

Mercury Initial Assessment Report

Federal Democratic Republic of Ethiopia

Ministry of Environment, Forest and Climate Change

About this document

National governments, with funding provided by the GEF and technical assistance provided by GEF implementing agencies, will over the next few years be implementing Minamata Initial Assessments (MIAs) Enabling Activities (EAs) (from here on referred to as "MIA projects") that aim to strengthen national decision-making toward ratification of the Minamata Convention on Mercury and build national capacity towards implementation of future obligations.

Another objective of the MIA stems from the Minamata Convention's Article 30 (paragraph 4), which states "*Each State or regional economic integration organization" is encouraged to transmit to the Secretariat at the time of its ratification, acceptance, approval or accession of the Convention information on its measures to implement the Convention*."

A MIA project provides an opportunity for a country to undertake a **mercury inventory**, **determine and agree upon the measures it will take to implement the Convention**, **estimate associated costs** and **communicate this information in a concise and clear manner**.

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Glossary

FDRE –	Federal Democratic Republic of Ethiopia
MIA –	Mercury Initial Assessment
ERCA-	Ethiopian Revenue and Customs Authority
MOFEC-	Ministry of Finance and Economic Cooperation
MoWIE –	Ministry of Water. Irrigation and Electric
EPA-	Environmental Protection Agency
COP	Conference of Parties
EEU	Ethiopia Electric Utility
EEPCO	Ethiopia Electric Power Corporation
METEC	Metals Engineering Corporations
METEC-EPEI	Metals Engineering Corporation –Ethiopia Power Engineering Industry
MEFCC	Ministry of Environment, Forest and Climate Change
HEPP	Hydro Electric Power Plants
NGOs	Non- Governmental Organizations
NIP	National Implementation Plan
PCBs	Polychlorinated biphenyls
POPs	Persistent Organic Pollutants

Foreword by Government Official

In the past few decades, the Government of the Federal Democratic Republic of Ethiopia has significantly strengthened its effort to protect the environment from the harmful interventions of humans. Many lessons have been learned and systems are in the process of being strengthened, to ensure impact to the environment is reduced. Ethiopia is not a significant user of chemicals in general and mercury in particular. This, by no means, should implicate that the Country is not taking efforts to reduce the adverse impact of chemicals. Ethiopia recognizes the possible benefits of chemicals for development if managed properly in an environmentally sound manner. To this effect, Ethiopia is part of the major chemical conventions, Basel, Rotterdam, Stockholm and Bamako Conventions. National efforts are being undertaken to implement the conventions and meet national obligations stipulated in the respective conventions.

Ethiopia is undertaking this Mercury Initial Assessment to foresee the extent of mercury problem in the Country, to assess the compatibility of national legislative frameworks to implement the obligations under the Minamata Convention. The Government is continuing its efforts to address issues related to mercury by creating awareness to the community. This assessment will guide policy makers and technical experts in taking further actions to reduce the release of mercury to the environment.

H.E Rd. Gemedo Dalle

Minister,

Ministry of Environment, Forest and Climate Change

Acknowledgement

The Federal Democratic Republic of Ethiopia, Ministry of Environment, Forest and Climate Change is honored to present the this important and prestigious study. We are thankful to experts in different offices for their unreserved support in the study and necessary guidance at various stages of the study. We are also extremely thankful to those who have helped in facilitating the survey, data collection and providing information. In this context we wish to thank the chief facilitator and Director General of Law, Standards and Policy Directorate Dr. Ayele Hegena Anabo, Project coordinator Mr. Binyam Yakob Gebreyes and the lead inventory experts Mr. Belachew Hailemariam Maru and Mr. Girma Gemechu Kenne.

Special thanks are due to the project funding entity GEF (Global Environmental Facility) for the financial support, UNEP and Groundworks for their unreserved assistance through out the project implementation. We acknowledge with gratitude the intellectual advice and support of Mr. Jakob Maag and Mr. Rico Euripidou provided both technically and logistically. We are also highly thankful to officials of numerous non-government organizations for their cooperation with the during the course of field work.

Finally, but not the least, we are extremely thankful to all the respondents, who took out time to answer lengthy questionnaires and sparing time. We are extremely confident that this report would go a long way in helping the policy makers in their effort of making a better environment for Ethiopia. The report would also be helpful to academicians and researchers in understanding the problems of mercury at large.

H.E Mr. Kare Chawicha

State Minister, Environment and Climate Change Sector

Ministry of Environment, Forest and Climate Change

Scope and Limitations

This report has been prepared based on the outlines Mercury initial Assessment project and as per UNEP toolkit. This report constitutes a technical account and by no means a policy document. Any opinions expressed are those of the authors and use of the information in the report by any other party or for any other purpose is at that party's risk.

This report has been crafted based on available national and international literatures. The information has been accepted as provided and has not been peer reviewed by international experts. The data has been used in good faith but it could contain errors and assumptions.

In calculating emission input factors, default toolkit value has been used due to lack of reliable data's. Where UNEP Toolkit default emission factors have had to be used it is expected that these values will result in conservative (high) estimates. The lack of reliable data may have resulted in over or under-estimates of particular types of emission sources, and of the natural and anthropogenic totals.

Executive Summary

The objective of the Mercury initial assessment is to facilitate the ratification and early implementation of the Minamata Convention by providing key national stakeholders in participating countries with the scientific and technical knowledge and tools needed for that purpose. The main outputs will be assessments of national infrastructure and capacity for the management of mercury, mercury release inventories and the identification of challenges, needs and opportunities to implement the Minamata Convention on Mercury. Generally, this inventory tries to develop a situation analysis of mercury in Ethiopia and assess mercury use and sources, mercury containing products, and identify, if any, vulnerable populations that require awareness raising about the mercury issue to protect human health and the environment.

Mercury is a toxic, naturally occurring heavy metal. It occurs in three forms, elemental mercury (as a liquid or vapour), inorganic mercury compounds and organic mercury compounds. The most toxic form is the organic compound methyl-mercury. Elemental mercury and inorganic and organic mercury compounds can be transformed in the environment from one form to another in a series of complex processes. In general, however, elemental mercury exists mostly in the atmosphere, while inorganic and organic mercury compounds exist mostly in land and water environments.

The total annual mercury emissions for Ethiopia in the year 2014/15 have been estimated using the 2017 draft of the UNEP Mercury Toolkit to be 67,152 kg Hg/year. A lack of data means that some of the UNEP categories could not be estimated or were over estimated. Emissions from these sources are thought to be small. The most significant sources of mercury identified in the inventory comprising 33% (22198 Kg Hg/year) of the mercury emission was consumer products with intentional use of mercury and primary metal production with 28% (18750 Kg Hg/year) of the total mercury emission.

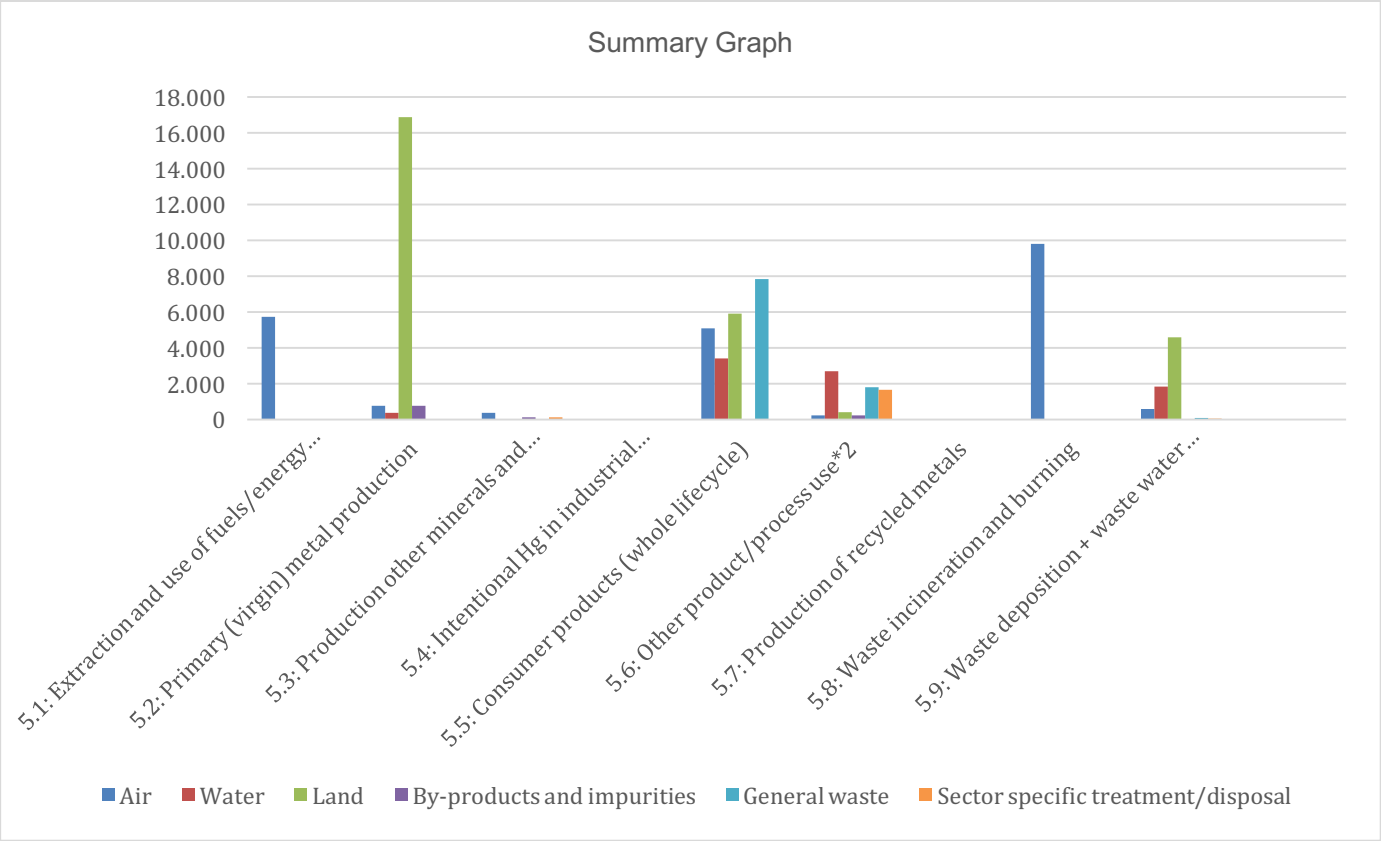
More specifically, Batteries with mercury was calculated with the highest input to society with 8116 Kg Hg/year followed by Thermometers with mercury and Electrical switches and relays with mercury with their respective emission of 6171 Kg Hg/year and 5170 Kg Hg/year. This number could vary as estimates where taken in determining the specific type of batteries, thermometers and electrical switches and relays. Ethiopian Revenue and Customs Authority registers only 10 Digit HS Code which limits the possibility of identifying imported items with mercury content. Thus, inventory team resorted to other data sources and estimates.

With respect to the effects of mercury on the environment, most concern has been expressed globally over the accumulation of anthropogenic mercury from diffuse sources in aquatic ecosystems. Bioaccumulation and bio magnification of mercury may result in adverse effects on the aquatic animals and associated wildlife, but can also cause increased dietary intakes of mercury in the human population due to higher concentrations of methyl-mercury in fish. There is limited evidence that mercury exposure is of concern in Ethiopia, however. Existing national data and information for and beyond 2014 implicate that the Gold and silver extraction is done via traditional method free from mercury use.

There are numerous environmental legislations that regulate and control matters related to the use, storage and discharge of hazardous substances. Both International agreements and national legislative frameworks exist for the adequate management of chemicals in general. But there is no specific legislation regarding mercury and mercury added products.

The study has shown that significant mercury release is from Mercury added products. The Minamata Convention on Mercury aims to limit the use of mercury added products listed under the annex mostly by 2020. As Ethiopia is not a producer but an importer, phase out should be done in a strategic manner. Ethiopia supports the phase out of mercury added products like batteries,

thermometers, light sources, however, inventories have showed that the country imports and uses these products. Ethiopia should aim to develop applicable strategies in terms of environmental and health consideration as well as socio-economic aspects, to adopt alternatives and phase out procedures. Thus, request should be made for exemption for import of these mercury added products to 2025.



Introduction

The Minamata Convention on Mercury, adopted in October 2013 in Japan, seeks "to protect the human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds". Exposure to high levels of mercury can cause harm to the brain, lungs, kidneys and immune system of people of all ages. Human exposure through eating of contaminated fish is due to the increased levels of mercury in the environment. The Minamata Convention on Mercury (Convention) is a major international development in controlling the harmful effects of mercury pollution. The Convention is the latest in the series of chemicals and waste conventions. It follows the Stockholm Convention on Persistent Organic Pollutants (POPs), 12 years after that convention was adopted in 2001.

This objective reflects the critical findings of UNEP's first Global Mercury Assessment in 2002, and the updated 2013 Global Mercury Assessment.4 Both documents highlight the adverse impacts of mercury to human health and the environment, mercury's global reach, and the serious challenges facing its continued use and risk.

The limited focus of the Convention, however, belies the range of control it has over the life cycle of mercury. The Convention covers the following major areas:

1. Mercury supply sources and trade (Art. 3);
2. Mercury-added products (Art.4);
3. Manufacturing processes in which mercury or mercury compounds are used (Art. 5);
4. Artisanal and small-scale gold mining (ASGM) (Article 7);
5. Emissions (to air) (Art. 8);
6. Releases (to land and water) (Art. 9);
7. Environmentally sound interim storage of mercury, other than mercury waste (Art. 10);

8. Mercury wastes (Art. 11);
9. Contaminated sites (Art.12); and
10. Health aspects (Art. 16).

The Convention also outlines certain processes that will help countries comply with their obligations, and ensure that other countries will do the same. These include:

1. Financial resources and mechanism (Art.13);
2. Capacity-building, technical assistance, and technology transfer (Art.14);
3. Implementation and Compliance Committee (Art. 15);
4. Information exchange (Art. 17);
5. Public information, awareness, and education (Art. 18);
6. Research, development, and monitoring (Art. 19); and
7. Implementation plans (Art. 20).

The objective of the Mercury initial assessment is to facilitate the ratification and early implementation of the Minamata Convention by providing key national stakeholders in participating countries with the scientific and technical knowledge and tools needed for that purpose. The main outputs will be assessments of national infrastructure and capacity for the management of mercury, mercury release inventories and the identification of challenges, needs and opportunities to implement the Minamata Convention on Mercury.

Ethiopia along with four African countries signed an Enabling activity project to develop Minamata convention initial assessment. GEF/ UNEP project Enabling Activity Development of Minamata Initial Assessment in Ethiopia is implemented by the Ministry of Environment, Forest and Climate Change in cooperation with other relevant ministries, and the expected out-comes will contribute to policy makers for the ratification of the Minamata Convention. The project objective is to facilitate the ratification and early implementation of the Minamata Convention by providing key national stakeholders in participating countries with the scientific

and technical knowledge and tools needed for that purpose. The main outputs will be assessments of national infrastructure and capacity for the management of mercury, mercury release inventories and the identification of challenges, needs and opportunities to implement the Minamata Convention on Mercury.

Before Ethiopia ratifies the Minamata Convention, there is a need to assess the existing policy and legislation to identify what current laws may need to be changed in order to conform fully to this convention. Not only the legal framework but the amount of mercury release must be clearly known. This information is crucial and critical for policy makers and key stakeholders in the ratification process. Total amount of 126,000 USD is allocated to the Mercury Initial Assessment Project. First National Inception Workshop has been held in August 2015 and 2 staff Members of the Ministry took part in the training on the inventory in Cape Town, South Africa. Following the training the inventory team made a mapping exercise of key stakeholders and methodology for data collection. In the process different consultations have been made in peer-to-peer review and group discussions. Fields visits to gold mining sites were undertaken to observe method of Gold mining of Artisanal and Gold Scale Miners.

Chapter I: National Background Information

1.1 Country profile

Chemicals are an integral part of our life. Many socioeconomic evidences show that they are essential elements in improving the quality and quantity of production and productivity in agriculture, health, mining, energy production, manufacturing and service giving industries. They are also useful not only in bringing about clean technologies in our daily life but also contributes a lot to the efforts of poverty alleviation for the fact that they are sources of employment and income for large number of people. It is, therefore, certain that millions of people lead improved life because of the thousands of chemicals released in the global market. Although they are major contributor to the national as well as global socioeconomic development, chemicals can have adverse effects on human health and environment unless they are properly managed. The releases from the production, distribution, consumption and disposal of chemicals may permanently damage the bio-physical environment. They can be the cause for harmful effects, for instance, on workers, consumers or other affected communities as well as the environment at large through exposure.

Ethiopia is endowed with various natural resources. The resources are however affected by continuous malpractices and natural catastrophes. Unattended human activities increase in the exploitation of natural resources is a major cause of natural resource depletion. Even though the national use of chemicals and more specifically mercury is insignificant, the potential increase of use of mercury as the country shifts to an industry led economy will be an area for concern.

Ethiopia is neither a heavy user nor a producer of mercury chemicals. The chemical industry in general in Ethiopia is very young. What the sub-sector produces is limited to consumer chemicals- soaps, detergents, paints, drugs, and a few industrial chemicals like carbon dioxide, oxygen, foam, alkyine resin,

Caustic Soda produced by non mercury (old) catalyst process, aluminium sulphate and sulphuric acid. Most chemicals are imported from diverse countries.

1.1.1 Geography and population

Scientific studies on the environmental behaviour of chemicals revealed that some geographical factors directly or indirectly affect their residence time (degradation processes) and global distribution through various transportation media (such as water, air, food chain). Climate variables (temperature, precipitations, Wind speed, atmospheric pressure, light and radiation), marine salinity, ocean currents, ice cover, vegetation mass and type, organic carbon content, sediment re-suspension and deposition, and population dynamics affect the emission rates from primary and secondary sources, particle–phase partitioning, reaction rates (biodegradation, oxidation), air–surface exchange (volatilization), air–soil exchange (deposition) and hydroxyl radical formation of chemicals.

Ethiopia is a land locked country located in the Horn of Africa stretching from 30 to 150N and 330 to 480E. It shares boarder with Djibouti in the northeast, Somalia in the east and southeast, Kenya in the south, South Sudan in the west, the Sudan in the northwest, and Eritrea in the north. It occupies a strategic position between Europe, the Middle East and Africa with total area coverage of about 1.104 million square kilometres (440,284 square miles).

The country is characterized largely by high flat-topped plateaus and mountain ranges with deep gorges, incised river valleys and vast rolling plains. Its altitude ranges from more than 100 meters below sea level to mountain peaks of over 4600 meters above sea level. The Great East African Rift Valley system, which is stretching from Syria to Mozambique, bisects the extensive highlands of the country into the western and the south-eastern highlands. These highlands form high escarpment towards the rift-system and gradually descend to the eastern,

western and southern lowlands of the country. The variation in altitude has great influence on the country's climate.

The principal climate group prevailing in the country, in general, includes dry, tropical rainy and warm temperate rainy climates. Spatially, the central plateaus have moderate climate with minimal seasonal temperature variation. And, the temperature variations in the lowlands are much greater with occasional highs of 60°C. The average annual precipitation also varies from less than 100mm in the arid region to above 2000mm in wet areas.

Temporally, there are two distinct seasons, i.e. the dry season, which is for the most part from October to May and rainy season, from June to September. Large part of the country receives heavy rainfall during June, July and August. The high plateaus also experience a second, though much milder, rainy season between December and February. However, the eastern and south-eastern highlands receive bi-annual precipitation during autumn and spring seasons.

