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Contents

FOREWORD

HON. CHEPTORIS SAM

The Minamata Convention on Mercury is a global Agreement to protect human health and the environment from the adverse effects of mercury. The objective of the Convention is to protect human health and the environment from anthropogenic emissions and releases of mercury and its compounds. It provides guidance on all activities and actions that assenting nations should progressively adopt and implement in the long run quest to eliminate both direct and indirect exposure of both humans and the environment to mercury. The Minamata Convention on Mercury was adopted by the Conference of Plenipotentiaries on 10 October 2013 in Japan and was opened for signature thereafter. Uganda assented to the Minamata Convention and it is under obligation to implement all the activities and actions set forth by the Convention. However, to meet her obligations, it is essential that the country has; Inventory of mercury sources, adequate policy, regulatory and institutional frameworks and capacities to guide the implementation process. With funding from GEF, the Government of Uganda has been implementing the Minamata Initial Assessment (MIA) to determine the national requirements and needs of the convention for its implementation. The purpose of the MIA is to strengthen national decision-making toward ratification of the Minamata Convention on Mercury and build national capacity towards implementation of future obligations. The other objective of the MIA is derived from Article 30 (paragraph 4) of the Minamata Convention which states that, "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".

Under the Convention, assenting countries are obliged to develop and implement strategies and best practices that minimize and eliminate human and environmental exposure to mercury. With funding from UNEP through GEF, National Environment Management Authority (NEMA) has conducted a Minamata Initial Assessment (MIA) project to strengthen national decision making towards ratification of the Minamata Convention and build capacity towards implementation of future provisions. This report, therefore, provides the results of the Minamata Initial Assessment. It also reviews the ability and capacity of existing domestic legislations and institutions to implement the Minamata Convention on Mercury that prescribes elimination where feasible and otherwise minimize exposure of humans and environment; and, identifies gaps that current legislations and institutions do not address and makes suggestions on how these gaps could be bridged if Uganda is to meet the targets set by the Convention.

It is my hope that that this Minamata Initial Assessment (MIA) Report meets the expectations of all Ugandans and stakeholders who will be involved in the different programmes and activities to ensure the implementation of the Convention's obligations.

HON. CHEPTORIS SAM
MINISTER OF WATER AND ENVIRONMENT

ACKNOWLEDGEMENT


Dr. Tom. O.Okurut

The preparation of the Minamata Initial Assessment (MIA) Report was a concerted effort involving a number of stakeholders including, Ministries, Departments, Agencies, Civil Society Organisations and Private Sector. With funding from UNEP through GEF, National Environment Management Authority (NEMA) conducted a Minamata Initial Assessment (MIA) project to strengthen national decision making towards ratification of the Minamata Convention and build capacity towards implementation of future provisions.

Mercury's unique characteristics and availability as a material throughout the ages has allowed it to be widely used in many products and applications. The report therefore highlights the results of the Minamata Initial Assessment. It also reviews the ability and capacity of existing domestic legislations and institutions to implement the Minamata Convention that prescribes elimination where feasible and otherwise minimise exposure of humans and environment; and, identifies gaps that current legislations and institutions do not address and makes suggestions on how these gaps could be bridged if Uganda is to meet the targets set by the Convention.
It is my hope that this Report will go a long way in guiding the users appreciate and apprehend strategic planning and decision making in line with mercury undertakings to ensure sustainable development.

NEMA acknowledges the United Nations Environment Program (UNEP), and the Global Environment Facility (GEF) for the financial support extended to facilitate development of the report.
Valuable technical guidance by Professor. Steven Nyanzi the consultant from Makerere University is highly appreciated. The efforts of the National Coordination Mechanism/core working group that developed the initial content for the report; as well as the various Lead Agencies (LAs), the private sector, and Civil Society Organisations for their timely contributions in their capacities are appreciated.
Gratitude is extended to NEMA staff for their various technical input, in particular, Ms. Anne Lillian Nakafeero, Coordinator of the Minamata Initial Assessment (MIA) project at NEMA and Ms. Monica Angom, the Project Assistant.

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Glossary

Term or abbreviation	Explanation
ASGM	*Artisanal and Small Scale Gold Mining* means gold mining conducted by individual miners or small enterprises with limited capital investment and production
BAT	*Best Available Techniques* means the most effective and advanced stage in the development of activities and their methods of operation which indicate the practical suitability of particular technics for providing in principle the basis for release limitations designed to prevent and, where that is not practicable, generally to reduce releases of chemicals listed in Part I of Annex C and their impact on the environment as a whole. (Convention text)
BEP	*Best Environmental Practices* means the application of the most appropriate and combination of environmental control measures and strategies. (Convention text)
CCFL	Cold Cathode Fluorescent Lamps
CFL	Compact Fluorescent Lamps
COP	*Conference of the Parties means* countries that have ratified the Convention, keeps under continuous review and evaluates the implementation of the Convention
DGSM	Directorate of Geological Survey and Mines
EAC	East African Community
GDP	Gross Domestic Product
GEF	Global Environment Facility
GOU	Government of Uganda
HPMV	High Pressure Mercury Vapour Lamps
HS	Harmonized System
INC	Inter-Governmental Negotiating Committee
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LFL	Linear Fluorescent Lamps
LGDP	Local Government Development Plan
MIA	Minamata Initial Assessment
MT	Metric Tons
NAP	National Action Plan
NDP	National Development Plan
NEMA	National Environment Management Authority
NRDC	Natural Resources Defense Council
Party	A member country to Conference of Parties to the Minamata Convention
SIP	Sector Investment Plan
UBOS	Uganda Bureau of Statistics
UGX	Uganda Shillings
UNEP	United Nations Environment Program
USD	United States Dollar
WHO	World Health Organization

EXECUTIVE SUMMARY

The Minamata Convention on Mercury, hereafter referred to as the Convention, was adopted by the Conference of Plenipotentiaries on 10 October 2013 in Japan and was opened for signature thereafter. Uganda has signed the treaty, but has not ratified it yet.

The objective of the Minamata Convention on Mercury is to protect the human health and the environment from the anthropogenic emissions and releases of mercury and mercury compounds. The treaty calls for its Parties to set up and implement a number of regulatory and policy measures to control the supply and trade of mercury and/or its compounds, including certain specific sources of mercury such as primary mining, mercury-added products such as dental amalgams, various measurement equipment, fluorescent bulbs and, manufacturing processes in which mercury or mercury compounds are used, as well as artisanal and small scale gold mining. In addition, the Convention requires its parties to control air emissions, water and land releases of mercury and/or its compounds by establishing measures that include one or more of the following, as appropriate; Release limit values, use of BAT and BEP, multi-pollutant control strategy that will deliver co-benefits for control of mercury releases and alternative measures to reduce releases from relevant sources. It also contains provisions on the environmentally sound interim storage of mercury and on mercury wastes, contaminated sites, public health and information dissemination aspects.
Mercury has a wide range of industrial and chemical applications. Despite its wide applicability, mercury is a highly toxic element which can result into fatalities if exposed to humans and the environment.

Under the Convention, assenting countries are obliged to develop and implement strategies and best practices that minimize and eliminate human and environmental exposure to mercury. With funding from UNEP through GEF, National Environment Management Authority (NEMA) - Uganda has conducted a Minamata Initial Assessment (MIA) project to strengthen national decision making towards ratification of the Minamata Convention and build capacity towards implementation of future provisions. The project had the following objectives;

a) Establishing of a coordination mechanism and organisation of the process.
b) Assessing of the national infrastructure and capacity for the management of mercury, including national legislation.
c) Developing of a mercury inventory using the UNEP mercury toolkit and strategies to identify and assess mercury contaminated sites.
d) Identifying of challenges, needs and opportunities to implement the Minamata convention on Mercury.
e) Preparing, validating of the National MIA report and implementation of awareness raising activities and dissemination of results.

This report, therefore, provides the results of the Minamata Initial Assessment in Uganda.

Mercury Inventory, Sources and Stockpiles
United Nations Environment Programme (UNEP) toolkit for quantification of mercury emissions and releases has been used to estimate quantities of mercury from all anthropogenic sources. Assessment results reveal a total mercury output of 31,087 kg/y. In Uganda, the major source of mercury emissions and releases is primary metal production (gold extraction with mercury amalgamation processes) as shown Table 1 below.

