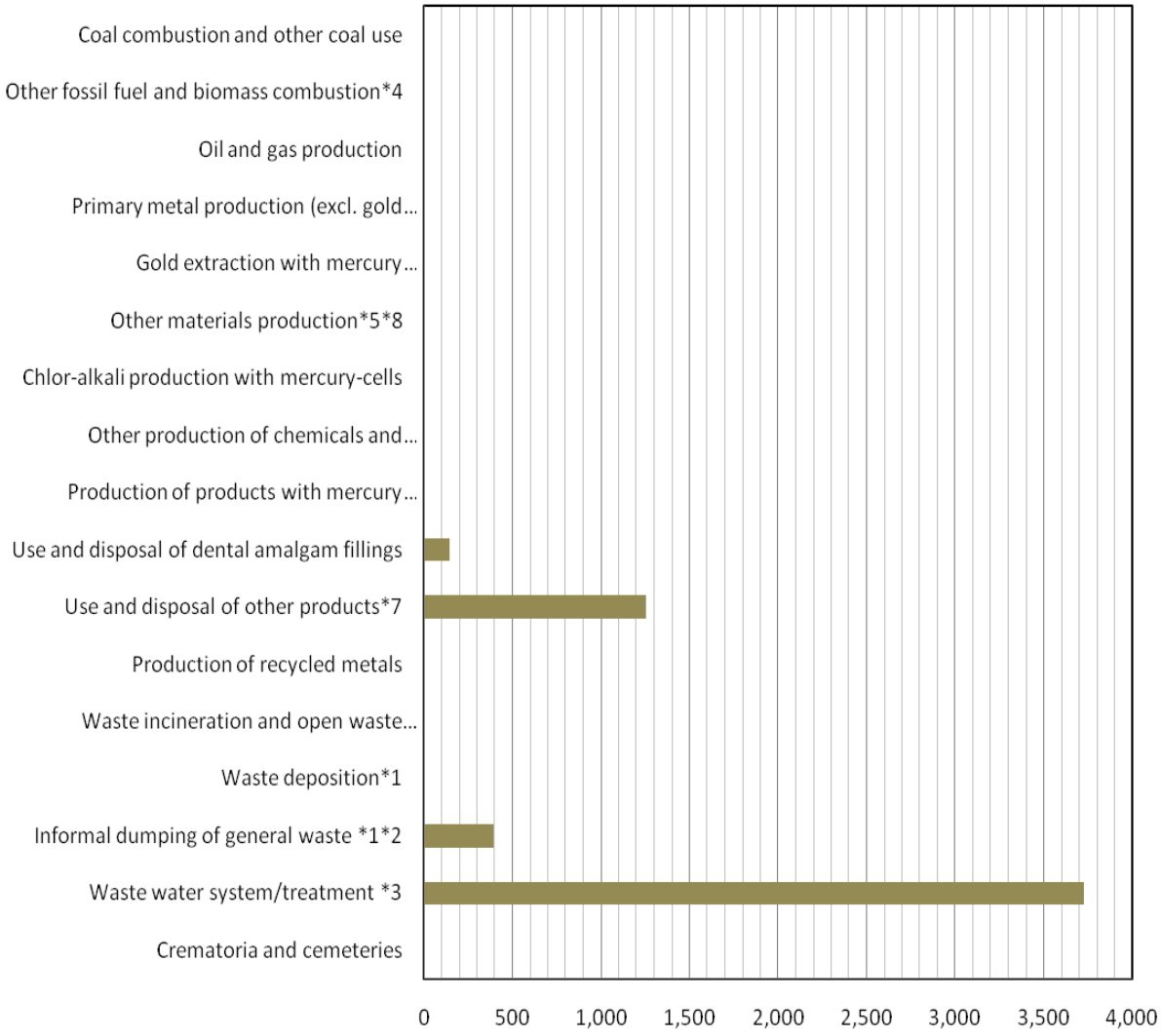


Figure 2.3: Estimated Mercury Releases to Water (kg Hg/y)

Major Sources of Mercury Releases to Water

1. Wastewater system/treatment; (3,728 kg Hg/y)
2. Use and disposal of other products; (1,253 kg Hg/y)
   - Medical blood pressure gauges (mercury sphygmomanometers); (873.7 kg Hg/y)
   - Other laboratory and medical equipment with Hg; (214.4 kg Hg/y)
   - Thermometers; (87.1 kg Hg/y)
   - Laboratory chemicals; (53.6 kg Hg/y)
   - Other manometers and gauges with Hg; (24.4 kg Hg/y)
3. Informal dumping of general waste; (396 kg Hg/y)
4. Use and disposal of dental amalgam fillings; (146 kg Hg/y)

RELEASES TO LAND

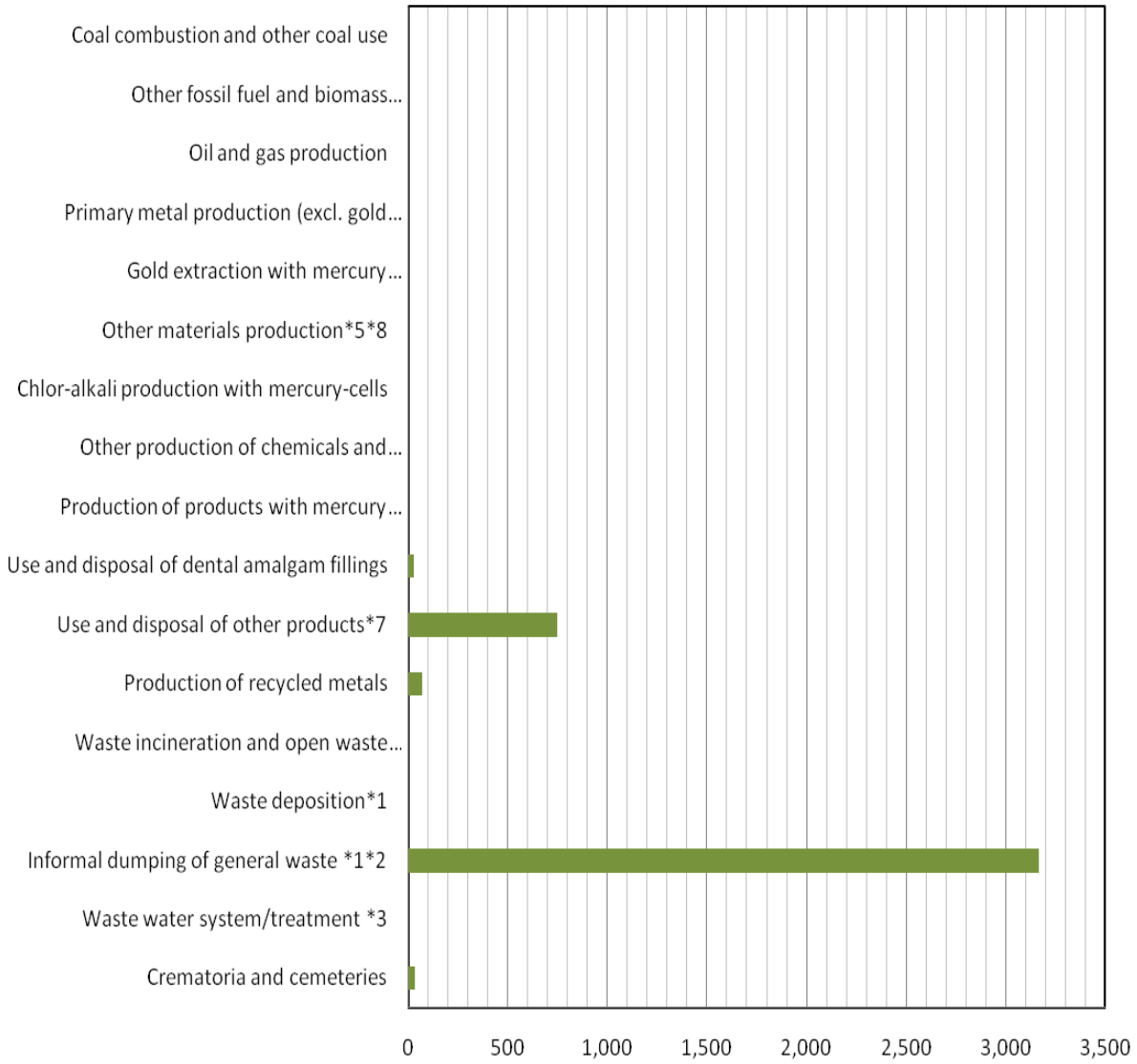


Figure 2.4: Estimated Mercury Releases to Land (kg Hg/y)

Major Sources of Mercury Releases to Land

1. Informal dumping of general waste; (3,168 kg Hg/y)
2. Use and disposal of other products; (746kg Hg/y)
   - Medical blood pressure gauges (mercury sphygmomanometers) ; (582.5 kg Hg/y)
   - Thermometers; (58 kg Hg/y)
   - Light sources with mercury; (55.3 kg Hg/y)
   - Batteries with mercury; (34.3 kg Hg/y)
   - Other manometers and gauges with Hg; (16.2 kg Hg/y)
3. Production of recycled metals; (70 kg Hg/y)
4. Crematoria and cemeteries; (30 kg Hg/y)
   - Cemeteries; (30.1 kg Hg/y)
5. Use and disposal of dental amalgam fillings; (27 kg Hg/y)

RELEASES TO BY-PRODUCTS AND IMPURITIES

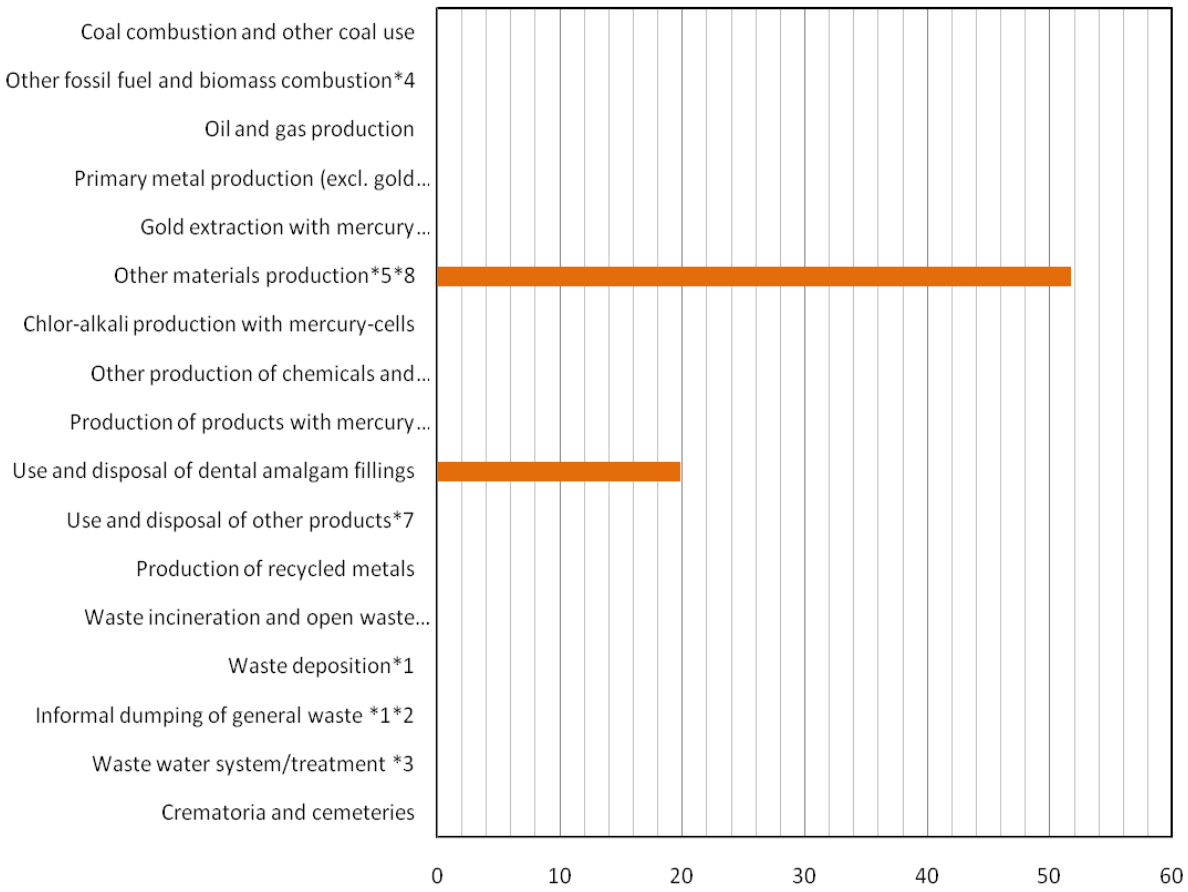


Figure 2.5: Estimated Mercury Outputs to By-Products and Impurities (kg Hg/y)

Mercury Source Categories of Mercury Outputs to By-Products and Impurities

1. Other materials production; (52 kg Hg/y)
   - Cement production; (51.8 kg Hg/y)
2. Use and disposal of dental amalgam fillings; (20 kg Hg/y)

RELEASES TO GENERAL WASTE

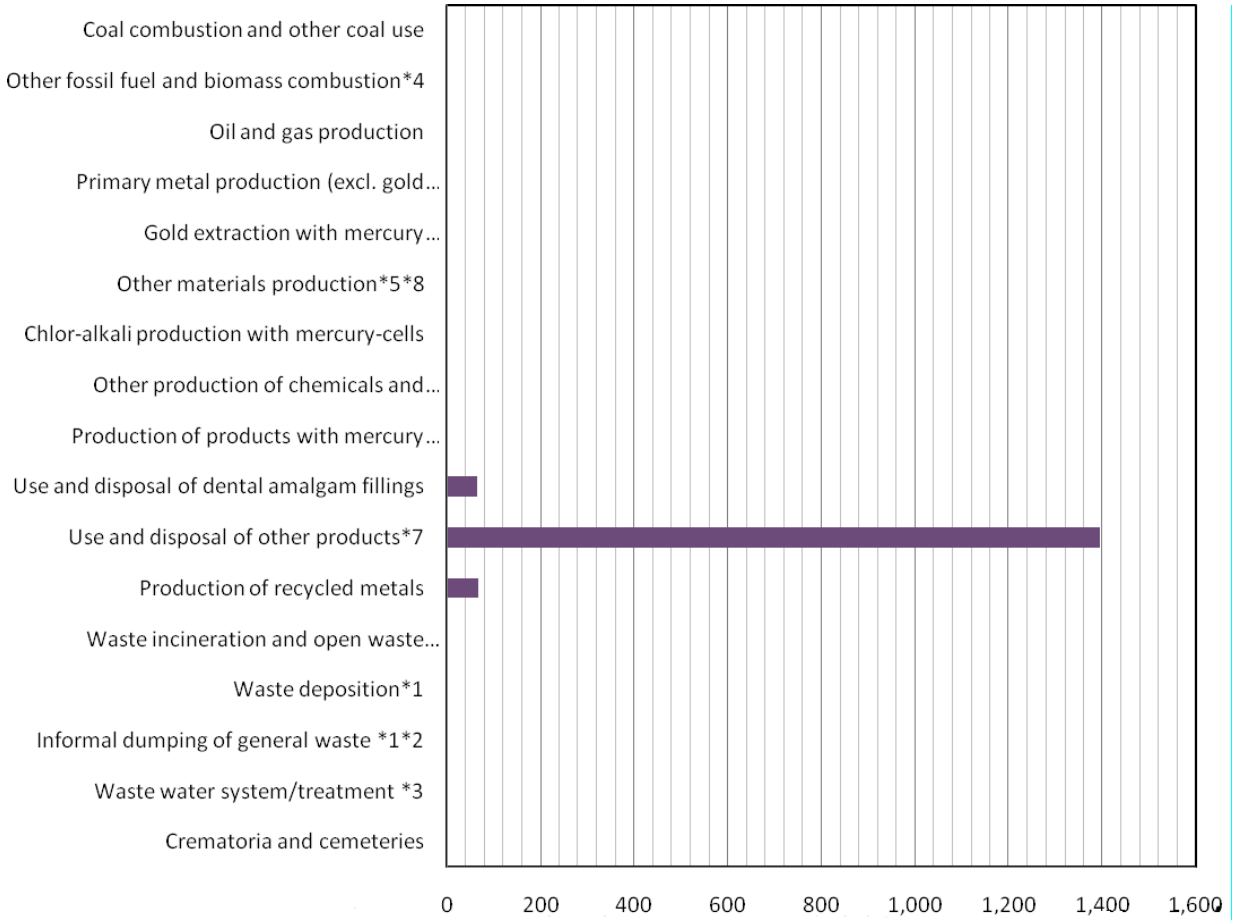


Figure 2.6: Estimated Mercury Releases to General Waste (kg Hg/y)

Mercury Source Categories for Mercury Releases to General Waste

1. Use and disposal of other products; (1,396 kg Hg/y)
   - Medical blood pressure gauges (mercury sphygmomanometers) ; (873.7 kg Hg/y)
   - Other laboratory and medical equipment with Hg; (214.4 kg Hg/y)
   - Thermometers; (87.1 kg Hg/y)
   - Light sources with Hg; (73.8 kg Hg/y)
   - Batteries with Hg; (68.6 kg Hg/y)
   - Laboratory chemicals; (53.6 kg Hg/y)
   - Other manometers and gauges with Hg; (24.4 kg Hg/y)
2. Production of recycled metals; (68 kg Hg/y)
3. Use and disposal of dental amalgam fillings; (66 kg Hg/y)

RELEASES TO SECTOR SPECIFIC WASTE TREATMENT/DISPOSAL

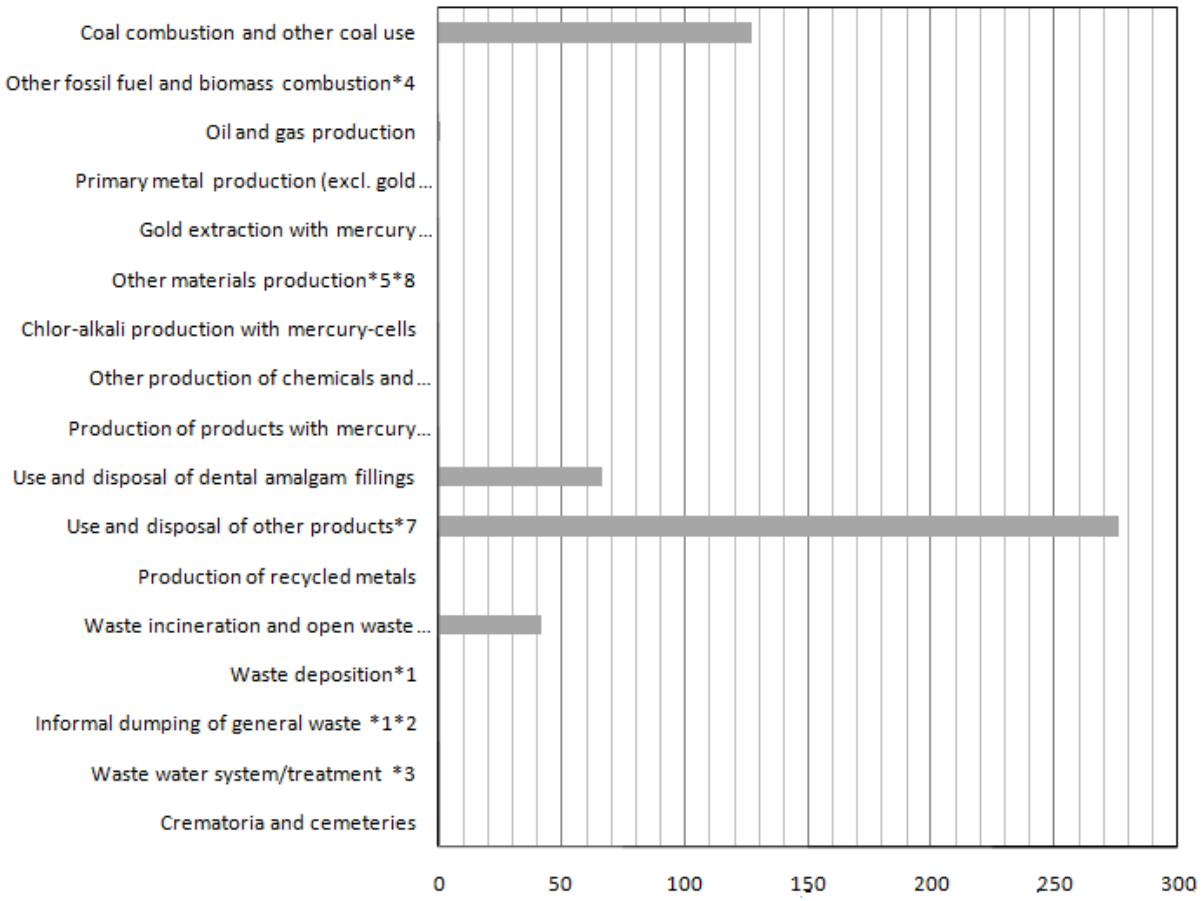


Figure 2.7: Estimated Mercury Releases, Sector Spec. Waste (kg Hg/y)

Sources of Mercury Releases in Sector Specific Waste Treatment

1. Use and disposal of other products; (276 kg Hg/y)
   - Other laboratory and medical equipment with Hg; (220.9 kg Hg/y)
   - Laboratory chemicals; (55.2 kg Hg/y)
2. Coal combustion and other coal use; (127 kg Hg/y)
   - Coal combustion in large power plants; (126.3 kg Hg/y)
   - Coal combustion in coal fired industrial boilers; (1 kg Hg/y)
3. Use and disposal of dental amalgam fillings; (66 kg Hg/y)
4. Waste incineration and open waste burning; (41 kg Hg/y)
   - Incineration of hazardous waste; (34.2 kg Hg/y)
   - Incineration/burning of medical waste; (7.1 kg Hg/y)

2.1.4 SUMMARY OF MERCURY STOCKPILES, AND SUPPLY AND TRADE

Mercury is not mined in Sri Lanka and its demand of domestic use is totally met by imports. This commodity is freely traded within and between countries, due to the absence of domestic or international laws governing mercury supply and trade. However, a few countries including European Union and the USA have announced an export ban on mercury in order to reduce the total mercury availability in global circulation.

As per Article 3 of the Minamata Convention on Mercury, as a Party, Sri Lanka shall identify stocks of mercury or mercury compounds exceeding 50 tonnes and 10 tonnes per year within its territory. However, in the absence of primary mercury mines, production facilities for mercury-added products, or facilities reliant on processes that use mercury or mercury compounds such as chlor-alkali facilities, and military storage facilities or government storage facilities in Sri Lanka, such large stocks of mercury was not identified within the country.

The 8.8 tonnes stock of recovered mercury and phosphor powder (mercury waste) maintained at the fluorescent bulb recycling facility can be considered as the reported highest stock of mercury compound in the country.

No mercury exports were done after export of 33 kg in 2005. With regard to mercury imports, there is a remarkable decrease in imported quantity along with huge price increment after 2017, which could be due to the enforcement of this convention in the same year.

2.2 DATA AND INVENTORY ON ENERGY CONSUMPTION AND FUEL PRODUCTION

The main energy supply forms currently being used to meet the energy demands of the country are; Biomass, Petroleum, Coal and Electricity[1] (SLSEA, An Analysis of the Energy Sector Performance). In addition, coconut shell charcoal is found to be use in small-scale energy applications. Hence, activity rates for the following mercury release sub-categories were used to estimate the respective mercury input figures of the Level 1 mercury inventory.

2.2.1 ENERGY CONSUMPTION

COAL COMBUSTION IN LARGE POWER PLANTS

In Sri Lanka, only one coal fired thermal power plant is in operation under the purview of CEB. The total generation capacity of the coal power plant in 2016 was 900 MW, whereas the annual gross generation was 5,068 GWh and percentage contribution to the generation mix was about 35% (PUCSL, 2016). Table 2.5 summarizes the total amount of coal received at the jetty, countries of origin of the imported coal, and annual coal consumption for power generation during the period of 2012-2016.

[1] Conversion of primary energy resources to a more usable form that vary from producing electricity from the renewable energy sources (hydro power, biomass, solar and wind) and non-renewable energy sources (coal and petroleum oil)

Table 2.5: Annual Coal Usage of the Coal Power Plant and Country of Origin of Coal

Year	Amount of Coal Received (tonnes)	Country of Origin of Coal (tonnes)			Coal Consumption (tonnes)
		Indonesia	South Africa	Russia	
2012	739,948	739,948	-	-	609,239
2013	1,032,510	851,693	180,817	-	677,633
2014	1,551,148	733,844	-	817,304	1,371,539
2015	1,702,222	218,182	965,737	518,303	1,880,012
2016	**2,198,480**	**-**	**1,982,819**	**215,661**	**2,004,021**

(CEB)

Flue Gas Cleaning:

Each power generation unit is equipped with an Electro Static Precipitator (ESP) of 99.5% efficiency followed by a once through wet Flue Gas De-sulphurisation (FGD) for acid gas scrubbing. Source emission monitoring data for mercury is not available.

Coal Yard:

An anti-seepage structure of 500 mm poor coal, 300 mm crushed stone, 200 mm sand, anti-seepage geo-membrane, and leveling and compaction of the original soil were constructed in the coal yard.

Ash Handling:

Compacted bottom ash (60 tonnes/day) is dumped in an ash yard with an anti-seepage structure of 300 mm thick stone protection, 200 mm thick gravel bedding and 1 mm High Density Poly Ethylene (HDPE) layer. The ESP collects about 850 tonnes of coal fly ash every day, from which a part is sold to cement manufacturers, roofing sheets manufacturers and brick manufacturers where the rest is dumped in the ash yard. Test results indicated that mercury was not detected in fly ash and bottom ash samples tested (limit of detection, 0.05 mg/kg).

COAL COMBUSTION IN COAL FIRED INDUSTRIAL BOILERS

In 2016, only two (2) coal fired industrial boilers were in operation in two large-scale textile industries; one for steam and power generation and the rest is for steam generation only. The annual average coal consumption for these industrial boilers was estimated at 24,000 tonnes.

Flue Gas Cleaning:

During normal operation of one boiler, flue gas is cleaned by an ESP, whereas a wet scrubber is used during both the start-up and stand-by operation modes. The other boiler is equipped with a pulse-jet fabric filter, a cyclone separator and a wet scrubber to be used in general, start-up and stand-by operations respectively.

OTHER COAL USES

Coal Use in Clinker Production

Apart from coal use for power generation and industrial boilers, coal is mainly used in clinker production. The Puttalam Cement Works (PCW) is the only fully integrated cement manufacturing plant in Sri Lanka. In this plant, high-grade coal (gross calorific value>6300 kcal/kg) imported from Indonesia is used as the energy source in clinker production (for primary firing of the rotary kiln). Respective coal import data during the period of 2012-2016 is given in Table 2.6.

Table 2.6: Annual Coal Consumption in Cement Production

Year	Imported Coal Amount (tonnes)
2012	76,491
2013	81,084
2014	93,665
2015	101,550
2016	**64,245**

(Siam City Cement (Lanka) Limited)

Coal Use in Transportation

Based on 2016 import data obtained from SLC, 55.15 tonnes of coal was imported from United Kingdom and Zimbabwe by a travelling agency to be utilized for a tourist train powered by a coal engine.

COMBUSTION/USE OF PETROLEUM COKE AND HEAVY OIL

A few years back, the glass manufacturing industry (there is only one industry in Sri Lanka) and a large-scale steel manufacturing industry requested to use petroleum coke (pet coke) as the energy source. However, permission was not granted by the authorities due to its high sulphur content.

Furnace Oil/Fuel Oil (FO) is mainly used for thermal power generation and for industrial heating purposes (i.e. boilers, thermic fluid heaters, incinerators, furnaces). However, due to difficulty in finding fuel consumption data at the point of use, annual sales figures for the inventory year (2016) was obtained from the Sri Lanka Sustainable Energy Authority (SLSEA) (Table 2.7). It was assumed that the total amount of FO sold in a given year has been consumed within the same year.

Table 2.7: Annual Sales Figures of FO (2016)

Use Category	Annual Sales Amount	
	(tonnes)	%
Domestic Sales	**532,750**	**88.98**
Commercial	375,580	62.73
Power Generation	156,970	26.22
Estates Sector	200	0.03
Domestic Bunkers	**65,990**	**11.02**
Total	**598,740**	

(Sri Lanka Energy Balance, SLSEA)

The MIA survey findings revealed that the thermal power plants run on FO are not equipped with any air pollution control (APC) system. In contrast, APC systems were found to be installed in some FO fired boilers, thermic fluid heaters, incinerators, furnaces. However, due to a lack of central data sources for such data, the estimation of commercial/industrial facilities having FO fired units with APC systems (as a percentage) by individual industry survey was impractical.