The plateaus and mountain ranges of the country are dissected by a number of streams and rivers that drain twelve major river basins and numerous sub-basins with 122 billion m3 estimated annual flow of water. The first ten major rivers cover a total length of more than 7000 km. The country also has lakes, mostly confined to the rift-valley basin, and swamps that all together cover about 7500 km2 area. The wide range of altitude and climate has made the country known for high ecological diversity that extends from desert through tropical forests to alpine. This ecological diversity encourages the existence of endemic plant and animal species in the country.

Ethiopia is the second populous country, following Nigeria, in Africa with recently estimated number of more than ninety million inhabitants and annual growth rate of 2.5%. Of the total population, female accounts for almost 50%. In terms of age group, more than 36 million are under fifteen while a little more than four million are 60 and above years of age. The overwhelming majority of the population

(about 72.6 million) resides in rural areas where as the urban population is estimated to be 17.4million. However, population growth in urban areas is out stripping rural areas mainly due to high rural-urban migration. The overall population density of the country is 45 persons per square kilometre. However, the pattern of population distribution is uneven. For instance, more than 85% of the population is concentrated in barely 45% of the total area, i.e. the highlands which are favoured by relatively higher rainfall, cool temperature and low malaria and tsetse fly incidences.

1.1.2 Political, legal and economic profile

Ethiopia adopted a federal system with parliamentarian form of government named after the Federal Democratic Republic of Ethiopia. The Federal Democratic Republic of Ethiopia comprises the Federal Government and nine regional states, viz. the National Regional States of Tigray, Afar, Amhara, Oromia, Somali, Benishangul-Gumuz, the Southern Nations, Nationalities and Peoples, Gambela Peoples and Harari People. Addis Ababa, the Capital City of the Federal Government, and Dire Dawa are the two city administrations that are accountable to the federal government, and provided with full measure of self-government. Both the Federal Government and member Regional States have their own legislatives, executive and judicial powers.

The federal system of the country comprises two federal houses: The House of Peoples' Representatives that are elected by the people for a term of five years on the basis of universal suffrage, and the House of the Federation that is composed of at list a representative selected by the state council from each nation, nationality and people.

The highest authority of the Federal Government vested in the power of the House of Peoples' Representatives, which is responsible to the People of the country in general, and the highest organ of the Regional State Authority resides

in the power of the Regional State Council, which is responsible to the people of the state in particular.

The executive branch includes the President, the Council of States, and the Council of Ministers. The president of the federal government is the Head of State. The term of office of the president will be six years, and a person can become a president only for two terms. And, the highest executive powers of the federal government are vested in the Prime Minister, who is the chief executive, the Chairman of the Council of Ministers and the Commander-in-Chief of the national armed forces, and Council of Ministers. The Regional State Administration constitutes the highest organ of executive power. Supreme Federal and State judicial authority is vested in the Federal and Regional State Supreme Courts, respectively. Unless it deems necessary, the Regional State Courts are delegated to the jurisdictions of the Federal High and First-Instance Courts. Adequate power is also granted to the lowest administrative units to facilitate the direct participation of the people in their own administrative matters. Ethiopia envisions a major leap in economic structure and income level through enhanced private investment and agriculture-led industrialization. To achieve this vision, it has been implementing policies, strategies and plans to guide and manage the overall development efforts.

1.1.3 **Profiles of economic sectors**

The country has formulated the First five years Growth and Transformation Plan (GTP-I) that lasts between 2010/11 and 2014/15 (its fiscal year) with the objective of achieving rapid, broad-based, sustained and equitable economic growth by to eradicate poverty. The major goals of this macroeconomic policy were to maintain double digit economic growth within a stable macroeconomic environment, to increase the share of gross domestic saving (GDS) in GDP to 15 percent and to increase the share of export in GDP to 22.5 percent (GTP II). During the first four years of implementation period (2010/11-2013/14), it has registered high annual average rate of real GDP (10.1%), which has been

inclusive, spanning different economic sectors such as agriculture, industry and services that have registered an annual average growth rate of 6.6%, 20% and 10.7%, respectively (National Planning Commission (2015).

Sector	Base year (2009/10)	Average1 (2010/11-2013/14)
Agriculture & allied activities	7.6	6.6
Crop	8.7	7.5
Livestock & Hunting	6.2	5.0
Industry	10.8	20.0
Construction	10.9	29.9
Manufacturing	11.6	13.0
Service Sector	13.2	10.7
Gross Domestic Product	10.5	10.1

Table 1: GDP growth rate by major economic sectors (%)Source: National Planning Commission (2015), the Second Growth and Transformation Plan (GTP II), Addis Ababa, Ethiopia.

The share of, respectively, in 2013/14 fiscal year in GDP averaged at 40.2%, 14.3% and 46.2 %, (GTP II). Agriculture, which contributes 40.2%, 80% and 70% to the gross domestic product, the national employment and the export earnings of the country, respectively, is the mainstay of the country's economy (www.africaneconomicoutlook.org). The growth and transformation plan of Ethiopia aims to maintain the role of agriculture as a major source for economic growth and poverty reduction. To increase agricultural production, the government has pursued a number of initiatives such as promoting the use of modern technologies, supporting the commercialization of agriculture and production of high value crops, encouraging micro irrigation schemes, and improving marketing institutions and infrastructure. Major efforts have also been made to ensure adequate agricultural input supply and strengthen agricultural extension services.

The industrial sector is also growing positive during the first four years of the GTP I implementation period. For instance, the share of the industrial sector in the real GDP was 14.3%, of which the share of manufacturing averaged about 5% while construction accounts for nearly 50% (National Planning Commission (2015). In

this period, the export-oriented light manufacturing industries particularly textile, garment, leather, furniture, agro processing and other small and medium scale manufacturing have been given due emphasis, and the textile, garment and leather industries show significant development potential with the opportunity to expand into large-scales.

The key policy goal during the first GTP period was to increase the share of export in GDP to 22.5 percent by the end of the plan period. However, the share of export in GDP reached 12.4 percent by the end of 2013/14 so that foreign exchange earnings from merchandise export covers 23.7%. Thus, improving production capacity, utilizing the opportunities in the international market & encouraging the manufacturing sector to engage in the production of manufactured exports have been the key lessons drawn during GTP implementation period (National Planning Commission, 2015).

To meet the growing demand and support the on-going development efforts, the country has initiated economic infrastructure mega projects. Accordingly, a huge investment has been made on energy (hydro and wind electric power generation, sub-station, transmission and distribution), transport (road, railway, and air) and telecommunication projects. In addition, the country has also made a quite significant investment in basic service delivery such as education and health. This rapid expansion of basic services has helped Ethiopia in achieving the MDGs as related to gender parity in primary education, reducing child mortality, fighting HIV/AIDS, malaria and access to primary education.

The aforementioned trend of growth is expected to remain strong in the coming years. The country's macroeconomic plan for the period between 2015/16 and 2O19/20 (The Second Growth and Transformation Plan - GTP II) indicates that the real GDP is projected to grow at annual average rate of 11 percent. The GDP of agriculture, industry and service sectors are also planned to increase at annual average rate of 8, 19.8 and 10.1 percent, respectively.

The industry sector (manufacturing, construction, mining and electricity) is expected to increase from 14.6% in 2014/15 to 22.8% by the end of 2019/20. The manufacturing subsector focusing on light manufacturing is projected to increase from 4.6% in 2014/15 to 8% while its GDP is projected to grow at an annual average rate of 23.9% during the same period. It is also targeted to raise the share of export to GDP to 11.8 % while the share of manufacturing goods export to GDP is projected to increase to 3.1 % by 2019/20. At the same time, the ratio of export of goods and non-factor services to GDP is projected to increase to 20.6 percent in 2019/20 from 12.8 percent in 2014/15. Similarly, the ratio of import of goods and non-factor services to GDP is expected to rise from 29.6 percent to 32.3 percent during the same period. Therefore, the increase in production, distribution, consumption and disposal of chemicals and chemical products will be quite significant within the second growth and transformation period.

1.1.4 Environmental overview

Ethiopia is endowed with various natural resources. The resources are however affected by continuous malpractices and natural catastrophes. Unattended human activities increase in the exploitation of natural resources is a major cause of natural resource depletion. Land degradation is the biggest challenge of the country. The problem ranges from land degradation, due to deforestation and soil erosion, to environmental pollution, ensuing from the unwise use of a wide variety of chemicals for agriculture, domestic purposes or for the manufacturing of industrial products with steadily growing devastating effects on the environment and public health.

The impact of soil erosion is considerable particularly in the highlands of the country. It has led to the loss of nutrient in agricultural farmlands which in turn become the reason for decreased agricultural outputs and hence to food insecurity. It is also the major reason to the damage of water bodies like lakes

through siltation. Ethiopia is not an industrialized country. Despite the limited numbers of factories in the country, their impact in terms of pollution is enormous. A great majority of these industries discharge their waste in the form of liquid, dust particles and smoke, without any treatment into nearby water bodies and open spaces.

Ethiopia's is rich in biodiversity. However, it has been affected by a number of factors such as the introduction of invasive alien species, settlement and investment activities that do not take into account environmental concerns, inappropriate use of natural resources, the continuous increase in the amount of toxic waste and other pollutants, low awareness level of the public regarding the value of biodiversity, high degradation of forests, vegetation cover and water & soil resources, the impact of widespread poverty in the country and the recurring drought and desertification.

Ethiopia is also often known for its vast water resources that could be applicable for various economic and social purposes. However, the resource is not presently being used to the desired extent. Furthermore, the water resources and the related aquatic eco-systems are facing a great deal of pressure from siltation, inappropriate utilization and pollution.

Chapter II: Mercury Inventory and Identification of Emissions and Resources

2.1 Identified hot-spots of Mercury Contamination (Contaminated Sites)

There are no confirmed hot-spots of mercury contamination in Ethiopia. There has been no intentional use of mercury in the country to produce mercury-added-products, nor any other industrial uses of mercury. This reduces the probability of finding mercury-contaminated sites.

Ethiopia is, according to the available information, unique as a country with ASGM activities, but with no current use of mercury for extraction of gold. This is considered as a well-established fact due to the special conditions pre-vailing for the gold trade in the country; se the section on gold production for more details.

Mercury amalgamation was observed about 10 years ago in one site, but since then, the activities on the site was observed to be shut down. The extend of any mercury contamination on this site has not been investigated in detail. Thus, further attempts should be made to assess mercury contamination, if any, with the help of the universities and scientific research facilitates.

2.2 Data and inventory on Extraction and Use of Fuels/Energy

In this source category, data analysis has shown that Ethiopia releases mercury from Mineral Oils use and Biomass fired power and heat production. These two are discussed in detail below. In Ethiopia there are no activities related to the coke production or wash. The country only imports coals for combustion mainly in the cement industry as source of energy in calcinations process.

Based on the secondary data from the “Energy balance and Statistics for years 2013/14 report” by the Ministry of Water and Energy a total of 291,388 tons of coal has been imported in the year 2014. Concerning which types of the coal was imported, data was collected from the Ethiopian Petroleum Supply

Enterprises and National Oil Company (NOC). Both companies revealed that the hard coal (anthrasite and bituminous) were the types coal introduced into the country. There was no a specific data on the mercury contents of the coal imported in to Ethiopia.

2.2.2 Mineral Oils Extraction, Refining and Use

According to the toolkit this sub category sources includes extraction, refining and According to the toolkit this sub category sources includes extraction, refining and use of mineral oils or petroleum oil. This includes the combustion of oil to provide power, heat and transportation and other uses of oil. Ethiopia is a non-oil producing country and in the country there is no oil refining facility. Thus research considerations where made specifically on the sub category of Use of these mineral oils. The use of these mineral oils relates to heavy oil and petroleum coke and also gasoline, diesel, light fuel oil, kerosene, LPG and other light mineral oils.

The table below shows the five year averages and total importation of individual minerals oils in tones.

Year	LPG	Gasoline	Jet fuel + Kerosene	Diesel/ gasoil	Light fuel oil	Heavy fuel oil	petroleum coke
2009/10	7650	155,760	529,786	1,237,078	10,700	100,870	16,711
2010/11	8400	143,879	548,765	1,182,725	35,760	95,627	102,859
2011/12		134,761.19	535,304.32	1,206,215.70	36,492.03	107,963.90	208,298
2012/2013	5445.3	193,032	613,743	1,322,548	37,422	122,875	62,253
2013/2014	7231.1	211,598	700,744	1,558,342	37,128	144,995	143,662.72
Total	28726.4	839,030.19	2,928,342.323	8,065,250.7	194,630.0	572,330.9	533,783.7
Average	7181.6	167806.04	585668.4646	1613050.14	38926.006	114466.18	106756.744

Table 2: Energy Balance Report 2013/14

Source: the data was compiled from the energy balance report of Ethiopia 2013/14Note: The years are in Ethiopian physical year (from July 08 2009 to July 07 2010)

From the above data we can conclude that the importation and consumption of mineral oils in general has show a steady increasing trend. Use of heavy oil and petroleum coke is only in oil combustion facilities in Ethiopia. Interview with the sole importer of these heavy oil and petroleum coke implied that nationally the use amounts to 262,603 Oil tone per year used for oil combustion facilities.

This number has been checked and verified with Ethiopian Energy Balance Report and thus served as an input for the inventory. To estimate the mercury from the combustion of heavy oil and petroleum coke the total tones consumption of 2013/14 was taken by adding the individual consumption (heavy oil and petroleum coke) as shown in table below. There was no data on the actual mercury content of the heavy oil and petroleum coke imported into the country the UNPE's default factor has been considered to calculate the total mercury release from the two sources. The table below shows the 2014 individual minerals oils consumption in tones.

Items	LPG	Gasoline	Jet fuel	Diesel/ gasoil	Light fuel oil	Heavy fuel oil	petroleum coke	Kerosene
Individual Consumption	0	207,819	411,593	1514693	37,319	118,940	143,663	256,739
Transportation and other uses other than combustion		2,171,424						
Use of heavy oil and petroleum coke: Other oil combustion facilities						262,603		
Residential heating with no controls								256,739

Table 3: Mineral Oil Consumption in Tons

The demand for diesel, gasoil, petroleum, kerosene is high in Ethiopia, as they are used majorly for the transport sector, energy generation, fuelling, cooking etc. The Ethiopian Energy Balance report states that the use in the transportation sector and other uses other that combustion has been 2,171, 424 Oil ton/y in 2013/14. (*Energy Balance Report, 2014*). This was also being calculated by

summing the individual consumption of minerals oil that include LPG, Gasoline, Jet fuel, diesel and light fuel. There was no a specific data on the mercury contents of the minerals oils in to Ethiopia, the recommended default factors from the toolkit were used to estimate the mercury release from the mineral consumption. This data has been verified by the Ethiopian Petroleum Supply Enterprise (EPSE) which is the sole government body tasked with the import of fuel. Petroleum distribution companies buy the fuel from EPSE at the port of Djibouti, transports it to Ethiopia and distributes to all parts of the country. The data for residential heating has also been extracted from the energy balance report. The use of Mineral oils for residential heating amounted to 256,739 Oil t/y.

In Ethiopia such usage is used at a household level for cooking, light generation and warming houses. In this case the data obtained from the energy report and interview of the Ethiopian petroleum supply enterprise indicate that the total kerosene imported in 2013/14 was consumed by households. Therefore, an assumption has been taken that all consumed kerosene for the purpose of lighting in rural area, for cooking and residential heating. In Ethiopia gasoline is blend with ethanol at a percentage 10 ethanol with 90 percent gasoline. For example, in the 2013/2014 Ethiopian fiscal year 7,650 683 litres of ethanol was produced from sugar molasses and blend with ethanol (Ethiopian energy balance report 2013/14). However, there was no a consideration of this ethanol blending to include in this mineral oil combustion.

Mineral Oil Use, Refining and Extraction (Use of Gasoline Diesels, Light Fuel, Oil Kerosene, LPG and Other Light to Medium Distillation)	**Unit**	**Production**	**Use**	**Disposal**	**Sum of releases to pathway from assessed part of life-cycle**
Activity rate	Ton/Year	-	2171 424	-	-
Input factor for phase	Mg Hg/t	-	2	-	-
Calculated input to phase	Kg Hg/y	-	4	-	4
Output distribution factors for phase:					
- Air		-	1	-	1

Mineral Oil Use, Refining and Extraction (Use of Gasoline Diesels, Light Fuel, Oil Kerosene, LPG and Other Light to Medium Distillation)	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of life-cycle
- Water		-	-	-	-
- Land		-	-	-	-
- Products		-	-	-	-
- General waste treatment		-	-	-	-
- Sector specific waste treatment		-	-	-	-
Calculated outputs/releases to:					
- Air	Kg Hg/y	-	4	-	4
- Water		-	-	-	-
- Land		-	-	-	-
- Products		-		-	-
- General waste treatment		-		-	-
- Sector specific waste treatment		-		-	-

Mineral Oil Use, Refining and Extraction (Other Oil Combustion Facilities)	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of life-cycle
Activity rate	Ton/Year	-	258658	-	-
Input factor for phase	Mg Hg/t	-	2	-	-
Calculated input to phase	Kg Hg/y	-	1	-	1
Output distribution factors for phase:					
- Air		-	1	-	1
- Water		-	-	-	-
- Land		-	-	-	-
- Products		-	-	-	-
- General waste treatment		-	-	-	-
- Sector specific waste treatment		-	-	-	-
Calculated outputs/releases to:					
- Air	Kg Hg/y	-	1	-	1
- Water		-	-	-	-
- Land		-	-	-	-
- Products		-		-	-
- General waste treatment		-		-	-
- Sector specific waste treatment		-		-	-

2.2.3 Biomass Fired Power and Heat Production

Ethiopia's energy sector is highly dependent on biomass (firewood, charcoal, crop residues and animal dung). The bulk of national energy consumption is met from biomass sources. As Ethiopia has not yet realized full electrification in the country, the rural area highly depends on Biomass for household use including cooking and lighting.

The Ethiopia biomass strategy of 2013 estimated that biomass energy accounted for 89 percent of the total national energy consumption in 2010.76,571,997tons of biomass is consumed for energy purpose with about 81% of the estimated 16 million households using fire wood and 11.5% of them cooking with leaves and dung cakes. (Ethiopia Biomass Strategy, 2013). Thus the data used for calculating the mercury release of biomass was gathered from the Ethiopian biomass strategy of 2013.

Ethiopia is still heavily dependent on charcoal for domestic energy consumption, especially for cooking. The Ethiopia biomass strategy of 2013 shows that 28,600,468 ton/y of charcoal has been produced in Ethiopia. This data was used for calculating the mercury release from charcoal.

Biomass Fired Power and Heat Production	**Unit**	**Production**	**Use**	**Disposal**	**Sum of releases to pathway from assessed part of life-cycle**
Activity rate	Ton/ Year	-	76571 997	=	-
Input factor for phase	G Hg/t	-	0/03	-	-
Calculated input to phase	Kg Hg/y	-	2297	-	2297
Output distribution factors for phase:					
- Air		-	1	-	1
- Water		-	-	-	-
- Land		-	-	-	-
- Products		-	-	-	-
- General waste treatment		-	-	-	-
- Sector specific waste treatment		-	-	-	-

Biomass Fired Power and Heat Production	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of life-cycle
Calculated outputs/releases to:	Kg Hg/y				
- Air		-	2297	-	2297
- Water		-	-	-	-
- Land		-	-	-	-
- Products		-	-	-	-
- General waste treatment		-	-	-	-
- Sector specific waste treatment		-	-	-	-

Charcoal Combustion	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of life-cycle
Activity rate	Ton/Year	-	28600468	=	-
Input factor for phase	G Hg/t	-	0.12	-	-
Calculated input to phase	Kg Hg/y	-	3432	-	3432
Output distribution factors for phase:					
- Air		-	1	-	1
- Water		-	-	-	-
- Land		-	-	-	-
- Products		-	-	-	-
- General waste treatment		-	-	-	-
- Sector specific waste treatment		-	-	-	-
Calculated outputs/releases to:	Kg Hg/y				
- Air		-	3432	-	3432
- Water		-	-	-	-
- Land		-	-	-	-
- Products		-	-	-	-
- General waste treatment		-	-	-	-
- Sector specific waste treatment		-	-	-	-

2.3 Data and inventory on Primary (Virgin) Metal Production

2.3.1 Gold (and Siver) Extraction with Mercury Amalgamation Processes

Existing national data and information for and beyond 2014 implicate that the Gold and silver extraction is done via traditional method free from mercury use. In Ethiopia, the Ministry of Mines, Petroleum and Natural Gas is one of the Federal Ministries which is given the responsibility of the proper development of mining, petroleum and natural gas resources. The role of the Ministry is mainly to generate the basic geosciences data of the country and to promote the mineral, petroleum and natural gas potentials of the country. Artisanal and Small Scale Gold Mining are licenced by the Ministry of Mines, Petroleum and Natural Gas. The registering and monitoring Artisanal and small scale Gold Mining is part of the mandate of the Ministry.