Table 1: Total mercury output

Source category	Calculated Hg output, Kg/y							
	Air	Water	Land	By-products	General waste	Sector specific	Total releases	Percentage (%)
Primary (virgin) metal production	12,138	3,333	3,027	-	-	0.1	18,498	60
Waste incineration and burning	5,308	-	-	-	-	13.7	5,322	17
Production of recycled metals ("secondary metal production")	12	-	13	-	12	-	37	0
Intentional use of Consumer products	1,192	105	1,241	-	2,220	-	4,758	15
Waste deposition	114	300	939	-	58	57.8	1,469	1
Extraction and use of fuels/ energy sources	952	-	-	-	-	0.3	952	3
Other intentional product/ processes	44	173	51	8.6	146	85.8	508	2
Crematoria and cemeteries	1	-	362	-	-	-	363	1
Production of other minerals	165	-	-	70.7	-	-	236	1
SUM OF QUANTIFIED RELEASES	**19,926**	**3,719**	**4,770**	**79**	**2,436**	**158**	**31,087**	**100**

Mercury can neither be created nor destroyed; all the mercury released is absorbed or deposited into release pathways. The main pathway for mercury released from point and non-point sources is air (atmosphere) followed by water (marine and freshwater bodies, including via waste water systems), land, general waste, and sectors specific waste disposal respectively as shown in Figure 1 below. Another important pathway is "by-products and impurities" in which case mercury flows back into the market through by-products and mercury containing products.

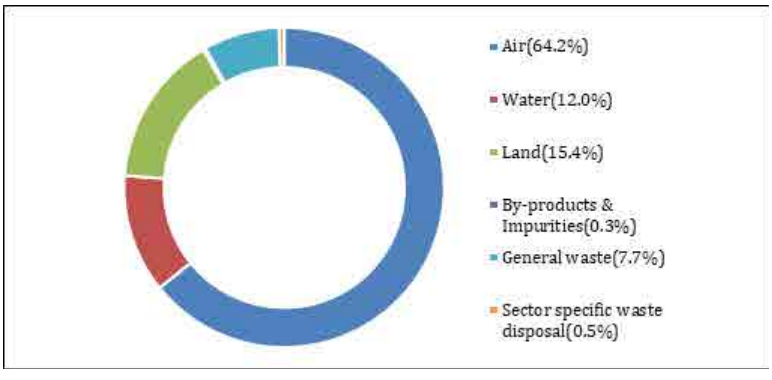


Figure 1: Mercury output pathways

Specifically, gold (and silver) extraction with mercury amalgamation processes; Batteries with mercury; Informal waste burning; biomass fired and heat production (including charcoal production) and informal dumping of general waste make the largest contributions to mercury emissions (into air). Similarly, gold (and silver) extraction with mercury amalgamation processes is the principal contributor

of mercury releases (water and land). The other prominent contributors of mercury releases are; Waste water treatment; Informal dumping of waste; Cosmetics and related products; Dental amalgam fillings; Manometers and laboratory chemicals and equipment with mercury.

Policy, Regulatory and Institutional Framework

This report analyses both the policy and institutional framework in respect to effective management of mercury supply, trade, use, and disposal. The assessment findings show no existing stand-alone laws for mercury management currently in place in Uganda. However, there are enabling laws that facilitate mercury management with a broad focus on preventing human and environmental exposure to hazardous and toxic chemicals. As such, these laws may be subject to selective interpretation.

Similarly, the assessment reveals that there is no single institution with an overall mandate to regulate mercury supply, trade and use. There are a number of institutions directly involved in regulation of chemicals and standards and as such are indirectly involved in mercury regulation. It is further revealed that there is no formal coordination mechanism existing between the various stakeholders and institutions; this poses significant challenges to effective regulation of mercury use as individual and arbitrary efforts seldom result into broader gains at national level. The regulatory (policy) and institutional (capacity) recommendations for effective implementation of the Minamata Convention are summarized in Table 2 below.

Table 2: National policy, regulatory, institution and capacity needs for effective implementation of the Minamata Convention in Uganda

Policy and regulatory needs	Institutional and Capacity needs
Article 3 - Mercury supply sources and trade	
▪ Prohibit primary mining of mercury ▪ Prohibit the import of primary mercury ▪ Classify mercury needs to be classified as an export/import restricted ▪ Create an inventory of all mercury supplied for artisanal and small scale mining	▪ Establish a mercury use licensing system ▪ Establish an inventory of mercury trade ▪ Establish an autonomous department or secretariat to coordinate the management of chemicals (mercury) in Uganda
Article 4 - Mercury Added Products	
▪ Restrict the import and export added products. ▪ Restrict the manufacture and trade of mercury added products ▪ Restrict and reduce the use of dental amalgam	▪ Purchase specialized equipment and train personnel to detect and measure mercury in mercury added products ▪ Formalize and document of all traders of mercury and mercury containing products ▪ Establish standard mercury testing laboratories in the country ▪ Develop an inventory of mercury containing and mercury added products
Article 5 – Manufacturing processes in which mercury or mercury compounds are used	
▪ Prohibit the use of mercury in manufacturing ▪ Prohibit the establishment of any facility using mercury in its industrial processes	▪ Increase the number of Environmental and Labor inspectors. ▪ Put in place measures to adopt mercury-free manufacturing processes. ▪ Enhance formal interaction and coordination mechanisms amongst these stakeholders in chemicals management including mercury.

Article 7 – Artisanal and Small scale Gold Mining	
▪ Formulate a national action plan on Artisanal and small-scale gold mining ▪ Reduce and where feasible eliminate the use of mercury in gold mining	▪ Build the capacity of NEMA to conduct environmental inspection ▪ Develop and implement health education and behavioral change programs, techniques and technologies, including early recognition and identification of mercury poisoning at community level, to reduce mercury use and poisoning in ASGM areas ▪ Development an inventory of artisanal gold mining sites and miners in Uganda ▪ Develop a formal framework to guide and regulate Artisanal and small scale gold mining
Article 8 – Emissions	
▪ Establish mercury emission standards, guidelines and objectives for mercury emission processes ▪ Develop an Inventory of mercury emissions ▪ Develop Best Available Techniques and practices to control and reduce mercury emissions	▪ Develop an inventory of mercury emissions ▪ Build NEMA's capacity to detect, profile and monitor mercury emissions ▪ Develop mercury emission standards and guidelines ▪ Develop best practices and actions that minimize mercury emissions ▪ Procure equipment that can detect, trace and quantify mercury emissions
Article 9 – Releases	
▪ Develop, document and disseminate Best Available Techniques and Practices for control of mercury releases ▪ Develop an inventory of all mercury releases from various sources ▪ Identify all relevant point source categories of mercury	▪ Develop an inventory of mercury releases ▪ Build the capacity of NEMA to detect, profile and monitor mercury releases ▪ Develop mercury release standards, guidelines and procedures ▪ Develop best practices and actions that minimize release of mercury to the environment
Article 11 – Mercury wastes	
▪ Develop environmentally standards and guidelines for management of mercury wastes ▪ Prohibit the transportation of mercury wastes across borders	▪ Create appropriate incentives for the sound disposal of mercury containing wastes ▪ Develop capacity of waste management companies to detect and sort mercury containing waste for safe disposal ▪ Establish dump sites and recycling areas that specifically handle mercury waste ▪ Mainstream sorting and management of mercury across all the stakeholders involved in wastes
Article 12 – Contaminated sites	
▪ Develop strategies and guidelines to identify and manage contaminated sites ▪ Conduct a health and environmental risk assessment for mercury in ASGM sites	▪ Build the capacity of NEMA to identify, assess and reclaim sites contaminated by mercury and mercury compounds ▪ Develop tools, protocols and guidelines for identifying and assessing contaminated sites. ▪ Develop emergency health guidelines for all people poisoned from mercury

Article 18 – Public Information, Awareness and Education	
▪ Develop behavioral change communication programs on the effects of mercury and mercury compounds and alternatives to mercury	▪ Mainstream chemical management especially mercury management in the teaching curricula ▪ Develop a tailored national outreach and behavioral change programs on the effects of mercury and the safe alternatives to mercury ▪ Establish a national mercury knowledge/ information management system

Plate 1: Women in Mubende district panning gold concentrates using mercury

INTRODUCTION

The Minamata Convention[1] on Mercury is the International Agreement on Management of Mercury. The objective of the Convention is to protect human health and the environment from anthropogenic emissions and releases of mercury and its compounds. It provides guidance on all activities and actions[2] that assenting nations should progressively adopt and implement in the long run quest to eliminate both direct and indirect exposure of both humans and the environment to mercury.