COMBUSTION/USE OF DIESEL, GASOIL, PETROLEUM, KEROSENE, LPG AND OTHER LIGHT TO MEDIUM DISTILLATES

Light to medium petroleum distillates are consumed by transport, industrial and household sectors. Due to the difficulty in obtaining consumption data at the point of use, annual sales in the inventory year (2016) as depicted in Table 2.8 were utilized and it was assumed that all distillates sold would be used within the same year.

Accordingly, more than 99% of light to medium petroleum distillates was consumed for domestic use in the year 2016, from which majority was for the transport sector (≈ 84%) and the rest is for power generation (≈ 9%), industrial (for LPG, Kerosene, Auto Diesel fired heating units) and household purposes (LPG and Kerosene).

Table 2.8: Annual Sales Figures of Light to Medium Petroleum Distillates (2016)

Use Category	Annual Sales Amount	
	(tonnes)	%
Domestic	**4,401,140**	**99.71**
LPG	356,000	8.06
Naphtha	174,270	3.95
Power Generation	174,270	3.95
Gasoline	1,463,060	33.14
Transport	1,463,060	33.14
Kerosene	172,380	3.91
Industrial	5,670	0.13
Household	166,710	3.78
Auto Diesel	2,148,790	48.68
Transport	1,902,580	43.10
Industrial	21,670	0.49
Power Generation	223,970	5.07
Estates Sector	570	0.01
Super Diesel	86,640	1.96
Transport	86,640	1.96
Domestic Bunkers	**1,280**	**0.03**
Marine Gas Oil	1,280	0.03
Domestic Aviation	**2,850**	**0.06**
Avtur	2,710	0.06
Avgas	140	0.00
Packaged Products	**8,870**	**0.20**
LPG	8,870	0.20
Total	**4,414,140**	

(Sri Lanka Energy Balance, SLSEA)

Thermal power plants run on Naptha and Auto Diesel are not equipped with any APC for mercury control. Since LPG, Kerosene and Auto Diesel are considered as clean fuels, industrial heating units run by these fuels were believed to be operated without any flue gas cleaning APC mechanisms.

BIOMASS FIRED POWER AND HEAT PRODUCTION

Biomass shared a prominent place in the Sri Lankan primary energy supply, where the overall quantity of biomass demand has a consistent upward trend with increases in total energy demand (Figure 2.8). Firewood[2], saw dust, paddy husk, coconut shells and process waste[3] were the most noticeable biomass types used in energy applications in Sri Lanka (SLSEA, 2015).

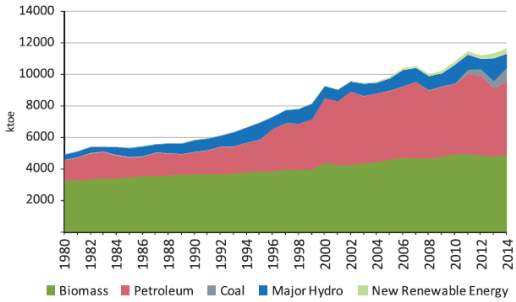


Figure 2.8: Total Primary Energy Supply (By Source)
(SLSEA, 2015)

Biomass Fired Power Production

By 30 June 2015, three dendro power plants, two paddy husk fired power plants, and one waste heat recovery plant (coconut shell gasification plant) have been commissioned under the biomass category. All these power plants are located in remote areas of the country. Cumulative addition of the six commissioned biomass based power plants was 23.5 MW, from which 41.2 GWh of biomass electricity was provided to the national grid in 2014 (SLSEA, 2015).

[2] Rubber wood, mixed firewood, gliricidia and cinnamon wood

[3] Bagasse, the fibre remaining after the extraction of the sugar-bearing juice from sugarcane is used on-site for energy applications by sugar mills and is not used in outside industries. Empty palm fruits, empty cocoa shells, waste tea, different process wastes, reject products and sludge of water treatment plants were also seen as fuel for boilers (SLSEA, 2015).

Biomass Fired Heat Production (Household, Commercial/Industrial and Other Applications)

Biomass resources are largely utilized for domestic cooking and water heating applications in Sri Lanka. With increases in the price of fossil fuels in the domestic market, industries started using biomass to operate their boilers, driers, furnace, etc. For example, vast majority of tea factories have switched to biomass energy. High consumption of fire wood and saw dust was recorded in the BOI industrial zones at Biyagama, Seethawaka and Horana. Furthermore, many small-scale industries viz. brick, bakery, tile, lime, pottery use biomass as a source of thermal energy (SLSEA, 2015).

In 2015, the largest biomass consumption of the firewood equivalent was observed in the brick industry (1,081,000 t/year), followed by the tea industry (769,000 t/year). However, the tea industry is the highest consumer of firewood (705,000 t/year). The textile industry is moving towards alternative biomass fuels, and the highest saw dust consumption was found in the textile industry, whereas the brick industry was the highest consumer of paddy husk. Bagasse accounts for 94% (w/w) of the process waste used in industry, while the remaining share is the waste originated from palm oil production (SLSEA, 2015).

Total Biomass Consumption

According to the survey conducted by SLSEA, firewood was recorded as the most commonly used biomass type, with a share of 63% of the total firewood equivalent value. Percentage demand of firewood equivalent by industrial sectors is graphically illustrated in Figure 2.9.

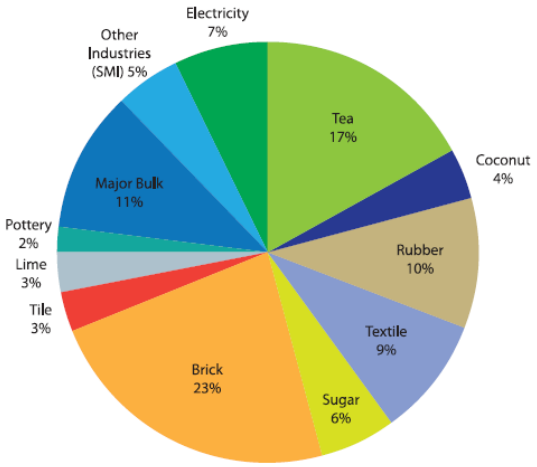


Figure 2.9: Percentage Demand of Firewood Equivalent by Industrial Sectors
(SLSEA, 2015)

Annual biomass consumption details during 2011-2015 period is given in Table 2.9. Accordingly, the average total biomass consumption is 12,594,302 tonnes per year. During the data collection period of the national mercury inventory, the preparation of sectorial fuel wood consumption inventory for 2016 was in progress. In the absence of the relevant data for the inventory year, annual total biomass consumption during the preceding year (12,401,590 tonnes) was considered for estimation of mercury inputs from the 'Biomass fired power and heat production' sub-category.

Table 2.9: Sectorial Consumption of Fuel Wood

Sector	Annual Total Biomass Consumption (tonnes)				
	2011	2012	2013	2014	2015
Industries	4,040,980	4,158,130	4,139,250	4,436,040	4,531,270
Household, commercial and others	8,791,010	8,460,620	8,283,460	8,260,430	7,870,320
Total	12,831,990	12,618,750	12,422,710	12,696,470	**12,401,590**

(Sri Lanka Energy Balance, Sectoral Consumption of Fuel Wood, SLSEA)

CHARCOAL COMBUSTION

Charcoal Production

The coconut industry is a well-established export-oriented major industry sector in Sri Lanka. The coconut industry can be managed as a waste free industry, where the industry make a wide range of value added products including shell based products; mainly charcoal and activated carbon. Both charcoal and activated carbon sectors use coconut shells as raw materials and the waste heat from this process is utilized for energy requirements. According to Coconut Development Authority (CDA), there are seven activated carbon manufacturers in Sri Lanka (SLSEA, 2015). Some of them attempted to manufacture charcoal in metal retorts to make better quality charcoal. In contrast, charcoal industries are volatile where a large number of small or micro scale producers are involved (SLSEA, 2015). These small-scale producers use traditional 'earth pit or mound' method and coconut shell charcoal made from these small units are purchased by larger-scale industries.

However, wood charcoal production is discouraged in Sri Lanka due to associated detrimental environmental and social impacts.

Local Energy Uses of Charcoal

In Sri Lanka, coconut shell charcoal is mainly used to produce activated carbon for the export market. However, charcoal is not known to be used as a cooking fuel in the country. Perhaps there may be such operations taking place in the country without much publicity.

Small-Scale Industrial/Commercial Energy Uses

- As efficient industrial fuel for boilers in garment industries and laundries
- By blacksmiths and goldsmiths and recovery of precious metals
- Cast iron industries and foundries involve in manufacturing of industrial pumps, motors and machinery parts (as carbon additive)
- Hotels and restaurants and domestic use for heating purposes and for barbeque grills

Even though, export statistics of the coconut industry sector is well documented (Table 2.10), data on local consumption is not recorded. Therefore, based on experts from the CDA, local consumption of coconut shell charcoal for energy use was assumed to be 10% from the total average exports of coconut shell charcoal and activated carbon.

Table 2.10: Export Statistics of Charcoal and Activated Carbon

Year	Total Average Exports* (tonnes)		
	Coconut Shell Charcoal	Activated Carbon	Total
2014	8,736	37,230	45,966
2015	8,853	31,747	40,600

(CDA, Sri Lanka Coconut Statistics, 2015)

In the absence of 2016 coconut export statistics, the amount of coconut shell charcoal utilized for local energy purposes derived from the respective export figures of the preceding year (2015) was considered for the inventory.

2.2.2 FUEL PRODUCTION

OIL REFINING

There is only one crude oil refining plant in Sri Lanka. Crude oil import data of the refinery is given in Table 2.11.

Table 2.11: Crude oil imports of the Oil Refinery

Year	Crude Oil Quantity Imported (tonnes)
2012	1,596,058
2013	1,643,218
2014	1,760,170
2015	1,692,074
2016	**1,746,180**

(Ceylon Petroleum Corporation)

Imported crude oil is refined to a number of products (Table 2.12). A comparative illustration of the refinery production data for the period of 2012-2016 is given Figure 2.10. Accordingly, 1,746,180 tonnes of imported crude oil was refined during the inventory year (2016) to produce 1,641,064 tonnes of refined products.

As instructed by the refinery, under the basis of maintaining constant crude oil stock at the refinery, the annual crude oil refined was assumed equal to the amount imported during the same year.

Table 2.12: Oil Refinery Production

Refined Product	2012	2013	2014	2015	2016
Petrol 90	150,513	142,731	152,261	153,316	163,840
Petrol 95	1,060	1,188	0	927	1,942
Lanka Auto Diesel	392,686	388,481	495,983	516,650	578,657
Kerosene	74,840	56,987	65,195	75,228	104,244
JET A-1	93,162	124,544	168,481	154,571	147,525
HFO 800	66,953	56,011	52,011	336,277	478,901
HFO 1500	364,607	521,224	419,579	204,847	0
HFO 3500	216,846	147,371	169,037	10,258	0
Naphtha	70,878	86,545	120,116	136,558	154,467
Special Boiling Point Liquid	3,700	2,995	2,514	1,514	635
LPG	17,437	22,136	28,116	9,649	8,837
Asphalt	26,548	5,025	0	0	0
Total	1,481,242	1,557,251	1,675,307	1,601,810	**1,641,064**

(Ceylon Petroleum Corporation)

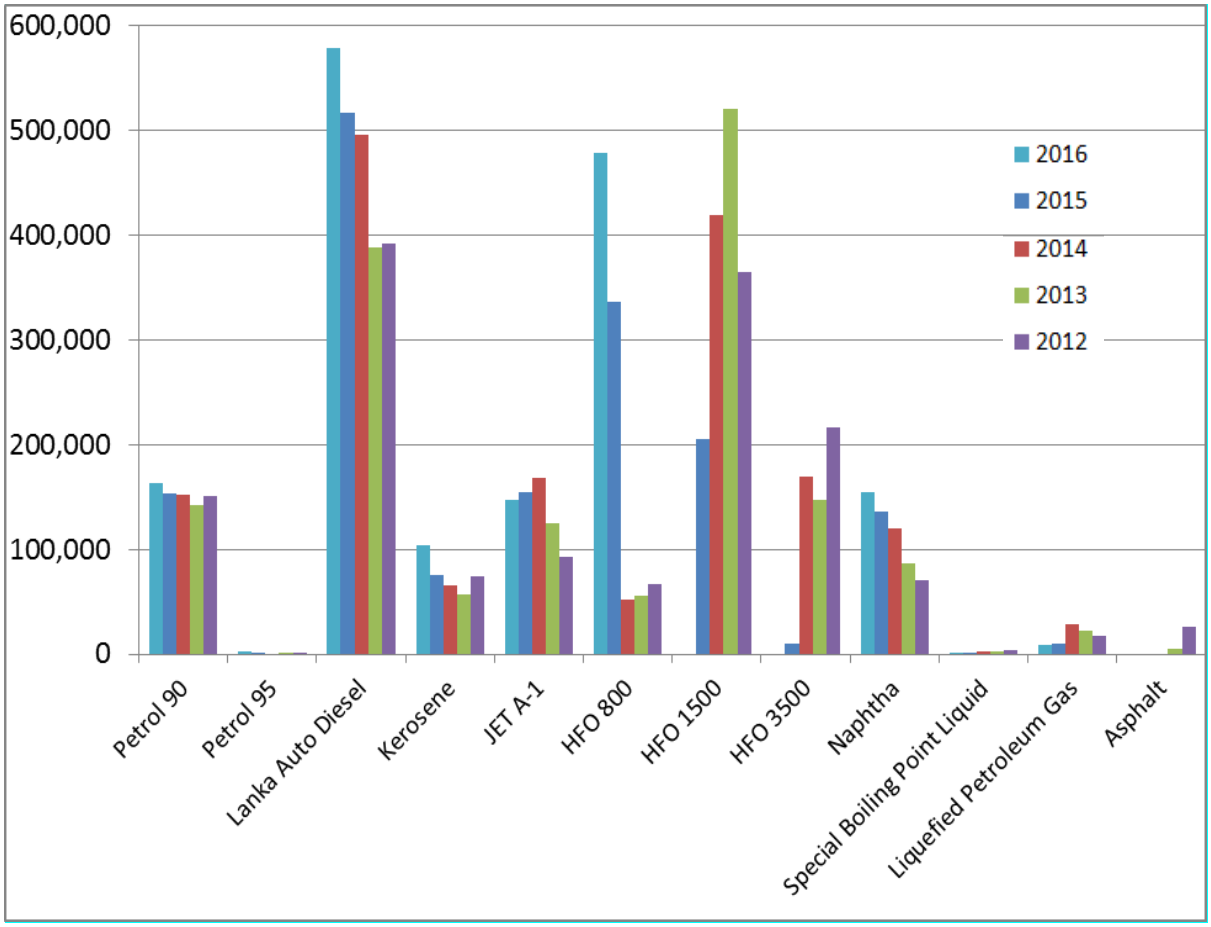


Figure 2.10: Oil Refinery Production (2012-2016)

(Ceylon Petroleum Corporation)

2.3 DATA AND INVENTORY ON DOMESTIC PRODUCTION OF METALS AND RAW MATERIALS

Primary Metal Production or ASGM is not practiced in the country. Hence, other materials production was only considered.

2.3.1 OTHER MATERIALS PRODUCTION

'Cement production' and 'Pulp and paper production' are considered as mercury release sub-categories under this topic.

There were two paper factories under National Paper Company Limited (NPCL), which is the oldest industry of the Country. It was later renamed as National Paper Corporation. The country's first paper factory at Valaichchenai (Eastern Province) was established in 1955 and commissioned for commercial operation in 1956. With the expansion programme, a second paper mill, that was believed to be the largest paper factory in Asia, was constructed at Embilipitiya (Sabaragamuwa Provice) in 1976. However, both Embilipitiya and Valaichchenai factories were decommissioned in 2011 and 2014 respectively. Presently, NPCL is involved in formal waste paper collection for exporting to paper recycling companies. Therefore, by 2016, pulp and paper factories were not in operation in the country, and were thus excluded from the mercury inventory.

Under the above circumstances, 'Cement production' is discussed as the only mercury release sub-category under this section.

CEMENT PRODUCTION

There is only one fully integrated cement plant, which consists of a dry process cement plant with two identical kilns. Each kiln has capacity of 1,100 tonnes/day. The kilns operate as rotary, counter current plug flow reactors and have operating temperatures in the range of 900 °C and 1450 °C at the material entry and exit ends. The plant approximately produces 1.3 million tonnes of cement and 640,000 tonnes of clinker annually (Wijayasundara, 2011).

Co-processing[4] was started in the cement kiln in 2002, where rice husk and saw dust were the key alternative fuels used. This facility was then approved to co-process AFR, including hazardous wastes (also known as scheduled wastes[5] in Sri Lanka) and non-hazardous wastes. To date, the facility has primarily co-processed biomass wastes (rice husks and sawdust) and textile scraps, but has also processed petroleum sludge, waste oil, and outdated pharmaceuticals. The AFR co-processing currently provides up to 35% of the kiln fuel, primarily from non-hazardous wastes, including biomass and textile scraps. Mercury content in the AFR varies with type and amount of the co-processed waste, sometimes higher compared to virgin raw materials, which may increase the total input of mercury to the cement production.

Table 2.13 depicts annual cement production and co-processed AFR amounts.

Table 2.13: Annual Cement Production and Co-processed AFR Amounts

Year	Annual Cement Production (tonnes)	Co-processed AFR Amount* (tonnes)
2012	1,093,565	61,555
2013	1,007,033	69,620
2014	997,034	56,311
2015	1,044,242	65,663
2016	**1,103,096**	**64,664**

**Both hazardous and non-hazardous AFR*
(Siam City Cement (Lanka) Limited)

The primary output pathways of mercury fed in with raw materials, including AFR, are released to the atmosphere, and through trace mercury levels in the produced cement. However, mercury contributions from coal is automatically deducted in the calculation spreadsheet as it is accounted for under the 'Other coal uses' sub-category.

Testing and Pre-Qualification Procedure:

A technical feasibility analysis is done prior to accepting a waste, assessing mainly the possible combustion products and pre-processing required for the bulk waste load. The cement plant sets the specifications for acceptance for the waste following pre-qualification analysis.

[4] Co-processing is primarily defined as two processes occurring simultaneously. While clinker is produced in the cement kiln by calcination, thermal destruction of the waste (coming via waste derived fuels) takes place simultaneously in the cement kiln.

[5] Prescribed list of waste, which refers as scheduled waste to facilitate the easy identification of Waste types which should follow this regulation without undergoing expensive analytical methods; National Environmental (Protection & Quality) regulation No. 01 of 2008 as amended by the gazette notification No 1534/18



i. The process, material safety data sheet (MSDS) of chemicals and raw materials used in the process and waste sources of the customer are thoroughly studied
ii. For pure chemical disposal request, accepted mercury content is less than 5 ppm
iii. Samples are analyzed for mercury content. Even though, this service was previously obtained by accredited laboratories, in 2017 an in-house test facility was implemented which use methods ICPOS, VGA (volatile method)

Compliance Monitoring Procedure:

The flue gases of the combustion process are monitored on a continuous basis to ensure that the emissions are within the permissible limits set for the cement manufacturing process. Weekly composite samples of clinker are tested for heavy metals, including mercury (limit of quantification of mercury as Hg is 0.007 mg/L).

Air Pollution Control:

The cement plant is equipped with pulsejet fabric filters.

2.4 DATA AND INVENTORY ON DOMESTIC PRODUCTION AND PROCESSING WITH INTENTIONAL MERCURY USE

2.4.1 PRODUCTION OF CHEMICALS

After shutdown of several basic chemical plants including ammonia/urea, sulfuric acid/alum, and the Chlor-alkali plant in late 90's, Sri Lanka did not involve in basic chemicals or active ingredient production. There are several chemical formulation plants that totally depend on imported chemicals and few industrial gas manufacturing plants.

2.4.2 PRODUCTION OF PRODUCTS WITH MERCURY CONTENT

Sri Lanka has never been involved in the production of mercury containing or mercury added products.

Country status of the production and use of mercury-containing or mercury-added products is discussed below.

MERCURY-ADDED THERMOMETERS

All thermometers (medical, air, lab, industrial) are imported to the country.

ELECTRICAL SWITCHES AND RELAYS WITH MERCURY

There are number of assembling plants based on imported parts that may/may not contain mercury. In addition, direct imports are being done to supply the local demand.

LIGHT SOURCES WITH MERCURY

There are number of fluorescent light assembling plants that based on imported parts. Additional demand is met through direct imports.

BATTERIES WITH MERCURY

All mercury-added batteries are imported to the country.

MANOMETERS AND GAUGES WITH MERCURY

Manufacturing of mercury containing sphygmomanometers is not done in Sri Lanka. But repairing had been carried out by the Biomedical Engineering Division of Ministry of Health (MOH) in the past, for which mercury has been purchased. Since 2013, they have stopped repairing sphygomanometers and the purchase of mercury has not been carried out since then. Thereafter, all manometers and gauges are being imported.

BIOCIDES AND PESTICIDES WITH

MERCURY

According to the available literature, the amounts of trace elements present in pesticides decrease in order; Pb>Cr>Hg>As in studies conducted in Brazil. Pesticides (in the form of wettable powder or water dispersible granules) used in Sri Lanka were reported to consist of an average mercury content of 36.9 ppb (n=18, SD=51.8, Min=0.73, Max=218.5 and Median=20.5). However, mercury levels were not declared as impurities in pesticide formulations by the Food and Agriculture Organization (FAO) or World Health Organization (WHO).

PAINTS WITH MERCURY

None of the paint manufacturing plants in Sri Lanka use mercury as a raw material or additive.

SKIN LIGHTENING CREAMS AND SOAPS WITH MERCURY CHEMICALS

There are 23 local cosmetics and pharmaceutical manufacturing industries involved in the production of cosmetics and soaps in Sri Lanka. Out of them 68% (n=15) responded through questionnaire surveys and telephone interviews. None of the responding industries were found to be using mercury as an additive for their production process.

2.5 DATA AND INVENTORY ON WASTE HANDLING AND RECYCLING

2.5.1 PRODUCTION OF RECYCLED METALS

PRODUCTION OF RECYCLED MERCURY (SECONDARY PRODUCTION)

Mercury recycling is not done in Sri Lanka due to the absence of such technology in the country. During CFL and fluorescent lights recycling, mercury and phosphor powder is recovered and are stored until exporting to a country having mercury refining technology.

PRODUCTION OF RECYCLED FERROUS METALS (IRON AND STEEL)

Most of the steel products manufacturing companies operate in Sri Lanka perform scrap smelting process as the primary operation. However, ELV scrap recycling is not done in the country. In addition to the local scrap, recycling of imported scarp is also done, where processable metal scraps within the country are not allowed to be exported.

Iron and steel scrap (waste code: B1-2 B1010 GA430) is applicable for import, export and transit under Appendix 2 LIST IIB – Non-Hazardous Wastes of the Basel Convention. Hence, industries shall get recommendations from Central Environmental Authority to obtain an Import Control License.

Dross, scaling and other wastes from the iron or steel industry (waste code: A1-36 AA010) is listed under Appendix 1 LIST IA – Hazardous Waste of the Basel Convention. Accordingly, it is prohibited for import, but applicable for export and transit.

Table 2.14 compares the import and export of quantities of iron and ferrous waste/scrap in 2016.

Table 2.14: Imports and Exports of Ferrous Waste and Scrap and Re-Melting Scrap Ingots of Iron or Steel during 2016

HS Code*	Sub Category Description	Quantity (kg)	
		Imports	Exports
7204.10	Waste and scrap of cast iron	162	2,789
7204.21	Waste and scrap of stainless steel	10	1,209
7204.29	Waste and scrap of alloy steel (excluding stainless steel)	-	1,333
7204.30	Waste and scrap of tinned iron or steel	-	438
7204.41	Turnings, shavings, chips, milling waste, sawdust, filings, trimmings and stampings, whether or not in bundles	-	248
7204.49	Other ferrous waste and scrap	4,762	11,287
7204.50	Re-melting scrap ingots	-	-
Total		**4,934**	**17,303**

*National Customs Tariff Guide (NCTG) 2017, Chapter 72, Iron and steel

(Export Development Board Trade Statistics)

Any proper quantification data source was not available for the metal recycling sector. Thereby assuming 90% of the iron and steel scrap was recycled by the main scrap smelters (Table 2.15), the total ferrous metal scrap recycling rate was estimated at 186,500 tonnes/year. According to World Steel Association, on average, 900 kg of steel is used per vehicle. The average light vehicle in 2014 contained about 60% of steel, most of it conventional steel, accounting to 1,090 kg (Average Material Consumption for a Domestic Light Vehicle, Model Years 1995, 2000, and 2014). Therefore, the average weight of steel in a vehicle was taken as 1,000 kg (1 tonne). Accordingly, the estimated equivalent ELV scrap recycled in 2016 was accountable to 186,500 vehicles.

Table 2.15: Annual Production of Large and Medium Scale Ferrous Metal Recycling Industries in 2016

	Annual production (tonnes)
Industry 1	60,000
Industry 2	36,500
Industry 3	30,000
Industry 4	14,400
Industry 5	12,600
Industry 6	8,640
Industry 7	4,200
Industry 8	900
Industry 9	600
Total	**167,840**

(Individual Industry Survey)

2.5.2 WASTE INCINERATION AND OPEN WASTE BURNING

INCINERATION OF MUNICIPAL/GENERAL WASTE

Incineration of municipal/ general waste is not praciced in Sri Lanka (Karunaratne, 2015).

INCINERATION OF HAZARDOUS WASTE

As per the information provided by the Waste Management Unit of CEA, respectively 12,091 tonnes, 14,108 tonnes and 14,262 tonnes of hazardous waste was recorded to be co-processed at the PCW cement kilns in 2014, 2015 and 2016.

INCINERATION/BURNING OF MEDICAL WASTE

Disposal of medical waste in government health institutions is carried out by incineration (combustion under controlled conditions) and burning (open burning). In addition, abut ten (10) large private hospitals have their own medical waste incineration facilities. The CEA have already issued the 'Scheduled Waste Disposal License' for some of the medical waste incineration facilities.

Medical waste incineration data of government hospitals are documented in the Ministry of Health (Table 2.16). However, Information on burning of medical waste was not available in CEA, Ministry of Health or any other reliable data source.

In most health institutions, records of medical waste generation and disposal (including incineration/burning) are not properly maintained at an institutional level. Also, CEA is still in the process of issuing 'Scheduled Waste Disposal License' for medical waste incineration facilities. Therefore, it is difficult estimate the quantity of medical waste incinerated or burnt at private health institutions.

Table 2.16: Medical Waste Incinerators Available in Sri Lanka by End 2016

Ownership	Number Incinerators Available	Maximum Incineration Temperature (°C)	Incineration Capacity (tonnes/day)	Quantity of Medical Waste Incinerated in 2016 (tonnes)
Public Private Partnership (3 chamber incinerator facility at Mulleriyawa)	02	1,400	8-10	3,650
Government hospitals	61	1,100 – 1,200	10	3,550
Total quantity of medical waste incinerated in 2016				**7,200**

(Ministry of Health)

Flue Gas Cleaning:

According to the Ministry of Health, there are three (3) incinerator suppliers in the country. Details on air pollution control systems of the existing medical waste incineration facilities were obtained through formal communications with those incinerator suppliers who provided specifications and conducted flue gas assessment for most of the medical waste incinerators. Accordingly, only one medical waste incinerator, which is located Mulleriyawa is equipped with a wet scrubber.

SEWAGE SLUDGE INCINERATION

Disposal of sewage sludge[6] by incineration is not widely practiced in Sri Lanka. However, one major apparel industry group started co-incineration of sewage sludge with biomass. The sewage sludge is generated from the Central Wastewater Treatment Plant of their privately owned Industrial Park, which is dedicated to textile and apparel manufacturing industries (consisting of six manufacturing industries and associated service industries). Sludge generated from chemical treatment processes is dewatered in a filter press that is further dried in a solar dryer to achieve moisture content less than 30%. Part of the dried sludge is mixed with biomass (sawdust and wood chips of rubber wood/gliricidia/wood off-cuts) for co-incineration in a biomass boiler. Even though the approved mixing ratio of total biomass to dried sludge is 10:1, the mixing ratio is maintained at 50:1. The amount of total dried sludge mixed with biomass in

[6] Residual, semi-solid material that is produced as a by-product during sewage treatment of industrial or municipal wastewater

2016 was 128.8 tonnes.

Fly ash generated from the boiler is utilized for manufacturing cement blocks (CEA approved process). Excess sludge is disposed of via co-processing in the PCW cement kilns.

OPEN FIRE WASTE BURNING (ON LANDFILLS AND INFORMALLY)

Open Burning of MSW

According to a 5% survey of the population on waste generation and disposal methods conducted by the Department of Census and Statistics in 2012, 46.9% of the generated MSW is burned (MMDE, 2016). Based on the acquired data during the MIA industry sector survey; MSW generation, collection, recycling, composting or biogas generation, and dumping data for year 2016 is summarized in Table 2.17. Accordingly, the MSW generation in 2016 was 3,531,935 tonnes/year, thus about 1,656,477 tonnes of MSW was estimated to be set on open burning.