For the registered Small scale and Artisan mining associations, gold extraction is source of basic income as they are engaged on a regular basis. The associations of miners are registered by the Ministry thus all miners in all parts of Ethiopia are known by the government. In Ethiopia over 1,000,000 million people are engaged in ASM. 5,000,000-7,000,000 people are indirectly depending on ASM for their livelihood, out of which women are estimated about 30%who are the most disadvantaged.

Artisanal miners are engaged in mining /Gold, clay, Gemstone, tantalum& salt/ in different regions, such as Oromia, Amhara, Southern Nations & nationalities, Tigray, Afar and Benshangul Gumuz. Artisanal and Small Scale Gold miners are organized as cooperatives pursuant to the proclamation No 147/91. Based on this proclamation, artisanal miners organized in to cooperatives and administer themselves by their own work planning programs. The minimum Number of the members of the cooperatives is 10. The cooperative expansion agency of Ethiopia will issue a cooperative certificate for those organized by it. After the

establishment of the cooperatives, they can request the mining license from regional mining agency, and issued according to the law.

After mining, the cooperatives sell the Gold product to the National Bank of Ethiopia. The only Gold purchaser in the country is the National Bank of Ethiopia mandated by the government. Artisanal Miners are free from taxes. According to the mining law, any cooperative that have an Artisanal mining license has to pay 8% Royalty to the regional mining agency. The cooperatives can lend money from micro finance institutions.

The mining methods are still primitive due to different circumstance. The major reason miners state for such inclination towards traditional method is the long line of trust built over time to such methods as the most effective way of gold extraction. The untrustworthiness of the methods introduced by State and Non State Actors including NGOs in the past has also been an issue raised. Some miners think that new methods could risk the possibility of mining gold.

Assessing the use of mercury in Ethiopia in the Artisanal and Small Scale Mining was difficult. Thus, estimation had to be made based on available facts and assumptions. The inventory team undertook site visits to major ASGM sites in Ethiopia, namely Shakiso Wolabo Gold Mining site, Dolovia gold mining site and Adola Megado Gold Mining site. The inventory team did not find any use of mercury in the gold extraction method. Interviewed miners engaged in different production and processing phase stated that the manual outdated method of Gold mining is applied in the sites and called for better technology to to minimize the excess effort exerted.

This can not create a presumption of mercury free ASGM Gold mining but the inventory team assumes that miners would value the mercury items than the possible gold extracted using mercury. This assumption bases on a traditional myth in Ethiopia that mercury is a very precious element that would create a fortune to its owner. Thus the feedback of miners in response to our questions

about mercury imply that they would not use the mercury to get gold. The inventory team, taking note of possible misleading communication by the miners from the survey, concluded that mercury is not used in ASGM mining. But the inventory team also noted the need for further investigation and scientific assessment to have a concrete data in this area.

2.3.2 Gold Extraction and Initial Processing by Methods other than Mercury Amalgamation

In the country currently, there is only one large company gold mining "MIDROC Legedembi Gold Mine" (a subsidiary of Midroc group) produced and exported 30% of the total gold in 2014. (References). Therefore, the sources of mercury release from this sub category only from this large scale gold mining company that operates an open pit mining in western the country. The amount of gold produced using cyanide by the private company was collected and the recommended conversion unit in the toolkit was used to calculate the total amount of the ore extracted to produce a tone of gold for the estimation of mercury release from this source. (i.e. 1,125,000 tones of ore are used to yield a tone of gold). Since there is no concrete data on the mercury content of the ore extracted for the gold production in the country, the recommended mercury input factor in the toolkit has been used to estimate the mercury release.

Gold Extraction and initial Processing by Methods other than Mercury Amalgamation	**Unit**	**Production**	**Use**	**Disposal**	**Sum of releases to pathway from assessed part of life-cycle**
Activity rate	Ton/Y	1250000	-	-	-
Input factor for phase	GHg/t	15	-	-	-
Calculated input to phase	Kg Hg/y	18750	-	-	18750
Output distribution factors for phase:					
- Air		0.04	-	-	0.04
- Water		0.02	-	-	0.02
- Land		0.9	-	-	0.9
- Products		0.04	-	-	0.04
- General waste treatment		-	-	-	-

Gold Extraction and initial Processing by Methods other than Mercury Amalgamation	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of life-cycle
- Sector specific waste treatment		-	-	-	-
Calculated outputs/releases to:			-	-	-
- Air	Kg Hg/y	750	-	-	750
- Water	Kg Hg/y	375	-	-	375
- Land	Kg Hg/y	16875	-	-	16875
- Products	Kg Hg/y	750	-	-	750
- General waste treatment			-	-	-
- Sector specific waste treatment					-

2.4 Data and inventory on intentional Use of Mercury in Industrial Processes

In Ethiopia there is no domestic production of chemicals, which involves the use of a Mercury catalyst or Mercury cells. Even though Ethiopia produces caustic soda its by using an old method that doesn't involve mercury as a catalyst.

2.5 Data and inventory on Production of Other Minerals and Materials with Mercury Impurities

2.5.1 Cement Production Without Co-Incineration of Wastes

In Ethiopia cement production and consumption has been showing an increasing trend. At the time of the inventory, the country has more than 16 cement plants. The following data shows 11 years of Cement production, import and consumption amount in the country, as they were reported by Ethiopia cement industry Development strategy (2015). We assume there was no export.

The Ethiopian cement industry development strategy of 2015 revealed that 5.47 million tonnes of cement was produced in 2014. It also indicates that cement was neither exported nor imported at that year. The activity data 5.47 million tonne was used to calculate the mercury release from the cement industry. Based on the interview data obtained from Cement Industry Development

directorate under Chemical and Construction Inputs Industry Development Institute (2016), all cement industry produces Cement without co-incineration of wastes. A questionnaire was also developed and sent to all industries to collect data on the amount cement produced in each facility and the type of the technology they used to reduce pollution. From the collected questionnaires (3 replied out of the 16 companies asked), we got the same result given by cement industry development directorate.

Regarding mercury inputs from fuels, please see the section on "Other coal use", as the primary coal use in the country is for cement production. There was a difficult because many cement industries were not willing to provide information about the type of technologies they used to reduce pollution.

As mentioned above the annual cement produce in the country in 2014 was 5.47 Mt with zero net import and export. To estimate the mercury, release the recommended UNEP's input factor was used. So total mercury release was calculated by multiplying input factor by annual produced cement. Additionally, the output distribution was also estimated based on the data obtained from the cement industry development directorate that all cement industry is equipped with a minimum of simple particle control technologies and no cement company uses dust recycling technologies so far.

Cement Production with Co Incineration of Waste	**Unit**	**Production**	**Use**	**Disposal**	**Sum of releases to pathway from assessed part of life-cycle**
Activity rate	Ton/ year	5470000	-	-	-
Input factor for phase	g Hg/t	-	0.11	-	
Calculated input to phase	Kg Hg/y	602	-	-	602
Output distribution factors for phase:					
- Air		0.6	-	-	
- Water		-	-	-	-
- Land		-	-	-	-
- Products		0.2	-	-	-
- General waste treatment		-	-	-	-

Cement Production with Co Incineration of Waste	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of life-cycle
- Sector specific waste treatment		0.2	-	-	-
Calculated outputs/releases to:			-	-	
- Air	Kg Hg/y	361.2	5	-	361.2
- Water	Kg Hg/y	-	-	-	-
- Land	Kg Hg/y	-	-	-	-
- Products	Kg Hg/y	120.4	-	-	120.4
- General waste treatment	Kg Hg/y		-	-	-
- Sector specific waste treatment	Kg Hg/y	120.4	-	-	120.4

2.6 Data and inventory on Consumer Products with Intentional Use of Mercury

There are no activities related to the intentional use of mercury in industrial processes in Ethiopia. There are eight sub categories addressed in the UNEP Toolkit regarding consumer products with intentional use of mercury including thermometers with mercury, electrical and electronic switches, contacts and relays with mercury, light sources with mercury, batteries containing mercury, biocides and pesticides, paints, pharmaceuticals for human and veterinary uses and cosmetics and related products.

So far, there is no concrete evidence of the mercury being used in the above described products in Ethiopia except medical thermometers (use identified via interviews with hospitals doctors), some batteries and some light sources. According to the Toolkit, mercury thermometers can also be being used for ambient air temperature measurement, in chemical laboratory, and in industrial equipment, but these latter uses have not been identified in Ethiopia (but they may be present).

General purpose batteries are being use to power electrical device, i.e. radio and source light for hand batteries throughout the country, and according to the Toolkit, regional brands may still contain mercury, whereas global brands of

these battery shapes are generally mercury-free today. According to the Toolkit, mercury is primarily used in button cell batteries today,

Beside information on thermometers, battery containing mercury and light sources with mercury there is no any information related to the quantity of other consumer products i.e. electrical and electronic switches, biocides and pesticides, pharmaceuticals for human and veterinary uses, and cosmetic and related products being imported to in Ethiopia. Considering the sub-categories on consumer products that may release mercury, the survey team undertook different method to calculate the emissions and releases, and the findings are described below.

2.6.2 Thermometers with Mercury

In Ethiopia, Medical thermometer is well known by most people, except its risk to human health, when containing mercury. Such thermometers are generally used at all hospitals, clinics and Schools. Unfortunately, the total numbers of medical thermometers that have been disposed annually in Ethiopia so far remain unknown. But from the data obtained from UN trade com and Ethiopian Customs Authorities data base the import and export of thermometers is summarized in the below table.

Period	Reporter	Partner	Import Kg/y	Export Kg/y	Consumption Kg/y	Trade Quantity	Unit conversion
2011	Ethiopia	World	9,952	174	9,778	N/A	
2012	Ethiopia	World	9,534	10	9,524	17,995	
2013	Ethiopia	World	8,667	5	8,662	N/A	
2014	Ethiopia	World	26,363	601	25,762	N/A	
2015	Ethiopia	World	23,668	59	23,609	N/A	
					24,686		6171375

Table 4: Import and Export of thermometers

The table above the data shows a drastic increment from the level of around 9000 Kg/y in 2011-2013 to around 24000 Kg/y in 2014-2015. The inventory team assumes that the quite different levels may be caused by changes in trade import

registration practices, and as a conservative estimate, the average consumption of 2014 and 2015 - 24686 Kg/y - is used for the mercury estimations. The Toolkit unit is items/y and we therefore converted the weight to items using the Toolkit conversion factor (assuming that they are all mercury-filled thermometers, see below). The resulting estimate for consumption of thermometers is thus 6171375 thermometers/y in the country; this number is used as a rough estimate for the calculation of mercury emissions/releases from use and disposal.

Based on the assessment on five hospitals there are three types of thermometers used there: the mercury in glass, the alcohol in glass and the digital one, and the most widely used is the mercury containing one. Unfortunately, the exact net-import of mercury-containing thermometers is not known. According to data from the Ethiopian Revenue and Customs Authority, the origin of imported liquid in glass (mercury and alcohol-filled) thermometers is EU countries, Japan, China, USA, India, among others. It is hard to say if all thermometers imported are mercury-based, however, for future sound management of mercury we have assumed that the supplied thermometers are mercury-based.

Mercury input factors for this section is varying from one field to another i.e. medical thermometers, household thermometers, ambient air temperature thermometers, industrial and special application thermometers, laboratory thermometers, and thermometers for testing petroleum products. Nevertheless, for Ethiopia case, only medical thermometers are commonly used by medical practitioners and could be the most well known one. The extent of the use of mercury thermometers in other sectors is unknown.

In this regards and based on thermometer's information available, the mercury input factors provided by the UNEP Toolkit range from a minimum of 0.25 g to a maximum of 2 g per thermometer, depending on the specific product and perhaps the country or region in question. For calculation mercury release by this sector, the UNEP Toolkit, provide preliminary default mercury input factors for

medical thermometer ranged from 0.5 g to 1.5 g per thermometer. In this regards, the average input factor (1 g per thermometer) has been selected for calculation the release of mercury in Ethiopia.

According to information from the hospital interviews made, the lifetime for mercury thermometers is only in the range of a few months. The contacted hospitals were also asked about the fate of used thermometers, but no answers were obtained on this issue. Through other studies of hospital waste and a field visit to one hospital, it is known however that spent thermometers would generally be disposed with other hospital waste, that is, buried on-site, burned on-site or perhaps in some case be disposed with general waste to landfills.

According to information from the field visit, mercury from broken thermometers spilled on the floor would simply be washed out with water. This water likely ends up in the sewer system or on the ground on-site, depending on local settings. Accordingly, the Toolkit's default output distribution factors for the output scenario "No separate collection Informal waste handle widespread" was used.

Thermometers	**Unit**	**Production**	**Use**	**Disposal**	**Sum of releases to pathway from assessed part of life-cycle**
Activity rate	kg	-	-	6171375	6171375
Input factor for phase	g Hg/I	-	-	1	1
Calculated input to phase	Kg Hg/y	-	-	6171	6171
Output distribution factors for phase:					
- Air		-	-	-	0.2
- Water		-	-	-	0.3
- Land		-	-	-	0.2
- Products		-	-	-	0.00
- General waste treatment		-	-	-	0.3
- Sector specific waste treatment		-	-	-	0.00
Calculated outputs/releases to:	Kg/y				
- Air		-	-	1234.28	1234.28
- Water		-	-	1851.41	1851.41
- Land		-	-	1234.28	1234.28

Thermometers	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of life-cycle
- Products		-	-	0.00	0.00
- General waste treatment		-	-	1851.11	1851.11
- Sector specific waste treatment		-	-	0.00	0.00

2.6.4 Electrical Switches and Relays

Mercury is a component in many electrical switches such as displacement/plunger relays and tilt switches. Small electrical switches may contain 3.5 g of mercury, while larger industrial switches may contain as much as 3.5 kg of mercury (Wisconsin Mercury Sourcebook, 1997). Mercury-containing switches are found in some cars in tilt switches for the boot light (although boot switches may also be mechanical). Each switch contains approximately 0.8 g of mercury (Ecology Centre Great Lakes United University of Tennessee, 2001). Such switches account for more than 99% of the mercury used in automobiles in the United States (Ecology Centre Great Lakes United University of Tennessee, 2001). It is not known how common such switches are in the Ethiopia vehicle fleet.

Due to absence of data in this regard the inventory team decided to use the option of using national electrification rate and number of the habitats for emission estimation. The World Bank reported the electrification rate of the country is about 26.6%. Nevertheless, the inventory team decided to use electrification rate of 41% from the report already communicated in the level one inventories. So due to these factors uncertainty may arise.

The toolkit provides 0.02-0.25 g Hg y* inhabitant Default input factor and 0.14 input factor for the calculation of emission from Electrical switches and relays with mercury. Based on the local practise of waste management “no separate collection informal waste handle widespread” scenario is selected and the output distribution factor is0.3 for air, 0.4 for land and 0.3 for general waste.

Electrical Switches and Relays	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of life-cycle
Activity rate	Inh*	-	90076012		-
Input factor for phase	% Inh*E	-	41		-
Calculated input to phase	Kg Hg/y	-		5170	-
Output distribution factors for phase:					
- Air	-	-	-	-	0.3
- Water	-	-	-	-	0.00
- Land	-	-	-	-	0.4
- Products	-	-	-	-	0.00
- General waste treatment	-	-	-	-	0.3
- Sector specific waste treatment	-	-	-	-	0.00
Calculated outputs/releases to:					
- Air		-	-	1551.11	-
- Water		-	-	0.00	-
- Land		-	-	2068.15	-
- Products		-	-	0.00	-
- General waste treatment		-	-	1551.11	-
- Sector specific waste treatment		-	-	0.00	-

2.6.5 Light Source with Mercury

Mercury is used in small amounts per lamp in a number of different types of discharge lamps, with fluorescent tubes and compact fluorescent lamps (CFLs) as the most common examples (COWI, 2002). Approximately 95% of the mercury-containing lamps used in the USA are linear fluorescent light tubes (NESCAUM, 1998). The remainders are compact fluorescents or specialty lamps (such as metal halide, mercury vapour, high-pressure sodium, and neon lamps) which are produced for commercial or municipal use, such as street lighting (NJ MTF, 2002).

Significant progress has been made by some producers to reduce the amount of mercury per lamp, with reductions of about a factor 10 achieved in newer mercury-lamps as compared to traditional types. Lamp types with high mercury

content are, however, still reported to be on the market, and may be sold in large quantities as they are generally cheaper than low-mercury lamps. Non-mercury alternatives for these lamps, with similar energy saving qualities, are not yet available on the market; however, they are under development (COWI, 2002). Other light sources reported to contain mercury include: special lamps for photographic purposes, chemical analyses (atomic absorption spectrometry lamps), ultraviolet sterilization, and back lights for flat-screens for computers (and likely for televisions).

Ethiopia lacks proper management of hazardous and solid waste materials which makes it difficult to accurately estimate mercury releases from the light sources. Light bulbs are commonly disposed with household wastes with no special sorting method. Unfortunately, the total numbers of Light sources with mercury that have been disposed annually in Ethiopia so far remain unknown but from the data obtained from UN trade com and Ethiopian Customs Authorities data base the import and re export of light source summarized below**.**

a) Fluorescent tubes (double end)

Period	Trade Quantity	Export items/y	Consumption Item	Average
2011	*4,141,560*	*347*	4,141,213	
2012	888,232	*33,958*	854,274	
2013	*3,812,423*	*12,047*	3,800,376	2,931,954
2014	*1,496,208*	1	1,496,207	
2015	*2,332,262*	*2,963*	2,329,299	1,912,753

b) Compact fluorescent lamp (CFL single end)

Period	Imported Item quantity	Exported Item quantity	consumption	Average
2011	78,852		78,852	
2012	146,188		146,188	
2013	462,915		462,915	229,318
2014	707,340	17,239	690,101	
2015	1,586,033	16,156	1,569,877	

c) High pressure mercury vapor

Period	Net Weight (kg)	Trade Quantity	Export net w	Consumption net weight	average
2011	20,859	*10,654*		20,859	
2012	53,753	25,611	4	53,749	
2013	52,180	*36,350*	221	51,959	42,189
2014	51,092	*45,758*		51,092	
2015	137,060	*103,744*		137,060	

d) UV light for tanning

Period	Import Net Weight (kg)	Export net w	Consumption net weight	average
2011	1,018	5	1,013	
2012	13,310	38	13,272	
2013	13,923		13,923	9,403
2014	85,084		85,084	
2015	99,586	13	99,573	

Light Source with Mercury	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of life-cycle
Activity rate	Items/y	-	-	8034241	-
Input factor for phase	mg Hg/item	-	-	10-30	-
Calculated input to phase	Kg Hg/y	-	-	133	-
Output distribution factors for phase:					
- Air		-	-	0.3	-
- Water		-	-	0.00	-
- Land		-	-	0.3	-
- Products		-	-	0.00	-
- General waste treatment		-	-	0.3	-
- Sector specific waste treatment		-	-	0.00	-
Calculated outputs/releases to:					2029.00
- Air	-	-	-	-	0.00
- Water	-	-	-	-	0.00
- Land	-	-	-	-	2029.00
- Products	-	-	-	-	0.00
- General waste treatment	-	-	-	-	4058.00
- Sector specific waste treatment	-	-	-	-	0.00

2.6.6 Batteries with Mercury

There are several different types of batteries that contain mercury. These include ‘button cells’ of silver oxide, zinc air and mercury oxide composition, in addition to some alkaline, and zinc carbon batteries. Silver oxide batteries are used in devices such as watches and calculators, zinc air and mercury oxide batteries are used in hearing aids, alkaline batteries are for general purposes, and zinc carbon batteries are commonly used in smoke alarms and clocks (Gresham, Brickner and Bratton, Inc., 1992 as cited in Draft Wisconsin Mercury Sourcebook, 1997). In Ethiopia also there are many type of batteries is consumed for various purpose.