Uganda assented to the Minamata Convention and it is under obligation to implement all the activities and actions set forth by the Convention. However, to meet her obligations, it is essential that the country has; Inventory of mercury sources, adequate policy, regulatory and institutional frameworks and capacities to guide the implementation process. With funding from GEF, the Government of Uganda has been implementing the Minamata Initial Assessment (MIA) to determine the national requirements and needs of the convention for its implementation. The purpose of the MIA is to strengthen national decision-making toward ratification of the Minamata Convention on Mercury and build national capacity towards implementation of future obligations. The other objective of the MIA is derived from Article 30 (paragraph 4) of the Minamata Convention which states that "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."

Uganda's jurisprudence has no specific policy and legal framework on the management and regulation of mercury use, supply, trade and disposal. Nevertheless, guidance can be drawn from a number of domestic legislations. However, these are not exhaustive and may fail to provide guidance on activities and actions specific to mercury management.

This MIA therefore reviews the ability and capacity of existing domestic legislations and institutions to implement the Minamata Convention that prescribes elimination where feasible and otherwise minimise exposure of humans and environment. It also identifies gaps that current legislations and institutions do not address and makes suggestions on how these gaps could be bridged if Uganda is to meet the targets set by the Convention.

Specifically, the MIA was guided by three (3) main objectives;

1) To undertake a mercury inventory in the country;

2) To determine existing policy and regulatory gaps to implementation of Uganda's obligation under the convention; and,

3) To assess exiting institutional and capacity gaps to implementation of Uganda's obligation under the Convention.

Mercury and Mercury Poisoning

Mercury is a highly vaporizable silver white metal which is liquid at room temperature. It belongs to group IIB of the periodic table. It is used in electrical and electronic devices, switches, thermostats and relays, measuring and control equipment, energy efficient fluorescent light bulbs, batteries, mascara, skin lightening creams and other cosmetics, dental fillings and a host of other consumables worldwide (Parson and Percival, 2005).

Despite having a wide range of unique industrial and medical applications and uses, mercury similarly has a number of negative effects on humans and the environment including;

a) Disrupting the development of fetuses and young children;
b) In the vapour form, mercury is rapidly absorbed into the blood stream and when inhaled it damages the central nervous system, thyroid, kidneys, lungs, immune system, eyes, gums and skin; and,
c) In children it can cause neurological damage resulting into symptoms such as; mental retardation, seizures, vision and hearing loss, delayed development, language disorders and memory loss (ATSDR, 1999; Clarkson 2002; Counter and Buchanan 2004; Wigle 2003).

Because of its significant negative effects on human and environmental health, reduction and elimination of environmental and human exposure to mercury needs not to be over- emphasized. It is against this background that in 2013, in Minamata - Japan, countries including Uganda, signed a Convention to protect human health and environment from anthropogenic emissions and releases of mercury and its compounds.

Uganda is not a primary producer of mercury. However, substantial amounts of mercury are imported into the country directly or indirectly as a component of other products especially cosmetics and consumer products. The main mercury exposure activity in Uganda is Artisanal and Small scale Gold Mining (ASGM) where it is used to concentrate gold. Humans are also exposed to mercury through lightening creams and lotions. A number of mercury containing creams have hitherto been available on the Ugandan market. Whereas these cosmetics products[3] have since been banned, they still find their way onto the market through the country's porous borders.

Chapter I: National Background Information

1.1 Country Profile

1.1.1 Geographical, and Demographic Profile

Uganda is located in East Africa and lies across the equator, about 800 kilometers in land from the Indian Ocean. It lies between 10 29' South and 40 12' North latitude, 290 34 East and 3500' East longitude. The country is landlocked, bordered by Kenya in the East; South Sudan in the North; Democratic Republic of Congo in the West; Tanzania in the South; and Rwanda in South West. It has a total area of 241,551 square kilometers, of which land area covers 200,523 square kilometers (UBOS, 2016a).

Uganda has a diverse culture. It encompasses religion, tribe, traditions and beliefs, value systems and language, among others. Uganda's population is made up of different ethnic groups with unique customs and norms. These play a major role in shaping the behavior and ways of life of people in the country. Lately, some of the traditional values have changed due to integration as a result of migration and/or inter-marriages. Some cultural groupings are headed by traditional kings or chiefs who are not politically elected but have an indirect role in community governance and moral build up (UBOS, 2016b).

The main ethnic groups in Uganda include; Baganda, Banyankole, Bahima, Bakiga, Banyarwanda, Banyoro, Batoro, Langi, Acholi, Lugbara, Karamojong, Basoga, Bagisu, and others. The Baganda are the largest ethnic group in Uganda and comprise approximately 17% of the population.[4]

Language is one of the uniting factors in any society. In Uganda, while English is the official language, there are a number of other languages spoken. However, Swahili is being promoted in the spirit of regional integration within the East African Community (EAC). Uganda's Constitution (1994) allows freedom of worship. There are various religious groupings in the country including; Christians, Muslims and others.

Uganda has a population of 34.6 million people (UBOS, 2016a). The population dividend is such that urban towns and districts have more people per square kilometer than the rural areas. Table 3 shows the least and most populated districts in Uganda. Despite urban centers having a high population per square meter, the bulk of Uganda's population live in rural areas in extended and semi extended households which are highly dependent on the natural ecosystem goods and services for their subsistence. Of the 34.6 million people in Uganda only 7.2 million were living in urban centers, defined as recognised urban centers, in 2016.

Table 3: Least and Most Populated Districts in Uganda

Most Populated Districts		Least Populated Districts	
District	**Population**	**District**	**Population**
Wakiso	1,997,418	Kalangala	54,293
Kampala	1,507,080	Ntoroko	67,005
Kibaale	785,088	Bukwo	89,356
Arua	782,077	Buvuma	89,890
Kasese	694,992	Kween	93,667
Mubende	684,337	Lyantonde	93,753
Mukono	596,804	Butambala	100,840
Hoima	572,986	Moroto	103,432
Kabale	528,231	Otuke	104,254
Tororo	517,082	Kapchorwa	105,186

Source: Uganda National Population Census, 2014

1.1.2 Political Profile

Uganda is a presidential republic with a multi-party system. The executive is made up of the President and the cabinet of Ministers, headed by the Prime Minister. The legislative branch is represented by the Parliament of Uganda and the judicial branch includes the Supreme, Constitutional, and Commercial Courts. The system is based on a democratic parliamentary system with universal suffrage for all citizens over 18 years of age. The country is divided into 112 districts and one capital city as shown in figure 2 below . Districts are further subdivided into counties, sub-counties and parishes. The role of these Local Governments is to implement and monitor Government programs at the respective levels. Over time, the administrative units have been sub-divided with the aim of easing administration and improving the delivery of services (UBOS, 2016a).