Table 2.17: MSW Management Data of Sri Lanka (2016)

	Unit	Western Province (3 Districts)	Other Provinces (22 Districts)	Total
Total MSW Generation	t/day	2,600.93	7,210.00	9,810.93
	t/year	**936,334.80**	**2,595,600.00**	**3,531,934.80**
Total MSW Collection	t/day	1,965.11	1,802.00	3,767.11
	t/year	**707,439.60**	**648,720.00**	**1,356,159.60**
	%	**75.55**	**24.99**	**38.40**
Total MSW Recycled	t/day	120.89	829.00	949.89
	t/year	**43,520.40**	**298,440.00**	**341,960.40**
	%	**4.65**	**11.50**	**9.68**
Total MSW Composted and Used for Biogas Generation	t/day	139.00	447.00	**586.00**
	t/year	**50,040.00**	**160,920.00**	**210,960.00**
	%	**5.34**	**6.20**	**5.97**
Total MSW Disposed in Sanitary Landfills or Open Dumped	t/day	1,705.22	526.00	**2,231.22**
	t/year	**613,879.20**	**189,360.00**	**803,239.20**
	%	**65.56**	**7.30**	**22.74**

Note: All percentage values were calculated based on total MSW generation
(Western Province Wasete Management Authority) (MMDE, 2016)

Open Burning of Agriculture Waste

During the national mercury inventory preparation, the total amount of open burnt agriculture waste in 2016 was estimated at 697,888 tonnes (Table 2.18).

Table 2.18: Estimated Quantity of Open Burnt Agriculture Waste (2016)

Agriculture Waste	Quantity Burnt (tonnes)
Rice straw	440,000
Sugar cane residue	35,934
Maize stalk	197,292
Maize cob	24,662
Total	**697,888**

Total open fire waste burning

Considering the estimated values of open burning of MSW (1,656,477 tonnes) and open burning of agriculture waste (697,888 tonnes), the total amount of open fire waste burning during the inventory year was estimated at 2,354,365 tonnes.

2.5.3 WASTE DEPOSITION

CONTROLLED LANDFILLS/DEPOSITS

By 2016, there were only one sanitary landfill and one semi-engineered sanitary landfill in the country by 2016 (Table 2.19), which were capable of providing landfill facility only for 11,160 tonnes/year (0.3% from the total MSW generation and 0.8% from the total MSW collection).

Table 2.19: Details of Sanitary Landfill Facilities in Sri Lanka by 2016

Location	Type	MSW Dumping (Maximum) tonnes/year	
Dompe	Sanitary Landfill	6	2,160
Nuwara Eliya	Semi-engineered Sanitary Landfill	25	9,000
Total MSW Dump in Controlled Landfills		**31**	**11,160**

(CEA and Nuwara Eliya Municipal Council)

2.5.4 INFORMAL DUMPING OF GENERAL WASTE

The estimated total amount of MSW dumped in 2016 is 803,240 tonnes (Table 2.17), from which 11,160 tonnes is anticipated to be dumped in available landfill facilities (Table 2.19). The rest was likely dumped in open dump yards, including government approved dump sites. Accordingly, the amount of informal dumping of general waste in 2016 was estimated at 792,080 tonnes.

2.5.5 WASTEWATER SYSTEM/TREATMENT

Aggregated national data on water production or use is not available in Sri Lanka. Hence, water use data published in the Central Bank of Sri Lanka, Annual Report 2016 was extrapolated to the whole population in order to estimate wastewater generation in 2016.

Details of piped sewerage facilities managed by National Water Supply and Drainage Board and BOI are readily available. However, details on raw wastewater volume, wastewater treatment processes, treated wastewater volume and quality, treated wastewater and sludge disposal methods, and final discharge points of wet industries are not available in a single data source. Also, there are no reliable figures available regarding agriculture management practices and on domestic black and gray water management. Hence, estimations for the percentage of distribution of their treatment methods were difficult.

(i)	Mid-year population	= 21,203,000 (a)
(ii)	Access to pipe borne water	= 47.7% (a)
(iii)	Pipe borne water served population	= 10,113,831
(iv)	Total water production by NWSDB	= 649,000,000 m^3 (a)
(v)	Island wide non-revenue water	=25.6% (a)
(vi)	Total use of NWSDB produced water	= 482,856,000 m^3
(vii)	Total pipe borne water consumption	≈ 131 Lpcd

Based on expert opinion and field experience, assuming 100 Lpcd water consumption by population depend on dug wells, tube wells, streams and rivers etc.;

(viii)	Population without pipe borne water	= 11,089,169
(ix)	Total non-pipe borne water consumption	≈ 404,754,670 m^3
(x)	**Total annual water consumption**	**= 887,610,670 m^3**

Based on field experience, assuming wastewater generation is 80% from the total water use;

(xi)	**Total annual wastewater generation**	**= 710,088,536 m^3**

(a) Central Bank of Sri Lanka, Annual Report 2016

2.5.6 TEST OF WASTE AND WASTEWATER DEFAULT FACTORS

In this inventory, default input factors were used for the estimation of mercury releases from general waste treatment and wastewater treatment. The default factors were based on literature data of mercury contents in waste and wastewater, and these data were only available from developed countries. The following test of the results was performed to qualify the results for these sources.

The test made for general waste compares the calculated inputs to all four general waste sub-categories with the sum of general waste outputs from intentional mercury uses in products plus processes as follows, using data from the Inventory Level 1 spreadsheet:

The test made for wastewater compares the calculated inputs to wastewater treatment with the sum of outputs to water from intentional mercury uses in products plus processes as follows, using data from the Inventory level 1 spreadsheet:

In the IL1 spreadsheet, the test was done as follows: **Tab "Level 1-total summary"**:

(E60+E64+E66+E67) = (0+0+0+56) = 56 kg Hg/y
2*(J25+J26+∑(J31 to J55)) = 2 x {0+0+(66.3+87.1+73.8+68.6+873.7+24.4+53.6)}
= 2 x 1,247.5 = 2,495 kg Hg/y

(E60+E64+E66+E67) < 2 x {J25+J26+∑(J31 to J55)}

The calculations made indicate that the default input factors for **general waste may over-estimate the mercury releases** from these sub-categories. This may be of priority in follow-up work, as feasible.

In the IL1 spreadsheet the test was done as follows: **Tab "Level 1-Exec Summary":**

B19 = 3,728 kg Hg/y
2*(D8+D10+D11+D12+D13+D14+D15) = 2 x (0+0+0+0+145.8+1,253.1+0)
= 2 x 1,398.9 = 2,797.8 kg Hg/y

B19 > 2 x (D8+D10+D11+D12+D13+D14+D15)

The calculations made indicate that the default input factors for **wastewater treatment does not necessarily over-estimate** the mercury releases from these sub-categories.

2.6 DATA AND INVENTORY ON GENERAL CONSUMPTION OF MERCURY IN PRODUCTS, AS METAL MERCURY AND AS MERCURY CONTAINING SUBSTANCES

2.6.1 GENERAL BACKGROUND DATA

Background calculations for the product groups listed below were based on population data in combination with other country-specific activity level indicators shown in Table 2.20.

Table 2.20: Default Data Types Used As Activity Rates

Sub-Category	Data Types Used As Activity Rates
Dental amalgam fillings ("silver" fillings)	Population Density of dental personnel[7]
Electrical switches and relays with mercury	Population Electrification rate (percent of population

[7] To adjust approximately for the frequency of dental restoration in the country of interest, the calculated mercury input is further reduced with a factor describing the access to dental care in the country.



Polyurethane (PU, PUR) produced with mercury catalyst	with access to electricity)[8]
Other manometers and gauges with mercury	
Laboratory chemicals	
Other laboratory equipment with mercury	

Annex 8.4 of UN Environment's "Toolkit for Identification and Quantification of Mercury Releases Reference Report and Guideline for Inventory Level 2 (Version 1.4 January 2017)" provides references to Country data for default calculations for the above source sub-categories. However following deviations for the defaults values were noticed in 2016.

Deviations from the Default Values

- Population of Sri Lanka in 2010 (20,653,000) is set as the default data on population. This value has been replaced by the 2016 population of Sri Lanka equivalent to 21, 203,000 (Central Bank, 2016).
- At the end of 2015, there were 1,322 numbers of Dental Surgeons in the country (MOH, 2016). Dental personnel per 1000 inhabitants are specified by default as 0.065 (≈0.1). This value is based on most recent data of WHO on Human Resources for Health, where the ranking of Sri Lanka is 112 among 175 countries (WHO).
- A 77% electrification rate is used as the default value as derived from the International Energy Agency (IEA) in 2009. However, the national, urban and rural electrification rates of Sri Lanka are reported in IEA World Energy Outlook 2016 as 99%, 100% and 98% respectively. Central Bank of Sri Lanka Annual Report 2016 reported electrification level of 99.3%.

2.6.2 DENTAL AMALGAM FILLINGS

In dental practice, pure mercury and alloys are purchased separately. At the time of filling, both ingredients are mixed to form the amalgam. Dental surgeons and their support staff are at risk of exposure to mercury during this process. The information regarding the use of dental amalgams within the country was obtained through questionnaire surveys from both private and government dental health institutions.

Table 2.21 provides dental amalgams supplied by Medical Supplies Division of Ministry of Health during the period of 2014-2016.

Table 2.21: Purchase of Dental Amalgam (30 g bottles) by Ministry of Health

Unit	Annual Amount Supplied		
	2014	2015	2016
No. of Bottles	5202	5236	**5861**

[8] To adjust approximately for the prevalence of "technical installations" in the country, the calculated mercury input is further reduced with the fraction of the population with access to electricity. In some cases, electricity access was selected as an indirect indicator of technological development relevant for this material.

Wight (kg)	156.06	157.08	**175.83**

(Ministry of Health)

According to the presentation made by Dr. Manil Fonseka, University of Peradeniya, on 20th January 2017, the average usage of dental amalgam during the inventory year (2016) was about 180 kg in the government sector, whereas in the private sector this estimate was 150-180 kg. However, questionnaire surveys revealed lesser amount of mercury amalgam usage; 121 kg in 2014, 115 kg in 2015 and 121.4 kg in 2016 respectively.

Questionnaire survey revealed that, information regarding the disposal of dental amalgams was communicated to dental surgeons during staff reviews and by Consultants of Community Dentistry. According to the feedback of the questionnaire survey, a majority of the dental surgeons are well aware of the communications pieces issued by the Ministry of Health. However, there was a major concern about the lack of collection mechanisms and proper disposal methods for used dental amalgam by the dental surgeons who responded to the survey. Even though, mercury separators were distributed to health institutions in 2013, they were not used due to administrative and management issues, such as lack of proper recycling methods. Therefore, mercury controls were considered to be not available

Methods of Disposal:

Currently, methods of disposal in the government sector vary between institutions where a majority are collecting extracted tooth and mercury waste in closed containers and some are destroyed through incineration or burning. As per the questionnaire survey findings, most of the private hospitals incinerate their dental amalgam waste.

2.6.3 THERMOMETERS

Though there are attempts to increase the use of digital thermometers, mercury containing thermometers are still widely used in all types of health institutions in Sri Lanka. In addition, thermometers are used in veterinary practices, laboratories (industries, schools, universities and other institutions with testing facilities), as well as in households.

MEDICAL THERMOMETERS

According to the information obtained, the purchasing of thermometers is carried out through Medical Supplies Division of Ministry of Health, by the provincial health authorities, local purchase by the health institutions or through donations. The Medical Supplies Division procures thermometers mainly for use in ministry health institutions (Table 2.22).

Table 2.22: Purchase of Thermometers by Medical Supplies Division

Item Purchased	Quantity			
	2013	2014	2015	2016
Clinical oral Thermometer	3,052	2,002	1,375	**193**
Clinical rectal Thermometer	28	124	67	**114**
Total	3,080	2,126	1,442	**307**

(Ministry of Health)

Information on the purchase and availability of thermometers meters in 2016 was obtained through a questionnaire survey from government health institutions (western, ayurveda, and homeopathy), private hospitals and nursing homes from within the entire country. The summary of mercury-filled thermometer purchases in 2016 is given in Table 2.23. However, to avoid

duplication, the information obtained by the questionnaire survey was not used for estimation of the inventory input data.

Table 2.23: Summary of Mercury-Filled Thermometer Purchased in 2016

Sector	No. of Mercury-Filled Thermometers
Government	30,749
Private	25,945
Ayurvedic (Indigenous Medicine)	787
Total	**57,481**

Information regarding the import of thermometers was mainly obtained from SLC under HS 90.25.11, which is for thermometers and pyrometers not combined with other instruments (liquid-filled, for direct reading). According to the data provided by the SLC, the total number of imports under HS 9025.11.00 for the year 2016 was 250,678. However, as this information includes data on both alcohol thermometers and mercury thermometers, individual importers of thermometers and pyrometers under HS 9025.11.00 were contacted to find the number of mercury filled thermometers (out of the total imports). Accordingly, 99.22% of the import data were confirmed by these importers. Accordingly 240,790 Numbers of medical thermometers were imported to the country in 2016.

Methods of Disposal:

The questionnaire survey revealed that, a majority of government institutions have received instructions at meetings held at Regional Director of Health Services offices and are aware of the circular issued by the Ministry of Health with regard to method of disposal of damaged/broken medical thermometers. However, this information was not available for most of the institutions in the Ayurveda and private sector. According to the survey, the current disposal practices for damaged/broken medical thermometers include burning in deep pit or incineration.

OTHER GLASS MERCURY THERMOMETERS (AIR, LABORATORY, DAIRY, ETC.)

Accordingly, to custom date, total numbers of 244,907 mercury-filled thermometers were imported in 2016. The distribution of mercury-filled glass thermometers (air, laboratory, dairy, etc.) in education and industry sector is given below.

- Education sector – 3,804 Nos.
- Industry sector – 313 Nos.

ENGINE CONTROL MERCURY THERMOMETERS AND OTHER LARGE INDUSTRIAL OR SPECIALTY MERCURY THERMOMETERS

According to the information acquired through formal communications, mercury-filled large-scale industrial thermometer importers/suppliers were not found in the country.

2.6.4 ELECTRICAL SWITCHES AND RELAYS WITH MERCURY

There are number of electric switches and relay assembling plants in the country, which are based on imported parts that may/may not contain mercury. Apart from that, electric switches and relays are directly imported under the main category of 'Electrical apparatus for switching or protecting electrical circuits, or for making connections to or in electrical circuits (for example, switches, fuses, lightning arresters, voltage limiters, surge suppressors, plugs and other connectors, junction boxes)'; HS 8535 (voltage > 1,000 volts) and HS 8536 (voltage < 1,000 volts). The HS codes, under which

electric switches and relays are imported, include wide range of products. Therefore, it is practically not possible to find the fraction of mercury added switches and relays from the total imports under the relevant HS codes.

Owing to environmental considerations about the toxicity of mercury and due to the expense of liquid mercury and availability of modern alternatives, mercury added switches and relays are now rarely used worldwide; mercury relays are comparatively uncommon and mostly obsolete and being replaced by solid state relays. However, mercury switches are still used in electro-mechanical systems where physical orientation of actuators or rotors is a factor (Mercury switch, 2017) (Mercury relay, 2017).

Since most of the main suppliers of electric switches and relays were not able to be contacted, reliable data on its supply and trade could not be obtained from them. Hence, this source sub-category was excluded from the Level 1 mercury inventory.

2.6.5 LIGHT SOURCES WITH MERCURY

Fluorescent and other mercury added lamps are increasingly popular, in both indoor and outdoor applications as they are more energy efficient and typically last longer than incandescent lamps, yet sometimes people do not realize that they contain mercury. In Sri Lanka, these lamps are expected to flood the consumer markets in recent years and be used in homes, businesses and institutions. The MIA health sector survey concluded that CFL bulbs and liner fluorescent lamps are used in all most all health institutions in both government and private sectors.

All fluorescent lamps produce light when electric current passes between two electrodes in a phosphor-lined tube filled with low-pressure mercury vapor and inert gases, such as argon and krypton where electric current excites the mercury vapor in the tube. Hence, mercury is present in fluorescent lamps in both the phosphor powder and in the vapor. Most CFLs contain 3-5 mg per bulb, with the bulbs labeled "eco-friendly" containing as little as 1 mg (Compact fluorescent lamp, 2017). Lamps with high mercury content are, however, still on the market, and may still be sold in large quantities as they are generally cheaper than low-mercury lamps. Though, non-mercury alternatives for these lamps with more energy saving specifications are now widely available on the local market, the demand for fluorescent lamps seem to be declining.

Mercury added light sources and parts are imported to the country for local assembling plants under the main category of ‘Electric filament or discharge lamps, including sealed beam lamp units and ultra-violet (UV) or infer Red (IR) lamps; arc-lamps’. Table 2.24 provides imported quantities under the respective HS codes during 2013-2016. Accordingly, about 99% of the mercury-containing lamps imported to Sri Lanka were fluorescent lamps, from which over 87% were comprised of energy efficient CFL. As confirmed by the respective importers, the remainder was high intensity discharge lamps imported to be utilized for street lighting purpose.

Table 2.24: Imported Quantities Of Mercury Added Light Sources During 2013-2016

HS Code	Sub Category	Quantity Imported (No)			
		2013	2014	2015	2016
8539.31.10	Energy efficient alternating current (AC) CFL	16,953,846	16,553,105	15,968,267	13,600,298
8539.31.20	12 V, direct current (DC) fluorescent lamps (straight tubes as well as compact types)	40,307	9,590	694	1,491
8539.31.90	Other fluorescent	2,016,324	1,839,390	2,181,757	1,835,188
8539.32	Mercury or sodium vapour lamps; metal halide lamps	297,548	215,199	95,942	113,459
Total		**19,308,025**	**18,617,284**	**18,246,660**	**15,550,436**
Percentage fluorescent lamps from the total imports		**98%**	**99%**	**99%**	**99%**
Percentage CFL from the total imports		**88%**	**89%**	**88%**	**87%**

(Export Development Board Trade Statistics)

Mercury-added lamps also come as components of larger products that are not specifically identified by the manufacturer or those that do not fit into the defined HS codes, such as lamps used in semi-conductor equipment. Examples of larger products containing mercury added lamps include Air purification units, Medical instruments, Tanning beds, Air cleaners, Sterilization systems (ultraviolet sterilization), Pressure cookers, Meat smokers, Televisions (back-lighting for flat-screen displays), Lab equipment (chemical analyses such as atomic absorption spectrometry lamps), Water purification units, Range hoods, Exhaust fans, Insect traps, Sewing machines, Cooking ranges, Liquid crystal display monitors (back-lighting), Printers, Digital workstations, Ice merchandisers, Exit signs, Refrigerators, Automatic teller machines, Cameras (special lamps for photographic purposes) and Projectors. Due to a huge variation of product catergories, capturing the use of mercury added light sources in such products through the current SLC import data or relevant trade statistics is not practically possible.

Methods of Disposal:

Recycling of CFL and fluorescent lamps is performed by a leading bulb company at company owned recycling plant, which has an annual recycling capacity of 30 million bulbs. To ensure proper collection of fluorescent lamps, this bulb company makes regular collections from banks, schools, universities, factories, hospitals and government agencies. For other consumers and households, the company has provided designated collection centres and has also placed collection boxes at supermarkets and distributor points. Efficient disposal is encouraged by enticing consumers with monetary incentive. For example, on returning any brand CFL bulb to a vendor, a consumer gets LKR 10 discount on a new purchase.

The components of fluorescent lamps are first separated manually in the recycling plant. The bulb waste is then put inside the Mercury Recovery Technology machine, which has been imported from Sweden. The machine breaks down this waste and segregate into plastic, metal and glass fractions. A second tumbling cycle is required to breakdown the glass containing mercury.

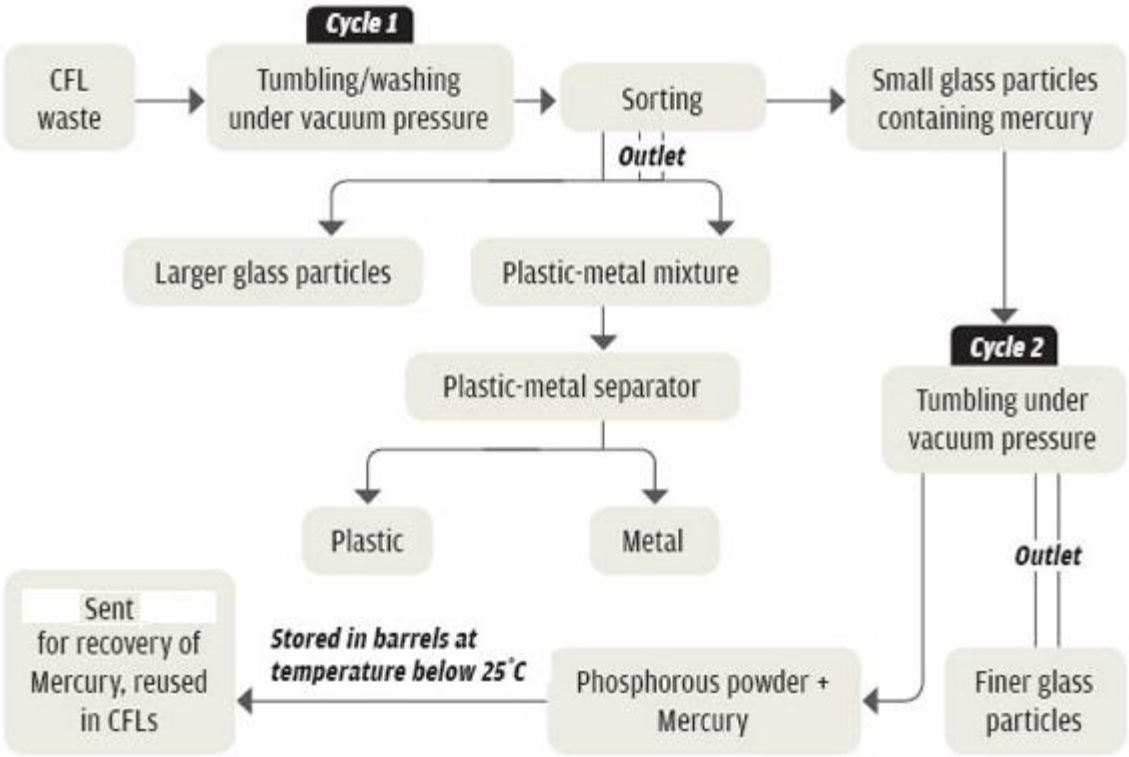


Figure 2.11: Mercury Recovery Process
(Asia Recycling (Pvt) Ltd, Orel Corporation)

The extracted glass, plastic and metal are sold to different companies within the country for reuse, and recovered mercury and phosphor powder are stored until exporting to a country having mercury recycling technology (Figure 2.11). The bulb recycling plant currently receives and recycles 100,000 to 150,000 bulbs every month.

Table 2.25 summarizes the bulb recycling quantities for the period of 2013-2016.

Table 2.25: Annual Bulb Recycling Quantity in Sri Lanka (2013-2016)

Year	Number of Bulbs Recycled	Approximate Mercury Content (kg)
2013	917,382	3-5
2014	1,056,978	3-5
2015	839,435	3-4
2016	**1,054,402**	**3-5**

(Asia Recycling (Pvt) Ltd, Orel Corporation)

However, discarded mercury containing lamps are still dumped with general MSW due to poor segregation practices and lack of awareness among general public. In the health sector, most of the government health institutions collect and store CFL bulbs, but a majority of Ayurveda institutions bury them in deep pits.

2.6.6 BATTERIES WITH MERCURY

Primary batteries are not manufactured in Sri Lanka. Hence, all types of batteries are directly imported to the country. Use of mercury in these batteries has been among the largest product uses of mercury in recent decades. However, the global use of mercury in various types of primary cells is decreasing. The quantities of mercury containing primary cells and primary batteries imported during the inventory year (2016) with the respective HS code are given in Table 2.26.

Table 2.26: Imported Quantities of Primary Cells and Primary Batteries in 2016

HS code	Product	Quantity Imported	
		(kg)	(tonnes)
HS 8506.30	Mercuric oxide	6.38	0.006
HS 8506.40	Silver oxide	3,217.44	3.217
HS 8506.60	Air-zinc	250.05	0.250
HS 8506.80	Other	443,646.39	443.646

(SLC)

As per the import data provided by SLC, during 2016, 2.5 kg of spent primary cells has been imported under HS 8548.10.20 (Spent primary cells, spent primary batteries and spent electric accumulators) by two importers; 0.5 kg by a general laboratory and biotechnology equipment suppliers, and 2 kg by a local facility of an international electronic assemblies and integrated systems solutions provider. However, from formal communications, it was revealed that the imported batteries from these companies were new (not used or scrap batteries). Hence, inclusion under HS 8548.10.20 was concluded to be a mistake.

In addition to plain battery sales, batteries may be imported and exported all over the world in substantial amounts enclosed in other products like electronics, toys, greeting cards with sounds, etc (UNEP, 2006). However, due to huge variation of product catergories, capturing the use of mercury added baterries in such products is not practically possible through import data.

2.6.7 POLYURETHANE (PU) PRODUCED WITH MERCURY CATALYST

Based on the assessment of material safety data sheets (MSDS) of chemicals used in BOI industries that involve PU products manufacturing, BOI has formally confirmed that PU products manufacturing industries under their purview are not using mercury catalyst. Hence, this source sub-category was excluded from the Level 1 mercury inventory.

2.6.8 PAINTS WITH MERCURY PRESERVATIVES

Phenyl mercuric acetate (PMA) and similar mercury compounds have been widely used as water-based paint additives, and may still be used in some countries. These compounds were used as “in-can” preservatives to extend the shelf life by controlling bacterial fermentation in the can (as a biocides), as well as to retard fungus attacks on painted surfaces under damp conditions (as a fungicides). Inorganic mercury compounds of very low solubility have also been used as additives in marine coatings and paints to impede bacteria formation and to hinder the development of marine organisms. This use is believed to have been largely discontinued by the mid 1970s (UNEP, 2006).

Based on the formal communication with Colombo Dockyard PLC (Sri Lanka's leading ship repair, ship building, heavy engineering and offshore engineering facility) and main local paint manufactures, it was concluded that mercury containing paints are neither used nor produced in Sri Lanka. Hence, this source sub-category was excluded from the Level 1 mercury inventory.

2.6.9 SKIN LIGHTENING CREAMS AND SOAPS WITH MERCURY CHEMICALS

Skin lightening (or whitening) cosmetic products are popular all over the world, including Sri Lanka. Several survey findings have highlighted that some of these products are available in populated, as well as very rural areas of Sri Lanka (C Rubesinghe, 2013). Use of imported whitening

creams can pose dangers to health due to the availability of high levels of mercury and hydroquinone. In addition to the local manufactured products, cosmetics are imported from other countries to Sri Lanka. Based on the questionnaire survey, none of the responded industries (n=15, 68% from the total survey sample) intentionally use mercury as an ingredient or additive.

According to the information obtained from the cosmetics unit of Ministry of Health, until 2015, registration for cosmetic products was based on the Sri Lanka Standards (SLS) 'The specification for raw materials of skin creams and lotions are given under SLS 457, Part 2 (SLS, 2008)'. However, at present, imported cosmetic products registration is not done due to a change in the mandate of the institution. The maximum permissible mercury concentration for skin creams, lotions and powders stipulated by the existing SLS specifications is, 1 mg/kg (1 ppm). However, mercury limits are not specified for soaps.

The HS codes under which cosmetic products are imported include a wide range of products. Therefore, it is practically not possible to find the fraction of skin lightning creams and soaps from the total imports under the relevant HS codes. Also reliable data source of skin lightning cosmetic product importers is not available due to unavailability of cosmetic product registration procedure in the country. Hence, this sub-category was excluded from the Level 1 mercury inventory.

It is necessary to develop a mandate that all the skin lightening cosmetics should obtain a license based on testing to confirm safe levels of heavy metals, including mercury and hydroquinone (C Rubesinghe, 2013).

2.6.10 MEDICAL BLOOD PRESSURE GAUGES (MERCURY SPHYGMOMANOMETERS)

Though some bigger hospitals have shifted to digital manometers, blood pressure (BP) meters with mercury are still used in most of the hospitals in the health sector. Most of the private hospitals visited are also using mercury containing BP meters.

Mercury containing BP meters are imported under HS 9026.20 as 'Instruments and apparatus for measuring or checking pressure'. This includes a wide range of pressure measurement equipment, hence custom the data was not utilized for quantification of inventory inputs.