Primary cells & primary batteries, air-zinc

Period	Partner	Net Weight (kg)	Export Net Weight	Consumption Net Weight	Average
2011	World	244		244	
2012	World	557		557	
2013	World	835	10	825	
2014	World	177,082		177,082	
2015	World	180,240		180,240	178,661

According to the data from Ethiopian Custom and Revenue Authority and UN Data base 358,948 Kg of net Primary cells & primary batteries, air-zinc is consumed in the last five years. From the table above the net consumption of primary cells and primary batteries, air – zinc batteries rise from 0.24 tons 2011 to 179 tons in 2015. Even though the data are difficult to interpret but as a conservative measure we take average of the last two years.

For zinc air button cells which are normally used in smaller quantities compared to Alkaline, other than bottom cell shapes batteries the Toolkit's input factors (0-12 Kg Hg/ton battery) are used in the calculations. Based on local practice, the out of used batteries have been disposed of with general waste without separation practice, for all urban areas. For people who living in country side, the used batteries are disposed of right away at their back yards, whether burred or burned with general waste, according to assessment report on twenty-four city and report from Urban development and Housing Ministry. Accordingly, the Toolkit's default output distribution factors for the scenario "No or very limited separate batteries collection. Missing or informal collection and handling of general waste is widespread" were applied in the calculations, in which, the output distribution factor for this sector is 0.25 for air, 0.25 for land, and 0.5 for general waste. So the estimated possible release of mercury and its distribution pathways for Primary cells & primary batteries, air-zinc is shown in the below table.

A. Alkaline, other than button cell shapes

Period	Trade flow	Partner	Import Net Weight	Export Net weight	Consumption Net Weight	Average
2011	Ethiopia	World	16,267,807	23,881	16,243,926	
2012	Ethiopia	World	15,435,629	3,326	15,432,303	
2013	Ethiopia	World	21,726,067	37,402	21,688,665	
2014	Ethiopia	World	28,086,119	176,756	27,909,363	
2015	Ethiopia	World	22,109,082	96,641	22,012,441	23,870,156

From the table above the net consumption of Alkaline, other than button cell shapes batteries rise from 16,243,926 Kg 2011 to 22,012,441 tons in 2015. Because the batteries are short life time batteries and as conservative measure the average 23,870,156 Kg is used in calculation.

For general Alkaline, other than button cell shapes batteries which are normally used in large quantities compared to other battery types. The Toolkit's input factors for alkaline batteries (0-0.25 Kg Hg/ton battery) are used in the calculations. The resulting mercury input estimates are associated with a substantial uncertainty, but do however serve to indicate an order of magnitude of the mercury input to Ethiopia with batteries.

Based on local practice, the out of used batteries have been disposed of with general waste without separation practice, for all urban areas. For people who living in country side, the used batteries are disposed of right away at their back yards, whether burred or burned with general waste, according to assessment report on twenty-four city and report from Urban development and Housing Ministry. Because no output destruction factor is given in the spreadsheet the calculation for Alkaline, other than button cell shapes batteries the calculation is omitted.

Batteries with Mercury	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of life-cycle
Activity rate	t/y			24049	-
Input factor for phase	Kg Hg/t			0.25-12	-
Calculated input to phase	Kg Hg/y			8116	-
Output distribution factors for phase:					
- Air	-	-	-	0.25	-
- Water	-	-	-	0.00	-
- Land	-	-	-	0.25	-
- Products	-	-	-	0.00	-
- General waste treatment	-	-	-	0.5	-
- Sector specific waste treatment	-	-	-	0.00	-
Calculated outputs/releases to:					
- Air	-	-	-	2029.00	2029.00
- Water	-	-	-	0.00	0.00
- Land	-	-	-	2029.00	2029.00
- Products	-	-	-	0.00	0.00
- General waste treatment	-	-	-	4058.00	4058.00
- Sector specific waste treatment	-	-	-	0.00	0.00

2.6.7 Polyurethane with Mercury Catalysts

Polyurethane is a synthetic material that is used in various applications in nearly every field imaginable. It is renowned for its durability and flexibility and can be produced in a number of different forms based on what it will be used for. Everything from airplane wings to tires can be made with polyurethane. In Ethiopian case the production, the level of mercury content and amount in used are not well known.

According to trade com and Ethiopian custom and revenue authority data base 3039564 Kg of fabrics covered with Polyurethane and cellular Polyurethane is consumed from 2011 until 2015. With the absence of clear boundaries with those having mercury and those who do not the inventory team uses conservative approach and utilize the population number for the calculation and because of this uncertainty may happen.

The toolkit provides the input factor for Polyurethane with mercury catalysts use and disposal reneging from 0-0.03 g/Hg (y*inhabitant) for the calculation. The resulting mercury input estimates are associated with a substantial uncertainty, but do however serve to indicate an order of magnitude of the mercury input to Ethiopia with Polyurethane with mercury catalysts

Based on local practice, the out of used shoe soles, conveyer belts, and others disposed of with general waste without separation practice, for all urban and rural areas the end of its life is whether burred or burned with general waste “No separate collection. Informal waste handle is Widespread” factor is chosen for the calculation and the output distribution factor for this sector is 0.2 for air, 0.1 for water 0.4 for land and 0.3 for general waste. So the estimated possible release of mercury and its distribution pathways for Polyurethane with mercury catalysts is shown in the below.

Polyurethane with Mercury Catalysts	**Unit**	**Production**	**Use**	**Disposal**	**Sum of releases to pathway from assessed part of life-cycle**
Activity rate	Inh	-	-	90076012	90076012
Input factor for phase	G Hg (y*in	-	-	-	-
Calculated input to phase	Kg Hg/y	-	-	1107.9	1107.9
Output distribution factors for phase:					
- Air	-	-	-	0.2	-
- Water	-	-	-	0.1	-
- Land	-	-	-	0.4	-
- Products	-	-	-	0.00	-
- General waste treatment	-	-	-	0.3	-
- Sector specific waste treatment	-	-	-	0.00	-
Calculated outputs/releases to:					
- Air	-	-	-	221.59	221.59
- Water	-	-	-	110.79	110.79
- Land	-	-	-	443.17	443.17
- Products	-	-	-	0.00	0.00
- General waste treatment	-	-	-	332.38	332.38
- Sector specific waste treatment	-	-	-	0.00	0.00

2.6.8 Paint with Mercury

Phenyl mercuric acetate (PMA) and similar mercury compounds were formerly widely added as biocide to water based paints and may still be used in some countries. These compounds were used to extend shelf-life by controlling bacterial fermentation in the can (in-can preservatives) and to retard fungus attacks upon painted surfaces under damp conditions (fungicides). According to the Chemical and Construction Impute Development Institute report the paint manufacture the content of mercury they manufactured in the country is not yet known.

2.6.9 Cosmetics and Related Products with Mercury

Mercury has been used in skin lightening creams, soaps, and as preservatives in some eye cosmetics. Based on the information compiled on ten cosmetics shops found in Addis Ababa the utilization of skin lighting cream, mascara is very low and The most commonly used products were body creams and lotions (68%), shampoos and conditioners (35%), and deodorants and perfumes (29%). Being single, female, and in the age group of 18–20 years increased the odds of cosmetics utilization. And none of this cosmetics product mentioned having mercury furthermore the production and utilization of skin lightening creams, soaps and preservatives has not registered in the country and the trained is very minimal.

Mercury releases may occur during production, use and disposal of these products (UNEP, 2002 and COWI, 2002). For conservative approach based on the minimal information we have gate from Mekelle and Jigjiga University student research the inventory team estimated 50 tonnes of cosmetics products are utilized in the year 2014.the possible impact of such products on human health needs further scientific researches in this area. Different literature studies clearly implicate the possible negative impact in using this product. But nationally, research is not well developed.

The toolkit provides (0-30 kg Hg/t) input factor for cosmetics and related products with mercury and The resulting mercury input estimates are associated with a substantial uncertainty, but do however serve to indicate an order of magnitude of the mercury input to Ethiopia with cosmetics and related products The output distribution factor for this sector is 0.95 for water and 0.55 for land. So the estimated possible release of mercury and its distribution pathways for Cosmetics and related products with mercury is shown in the below.

Cosmetics and Related Products with Mercury	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of life-cycle
Activity rate	t/y	-	50		50
Input factor for phase	Kg Hg/t	-	1500		1500
Calculated input to phase	Kg Hg/y				-
Output distribution factors for phase:					
- Air	-	-	0.00	-	-
- Water	-	-	0.95	-	-
- Land	-	-	0.55	-	-
- Products	-	-	0.00	-	-
- General waste treatment	-	-	0.00	-	-
- Sector specific waste treatment	-	-	0.00	-	-
Calculated outputs/releases to:	-	-		-	-
- Air	-	-	0.00	-	0.00
- Water	-	-	1425.00	-	1425.00
- Land	-	-	75.00	-	75.00
- Products	-	-	0.00	-	0.00
- General waste treatment	-	-	0.00	-	0.00
- Sector specific waste treatment	-	-	0.00	-	0.00

2.7 Data and inventory on Other Intentional Use/Processes in Use

2.7.1 Dental Mercury Amalgam Fillings

Dental amalgam fillings consist of an alloy of mercury, silver, copper and tin (typically about 44-51% mercury by weight). The alloy is typically supplied to the dentists either: 1) as pure mercury along with a powder mix of the other metals,

which are weighed and mixed in an agitator in the clinic; or 2) as small capsules where mercury and the metal powder are present in the right formula and only need to be mixed (in the capsule before opening) in the clinic, prior to filling the cavity in the tooth (COWI, 2002). Other variants of the same principles may occur.

Mercury is released to air, water, and wastes during the production, use and disposal of the amalgam fillings (such as following the removal of fillings or teeth containing fillings during medical/dental procedures, or through lost teeth). Also, releases can occur at the end of life of a person with fillings.

The market for sale of Dental amalgam in Ethiopia does not exist adequately thus practitionaires use amalgam imported in small quantity from foreign countries without registration by the ERCA. This makes tracking and monitoring of dental amalgam in the country difficult.

The toolkit provides 0-0.15 g/Hg (Y*inhabitant) input factor for realize estimation. The output distribution factor for this sector is 0.02 For Air, 0.14 for water, 0.12 for general waste and 0.12 for sector specific treatment/ disposal.

According to the dentist association preparation and fillings of mercury amalgam is done without basic safety measures and there is no registered data to set the share of current mercury amalgam fillings so there the emission from this source is calculated by the population 2014 and according to the Central Statics Agency the population is 90,076,012.

Dental Mercury Amalgam Fillings	**Unit**	**Production**	**Use**	**Disposal**	**Sum of releases to pathway from assessed part of life-cycle**
Activity rate	Inha.	-	90076012		-
Input factor for phase	gHg/y*Inha	-	0.2		-
Calculated input to phase	Kg Hg/y	6083	3650.009	3650.009	-

Dental Mercury Amalgam Fillings	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of life-cycle
Output distribution factors for phase:					-
- Air	-	-	0.02	-	0.02
- Water	-	-	-	0.02	0.02
- Land	-	-	-	-	-
- Products	-	-	-	0.06	0.06
- General waste treatment	-	-	-	0.26	0.26
- Sector specific waste treatment	-	-	-	0.24	0.24
Calculated outputs/releases to:					-
- Air		-	60.835	60.835	121.67
- Water		-	973.34	973.34	1946.67
- Land		-	146	146	292
- Products		-	109.5	109.5	219
- General waste treatment		-	511	511	1022
- Sector specific waste treatment		-	511	511	1022

2.7.2 Manometers and Gauges with Mercury

According to the report from Ethiopian food medicine and health care administration Authority there is no production of medical blood pressure gauges in the country. Mercury is used in some blood pressure gauges, industrial and meteorological manometers, and pressure valves (UNEP, 2002). Blood pressure gauges are probably mainly supplied with mercury in the product. For pressure valves in district heating and educational uses the metallic mercury used is often supplied separately and not as integrated in the product. Mercury may be supplemented during the use period for all types mentioned.

The mercury may be disposed of with the apparatus or separately. Non-mercury alternatives exist for all uses and are gradually substituting for the mercury-using equivalents in some countries (Maag et al., 1996, as cited in COWI, 2002). It should be noted that quantification of mercury supplied separately for these uses

may be difficult to distinguish from other metallic mercury consumption (COWI, 2002).

And the sub categories comprise medical blood pressure gauges, Manometers U-shaped manometers for milking systems Manometers and barometers used for measuring air pressure Barometers Environmental Manometers Pressure valves in district heating plants Pressure gauges and the number of this manometers used in the country is not registered and known and because of these the emission relies estimation is based on the electrification rate and inhabitant in 2014 of the country

The inventory toolkit provides the input factor for other manometers (level 1default for whole group is 0-005 g Hg y* inhabitant is used for the calculation. Based on local practice, medical waste is disposed of with general waste without separation practice, for most urban and rural areas so there for “No separate collection. Informal waste handle is Widespread” factor is chosen for the calculation and the output distribution factor for this sector is 0.2 for air, 0.3 for water 0.2 for land and 0.3 for general waste. So the estimated possible release of mercury and its distribution pathways for Manometers and gauges with mercury is shown in the below table.

Summary of emission release

Manometers and Gauge with Mercury	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of life-cycle
Activity rate	Inha.	90076012	-	-	-
Input factor for phase	gHg/y*Inha	0.15	-	-	-
Calculated input to phase	Kg Hg/y	175			-
Output distribution factors for phase:					
- Air		-	-	0.2	-
- Water		-	-	0.3	-

Manometers and Gauge with Mercury	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of life-cycle
- Land		-	-	0.2	-
- Products		-	-	0.00	-
- General waste treatment		-	-	0.3	-
- Sector specific waste treatment		-	-	0.00	-
Calculated outputs/releases to:					
- Air		-	-	37.00	37.00
- Water		-	-	55.5	55.5
- Land		-	-	37.00	37.00
- Products		-	-	0.00	0.00
- General waste treatment		-	-	55.50	55.50
- Sector specific waste treatment		-	-	0.00	0.00

Activity data for Medical blood pressure gauges

The inventory team took a survey on five major Government hospitals found at Addis Ababa namely Zewditu Memorial Hospital, Minilik Hospital, Gandhi Memorial Hospital, Balcha Hospital and Paulos millennium hospitals. Based on the data obtained from these hospitals the inventory team made estimation for the rest 121 government hospitals and the estimated number of medical blood pressure gauges which are under utilizations are about 1573 items in 2014.

Based on the local practice, medical waste is disposed of with general waste without separation practice, for most urban and rural areas so therefore “No separate collection. Informal waste handle is Widespread” factor is chosen for the calculation and the output distribution factor for this sector is 0.2 for air, 0.3 for water 0.2 for land and 0.3 for general waste. The inventory toolkit provides the input factor for Medical blood pressure gauges 80 g Hg/Item is used for the calculation.

Data gap

The estimated realize from this sub category is highly subjected to uncertainty because of absence of registered data for the number of blood pressure gauges

used but for the better focus of future sound management of the release from this sub category the summarized data is given below.

Summary of emission release

Blood pressure gauges	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of life-cycle
Activity rate	Items/y	-	-	1573	-
Input factor for phase	g/Hg/Item	-	-	80	-
Calculated input to phase	Kg Hg/y				-
Output distribution factors for phase:					
- Air		-	-	0.2	-
- Water		-	-	0.3	-
- Land		-	-	0.2	-
- Products		-	-	0.00	-
- General waste treatment		-	-	0.3	-
- Sector specific waste treatment		-	-	0.00	-
Calculated outputs/releases to:					
- Air		-	-	25.2	25.2
- Water		-	-	37.80	37.80
- Land		-	-	25.20	25.20
- Products		-	-	0.00	0.00
- General waste treatment		-	-	37.80	37.80
- Sector specific waste treatment		-	-	0.00	0.00

2.7.3 Laboratory Chemicals and Equipment with Mercury

The sub categories contain Laboratory chemicals (level 1 default for lab chemicals) and Other laboratory equipment (level 1 default for group) and the amount of laboratory chemicals and equipment's used in the country has no registration system at all.

a. Laboratory chemicals (level 1 default for lab chemicals)

Mercury is used in laboratories in instruments, reagents, preservatives, and catalysts. Some of this mercury is released to air, primarily through lab vents. However, most of the mercury may be released in wastewater or disposed of as hazardous waste or municipal waste.

Because there is no registered data on the consumption and management of laboratory chemicals in the country the emission of mercury from these sub categories is also estimated based on the number of population of the countries. And because of this uncertainty may arise. The toolkit provides 0.01 g Hg/y* inhabitant for the calculation of the relies from Laboratory chemicals. The distribution factor for these sub categories is 0.33 for water, general waste and sector specific treatment /disposal.

Laboratory chemicals and Equipment's with Mercury	**Unit**	**Production**	**Use**	**Disposal**	**Sum of releases to pathway from assessed part of life-cycle**
Activity rate	Inha.	90076012			-
Input factor for phase	gHg/y*Inha	0.15			-
Calculated input to phase	Kg Hg/y	369.3			-
Output distribution factors for phase:					
- Air				0.00	-
- Water				0.33	-
- Land				0.00	-
- Products				0.00	-
- General waste treatment				0.33	-
- Sector specific waste treatment				0.33	-
Calculated outputs/releases to:					
- Air				0.00	
- Water				121.87	
- Land				0.00	
- Products				0.00	
- General waste treatment				121.87	
- Sector specific waste treatment				125.57	

b. Other Laboratory Equipment

Mercury is used in other laboratory equipment's. Some of this mercury is released to air, primarily through production and disposal of the equipment with general waste.

Because there is no registered data the number of mercury containing equipment used and discard each year in the country the emission of mercury from these

sub categories is estimated based on the number of population of the countries. And because of this uncertainty may arise.

The toolkit provides 0.04 g Hg/y* inhabitant for the calculation of the relies from other laboratory equipment's. The distribution factor for these sub categories is 0.33 for water and general waste and 0.34 for sector specific treatment /disposal.