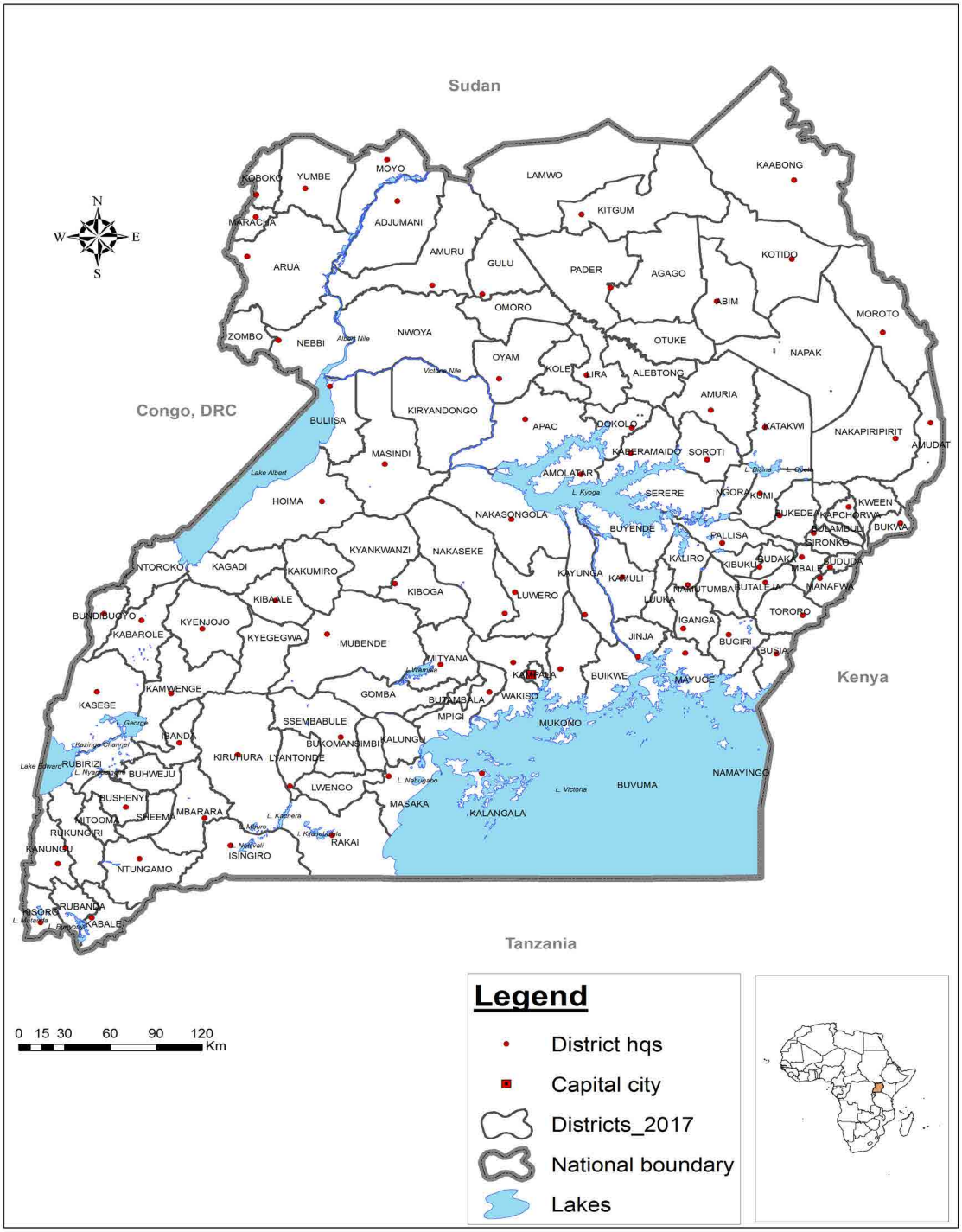


Figure Figue 2: Map of Uganda showing districts

1.1.3 Profiles of Economic Sectors

According to Uganda statistical abstract (UBOS, 2016b), services make the biggest contribution to the country's GDP as shown in table 4 below.Services are followed by agriculture, forestry and fishing. Industry follows afterwards and contributes 19.8% to Uganda's GDP. Specifically, the contribution of mining to overall GDP in the country is very small (0.6%). Most of Uganda's mining and minerals processing facilities are privately owned characterized with limited capital and technology to fully exploit the available resources. The low contribution to overall GDP is greatly attributed to; rudimentary methods of work, clandestine nature of the sector activities and tax evasion.

Table 4: Percentage Contribution of Different sectors to National GDP

GDP at market prices	2011	2012	2013	2014	2015
Agriculture, forestry and fishing	**26.3**	**26**	**24.7**	**24.7**	**23.5**
Cash crops	2.4	1.7	1.6	1.7	1.7
Food crops	14.2	13.8	12.6	13	12.1
Livestock	4.1	4.7	4.4	4.2	4.2
Agriculture Support Services	0	0	0	0	0
Forestry	4	4.4	4.5	4.2	4
Fishing	1.5	1.4	1.5	1.5	1.5
Industry	**21**	**20.3**	**20.3**	**19.7**	**19.8**
Mining and quarrying	0.8	0.9	0.8	0.7	0.6
Manufacturing	10.5	9.4	8.9	8	8.5
Electricity	0.7	0.9	0.9	0.9	0.9
Water	1.9	2.1	2.4	2.5	2.5
Construction	7.2	6.9	7.4	7.5	7.3
Services	**46**	**46.9**	**47.7**	**48.1**	**48.8**
Trade and Repairs	14.7	13.9	13.3	12.4	13.4
Transportation and Storage	2.6	2.9	3.2	3.1	3
Accommodation and Food Service Activities	2.4	2.6	2.8	2.7	2.6
Information and Communication	2.4	2.8	3	3.3	3.5
Financial and Insurance Activities	2.4	2.5	2.4	2.8	2.8
Real Estate Activities	3.7	4	4.4	4.5	4.5
Professional, Scientific and Technical Activities	3.3	3.2	2.6	2.5	2.5
Administrative and Support Service Activities	1.8	1.6	1.5	1.6	1.7
Public Administration	2.9	2.9	2.8	2.9	2.9
Education	4.4	4.7	5.4	5.9	5.5
Human Health and Social Work Activities	3.6	4.1	4.5	4.6	4.5
Arts, Entertainment and Recreation	0.3	0.3	0.3	0.3	0.3
Other Service Activities	0.9	1.1	1.1	1.1	1.2
Activities of Households as Employers	0.4	0.4	0.4	0.4	0.4
Adjustments	**6.7**	**6.8**	**7.2**	**7.6**	**7.9**
Taxes on products	6.7	6.8	7.2	7.6	7.9

1.1.4 Policy Context

Uganda's political, economic and development ambitions are enshrined in NDPII - second National Development Plan (GOU, 2015) whose overall vision is *"A Transformed Ugandan Society from a Peasant to a Modern and Prosperous Country within 30 years"*. The overall goal of NDPII is to transform Uganda into a

middle income country by the year 2020. There are four main objectives under this goal and these include;

a) To increase sustainable production, productivity and value addition in key growth opportunities;
b) To increase the stock and quality of strategic infrastructure to accelerate the country's competitiveness;
c) To enhance human capital development; and,
d) To strengthen mechanisms for quality, effective and efficient service delivery.

The NDP is implemented through Sector Investment Plans (SIPs), Local Government Development Plans (LGDPs), Annual work plans and Budgets of Ministries, Departments and Agencies (MDAs). The NDPII also seeks to leverage the international and regional frameworks such as Africa Agenda 2063 and Post 2015 Development Agenda to exploit growth opportunities. Uganda is party and subscribes to the 1992 Rio resolution and blue print for sound environmental management.

1.1.5 Environmental and Natural Resources Overview

Uganda's natural resource base is one of the richest and most diverse in Africa. As such, the country's economy relies heavily on goods and services provided by natural capital[5]. Therefore sound use and management of the environment and natural resources is central and emphasized in all government policies, plans and strategies that strive to achieve sustainable development and poverty alleviation.

National Environment Management Authority (NEMA) is a semi-autonomous institution established in May 1995 under the National Environment Act Cap 153. NEMA is the principal agency charged with the responsibility of coordinating, monitoring, regulating and supervising environment management in Uganda. NEMA advises Government and spearheads the development of environmental policies, laws, regulations, standards and guidelines for sound environmental management.

The mandate, vision, goal and objectives of NEMA aim at ensuring and promoting a clean, healthy, and productive environment for sustainable socio-economic development in Uganda.

Chapter II: Mercury Inventory and Identification of Emissions and Releases

This section identifies the sources and quantities of mercury emissions to air and releases to land and water. It also provides an overview of the initial inventory of mercury in Uganda. In developing the mercury inventory, the assessment has used the UNEP toolkit level 2 for identification and quantification of mercury releases considering 2014 as a reference year. The toolkit was designed to guide inventory developers through the different stages of identifying sources and quantifying the emissions and releases from different sources.

2.1 Mercury Releases, Stockpiles, Supply and Trade

2.1.1 Mercury Release Sources in Uganda

The main categories of mercury sources in Uganda include; extraction and use of fuels, primary metal production, production of other minerals and materials with mercury, intentional use of mercury as an auxiliary material in industrial processes, consumer products with intentional use of mercury, other intentional products/process uses, production of recycled metals, waste incineration and waste deposition/ landfilling and waste water treatment and residue deposits as shown in Table 5 below.