Currently, mercury containing BP meters are purchased locally at the provincial level and or by institutions. The Biomedical Engineering Division of Ministry of Health purchased 1,600 BP meters in 2012 that were mainly distributed among the ministry institutions. However, that process has been stopped since 2013. According to the data obtained from the questionnaire survey (Table 2.27), 36,406 number of BP meters were purchased in 2016.

Table 2.27: Summary of Mercury Containing BP Meter Purchases in 2016

Institutions	Number of BP Meter Purchases
Government sector	21,575
Private sector	13,738
Ayurvedic	1,093
Total	**36,406**

Methods of Disposal:

According to the information obtained through the questionnaire survey, a majority of the government institutions has received instructions and aware about the educational information issued by the

Ministry of Health.

As per the respondents of the questionnaire survey, the current disposal practices of damaged/broken mercury containing BP meters include collection by CEA and burning in deep pit or incineration.

2.6.11 OTHER MANOMETERS AND GAUGES WITH MERCURY

According to the data collected from the customs and trade statistics under relevant HS codes and surveys carried out in schools, universities and laboratories; zero imports were recorded for the year 2016 under manometers and gauges containing mercury. However, activity rate under this sub-category was automatically calculated by the electronic calculation spreadsheet by using 'population' as default data type (Refer Section 2.2.1).

2.6.12 LABORATORY CHEMICALS

Activity rate under this sub-category was automatically calculated by the electronic calculation spreadsheet by using 'population' as default data type (Refer Section 2.2.1).

IMPORT OF MERCURY AND OTHER CHEMICAL COMPOUNDS OF MERCURY

Imported quantities of mercury and other chemical compounds of mercury during 2016, was obtained by SLC under the HS codes listed in Table 2.28. Accordingly, 1,817.85 kg of metallic mercury has imported to the country in 2016.

The Minamata Initial Assessment reveals that in Sri Lanka metallic mercury is used in the educational sector (laboratories), health sector (preparation of Ayurvedic drugs) and in the industrial sector. As metallic mercury is not recorded to be intentionally used for other industrial purposes, the main industry sector use may be for small-scale gold waste recovery. However, reliable data sources were not available to estimate percentage use in different sectors.

USES OF CHEMICAL COMPOUNDS OF MERCURY IN EDUCATION SECTOR

According to data collected from education institutions viz. schools, universities and laboratories in Sri Lanka, the most commonly used chemical compounds of mercury are listed in Table 2.29. Apart from this, some chemical compounds of mercury were found in stocks in University laboratories.

Stocks of Chemical Compounds of Mercury in University Laboratories

- Mercury(I) oxide: Hg_2O
- Mercury(II) phosphate: $Hg_3(PO_4)_2$
- Mercury(I) sulphate: Hg_2SO_4
- Mercury(II) thiocyanate: $Hg(SCN)_2$
- Mercury(II) Nitrate Dihydrate: $HgNO_3.2H_2O$
- Mercury(I) chloride: HgCl
- Mercury(II) iodide: HgI_2
- Mercury(II) acetate: $Hg(CH_3CO_2)_2$
- Mercury(II) sulphide: HgS
- Mercury(II) bromide: $HgBr_2$

According to the provided data during the survey, 500 g of $Hg(NO_3)_2$ and 100 g of $HgSO_4$ has been purchased in 2016 (by University of Jaffna, Faculty of Science). All of the other mercury compounds were purchased before 2016. Some of these chemicals remain in stocks since the respective university/faculty was established. According to the data provided by the Additional Director, Science (Ministry of Education, Sri Lanka) starting from the year 2013 to May, 2017 a total of 43.9 kg of elemental mercury has been distributed to 878 government schools with approximately 50 g per school.

Table 2.28: Imported Quantities of Mercury and Other Chemical Compounds of Mercury during 2016

HS Code	Description	Net Weight Imported in 2016 (kg)*
HS 28.05	Alkali or alkaline-earth metals; rare-earth metals, scandium and yttrium, whether or not intermixed or inter-alloyed; mercury.	
HS 2805.40	- Mercury	1817.85
HS 28.52	Inorganic or organic compounds of mercury, whether or not chemically defined, excluding amalgams.	
HS 2852.10	- Chemically defined All organic or inorganic compounds of mercury meeting the requirements (a) to (e). a) Separate chemical elements and separate chemically defined compounds, whether or not containing impurities. b) Mixtures of two or more isomers of the same organic compound (whether or not containing impurities), except mixtures of acyclic hydrocarbon isomers (other than stereoisomers), whether or not saturated. c) These products either dissolves in water or other solvents provided that the solution constitutes a normal and necessary method of temporally for safety or for transport purposes. The used solvent does not render the product suitable for specific use other than for general use. d) Mentioned product with an added stabilizer (including anti-caking agent) necessary for their preservation or transport. e) Mentioned product upon the addition of anti-dusting agent or a colouring substance added to facilitate identification or for safety reasons. These additives do not render the product particularly suitable for specific use rather than for general use.	27.35
HS 2852.90	- Other Compounds of mercury that does not meet the requirements of HS Code: 2852.10.00 (a) to (e)	186.30
HS 29.31	Other organo-inorganic compounds	
HS 2931.90.20	--- Organo-mercury compound	No imports

(SLC)

Table 2.29: Commonly Used Chemical Compounds of Mercury in Education Institutions

Chemical Compound	Uses
Mercury(II) sulphate; $HgSO_4$	• Chemical oxygen demand – measuring of the oxygen equivalent of organic matter content of a sample that is susceptible to oxidation by a strong chemical oxidant (0.4 g). • Barbiturates test – detection for the presence of barbiturates (0.003 g).
Mercury(II) chloride; $HgCl_2$	• Qualitative analysis of anions and cations in samples.
Mercury(II) oxide; HgO	• Preparation of staining solutions. Used in hemotoxylin and eosin staining for nuclear detail/definition in oxidation of hematoxylin to hemalein (minute quantities). • Formic acid test – analysis of formic acid present in foods, beverages and other materials (0.001 g). • Identification of isopropyl alcohol (0.25 g).
Nessler's reagent; K_2HgI_4 (0.09 mol/L) in KOH (2.5 mol/L)	• Identification for the presence of $[NH_4]^+$ (0.1 mL)
Millon's reagent; $Hg(NO_3)_2$	• Identification of tyrosine residues in proteins (2 drops).

(5 % w/v) in HNO_3	

2.6.13 OTHER LABORATORY AND MEDICAL EQUIPMENT WITH MERCURY

According to the data obtained by surveys, several mercury containing laboratory equipment/apparatus were found to be present/used in education institutions of the country. Some equipment was found only at a single institute.

Mercury Containing Laboratory Equipment and Apparatus Present/Used in Education Institutions

- Calomel electrode ($Hg:Hg_2Cl_2$ 0.75:0.25)
- Dropping mercury electrode
- Barometer
- Hygrometer
- Boyle's apparatus
- Hygroscope
- Manual universal tensometer (University of Moratuwa, Faculty of Engineering)
- Mercury hollow cathode lamp for atomic absorption spectrophotometer
- Blaine apparatus (Tokyo Cement Group, used for cement calibration)
- Distillation column with mercury (University of Peradeniya, Faculty of Engineering)
- Mercury spectral lamp (University of South Eastern University, Faculty of Applied Science)

Activity rate under this sub-category was automatically calculated by the electronic calculation spreadsheet by using 'population' as default data type (Refer Section 2.2.1).

2.7 DATA AND INVENTORY ON CREMATORIA AND CEMETERIES

2.7.1 CREMATORIA AND CEMETERIES

Information was obtained through a questionnaire survey from all local government institutions of the county who keep records on cemeteries and cremations. Out of the 25 Districts, information on cremations in both gas chambers and firewood cremations were received from 17 Districts (68%). Six of the responded institutions informed that they do not keep records. Data for burials were obtained from 19 Districts. Some local government institutions/LAs do not keep records on burials and some do not have information on burials of Muslims. Therefore, based on the available data, a 100% extrapolation was done (Table 2.30). Accordingly, the estimated number of cremations and burials is 38,660 and 12,033 corpses per year.

2.8 STOCKS OF MERCURY AND/OR MERCURY COMPOUNDS, AND STORAGE CONDITIONS

As per Article 3 of the Minamata Convention on Mercury, each Party shall endeavor to identify individual stocks of mercury or mercury compounds over 50 tonnes, as well as sources of mercury supply generating stocks exceeding 10 tonnes per year, that are located within its territory. However in the absence of primary mercury mines, production facilities for mercury-added products, or facilities reliant on processes that use mercury or mercury compounds such as chlor-alkali facilities, and military storage facilities or government storage facilities in Sri Lanka, such large stocks of mercury was not identified within the country.

Table 2.30: Details on Cremations and Burials

Province	Population (000')*	No. of Crematoria**	No. of Cremations*** (corpses/year)		No. of Burials (corpses/year)	
			2015	2016	2015	2016
Western	6,028	27	5,278	3,984	461	443
Northern	1,107	9	313	338	533	526
Central	2,690	18	2,963	2,813	5,792	6,138
Uwa	1,333	3	451	413	288	312
Sabaragamuwa	2,009	7	3,433	3,785	86	102
Eastern	1,645	NR	NR	NR	379	175
Southern	2,584	31	-	6,794	1,357	1,449
North Western	2,477		2,182	2,681	NR	NR
North Central	1,330	Not Indicated	NR	NR	NR	NR
Total Received			20,228	26,289	8,896	9,145
100% Extrapolation			29,747	**38,660**	11,705	**12,033**

NR - Not Received
*2016 projections of Department of Census and Statistics
** (questionnaire survey)
***Firewood cremations and crematoria data were considered together

2.8.1 OVERVIEW OF STOCKS OF MERCURY AND/OR MERCURY COMPOUNDS

About 8.8 tonnes stock of recovered mercury and phosphor powder (mercury waste) is maintained at the fluorescent bulb recycling facility. This can be considered as the reported highest stock of mercury compound in the country.

Stocks of elemental mercury and mercury compounds can be found in limited quantities with the mercury traders, education sector (institutions, universities and school laboratories). Some of these chemicals remain in stocks since the respective institution/laboratory was established. Reliable data was not available on exact quantities of these stocks.

In the healthcare sector, required stocks of dental amalgam are maintained by Medical Supplies Division of the Ministry of Health and private dental practitioners. Also, a limited stock of elemental mercury is maintained to prepare mercury-containing ayurvedic drugs in both government and private indigenous medical (ayurvedic) hospitals and by private ayurvedic practitioners. As preparation of these drugs is highly cease-specific, their respective mercury stock is maintained based on the requirement only. In addition, stocks Homeopathy drugs (ayurveda or herbal preparations) required by government sector are maintained by the State Pharmaceuticals Corporation, while private Homeopathic practitioners maintain their own stocks based on their use. Since dental amalgam and mercury-containing drugs are fast moving and purchased or prepared on demand basis, stocks of mercury and mercy compound in the healthcare sector can be considered as negligible. Stocks of broken/obsolete mercury-added healthcare

measuring instruments (medical thermometers and BP meters) can also be present in the healthcare institutions. However, reliable data is not available in this regard. Some government and private institutions maintain a temporary storage facility within their premises for broken or discarded fluorescent lamps.

2.8.2 ASSESSMENT OF CURRENT STORAGE CONDITIONS

The mercury and phosphor powder recovered during fluorescent bulb recycling process is stored in a dedicated container maintained at cooled condition (< 25 °C) within the premises of the bulb recycling facility.

2.8.3 EVALUATION OF POTENTIAL STORAGE NEEDS IN THE FUTURE ONCE THE CONVENTION IS IMPLEMENTED.

There is an urgent requirement to conduct a detailed estimation on broken or obsolete mercury-added healthcare measuring instruments possibly with surplus mercury, which might require safe disposal or long term storage facilities. The country is currently lacking any appropriate measures to keep and/or to manage and dispose of the mercury waste, particularly broken or obsolete mercury-added products in an environmentally sound manner. This may require short term and long term mercury waste storage facilities.

2.9 SUPPLY AND TRADE OF MERCURY AND MERCURY COMPOUNDS, INCLUDING SOURCES, RECYCLING ACTIVITIES AND QUANTITIES

2.9.1 SUPPLY AND TRADE OF ELEMENTAL MERCURY

According to the trade statistics Mercury exports were not done after 2005.
Trade statistics for mercury import is given in Table 2.31, whereas Figure 2.12 shows variation of import quantity and import value (per kg) over past 10 years.

Table 2.31: Trade Statistics of Mercury Imports (HS 2805.40)

Year	Import Quantity (kg)	Total Import Value (LKR)	Import Value per kg (LKR)
2009	186	723,029	3,887
2010	42,645	5,007,060	117
2011	749	5,487,279	7,326
2012	495	5,827,943	11,774
2013	385	5,981,216	15,536
2014	985	8,911,030	9,047
2015	1,404	8,097,494	5,767
2016	1,826	5,431,790	2,975
2017	1,902	4,058,966	2,134
2018	180	3,346,886	18,594
2019*	160	2,659,323	16,621

*by mid July 2019

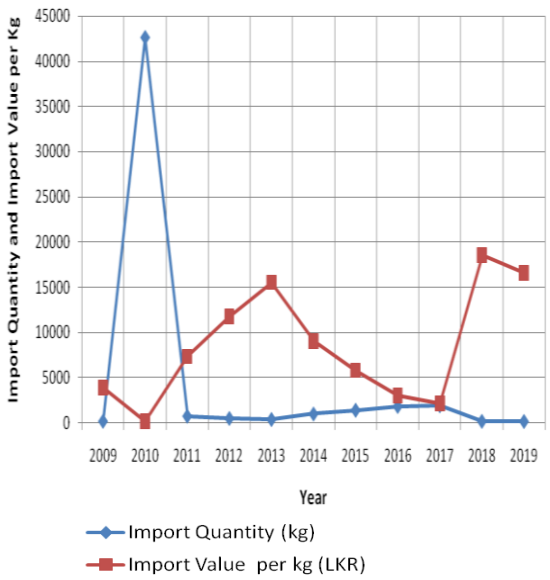


Figure 2.12: Variation of Import Quantity And Import Value (per kg) Over Past 10 Years

Minamata convention was open for signature on October 10, 2013

and entered into force on August 16, 2017. The remarkable decrease in imported quantity along with huge price increment after 2017 could be due to the convention ratification.

2.9.2 SUPPLY AND TRADE OF MERCURY COMPOUNDS

INORGANIC OR ORGANIC COMPOUNDS OF MERCURY, EXCLUDING AMALGAMS

There are no exports under this category.

Chemically defined inorganic or organic compounds of mercury, excluding amalgams was imported under HS 2852.00 until mid 2012 and then by HS 2852.10. The respective import figures are presented in Table 2.32.

Table 2.32: Trade Statistics of Chemically Defined Inorganic or Organic Compounds of Mercury, Excluding Amalgams (HS 2852.00 and HS 2852.10)

Year	Import Quantity (kg)	Total Import Value (LKR)	Import Value per kg (LKR)
2009[1]	03	7,149	2,383
2010[1]	20	36,176	1,809
2011[1]	18	168,282	9,349
2012[1]	50	308,956	6,179
2012[2]	01	2,331	2,331
2013[2]	28	388,541	13,876
2014[2]	11	214,859	19,533
2015[2]	08	206,619	25,827
2016[2]	34	743,534	21,869
2017[2]	24	574,229	23,926
2018[2]	46	251,243	5,462
2019[2]*	42	250,540	5,965

[1] Imports under HS 285200
[2] Imports under HS 285210
*by mid July 2019

Chemically undefined inorganic or organic compounds of mercury, excluding amalgams was imported under HS 2852.90 for which import statistics are given in Table 2.33.

Table 2.33: Trade Statistics of Chemically Undefined Inorganic or Organic Compounds of Mercury, Excluding Amalgams (HS 2852.90)

Year	Import Quantity (kg)	Total Import Value (LKR)	Import Value per kg (LKR)
2013	83	11,737	141
2014	4,894	236,559	48
2015	00	-	-
2016	186	126,438	680
2017	216	86,118	399
2018	01	10,435	10,435
2019*	03	16,209	5,403

*by mid July 2019

ORGANO-MERCURY COMPOUNDS

Organo-mercury compounds are imported under HS 2931.90.20. According to trade statistics, after 2012, only 4 kg of chemicals are imported under this category in 2018 at LKR 12,887 value.

DENTAL AMALGAM

Dental amalgam is traded under the category of 'Colloidal precious metals; inorganic or organic compounds of precious metals, whether or not chemically defined; amalgams of precious metals', HS 2843.90. No exports were recorded under this category after 2007 (1 kg).

The respective trade statistics are given in Table 3.34. Though dental amalgam is mainly imported under HS 2843.90, other amalgams of precious metal can also include in the same category. Therefore, it is difficult to filter the exact trade figures for the dental amalgam.

Table 2.34: Trade Statistics of Colloidal Precious Metals; Inorganic or Organic Compounds of Precious Metals, Whether or Not Chemically Defined; Amalgams of Precious Metals (HS 2843.90)

Year	Import Quantity (kg)	Total Import Value (LKR)	Import Value per kg (LKR)
2009	551	1,623,446	2,946
2010	52	2,600,504	50,010
2011	69	2,852,280	41,337
2012	116	813,882	7,016
2013	75	536,364	7,152
2014	32	622,169	19,443
2015	458	1,285,789	2,807
2016	190	1,799,359	9,470
2017	223	1,314,168	5,893
2018	150	1,684,191	11,228
2019*	08	65,292	8,162

*by mid July 2019

2.10 CONTAMINATED SITES

In Sri Lanka, there is no standard procedure or appropriate strategies for identification of mercury contaminated sites. In the absence of such procedure, mercury contaminated sites are not yet officially identified or declared.

As per the information provided by the national mercury inventory, mercury mining, mercury recycling (secondary production), primary metal production (including gold production by amalgamation), production of basic chemicals or industrial processes, which use mercury as a raw material are not practiced in the country.

However, the prevalence of mercury contamination is expected to be considerable because of the uncontrolled disposal or open dumping of general waste contaminated with e-waste (including fluorescent bulbs) and discarded mercury-added products (thermometers, light sources, batteries, skin lightening creams, etc.). The main open dump yards of Sri Lanka are; Meethotamulla garbage dump site and Karadiyana garbage dump site in Western Province, Gohagoda garbage dump site in Central Province and Dump sites at Ampara District in Eastern Province.

In addition to these dump yards, temporary storage or dumping sites of discarded mercury-containing medical equipment (thermometers and BP meters), fluorescent bulbs and laboratory chemicals can also be potentially contaminated with mercury. Coal fired power plants and surrounding areas can also be identified as a probable site which may have mercury contamination. However, these sites have not been investigated or reported upon mercury contamination.

2.11 IMPACTS OF MERCURY IN HUMAN HEALTH AND THE ENVIRONMENT

Mercury is a very toxic substance, which has serious effects on both human health and the environment. Sources of mercury exposure are widespread. For example, inhalation or absorption of inorganic mercury vapour after a spill or during a manufacturing process or ingestion of methylmercury from contaminated fish.

Mercury Exposure Sources

- Inhalation of mercury vapors in ambient air
- Ingestion of methylmercury via fish and drinking water
- Inhalation or ingestion due to occupational exposures, personal or domestic exposures from mercury-added products (dental amalgams, skin lightening creams, broken fluorescent bulbs, and thermometers, etc.).

When expose to mercury, it can pass through skin, blood-brain and placental barrier and can cause devastating effects on the function and growth of brain in the growing fetus.

Inhalation of mercury vapours can cause harmful effects on the nervous, digestive and immune systems. It can also cause neurological and behavioural disorders, and symptoms such as insomnia, memory loss, neuromuscular effects, headaches, and cognitive and motor dysfunction. Absorption is about 80% for mercury vapor and nearly 100% for oral absorption. It is primarily distributed in the kidneys and brain and readily transferred to the fetus via the placenta, hence it is a neuro and nephro-toxicant. After exposure, mercury is eliminated from the human body via the urine, feces, expired air, and breast milk. Therefore, in addition to blood, urine and breast milk samples are commonly used to test the level of mercury in human.

Methyl mercury is bioaccumulate and biomagnify within the environment. Mercury vapour can travel long distances and even can cross-global barriers moving from one country to other before settling into the atmosphere where it bio-accumulates, further volatizes, or is converted to methylmercury by microorganisms.

Chapter III

Policy, Regulatory and Institutional Framework Assessment

The ratification process to the Minamata Convention on Mercury involved carrying out a national situation analysis, identifying existing relevant domestic legislation and identifying legal or administrative actions that may be needed.

In order to ensure effective implementation of the Minamata Convention through coordinated actions from institutions and stakeholders in the country, it is important to identify the relevant Government ministries, agencies and institutions as well as non-government institutions, private sector stakeholders and others as well as their respective roles and responsibilities.

Table 3.1 is organized according to the provisions of the Minamata Convention to present a summary assessment of situational analysis of the existing policy, regulatory and institutional frameworks and an analysis of possible gaps for the implementation of the Minamata Convention and ensure the sound management of mercury.

3.1 POLICY AND REGULATORY FRAMEWORK ASSESSMENT

Article 3

a. Not allow new primary mercury mining

Sri Lanka does not have mercury ores. However, if any requirement arises, amendment to the existing Mines and Minerals Act No. 33 of 1992 can be done to prohibit the primary mining by including Mercury in to the list of minerals given in the section 33 (1) as mentioned below. If such activity is controlled as per section 66 (4) it is applied to the coastal zone as well.

Relevant Acts

Section 33 of Mines and Mineral, Act, No. 33 of 1992,

1) No license to explore for or mine, transport process, trade in or export uranium, thorium, beryllium, lithium, coral and any other prescribed mineral shall be issued under this Act except with approval of the Minister and any other relevant Minister.
2) The Minister may, by Order published in the Gazette declare such other category of minerals as may be specified in such Order to be a reserved mineral and prescribe the conditions subject to which a license to explore for or mine, collect, remove, transport, process, trade in or export such minerals shall be issued :

Section 66 of Mines and Mineral, Act, No. 33 of 1992, the Coast Conservation

Act, No. 57 of 1981, is amended as follows:

1) in subsection (1) of section 14 of that Act, by the substitution for the words " permit issued in that behalf by the Director ", of the words " permit issued in that behalf by the Director or of a license issued under the Mines and Minerals Act, No. 33 of 1992"
2) in subsection (2) of section 14 of that Act, by the substitution for the words " under subsection (1) ", of the words " under subsection (1) or a license issued under the Mines and Minerals Act, No. 33 of 1992.
3) by the addition at the end of subsection (3) of section 24 of that Act, of the following new subsection
4) Notwithstanding anything in the preceding provisions of this section, the holder of a license issued under the Mines and Minerals Act, No. 33 of 1992, shall not be required to obtain a permit from the Director or any officer authorized by him, for the occupation of any part of the foreshore or bed of the sea lying within the Coastal Zone."
5) in section 31A of that Act, by the substitution for the words "No person shall within the Coastal Zone", of the words "No person, other than a person holding a license issued under the Mines and Minerals Act, No. 33 of 1992, shall within the Coastal Zone"-

b. Phase out existing primary mercury mining within 15 years

As mentioned above, at present there is no mercury mining in Sri Lanka. Therefore, there are no legal provisions for this issue. Accordingly, once the above legal provisions are made to prohibit new mining of mercury, there is no requirement of additional legal measures for phasing out.

c. Prevent the import and use of mercury from primary mercury mining for artisanal and small-scale gold mining (ASGM)

Relevant Acts/ Regulations

Import Export Control Act No1 of 1969 and the regulations published in the extraordinary gazette No 1813/14 dated 05th June 2013 under the Act.

There is no legally prohibition or restriction of importing mercury in these regulations. As mercury is needed for laboratories and certain Ayurveda medicament preparations etc., imports should be managed by inclusion mercury for the list of controlled importation (scheduled I) published in the extraordinary gazette No 1813/14 dated 05th June 2013 under the import export control Act No 1 of 1969.

At present, there is no ASGM activity as such. However, there are some isolated incidences of separating gold from river sand. Mercury usage in these isolated practices is not clear. If it found to be significant actions will be taken to report as per Article 7.3 of the convention.

Therefore, in the process of issuing license for mercury imports, Prior Informed Consent (PIC) procedure must also be strengthen to prevent the use of mercury imports from primary mercury mining for the use of ASGM, if ASGM activity become significant in the future. As an example, in the process of issuing license for importing mercury, the request for a license is to be referred to Central Environment Authority(CEA) where, there is a top level committee (Technical) on Basel, Rotterdam and Stockholm Convention and Minamata convention to study the case by case and report to the Ministry of Environment. This procedure (PIC) must be strengthen for not to allow

Mercury imports for ASGM.

d. In accordance with Article 3.5(b), import and restrict the use of excess mercury from decommissioning chlor-alkali plants, and require environmentally sound disposal.

Relevant Acts/ Regulations

1) Import Export Control Act No1 of 1969 and the regulations published in the extraordinary gazette No 1813/14 dated 05th June 2013.

   Metal waste and waste consisting of alloys of mercury is listed under Basel Convention (Annex VIII, List A, A1010) and import of waste and scrap of the rare earth metals (including mercury) classified in HS code 2805.30.10 is controlled by this regulations.

   As previously mentioned, mercury imports can further be restricted by strengthening the PIC process to prohibit the possibilities of mercury imports from decommissioning Chlor-alkali plants.

2) National Environmental (Protection and Quality) Regulations No1 of 2008 made under the National Environment Act No 47 of 1980 and published in the extra ordinary gazette No 1534/18 dated 01-02-2008 for Emission, Disposal and Management of industrial and domestic waste.

3) Order made under the National Environmental Act No 47 of 1980 published in the Extra Ordinary gazette No 1533/16 dated 25-01-2008 listing the prescribed activities for Environment Protection License to be obtained.

   There are no decommissioned or ongoing chlor-alkali plants in Sri Lanka. Therefore, question of environmentally sound disposal does not arise. However, there is a potential of importing plants with these technology under the investment promotion schemes in the future.

   Chlor-alkali industry can be categorized in to "Chemicals manufacturing or formulating or repacking industries", which is in the prescribed list of activities required to obtain EPLs. Therefore, it can be prohibited either through EPLs process. Furthermore, importation of these plants can be listed as a banned item when the amendment is made for the gazette No 1813/14 dated 05th June 2013 in the future.

Obtain information on stocks of mercury or mercury compounds exceeding 50 metric tons (MT), and mercury supply generating stocks exceeding 10 MT/yr

Mercury supply is purely from imports. According to the custom statistics, the annual imports are in the increasing trend having value of 1784Kg (less than 0.04 of 50MT and 0.002 of 10MT) in 2016. Therefore, meeting the conditions stated in the Convention is seems to be impossible. The restrictions of the imports under the obligations of the convention, this amount is expected to be further decreased.

f. Not allow the import of mercury without government consent, ensuring both the mercury source and proposed use are allowed under the Convention (and applicable domestic law)

Existing Regulations/laws

Special Import License and Payment Regulations, No. 1 of 2011 published in the Gazette Extraordinary No. 1739/3 of 02 January 2012 amended by Extraordinary Gazette No. 1813/14 dated 05/06/2013 under the Import Export Act No 1/1969.

Mercury classified in HS code 2805.40 and but it is neither banned nor restricted by the above regulations. Therefore importations of mercury is to be controlled by amending the restricted list of importations and as in the case of (c) above. The PIC procedure should strengthen to inform the Ministry in charge of Environment Affairs, the National Focal Point through CEA and, to ensure the purpose of importing and meeting the obligations about the source of mercury under the convention (and applicable domestic law) to make the appropriate decision for importation.

g. Not allow the export of mercury unless the importing country provides written consent, the mercury is for an allowed use or environmentally sound storage, and all other conditions of Article 3.6 are met

Relevant Acts or Regulations

Import and Export Act No1 of 1969

Comment: Under the Import and Export and Act No1 of 1969 export of mercury is neither banned nor restricted. Therefore, mercury export has to be restricted by amending this act and PIC procedure should be strengthened. CEA, Ministry in charge of Environment (the focal point of the convention) should coordinate and to find the necessary information to decide whether exporting party satisfies the above conditions and makes decision on exportation.

Article 4: Mercury-added Products

Not allow the manufacture, import, and export of products listed in Part 1 of Annex A not otherwise excluded following the phase out date listed in the Annex

Relevant Laws and Regulations

1) Control of Pesticides Act No. 33 of 1980 and Regulations made under the Act published in Extraordinary Gazette No 1190/24 dated 29-06-2001.
2) National Environmental (Protection and Quality) Regulations No 1 of 2008 made under the National Environment Act No 47 of 1980 and published in the extra ordinary gazette No 1534/18 dated 01-02-2008 for Emission, Disposal and Management of industrial and domestic waste.
3) Order made under the National Environmental Act No 47 of 1980 published in the Extra Ordinary gazette No 1533/16 dated 25-01-2008 listing the prescribed activities for Environment Protection License required.
4) National Medicines Regulatory Authority Act No 5 of 2015:

Comment: Pesticides and topical antiseptics containing mercury compounds were regulatory banned in 1987 and legally banned in 2001 by the Extraordinary Gazette No. 1190/24 of 29/06/2001 under the control of Pesticides Act No. 33 of 1980. Therefore, except pesticides, importation and exportation of the other products should be banned after the phase out date by issuing an order through a gazette notification under the Import and Export Act No 1 of 1969.