Other Laboratory Equipment's	**Unit**	**Production**	**Use**	**Disposal**	**Sum of releases to pathway from assessed part of life-cycle**
Activity rate	Inha.	90076012	-	-	-
Input factor for phase	gHg/y*Inha	0.15	-	-	-
Calculated input to phase	Kg Hg/y	369.3	-	-	-
Output distribution factors for phase:					
- Air		-	-	0.00	0.00
- Water		-	-	0.33	0.33
- Land		-	-	0.00	0.00
- Products		-	-	0.00	0.00
- General waste treatment		-	-	0.33	0.33
- Sector specific waste treatment		-	-	0.34	0.34
Calculated outputs/releases to:		-	-		
- Air		-	-	0.00	0.00
- Water		-	-	487.49	487.49
- Land		-	-	0.00	0.00
- Products		-	-	0.00	0.00
- General waste treatment		-	-	487.49	487.49
- Sector specific waste treatment		-	-	502.27	502.27

2.8 Data and inventory on Production of Recycled Metals

There are three types of sub-categories considering in this sector including (1) production of recycled mercury, (2) production of recycled ferrous metal (iron and steel) and (3) production of other recycled metals. In Ethiopia a practices, the secondary metal production is available only for scraped iron, Aluminum and Copper and there is production of recycled mercury ("secondary production")

2.8.1 Production of Recycled Ferrous Metals (Iron and Steel)

Based on information from the Inventory Report of Unintentionally Produced POPs in Ethiopia, (inventory report, 2014) and the report from Metals Industry development institute it is known that recycled iron production undertaken at small scale handicraft and large industry scale.

The iron scrap recycling/production sources comprise 51 locations and most of them are located in Oromia regional state and Addis Ababa. According to the data the amount of iron annually produced is about 643 778 tons. The most common recycling kiln is a cylinder with a height of 1 meter and diameter of 0.7 meters. It is processed by Coal and Furness oil. The production of iron scrap recycling is made for other products, especially, spare parts for vehicles and any metallic machines. The recycling kiln is generally made of iron on the inside and bricks on the outside and most of them have no temperature controller or air pollution control system (APCS) applications applied. Under these conditions, most likely no potentially mercury-containing parts (switches and lights) will actually enter the melting furnace. To the extent cars with mercury containing parts (e.g. older cars from the Arabian state Europe) are present in the Ethiopia society, these parts may be collected for re-sale as spare parts or be lost to scrap heaps at the car scrappers, or go with general waste to landfills.

2.8.1 Production of Other Recycled Metals

The production of other recycled metals refers to the recycle of secondary scraped non-ferrous metals including aluminum, copper and lead. The aluminum recycling is available at 3 locations with the annually rate production of 699 tons. Same as the iron recycling kiln, the kiln for aluminum recycling is simply made of iron inside with the outside protected/covered by bricks. The recycling process is operated by using Furness oil. This oven has no temperature controller or APCS. The products of recycled aluminum can make many types of domestic objects,

for example, pots, plates, bowls, and other souvenir items. (The report from metals industry development institute, 2014)

As for ferrous metals, no mercury containing parts are expected to be fed to the furnaces; any parts present would likely be scrapped as waste.

2.9 Data and inventory on Waste Incineration and Burning

Waste incineration refer to any waste that going to burned down at incinerators regardless with or without air pollution control system. As indicated in the UNEP Toolkit, there are five type of waste incineration sub-categories addressed including: incineration of municipal/general wastes, incineration of hazardous waste, incineration of medical waste, incineration of sewage sludge, and informal incineration (burning) of waste.

In this regards and based on Ethiopia context, the waste incineration in Ethiopia can be addressed only two types: (1) medical waste incineration and (2) Informal waste burning.

2.9.1 Medical Waste Incineration

Medical waste is composed of needles, syringes, glass bottles, glasses, surgical wastes, and other pharmaceutical wastes. Currently, the medical waste is generally reasonably managed in terms of waste classification, collection, storage, and disposal/burning.

Based on the assessment made on nine private and Public hospitals and health care institutes the waste generation rate of hospitals was for inpatients1.5 kg/ bed/day and out patients 2.5 kg/outpatient/day and with the current malpractices of healthcare waste management the percentage of hazardous waste was estimated to be very high (61.04%). Based on this and the estimation made 2484 tons of medical waste incinerated in 2014.The common method of healthcare waste treatment was done by poor design and construction incinerators which

have low combustion capacity. 1 Thus due too inaccurate registered data uncertainty may arise. The toolkit provides 5 g Hg/t of waste incinerated for the calculation of the emission from this sector.

All medical waste incinerators do no install APCS, which all emission matters are gone directly into the atmosphere. So, as an indication of the potential mercury inputs with incineration of medical wastes, the Toolkit's maximum input factors (input factors ranged from 8 Kg to 40 Kg Hg/ton waste) are used in the calculations.

Accordingly, the UNEP Toolkit, the default output distribution factors for incineration of medical waste shall follow the default output distributors for incineration of municipal wastes. Thus default output distributions factors for the scenario "None" were applied in the calculations, in which, the output distribution factor for this sector is 1 for air. So the estimated possible release of mercury and its distribution pathways for this sub-category is

Medical waste Incineration	**Unit**	**Production**	**Use**	**Disposal**	**Sum of releases to pathway from assessed part of life-cycle**
Activity rate	t/y	-	-	2484	2484
Input factor for phase	gHg/t WI	-	-	24	24
Calculated input to phase	Kg Hg/y	-	-	60	60
Output distribution factors for phase:					
- Air		-	-	1	1
- Water		-	-	0.00	0.00
- Land		-	-	0.00	0.00
- Products		-	-	0.00	0.00
- General waste treatment		-	-	0.00	0.00
- Sector specific waste treatment		-	-	0.00	0.00
Calculated outputs/releases to:		-	-		
- Air		-	-	60	60

[1]Esubalew Tesfahun, Abera Kumie & Abebe Beyene. "Critical assessment of healthcare waste management practice in Ethiopia''

Medical waste Incineration	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of life-cycle
- Water		-	-	0.00	0.00
- Land		-	-	0.00	0.00
- Products		-	-	0.00	0.00
- General waste treatment		-	-	0.00	0.00
- Sector specific waste treatment		-	-	0.00	0.00

2.9.2 Informal Waste Burning

Informal waste burning is defined here as waste burning undertaken at informal conditions, in barrels, containers, or on bare land, with no flue gas controls and diffuse spreading of incineration residues on land. If mercury is present in the waste, part of it will be released to air, and part of it will remain in incineration residues (including unburned and semi-degraded waste) with a potential for additional subsequent mercury releases to air, ground water and surface waters. Given the volatility of mercury, it is expected that most of the mercury is released into the air as a result of informal waste incineration. This waste disposal method may pose an immediate risk for the local community in which it takes place, because air emissions (of several potent pollutants) are not controlled and residues may cause contamination of the local ground water.

According to the Assessment report from Ministry of Environment, Forest and Climate Change and Ministry of Urban Development and Housing burning of waste at dump site and open space is most common practice in large cities like Addis Ababa, Bahir Dar, Mekelle, Harare, Assosa, Gambella and most small city in the country. In addition, only 40-50% of waste is collected and goes to dump site the remaining is left in open space and river side and the per capital generation is rages from 0.24 to 0.36kg/day.

Based on the estimation made by experts from Ministry of Environment, Forest and Climate Change and Ministry of Urban Development and Housing, 45-55% of the waste is collected and transported to the dump site and 20-25% of waste is exposed for fire both at damp site and open space thus giving a total estimate of 1949995 tons of waste burned in 2014. Unfortunately getting registered data is serious problem both in municipal and industries waste management system. The data mentioned above is manipulated from twenty-four cities to the national level and uncertainties common and expected.

The toolkit provides 5 g/Hg/t of waste burned for the calculation of the emission from informal burning of waste. In general, the waste management practice very low and the major portion of uncollected waste and the small amount of waste collected and transported in to dump sites are exposed of fire and the output distribution factor is 1 for air.

Informal Waste Burning	**Unit**	**Production**	**Use**	**Disposal**	**Sum of releases to pathway from assessed part of life-cycle**
Activity rate	t/y	-	-	1949995	1949995
Input factor for phase	g/Hg/t	-	-	5	5
Calculated input to phase	Kg Hg/y	-	-	9750	9750
Output distribution factors for phase:	-	-	-		
- Air	-	-	-	1	1
- Water	-	-	-	0.00	0.00
- Land	-	-	-	0.00	0.00
- Products	-	-	-	0.00	0.00
- General waste treatment	-	-	-	0.00	0.00
- Sector specific waste treatment	-	-	-	0.00	0.00
Calculated outputs/releases to:	-	-	-		
- Air	-	-	-	9750	9750
- Water	-	-	-	0.00	0.00
- Land	-	-	-	0.00	0.00
- Products	-	-	-	0.00	0.00
- General waste treatment	-	-	-	0.00	0.00
- Sector specific waste treatment	t/y	-	-	1949995	1949995

2.10 Data and inventory on Waste Disposal, Deposition/landfilling

The category refers to any waste that going to disposal of at landfill or backyard. As indicated in the UNEP Toolkit, there are five type of waste deposition and waste water treatment sub-categories addressed including: controlled landfills/deposit, diffuse deposition under some control, informal local disposal of industrial production waste, informal dumping of general waste, and waste water treatment. In this regards and based on Ethiopian context, the waste deposition in Ethiopia can be addressed in two types: (1) waste water treatment, and (2) informal waste disposal.

2.10.1 Informal Dumping of General Waste

Informal dumping of waste is defined here as waste dumping undertaken under informal conditions with no public control and no safeguards to minimize releases of pollutants to the surroundings. If mercury is present in the waste, it represents a potential for mercury releases to soil, air, ground water and surface waters. This waste disposal method may pose an immediate risk for the local community in which it takes place, because mercury (and other contaminants) may cause contamination of the local ground water.

In Ethiopia segregation of general waste is not common. Basically collected waste is dumped in one site nearby and based on the data manipulated from twenty-four cities of the country 1147056 tons of general waste was dumped in 2014.

Informal Dumping of General Waste	**Unit**	**Production**	**Use**	**Disposal**	**Sum of releases to pathway from assessed part of life-cycle**
Activity rate	WDt/y			1147056	1147056
Input factor for phase	g/Hg/tw			5	5
Calculated input to phase	Kg/Hg/y			5735	5735

Informal Dumping of General Waste	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of life-cycle
Output distribution factors for phase:		-	-		
- Air		-	-	0.1	0.1
- Water		-	-	0.1	0.1
- Land		-	-	0.8	0.8
- Products		-	-	0.00	0.00
- General waste treatment		-	-	0.00	0.00
- Sector specific waste treatment		-	-	0.00	0.00
Calculated outputs/releases to:		-	-		
- Air		-	-	537.5	537.5
- Water		-	-	537.5	537.5
- Land		-	-	4588.2	4588.2
- Products		-	-	0.00	0.00
- General waste treatment		-	-	0.00	0.00
- Sector specific waste treatment				0.00	0.00

2.10.2 Waste Water System/treatment

Waste water management systems in Ethiopian neither adequate nor proper, only the capital city Addis Ababa has two secondary sewerage treatment plant and centralized sewerage system and below 10% the sewer line of the city is connected to this central treatment plant and treating ting 18000m3 waste water per day (Mechanical and biological (activated sludge) treatment no land application But in other cities rural area of the country waste waters from various generating sources are being discharged into waterways or other receiving sources without treatment, and then stored in these areas.

According to Food and Agriculture and United nation report based on nine cities municipal waste water generated is estimated 106 m3 /y per habitat and it is estimated that the total waste water generation accounts about 263922715 m3 /y in 2014.

Based on input factor provided by UNEP Toolkit and the above description figures, thus the amount of mercury release by this category is shown

Waste Water System/Treatment	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of life-cycle
Activity rate	WDt/y	-	-	1359	263922715
Input factor for phase	g/Hg/t w	-	-	-	5
Calculated input to phase	Kg/Hg/y	-	-	-	5735
Output distribution factors for phase:					
- Air	-	-	-	-	0.00
- Water	-	-	-	-	1.00
- Land	-	-	-	-	0.2
- Products	-	-	-	-	0.00
- General waste treatment	-	-	-	-	0.55
- Sector specific waste treatment	-	-	-	-	0.35
Calculated outputs/releases to:					
- Air	-	-	-	-	0.00
- Water	-	-	-	1247.5	1247.5
- Land	-	-	-	-	0.00
- Products	-	-	-	-	0.00
- General waste treatment	-	-	-	-	0.00
- Sector specific waste treatment	-	-	-	83.10	83.10

2.11 Data and inventory on Crematoria and Cemeteries

2.11.1 Cemeteries

A cemetery is an area where human corpses are buried. Mercury in the human body, primarily from dental amalgam fillings, will be released to the soil at the cemetery Cemeteries is common practice in Ethiopia. According to the Central Statics Agency and World Bank report the death rate 0.08% or (8 people per 1000) and from this calculation 720,608 peoples died and corpses buried in 2014.

Toolkit provides 1-4 default factors has been set to indicate a low end estimate for the mercury input to the source category (but not the absolute minimum), and the high end factor will result in a high end estimate (but not the absolute maximum).

The output distribution factor this sub categories is 1 for Air and National data on grams of mercury (in amalgam fillings) per corpse buried will lead to the best estimates of releases absence of this may rise uncertainty.

Cemeteries	**Unit**	**Production**	**Use**	**Disposal**	**Sum of releases to pathway from assessed part of life-cycle**
Activity rate	Buried/y	-	-	720608	720608
Input factor for phase	g/Hg/co	-	-	2.5	2.5
Calculated input to phase	Kg Hg/y	-	-	1801.52	1801.52
Output distribution factors for phase:					
- Air	-	-	-	-	0.00
- Water	-	-	-	-	0.00
- Land	-	-	-	1	1
- Products	-	-	-	-	0.00
- General waste treatment	-	-	-	-	0.00
- Sector specific waste treatment	-	-	-	-	0.00
Calculated outputs/releases to:	-	-	-	-	
- Air	-	-	-	-	0.00
- Water	-	-	-	-	0.00
- Land	-	-	-	1801.52	1801.52
- Products	-	-	-	-	0.00
- General waste treatment	-	-	-	-	0.00
- Sector specific waste treatment	-	-	-	-	0.00

Chapter III: Policy, Regulatory and Institutional Framework Assessment

3.1 Policy and Regulatory Assessment

As ratification (or acceptance, approval or accession) by a country of the Minamata Convention on Mercury legally binds the country to the Convention's obligations, the ratification process involves carrying out a national situation analysis, identifying existing relevant domestic legislation and identifying legal or administrative actions that may be needed.

This chapter is an analysis of Ethiopia's environmental legal and regulatory framework with regard to the management of mercury and mercury compounds in comparison to the Minamata Convention on Mercury. A tabular exercise has been done to show the linkage of the convention with the national existing framework and also the identified gaps both in the legislative and institutional arrangements.

The 1995 Constitution presented a federal system of state structure, which consists of a federal and regional states. The power of these states is defined by the the constitution. The constitution is the supreme law of the land. The dichotomy in assigning power that rested on the constitution calls for a mutual respect in the exercise of their powers.

The primary legislative organ of the Federal Government is the House of Peoples' Representatives. The highest executive powers of the Federal Government are vested in the Prime Minister and the Council of Ministers that are collectively responsible to the House of Peoples' Representatives. As per Article 77 of the constitution, the Council of Ministers may be delegated by the House of Peoples' Representatives to make secondary legislation. The principal legislation for Environment and chemicals were adopted in 2007. Their contents, along with those of the most significant pieces of other relevant legislation are described in the following sections.

As per article 92 of the Constitution, the Government is required to endeavor to ensure that Ethiopians live in a clean and healthy environment. Article 92(3) of the Constitution further states that “People have the right to full consultation and to the expression of views in the planning and implementation of environmental policies and projects that affect them directly”.

The **Environmental Protection Organs Establishment Proclamation** (No. 295/2002) establishes the Environmental Protection Authority as an autonomous body accountable to the Prime Minister. The Authority includes a Director and a Council, among whose members are representatives of non-governmental organizations and trade unions (art.8) but presided by the Prime Minister or his designate. Its functions are to advise the government as well as to approve directives and guidelines issued by the Authority (art. 9). Every government agency must include an **environmental unit**, and Regional environmental agencies must also be created (arts. 14–15). These mandatory provisions have paved the way for 5 federal institutions to establish environmental units. The units are tasked to make sure that activities of the respective institution are respectful of environmental standards and laws. These institutions that set up environment units thus far are Ministries of Agriculture, Industry, Water and Energy, Ethiopian Roads Authority and Ethiopian Electric Power Corporation.

In a similar manner, all the nine Regional States and the two city state administrations of Dire Dawa and Addis Ababa have designated an environment body – either standalone or fused with another government body. These Regional environmental bodies oversee that development activities in their respective jurisdiction is being carried out by taking heed of environmental laws and standards. They are also required to submit a state of the environment report periodically to the federal environmental protection authority. The Regional environmental authorities are also expected to set their own environmental standards, which must not be less stringent than those adopted at the federal level, or adopt those developed by the federal government.

The **Environmental Impact Assessment Proclamation** (No. 295/ 2002) places the requirement of an environmental impact study before a development project is implemented. The law places a burden on the project proponent to develop an impact study on its investment activities. After the study is developed, it should be submitted to the Regional environmental authority for approval of the project. The environmental body will then analyze the study through experts as well as through public inputs – particularly by those in the vicinity of whom the project is devised to be implemented. The law has thus given a good opening where local community participation is solicited in an area where they live. It in fact requires that comments received, in particular from concerned communities, be adequately taken into account (art. 15). But apart from the general provisions of the law, there are no detailed rules to guide how such consultations are to be made. Again, there is no specific treatment of development impacts on wildlife, although the definition given of "environment" is quite broad and includes all living organisms.

The Solid Waste Management Proclamation (Proclamation No. 513/2007) aims to create a systematic approach to manage the existing solid waste in the country. The rationale behind the formulation of the proclamation is to promote community participation in order to prevent the adverse effect and to enhance the benefits resulting from solid waste. The proclamation aims to create a solid waste management action plan designed by and implemented at, the lowest administration unit of urban administration can ensure community participation. It further aims to enhance at all levels capacities to prevent the possible adverse impacts while creating economically and socially beneficial assets out of solid waste. This proclamation covers topics of obligation, solid waste management planning, collection & storage, transportation, treatment, disposal, incineration, recycling, and hazardous waste. It works hand in hand with the Environmental Pollution Control Proclamation No. 300/2002 which mandates that all urban governments are obligated to devise and implement safe and effective mechanisms to handle, transport, and store municipal waste. It also states that

any transporting or treatment of municipal waste can only be done with a permit from the authority.

The **Prevention of Industrial Pollution Council of Ministries Regulation (159/2008)** drew its legal basis from Article 20 of the Environmental protection control Proclamation No 300/2002 set to create guiding provisions to prevent the industrial pollution. The proclamation is directed to industry and in particular “factories”. The regulation does not provide a clear definition of “factories”. This provision deals with, inter alia, grace period for existing factories, emergency responses, licensing and penalties.