Table 5: Mercury Release Sources in Uganda

Source category	Source presence (y/n/?)
Main category - Extraction and use of fuels/energy sources	
Coal combustion in large power plants	N
Other coal combustion	Y
Extraction, refining and use of mineral oil	Y
Extraction, refining and use of natural gas	N
Extraction and use of other fossil fuels	N
Biomass fired power and heat production	Y
Geothermal power production	N
Main category - Primary (virgin) metal production	
Primary extraction and processing of mercury	N
Gold and silver extraction with the mercury-amalgamation process	Y
Zinc extraction and initial processing	N
Copper extraction and initial processing	N
Lead extraction and initial processing	N
Gold extraction and initial processing by other processes than mercury amalgamation	Y
Aluminium extraction and initial processing	N
Extraction and processing of other non-ferrous metals	N
Primary ferrous metal production	Y
Main category - Production of other minerals and materials with mercury impurities	
Cement production	Y
Pulp and paper production	N
Lime production and light weight aggregate kilns	N
Others minerals and materials	N
Main category – Intentional use of mercury as an auxiliary material in industrial processes	
Chloral-alkali production with mercury-technology	N
VCM (vinyl-chloride-monomer) production with mercury-dichloride ($HgCl_2$) as catalyst	N
Acetaldehyde production with mercury-sulphate ($HgSO_4$) as catalyst	N
Other production of chemicals and polymers with mercury compounds as catalysts	N
Main category - Consumer products with intentional use of mercury	
Thermometers with mercury	Y

Source category	Source presence (y/n/?)
Main category - Extraction and use of fuels/energy sources	
Electrical and electronic switches, contacts and relays with mercury	Y
Light sources with mercury	Y
Batteries containing mercury	Y
Biocides and pesticides	N
Paints	N
Pharmaceuticals for human and veterinary uses	N
Cosmetics and related products	Y
Main category - Other intentional products/process uses	
Dental mercury-amalgam fillings	Y
Manometers and gauges	Y
Laboratory chemicals and equipment	Y
Mercury metal use in religious rituals and folklore medicine	N
Miscellaneous product uses, mercury metal uses and other sources	Y
Main category - Production of recycled metals	
Production of recycled mercury ("secondary production)	N
Production of recycled ferrous metals (iron and steel)	Y
Production of other recycled metals	N
Main category – Waste incineration	
Incineration of municipal/general waste	Y
Incineration of hazardous waste	Y
Incineration of medical waste	Y
Sewage sludge incineration	N
Informal waste burning	Y
Main category - Waste deposition/landfilling and waste water treatment	
Controlled landfills/deposits	Y
Diffuse deposition under some control	Y
Informal local deposition of industrial production waste	N
Informal dumping of general waste	Y
Waste water system/treatment	Y
Main category - Cremation and cemeteries	
Crematoria	Y
Cemeteries	Y
Main category - Potential hot spots	
Closed/abandoned chloral-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 chloral-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	Y
Tailings/residue deposits from other non-ferrous metal extraction	N
Sites of relevant accidents	N
Dredging of sediments	N
Sites of discarded district heating controls using mercury pressure valves	N
Sites of previous recycling of mercury ("secondary" mercury production)	N

2.1.2 Quantities of Mercury Emissions and Releases (Inputs) in Uganda

Similar to the "principle of conservation of energy", mercury cannot be created or destroyed but it is only transformed from one form to the other. As such mercury releases and emissions (inputs) are absorbed or trans-located into the natural habitats (land, air and water) in a repetitive cyclical manner.

Mercury inputs are the amounts of mercury that are made available for potential releases through anthropogenic activities in the country. This therefore refers to the sources of mercury in the country or the various activities that introduce mercury into the environment as shown in table 6 and 7 below.

For waste categories, the "inputs" are calculated to show the distribution of mercury in waste through the different waste treatment activities; though waste is not an original source of input mercury into society (except in case of waste import). Waste "inputs" are marked in *italics.* The origin of mercury in waste and waste water produced in the country is mercury in products and materials. Waste fractions and waste water therefore do not represent original mercury inputs to society (except imported waste). Waste and waste water may however represent substantial flows of mercury through society. The following were found to be the major flows of mercury with waste and waste water; Informal waste burning, informal dumping of general waste, controlled landfills and waste water systems. The releases from informal waste burning and dumping of general waste is a consequence of use of mercury added products and absence of collection systems for mercury added products.

The main source category of mercury emissions and releases is primary metal production. The leading contributor of emissions is gold (and silver) extraction using mercury amalgamation process and the second most important source of mercury is waste incineration. This is followed by the use of consumer products (thermometers, electrical switches, and cosmetics, batteries with mercury and light sources that contain mercury). Waste deposition and extraction and use of fuels also make significant contributions to the mercury releases and emissions respectively. The least contributing sources are; production of recycled metals, cement production, cremation and cemeteries and other intentional products.

Table 6: Estimated Mercury Release

Source category	**Calculated Hg output, Kg/y**							
	Air	Water	Land	By-products	General waste	Sector specific	Total releases	Percentage (%)
Primary (virgin) metal production	12,138	3,333	3,027	-	-	0.1	18,498	60
Waste incineration and burning	5,308	-	-	-	-	13.7	5,322	17
Production of recycled metals ("secondary metal production")	12	-	13	-	12	-	37	0
Intentional use of Consumer products	1,192	105	1,241	-	2,220	-	4,758	15
Waste deposition	114	300	939	-	58	57.8	1,469	1
Extraction and use of fuels/ energy sources	952	-	-	-	-	0.3	952	3
Other intentional product/ processes	44	173	51	8.6	146	85.8	508	2
Crematoria and cemeteries	1	-	362	-	-	-	363	1
Production of other minerals	165	-	-	70.7	-	-	236	1
SUM OF QUANTIFIED RELEASES	**19,926**	**3,719**	**4,770**	**79**	**2,436**	**158**	**31,087**	**100**

Table 7: Estimated Mercury input

Source category	Estimated Hg input, Kg Hg/y, by life cycle phase (as relevant)		
	Production phase*1	Use phase	Disposal phase
Other coal combustion			**4****
Extraction, refining and use of mineral oil		**3**	
Biomass fired power and heat production	**945**		
Main category - Primary (virgin) metal production			
Gold and silver extraction with the mercury-amalgamation process	**18,495**		
Gold extraction and initial processing by other processes than mercury amalgamation	**0**		
Primary ferrous metal production	**2**		
Main category - Extraction and use of fuels/energy sources			
Main category - Production of other minerals and materials with mercury impurities			
Cement production	**236**		
Main category - Consumer products with intentional use of mercury			
Thermometers with mercury			**21**
Electrical and electronic switches, contacts and relays with mercury			**439**
Light sources with mercury			**149**
Batteries containing mercury			**4,045**
Cosmetics and related products			**104****
Main category - Other intentional products/process uses			
Dental mercury-amalgam fillings			**146**
Manometers and gauges			**205**
Laboratory chemicals and equipment			**157**
Main category - Production of recycled metals			
Production of recycled ferrous metals (iron and steel)	**37**		
Main category – Waste incineration			
Incineration of hazardous waste			***67***
Incineration of medical waste			***70***
Informal waste burning			***5,185***
Main category - Waste deposition/landfilling and waste water treatment			
Controlled landfills/deposits			***6***
Informal dumping of general waste			***1,078***
Waste water system/treatment			***385***
Main category - Cremation and cemeteries			
Crematoria			**1**
Cemeteries			**362**

Notes: *1: Production phase includes raw material production.

**: Use and disposal phases fused together

2.1.3 Mercury Output Pathways

The predominant pathway for the output mercury is air (atmosphere) followed by water (marine and freshwater bodies, including via waste water systems), land, general waste, and sectors specific waste disposal in that order as shown in Figure 3 below. Another output pathway is through "by-products and impurities" in which case mercury flows back into the market with by-products and products. The mercury pathways are explained in detail in Tables 8 and 9.

Gold (and silver) extraction with mercury amalgamation processes, batteries with mercury, informal waste burning, biomass fired and heat production (including charcoal production) and informal dumping of general waste made the largest contributions to mercury emissions and releases to the atmosphere. Similarly, gold (and silver) extraction with mercury amalgamation processes was the largest contributor of mercury releases to both water and land. The other prominent contributors of mercury release to water are; waste water treatment, informal dumping of waste, cosmetics and related products, dental amalgam fillings, manometers and laboratory chemicals and equipment with mercury. For land, other than the mercury amalgamation process, the other important sources of mercury releases are; batteries with mercury (batteries with mercury are also the biggest sources of mercury in general waste), electrical switches and relays, cemeteries, informal dumping of waste, manometers among others as shown in 9.