Section 144 of National Medicines Regulatory Authority Act No 5 of 2015 withdraws all the provisions set for controlling cosmetics by repealing the previously effective Cosmetics, Devices and Drugs Act No 27 of 1980.

Sri Lanka does not manufacture any of the listed products given under Part I of Annex A except cosmetics. However, CFL/LFL assembling plants are in operation within the country. These plants are not included in the list of prescribed activities to

obtain Environment Protection License required (above iii). Hence, they have to be included into the list necessary to obtain EPLs. There is no law to limit the mercury amount containing in CFL/FTLs for manufacturing. Therefore, the mercury levels as given in the part I of annex A of the convention for CFL and FTLs after 2020 should also be included as a requirement to obtain and renewal of EPLs by amending the regulations under National Environment Act No 47/1980.

Importation of CFL/FTL is also to be restricted by amending the Import and Export Control Act and the amendment with strengthening PIC procedure to satisfy the required mercury levels as given in the part I of Annex A.

Provisions to make any regulation of cosmetics have been disabled by the Section 144 of National Medicines Regulatory Authority Act No 5 of 2015 by repealing the Cosmetics, Drugs, and Devices Act No 27 of 1980 which previously included some regulations of cosmetics. Hence, there are no existing legislations or regulations to control the mercury content of cosmetics and skin whitening soaps (importing and manufacturing) at present. Importation of them may be controlled by amending the Import and Export Control Act and strengthening PIC procedure to satisfy the required mercury levels of cosmetics as given in the part I of Annex A.

Since there is no institution to regulate cosmetics, an authority is to be established by an Act and to take regulatory measures to restrict the mercury levels of the locally manufactured and importing cosmetics. Furthermore, interactions of Ministry of Environment with relevant health institutions are necessary to include the convention obligations of mercury in the process of formulation the new Act.

Switches/relays assembling industries using mercury are also to be regulated in the process of renewal/issuing of EPL by amending the Act47/1980. Importations of these items are also to be restricted by the Import and Export Act Control Act No 1 / 1969 with PIC to permit only to those items with not exceeding mercury levels given in the Annex A.

Mercury Containing Measuring Equipment

Mercury containing measuring equipment such as thermometers, hygrometers, barometers and sphygmomanometers etc., are not manufactured in Sri Lanka hence they are imported and importation of them is not restricted or banned. After careful considerations of them, some classical equipment used for precision measurement and measure the reference values may be allowed for importation and other equipment (containing mercury) for which alternate mercury free equipment can be used successfully could be banned by amending the Import and Export Control Act No 1 of 1969.

However, in HS Codes liquid filled thermometers and pyrometers (not combined with other instruments) are classified under 9025.11 and other types comes under 9025.80. They do not clearly indicate the quantities and the type of liquid. Therefore, to facilitate the restriction of imports of this equipment under the Import and Export Control Act No 1/1969, HS Sub headings are to be introduced for national purposes.

Article 5:

Manufacturing Processes in which Mercury or Mercury Compounds Are Used

a. Not allow the use of mercury or mercury compounds in the manufacturing processes listed in Part I of Annex B

   There is no law to cover this aspect and at present there are no Chlor

alkali plants and Acetaldehyde manufacturing factories. However, regulations have to be made to prohibit introduction/construction of such technologies utilizing mercury. Both of these industries can be categorized in to "Chemicals manufacturing or formulating or repacking industries" which is in the prescribed list of activities required to obtain EPLs as mentioned in the Article 3. Therefore, they can be prohibited through EPLs process. Furthermore, it is possible to include these plants to the prohibited list for the potential importations under the Import Export Act No 1 of 1969 too.

b. Restrict (as specified in the Annex) the use of mercury in the processes listed in Part II of Annex B

   There is no law to cover this aspect. Sri Lanka does not manufacture any of the listed products given under Part II of Annex B. However, regulations have to be made to prohibit new industries utilizing mercury for the processes given in the part II of Annex B. These processes can also be considered as "Chemicals manufacturing or formulating or repacking industries" listed in the order published in the Extra Ordinary gazette No 1533/16 dated 25-01-2008 under the National Environmental Act No 47 of 1980 where EPLs are necessary to obtained. Therefore, at the issuing stage of EPLs these processes can be prohibited. Furthermore, importations of the plants utilizing mercury for the manufacturing processes have to be banned by amending the Import and Export Act No 1 of 1969. Strengthening the PIC procedure is also necessary.

c. Not allow new facilities from using mercury in the processes listed in Annex B, except facilities using mercury catalysts to produce polyurethane.

   This issue has already been covered in the previous paragraph (b).

d. For facilities with processes listed in Annex B, identify and obtain information on mercury or mercury compound use; and control mercury emissions to air, and releases to land and water.

   There are no laws addressing this issue at present. As previously discussed, there are no processes listed in Annex B using mercury or mercury compounds. Establishment of new such manufacturing processes would be prohibited as mentioned in the above (b). Therefore, this requirement is not applicable.

e. Discourage new uses of mercury in industrial processes

   There are no constraints legally at present. The new uses of mercury in industrial processes may be discouraged at the processing stage of issuing the EPLs. Under the section 23W of National Environmental Act No 47 of 1980, using mercury for manufacturing processes may be prohibited by making regulations.

Article 7: Artisanal and Small-Scale Gold Mining (ASGM)

a. Take measures to reduce, and where feasible, eliminate mercury and mercury compound use, emissions (to air), and releases (to land and water) associated with ASGM

There is no law covering this issue and according to the definition given in the convention, there are no ASGMs in Sri Lanka. However, there are some isolated incidences of separating gold from river bed sand. Mercury usage in these isolated practices is not clear. If it is found to be significant, actions will be

taken to report as per Article 7.3 of the convention. Therefore, it is believed that no legal requirement to be made at present.

b. In case, where ASGM activity is "more than insignificant":

There is no law covering this issue.

Purification and separation gold from river bed sand are not included in the prescribed list of activities required to obtain the EPL under the National Environment Act No 47 of 1980. (No 46. Non-ferrous metal processing industries including secondary processes, smelting and recovery of metals is the closest activity in this regard). Therefore, the process of issuing EPL under National Environment Act has to be amended to include separation and purifying gold taken from riverbeds to the above mentioned list. In issuing process of EPL, conditions have to be set to minimize the use of mercury for these purposes and to eliminate open burning amalgam, burning mercury in residential area etc.

In the Prescribed form of Application for an Environmental Protection License for Emission and Disposal of Waste – Form A (regulation 5) Schedule II of the National Environment (Protection and Quality) Regulation published in the Extraordinary Gazette No 1534/18 dated 01/02/2008, a question can be included whether the activity involves the open burning amalgam and burning mercury in residential areas. Hence, decision on issuing the license can be made and thereby elimination of open burning amalgam and burning mercury in residential areas is ensured.

c. Establish coordinating mechanism and delineate agency roles for development/implementation of an ASGM National Action Plan (NAP)

No law covers this issue and there are no ASGMs as such. In case of the isolated cases of purification gold from river bed sand as mentioned above found to be significant, coordinating mechanism has to be made among the Ministry of Mahaweli Development (MMDE) and Environment, Geological Survey and Mines Bureau (GSMB), National Gem and Jewelry Authority (NGJA),Gem and Jewelry Research Institute (GJRI), Ministry of Health and Central Environment Authority (CEA) to ensure the devolution of responsibilities of each agency in developing an ASGM National Action Plan (NAP).

d. Define and formalize or regulate ASGM consistent with the Convention

No law covers this aspect.

If the above gold separating process is significant (use of mercury) it may locally be defined as an ASGM activity and act accordingly.

e. Eliminate whole ore amalgamation, open burning of amalgam or processed amalgam, burning of amalgam in residential areas, and cyanide leaching of mercury-laden sediment, ore or tailings (the "worst practices")

Existing legal Provisions

Draft Assaying and Hallmarking Regulation 2016.

No ore amalgamation practiced in Sri Lanka. However, amalgam is burnt during gold recovery from the dust. This is practiced in small scale jewelers working in the houses where they live while exposing the family members including pregnant mothers and small children.

Although the amount of mercury used in this practice is comparatively small, the exposure is significant as far as the impact on the health is concerned.

The draft Assaying and Hallmarking Regulation 2016 provides the legal power to the Assaying Officer for inspection of Jewelry Manufacturers. Therefore, inclusion of mercury usage reduction in manufacturing process is needed to this draft Act, and at the registration stage of the manufacturers, the techniques going to be used should also to be assessed. The Act is accordingly to be amended and published in the gazette.

f. Set mercury use reduction goals or targets consistent with the timely elimination of the worst practices and other use reduction efforts.

No law covers this issue.

Gold recovery from gold dust and probable gold findings from river bed sand are the major activities in this regard. These two activities including the amount and effect of mercury used have not been studied properly. When the studies are carried out and if the findings are significant, action can be taken accordingly.

g. Reduce mercury emissions, releases, and exposures associated with ASGM, and prevent mercury exposures of vulnerable populations (particularly women of child-bearing age and children)

No law covers this issue.

Predominantly adult men are involved in Jewelry making. However, it is done in domestic level hence, women of child-bearing age and children may be exposed. The associated health risk is not adequately known. These issues need to be incorporated in to Draft Assaying and Hallmarking Regulation 2016.

h. Prevent the diversion of mercury and mercury compounds from other sectors to ASGM, and manage mercury trade consistent with the NAP.

No law covers this issue.

After including mercury imports as a controlled item, the future imports can be made from the request through BRSM tech committee in which the material balance of the previous imports would be requested from the importer on case by case basis before granting the permission. This process will ensure the diversion of mercury from the allowed users to ASGM (locally possible closer activities as mentioned above).

i. Implement a public health strategy to address mercury exposures to ASGM miners and communities

No law covers

For jewelry manufacturers, safety measures may be included in the draft Assaying and Hallmarking Regulations Act 2016.

Act related to occupation health (National Occupational Safety and Health Policy, Factory Ordinance – workman compensation)

Article 8 - Emissions

a. Require best available techniques/best environmental practices (BAT/BEP) or associated emission limit values (ELVs) for new (as defined in Article 8.2(c)) sources listed in Annex D (coal-fired power plants, coal-fired industrial boilers, non-ferrous metal smelting and roasting processes, waste incineration, and cement production)

Existing Legal Situations:

1. Order made under the section 23 Z of the National Environmental Act 47/1980,
   National Environmental (Procedure for Approval of Projects) Regulation No.1 of 1993
   Published by the Gazette No. 722/22 of 24.06.1993 and the amendments published by the
   Gazette No Gazette No. 1104/22 of 05.11.1999.

   According to these regulations, the following project types are included in the list of prescribed activities (which are listed in the Annex D of the convention) requiring an Initial Environmental Examination (IEE)/ Environmental Impact Assessment (EIA)

   - Construction of thermal power plants having generation capacity exceeding 25 Megawatts at a single location
   - Smelting of aluminum or copper or lead of production capacity exceeding 25 tons per day/ Non-Ferrous Basic Metal
   - Manufacture of Cement through production of clinker

2. Cabinet Appointed Committee was established through the cabinet decision No dated to determine the siting of High and Medium Polluting industries outside the Investment Promotion Zones and Industrial estates.

3. Order made under Section 23A of National Environmental Act 47/1980 published in the gazette No. 1533/16 of 25/01/2008.
   According to this notification, the following activities belongs to the list of Annex D have been prescribed for which Environmental Protection License is to be obtained.
   - Non-ferrous metal processing industries including secondary process, smelting and recovery of metals.
   - Cement industries (clinker grinding, manufacturing or repacking).
   - Incinerators having a feeding capacity of 5 or more metric tons per day.

4. Draft National Environmental (Stationary Source Emission Control) Regulations under the National Environmental Act No. 47 of 1980. It mentions the limits of mercury emissions as given below:-

Thermal Power Plants (Schedule II, Part I)
Municipal Solid Waste (any rated output capacity) = 0.001 mg/Nm^3
Incinerators (Schedule II, Part IV)
Rated output capacity < 1 MT/hr = 0.01 mg/Nm^3
Rated output capacity > 1 MT/hr = 0.001 mg/Nm^3
Any infected waste incinerator = 0.001 mg/Nm^3
Pollutant Based standards (Schedule III (Part II)
Mercury or it compounds emitted from any processes/source = 0.01 mg/Nm^3 as
[Mercury (emission limit for combustion/non combustion)]

Comment and Recommendations:

1. The following activities have to be listed in the prescribed activities of "National Environmental (Procedure for Approval of Projects) Regulation" by making necessary amendments.
   - Coal-fired industrial boilers
   - Waste incineration facilities
2. Special attention is to be made to evaluate the BAT/ BEP with regard to mercury for the all new industries listed in the Annex D.

3. The following activities have to be included to the prescribed list required to obtain EPL to complete the list of Annex D.
    - Coal-powered power plants
    - Coal-fired industrial boilers.
4. Re-evaluate the emission limits to be used for Emission Limit value (ELV)for these categories (Annex D) of new industries, incorporate in to the Draft National Environmental (Stationary Source Emission Control) Regulations and publish in the gazette.

b. Require one or more measures identified in Article 8.5 to control/reduce mercury emissions from existing sources listed in Annex D, which shall be operational at the source within 10 years.

There are no laws covering this aspect except the Draft of the National Environmental (Stationary Source Emission Control) Regulations - 2016.

Recommendations:

- Consider the potentials of the existing industries to absorb the minimizing mercury emission steps given in 8.5 of the convention and prepare the national plan of mercury emissions for the next 10 years for the existing industries and set the standards to limit the mercury emissions for the existing sources.
- Amend the Draft of National Environmental (Stationary source emission control) Regulations for mercury emissions incorporating the plan for the existing sources and publish in the gazette.
- Implement those limits in renewing the EPL processes.

Article 9: Releases to Land and Water

a. Require reporting or otherwise obtain information as needed to identify significant sources of mercury/mercury compound releases to land or water, and to maintain an inventory of releases from the sources identified.

Existing Legal Situation:

There are no laws covering this issue.

However, this information can be obtained through the process of issuing EPLs. The Form A (Regulation 5) of Schedule II of National Environment (Protection and Quality) Regulations published in the Extra ordinary gazette No 1534/18 dated 01/02/1008 is recommended to amend (namely inclusion of a question to answer whether the mercury and mercury compounds are discharged and if so states the names and quantities).

b. Take one or more measures specified in Article 9.5 to control/reduce mercury and mercury compound releases to land and water from significant sources it identifies

Existing legal provisions:

1) National Environmental (Protection and Quality) Regulation No 1 of 2008 published in the Extraordinary Gazette No 1534/18 dated 01.02.2008.

When industry sector is concerned, there are maximum tolerant limits of mercury to discharge of the waste water to land and water, which have to be satisfied for EPL and they are given below:

- Discharge of industrial

waste into inland surface waters = 0.0005 mg/l

- Industrial waste discharge on land for irrigation purposes = 0.01 mg/l
- Industrial and domestic waste discharge into marine coastal areas = 0.01 mg/l
- Discharge of effluents into public sewers with central treatment plants = 0.005 mg/l
- Maximum tolerance limit mercury stipulated by BOI for industrial wastewater (effluents) discharged into the common waste water treatment plants = 0.001 mg/l.

With regard to mercury waste, the following activities are also included in the list of the schedule to take EPLs satisfying the above mercury levels:

- Discarded, used, fused, broken and off-specified fluorescent lamps/bulbs (waste code: N 291)
- Mercury wastes containing metallic mercury from manufacturing of fluorescent lamps (waste code: S 211)
- S212 Activated carbon waste containing mercury from hydrogen gas purification process. (Waste code: S 212)
- Mercury bearing sludge from brine treatment and Mercury bearing brine purification muds from chlorine (waste code: S 213)

Moreover, the same gazette notification mentions that the holder of a license shall forthwith notify the Authority of –

- Any changes made or proposal to be made in the particulars furnished in connection with his application for a license ;
- Any decision to terminate any activity to which the license relates, and shall comply with any directions that may be issued by the Authority to prevent or mitigate environmental pollution and hazards.
- Every applicant and every holder of a license shall comply with any direction given by or on behalf of the Authority for the purpose of protecting the environment (regulation 12).

2) Sri Lanka Standard Institutes (SLSI) has developed the standard for potable water { SLSI 614:2013} where the maximum limit of Mercury is 0.001 mg/l

3) Regulations published in the extraordinary gazette No 1816/37 dated 28-06-2013 under the Section 51 (read with Section 27 and 28) of Marine Pollution Prevention Act, no 35 of 2008 (for the license issued for the dumping of waste to sea).
The tolerant limit of mercury of the discharge from land based industries and other sources into marine and coastal areas: 0.01 mg/l
Therefore, legal provisions can be made by relevant institutes individually to control/reduce mercury through the above mention regulations. However, as a party it is recommended to amend the values of tolerant limits after discussing with the relevant parties with a grace period for the existing industries and implement immediately for the new industries at the EPL process.

Article 10: Environmentally Sound Interim Storage of Mercury, Other Than Waste Mercury.

a. Take measures to ensure interim mercury storage is conducted in an environmentally sound manner, taking into account guidelines to be developed by the Conference of the Parties (COP).

Existing Legal Situations:

There are no legal provisions to cover this aspect.

Since Sri Lanka does not have mercury mining and mercury utilizing manufacturing processes, interim storage cannot be expected to be large and the interim storage of mercury would mostly be with merchants. Therefore, once mercury is listed as a license item of the Import Export Act, the importer may be asked to provide the information on stock facilities at the stage of obtaining the license at the intervening stage of BRSM Tech committee as mentioned under Article 7.

Article 11: Mercury Waste Management

a. Take measures to manage mercury wastes in an environmentally sound manner, taking into account guidelines developed under the Basel Convention and in accordance with COP requirements to be developed.

Existing legal situation:

- Mercury waste containing metallic mercury, organic and inorganic mercury compounds is listed as scheduled waste by the National Environmental (Protection and Quality) Regulations, No. 1 of 2008 published by Extraordinary Gazette no. 1534/18 dated 01/02/2008
- Provisions under Basel Convention for import/ export of mercury waste:

Require transport across international boundaries in accordance with the Basel Convention, or if the Basel Convention does not apply, consistent with international rules, standards, and guidelines.

Sri Lanka is a party of Basel convention.

Although the gazette nu 1813/14 dated 05th June 2013, issued under the import and Export control Act 01 of 1969 identify inorganic and organic mercury compounds except amalgam as a licensed item, mercury waste has not been listed.

The issue has to be properly addressed under Import Export Act.

The role of BRS Tech and BRS National Coordinating Committee has yet to be legally empowered through a cabinet approval.

Article 12: Contaminated Sites

a. Develop strategies for identifying and assessing mercury/mercury compound contaminated sites

There are no legal provisions to cover this issue.

Industries which could make mercury waste (such as Acetaldehyde production) has not been operated in the country and therefore sites with significant contamination of mercury cannot be expected. However, the potential sites such as solid waste dumping sites and fly ash storage sites (Coal fired power plant and clinker manufacturing plant) has to be tested for mercury contamination. Assessing mercury/mercury compounds of these sites may be done through the relevant industries or institutions. For this purpose, process of renewing EPLs has to be amended by

inclusion of pertaining the testing arrangement of mercury/mercury compound and reporting to CEA as a necessary requirement.

b. If risk reduction activities are taken at contaminated sites, they are taken in an environmentally sound manner, incorporating risk assessment where appropriate.

There are no legal provisions in this issue. Severely contaminated sites are unlikely as industries listed in Annex B do not exit. However, if significant contaminated sites are identified, special measures are expected to take in environmentally sound manner.

implement the convention obligations which requires new regulations.

b. Access financial resources available under the Convention financial mechanism and other resources available from multilateral, regional, and bilateral funding sources.

There are no legal provisions to address this issue. However, representation will be made to obtain financial resources from multilateral, regional and bilateral agencies. Already requests have been already made to obtain funds to study the procedure of mercury usage in small scale jewelry manufacturing and the health impact.

Article 13: Financial Resources and Mechanisms

a. Access domestic resources as may be needed to implement Convention obligations

There are no legal provisions to address this issue.

Extended Producer Responsibilities (EPR) has been identified in several policies including National waste management policies in 2007. The Cabinet of Ministers has granted the approval to implement the EPR principal to two electronic equipment and two plastic products by the Cabinet Paper No 16/2236/704/061 and dated 11.10.2016. Institutional arrangement are being made for the implementation and on the success of this process, the same principal can be applied for the management of mercury containing equipment and other mercury uses to pay for the establishment of a trust fund to

Article 16: Public Health

a. Promote the development and implementation of strategies to identify and protect populations at risk, such as developing fish consumption guidelines.

Existing legal provisions:

1) Food ACT no 26 of 1980

To Regulate and control the manufacture, importation, sale and distribution of food,

To establish a food advisory committee

Section 2 (1) Under Part 1, No person shall manufacture, import, sell or distribute any food-(a) that has upon it any natural or added eleterious substance which renders it injurious to health; (b) that is unfit for human consumption;

2) Consumer Affairs Authority Act No 9 of 2003, Part I, section 7

The object of the Authority shall be - (a). To protect consumers

against the marketing of goods or services which are hazardous to life and property.

3) Import and Export Act No 1 of 1969
Standards for maximum mercury levels of the foods have to be developed and accordingly, amendments to the Food Act, Consumer Affairs Authority and Import Export Acts are to be made to restrict the manufacture, sale and imports of food items exceeding the mercury standards. Alternatively, recommended weekly consumption of foods with mercury levels such as fish should be given in the labels and be displayed in markets by making regulations under Consumer Affairs Authority Act.

In order to identify the communities in risk such as fishing communities, periodical tests for mercury levels are to be done through public health guidelines.

b. Promote occupational exposure educational and prevention programs

There are no legal provisions in this issue. However, the Factory Ordinance No 45 of 1942 has certain measures for the safety of workers in the factories while the safety for exposure to mercury has not been mentioned at all. As Sri Lanka does not have factories explicitly using mercury, the regulations to conduct periodically educational programmers on exposure to mercury along with other poisonous chemicals and safety measures are recommended to be included to the ordinance.

Article 17/ 18: Information Exchange/Awareness-Raising

a. Collect and disseminate information on annual quantities of mercury and mercury compounds emitted, released, or disposed; and other information specified in Article 18.

There are no legal provisions in this issue.

Relevant Acts/regulations

1) Right to Information Act, No. 12 of 2016

2) National Environmental (Protection and Quality) Regulation No 1 of 2008 published in the Extraordinary Gazette No 1534/18 dated 01.02.2008.

Annual amount of imports and exports of mercury and mercury compounds could be obtained from the Customs. Mercury emissions can be computed for the energy sector. In addition, at the national Level, mercury usage information can be obtained through the EPR process which is yet to be implemented to the all hazardous materials and chemicals. Further, providing the information on mercury as a requirement should be included to issuing the EPL process (by amending the Application form).

3) The Right to Information Act, No. 12 of 2016provides exchange of these data from the state sector. Therefore, CEA is in a position to collect the information.

b. Share information on the health and safety of humans and the environment as non-confidential, in accordance with Article 17.5

Relevant Regulations/Acts

Right to Information Act, No. 12 of 2016
Government information (except those which has implication of national security, derogation of the powers, privileges and practices of Parliament and the information affecting the

privacy of the personnel) can be shared under this act. Therefore, it allows sharing the required information in the state sector except the individual personnel information. However, information like statistics such as number, type of diseases, lives lost, time period etc. can be shared.

Provisions have to be made to collect the above information from private health institutions through the Private Health Regulatory Council.

c. Report to the COP on progress in implementing Convention obligations under Article 21

The Ministry of Mahaweli Development and Environment, the national focal point of the convention will report the progress of implementing the convention obligations.

Article 19: Research Development and Monitoring

a. Inventories of use, consumption, and anthropogenic emissions to air and releases to water and land of mercury and mercury compounds

There are no legal provisions for this issue.

Therefore, regulations have to be made under the National Environmental Act 47 of 1980 to each government and non-government institutions to maintain inventories and provide the information annually to CEA of utilizing mercury, mercury containing materials and equipment and material balance of mercury and mercury waste.

Assessments of the impact on human health and the environment, in addition to social, economic and cultural impacts, particularly in respect of vulnerable populations

There are no legal provisions in this issue.

Since Sri Lanka does not use mercury explicitly in industries, the health of vulnerable communities such as those engaged in jewelry crafting and those consuming fish heavily may be assessed at the beginning through the Ministry of Health and newly passed out graduates while funding the project through the Ministry of Mahaweli Development and Environment which collect all information. It is also possible to check the mercury levels of the biota of the possible contaminated sites.

On the basis of findings, research work can be extended to other communities as well.

In addition, the following gaps or solution to fill the above issues have also been identified.

- Increase popularity of the field through creating awareness among Post graduate trainees, making funds available.
- Promote research in the field of Ayurveda in order to get scientific evidence on detoxification of RASA. Prospective studies on patients consuming heavy metals containing medication including mercury.
- Establish/ strengthen adequate laboratory facilities to assess the contents of mercury in samples. Comparison of data taken at different institutions and different methods are also proposed for the credibility and the accuracy of the test results.
- Laboratory surveillance system needs to be strengthened incorporating assessment of body fluids regarding occupational exposures
- Use the findings of research for advocacy for policy makers in order to take evidence based approaches in prevention and care.
- Popularize the above findings among the public.
- The research findings are published among the scientists through a research symposium.

The major responsible institutions are MMDE, Ministry of Mass media and Finance, Ministry of Higher Education, Ministry of Science, Technology and Research.

Harmonized methodologies for the activities undertaken under those listed above

At present, the cooperation between relevant stakeholders both at technical and administrative levels are available. However, to harmonize the activities, a plan should be drawn for the activities by having consultative workshops and reviewing the progress by a steering committee comprising the representatives essentially from health, economic, social science, education, research and industry sectors. MMDE is the institution responsible for the establishment of such steering committee and organizing the consultative processes.

Information with regard to environmental mercury cycle and its changes

Since Sri Lanka does not have primary mercury mines, chlor-alkali plants and ASGMs, mercury has not been using exclusively. In addition, there is no arrangement (with whom and why) to collect information on the environmental cycle, transport (including long-range transport and deposition), transformation and fate of mercury compounds in a range of ecosystems. Moreover, there is no appropriate account of distinction, between anthropogenic and natural emissions and releases of mercury and remobilization of mercury from historic deposition.

It is also believed that only a few segments of the above are remained significantly to report. However, in future, the above information may be provided after making a detailed study which requires filling the gaps identified and mentioned under the different articles of the convention. MMDE is the major responsible institution to make administrative and technical arrangement.

Information on commerce and trade in mercury and mercury compounds and mercury-added products

Since Sri Lanka is an island, all trans-boundary trading of mercury, mercury compounds and mercury added products is carried out through the customs. Therefore, by strengthening the regulations in connection with imports and exports of those items to receive all related information to one place (such as CEA) is proposed to create a data base and information with regard to commerce and trade in mercury and mercury compounds. Concerning the information on commerce and trade within the country, internal trading procedures need to strengthen to receive the information. This can be done through introduction of licensing systems of traders. MMDE, Ministry of Industries and Commerce, BOI, Ministry of Finance, CEA, and Provincial councils are the major relevant institutions.

Recommendations

- Addressing the institutional gaps to access the data maintained by private sector laboratories have to be addressed.
- Establishment of a mechanism to collect laboratory findings and the data available with other institutions concerning the mercury of Human, mammals, environment etc. at national level.
- Strengthening of the laboratory facilities to assess body fluids and food samples, fish.
- Increase popularity of the field through creating awareness among Post graduate trainees, making funds available.

- Promote research in the field of Ayurveda in order to get scientific evidence on detoxification of RASA. Prospective studies on patients consuming heavy metals containing medication including mercury.
- Establish/ strengthen adequate laboratory facilities to assess the contents of mercury in samples. Comparison of data taken at different institutions and different methods are also proposed for the credibility and the accuracy of the test results.
- Laboratory surveillance system needs to be strengthened incorporating assessment of body fluids regarding occupational exposures
- Use the findings of research for advocacy for policy makers in order to take evidence based approaches in prevention and care.
- Popularize and publishing the above findings among the public.
- MMDE to establish a steering committee comprising the representatives essentially from health, economic, social science, education, research and industry sectors to harmonize and coordinate the implementation of the Minamata Convention.
- Strengthen internal trading procedures to receive relevant information through introduction of licensing systems of traders.