Table 1. *Policy and Regulatory Measures in Place and Remaining Gaps*

	Description of article	**summary of provisions[2]**	**Policy and regulatory measures in place *(Title and Reference)***	**Existing policy/regulatory measure**	**Outstanding regulatory or policy aspects**
Article 3 - Mercury supply sources and trade	Article 3 contains control measures aimed at limiting the global supply of mercury to complement and reinforce the demand reduction control measures in Articles 4-7. The Article 3 provisions limit the sources of mercury available for use and trade, and specify procedures to follow where such trade is still allowed.	Not allow new primary mercury mining 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)		Currently Ethiopia doesn't undertake primary mercury mining.	Legislating ban on primary mercury mining. The appropriate institution to put in place a mechanism for the government to give its consent when importing mercury in accordance to applicable international agreements.
Article 4 on mercury-added products	The Convention will reduce mercury demand in products	Not allow the manufacture, import, and export of products	Proc. No. 587/2008	All products entering the country are duly registered and	Officially ban mercury added products listed

[2] NRDC Checklist

	Description of article	**summary of provisions[2]**	**Policy and regulatory measures in place *(Title and Reference)***	**Existing policy/regulatory measure**	**Outstanding regulatory or policy aspects**
	through a combination of measures which phase out mercury uses in many key products, phase down mercury use in another, require the review of remaining products for possible restrictions within five years, and discourage the manufacture of new products using mercury.	listed in Part I of Annex A not otherwise excluded following the phase out date listed in the Annex Phase down the use of dental amalgam through two or more measures listed in Part II of Annex A Take measures to prevent the incorporation of products listed in Part I of Annex A into larger, assembled products Discourage the manufacture and distribution of new mercury product types	Proc. No. 622/2009	examined by Ethiopian Revenue and Customs Authority. Along with the imported item, the imports license and permit will be registered.	under the annexes with Domestic law. Incorporate detailed HS code for mercury added products in the national custom product registration system. Train customs officers and create awareness to the general public on the banned items. Strong follow up on the dental amalgam sale market Bring alternative solutions for

	Description of article	**summary of provisions[2]**	**Policy and regulatory measures in place *(Title and Reference)***	**Existing policy/regulatory measure**	**Outstanding regulatory or policy aspects**
					replacing dental amalgam with other affordable fillings.
Article 7 on artisanal and small-scale gold mining	Article 7 applies to artisanal and small-scale gold mining (ASGM), in which mercury is used to extract gold.	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	Proc. No. 678/2010	Its expected that licensed miners are to conduct mining operations in such a manner as to ensure the health and safety of his agents, employees and other persons, and comply with the applicable laws pertaining to environmental protection. Administrative ban has been made on the use of mercury for Gold extraction by the	Officially Ban the Use of mercury in ASGM to limit possible future use.

	Description of article	summary of provisions[2]	Policy and regulatory measures in place *(Title and Reference)*	Existing policy/regulatory measure	Outstanding regulatory or policy aspects
				Ministry of Mines, Petroleum and Natural Gas for the past 8 years	
Article 8 on emissions	Reduce mercury emissions to air from five of the most significant source categories identified	For New Sources. Parties MUST use best available techniques (BAT) and best environmental practices (BEP) to control and reduce emissions, as soon as practicable but no later than five years after the Convention enters into force for that Party. For Existing Sources. A government may choose among five options to control mercury emissions from existing sources. Regardless of	Proc. No. 886/2015	Establishment of industrial parks brings an opportunity to reduce environmental impact.	Based on the Mercury initial Assessment, develop national implementation plan Create a continuous inventory system to track and record emission and emission reduction interventions. Use best available techniques (BAT) and best environmental practices (BEP) to control and reduce

	Description of article	summary of provisions[2]	Policy and regulatory measures in place *(Title and Reference)*	Existing policy/regulatory measure	Outstanding regulatory or policy aspects
		the option chosen, compliance with the control measures should be achieved as soon as practicable, but certainly no later than 10 years after the Convention becomes effective for the country.			emissions.
Article 9 on Release	Party must identify significant point sources of mercury releases to land and water that are not addressed by other provisions of the Convention.	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 release from the sources identified Take one or more measures specified in			Hold continuous and updated inventory to track new source of mercury release to land and water that are not addressed by other provisions

	Description of article	**summary of provisions[2]**	**Policy and regulatory measures in place *(Title and Reference)***	**Existing policy/regulatory measure**	**Outstanding regulatory or policy aspects**
		Article 9.5 to control/reduce mercury and mercury compound releases to land and water from significant sources it identifies			
Article 10 on environmentally sound interim storage of mercury, other than waste mercury	Covers the environmentally sound interim storage of mercury and mercury compounds.	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)			The appropriate institution to take measures to establish an environmentally sound interim mercury storage
Article 11 on mercury wastes	focus on environmentally sound management (ESM) of mercury wastes and controls over its Transboundary movement. The Convention aspires to	Use a definition of mercury waste consistent with Article 11.2 Take measures to manage mercury wastes in an environmentally	Proclamation No: 513/2007	There is an over arching objective to promote ways that can hinder the hazardous impact of solid waste and turn it in to an economically and socially beneficial	Specific provisions related to mercury waste and the need to focus on environmentally sound management to control its movement.

	Description of article	summary of provisions[2]	Policy and regulatory measures in place *(Title and Reference)*	Existing policy/regulatory measure	Outstanding regulatory or policy aspects
	prevent both improper management of the waste at the domestic level and unwanted mercury waste dumping among nations.	sound manner, taking into account guidelines developed under the Basel Convention and in accordance with COP requirements to be developed. Take measures to restrict mercury derived from the treatment or re-use of mercury waste to allowed uses under the Convention or environmentally sound disposal Require transport across international boundaries in accordance with the Basel Convention, or if the Basel Convention does not apply,		asset.	

	Description of article	summary of provisions[2]	Policy and regulatory measures in place *(Title and Reference)*	Existing policy/regulatory measure	Outstanding regulatory or policy aspects
		consistent with international rules, standards, and guidelines.			
Article 12 on contaminated sites	calls for the creation and adoption of guidance in approaching contaminated sites,	Develop strategies for identifying and assessing mercury/mercury compound contaminated sites If risk reduction activities are taken at contaminated sites, they are taken in an environmentally sound manner, incorporating risk assessment where appropriate			
Article 13 on financial resources and	recognizes that providing financial assistance to	Access domestic resources as may be needed to implement			

	Description of article	summary of provisions[2]	Policy and regulatory measures in place *(Title and Reference)*	Existing policy/regulatory measure	Outstanding regulatory or policy aspects
mechanism	developing countries will improve the effective implementation of the Convention	Convention obligations Access financial resources available under the Convention financial mechanism and other resources available from multilateral, regional, and bilateral funding sources			
Article 14 on capacity building, technical assistance and technology transfer	Covers the support for developing countries in light of capacity building, technical assistance and technology transfer.	Parties shall cooperate to provide, within their respective capabilities, timely and appropriate capacity-building and technical assistance to developing country Parties,			Relevant institutions to identify their capacity and technology needs to developed country parties in request for support and assistance.
Article 16 on health aspects	promotes program development related to the health aspects of mercury,	Promote the development and implementation of strategies to identify and			

	Description of article	summary of provisions[2]	Policy and regulatory measures in place *(Title and Reference)*	Existing policy/regulatory measure	Outstanding regulatory or policy aspects
		protect populations at risk, such as developing fish consumption guidelines Promote occupational exposure educational and prevention programs Promote prevention, treatment, and care services for affected populations			
Article 17 on information exchange & Article 18 on public information, awareness and education.	focuses on the exchange of information between countries and on the sharing of information between government and the public.	Collect and disseminate information on annual quantities of mercury and mercury compounds emitted, released, or disposed; and other information specified in Article 18 Share information on		The ministry of environment forest and climate change is the mandated federal body that deals with environmental management, regulatory and protection activities.	

	Description of article	summary of provisions[2]	Policy and regulatory measures in place *(Title and Reference)*	Existing policy/regulatory measure	Outstanding regulatory or policy aspects
		the health and safety of humans and the environment as non-confidential, in accordance with Article 17.5 Report to the COP on progress in implementing Convention obligations under Article 21		This includes constituting community awareness regime structure in its constituency. The ministry under its structure established a directorate to disseminate information to the general public to create awareness.	
Article 19 on research, development and monitoring.	seeks cooperation among countries to develop and improve on key areas of research that can support effective implementation	research areas include, among others, inventories of mercury use and consumption; the levels of mercury in people, aquatic food sources, and wildlife; and information on mercury commerce and trade.	Regulation No. 327/2014	The Ethiopian environment and forest research institute has been established to promote research in the area of environmental management and forest management	
Article 21 on	Reporting will be a	Reporting is expected			

	Description of article	**summary of provisions[2]**	**Policy and regulatory measures in place *(Title and Reference)***	**Existing policy/regulatory measure**	**Outstanding regulatory or policy aspects**
reporting	Principal bases for evaluating compliance.	on: Measures taken to implement the provisions of the Convention, the effectiveness of such measures, and the possible challenges in meeting the objectives of the Convention (Article 21.1). Information as called for in Articles 3 (Supply and Trade), 5 (Processes), 7 (ASGM), 8 (Emissions) and 9 (Releases) (Article 21.2).			

3.2 Institutional Assessment

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. Environmental management issues and the concept of sustainable development began to gain more prominence in Ethiopia from the mid-eighties onwards. Of particular importance in this respect was the initiation of the preparation of the Conservation Strategy of Ethiopia (CSE) in 1989 by the then Office of the National Committee for Central Planning (ONCCP).

The Environmental Protection Authority (EPA) was established as an autonomous government agency at the Federal level by Proclamation 9/1995 primarily responsible for environmental management and protection of the country and was subsequently re-established as an autonomous body responsible to the Prime Minister by the Environmental Organs Establishment Proclamation No. 295/2002.

Institutional framework for the implementation of Multilateral Environmental Agreements in general includes the national development framework, policies, strategies; laws and organizational arrangements that are in place relevant for MEA implementation as well as for the overall environmental management and protection of the country's resources. The institutional framework for the implementation of these agreements, including the allocation of coordination mandates, is found in: environmental policy documents; general legislation for the establishment and mandating of federal government organs; and, the specific law on the establishment of environmental protection organs.

A number of government organizations such as line ministries, agencies and others public institutions are directly or indirectly responsible for, and concerned with various aspects of chemicals management. These include, among others:

- The Ministry of Environment, Forest and Climate Change:

The Ministry of Environment, Forest and Climate Change is responsible to ensure the realization of the environmental rights, goals, objectives and basic principles enshrined in the Constitution as well as the Environment Policy of Ethiopia through coordinating appropriate measures, establishing systems, developing programmes and mechanisms for the welfare of humans and the safety of the environment. It is mandated to formulate or initiate and coordinate the formulation of strategies, policies, laws and standards as well as procedures and up on approval monitor and enforce their implementation. It is also responsible for the synergistic implementation and follow-up of international and regional environmental agreements, including those pertaining to hazardous chemicals, industrial wastes and anthropogenic environmental hazards in which Ethiopia is a party. All Multilateral Environmental Agreement's, including Minamata convention, are currently being coordinated and monitored by the Ministry of environment, Forest and climate Change.

- The Ministry of Health:

The Ministry of Health, as per Proclamation No. 475/1995 (as amended by 916/2015) has given powers and duties to formulate development strategies and programmes pertaining to the health sector and follow-up and evaluate their implementation. It is also responsible for preventive actions on occurrences that threaten public health, for supply and management of medicines and medical equipment and also for the proper execution of food, medicines and health care regulatory functions. The main aim of this ministry is to reduce morbidity, mortality and disability and improve the health status of the Ethiopian people through providing and regulating a comprehensive package of promotive,

preventive, curative and rehabilitative health services via a decentralized and democratized health system.

The Ministry of Agriculture and Natural Resources:

The Ministry of Agriculture and Natural Resources is an important institution among the line ministries in terms of mandates over the development, utilization and conservation of environmental resources such as land and water, disaster preparedness including climate resilience, the conservation of bio-diversity, and control of pesticides.

Under the provisions of Proclamation 692/2010, the Ministry has, *inter alia*, the powers and duties to formulate and facilitate the implementation of a strategy for natural resources protection and development through sustainable agricultural development, establish and direct training centers that contribute to the enhancement of agricultural development and the improvement of rural technologies; undertake disaster prevention and preparedness activities and ensure the proper implementation of the food security program; monitor events affecting agricultural production and set up an early warning system and establish a system whereby stakeholders of agricultural research coordinate their activities and work in collaboration.

The powers and duties formerly assigned to the Ministry of Agriculture and Rural Development have also been given to the Ministry of Agriculture. The Ministry of Agriculture and Natural Resources is vested with powers of promoting extension services to improve agricultural productivity, controlling the out breaks of animals and plant diseases and pests. It is also responsible to ensure the supply, distribution and marketing of agricultural inputs, the proper administration and control of pesticides and veterinary drugs and also monitoring the occurrences affecting agricultural production.

- The Ministry of Water, Irrigation and Electric:

The former Ministry of Water Resources has been re-established as the Ministry of Water and Energy under the Definition of Powers and Duties of the Executive Organs of the Federal Democratic Republic of Ethiopia Proclamation (Proclamation No. 691/2010) now re structured to the Ministry of Water, Irrigation and Electric as per proclamation No 916/2015. Currently The Ministry of Water, Irrigation and Electric is empowered to promote the expansion of medium and large irrigation dams, the growth and expansion of electric energy supply. It is also mandated to issue permits and regulate the construction and operation of water works.

The powers and duties of the Ministry focus on overall water resources management, such as promoting the development of water resources and energy, construction and administration of dams, and prescribing quality standards for waters to be used for various purposes as well as supporting the expansion of potable water supply coverage. In addition, the Ministry of Water and Energy has taken over the totality of the powers and duties given to the Ministry of Water Resources and the Ministry of Mines and Energy.

- The Ministry of Finance and Economic Cooperation

The Ministry of Finance and Economic Cooperation as per proclamation no Proclamation No. 916/2015, is the key institution in Ethiopia's national policy development and monitoring system across socio-economic development issues. As such, monitoring data and information in every sector, including the sectors directly relevant to the implementation of MEAs, ultimately ends up the Ministry's information system. The duties and responsibilities of this ministry under Proclamation No. 691/2010 is, inter alia, prepare the country's economic and social development plan and follow-up their implementation of same upon approval; follow up and evaluate the performance of general, sectoral and multi-sectoral development plans; prepare a national report on the implementation of

development plans which shall include the performance of regional states plans And prepare the federal government budget, make disbursements, and evaluate the performance of the budget.

- The Ministry of Industry:

The Ministry of Industry is a federal government entity that took the mandate and responsibility to promote and facilitate enabling environment for industry and investment expansion in the country. The main vision of this ministry is to secure, in 2023 a globally competitive industry sector with a leading role in the economy and that has a rapid and sustainable growth.

- The Ministry of Trade:

The Ministry of Trade is an authorized federal government entity that promotes legitimate expansion of domestic and international trade. It has a mandate to establish foreign relation, coordinate negotiation as well as sign and implement agreements pertaining to international trade. In addition, it is responsible for establishing, regulating and enforcing legal metrological systems, and also for the provision and control of commercial registration and licenses.

- The Ministry of Transport:

The Ministry of Transport is responsible for the expansion of integrated transport services in line with the development strategies and regulatory systems of the country. It is also mandated to ensure the construction, upgrading and maintenance of transport infrastructures.

- The Ministry of Mine, Petroleum and Natural Gas:

The Ministry of Mine, Petroleum and Natural Gas is concerned with petroleum storage and distribution facilities, as well as volume of reserve. It is authorized to promote the development of mining, to issue and control mineral exploration and exploitation licenses.

- The Ministry of Labor and Social Affairs:

The Ministry of Labor and Social Affairs has the power and duties to issue and follow-up occupational health and safety standards.

- The Ministry of Justice:

The Ministry of Justice is the chief advisor of the federal government on matters of law, and responsible for the prevention and investigation of crimes against the rules and procedures set. And also mandated to establish systems for gathering, handling and distribution of information related to criminal justice, institute suit on behalf of public organizations or intervene at any stage of the proceedings of such suits before the competent courts or other judicial bodies where the rights and interest of the public or the government so required; and follow-up the execution of court decision which made the concerned public organization judgment creditors.

- The Ministry of Federal and Pastoral Affairs:

The Ministry of Federal and Pastoral Affairs has power to ensure the proper execution of functions relating to the federal police, federal prisons and minesweeping, to issue permits for the possession, use, selling and repairing of firearms and explosives, and to determine applicable conditions for the selling of explosives.

- The Ministry of Foreign Affairs:

The Ministry of Foreign Affairs is mandated, as deemed necessary, to negotiate and sign, upon approval, treaties that Ethiopia enters into with other countries and regional and international communities and ensure the enforcement of rights and obligations emanating from the signed treaties, and also coordinate all foreign relations.

- The Ministry of Science and Technology:

The Ministry of Science and Technology has power and duties that extend to prepare and coordinate science and technology national research and development programmes, establish a system for technology need assessment, identification, acquisition, packaging, utilization and disposal, and undertake their implementation follow-up. Its responsibility also goes to register technology transfer made in every sector, coordinate efforts of codification and technology capability accumulation and ensure their successive use.

- The Ministry of Urban Development and Housing:

The provision of all-round and coordinated support to and follow-up of the activities of urban centers for improving their service delivery is a legally bound duty of the Ministry of Urban Development and Housing.

- The Ministry of Education:

The Ministry of Education is vested with executive power of formulating curricula frameworks for the country's education. The Vision of this ministry is Sustainably building an education and training system that ensures quality and equitable education for all citizens and that continuously produces a competent and competitive workforce fueling the country's economic development. The Ministry envisions to ensuring effective, quality and equitable education and training system through building the implementation capacity of the education sector at all levels, designing and regulating standards of efficiency, expanding standardized education throughout the country, as well as complementing and leveraging education sector development interventions with strategic communications and public awareness,

- Ministry of livestock and Fisheries:

Instituted in 2016, this ministry has been mandated to, inter alia, establish a system that ensures quality standard of any livestock or livestock product supplied to the market.

- Ethiopian Revenue and Customs Authority

ERCA is the main organ that is responsible for the Customs operation in Ethiopia. Previously it was the Ethiopian Customs Authority that oversaw the Customs operation in Ethiopia. But, since the second half of 2008, the Ministry of Revenue has been reorganized as the Ethiopian Revenues and Customs Authority by proclamation number 587/2008. In addition to raising revenue, it is responsible to protect the society from adverse effects of smuggling and contraband. It seizes and takes legal action on the people and vehicles involved in the act of smuggling, any tax evasion and avoidance while it facilitates the legitimate movement of goods and people across the border.

- Ethiopian Standards Agency

Ethiopian Standard Agency (ESA) is a governmental non-profitable organization and the sole National Standards Body (NSB) which represents Ethiopian interest in economical, social and environmental aspects with regard to standard benefits across International and regional Arena. Besides working with international and Regional standard bodies, ESA also work closely with different national standard bodies under bilateral agreements.

Ethiopian Standard Body has undergone several structural and name changes since its first birth back in 1970, and ESA was established as per the latest restructuring, as per Ethiopian Council of Minister Regulation No. 193/2010, which caused the splitting of former Quality and Standards Authority of Ethiopia (QSAE) into four including the new national standards body (NSB) – Ethiopian Standards Agency (ESA), Ethiopian Conformity Assessment Enterprise, Ethiopian Metrology Institute and Ethiopian Accreditation office.

Ethiopian Standard Agency (ESA) is a governmental agency which is accountable to Ministry of Science and Technology, and has a National Standardization council which work together with the agency, the member of the

council is drawn from appropriate Governmental and Other bodies and designated by the government. Ethiopian standards agency has three core business areas which mainly focus on the standard formulation, training and Technical support and organizing and disseminating standards, Conformity assessment procedures and Technical regulation for the customers.

The following table displays the comparative analysis of national legislation in light of the institutional framework and the relevant provisions.