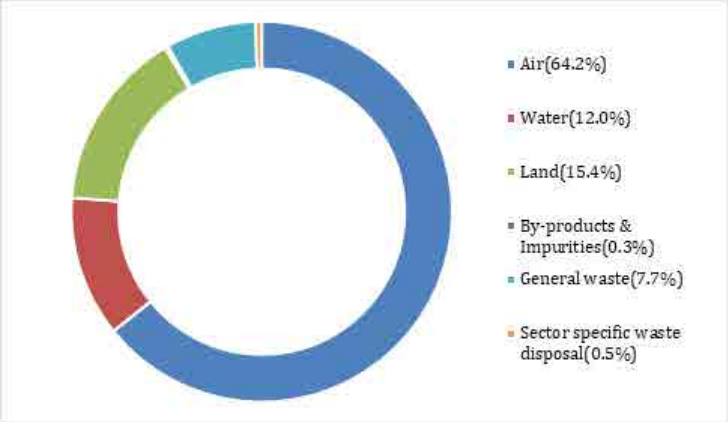


Figure 3: Mercury output pathways, 2014

Table 8: Mercury Output Pathways from Different Sources

C	Sub-C	Source category	Exists? (y/n/?)	Calculated Hg output, Kg/y					
				Air	Water	Land	By-prod. +impurities	General waste	Sector spec. treatment/disposal
5.1		Source category: Extraction and use of fuels/energy sources							
	5.1.1	Coal combustion in large power plants	Y	0	0	0	0	0.0	0
	5.1.2	Other coal use	Y	4	0	0	0	0	0
	5.1.5	Other fossil fuels - extraction and use	Y	3	0	0	0	0	0
	5.1.6	Biomass fired power and heat production	Y	945	0	0	0	0	0
5.2		Source category: Primary (virgin) metal production							
	5.2.2	Gold (and silver) extraction with mercury amalgamation processes	Y	12,136	3,333	3,027	0	0	0
	5.3.6	Gold extraction and initial processing by methods other than mercury amalgamation	Y	0	0	0	0	0	0
	5.3.9	Primary ferrous metal production	Y	2	0	0	0	0	0
5.3		Source category: Production of other minerals and materials with mercury impurities							
	5.3.1	Cement production	Y	165	0	0	71	0	0
	5.3.2	Pulp and paper production	Y	0	0	0	0	0	0
5.5		Source category: Consumer products with intentional use of mercury							
	5.5.1	Thermometers with mercury	Y	4	6	4	-	6	0
	5.5.2	Electrical switches and relays with mercury	Y	132	0	176	-	132	0
	5.5.3	Light sources with mercury	Y	45	0	45	-	60	0
	5.5.4	Batteries with mercury	Y	1,011	0	1,011	-	2,023	0
	5.5.8	Cosmetics and related products with mercury	Y	0	99	5	-	0	0
5.6		Source category: Other intentional product/process use							
	5.6.1	Dental mercury-amalgam fillings*4	Y	3	60	10	9	32	32
	5.6.2	Manometers and gauges with mercury	Y	41	62	41	0	62	0
	5.6.3	Laboratory chemicals and equipment with mercury*4	Y	0	52	0	0	52	53
5.7		Source category: Production of recycled metals ("secondary" metal production)							
	5.4.2	Production of recycled ferrous metals (iron and steel)	Y	12	0	13	0	12	0
5.8		Source category: Waste incineration							
	5.8.2	Incineration of hazardous waste*1	Y	60	0	0	0	0	7
	5.8.3	Incineration of medical waste*1	Y	63	0	0	0	0	7
	5.8.5	Informal waste burning*1	Y	5,185	0	0	0	0	0
5.9		Source category: Waste deposition/landfilling and waste water treatment							
	5.9.1	Controlled landfills/deposits*1	Y	6	0	0	0	0	0
	5.9.3	Informal local disposal of industrial production waste	Y	0	0	0	-	-	-
	5.9.4	Informal dumping of general waste*1*2	Y	108	108	862	-	-	-
	5.9.5	Waste water system/treatment*3	Y	0	193	77	0	58	58
5.10		Source category: Crematoria and cemeteries							
	5.10.1	Crematoria	Y	1	0	0	-	0	0
	5.10.2	Cemeteries	Y	0	0	362	-	0	0
SUM OF QUANTIFIED RELEASES:				19,926	3,719	4,770	79	2,436	158

Notes: *1: The mercury sources to waste are consumer products with intentional mercury content, the estimated quantities indicate the flow of mercury through the different pathways *2: The estimated quantities include mercury in products which has also been accounted for under each product category. To avoid double counting, the release to land from informal dumping of general waste has been subtracted automatically in the TOTALS. *3: The estimated release to water includes 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 TOTALS.*4: The mercury output is not equal to the input because of the existing pollution abatement systems.

Table 9: Description of Pathway Types and Sources

Calculation result type	Description
Estimated Hg input, Kg Hg/y	The standard estimate of the amount of mercury entering this source category with input materials, for example calculated mercury in the amount of coal used annually in the country for combustion in large power plants.
Air	Mercury emissions to the atmosphere from point sources and diffuse sources from which mercury may be spread locally or over long distances with air masses; for example, from: • Point sources such as coal fired power plants, metal smelter, waste incineration; • Diffuse sources as small scale gold mining, informally burned waste with fluorescent lamps, batteries, thermometers.
Water	Mercury releases to aquatic environments and to waste water systems: Point sources and diffuse sources from which mercury will be spread to marine environments (oceans), and freshwaters (rivers, lakes, etc.). for example, releases from: • Wet flue cleaning systems from coal fired power plants; • Industry, households, etc. to aquatic environments; • Surface run-off and leachate from mercury contaminated soil and waste dumps
Land	Mercury releases to soil, the terrestrial environment: General soil and ground water. For example, releases from: • Solid residues from flue gas cleaning on coal fired power plants used for gravel road construction; • Uncollected waste products dumped or buried informally • Local un-confined releases from industry such as on site hazardous waste storage/ burial • Spreading of sewage sludge with mercury content on agricultural land (sludge used as fertilizer) • Application on land, seeds or seedlings of pesticides with mercury compounds
By-products and impurities	By-products that contain mercury, which are sent back into the market and cannot be directly allocated to environmental releases, for example: • Gypsum wallboard produced from solid residues from flue gas cleaning on coal fired power plants. • Sulphuric acid produced from desulphurization of flue gas (flue gas cleaning) in non-ferrous metal plants with mercury trace concentrations • Chlorine and sodium hydroxide produced with mercury-based chlor-alkali technology; with mercury trace concentrations • Metal mercury or calomel as by-product from non-ferrous metal mining (high mercury concentrations)
General waste	General waste: Also called municipal waste in some countries. Typically, household and institution waste where the waste undergoes a general treatment, such as incineration, landfilling or informal dumping or burning. The mercury sources to waste are consumer products with intentional mercury content (batteries, thermometers, fluorescent tubes, etc.) as well as high volume waste like printed paper, plastic, etc., with small trace concentrations of mercury.
Sector specific waste treatment /disposal	Waste from industry and consumers which is collected and treated in separate systems, and in some cases recycled; for example, • Confined deposition of solid residues from flue gas cleaning on coal fired power plants on dedicated sites. • Hazardous industrial waste with high mercury content which is deposited in dedicated, safe sites • Hazardous consumer waste with mercury content, mainly separately collected and safely treated batteries, thermometers, mercury switches, lost teeth with amalgam fillings etc. • Confined deposition of tailings and high volume rock/waste from extraction of non-ferrous metals The country-specific waste treatment/disposal method is described for each sub-category in the detailed report sections below.

2.2 Extraction and Use of Fuels/Energy Sources

2.2.1 Other Coal Uses – Combustion

Data from COMTRADE[6] for the recent years (2011 to 2015) for the sub categories with HS codes; 270111 – bituminous coal, not agglomerated, 270112 – anthracite coal, not agglomerated, 270119 - Coal except anthracite or bituminous, not agglomerated, 2704 - Retort carbon, coke or semi-coke of coal, lignite pea, 2706 - Tar from coal, lignite or peat, other mineral tars, 2707 - Coal -tar distillation products including oils and 270779 - Coal tar distillation products has been considered and average consumption derived as seen in tables 10,11,12,13 and 14 below. It should be noted that there is no production of any of the coals in Uganda.