Information and research on the technical and economic availability of mercury free products and processes on BAT and BEP to reduce and monitor emissions and releases of mercury and mercury Compounds

The facilities such as financial, technological and institutional are to be developed/ improved to encourage research on low cost, user friendly alternate methods for health, industry and trade sectors and monitoring systems of emissions and release of mercury. Financial encouragement is also needed for introduction of available techniques for these sectors such as concession of mercury free alternates and for BAT. These new technology and practices can be published and popularized through the mechanisms such as research symposia, media publicity. The steering committee may take the appropriate actions to collect all the information and publication.

Recommendations

- Study mercury usage in indigenous medicine sector and jewelry crafting and the health of the exposed communities
- Develop or improve financial, technological and institutional facilities to encourage research on low cost, user friendly alternate methods for health, industry and trade sectors and monitoring systems of emissions and release of mercury.
- Provide financial encouragement to introduce the available techniques for these sectors such as concession of mercury free alternates and convert to BAT.
- Popularize the new technology and practices through media publicity, seminars and publish the research findings through research symposium
- Collect all findings and information and take actions to publicize (by the steering committee.)

The major relevant organizations are MMDE, Ministry of Industries and commerce, Ministry of Health, Universities, Ayurvedha Research Institute, College of dental surgeons, ITI, Ministry of Science, Technology and Research, Ministry of Parliamentary Affairs and Mass Media.

b. Modeling and geographically representative monitoring of

levels of mercury and mercury compounds in vulnerable populations and in environmental media, including biotic media such as fish, marine mammals, sea turtles and birds, as well as collaboration in the collection and exchange of relevant and appropriate samples

There are no legal provisions in this issue.

c. **Assessments of the impact of mercury and mercury compounds on human health and the environment, in addition to social, economic and cultural impacts, particularly in respect of vulnerable populations**

d. **Harmonized methodologies for the activities undertaken under those listed above**

e. **Information on the environmental cycle, transport (including long-range transport and deposition), transformation and fate of mercury compounds in a range of ecosystems, taking appropriate account of the distinction, between anthropogenic and natural emissions and releases of mercury and remobilization of mercury from historic deposition**

f. **Information on commerce and trade in mercury and mercury compounds and mercury-added products**

g. **Information and research on the technical and economic availability of mercury free products and processes and on best available techniques and best environmental practices to reduce and monitor emissions and releases of mercury and mercury compounds**

3.2 INSTITUTIONAL FRAMEWORK ASSESSMENT

Article 3

Mercury Mining

At present, ordinary mercury mining is not carried out in Sri Lanka. Thus, there is no law to prohibit mercury mining.

However, section 33 (i) of the Mines and Minerals Act. No 33 of 1992, mentions that "No license to explore for mine, trade in or export uranium, thorium, beryllium, lithium, coral and any other prescribed mineral shall be issued under this Act, except with approval of the Minister and any other relevant Minister." Therefore, amending this section by inserting mercury to the list of minerals, mercury mining can be prohibited. Section 66 of the same Act amends the Coast Conservation Act No 57 of 1981, making necessary to obtain license under the Mines and Minerals Act, No 33 of 1992 for activities in sea beds within the coastal zone. Therefore, mercury mining within the country including the coastal zone can be prohibited by the prescribed amendment. Ministry of Mahaweli Development and Environment (MMDE), Geological Survey and Mines Bureau (GSMB) and the Department of Coast Conservation are the main responsible institutions for making the necessary amendment.

Mercury Imports

Importation of mercury is not legally prohibited in the country. According to the definition of ASGM in the convention, mercury utilizing for ASGMs are either insignificant or not practiced in Sri Lanka. However, there are some isolated incidences of separating gold from river sand. Mercury usage in these isolated practices is not clear. If it found to be significant, actions will be taken to report as per para 3 of Art 7.3.

According to available information, heavy metals including Mercury are

used for 35-40% of all Ayurveda medicines in a process called detoxification (form in the medical preparation called “Rasa”). Ayurveda cooperation is the main manufacturer of “Rasa” preparations. Ayurveda Department gets down their requirement of mercury through registered suppliers adhering to procurement procedures. In addition, Mercury is imported to Sri Lanka for the use of health sector to repair Mercury containing Sphygmomanometers. Mercury is also used in laboratory experiments including the education sector. As they are for experiments and research purposes, are exempted as mentioned in the Article 3. However, the estimate on the amount of Mercury used by the small-scale jewelers is not known yet.

Mercury Stocks

With regard to mercury stocks, only one fluorescent bulb assembling industry and the mercury merchants may have some stocks of mercury wastes. Since all companies importing mercury has to be registered with customs, the importing amount of mercury is recorded in the Sri Lanka Customs database. Accordingly, 2.8 tonnes of mercury has been imported in the year 2015 and it is higher than that in the previous years. Therefore, the total amount of importing mercury (the only way of generating) is not expected to be less than 10 tonnes per year.

There are no decommissioned or ongoing chlor-alkali plants in Sri Lanka. Using Mercury for chlor-alkali plants is an outdated technique; hence new plants with such technology will not be established. However, there is a possibility of importing and fixing old machines from some other countries through various investment promotion programmes carried out by Sri Lankan government. These potentials should be prohibited by amending the import and export control act and during the process of issuing environment clearance for the new plants. MMDE, Central Environment Authority (CEA) Ministry of Industries and Commerce and Board of Investments of Sri Lanka (BOI) are the responsible institutions.

Mercury Exports

Since mercury mining is not practiced in Sri Lanka, the only possibility for exporting of mercury is those already imported or mercury recovered from mercury waste. Concerning the mercury recovery facilities, there is only one industry involve in recovery of phosphor powder from the discarded fluorescent bulbs. However, there is no efficient mechanism for collection of the fluorescent bulb wastes separately and therefore the Company has not able to collect sufficient stocks to be shipped.

As there is no restriction of exporting Mercury, it should be regulated by amending Export and Import control Act or issuing regulations including Gazette under the act to satisfy the conditions of Article 3.6. MMDE, CEA, Department of Imports and Export Control, Ministry of Trade and Industries and Sri Lanka Customs are the responsible institutions.

Restriction of Mercury Imports:

At present, Mercury can be imported freely. Therefore, regulations have to be made so as to satisfy the conditions of Article 3.8. MMDE, Imports and Export control department, Ministry of Trade and Industries, Ministry of Health, Board of Investment and Customs are the responsible institutions.

Identified Gaps and Recommendations

- Prohibition of mercury mining within the country including the coastal area by amending Section 33 (i) of Mines and Minerals Act. No 33 of

1992by inserting mercury to the list of minerals for which no mining license will be issued.

- Potential for establishment of new chlor-alkali facilities using mercury based technique should be prohibited by amending the import and export control act and during the process of issuing environmental clearance/approval.
- Regulation of mercury export by amending Export and Import control Act or issuing regulations under the act to satisfy the conditions of Article 3.6.

Article 4 - Mercury Added Products

Except pesticides and biocides (as they are prohibited through the Pesticides control Act), other products listed under part I of Annex A of the convention may be imported to the country. Therefore, regulations are to be enforced under the import and export control act to include mercury added products into the import export control list in order to limit the importations and exportations. Fluorescent bulbs are assembled in Sri Lanka. Therefore, this has to be controlled through the process of issuing/renewing the Environment Protection License (EPL) under Environmental law 47/1980. Switches/relays assembling industries using mercury (if any) are also to be regulated in the process of renewal/issuing of EPL by amending the Act47/1980. Importations of these items are also to be controlled by the Import and Export Act.

Importation of mercury containing medical equipment are included in HS code 90.25 are controlled under the Special Import License and Payment Regulations, No. 1 of 2011 published in the Gazette Extraordinary No. 1739/3 of 02 January 2012 of the Import and Export control Department.

Measuring Equipment such as, Mercury Thermometers, Sphygmomanometers and Barometers etc. are not manufactured in Sri Lanka and therefore, they are imported. The HS code 9025.11 is utilized for all liquid filled direct reading thermometers. The liquid, however, may be mercury, alcohol or any other liquid as it is not exclusively mentioned as mercury. Therefore, in order to identify the quantities of mercury containing thermometers, national sub headings of HS codes to be established depending on the liquid.

The HS code 9025.80 is for liquid filled measuring instrument excluding thermometers (such as barometers, hygrometers, phsychrometers, etc.), which also may or may not contain mercury. Therefore, national sub headings for HS codes are to be introduced for mercury containing these types of equipment as well. MMDE, Ministry of Finance and Sri Lanka Customs are the major responsible institutions.

The Ministry of Health, has taken initiatives (through internal guidelines) to discourage the mercury containing equipment and accordingly, purchasing the clinical oral thermometers has drastically reduced during the past few years. However, still some medical practitioners prefer for mercury sphygmomanometers. Department of Meteorology uses thermometers and barometers for environmental monitoring. They have the intention of replacing them with non-mercury alternatives but the equipment at present will continue to be used until they are non-serviceable. Due to the national obligations on the data accuracy, even the modern equipment is to be calibrated against classical equipment that contains mercury. Hence, they expect to retain a few mercury contained

equipment to take as reference values, even after gradual replacement of them.

Section 144 of The National Medicine Regulatory Authority Act no 5 of 2015 repeals the Cosmetics, Devices and Drugs Act, No. 27 of 1980 which has the provisions to regulate cosmetics. However, the new act has no provisions to regulate cosmetics. Prior to 2015, mercury content in cosmetics and whitening creams was checked during the registration process but this procedure is not carried out as registration of cosmetics are not taking place in Sri Lanka at present. In the previous registration process (Act no. 27 of 1980) of any cosmetic, an application was to be made to the Cosmetics Drugs and Devices Authority and it was referred to the cosmetic subcommittee of the Ministry of Health, where assessment of heavy metals (Cd, Hg, Pb, As) were taken from the approved laboratory (ITI) before granting the registration. Further, the labeling of the product should include key ingredients and raw materials were assessed using the SLS standards list (maximum allowed mercury concentration for cosmetics and toothpastes were 1ppm and 0.2 ppm respectively). The validity of the registration was for a five year period.

Discourage the manufacture and distribution of new mercury containing products

Manufacturing and distribution of new mercury containing products is discouraged at the project approval stage. The exiting industries may be discouraged by setting conditions appropriately at the renewal of EPL under Environmental Act 47/1980.

Ministry of Mahaweli Development and Environment (MMDE), Central Environmental Authority (CEA), Ministry of Health Nutrition and Indigenous Medicine, Consumer Affairs Authority (CAA), Sri Lanka Standard Institute (SLSI), Department of Measurement Unit, Standards and Services , Board of Investment (BOI), Ministry of Industries and Commerce, Registrar of Pesticides (ROP), Ministry of Agriculture, Department of Import Export Control and Department of Customs are the major responsible institutions for formulation of regulations and standards required.

Pesticides and biocides containing Mercury compounds were regulatory banned in 1987 and legally banned in 2001 by the Extraordinary Gazette No. 1190/24 of 29/06/2001 under the control of pesticides act No. 33 of 1980. The lab facilities to analyze heavy metals in pesticides and biocides including mercury are available with the Registrar of Pesticides.

Gaps and recommendations identified

- There is no functioning authority for registration of cosmetics in Sri Lanka after dissolving of Cosmetics, Devices and Drugs Regulatory Authority in Sri Lanka in March 2015 and establishment of the separate National Medicines Regulatory Authority, which does not mention about Cosmetics.
- Standards on permissible levels for heavy metals are still at the draft stage.
- There are no accredited laboratories to assess the contents of Mercury. Laboratory of the Industrial Technology Institute (ITI) and Bureau Veritas are the approved laboratory but not yet accredited for testing of Mercury. The National Drugs Quality Assurance laboratory of Ministry of Health does not have adequate facilities to analyze the heavy metals.
- Nationally, there is a huge deficiency in human resources who are responsible for enforcement of legal procedures. There are only 46 Food and Drugs

inspectors and 1682 Public Health Inspectors in the government service who are mainly involved in enforcement of Food Act.

- There are no legislations for regulation and control of cosmetics in Sri Lanka since March 2015 as Cosmetic, Devices and Drugs Act No 27 of 1980 (which had the regulations to control) has been repealed by the section 144 of National Medicines Regulatory Authority Act no 5 of 2015.
- In addition to the products imported, there may be locally manufactured products and adding mercury to the creams at beauty salons. Therefore, these activities and the ingredients of the products they used are to be monitored.
- Regulations are to be enforced under the import and export control act to include mercury added products into the import export control list to limit the importations and exportations:

  The assembling of CFL bulbs has to be controlled through the process of issuing/renewing the Environment Protection License (EPL) under Environmental law 47/1980.

  Switches/relays assembling industries using mercury are also to be regulated in the process of renewal/issuing of EPL by amending the Act 47/1980.

  Importations of these items are also to be prohibited by the Import and Export Act.
- In order to identify the quantities of mercury containing thermometers, national sub headings of HS codes (HS codes 9025.11, 9025.80) to be established depending on the liquid.
- Discourage establishing of new industries using mercury through prohibition of issuing EPLs.

Existing Domestic Guidelines for Mercury Containing Equipment

There are no guidelines with regard to mercury containing equipment other than those issued by the Secretary of Health dated 24-01-2013 to the health sector.

The following instructions were included pertaining to mercury containing measuring instrument and light sources in these guidelines:

- To purchase non- mercury thermometers and phase out use of mercury in health ministry institutions. As the guidelines does not mention about phasing out date it is recommend to reissue/amend the guidelines with a date for phasing out
- To procure non- mercury aneroid sphygmomanometers and phase out use of mercury containing sphygmomanometers.
- To collect mercury in hospitals due to breakages of thermometers safely in glass bottles with stopper and store them safely
- To store obsolete CFL bulbs without breaking (preferably in a barrel) until suitable collection and disposal mechanism worked out.

Limitations/Gaps identified (mercury containing products in the Health and other sectors)

- There is no data base on mercury containing equipment in central as well as regional levels. Data are obtained from different registers but equipment donated to health institutions is not sometimes in records.
- Some physicians prefer usage of Mercury sphygmomanometers may be due to familiarity, simplicity, clearly understood mechanism and long lasting accuracy than alternate equipment.
- There is no method for collection or disposal of broken sphygmomanometers and thermometers.

- The guidelines distributed regarding management of Mercury in the health sector dated 24-01-2013 issued by the Secretary Health has limited validity in legal perspective. It does not have a circular number. In addition, it does not contain adequate information (such as handling spilled mercury) for people to act; therefore the level of implementation is uncertain.
- Most of the available guidelines related to mercury are limited to health ministry institutions.
- Monitoring mechanism to measure the implementation status of guidelines was not established so far and no directives were given for collection mechanism of broken equipment and amalgam.
- There are no proper guidelines about precautions to be taken during breakage of mercury containing equipment or spillage
- Used CFL bulbs are stored but no mechanism for collection.

Recommendations identified (mercury containing products in the Health and other sectors)

- Consider quality including durability of alternate products (sphygmomanometers etc.) during tender procedures. Phasing out mercury containing equipment with definite dead line should be done in parallel with awareness campaigns.
- Establish a collection system for broken instruments and lights (CFL and FTL) s and a method of disposal before replacing with alternatives.
- Preparation of guidelines on measures to be taken on spillage and safe storage of obsolete equipment.
- Prepare separate guidelines and standards for "Rasa vedakama" on minimizing the use of mercury and prescribing Rasa oushada (medicaments with mercury) in consultation with sector experts and, enforcing them through Indigenous Medicine sector of the Ministry of Health.
- Enforce guidelines and standards related to above matters on minimizing mercury usage and to private sector health institutions through Private Health Service Directorate.
- Making representations to the COP about Rasavedakama.
- Ministry of health services and Indigenous Medicine, MMDE, CEA, SLSI and Department of Ayurveda are the main responsible institutes.

Legislations/Guidelines related to Amalgam

Amalgam is classified in HS code 2843.90 and controlled under the Special Import License and Payment Regulations, No. 1 of 2011 published in the Gazette Extraordinary No. 1739/3 of 02 January 2012.

Ministry Guidelines:

a) Instructions regarding management of Mercury in the health sector dated 24-01-2013 issued by the Secretary Health. In connection with dental fillings, it instructs to collect dental amalgam using amalgam separators for safe handling.
b) Practice guidelines on Oral healthcare during pregnancy, Published by Family Health Bureau, Ministry of Health, Sri Lanka – 2009 instructs to using amalgam, GIC, composite chemical or light cured and zinc oxide and eugenol cement for uncomplicated restorations

Limitations/ Gaps Identified

- Importation of amalgam is not

banned; therefore mercury can be purchased from importers.

- Alternate methods are more expensive than dental amalgam and there are many advantages over dental amalgam. Therefore, some dental surgeons prefer amalgam
- The guidelines sent regarding management of Mercury in the health sector dated 24-01-2013 issued by the Secretary Health has limited validity in legal perspectives. It does not have a circular number.
- Proper disposal mechanisms are not established. Collection of stored waste are not carried out
- Underutilization of amalgam separators due to limitation of recycling facilities and some administration problems.

Recommendations (Dental Amalgam)

- A separate guideline should be prepared including more details on safe storage, disposal methods etc.
- Composite fillings or other alternatives need to be made available in adequate quantity before completely banning and it should couple with adequate awareness among dental surgeons, staff attached to dental clinics and as well as public.
- As alternate dental restorations are expensive, encourage insurance scheme to cover the cost for mercury free dental fillings.
- Discourage insurance schemes for existing dental fillings.
- Introduce tax revision to increase the price of mercury containing amalgam and to grant concessions on mercury free alternate
- Better awareness campaign for general public on dental care to avoid the need of dental fillings.
- Research on alternate dental restorations and minimizing the use of mercury for the existing restorations.

Ministry of health services and Indigenous Medicine, MMDE, CEA, Faculty of Dental Science, Ministry of Science, Technology and Research, SLSI, Ministry of Finance and Insurance Companies are the main responsible institutes.

Article 5 - Manufacturing Processes in which Mercury or Mercury Compounds are Used

Sri Lanka does not manufacture Chlor-alkali and Acetaldehyde (Part I of Annex B). Mercury cell process for Chlor-alkali production is also an outdated technique and has been internationally phased out. However, there is a possibility of bringing these plants in to the country. Therefore, such attempts should be prohibited by including these plants to the prohibited list of importing. It also can be restricted at the Environmental Clearing stage.

In the process of Acetaldehyde production, using mercury as a catalyst is also an outdated technology. Potential importation and establishment of these plants are also to be prohibited at the stage of Environmental Clearing stage and importations. CEA, BOI and Ministry of Industry and Commerce are the relevant institutions for the necessary regulation formulation.

Sri Lanka does not manufacture any of the listed products mentioned in the Part II of Annex B. As in the case of Part I of annex A, attempts of importing and establishing these technologies may be prohibited.

Article 7 - Artisanal and Small-Scale Gold Mining

In Sri Lanka there are no gold

mining activities practiced as such. Therefore, there are no laws to cover any aspects in this regard. However, some isolated incidences of separating gold from sands in riverbeds had been reported recently which have not been investigated properly. On the other hand, these practices seem to be not falling into the definition of ASGM given in the convention. If these practices are becoming significant in the future, it may be regulated by amending Mines and Mineral Act No 33 of 1992.

These activities are to be studied to find whether they are significant and whether mercury is used for separating and cleaning the gold. If mercury is used, it may locally be defined as an ASGM activity and act appropriately (to NAP etc.). MMDE, ITI, National Gem and Jewelry Authority (NJGE) and Geological Survey and Mines Bureau are the main institutions responsible.

Purification of Gold in the Process of Manufacturing Jewellerys

According to National Gem and Jewelry Authority, the jewelry manufacturing industry in Sri Lanka at present employs approximately 15,000 persons of whom around 10,000 are registered individual craftsmen while the rest are employed in factories and workshops producing jewelry mainly for the export market. There may be around 1,500 unregistered employees working under registered craftsmen. About 60% of the jewelry workshops and craftsmen are located mainly in the rural areas of Southern and Central provinces and in pockets in the North Western, Eastern and Northern provinces. 30% and 10% of jewelry workshop are located in Suburban and Urban areas respectively.

During the process of jewelry manufacturing, the gold is recovered from gold dust which is not legally banned. In the recovery process, gold dust is mixed with mercury without much care and resulting in amalgam is heated to evaporate mercury. Majority of them work in small rooms or houses where all family members reside. Therefore, the possibility of exposure of the all family members including small children, mothers bearing small children and pregnant mothers to mercury is very high. Most of these communities are unaware of health risk of mercury. The safe techniques (BAT) are not known, not provided or not available to these communities.

The draft Assaying and Hallmarking Regulation 2016 provides the legal power to the Assaying Officer for inspection of Jewelry Manufacturers. Therefore, inclusion of mercury usage reduction in manufacturing process is needed to this draft Act, and at the registration stage of the manufacturers, the techniques going to be used should also to be assessed. The Act is accordingly to be amended and published in the gazette. Laboratory investigations about mercury content of air inhaled by the workers of Jewelry manufacturing is also to be monitored to know the severity of the activity.

Recommendations

Therefore, the following measures have to be taken for the safety of these communities:

- Introducing BAT and requirement of having safety measures against mercury at the registration with NGJA
- Launching awareness program about Health strategy.
- Regular monitoring the mercury levels of the body, blood etc.
- Research activities to introduce cost effective safe methods for this purposes
- Regular inspection by NGJA whether the conditions set for minimum exposure are met

- Establish adequate laboratory facilities to conduct necessary tests regularly.

MMDE, CEA, NGJA, Ministry of Health, Ministry of Science and Technology and Research are the major responsible institutions.

Diversion mercury to ASGMs

As Sri Lanka does not have ASGMs, the question of diversion of mercury from other sectors to ASGM does not arise. However, the provision of mercury usage of any exempting activities such as Rasa vedakama, etc., should not be misused and appropriate regulations have to be made by the relevant Ministries or by the MMDE. This has to be coordinated by the MMDE.

Article 8 - Emission

Requiring best available techniques/best environmental practices (BAT/BEP) or associated emission limit values (ELVs) for new (as defined in Article 8.2(c)) sources listed in Annex D.

Presently, in Sri Lanka, under the provisions of the National Environmental Act No. 47 of 1980 the following project types included in the list of prescribed projects requiring an Initial Environmental Examination/ Environmental Impact Assessment.

- Construction of thermal power plants having generation capacity exceeding 25 Megawatts at a single location
- All renewable energy based electricity generating stations exceeding 50 Megawatts.
- Smelting of aluminum, copper or lead of production capacity exceeding 25 tons per day/ Non-Ferrous Basic Metal
- Manufacture of Cement through production of clinker

To determine the Siting of High and Medium Polluting Industries outside Export Promotion Zones and Industrial estates, a Committee is appointed by the Cabinet to make the recommendations; thereby the pollution levels regarding the new establishment of industries are controlled.

In addition, there is a Draft National Environmental (Stationary Source Emission Control) Regulations 2013 under the National Environmental Act No. 47 of 1980 (to be published in the Gazette) which mentions the maximum levels of mercury (given below).

Thermal Power Plants (Schedule II, Part I)
MSW (any rated output capacity) = 0.001 mg/Nm^3

Incinerators (Schedule II, Part IV)
Rated output capacity < 1 t/hr = 0.01 mg/Nm^3
Rated output capacity > 1 t/hr = 0.001 mg/Nm^3
Any infected waste incinerator = 0.001 mg/Nm^3

Pollutant Based standards (Schedule III (Part II)
Mercury or its compounds emitted from any processes/source = 0.01 mg/Nm^3 as Hg (emission limit for combustion/non combustion)

The existing list of EIA consultants registered under CEA and SGS Lanka are the laboratories having facilities to monitor source emission. Obtaining Data about mercury of these plants and monitoring can be done through CEA in the process of EPL. However, the monitoring capacity is not adequate at present hence, they have to be improved. MMDE, CEA, BOI and Ministry of Industries and commerce are the main responsible institutes.

Measures identified in Article 8.5 to control/reduce mercury emissions from existing sources listed in Annex D, which shall be operational at the source within 10 years

At present there are no regulations to cover this requirement. Regulations are to be made with renewal of EPL of these

activities. The major responsible institutes: CEA, BOI, ITI and Ministry of Industry and Commerce.

Gaps identified:

- **T**he Draft National Environmental (Stationary Source Emission Control) regulations under the Act No 47 of 1980 have not yet been published in the gazette.
- Modifications to control the existing mercury emission or introducing new measures to reduce the mercury have to be investigated.
- The monitoring facility is also to be improved so as to monitor regularly. The monitoring data should receive the CEA and BOI through the process of issuing and renewal of EPL.
- Considering the mercury content of the coal when they are imported to select the coal with minimum mercury emission.

Require Monitoring/reporting and otherwise establish a mercury emissions inventory for sources listed in Annex D.

At present, there is no law or institutional arrangement for this purpose. Therefore, requirement of monitoring/reporting to Central Environmental Authority to be included as a necessary condition in the process of renewal of EPL for existing industries and issuing EPL for new industries fall in the list in Annex D. Accordingly, CEA will be in a position to develop a national inventory.

CEA, Ministry of Mahaweli Development and Environment, BOI, and Ministry of Industries and Commerce are the major institutions responsible for development of the mechanism for national inventory preparation.

Article 9 - Releases

Reporting or otherwise obtain information as needed to identify significant sources of mercury/mercury compound releases to land or water, and to maintain an inventory of releases from the sources identified

There is no national data base on release of mercury. In industry sector, the required information can be obtained under National Environmental Act 47 of 1980 and it's Amendment (Act 56 of 1988) in the process of issuing and renewal stage of EPL. However, conditions apply to EPL licensing at North Western Province may be differ from the national level as they have established separate environment authority under the provisions of 13th amendment of the constitution. The information can also be taken in the process of Environment Impact Assessment and Initial Environmental Examinations prior to the installation of techniques.

The relevant institutes for data base creation are CEA, BOI, ICTA (Information and Communication Technological Agency Ltd.), Northwestern Provincial Environment Authority and Sri Lanka Accreditation Board. The data can be collected to CEA and BOI through EPL and through Northwest Provincial Environment Authority.

With regard to the Mercury testing capabilities, ITI, SGS Lanka Pvt Ltd, Aqua Technologies Pvt Ltd, Bureau Veritas, Bamber & Bruise, Intertek Lanka and National Water supply and Drainage Board (Jaffna Branch) have the monitoring mercury level of water/waste water, and ITI has the facilities that of soil.

In small scale, it has been observed that the mercury waste is not handled properly in the laboratories in many education institutes. Mercury spillages are added with

sulfur and the resulting in mercury sulfide is simply disposed to the sink which eventually goes to the land and water. Broken glassware with mercury is also simply disposed directly to land.

These gaps can be addressed by educating the students and the staff about the hazards of mercury and mercury wastes and safe handling instructions. For instance, handling mercury in fume hoods, mercury spilled cleaning kits, storing the mercury waste in a plastic container and in a secondary plastic or steel container with clear labeling are some of the safe steps proposed. Since the group of staff and students change, these awareness procedures should be conducted regularly. It is also recommended that the testing of soil and water close to the area where there is a risk of contamination to identify the level of pollution is also to be done.

Measures specified in Article 9.5 to control/reduce mercury and mercury compound releases to land and water from significant sources

When industry sector is concerned, according to the National Environmental Act, there are maximum tolerant limits of mercury to discharge of the waste water to land and water, which have to be satisfied for EPL and they are given below:

- Discharge of industrial waste into inland surface waters = 0.0005 mg/l
- Tolerance limit for industrial waste discharge on land for irrigation purposes = 0.01 mg/l
- Tolerance limit for industrial and domestic waste discharge into marine coastal areas = 0.01 mg/l
- Tolerance limit for discharge of effluents into public sewers with central treatment plants = 0.005 mg/l

Maximum tolerance limit stipulated by BOI for industrial wastewater (effluents) discharged into the common wastewater treatment plants = 0.001 mg/l.

Therefore, it is necessary to test whether these conditions are satisfied by the relevant organizations and steps to improve monitoring capacity (including human resources) are to be taken to meet this requirement. In addition, Sri Lanka Standard Institutes (SLSI) has developed the standard for potable water – SLS 614:2013 which says the limit for toxic substance as Mercury is 0.001mg/l.

As per the National Environmental (Protection and Quality) Regulations, No. 1 of 2008 published from CEA by Extraordinary Gazette no. 1534/18 dated 01/02/2008, Scheduled Waste License shall be obtained for collection, transportation, storage and recycling of following mercury waste containing metallic mercury, organic and inorganic mercury compounds.