Legal Instrument	Institutional Arrangement	Objective	Relevant Provision	Analysis
Dangerous Drug Proclamation 1942	Ministry of Commerce and Industry	To restrict and control the import and sale of dangerous drugs	Articles 2–4	It protects the human health and environment by restricting and controlling the importing and selling of dangerous drugs, however, it makes no reference as to how to control anthropogenic emissions and releases of mercury and mercury compounds.
Explosive Proclamation 1942	Security, Immigration and Refugee Affairs Authority	To restrict and control sale, possession and use of explosives	Articles 1–4	It protects the human health and environment by restricting and controlling the sale, possession and use of explosives, however, it makes no reference as to how control anthropogenic emissions and releases of mercury and mercury compounds.
The 1957 Penal Code of Ethiopia Amended as The Criminal Code of the Federal Democratic Republic of Ethiopia: Proclamation No. 414/2004	Ministry of Justice	To prosecute those dealing in prohibited chemicals	Articles 510, 511, 784 and 786	As it is the Criminal code of the Federal Democratic Republic of Ethiopia it has general purpose of stating out the crimes and the punishments related there to. It is in the right track as it deals with the prosecution of those dealing in

Legal Instrument	Institutional Arrangement	Objective	Relevant Provision	Analysis
				prohibited chemicals; however, specific legislations dealing with different prohibited chemicals should be enacted.
The 1960 civil Code of Ethiopia	civil courts (at the initiative of plaintiff	Cessation of nuisance and the Pollution	Articles 1225, 1242/2 and 1243/1	Stipulates the civil liabilities associated with nuisance and pollution in the general.
Pharmacy Regulation No. 288/1964	Ministry of Health	To control production, import, sale and disposal of drugs and psychotropic substances	Articles 34 & 39ff	It protects the human health and environment by controlling production, import, sale and disposal of drugs and psychotropic substances; however, it makes no reference as to how to control anthropogenic emissions and releases of mercury and mercury substances.
Industrial License Proclamation 1971	Ministry of Trade	To ensure that development projects are non-polluting	Article 11	It protects the human health and environment by ensuring the development projects that are non-polluting; however, it makes no reference as to how to control anthropogenic emissions and releases of mercury and mercury substances.
Ethiopian Standard Regulation No. 12/1990	Quality and Standard Authority of Ethiopia	To specify physical and bacteriological requirements of piped supplies of water for	Articles 4/2	It protects the human health and environment by specifying the physical and bacteriological requirements of

Legal Instrument	Institutional Arrangement	Objective	Relevant Provision	Analysis
		drinking and domestic use		piped supplies of water for drinking and domestic use; it is closely related to the Minamata Convention as the Minamata disease was first exhibited in water.
Pesticide Registration and Control Council of State Special Decree No. 20/1990 amended as Pesticide Registration and Control Proclamation No.674/2010	Ministry of Agriculture and Natural Resources	To minimize the adverse effects of pesticides on human beings, animals, plants and the environment	Articles 4-10	It protects the human health and environment by minimizing the adverse effects of pesticides on human beings, animals, plants and the environment; however, it makes no reference as to how to control the anthropogenic emissions and releases of mercury and mercury compounds.
International Labor Organization Conventions: Ratification Council of State Decree No. 37/1990	Ministry of Labor and Social Affairs	To handle and use hazardous substances safely (including chemicals)	Article 2/4 of the Decree and 12ff of the Convention 155/1981	It is the first international document to provide for the safe handling and use of hazardous substances (including chemicals) in the work environment.
Road Transport Regulation Proclamation No.14/1992 amended as Transport Proclamation No. 468/2005	Ministry of Transport	To prevent or mitigate vehicular pollution.	Article 21	It protects the human health and the environment by preventing or mitigating vehicular pollution; however, it makes no specific reference as to how to control the anthropogenic emissions and

Legal Instrument	Institutional Arrangement	Objective	Relevant Provision	Analysis
				releases of mercury and mercury compounds.
Labor Proclamation No. 42/1993 amended as Labor (Amendment) Proclamation No. 377/2003 Labor (Amendment) Proclamation No. 466/2005 Labor (Amendment) Proclamation No. 494/2006	Ministry of Labor and Social Affairs	To handle and use hazardous substances safely (including chemicals)	Articles 92 & 93	It is the first of national document to deal with the safe handling and use of hazardous substance (including chemicals)
Radiation Protection Proclamation No. 79/1993 amended as Radiation Protection No. 571/2008	National Radiation Protection Authority	To regulate, control, and supervise radiological and all activities relating to acquisition, use, transportation and disposal of radioactive substances	Articles 3, 7, and 13–15	It protects the human health and environment by regulating, controlling and supervising radiological and all activities relating to acquisition, use, transportation and disposal of radioactive substances; however, it makes no specific reference as to how to control the anthropogenic emissions and releases of mercury and mercury compounds.
Framework convention on climate Change: Ratification Proclamation	Ministry of Environment, Forest and Climate Change and other	To Reduce the emission of greenhouse gases	Articles 1–6	One of the first few significant international documents to raise the issue of Environment.

Legal Instrument	Institutional Arrangement	Objective	Relevant Provision	Analysis
No. 97/1994	relevant sectors			
Vienna convention for the Protection of the Ozone Layer	Ministry of Environment, Forest and Climate Change (for policy matters) & National Meteorology Service Agency (for technical matters)	To protect human health and the environment against adverse effects resulting or likely to result from human activities which modify or are likely to modify the ozone layer	Articles 1–5	It protects the human health and the environment against adverse effects resulting or likely to result from human activities which modify or are likely to modify the ozone layer; however, it makes no specific reference as to how to control the anthropogenic emissions and releases of mercury and mercury compounds.
Mining Operations Council of Ministers Regulation No. 182/1994 amended as Mining Operations Council of Ministers Regulations No. 124/2006	Ministry of Mines, Petroleum and Natural Gas	To regulate mining operations	Article 29 sub-articles 1 & 2	It protects the human health and the environment by regulating mining operations; however, it makes no specific reference as to how to control the anthropogenic emissions and releases of mercury and mercury compounds.
The Constitution of the Federal Democratic Republic of Ethiopia: Proclamation No. 1/1995	The pertinent ministries and State bodies	To ensure the right to a clean and healthy environment. To ensure that designs and implementation programmes and projects of development shall not damage or destroy the	Articles 44 and 92	Having in mind that the Constitution of the Federal Democratic Republic of Ethiopia is the first constitution of the country to address the right to a clean and healthy environment, there should be supplement legislations to address specific issues related

Legal Instrument	Institutional Arrangement	Objective	Relevant Provision	Analysis
		environment.		to the environment and health.
Definition of Powers and Duties of the Executive Organs of the FDRE: Proclamation No. 4/1995	Ministry of Water, Irrigation and Electricity	To protect and utilization of water To prescribe the quality standard for water to be used for various purposes	Article 17 sub-articles 2 & 9	It is one of the first National documents to define the powers and duties of several Executive Organs of the Federal Democratic Republic of Ethiopia and allocated such powers and duties for the protection of the human health and the environment to the different Executive Organs
Amendment Proclamation No. 93/1997 Amendment Proclamation No. 134/1998 Amendment Proclamation No. 256/2001 Amendment Proclamation No. 320/2003 Amendment Proclamation No.	Ministry of Environment, Forest and Climate Change	To ensure that development activities are carried out in a manner that protects the welfare of humans and sustainably protect, develop, and utilize the resource base	Article 6	A national document that paved a way to deal issues related to the protection of the human health and the environment; based up on this specific documents dealing with the anthropogenic emissions and release of mercury and mercury compounds should be enacted.

Legal Instrument	Institutional Arrangement	Objective	Relevant Provision	Analysis
411/2004 Amendment Proclamation No. 465/2005 Amendment Proclamation No. 471/2005 Amendment Proclamation No. 803/2013 Amendment Proclamation No. 919/2015				
Re-establishment Environmental Protection Organs Establishment Proclamation No. 295/2002 Amendment Proclamation No. 803/2013 Amendment Proclamation No. 919/2015	Ethiopian Petroleum Enterprise	To import and arrange the sell and processing of crude oil as well as refined petroleum and its products	Article 5 sub-articles 1 & 2	It provides for the safe handling and use of petroleum and processing of crude oil; however, it makes no specific reference as to how to control the anthropogenic emissions and releases of mercury and mercury compounds.

Legal Instrument	Institutional Arrangement	Objective	Relevant Provision	Analysis
Ethiopian Health and Nutrition Research Institute Establishment Council of Ministers Regulation No. 4/1996	Ethiopian Health & Nutrition Research Institute	To conduct research on traditional medicines, modern drugs and improvement of health	Article 5/2	It protects the human health and the environment by conducting research on traditional medicines, modern drugs and improvement of health; however, it makes no specific reference as to how to control the anthropogenic emissions and releases of mercury and mercury compounds
Convention on the Prohibition of the Production, Stockpiling and Use of Chemical Weapons and on their Destruction: Ratification proclamation No. 30/1996	Ministry of Commerce and Industry	To undertake all acts necessary for the implementation of the Convention on the prohibition of the development, production, stockpiling, and use of chemical weapons and their destruction	All articles in the convention	It protects the human health and the environment by prohibiting the development, production, stockpiling, and use of chemical weapons and their destruction; however, it makes no specific reference as to how to control the anthropogenic emissions and releases of mercury and mercury compounds.
Investment Proclamation No. 37/1996	Ethiopian Investment Authority	To protect the environment	Article 14/1	It protects the human health and the environment by aligning investment with the protection of the environment; however, it makes no specific reference as to how to control the anthropogenic emissions and releases of mercury and

Legal Instrument	Institutional Arrangement	Objective	Relevant Provision	Analysis
				mercury compounds.
The Re-establishment and modernization of Customs Authority Proclamation No. 60/1997	Customs Authority	To control the import and export of prohibited or restricted goods	Part 2 articles 1 & 2	It protects the human health and the environment by controlling the import and export of prohibited or restricted goods that could result in the damage of human health and the environment; however, it makes no specific reference as to how to control the anthropogenic emissions and releases of mercury and mercury compounds.
Fertilizer Manufacturing and Trade Proclamation No.137/1998 amended as R organization of the Executive Organs of the Federal Democratic Republic of Ethiopia/Amendment Proclamation No. 380/2004- the power and duties given to the National Agricultural Input Authority by the Fertilizer Manufacturing and Trade Proclamation No. 137/1998 are hereby given to the Ministry of	National Fertilizer Industry Agency	To increase fertilizer use to improve agricultural productivity on sustainable basis	Articles 13–23	It protects the human health and the environment by promoting the safe handling and use of fertilizers; however, it makes no specific reference as to how to control the anthropogenic emissions and releases of mercury and mercury compounds.

Legal Instrument	Institutional Arrangement	Objective	Relevant Provision	Analysis
Agriculture and Rural Development.				
Basel Convention Ratification proclamation No. 192/2000	The Ministry of Environment, Forest and Climate Change	To protect human health and environment To control the Transboundary Movements of Hazardous Waste and their Disposal	Article 6 – 10	It is one of the international documents that controlled the trans-boundary movements of hazardous waste and their disposal and it could be related to the Minamata Convention as the Mercury and Mercury compounds are hazardous waste and the Minamata disease emerged because Mercury wasn't effectively disposed.
Rotterdam Convention Ratification Proclamation No. 278/2002	The Ministry of Environment, Forest and Climate Change	To protect human health and environment To promote shared responsibility and cooperative efforts among parties in international trade of certain hazardous chemicals and to contribute to their environmentally sound use	Article 10 – 13	It is also one of the international documents that promoted shared responsibility and cooperative efforts among parties in international trade of certain hazardous chemicals and to contribute to their environmentally sound use; this could also be applied to the case of Mercury and Mercury Compounds, however, other specific legislations dealing with the issue should be enacted.
Stockholm Convention Ratification Proclamation	The Ministry of Environment, Forest and	To protect human health and environment from	Article 3 – 6	This is also another international document that

Legal Instrument	Institutional Arrangement	Objective	Relevant Provision	Analysis
No.279/2002	Climate Change	persistent organic pollutants		dealt with the protection of human health and environment from persistent organic pollutants, Mercury and Mercury compounds could be said to fall under this; however, specific legislation dealing with the issue should be enacted.
Bamako Convention Ratification Proclamation No. 355/2003	The Ministry of Environment, Forest and Climate Change	To prohibit the import of hazardous and radioactive wastes into the African continent To minimize and control Transboundary movements of hazardous wastes within the African continent To prohibit all ocean and inland water dumping or incineration of hazardous wastes To ensure that disposal of wastes is conducted in an environmentally sound manner To promote cleaner		It is one of the regional instruments dealing with the prohibition of the importation of hazardous and radioactive wastes; Transboundary movements of hazardous wastes; prohibition of ocean and inland water dumping or incineration of hazardous wastes and ensuring the disposal of wastes in an environmentally sound manner in the Continent; however, it makes no specific reference as to how to control the anthropogenic emissions and releases of mercury and mercury compounds.

Legal Instrument	Institutional Arrangement	Objective	Relevant Provision	Analysis
		production over the pursuit of a permissible emissions approach based on assimilative capacity assumptions		
Pesticide Registration and Control Proclamation No.674/2010	Ministry of Agriculture and Natural Resources	To minimize the adverse effects of pesticide use might cause to human beings, animals, plants and environment To enact a comprehensive legislation to regulate the manufacture, formulation, import, export, transport, storage, distribution, sale, use and disposal of pesticides and other matters related.	Article 3 – 14	It protects the human health and the environment by minimizing the adverse effects of pesticide use; however, it makes no specific reference as to how to control the anthropogenic emissions and releases of mercury and mercury compounds.
Ethiopian Mineral, Petroleum, and Bio-fuel Corporation Establishment Council of Ministers Regulations No. 367/2015	Ministry of Public Enterprises	To establish the Ethiopian Mineral, Petroleum and Bio-fuel Corporation as a Federal Government Public Enterprise	Articles 3 and 6	It proposes to establish Ethiopian Mineral, Petroleum and Bio-fuel Corporation as a Federal Government Public Enterprise, which would help with the effective management of Minerals, Petroleum and Bio-fuel; however, it makes no specific reference as to how to control the anthropogenic

Legal Instrument	Institutional Arrangement	Objective	Relevant Provision	Analysis
				emissions and releases of mercury and mercury compounds.
Convention on Elicit Trafficking and Abuse of Narcotic and Psychotropic Substances	Ministry of Health	To control elicit trafficking and abuse of narcotic and psychotropic substances	All articles of the Convention	It protects the human health and environment by controlling the elicit trafficking and abuse of narcotic and psychotropic substances; however, it makes no specific reference as to how to control the anthropogenic emissions and releases of mercury and mercury compounds.
Definition of Powers and Duties of the Executive Organs of the Federal Democratic Republic of Ethiopia: Proclamation No. 916/2015	• Ministry of National Defense • The Ministry of Federal Pastoralist Development Affairs • The Ministry of Foreign Affairs • The Ministry of Justice • The Ministry of Public Service and Human Resource Development • The Ministry of Finance and Economic Cooperation • The Ministry of Agriculture and	To re-allocate and re-define different powers and duties of the Executive Organs of the Federal Democratic Republic of Ethiopia	All provisions of the Proclamation	

Legal Instrument	Institutional Arrangement	Objective	Relevant Provision	Analysis
	Natural Resources • The Ministry of Livestock and Fisheries • The Ministry of Industry • The Ministry of Trade • The Ministry of Science and Technology • The Ministry of Transport • The Ministry of Communication and Information Technology • The Ministry of Urban Development and Housing • The Ministry of Construction • The Ministry of Water, Irrigation and Electricity • The Ministry of Mines, Petroleum and Natural Gas • The Ministry of Environment, Forest and Climate Change			

Legal Instrument	Institutional Arrangement	Objective	Relevant Provision	Analysis
	• The Ministry of Public Enterprises • The Ministry of Education • The Ministry of Health • The Ministry of Labor and Social Affairs • The Ministry of culture and Tourism • The Ministry of Women and Children Affairs • The Ministry of Youth and Sports			

Source: Law and Standards Directorate, Ministry of Environment, Forest and Climate Change, Compilation

The following table shows the specific provisions of the Minamata convention in-light of the management trends. This table should be read in conjunction with the previous legislation analysis (table) and legal assessment (table).

Article In MC	Management System	Gap	Recommendation
Article 3	• Ethiopia does not exercise primary mercury mining.	• No explicit ban on primary mercury mining.	• Incase there is recovery of potential mercury, legislating the ban with a monitoring system in place

Article In MC	Management System	Gap	Recommendation
	• Ethiopia is currently implementing the Basel Convention Prior Informed Consent. • All trade related to mercury is recorded by both the Ministry of trade and Ethiopia Revenue and Customs Authority. • Ethiopian Revenue and Customs Authority has the mandate to oversee all items exported including mercury.	• No Specific management system for prior informed consent in relation to trade for mercury. • Tracking of the imported /exported mercury is weak.	• Create a coordinated system to manage the trade of mercury in relation to the PIC requirements of the Minamata Convention • Creating awareness to the society especially in boarder areas. • Train and equip customs and boarder officers with adequate knowledge to tackle the problem.
	•Ethiopian Revenue and Customs Authority has the mandate to oversee all items imported, including mercury.	•Tracking of the imported /exported mercury is weak. •No monitoring mechanism of mercury stocks.	•Monitoring system should be in place. •Mercury holders should have a way of notifying the mercury stock they are holding in a timely manner.
Article 4	•All products entering the country are duly registered by Ethiopian Revenue and Customs Authority. •Along with the imported item, the imports license and permit will be registered.	•As there is no direct law dealing with mercury and mercury added products, import is not address by the existing legislative framework.	•Identification of mercury added products under the national import system •Legally ban mercury added products listed under the annexes •Train customs officers and create

Article In MC	Management System	Gap	Recommendation
			awareness to the general public on the banned items.
		•As there is no direct law dealing with mercury and mercury added products, import is not address by the existing legislative framework •The market for sale of Dental amalgam is poor thus practitioners use amalgam imported in small quantity from china without registration by the ERCA.	•Create awareness especially on the use of Dental Amalgam to users and practitioners. •Strong follow up on the dental amalgam sale market •Bring alternative solutions for replacing dental amalgam with other affordable fillings.
		No existing international/national standard limiting mercury added products in assembled products	Create standard limiting mercury added products in assembled products

Article In MC	Management System	Gap	Recommendation
			Hold public awareness campaigns to discourage consumers from purchasing and manufactures/distributers from selling new products with mercury.
Article 7	• Administrative ban has been made on the use of mercury for Gold extraction by the Ministry of Mines, Petroleum and Natural Gas for the past 8 years	• No specific legislation relating to the ban on the extraction gold using mercury.	• Legislating the ban on extraction of gold using mercury in Artisanal and small scale mining.
Article 8	• No management system for emission reduction of mercury.	• No existing system to monitor, track and record emissions and emission reduction interventions.	• Based on the Mercury initial Assessment, develop national implementation plan. • Create a continuous inventory system to track and record emission and emission reduction interventions. • use best available techniques (BAT) and best environmental practices (BEP) to control and reduce emissions,

Article In MC	Management System	Gap	Recommendation
Article 9	• No system to identify release of Mercury that has not been dealt under the Minamata convention.	• - there has been no dedicated identification procedure with a specific view on mercury releases	Devise a procedure to identify mercury releases.
Article 10	Separate storage mechanisms	Regarding storage of mercury, the national management system is sufficiently covered	Need to identify ways of creating procedure for storage of non waste mercury
Article 11	No separate mercury waste collection mechanism in place	Lack of proper mercury waste collection mechanism	Establish a separate mercury waste collection mechanism.
Article 12		No scientifically identified contaminated site	Identify scientifically hotspots and contaminated sites in the country.
Article 13	Diverse legislative and administrative measures in different policy fields that aim to protect the health of humans.	No specific reference to mercury in some of the policy fields	Health legislation assessment to identify the inclusion of mercury in the legislation. Awareness raising activities to identify vulnerable society to the impact of mercury.

Chapter IV: Identification of Populations at Risks and Gender Dimensions

4.1 Preliminary Review of Potential Populations at Risk and Potential Health Risks and Gender Dimensions Related to The Management of Mercury

There is a growing concern among health officials and policy makers about chemicals units' potential impact on the environment and human health. The potential impact of chemicals in general a mercury in particularly on population health is enormous and is expected to worsen unless efforts are made to curb the emission and release to the environment.