Using $Consumption_{average} = production_{average} + import_{average} - export_{average}$

Table 10: Quantities of Anthracite Coal (Not agglomerated)

Year	Import(kg)	Export(kg)	Consumption(kg)
2011	265	-	265
2012	381	-	381
2013	-	-	-
2014	21,315	-	21,315
2015	213	-	213

$Consumption_{average}$ for 2013-15:
= (0 + 21,315 + 213)/3
= 7.176 kg **(7 MT)**

Table 11: Quantities of Coal Except Bituminous or Anthracite (Not Agglomerated)

Year	Import(kg)	Export(kg)	Consumption(kg)
2011	43,614,000	-	43,614,000
2012	13,994,093	-	13,994,093
2013	40,563,480	-	40,563,480
2014	29,123,480	-	29,123,480
2015	39,695,299	230	39,695,069

$Consumption_{average}$ for 2013-15:
= (40,563,480 + 29,123,480 + 39,695,069)/3
= 36,460,676.3 kg **(36,461 MT)**

Table 12: Coal Tar Distillation Products Including Oils

Year	Import(kg)	Export(kg)	Consumption(kg)
2011	1,666,167	5,409	1,660,758
2012	1,703,154	4,782	1,698,372
2013	997,075	761	996,314
2014	2,373,994	9,314	2,364,680
2015	2,099,575	7,270	2,092,305

$Consumption_{average}$ for 2013-15:
= (996,314 + 2,364,680 + 2,092,305)/3

6 www.comtrade.un.org/db

= 1,817,766.33 kg **(1,818 MT**)

Table 13: Quantities of Coal Tar Distillation Products

Year	Import(kg)	Export(kg)	Consumption(kg)
2011	15,682	5,409	10,273
2012	18,057	4,532	13,525
2013	107,822	761	107,061
2014	210,334	6,710	203,624
2015	32,877	1,900	30,977

$Consumption_{average}$ for 2013 to 15:
= (107,061 + 203,624 + 30,977)/3
= 113,887.333 kg (**114 MT**)

Total $consumption_{average}$ of lignite coal (MT) = (36,461 + 1,818 + 114)
= **38,393**

For consistence, an average for the consumption quantities for the years (2013 - 2015) has been taken as the estimated consumption. The total estimate of coal for other uses (combustion) has been considered to be the sum of all the averages for all the different coal sub-categories consumed in the country. Some coal types, whose statistical estimations appeared to be too small, have been considered insignificant.

Table 14: Summary of Inputs and Results of Other Coal use - Combustion

Other coal use – combustion	Unit	Production	Use	Disposal
Activity rate	t/y	-	38,393	-
Input factor for phase	g Hg/t	-	0.1	-
Calculated input to phase	kg Hg	-	3.8	-
Output distribution factors for phase:				
- Air			0.95	-
- Water			0.00	-
- Land			0.00	-
- Products			0.00	-
- General waste treatment			0.00	-
- Sector specific waste treatment			0.05	-
Calculated outputs/releases to:				
- Air	kg Hg		3.61	-
- Water			0.00	-
- Land			0.00	-
- Products			0.00	-
- General waste treatment			0.00	-
- Sector specific waste treatment	kg Hg		0.19	-

2.2.2 Use of Heavy oil and Petroleum Coke in Oil Combustion Facilities

Data from COMTRADE for the recent years (2011-2015) using the following HS codes; 271311-petroleum coke, not calcined, 2713-petroleum coke, bitumen and other oil industry residues, 271312-petroleum coke, calcined and 271091-Heavy Furnace oil, 271390- Residues of petroleum oils, 340319-Lubricating oil, 381121-Lubricating oil additives with petroleum, bitumen oil was obtained. The results are presented in the tables 15,16 and 17 below. For consistence, the average consumption quantity for three years of (2013-2015) has

been considered as the estimated average consumption. The total estimate of petroleum coke and heavy oils for combustion has been considered to be the sum of all the averages for all the different sub- categories consumed in the country. From a trend line analysis, the use of heavy oil has been considered insignificant because of the low import figures.

It is important to note, there is no production of heavy oil and petroleum coke in Uganda. The calculations are as elaborated hereafter;

Using; $Consumption_{average} = production_{average} + import_{average} - export_{average}$

Table 15: Quantities of Petroleum Coke (Not Calcined)

Year	Import(kg)	Export(kg)	Consumption(kg)
2011	-	-	-
2012	-	-	-
2013	270,000	-	270,000
2014	23,835,000	-	23,835,000
2015	33,128,610	-	33,128,610

$Consumption_{average}$ for 2013 to 15;
= (270,000 + 23,835,000 + 33,128,610)/3

= 19,077,870 kg (**19,078** MT)

Table 16: Quantities of Petroleum Coke, Bitumen and Oil Industry Residues

Year	Import(kg)	Export(kg)	Consumption(kg)
2011	3,498,351	925	3,497,426
2012	5,926,339	42,458	5,883,881
2013	11,056,096	91,738	10,964,358
2014	29,509,004	113,428	29,395,576
2015	54,905,344	364,160	54,541,184

$Consumption_{average}$ for 2013-15:
= (10,964,358 + 29,395,576 + 54,541,184)

= 31,633,706 kg (**31,634** MT)

Total $consumption_{average}$ of petroleum coke (MT) = 19,078 + 31,634

= **50,712**

Table 17: Summary of Inputs and Results of Heavy oil and Petroleum Coke in Oil Combustion Facilities

Use of Heavy oil and petroleum coke in oil combustion facilities	Unit	Production	Use	Disposal
Activity rate	t/y	-	50,712	-
Input factor for phase	mg Hg/t	-	20	-
Calculated input to phase	kg Hg	-	1.0	-
Output distribution factors for phase:				
- Air			0.90	-
- Water			0.00	-
- Land			0.00	-
- Products			0.00	-
- General waste treatment			0.00	-
- Sector specific waste treatment			0.10	-
Calculated outputs/releases to:				
- Air	kg Hg		0.90	-
- Water			0.00	-
- Land			0.00	-
- Products			0.00	-
- General waste treatment			0.00	-
- Sector specific waste treatment	kg Hg		0.10	-

2.2.3 Use of Gasoline, Diesel, Light fuel oil, Kerosene, LPG and other light to Medium Distillates.

Results on use of Gasoline, Diesel, Light fuel oil, Kerosene, LPG and other light to Medium Distillates are detailed in Tables 18 and 19 below. Statistical data used here (1,461,000,000 litres as total imports; petrol – 644,265,185 litres , kerosene – 67,164,898 litres, diesel – 727,417,159 litres) has been obtained from Uganda Bureau of Statistics (Statistics, 2015) for the year 2014. Assuming 70% of the total oil was used for transportation and uses other than combustion and the rest into other oil combustion facilities. An average density of 0.84675 kg/litre has been used for calculations.

Total oil (kg) = 1,461,000,000*0.84675

= 1,237,101,750 kg **(1,237,102 MT)**

Transportation and uses other than combustion = (0.7*1,237,102)

= **865,971 MT**

Other uses other than combustion = (0.3*1,237,102)

= **371,131 MT**

Table 18: Summary of Inputs and Results of Transportation and Uses Other Than Combustion

Transportation and uses other than combustion	Unit	Production	Use	Disposal
Activity rate	t/y	-	865,971	-
Input factor for phase	mg Hg/t	-	2	-
Calculated input to phase	kg Hg	-	2	-
Output distribution factors for phase:				
- Air			1.00	-
- Water			0.00	-
- Land			0.00	-
- Products			0.00	-
- General waste treatment			0.00	-
- Sector specific waste treatment			0.00	-
Calculated outputs/releases to:				
- Air	kg Hg		2.00	-
- Water			0.00	-
- Land			0.00	-
- Products			0.00	-
- General waste treatment			0.00	-
- Sector specific waste treatment	kg Hg		0.00	-

Table 19: Summary Input and Results of Uses Other than Combustion

Other uses other than combustion	Unit	Production	Use	Disposal
Activity rate	t/y	-	371,131	-
Input factor for phase	mg Hg/t	-	2	-
Calculated input to phase	kg Hg	-	0.7	-
Output distribution factors for phase:				
- Air			1.00	-
- Water			0.00	-
- Land			0.00	-
- Products			0.00	-
- General waste treatment			0.00	-
- Sector specific waste treatment			0.00	-
Calculated outputs/releases to:				
- Air	kg Hg		0.70	-
- Water			0.00	-
- Land			0.00	-
- Products			0.00	-
- General waste treatment			0.00	-
- Sector specific waste treatment	kg Hg		0.00	-

2.2.4 Biomass Fired Power and Heat Production

According to Uganda Bureau of Statistics (Statistics, 2015), it is reported that 31,500,000 MT and 18,000,000 MT were used for biomass fired power and heat production and charcoal combustion respectively. Biomass for fired power production consists of agro-residues and wood. It should be noted that this is the predominant source of energy and there are no heat production facilities in the country. The summary of Inputs and results of Biomass Fired Power and Heat Production are detialed in tables 20 and 21 below.