- Discarded, used, fused, broken and off-specified fluorescent lamps/bulbs (waste code: N 291)
- Mercury wastes containing metallic mercury from manufacturing of fluorescent lamps (waste code: S 211)

Municipal waste management has been a responsibility of the local authorities and later it was assigned to Central Environment Authority (CEA). The CEA has launched a project namely, ' Pilisaru' National Solid Waste Management Program (PNSWMP) for an integrated approach for solid waste management supported by all the relevant stakeholder institutions towards developing environmentally sound options to ensure proper solid waste management system in the country. The Programme focuses on the development of solid waste

management systems. This includes waste segregation, collection, transportation, treatment (composting), recycling and final disposal facilities including construction, implementation, operational, monitoring and educational and awareness raising activities in the island. However, after the disaster of landslide of Meethotamulla garbage dump in Colombo in April 2017, the responsibility was changed to again to local authorities. The Ministry of Local Government and Provincial Government has issued directives to the local authorities to segregate solid waste and encourage all citizens to adhere for segregation before handing over the garbage to the garbage collectors of Local Authorities. However, there is no specific separation for mercury waste in these directives.

The waste segregation is to be further strengthening through the effective public participation which will help for separation of domestic mercury waste.

Decreasing the release limits (tolerance limits) where feasible can be done through the amending of EPLs. Using BATs, polluting control mechanisms and introducing alternate measures may also be done through EPLs. The relevant institutions are CEA, Water Resource Board, National Water Supply and Drainage Board, MMDE, Ministry of Science, Technology and Research Science, BOI, Ministry of Industry and Commerce.

In the western province where highest amount of waste is generated, there are 25 open solid waste dumps and 2 controlled dumps.

Recommendations

- Regular awareness raising among the students and the staff of laboratories and education institutes about the hazards of mercury and mercury wastes and safe handling instructions
- Test whether the maximum tolerant limits of mercury to discharge of the waste water to land and water are satisfied by the relevant organizations.
- Improvement of monitoring capacity (including human resources) to be taken to meet this requirement.
- The waste segregation is to be further strengthening through the effective public participation which will help for separation of domestic mercury waste.
- Decreasing the release limits (tolerance limits) through the amending of EPLs.
- Using BATs, polluting control mechanisms and introducing alternate measures through EPLs. .

Article 10 - Environmentally Sound interim storage of mercury, other than waste mercury

Sri Lanka does not have mercury mining and excess mercury from chlor-alkalii plants (no such plants). Therefore, the stock of mercury if any is predominantly with the imported stocks by the merchants. As there are no ASGMs (as defined by the convention test), the mercury stocks even with merchants may not be that large. However, it is to be checked with merchants on the ways of amount and storing mercury. Nationally, the number and conditions of interim storage of mercury is not available.

CEA, department of Imports and Exports, Customs and Consumer Affairs Authority are the major responsible institutions to take measures to ensure mercury storage in an environmentally sound manner, taking into account guidelines going to be developed by the Conference of Parties (COP).

It has also been observed that

the most of the persons handling mercury (except in the health) are not aware of the health and environmental problems of mercury. Therefore, guidelines for storage of mercury and mercury products etc., need to be made available for use in relevant sectors (to fill the gaps as given below)

Gaps and recommendation identified

- Method of safe storage of mercury and mercury products, mercury containing instruments in most of the private sector institutions are unknown.
- Storage facilities in Ayurveda institutions need to be strengthened.
- The practices of storage in small government institutions depend on the storage capacity, knowledge and attitudes of the handling person.
- Monitoring is mostly not conducted properly at many institutions such as laboratories
- No separate guideline for mercury containing products storage.
- Maintain an inventory in mercury usage, location of storage and amounts

In these guidelines, Globally Harmonized System (GHS) for Hazard Ratings (given below) which classified the chemicals according to their severity is recommended to be used for labeling etc.

Article 11 - Mercury Waste Management

Taking measures to manage mercury wastes in an environmentally sound manner

At present, mercury waste containing metallic mercury, organic and inorganic mercury compounds is listed as scheduled waste by the National Environmental (Protection and Quality) Regulations, No. 1 of 2008 published by Extraordinary Gazette no. 1534/18 dated 01/02/2008. Accordingly, details on storage and treatment of waste, transportation of waste, disposal of waste, environmental surveillance has to be submitted to CEA periodically as specified by the Scheduled Waste License. Scheduled Waste License issued by CEA and the provisions under Basel Convention is evaluated by technical committee appointed by CEA (This TEC focuses on all the matters related to BRS and also Minamata Conventions).

There are also provisions under Basel Convention for import/ export of mercury waste. Asia Recycling which involves in CFL/FTL bulb recycling has the main mercury waste stock (belongs to industrial sector) in Sri Lanka. During the period of November 2011 to December 2016 (≈5 years) they have recycled 4.5 million bulbs by extracting mercury wastes. This entity has obtained Scheduled Waste License from the CEA for collection, transportation, storage and recycling of CFL/FTL bulbs and has an air conditioned container for storage of mercury waste. However, in majority of the other places such as laboratories, mercury wastes are not collected and stored safely. Only ITI has the laboratory facilities to monitor the mercury levels of mercury wastes which are not adequate. Therefore, monitoring facilities should also be enhanced for regular monitoring.

In addition, guidelines should be prepared in accordance with COP requirement for all sectors about storing and managing mercury wastes. CEA, MMDE, Occupation Health Division, Ministry of Health, Nutrition and Indigenous Medicine, Ministry of Education, Ministry of Industries and Commerce are the main responsible institutions.

Measures to restrict mercury derived from the treatment or re-use of mercury waste to allowed uses under the Convention or environmentally sound disposal.

At present, there are no complete mercury recovery facilities available in the

country. Therefore, as stated above the mercury wastes recovered from CFL and FTL are still remain at the site of Asia recycling PVT ltd. On the other hand, allowed uses such as traditional medicines fulfill their requirement from pure mercury imported. As such, there is no reason to reuse of mercury. Except in the health sector (where there are guidelines to collect the broken instruments and bulbs etc. and collect dental amalgam using amalgam separators) there are no even guidelines with regard to mercury. In conclusion, there is no trans-sectorial movement of mercury in the country

Transporting mercury waste across international boundaries

There are provisions under Basel Convention for import/ export of mercury waste. However, the gazette nu 1813/14 dated 05th June 2013, issued under the import and Export control Act 01 of 1969 identify inorganic and organic mercury compounds (except amalgam) as a licensed item, but mercury waste has not been listed. Besides, the Import and Export Control Department refers the request for importation, to the BRS technical committee prior to granting the approval for importation. Thereby, risk of importing mercury waste can be reduced. Further, this issue can be properly addressed under Import and Export act. However, the roles of BRS technical committee and BRS National Coordinating Committee have yet to be legally empowered through a cabinet paper.

As Sri Lanka does not have complete recovery facilities of mercury, mercury wastes from CFLs and FTLs are to be exported to Sweden as in the agreement of Asia recycling Pvt. LTD. In this process, the internal regulations are not violated. However, as a member country of Basal Convention, provisions have to be granted to export considering the requirement.

The institutional set up has not been established to meet this issue of mercury. Responsible institutes are MMDE, CEA, Ministry of finance, Department of Import Export and Customs. The relevant import export data can be taken from the Customs once the above requirements are fulfilled.

Recommendations

- Monitoring facilities should also be enhanced for regular monitoring of mercury level in waste.
- Preparation of guidelines in accordance with COP requirement for all sectors about storing and managing mercury wastes.
- Legal empowerment of the roles of BRS technical committee and BRS National Coordinating Committee through a cabinet paper
- Enforce extended producer responsibility (EPR) for management of mercury wastes
- Continue effectively with recent enforcement of source segregation of MSW and enforce special mercury waste separation after getting used to the existing waste separation

Article 12 - Contaminated Sites

Strategies for identification and assessing mercury/mercury compound contaminated sites

There is no national database of contaminated sites. Since ASGMs and Chlor alkali plants are not operated in the country, significant contaminated sites are not expected. By nature, the following sites are determined to be tested for mercury contaminations.

- MSW waste dump sites
- Industrial waste dump sites
- Clinical waste dump sites

- Incinerator ash disposal sites
- Fly ash and bottom ash disposal sites
- Metal slag disposal sites and
- Disposal sites of sludge generated from Industrial effluent treatment plants

After testing the above potential contaminated sites, the risk reduction activities could be done accordingly.

Therefore, strategies are to be developed for identifying and assessing mercury/mercury compounds contaminated sites and risk assessment. ITI, SGS Lanka Pvt Ltd and Bureau Veritas are the laboratories having facilities to monitor mercury level in soil, leachate, ground water, surface water. Proper mechanism has also to be enforced for data collection, monitoring and formulate necessary measures to minimize the impact.
Guidelines of COP are also expected to be used for strengthening the identification and risk assessment, and international support is expected for expanding the laboratory facilities.

Environmentally sound Risk Reduction Activities

At present, the Central Government is supporting to local authorities to phase out dump sites through "Pilisaru Project" under CEA. However, segregation of Municipal Solid Waste has been not effectively done. After the recent disaster of Meethotamulla (landslide of garbage dump in April 2017), the Ministry of Provincial Governments and Local Governments has directed to local authorities to adhere for waste segregation. Accordingly, solid waste has to be separated only on physical nature (glass, metal, polythene etc.). However, there is no special separation for mercury waste. As these dump sites contain mercury waste, monitoring the mercury levels surrounding water of the dumps will provide the level of contamination. Accordingly, strategies to be developed for risk assessment of probable contaminated sites.

- [Enforce extended producer responsibility (EPR) for management of mercury wastes
- Continue effectively with recent enforcement of source segregation of MSW and enforce special mercury waste separation after getting used to the existing waste separation
- Guidance going to be adopted at COP for the activities as given in Article 12.3 of the convention will also be followed as appropriately.]

The major responsible parties are CEA, Local Authorities, Ministry of Provincial Councils and Local Governments, Ministry of Health and Urban development Authority.

Recommendations

- Test and identifying contaminated sites
- Development of strategies to identify and assess contaminated site and conduct risk assessment
- Development of a mechanism for data collection

Article 13 - Financial Resources and Mechanism

Sri Lanka is a developing country of which the economy is not sound enough to make contributions to other parties to implement the convention. Instead, it requires the financial and technical support from other international organizations and parties to implement the matters related to convention. However, the required human resources to manage these activities are

available in the government and private sectors of Sri Lanka.

The usual practice obtaining Government fund (consolidated fund):

The responsible institute should identify the project and include it in to the corporate plan and annual plans. The annual identified activities and estimates of the project have to be included in the annual action plans of the respective Institutes and forwarded to the ministry of finance through the respective ministry and accordingly GOSL funds can be requested for the project from the Ministry of Finance. The required amount for the identified activities in the following year is to be requested from the Ministry of Finance through the relevant ministry in the current year. After considering all activities of the government and identifying the priorities etc., if the Ministry of Finance accepts the proposal, the allocations should be included to the annual budget proposals which have to be approved by the parliament.

Other private sector funding agencies may be requested to participate in the related activities. In case of securing foreign funds, the ministry can discuss the relevant foreign parties and develop the proposal. After getting the consent from the foreign party, the proposal should be forwarded through the Department of External Resources. At the end, the funds should be credited to the Ministry of Finance through which the funds are released to the Ministry.

When out sourcing money from NGOs and private organizations or individuals to carry out activities regarding mercury related activities memorandum of understanding or proper agreement need to be signed in concurrence with both parties.

Financial requirement is needed to

Establish/strengthen the:

- Monitoring facilities
- Identifying contaminated sites
- Creating the national and institutional data bases (if required),
- Awareness rising
- Introduce best available techniques (BAT) – technology and human resource development,
- Risk reduction of contaminated sites,
- Research activities,
- Actions related to the health issues

The progress of financial and activities of projects are monitored institutionally, ministerial levels and finally the ministry of Finance quarterly.

Ministry of Finance, Ministry of Local Government, MMDE, Banks, NGOs and private sector companies are the relevant national institutions.

Access financial resources available under the Convention financial mechanism and other resources available from multilateral, regional, and bilateral funding sources

Sri Lanka wishes to make request from all funding agencies through the bilateral and multilateral relationship including UN bodies for the financial resources to implement the project. In order to accomplish this, the project proposals requesting financial assistance are to be well written by the each sector and forwarded through the focal point (MMDE) to the funding agencies.

It has been identified that the overall capacity of writing the project proposals in many institutions is not adequate at present and therefore, initially, training in writing the project proposals development of the relevant institutes is a major requirement to be addressed.

The major relevant institutes are Ministry of Health, MMDE, Ministry of Finance, Ministry of Foreign Affairs, External Resource Department, Ministry of Science, Technology and Research and, CEA.

Recommendations

- Train a group of people from relevant institutes in writing project proposals to mobilise funds from bilateral, multilateral and other donor institutions

Article 16 - Public Health

Promote the development and implementation of strategies to identify and protect populations at risk, such as developing fish consumption guidelines.

Food and Act 26 of 1980, has some regulations to prohibit selling, manufacture, importing, expose or store the foods that is injurious for human consumption. In addition, Consumer Affairs Authority (CAA) has the power to control to protect the consumers. However, there are no standards for maximum permissible level of mercury content in fish or any food item. Therefore, the laws have to be strengthen by inclusion the maximum permissible levels of mercury which also requires developing standards of food items with regard to mercury.

Except ITI, the approved laboratories in government sector do not have facilities for heavy metals in the food. Therefore, testing facilities for mercury levels of fish, dried fish and other food items have to be strengthened. Regular sample collection and testing is necessary and probable communities having mercury exposure are also to be regularly tested. Alternatively, the maximum amount of fish (of highest risk varieties) consumption per person for a week (for a certain period) can also be recommended.

MMDE, SLSI, ITI, NARA, Private laboratories, Ministry of Health Services and Indigenous Medicine, and Consumer Affairs Authority are the major responsible institutes.

Promote occupational exposure, educational and prevention program

Knowledge and attitudes regarding toxic effects of mercury and prevention from exposures are very poor among health workers, workers engaged in high risk occupations and among general public. Therefore, in addition to the general awareness, the risk populations should be well aware of health effects due to mercury poisoning. Health issues of mercury should also be included in the programs conducted by Vocational Training Institutions.

MMDE, Private laboratories, Ministry of Health Services and Indigenous Medicine, Ministry of Labour and Trade Unions, Ministry of Skills Development and Vocational Training are the major responsible institutes.

Recommendations

- Inclusion of the maximum permissible levels of mercury in existing law
- Developing standards of food items with regard to mercury.
- Promote occupational exposure, educational and prevention program

Article 17/ 18 - Information Exchange/Awareness-Raising

Collect and disseminate information on annual quantities of mercury and mercury compounds emitted, released, or disposed; and other information specified in Article 18

At present, there is no national data base on information pertaining to emissions, releases or disposal of mercury. Import /export data on mercury under the relevant HS code can be obtained from Sri Lanka Customs Database. At national level, information on mercy products, equipment, and mercury waste can easily be obtained by effective application of Extended Producer Responsibility (EPR). In Sri Lanka, EPR has been accepted only at various platforms but remain as a principle without implementing. Besides, the recent by approval received from the Cabinet of Ministers for application EPR for management of E-waste and other non-biodegradable waste (eg, PET bottles and yoghurt cups etc.). Further, Right to Information Act, No. 12 of 2016strengthens the Process of obtaining this information from the government institutions. Therefore, a mechanism has to be in place for establishment of National Data Bases on mercury use, emissions and disposal, utilizing these provisions. However, the data on individual basis of patients (who may affected by Mercury exposure) cannot be published on ethical and legal reasons and therefore, it may take some time to get the approval from the relevant sources to acquire those information from respective parties. Alternatively, without disclosing the personnel information, the other data such as amount, nature of the occupation etc. may be exchanged.

For International Exchange of information, MMDE is the focal point and the major responsible institutions are CEA, Ministry of Industries and Commerce, BOI, Ministry of Finance, Ministry of Health Services and Indigenous medicine, ITI and Ministry of Science and Technology.

Share information on the health and safety of humans and the environment as non-confidential, in accordance with Article 17.5

Although obtaining individual patient information may require authorization on ethical and legal grounds, nationally there is no restriction on sharing the information on the health and safety and the environment as non-confidential.

Concerning the research on the issues of mercury, a very isolated research studies have been done. In future, the information on research and technical and other information on mercury will be shared with others through MMDE, the national focal point of the Convention.

Report to the COP on progress in implementing Convention obligations under Article 21

Sri Lanka has not ratified the convention and expected to ratify and accordingly and COP Secretariat will be reported on the progress of implementation. The action will be taken by MMDE, the national focal point.

Recommendation

- Broad dissemination of relevant information on research and technical and other information on mercury through MMDE, the national focal point of the Convention.

Article 19 - Research Development and Monitoring

Inventories of use, consumption, and anthropogenic emissions to air and releases to water and land

At present, industrial database is maintained by CEA and Sri Lanka Customs has the data on imports and exports of mercury, mercury containing equipment and mercury compounds. The testing facilities are available with only ITI and Bureau Veritas but it is not adequate. In the Ministry of Health, preparation of national inventory of users, consumption and emission in the health sector is in progress and special arrangement is to be made for maintenance and update the data base.

After the ratification process is completed, the proposed legal provisions can be made. The work related to proper survey on mercury will be possible afterwards. The major responsible institutes are CEA, Sri Lanka Customs and Legal Draftsman Department.

Concerning the research at present, as mentioned earlier, a few isolated research studies have been carried out regarding the issues related to mercury in Sri Lanka. However, these research results have not been collected to one place as a central depository to avoid repetition and identify the research gaps. Monitoring of Mercury in rainwater is expected to be commence in near future, through APMMN (Asia Pacific Mercury Monitoring Network). Mercury content of fish may be available with fish exporters. The institutional gaps to obtain to access the data maintained by private sector laboratories have to be addressed.

It is also required to establish a mechanism to collect laboratory findings and the data available with other institutions concerning the mercury of Human, mammals, environment etc. at national level. In Sri Lanka, there are no modeling facilities and the adequate lab facilities for such activities.

The laboratory facilities to assess body fluids and food samples, fish, are also to be strengthening. The major responsible institutes are Ministry of Health, Ministry of Fisheries, ITI, Bureau of Standards, Ministry of Science, Technology and Research, NARA, CEA and MMDE, Marine Environment Pollution Authority, Industrial Hygiene unit of Ministry of Labour and Universities.

Assessments of the impact on human health and the environment, in addition to social, economic and cultural impacts, particularly in respect of vulnerable populations

At present, data and investigations focused on this area is very low and insufficient to draw general conclusions on impact of mercury on human health and the environment.

Right to Information Act, No. 12 of 2016 strengthens the process of obtaining the available information from the government institutions. However, legal rights for data exchange from the private sector have not been enacted, yet. Therefore, data cannot be taken easily for further investigation by an interested party.

Initially, prioritizing high risk communities (such as jewelry crafting, communities of consuming fish exclusively), research are needed on environment health including health/social/economic impacts of mercury. On the basis of findings, research

work can be extended to other communities as well.

In addition, the following gaps or solution to fill the above issues have also been identified.

- Increase popularity of the field through creating awareness among Post graduate trainees, making funds available.
- Promote research in the field of Ayurveda in order to get scientific evidence on detoxification of RASA. Prospective studies on patients consuming heavy metals containing medication including mercury.
- Establish/ strengthen adequate laboratory facilities to assess the contents of mercury in samples. Comparison of data taken at different institutions and different methods are also proposed for the credibility and the accuracy of the test results.
- Laboratory surveillance system needs to be strengthened incorporating assessment of body fluids regarding occupational exposures
- Use the findings of research for advocacy for policy makers in order to take evidence based approaches in prevention and care.
- Popularize the above findings among the public.
- The research findings are published among the scientists through a research symposium.

The major responsible institutions are MMDE, Ministry of Mass media and Finance, Ministry of Higher Education, Ministry of Science, Technology and Research.

Harmonized methodologies for the activities undertaken under those listed above

At present, the cooperation between relevant stakeholders both at technical and administrative levels is available. However, to harmonize the activities, a plan should be drawn for the activities by having consultative workshops and reviewing the progress by a steering committee comprising the representatives essentially from health, economic, social science, education, research and industry sectors. MMDE is the institution responsible for the establishment of such steering committee and organizing the consultative processes.

Information with regard to environmental mercury cycle and its changes

Since Sri Lanka does not have primary mercury mines, chlor-alkali plants and ASGMs, mercury has not been using exclusively. In addition, there is no arrangement(with whom and why)to collect information on the environmental cycle, transport (including long-range transport and deposition), transformation and fate of mercury compounds in a range of ecosystems. Moreover, there is no appropriate account of distinction, between anthropogenic and natural emissions and releases of mercury and remobilization of mercury from historic deposition.

It is also believed that only a few segments of the above is remained significantly to report. However, in future, the above information may be provided after making a detailed study which requires filling the gaps identified and mentioned under the different articles of the convention. MMDE is the major responsible institution to make administrative and technical arrangement.

Information on commerce and trade in mercury and mercury compounds and mercury-added products

Since Sri Lanka is an island, all trans-boundary trading of mercury, mercury compounds and mercury added products is carried out through the customs. Therefore,

by strengthening the regulations in connection with imports and exports of those items to receive all related information to one place (such as CEA) is proposed to create a data base and information with regard to commerce and trade in mercury and mercury compounds. Concerning the information on commerce and trade within the country, internal trading procedures need to strengthen to receive the information. This can be done through introduction of licensing systems of traders. MMDE, Ministry of Industries and Commerce, BOI, Ministry of Finance, CEA, and Provincial councils are the major relevant institutions.

Recommendations (Article 19)

- Addressing the institutional gaps to access the data maintained by private sector laboratories have to be addressed.
- Establishment of a mechanism to collect laboratory findings and the data available with other institutions concerning the mercury of Human, mammals, environment etc. at national level.
- Strengthening of the laboratory facilities to assess body fluids and food samples, fish.
- Increase popularity of the field through creating awareness among Post graduate trainees, making funds available.
- Promote research in the field of Ayurveda in order to get scientific evidence on detoxification of RASA. Prospective studies on patients consuming heavy metals containing medication including mercury.
- Establish/ strengthen adequate laboratory facilities to assess the contents of mercury in samples. Comparison of data taken at different institutions and different methods are also proposed for the credibility and the accuracy of the test results.
- Laboratory surveillance system needs to be strengthened incorporating assessment of body fluids regarding occupational exposures
- Use the findings of research for advocacy for policy makers in order to take evidence based approaches in prevention and care.
- Popularize and publishing the above findings among the public.
- MDE to establish a steering committee comprising the representatives essentially from health, economic, social science, education, research and industry sectors to harmonize and coordinate the implementation of the Minamata Convention.
- Strengthen internal trading procedures to receive relevant information through introduction of licensing systems of traders.

Information and research on the technical and economic availability of mercury free products and processes on BAT and BEP to reduce and monitor emissions and releases of mercury and mercury compounds

Recommendations

The facilities such as financial, technological and institutional are to be developed/ improved to encourage research on low cost, user friendly alternate methods

for health, industry and trade sectors and monitoring systems of emissions and release of mercury. Financial encouragement is also needed for introduction of available techniques for these sectors such as concession of mercury free alternates and for BAT. These new technology and practices can be published and popularized through the mechanisms such as research symposia, media publicity. The steering committee may take the appropriate actions to collect all the information and publication.

The major relevant organizations are MMDE, Ministry of Industries and commerce, Ministry of Health, Universities, Ayurvedha Research Institute, College of dental surgeons, ITI, Ministry of Science, Technology and Research, Ministry of Parliamentary Affairs and Mass Media.

In addition, special reference is to be given to study mercury usage in indigenous medicine sector and local jewelry crafting industry where mercury is used to separate the gold from the wastes at small scale gold smith.

Chapter IV

Identification of Populations at Risks and Gender Dimensions

4.1 PRELIMINARY REVIEW OF POTENTIAL POPULATIONS AT RISK AND POTENTIAL HEALTH RISKS

Generally, there are two susceptible sub-populations to mercury exposure; those who are more sensitive to the effect of mercury and those who are exposed to higher levels of mercury.

The fetus, the new born and children are especially susceptible to mercury exposure because of the sensitivity of the developing nervous system. In addition to in utero exposures, neonates can be further exposed by consuming contaminated breast milk. Thus, new mothers, pregnant women, and women who might become pregnant should be particularly aware of the potential danger of methylmercury. Individuals with diseases of the liver, kidney, nervous system, and lung are also at higher risk of suffering from the toxic effects of mercury (WHO, 2017).

The other subpopulation that may be at greater risk to mercury toxicity are those exposed to higher levels of methylmercury due to fish and seafood consumption (such as recreational anglers and subsistence fishers, as well as those who regularly eat large amounts of fish and other seafood).

Individuals with dental amalgams generally have greater exposure to elemental mercury than those who do not. Other populations with potential for higher than average exposure are workers with high occupational exposure (dental workers who use dental amalgam, indigenous medical practitioners involve in ayurvedic drug preparations containing mercury or mercury compounds, and e-waste collectors and recyclers), and individuals who use various consumer products that contain mercury such as skin lightening creams and soaps.

Note: Even though indigenous medical sector is excluded from the Convention, there may be mercury related health impacts on people involve in the mercury-containing ayurvedic drug preparations and their consumers.

Based on the information on sources of mercury releases, the populations identified to be at risk to mercury exposure in Sri Lanka are discussed below.

PEOPLE INVOLVE IN WASTE MANAGEMENT CYCLE AND PEOPLE AROUND WASTE DUMPING YARDS

Mercury can enter the environment through the improper disposal of electrical and electronic waste (e-waste) such as fluorescent tubes, tilt switches (switches in thermostats and other mechanical devices), older computers and batteries. Waste pickers collect such e-wastes and send them to recyclers, together with other wastes for further processing. Both the waste pickers and recyclers are at risk to mercury exposure.

People living in or near communities to recyclers of e-waste and general waste pickers are also at risk of mercury exposure. However, no studies were done to evaluate the level of contamination and to check the associated human impact.

INDUSTRY RELATED MERCURY EXPOSURE BY WORKERS AND GENERAL PUBLIC

Potential mercury exposure due to industrial activities can be identified as below.

- Occupational exposure to phosphor powder (mercury compound) emissions in fluorescent lamp assembling and recycling industry, users)
- Occupational and public exposure due to coal power plant emissions
- Occupational and public exposure due to kiln emissions during clinker manufacturing and hazardous waste co-processing

However, neither studies with regard to mercury levels in ambient air, water/sea water and soil in the vicinity of the respective industry premises nor human impact studies of workers and general public of concern were carried out.

DENTAL PRACTITIONERS, DENTAL WORKERS AND PATIENTS WITH DENTAL AMALGAM FILLINGS

Dental amalgam is a mercury and metal alloy mixture commonly used in dentistry to fill cavities caused by tooth decay. During the amalgam mixing process, dental surgeons and their support staff are at risk of exposure to mercury during this process. Dental patient who underwent the treatment of amalgam filling is also exposed to mercury compound (the dental amalgam) over its existence.

In addition, waste amalgam (either remaining from preparation or removed from patients) may be discarded and enter the general solid waste stream and wastewater systems, posing potential threats to humans and the environment.

PEOPLE ENGAGE IN AURVEDIC DRUG PREPARATION BY USE OF MERCURY AND THEIR USERS

Since metallic mercury is used for preparation of mercury-containing ayurvedic drugs, ayurvedic practitioners and staff of the indigenous medical institutions expose to mercury during the mixing process.

Users of these mercury-containing drugs are also potentially at risk due to ingestion of mercury compounds. Though a considerable percentage from the population depend on indigenous medical treatment, no studies have conducted to study the impact of mercury-containing indigenous medicine on its users.

FISH CONSUMERS

Fish products have been shown to contain varying amounts of heavy metals, particularly mercury and fat-soluble pollutants due to water pollution. Fish and shellfish concentrate mercury in their bodies, often in the form of methylmercury, a highly toxic organomercury compound that can biomagnifies in food webs and bioaccumulats over time in organisms. The dangers associated with the consumption of large amounts of methylmercury in fish are well recognized, and there is some evidence to suggest that methylmercury may be the cause of subtle neurological impairments when ingested at even low to moderate levels, particularly the prenatal and early childhood periods.

In general, fish species that are smaller, short-lived, and forage low on the food web contain less methylmercury, while predatory species that are long-lived and grow larger contain higher levels of mercury.

Seafood with Lower Mercury Levels
(**<0.22 ppm, wet weight;** *healthier choices*)

- Goatfish (Nagari)
- Grouper (Kossa)
- Parrot Fish (Girawa)
- Lobster (Pokirissa)
- Octopus (Boowalla)
- Shellfish (Bellan)

Seafood with Higher Mercury Levels
(**>0.22 ppm, wet weight;** *riskier choices*)

- Tuna (Kelawalla)
- Sailfish (Thalapath)
- Swordfish (Sappara)

Many of the marine fish available in Sri Lanka are predatory and are high in the food web.

Sri Lankan Tuna, shrimps and crabs play major role in the export market and are popular among the tourists due to quality of unique taste and the texture.

According to BRI, fish mercury concentrations in the Indian Ocean tend to be lower than in the northern Pacific and Atlantic Oceans. However, since tuna is a migratory species, its level of mercury can vary in a significant range, which should be further studied.