Different international studies show the possible effect of mercury to human health and wellbeing. Further national studies need to be undertaken to understand the overall circumstance of Ethiopia in-light of the potential populations at risk and also the potential health risks. Generally, women and children have been found to be most vulnerable in the assessment of POPs chemicals in 2016. Detailed studies on the possible impact of mercury will be an area of focus for Ethiopia to uphold.

Chapter V: Awareness/Understanding of Workers and the Public; and Existing Training and Education Opportunities of Target Groups and Professionals

While implementing the mercury initial assessment, different awareness raising meetings were incorporated. The awareness raising started initially for the staff in the Ministry of Environment, Forest and Climate Change followed by key stakeholder's discussion. Major Ministries and Agencies that were identified in the mapping exercise took part in the stakeholder's discussion.

The awareness raising work has also been extended to some of the major gold mining sites. The ministry, while assessing sites for gold mining sites with use of mercury, took time to discuss with regional authorities and miners regarding the possible impact of mercury.

The understanding of mercury and its impact on health is still weak in Ethiopia. Numerous activates are required to bring population to pace with the understanding of the impact of mercury. Thus, the Ministry of Environment, Forest and Climate Change along with relevant sector and regional authorities plans to design an awareness raising plan and implement a full scale national awareness raising campaign.

ANNEX I: Stakeholder Engagement process

- **Dr. Ayele Hegena**,
  Director General, Law, Standards and Policy Directorate, Ministry of Environment, Forest and Climate Change
- **Mr. Mehari Wondemagegn**,
  Director General, Compliance, Monitoring and Control Director General, Ministry of Environment, Forest and Climate Change
- **Ms. Roman Kassahun**,
  Director, Ministry of Environment, Forest and Climate Change
- **Mr. Binyam Yakob Gebreyes**,
  Focal Point for Minamata Convention, Ministry of Environment, Forest and Climate Change
- **Mr. Belachew Hailemariam Taye**,
  Policy Expert, Law, Standards and Policy Directorate, Ministry of Environment, Forest and Climate Change
- **Mr. Girma Gemechu Kenne**,
  Senior Hazardeous Waste Expert, Ministry of Environment, Forest and Climate Change
- **Mrs. Enatfanta Melaku**,
  Director, Ministry of Mines, Petroleum and Natural Gas
  Mr. Kassahun Tsegaye,
  Addis Ababa Solid Waste Reuse and Disposal Project Office
- **Mr. Taddesse Amare**,
  Director, Pesticide Action Nexus Association, PAN-Ethiopia
- **Mr. Epherem Sisay**
  Addis Ababa Solid waste recycling project office.
- **Tamirat Sulamo**
  Expert, Ministry of Urban Development and Housing.
- **Dr. Abera Kumai**
  Lecturer, Addis Ababa School of Public Health
- **Dawit Alemu**
  Expert, Chemical and Construction Input Development Institute.
- **Meseret Adamu**
  Expert, Chemical and Construction Input Development Institute.
- **Fitsum Anteneh**
  Expert, Ethiopian food medicine and health care administration and Control
- **Abreham Misganu**
  Ministry of Health.
- **Zewditu Memorial Hospital, Addis Ababa Ethiopia.**
- **Balcha hospital, Addis Ababa Ethiopia.**
- **Minilik hospital, Addis Ababa Ethiopia.**
- **Paulos Millennium Hospital Addis Ababa Ethiopia.**
- **Gandhi Memorial hospital, Addis Ababa Ethiopia.**
- **Sahara bulb factory, Addis Ababa, Ethiopia**

ANNEX II: UNEP TOOLKIT Calculation Spreadsheet

Table1 Summary of mercury inventory results

Source category	Calculated Hg output, Kg/y							
	Air	Water	Land	By-pro-ducts and impurities	General waste	Sector specific treatment /disposal	Total releases by source category	Percent of total releases*3*4
5.1: Extraction and use of fuels/energy sources	5.739,0	-	-	-	-	-	5.739	9%
5.2: Primary (virgin) metal production	750,0	375,0	16.875,0	750,0	-	-	18.750	28%
5.3: Production of other minerals and materials with mercury impurities*1	361,2	-	-	120,4	-	120,4	602	1%
5.4: Intentional use of mercury in industrial processes	-	-	-	-	-	-	-	0%
5.5: Consumer products with intentional use of mercury (whole life cycle)	5.075,7	3.387,1	5.889,3	-	7.845,9	-	22.198	33%
5.6: Other intentional product/process use*2	121,7	2.556,0	292,0	219,0	1.631,4	1.649,8	6.470	10%
5.7: Production of recycled metals	-	-	-	-	-	-	-	0%
5.8: Waste incineration and burning	9.810,0	-	-	-	-	-	9.810	15%
5.9: Waste deposition/landfilling and waste water treatment*3*4	573,5	1.821,0	4.588,2	-	83,1	55,4	7.121	2%
5.10: Crematoria and cemeteries	-	-	1.801,5	-	-	-	1.802	3%
SUM OF QUANTIFIED RELEASES*3*4	22.431	6.892	24.858	1.089	9.560	1.826	66.656	100%

Table 0-2 Summary of mercury releases (overleaf)

C	Sub-C	Source category	Exists? (y/n/?)	Calculate. Hg input to society	Calculated Hg output, Kg/y					
					Air	Water	Land	By-pro-ducts and impurities	General waste	Sector specific treatment/disposal
5.1		**Source category: Extraction and use of fuels/energy sources**								
	5.1.1	Coal combustion in power plants	0	0	0	0	0	0	0,0	0
	5.1.2.1	Coal combustion in coal fired industrial boilers	n	0	0	0	0	0	0	0
	5.1.2.2	Other coal use	n	0	0	0	0	0	0	0
	5.1.3	Mineral oils - extraction, refining and use	y	10	10	0	0	0	0	0
	5.1.4	Natural gas - extraction, refining and use	n	0	0	0	0	0	0	0
	5.1.5	Other fossil fuels - extraction and use	n	0	0	0	0	0	0	0
	5.1.6	Biomass fired power and heat production	y	5729	5729	0	0	0	0	0
	5.1.7	Geothermal power production	?	0	0	0	0	0	0	0
5.2		**Source category: Primary (virgin) metal production**								
	5.2.1	Mercury (primary) extraction and initial processing (a	n	0	0	0	0	0	0	0
	5.2.2	Gold (and silver) extraction with mercury amalgamation processes	n	0	0	0	0	0	0	0
	5.2.3	Zinc extraction and initial processing	n	0	0	0	0	0	0	0
	5.2.4	Copper extraction and initial processing	n	0	0	0	0	0	0	0
	5.2.5	Lead extraction and initial processing	n	0	0	0	0	0	0	0
	5.2.6	Gold extraction and initial processing by methods other than mercury amalgamation	y	18750	750	375	16875	750	0	0
	5.2.7	Aluminum extraction and initial processing	n	0	0	0	0	0	0	0
	5.2.8	Other non-ferrous metals - extraction and processing	n	0	0	0	0	0	0	0
	5.2.9	Primary ferrous metal production	n	0	0	0	0	0	0	0

C	Sub-C	Source category	Exists? (y/n/?)	Calculate. Hg input to society	Calculated Hg output, Kg/y					
					Air	Water	Land	By-pro-ducts and impurities	General waste	Sector specific treatment/disposal
5.3		**Source category: Production of other minerals and materials with mercury impurities**								
	5.3.1	Cement production	y	602	361	0	0	120	0	120
	5.3.2	Pulp and paper production	n	0	0	0	0	0	0	0
	5.3.3	Production of lime and light weight aggregates	?	0	0	0	0	0	0	0
5.4		**Source category: Intentional use of mercury in industrial processes**								
	5.4.1	Chlor-alkali production with mercury-technology	n	0	0	0	0	0	0	0
	5.4.2	VCM production with mercury catalyst	n	0	0	0	0	0	0	0
	5.4.3	Acetaldehyde production with mercury catalyst	n	0	0	0	0	0	0	0
	5.4.4	Other production of chemicals and polymers with mercury	n	0	0	0	0	0	0	0
5.5		**Source category: Consumer products with intentional use of mercury**								
	5.5.1	Thermometers with mercury	y	6171	1234	1851	1234	-	1851	0
	5.5.2	Electrical switches and relays with mercury	y	5170	1551	0	2068	-	1551	0
	5.5.3	Light sources with mercury	y	133	40	0	40	-	53	0
	5.5.4	Batteries with mercury	y	8116	2029	0	2029	-	4058	0
	5.5.5	Polyurethane with mercury catalysts	y	1108	222	111	443	-	332	0
	5.5.6	Biocides and pesticides with mercury	?	0	0	0	0	-	0	0
	5.5.7	Paints with mercury	?	0	0	0	0	-	0	0
	5.5.6	Pharmaceuticals for human and veterinary uses	?	0	0	0	0	-	0	0
	5.5.9	Cosmetics and related products with mercury	y	1500	0	1425	75	-	0	0
5.6		**Source category: Other intentional product/process use**								

C	Sub-C	Source category	Exists? (y/n/?)	Calculate. Hg input to society	Calculated Hg output, Kg/y					
					Air	Water	Land	By-pro-ducts and impurities	General waste	Sector specific treatment/disposal
	5.6.1	Dental mercury-amalgam fillings (b	y	4623	122	1947	292	219	1022	1022
	5.6.2	Manometers and gauges with mercury	y	0	0	0	0	0	0	0
	5.6.3	Laboratory chemicals and equipment with mercury	y	1847	0	609	0	0	609	628
	5.6.4	Mercury metal use in religious rituals and folklore medicine	n	0	0	0	0	0	0	0
	5.6.5	Miscellaneous product uses, mercury metal uses, and other sources	y	0	0	0	0	0	0	0
5.7		**Source category: Production of recycled metals ("secondary" metal production)**								
	5.7.1	Production of recycled mercury ("secondary production")	n	0	0	0	0	0	0	0
	5.7.2	Production of recycled ferrous metals (iron and steel)	?	0	0	0	0	0	0	0
	5.7.3	Production of other recycled metals	n	0	0	0	0	0	0	0
5.8		**Source category: Waste incineration*3**		0						
	5.8.1	Incineration of municipal/general waste	n	0	0	0	0	0	0	0
	5.8.2	Incineration of hazardous waste	n	0	0	0	0	0	0	0
	5.8.3	Incineration of medical waste	y	60	60	0	0	0	0	0
	5.8.4	Sewage sludge incineration	n	0	0	0	0	0	0	0
	5.8.5	Informal waste burning	y	9750	9750	0	0	0	0	0
5.9		**Source category: Waste deposition/landfilling and waste water treatment**								
	5.9.1	Controlled landfills/deposits*3	n	0	0	0	0	0	0	0
	5.9.2	Diffuse disposal under some control	-	0	-	-	-	-	-	-
	5.9.3	Informal local disposal of industrial production waste	n	0	0	0	0	-	-	-

C	Sub-C	Source category	Exists? (y/n/?)	Calculate. Hg input to society	Calculated Hg output, Kg/y					
					Air	Water	Land	By-pro-ducts and impurities	General waste	Sector specific treatment/disposal
	5.9.4	Informal dumping of general waste*1*3	y	5735	574	574	4588	-	-	-
	5.9.5	Waste water system/treatment*2	y	1386	0	1248	0	0	83	55
5.10		**Source category: Crematoria and Cemeteries**		0						
	5.10.1	Crematoria/cremation	n	0	0	0	0	-	0	0
	5.10.2	Cemeteries	y	1802	0	0	1801.52	-	0	0
SUM OF QUANTIFIED INPUTS AND RELEASES *1*2*3*4				**58501**	**22431**	**6892**	**24858**	**1089,400551**	**9560,347278**	**1826**

Notes: *1 Includes production of cement, pulp and paper, lime and light weight aggregates. *2 Includes dental amalgam fillings, manometers and gauges, lab chemicals and equipment, Hg use in religious rituals and folklore medicine, and miscellaneous product uses. *3: 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. *4: The estimated input and release to water include mercury amounts which have also been accounted for under each source category. To avoid double counting, releases to water from waste water system/treatment have been subtracted automatically in the TOTAL

Table 0-3 Identification of mercury release sources in the country; sources present (Y), absent (N), and possible but not positively identified (?).

Cat. no.	Source category	Source presence (y/n/?)
5.1	**Main category - Extraction and use of fuels/energy sources**	**Y**
5.1.1	Coal combustion in large power plants	**N**
5.1.2	Other coal combustion	**N**
5.1.3	Extraction, refining and use of mineral oil	**Y**
5.1.4	Extraction, refining and use of natural gas	**N**
5.1.5	Extraction and use of other fossil fuels	**N**
5.1.6	Biomass fired power and heat production	**Y**
5.1.7	Geothermal power production	**?**
5.2	**Main category - Primary (virgin) metal production**	**Y**
5.2.1	Primary extraction and processing of mercury	**N**
5.2.2	Gold and silver extraction with the mercury-amalgamation process	**N**
5.2.3	Zinc extraction and initial processing	**N**
5.2.4	Copper extraction and initial processing	**N**
5.2.5	Lead extraction and initial processing	**N**
5.2.6	Gold extraction and initial processing by other processes than mercury amalgamation	**Y**
5.2.7	Aluminum extraction and initial processing	**N**
5.2.8	Extraction and processing of other non-ferrous metals	**N**
5.2.9	Primary ferrous metal production	**N**
5.3	**Main category - Production of other minerals and materials with mercury impurities**	**Y**
5.3.1	Cement production	**Y**
5.3.2	Pulp and paper production	**N**
5.3.3	Lime production and light weight aggregate kilns	**?**
5.3.4	Others minerals and materials	**N**
5.4	**Main category – Intentional use of mercury as an auxiliary material in industrial processes**	**N**
5.4.1	Chlor-alkali production with mercury-technology	**N**

Cat. no.	Source category	Source presence (y/n/?)
5.4.2	VCM (vinyl-chloride-monomer) production with mercury-dichloride ($HgCl_2$) as catalyst	**N**
5.4.3	Acetaldehyde production with mercury-sulphate ($HgSO_4$) as catalyst	**N**
5.4.4	Other production of chemicals and polymers with mercury compounds as catalysts	**N**
5.5	**Main category - Consumer products with intentional use of mercury**	**Y**
5.5.1	Thermometers with mercury	**Y**
5.5.2	Electrical and electronic switches, contacts and relays with mercury	**Y**
5.5.3	Light sources with mercury	**Y**
5.5.4	Batteries containing mercury	**Y**
5.5.6	Biocides and pesticides	**?**
5.5.7	Paints	**?**
5.5.8	Pharmaceuticals for human and veterinary uses	**?**
5.5.8	Cosmetics and related products	**Y**
5.6	**Main category - Other intentional products/process uses**	**Y**
5.6.1	Dental mercury-amalgam fillings	**Y**
5.6.2	Manometers and gauges	**Y**
5.6.3	Laboratory chemicals and equipment	**Y**
5.6.4	Mercury metal use in religious rituals and folklore medicine	**N**
5.6.5	Miscellaneous product uses, mercury metal uses and other sources	**?**
5.7	**Main category - Production of recycled metals**	**N**
5.7.1	Production of recycled mercury ("secondary production)	**N**
5.7.2	Production of recycled ferrous metals (iron and steel)	**?**
5.7.3	Production of other recycled metals	**N**
5.8	**Main category – Waste incineration**	**Y**
5.8.1	Incineration of municipal/ general waste	**N**
5.8.2	Incineration of hazardous waste	**N**
5.8.3	Incineration of medical waste	**Y**
5.8.4	Sewage sludge incineration	**N**

Cat. no.	Source category	Source presence (y/n/?)
5.8.5	Informal waste burning	**Y**
5.9	**Main category - Waste deposition/landfilling and waste water treatment**	
5.9.1	Controlled landfills/deposits	**N**
5.9.2	Diffuse deposition under some control	**N**
5.9.3	Informal local deposition of industrial production waste	**N**
5.9.4	Informal dumping of general waste	**Y**
5.9.5	Waste water system/treatment	**Y**
5.10	**Main category - Cremation and cemeteries**	**Y**
5.10.1	Crematoria	**N**
5.10.2	Cemeteries	**Y**
	Main category - Potential hot spots	**N**
	Closed/abandoned chlor-alkali production sites	**N**
	Other sites of former chemical production where mercury compounds are/were produced (pesticides, biocides, pigments etc.), or mercury or compounds were used as catalysts (VCM/PVC etc.)	**N**
	Closed production sites for manufacturing of thermometers, switches, batteries and other products	**N**
	Closed pulp and paper manufacturing sites (with internal chlor-alkali production or former use of mercury-based slimicides)	**N**
	Tailings/residue deposits from mercury mining	**N**
	Tailings/residue deposits from artisanal and large scale gold mining	**?**
	Tailings/residue deposits from other non-ferrous metal extraction	**N**
	Sites of relevant accidents	**?**
	Dredging of sediments	**N**
	Sites of discarded district heating controls (and other fluid controls) using mercury pressure valves	**N**
	Sites of previous recycling of mercury ("secondary" mercury production)	**N**

Useful Resources

- **Minamata Convention Website:** http://www.mercuryconvention.org/
- **Minamata Convention Text** http://www.mercuryconvention.org/Convention/tabid/3426/Default.aspx
- **Materials developed by the interim secretariat of the Minamata Convention** http://www.mercuryconvention.org/AwarenessRaising/Resources/tabid/3873/Default.aspx
    - Becoming a Party to the Minamata Convention on Mercury (FACT SHEET)
    - Minamata Convention on Mercury at a glance (FACT SHEET)
    - Overview of the negotiations process (PPT)
    - Overview of the Minamata Convention on Mercury (PPT)
    - Provision of the Convention on financial and technical support (PPT)
    - Practical steps of the ratification, acceptance, approval or accession processes and notifications under the Minamata Convention (PPT)

- **Toolkit for Identification and Quantification of Mercury Releases (UNEP)**http://www.unep.org/chemicalsandwaste/Metals/MercuryPublications/GuidanceTrainingMaterialToolkits/MercuryToolkit/tabid/4566/language/en-US/Default.aspx
- **MercuryLearn Platform (UNITAR/UNEP)** http://mercurylearn.unitar.org/
- **List of Country Mercury Release Inventories (UNEP)**http://www.unep.org/chemicalsandwaste/hazardoussubstances/Mercury/Informationmaterials/ReleaseInventories/tabid/79332/Default.aspx
- **Checklist of legal authorities to implement Minamata Convention on Mercury [Natural Resources Defense Council - NRDC]** http://docs.nrdc.org/international/files/int_15101301a.pdf
- **Minamata Convention on Mercury - Ratification and Implementation Manual[Zero Mercury Working Group, Natural Resources Defense Council, Ban Toxics]** http://www.zeromercury.org/phocadownload/Developments_at_UNEP_level/minamatamanual_eng_january%202015%20final.pdf
- **Guidance for identifying populations at risk from mercury exposure (WHO/UNEP)**http://www.who.int/foodsafety/publications/risk-mercury-exposure/en/
- **Developing a National Action Plan to Reduce, and Where Feasible, Eliminate Mercury Use in Artisanal and Small Scale Gold Mining (UNEP, 2015)** HTTP://WWW.UNEP.ORG/CHEMICALSANDWASTE/NATIONALACTIONPLAN/TABID/53985/DEFAULT.ASPX
- **Chemicals Management: The why and how of mainstreaming gender (UNDP,**

2007) http://www.undp.org/content/undp/en/home/librarypage/environment-energy/chemicals_management/chemicals-management-the-why-and-how-of-mainstreaming-gender.html

- **Draft guidance on identification of individual stocks of mercury or mercury compounds exceeding 50 metric tons, as well as sources of mercury supply generating stocks exceeding 10 metric tons per year** http://www.mercuryconvention.org/Portals/11/documents/meetings/inc7/English/7_4_e_stock.pdf