USERS OF SKIN CREAMS AND LOTIONS

Skin creams and lotions include makeup cleansing, moisturizing, hair removal, sun screen, whitening, vanishing, cold and any other skin creams and lotions identified by the respective regulatory body.

Skin whitening injections, is also imported to the country by number of importers and it is not aware whether that injection contains mercury.

It was brought to the notice that there is a tendency of entering unsuitable skin creams and lotions in to the market with elevated mercury levels.

Eight (8) skin whitening cream samples of different brand names representing both locally produced and imported products and a vanishing cream were collected by the Ministry of Mahaweli development and Environment and sent to International POPs Elimination Network (IPEN) for analysis of mercury concentration. All the fairness cream samples were reported with 12-16 ppm of mercury, which is much higher than the maximum permissible level (1 ppm).

Research conducted by the Centre for Environmental Justice (CEJ) found very high levels of mercury in many whitening cream brands available in the local market. In 25 out of 46 samples, detected mercury concentrations were in the range of 0.06-30,137.66 ppm. Most of cosmetics with elevated mercury concentrations were found to be imported, mainly from China, where the language on the label and the information leaflet is not English, but rather is in either Mandarin or Thai languages. There was no warning message in the label or the information leaflet on the respective cosmetic. With regard to locally manufactured whitening creams, 2 product brands out of 5 had concentrations higher than the permissible level. It was also found that the contamination is a batch process coming from the base material, due to the fact that, two samples from the same brand does not indicate the same results. Hence, it was evident that whitening cream products in the local market contain dangerous amounts of mercury, which varies with the cosmetic product batch and size (C Rubesinghe, 2013).

The results of the existing studies reveal that mercury is present in most of the local and imported skin lightening/whitening creams and lotions at elevated levels. Hence, their users are at risk of health related impacts due to mercury.

PEOPLE INVOLVE IN EXTRACTION OF GOLD WASTE BY MERCURY AMALGAMATION IN SMALL SCALE JEWELRY SECTOR

Traditional gold craftsman shops are operated as small-scale industry units within the jewellery shops or as individual domestic cottage type units clustered in several villages/cities in the country from which local jewellery traders purchase jewellery. Kandy, Galle, Matara and Jaffna cities of Sri Lanka are well famous for traditional gold jewellery craftsmanship.

In these shops, recovery of gold waste[9] is usually done as an annual practice by acid treatment and mercury amalgamation. According to the preliminary survey conducted on 'Mercury use by traditional gold craftsman for gold waste recovery', the average mercury usage of individual gold craftsmen per annum amounts to 1-12 g in Galle (n=5), 1-12 g in Gampola (n=6), and 11-12 g in Kandy (n=4). As per the field observation of the waste gold recovery process in Jaffna (n=1), about 10 g of mercury is used to recover 10 g of pure gold.

This gold waste recovery process is performed either on-site by individual gold craftsmen, on-site by subsistence employees who are not officially employed by the jewellery shop or off-site by independent designated gold waste collectors.

In the case of recovery of gold waste by mercury amalgamation, the entire process is done manually by use of bare hands in confined spaces under poor ventilation condition, without using any safety precautions or mercury emission control technologies. Substantial amounts of mercury vapour and acid fumes are released directly in to the indoor working environment and ambient air. Hence, workers and their associates are directly exposed to mercury via inhalation and dermal contact subjecting them to occupational health and safety issues. Since traditional gold craftsmanship and gold waste recovery skills are transferred from generation to generation, most of the people engaged in gold waste recovery and their families may have been subjected to chronic exposure to mercury throughout their entire life span.

4.2 ASSESSMENT OF POTENTIAL GENDER DIMENSIONS RELATED TO THE MANAGEMENT OF MERCURY.

In the absence of relevant social and health data with respect to mercury exposure, it is difficult to identify potential gender dimensions for management of mercury.

[9] "Gold waste" means dust or fine particles of gold originated from; gold crafting, gold jewellery polishing (professional buffing), gold jewellery repairing and gold/gold jewellery testing (acid test by scratching the black touchstone leaving a streak on the stone), which is collected from the working table, with sweepings of the craftsmen shop, from workers hand washing bawls, from nearby yards of the craftsmen shop (gold waste carry away with workers), and from the sediments collected in earthen pits that receive bathing and laundry water of workers.

Chapter V

Awareness/Understanding of Workers and the Public; and Existing Training and Education Opportunities of Target Groups and Professionals

This chapter reports the level of awareness among stakeholders or existing training and education opportunities.

5.1 LEVEL OF AWARENESS AND UNDERSTANDING OF WORKERS AND THE GENERAL PUBLIC

AWARENESS BY THE MINISTRY OF HEALTH

The Ministry of Health issued a circular with the instructions to

AWARENESS THROUGH MIA PROJECT

The MIA project Sri Lanka facilitated several awareness programmes, training activities and publications on the risks of mercury.

Two awareness programs were conducted for the School Environment Pilots (Parisara Niyamu) and the teachers in-charge of Environment pilot program in the schools; one in Colombo for the schools in the Western Province and the other in Galle for the schools in the Southern Province. The total number of participants for both programmes were nearly 500.

The Ministry of Mahaweli development and Environment participated several national level science and technology related exhibitions to promote awareness on the Minamata Convention, mercury/mercury compound/mercury-added products, mercury wastes and health risk of mercury exposure among school children and general public.

Four news paper articles related to mercury management and Minamata Convention were published in a National news paper (Dinamina) on the Minamata day, followed by three articles in three issues of weekly news paper on science (Vidusara).

5.2 EXISTING TRAINING AND EDUCATION OPPORTUNITIES

Under the National Implementation Plan of the Stockholm Convention in Sri Lanka, school an university curricula has been recently revised. In addition a reference book Persistent Bioaccumulative Toxic Compounds (PBT) including mercury recommended for schools and universities was compiled, which will be published by in near future.

Chapter VI

Implementation Plan & Priorities for Action

The implementation plan summarizes the activities/actions that intended to undertake to meet the countries' future commitments under the Minamata Convention. Since Ssri Lanka is already ratified to the Convention, the priority activities/actions could include following.

- Actions the country plans to undertake to reduce the use, emissions and releases of mercury from mercury-added products (Article 4), point and release sources (Article 8 and Article 9).
- Management of mercury wastes (Article 11) and contaminated sites (Article 12)
- Approaches that will provide access to financial resources (Article 13), and build capacity, provide technical assistance and transfer technology (Article 14).
- Protect public health (Article 16)
- Actions to promote information Exchange/Awareness-Raising (Article 17 and Article 18).

Article 04: Mercury-Added Products **Article 11: Mercury Wastes**				
Strengthening National Capacity for Phasing Out Mercury Added Products and Environmentally Sound Management of Mercury Containing Waste in Sri Lanka				
Priority	**Proposed Actions/Activities**	**Lead Institution or Stakeholder**	**Anticipated Budget (US$)**	**Time Frame**
Very High	1. Assessment of mercury-free alternatives in terms of economical, technical and environmental aspects and estimation of costs associated with potential replacement scenarios 2. Development of a Technical guideline on environmentally sound management (ESM) of wastes consisting of elemental mercury and wastes containing or contaminated with mercury 3. Raising awareness and dissemination of information in health, educational, industrial and commercial sectors and the general public on health and environmental impacts of mercury added products and their waste management	Ministry of Mahaweli Development and Environment	Estimation in progress	30 months

Article 08: Emissions				
To Assess the Amount of Mercury Use in Small-Scale Jewellery Industry, In Order to Determine Whether the Persons Are At A Risk from Mercury Contamination				
Priority	**Proposed Actions/Activities**	**Lead Institution or Stakeholder**	**Anticipated Budget (US$)**	**Time Frame**
Very High	1. To quantify the mercury usage among the small-scale jewellery manufacturers. 2. Asses their exposure levels by using urine, blood and indirect indicators (hair and nail). 3. To establish a baseline data, that can be used in monitoring and compliance activity and planning and mitigation measures. 4. To sensitize persons of the implications of the improper use of mercury, mercury-free methods and also how to minimize their exposure to mercury. 5. Method development for safe mercury usage and/or introducing proper methods products and their waste management.	1. Ministry of Mahaweli Development and Environment 2. Gem and Jewellery Research and Training Institute 3. National Gem and Jewellery Authority	10,500	30 months



OVERALL NATIONAL ACTION PLAN FOR IMPLIMENTATION OF THE MINAMATA CONVENTION IN SRI LANKA

Activities	2016	2017	2018	2019	2020
Preparatory Activities for ratification of Minamata Convention					
Awareness Creation island wide on Mercury usage and management with special emphasis to Industry/ Health/ Education Sectors and General Public					
Preparation of education and communication materials on Mercury usage and management (Leaflets/ Posters/ Documentary/ TV spots)					
Preparation on guidelines on Mercury usage and Management on relevant sectors					
Need Assessments / Situation analysis and Research on Mercury usage and Management					
Facilitation of development of standards and formulation of legislations for Mercury management in the country					
Facilitation of Mercury waste disposal					
Develop new project proposals on Mercury Management					
Coordination, correspondence and submission of regular reports to Minamata Secretariat					
Convening of National Coordinating Committee on BRSM/ other meeting on Mercury Management					
Preparation of National Mercury Inventory in Sri Lanka (Health, Industry and Education sector) Minamata Initial Assessment (MIA) – Phase I					
Mercury Management in Small Scale Jewelry sector and mercury monitoring activities (MIA phase II) 2018 -2019					

BUDGET ALLOCATION FOR IMPLIMENTATION OF THE NATIONAL ACTION PLAN

Activities	Allocation [LKR Millions]
Mercury management in small scale jewelry sector and mercury monitoring activities • Island wide survey in small scale jewelry sector • Training of Trainers Programmes • Awareness Programmes	2.25
Testing feasibility of non- mercury alternative techniques with finding of the research	0.70
Bio-monitoring	0.80
Preparation of guidelines for mercury users	0.30
Preparation of awareness materials	0.50
Minamata steering committee meetings	0.30
General Awareness (Workshops/ Exhibitions / etc.) on Mercury	0.45
Maintenance of PMU	0.70
Grand Total	**6.00**

References

1. Amerasekera, R. (2015). Wood Charcoal production and Use in Sri Lanka: Looming Danger. Integrated Development Association (IDEA).

2. Ananda Jayalal, T. B., & Nadeeka Niroshani, S. L. (n.d.). Wastewater Production, Treatment, and Use in Sri Lanka.

3. *Automotive*. (2017). Retrieved 09 10, 2017, from World Steel Association: https://www.worldsteel.org/steel-by-topic/steel-markets/automotive.html

4. Average Material Consumption for a Domestic Light Vehicle, Model Years 1995, 2000, and 2014. (n.d.).

5. *Batteries*. (n.d.). (EEB Zero Mercury Campaign - Zero Mercury Working Group) Retrieved 10 14, 2017, from Zero Mercury Working Group: http://www.zeromercury.org/index.php?option=com_content&view=article&id=137&Itemid=54

6. C Rubesinghe, H. W. (2013). *Mercury and Lead Contamination in Selected Whitening Cream Samples Found in Sri Lanka.* CEJ. Centre for Environmental Justics/ Friends of the Earth Sri Lanka.

7. CDA. (2015). *Sri Lanka Coconut Statistics 2015.* Coconut Development Authority, Sri Lanka.

8. CEA. (2016, 06 09). *Request for Proposals to carry out a study on Current status of the Iron/Ferrous scrap Industry in Sri Lanka.* Retrieved 09 10, 2017, from http://www.cea.lk/web/index.php/en/news-and-events?id=25&start=5

9. CEYPETCO. (2017). *REFINERY*. Retrieved 09 05, 2017, from Ceylon Petroleum Corporation: http://ceypetco.gov.lk/refinery/

10. *Compact fluorescent lamp*. (2017, 09 09). (Wikipedia the Free Encyclopedia) Retrieved from wikipedia: https://en.wikipedia.org/wiki/Compact_fluorescent_lamp#Mercury_content

11. EML. (2016). *Status Report on Electronic and Electrical Waste Management in sri Lanka.* CEA.

12. Gamini, P. S. (n.d.). Challenges in the Water Sector and Wastewater Sector. Sri Lanka: Greater Kandy Water Supply Project, NWSDB.

13. Honda, S. (2008, Jul-Aug). Special Feature : E-Waste Management, Mercury in e-waste, Environmentally unsound disposal. Minamata City Kumamoto, Japan. Retrieved from www.techmonitor.net/tm/images/4/4f/08jul_aug_sf1.pdf

14. Human Resource Profile Ministry of Health, 2015

References...

15. IMERC Fact Sheet Mercury Use in Switches & Relays. (2014, January). US.

16. ITI. (2016). *Performance Assessment of Central Wastewater Treatment Plant of MAS Fabric Park at Thulhiriya.*

17. Javier Mateo-Sagasta, L. R.-S. (2015). Global Wastewater and Sludge Production, Treatment and Use. In P. Drechsel, M. Qudir, & D. Wichelns, *Wastewater, Economic Asset in an Urbanizing World.* Springer.

18. Karunaratne, D. G. (2015). *Dioxins & Furans Inventory and Recommendations for Emission Reduction.* Ministry of Mahaweli Development and Environment.

19. Kumararathna, G. (n.d.). *Domestic Wastewater Management in Sri Lanka* . Sri Lanka.

20. Mannapperuma, N. (2015, 12 27). *Business Opportunities Available in the Waste Management Sector - Western Province of Sri Lanka.* Retrieved from http://www.wmawp.lk/sn/admin/userfiles/files/Pre%20Bid%20UDA.pdf

21. May, J. (2015, 02 16). *US Steel Scrap Prices Plummet*. Retrieved 09 10, 2017, from MetalMiner, Sourcing & Trading Intelligence for Global Metals Markets: https://agmetalminer.com/2015/02/16/us-steel-scrap-prices-plummet/

22. *Mercury relay*. (2017, 06 24). Retrieved 09 14, 2017, from Wikipedia, the free encyclopedia: https://en.wikipedia.org/wiki/Mercury_relay

23. *Mercury switch*. (2017, 06 24). Retrieved 09 14, 2017, from Wikipedia, the free encyclopedia: https://en.wikipedia.org/wiki/Mercury_switch

24. MMDE. (2016). *Comprehensive Integrated Solid Waste Management Plan for Target Provinces in Sri Lanka.* Ministry of Mahaweli Development and Environment (MMDE) with technical assistance from the United Nations Human Settlements Programme.

25. MOH. (2016). *Human Resource Profile, Information on staff at the end of 2015.* Ministry of Health.

26. NEWMOA. (2008). *TREENDSS IIN MEERCURY USSEE IIN PRODUCTSS, Summary of the Interstate Mercury Education & Reduction Clearinghouse (IMERC) Mercury-added Products Database.* Northeast Waste Management Officials' Association (NEWMOA)/IMERC.

27. PUCSL. (2016). *Generation Performance in Sri Lanka.* PUBLIC UTILITIES COMMISSION OF SRI LANKA.



References...

28. PWC. (2014). *Water sector of Sri Lanka.* Embassy of the Kingdom of the Netherlands. PricewaterhouseCoopers (Private) Limited.

29. Senaratne, A. (2017, 03 21). Managing wastewater in Sri Lanka: An uncomfortable reality. Sri Lanka: Daily FT.

30. SLC. (2017). National Customs Tariff Guide. Sri Lanka Customs.

31. Sri Lanka Education Information 2013, 2013, Data Management Branch, Ministry of Education, Sri Lanka, http://www.moe.gov.lk/english/images/Statistics/sri_lanka_education_information_2013.pdf, DoA 19.02.2017.

32. SLS Standards, Sri Lanka Standards Institution

33. SLSEA. (n.d.). *An Analysis of the Energy Sector Performance*. Retrieved 09 05, 2017, from Sri Lanka Energy Balance: http://www.info.energy.gov.lk/

34. SLSEA. (2015). *Assessment & Mapping of Biomass Consumption in Sri Lankan Industries.* Sri Lanka Sustainable Energy Authority.

35. SLSEA. (n.d.). *Sectoral Consumption of Fuel Wood*. Retrieved 09 04, 2017, from Sri Lanka Energy Balance: http://www.info.energy.gov.lk/

36. UNEP. (2006). *Guide for Reducing Major Uses and Releases of Mercury.* UNEP Chemicals. INTER-ORGANIZATION PROGRAMME FOR THE SOUND MANAGEMENT OF CHEMICALS, A cooperative agreement among UNEP, ILO, FAO, WHO, UNIDO, UNITAR and OECD.

37. UNEP. (January 2017). *Toolkit for Identification and Quantification of Mercury Releases.* UN Environment Chemicals Branch. UN Environment.

38. UNIDO. (1977). *Chemical Industry Development, Sri Lanka Terminal Report.* Vienna: UNIDO executing agency for UNDP.

39. USEPA. (2015). *IMERC Fact Sheet Mercury Use in Batteries.* USEPA.

40. USEPA. (n.d.). *Mercury in Batteries*. Retrieved 09 14, 2017, from United States Environmental Protection Agency: https://www.epa.gov/mercury/mercury-batteries

41. W P D Perera, J. N. (1978). Reduction in Chlorate Content in De-Nora Type Electrolytic Diaphragm Cells used for the Manufacture of Caustic Soda in Sri Lanka. *Journak of National Science Council, Sri Lanka , 6* (2), 109-120.

References...

42. Wickramasuriya, S. (2015, 09 25). Oil and Gas in Sri Lanka, Impact on the National Economy. Sri Lanka: PRDS, PUCSL. Retrieved 09 05, 2017, from http://www.pucsl.gov.lk/english/wp-content/uploads/2015/09/Saliya-Wickramasuriya-PRDS.pdf

43. Wijayasundara, M. (2011). Sustainability in Manufacturing Built Materials:Cement Manufacturing Using Alternative Fuel and Raw Material in Cement Kilns.

44. Wikipedia. (2017, 06 24). *Mercury switch*. Retrieved 09 14, 2017, from Wikipedia the Free Encyclopedia: https://en.wikipedia.org/wiki/Mercury_switch#Vending

45. WS Atkins International Ltd (Water), U. a. (2007). *Democratic Socialist Republic of Sri Lanka: Greater Colombo Wastewater Project.* ADB.

46. WHO/UNEP Guidance for Identifying Populations at Risk from Mercury Exposure

47. UNDP Guide for Integrating the Sound Management of Chemicals into Development Planning

48. UNDP Guidance Document on Chemicals Management – The Why and How of Mainstreaming Gender.



ANNEX I: Stakeholder Engagement Process

All organizations/institutions and persons interviewed and engaged with during the preparation of the MIA Report, Mercury Inventory and other aspects of the MIA project are listed below.

INDUSTRY SECTOR STUDY

Sri Lanka Customs

1. Mr. R. D. A. M. G. Niyarepola, Deputy Director, Sri Lanka Customs

Import and Export Control Department

2. Ms. Kumuduni Vidyalankara, Assistant Controller, Import and Export Control Department

Ministry of Mahaweli Development and Environment

3. Ms. Sujeewa Fernando, Assistant Director (Environment Pollution Control & Chemical Management)

Ministry of Industry and Commerce

4. Mr. R S K Doolwalage, Director (Commerce)
5. Mr. Rohan Jayatilake, Acting Director, National Authority for the Implementation of Chemical Weapons Convention
6. Mr. M I D Ashok, Industrial Development Officer, National Authority for the Implementation of Chemical Weapons Convention

Ministry of Defense

7. Mr. Pathirana, Deputy Director (Explosives)

Sri Lanka Sustainable Energy Authority

8. Mr. Harsha Wickramasinghe, Deputy Director General (Strategy)
9. Eng. Ravini Karunarathne, Engineer
10. Ms. Nimashi Fernanado, Executive

Central Environmental Authority

11. Dr. Sanjaya Rathnayaka, Director (Environmental Pollution Control Unit)
12. Mr. Ajith Weerasundara, Director (Waste Management Unit)
13. Mr. Tissa Gamage, Assistant Director, Waste Management Unit
14. Mr. Mahesh Jaltota, Deputy Director, Waste Management Unit
15. Ms. Nadeeka Niroshani, Acting Assistant Director, Environmental Pollution Control Unit
16. Ms. Wilka Ransingha, Senior Environmental Officer, Waste Management Unit
17. Ms. N P Nagasinghe, Senior Environmental Officer, Galle Office

Provincial Environmental Authority, North Western Province

18. Mr. S K Lenaduwa, Acting Director

Coconut Development Authority

19. Mr. P. Edirimanne, Acting Director - Processing Development

Western Province Waste Management Authority

20. Mr. Susith Jayasekara, Zonal Manager

National Gem and Jewellery Authority

21. Ms. Uthpala Abeypala, Assistant Director

Office of Registrar of Pesticides

22. Dr. J A Sumith, Registrar of Pesticides

Ceylon Electricity Board

23. Eng. P G P Indrasiri, Deputy General Manager, Lakvijaya Power Station
24. Eng. Chinthaka Dissanayaka, Civil Engineer, Lakvijaya Power Station

National Water Supply & Drainage Board

25. Mr. Danesh Gunathilaka, Specialist (Sewage)
26. Mr. G A Piyal Pathmanatha, Assistant General Maner (Billing), Commercial Division

Industrial Development Board of Ceylon

27. Mr. P.L.U. Rathnamalala, Director General
28. Mr. P L Sarath Udayasiri, Director (Marketing)
29. Mr. Dammika, Assistant Director (Scrap Project)

Ceylon Petroleum Corporation

30. Mr. M A D Mallikarachchi, Actg. Deputy General Manager (Technical Service & Corporate Affairs)
31. Eng. K G H Kodagoda, Manager (Refinery Operations)

Board of Investment of Sri Lanka

32. Ms. Amara Beling, Director (Environment Management Department)
33. Mr R M U Senarath, Executive Director (Project Implementation)
34. Mr E G Gunasinghe, Deputy Director (Environment Management)

Colombo Municipal Council

35. Eng. (Mrs) Y Sylvester, Director Engineering (Solid Waste Management)
36. Mr. B M C Jagath Kumara, Engineer (Design), PBRS Division

Industrial Technology Institute

37. Eng. Thilak Gunasekara, Principal Research Engineer
38. Mr. Vijith Jayasinhge, Senior Laboratory Technologist

Gem and Jewellery Research and Training Institute

39. Mr. Naleen Jayasinghe, Head (Research Division)

Sri Lanka Standards Institution

40. Ms. J R D Mayuri Sajeewani, Assistant Director

Paranthan Chemicals Company Limited

41. Eng. Tissa Liyanage, Deputy General Manager (Engineering)

Non-Governmental/ Private Organizations

42. Eng. Samantha Kumarasena, Chief Executive Officer, National Cleaner Production Centre
43. Ms. Iresha Gurusinghe, Senior RECP Expert, National Cleaner Production Centre
44. Eng. Prasad de Silva, Group Quality Assurance Manager, Siam City Cement (Lanka) Limited
45. Eng. (Ms.) Arosha Hemali, Business Development Manager, Siam City Cement (Lanka) Limited
46. Eng. Harsha Deraniyagala, Deputy General Manager (Hydro & Environment), MAS Fabric Mark, MAS Holdings
47. Mr. Janaka Senarathne, DGM Engineering, Textured Jersey Lanka PLC
48. Mr. Udesh Jayakody, Brandix Textiles Ltd, Wayamba Industrial Zone
49. Mr. K D Dilshan Nilupul, Executive (Environment Management), OREL Corporation (Pvt) Ltd.
50. Mr. A R Zubair, Director/ Chief Executive Officer, Heyleys Electronics Lighting (Pvt) Ltd.
51. Mr. Premadasa, Aluminum/Cast Iron Foundries Development Association of Kaduwela Municipal Council
52. Mr. Nimal Hewage, Manager (Operations), Lanka Coal Company (Pvt.) Ltd.
53. Mr. Chittem Raju, Senior Vice President (Operations & Lube Blending Plant), Lanka IOC PLC
54. Mr. Yasantha Gunarathne, , Sisili Hanaro Encare (Pvt) Ltd
55. Eng. Kelum Liyanage, Assistant General Manager, Lanka Refractories Ltd.
56. Mr. Thusantha Karunanayake, Manager, PCL Solutions
57. Mr. Rohantha de Fonseka, BIOMED International
58. Mr. Shanaka Perera, Purchasing Manager, Variosystems (Pvt) Ltd.
59. Chaminda Ediriwickrama, Director Sales & Marketing/ Corporate Affairs, Litro Gas Lanka Limited
60. Eng. Heshan de Silva, General manager (Operations), LAUGFS Gas PLC
61. Mr. Manjula Hettiarchchi, Management Representative, Colombo Dockyard PLC
62. Mr. Hemantha Vithanage, Executive Director, Centre for Environmental Justice

HEALTH SECTOR STUDY

1. Dr. J M W Jayasundara Bandara, Director General of Health Services
2. Dr. Ananda Jayalal, Acting DDG (Environmental & Occupational Health)
3. Dr. Lakshman Gamlath, Director (Environmental & Occupational Health)
4. Dr. Inoka Suraweera (Consultant Community Physician, Directorate of Environmental & Occupational Health)
5. Mr. Karunathilake, Bio Medical Engineer, Biomedical Division
6. Dr. Vindaya Kumarapeli, Director (Training)
7. Dr. Lal Panapitiya, Director (Medical Supplies Division)
8. Mr. Upul Weerawardana, Assistant Director (Planning - Ayurveda)
9. Dr. Laksmi Kumarathilake, Director, Medical Research Institute
10. Dr. Ruwan Ferdinads, Director training, National Institute of Health Sciences
11. Dr. Hemantha, Consultant in Community Dentistry, Dental Institute Maharagama
12. Dr. Irosha Perera, Consultant in Community Dentistry, Dental Institute, Colombo
13. Ms. Monika Pharmacist Cosmetic Division, National Medicines Regulatory Authority
14. Ms. Ann Crooz, Chief Pharmasist, CDS National Programme for Tuberculosis Control and Chest Diseases (NPTCCD)
15. Provincial Directors of Health
16. Regional Directors of Health
17. Dr. Monika Wijeratna, Consultant Community Physician Western Province
18. Directors/ Medical Superintendents/ heads of hospitals & other Health institutions
19. Ms. H K D Dilhani, Assistant commissioner (Planning), Department of Ayurveda
20. Dr. N S Namasinghe, Chief Medical Officer, Ayurvedic Drug Cooperation
21. Dr. Sueewa Harapathdeniya, Ayurveda hospital
22. Dr. Chandani Herath, Medical Officer in-charge, Government Homeopathy Hospital
23. Provincial Ayurveda Commissioners
24. Heads of Government Ayurveda and homeopathy hospitals and Dispensaries
25. Ms. Sujeewa Fernando, Assistant Director (Environment Pollution Control & Chemical Management)
26. Ms. Subadra Walpola, Senior Assistant Secretary, Ministry of Local Government
27. Dr. Ruwan Wijemuni, Chief Medical Officer of Health, CMC
28. Mr. Chanaka, Borella Cemetery
29. Directors/ Medical Directors of private health institutions
30. Full time and Part time medical practitioners of Allopathic, indigenous and homeopathy medicine contributed for the questionnaire survey
31. Manufactures of ayurvedic drugs and cosmetics

EDUCATION SECTOR STUDY

1. Mr. M P Vipulasena, Additional Director of Science, Ministry of Education

2. Deans, Department Heads, Senior Lecturers and Technical Staff of Government Universities

3. Heads and Technical Staff in Government and Private Sector Schools

4. Directors, Additional Directors, Heads of Laboratories and Technical Staff of Government and Private Sector Accredited Laboratories

5. Sri Lanka Ports Authority

Importers of Thermometers

6. S.Q. Marketing, Dehiwala, Ms. Kalsha, DoC 10.08.2017
7. Sri Chin Holdings, Dehiwala, Dr. Liyanage, DoC 10.08.2017
8. Daytona Ltd., Borella, Mr. Bibal, DoC 10.08.2017
9. Organic Trading Pvt. Ltd., Colombo 11, Mr. Niron, DoC 10.08.2017
10. Chuleeka Diary Prodcuts, Battaramulla, Ms. Sudhanthi, DoC 10.08.2017
11. Paper Corner, Kurunegala, Mr. Basil Silva, DoC 12.08.2017
12. M G Medicals, Pahala Imbulgoda, Ms. Imalka, DoC 14.08.2017
13. Hemsons International Pvt. Ltd., Peliyagoda, Mr. Rizwan, DoC 14.08.2017

Importers of Mercury and Mercury Compounds

14. Paper Corner, Kurunegala, Mr. Basil Silva, DoC 26.08.2017
15. David Peiris & Co. Ltd., Colombo 11, Mr. Abeysekara, DoC 26.08.2017
16. Colombo Commercials, Colombo 12, Mr. Hassin, DoC 26.08.2017
17. Karunarathne & Company, Mulleriyawa, Mr. Chaminda, DoC 16.09.2017