Table 20: Summary of Inputs and Results of Biomass Fired Power and Heat Production

Biomass fired power and heat production	Unit	Production	Use	Disposal
Activity rate	t(dry weight)/y	-	31,500,000	-
Input factor for phase	g Hg/t (dry weight)	-	0.03	-
Calculated input to phase	kg Hg	-	945	-
Output distribution factors for phase:				
- Air		-	1.00	-
- Water		-	0.00	-
- Land		-	0.00	-
- Products		-	0.00	-
- General waste treatment		-	0.00	-
- Sector specific waste treatment		-	0.00	-
Calculated outputs/releases to:				
- Air	kg Hg	-	945	-
- Water		-	0.00	-
- Land		-	0.00	-
- Products		-	0.00	-
- General waste treatment		-	0.00	-
- Sector specific waste treatment		-	0.00	-

Table 21: Summary of Inputs and Results of Charcoal Combustion

Charcoal combustion	Unit	Production	Use	Disposal
Activity rate	t(dry weight)/y	-	18,000,000	-
Input factor for phase	g Hg/t (dry weight)	-	0.12	-
Calculated input to phase	kg Hg	-	2,160	-
Output distribution factors for phase:				
- Air		-	1.00	-
- Water		-	0.00	-
- Land		-	0.00	-
- Products		-	0.00	-
- General waste treatment		-	0.00	-
- Sector specific waste treatment		-	0.00	-
Calculated outputs/releases to:				
- Air	kg Hg	-	2,160.00	-
- Water		-	0.00	-
- Land		-	0.00	-
- Products		-	0.00	-

Charcoal combustion	Unit	Production	Use	Disposal
- General waste treatment		-	0.00	-
- Sector specific waste treatment		-	0.00	-

2.3 Primary (Virgin) Metal Production

Primary metal production is the largest source of mercury releases and emissions to land, air and water in Uganda. Gold and silver amalgamation is the biggest mercury emitting and releasing activity in this category. Primary ferrous metal production also makes significant contributions to mercury outputs of this category.

2.3.1 The Status of Artisanal and Small Scale Gold Mining in Uganda

Whereas there are a number of licensed mining companies, gold mining in Uganda is predominantly done by unlicensed and informal artisanal and small-scale miners. The DGSM (2013) estimates that Artisanal and Small Scale Gold (ASG) miners contribute most of the gold mined in the country. The known ASGM districts in Uganda include; Buhweju, Kaabong, Moroto, Busia, Bushenyi, Namayingo, Mubende and Kiboga as detailed in Annex III. It is here that gold worth billions of shillings is traded annually. The 'COWI ASGM site investigation reporting system' used by NEMA revealed that;

a) The price of gold per gram varied from USD 27.3 (UGX. 90,000) to USD 33.5 (UGX 110, 500) in 2016. The cost of panning a sack (5 to 7 basins) of concentrates was USD 4 (UGX. 14,000).
b) The daily miner income per working day ranges from USD 3 (UGX 10,000) to 5.4 (UGX 18,000).
c) One gram of Hg costs USD 0.18 to 0.30 (UGX. 600 to 1,000).
d) Mercury to gold ratio applied (Hg: Au) is 2 to 3g Hg: 1g Au. It is, therefore, very cheap to purchase mercury and its recovery efforts are considered useless by majority of the artisanal miners.

Different methods are used at different sites to extract gold from the ores as briefly explained below;

Mercury amalgamation

This is the most widely used method to extract gold from the ores. Mercury is added to crushed/whole ore and the resultant amalgam is subjected to heat. Mercury vaporizes off leaving gold. Some artisans use retorts for mercury recovery though the idea has not been fully appreciated

Plate 2: Physical crushing of ores

Plate 3: Gold and mercury amalgam on bare hand

Plat 4: Panning of core concentrates using mercury to capture gold

Plate 5: Use of a Centrifuge in Busia District

Plate 6: Use of centrifuge to concentrate gold in Busia District

Plate 7: Children panning gold in a river, Bukwo District

Cyanidation

This is usually used on ores of very low gold concentration (sometimes tailings after mercury amalgamation) – less than 10 g/t or 0.001 % (mass basis). At these concentrations the use of aqueous chemical (hydrometallurgical) extraction processes is an economically viable method of extracting the gold from the ore. Typical hydrometallurgical gold recovery involves a leaching step during which the gold is dissolved in an aqueous medium, followed by the separation of the gold bearing solution from the residues, or adsorption of the gold onto activated carbon. After elution from the activated carbon the gold is further concentrated by precipitation or electro-deposition. Use of cyanide, for gold extraction, has been greatly appreciated within the artisanal mining sites of Mubende District.

Use of borax

Recently, professional environmentalists with Uganda National Association of Community and Occupational Health (UNACOH) and Ban Toxics from the Philippines, with support from the Danish Government through Dialogos, a Danish NGO, started promoting a Mercury-Free gold mining system using borax in Mubende, Buhweju, Bugiri, Namayingo, Busia, Moroto and Nakapiripirit Districts. Borax, also known as sodium borate, is classified as non-toxic, causes no known chronic health effects. This method is so far reported the best with more gold extracted/ton of ore.

Other non-mercury extraction methods including; hand picking of alluvial gold as experienced in Kaabong District, panning and swirling in river beds have been reported in Katenga mining site in Buhweju District[7].

The Mercury Supply Chain

The mercury value chain in Uganda is illegal, informal and operates underground with its own sets of rules and regulations. Mercury used to amalgamate gold is smuggled into Uganda from Kenya, Democratic Republic of Congo and Tanzania through the country's porous borders. The Customs Officers are neither trained nor have equipment to detect presence of mercury in products and packages. Mercury that is smuggled into the country for use at ASGM sites is bought predominantly from gold buyers mostly Asians in Uganda's capital Kampala. At ASGM sites, miners actively deny using mercury doing whole ore amalgamation. In circumstances where they confess, they don't divulge their mercury sources.

Because gold processing using mercury mainly occurs at ASGM sites, disbanding these sites can greatly re-

duce mercury use in gold mining in Uganda. This has a greater possibility of fuelling mercury use and trade further underground. In underground processes, family members, especially children and women are at a higher risk of exposure to vapours with devastating effects on pregnancies and children. More toxic versions such as Inorganic mercury compounds where Mercury occurs inorganically as salts such as mercury(II)chloride, Mercuric cyanide (also known as Mercury (II) cyanide), $Hg(CN)_2$ and organic mercury compounds may be illicitly supplied in such scenarios.

2.3.1.1 Gold (and Silver) Extraction with Mercury Amalgamation

According to UNEP (2012), 17,050 artisanal miners in Uganda produced 1,210 kg of gold in 2008. A technical committee in 2010 reported that there were about 150,000 miners in Uganda. Assuming a 30% increment in the number of miners in the country for the year 2014, the quantity of gold produced estimation is as follows;

Number of miners in 2014 = (1.3* 150,000)

= 195,000 miners

Amount of gold produced in 2014 = (1,210*195,000)/17,050

= **13,839** kg of Gold

At the ASGM sites, two major gold extraction techniques are used; mercury amalgamation and non-mercury technics. Using 'COWI ASGM site investigation reporting system' developed for the estimation of mercury use (World Bank, 2016); NEMA estimates that "10% of the gold produced is obtained by use of methods other than mercury amalgamation. The rest of the gold produced by mercury amalgamation was extracted by concentrate method where 95% of them use concentrate. Nearly 5% of the artisanal miners who apply the concentrate techniques use retorts".

Other methods used are panning and segregating gold. This information was recorded at ASGM sites in the districts of; Mubende, Namayingo and Busia. In the districts of Kaabong, Moroto and Buhweju, about 95% of the gold is produced by panning and separation without use of mercury.

From the explanations above, estimates of gold produced by the use of other methods other than mercury amalgamation (and only simple concentration methods applied) is as below;

= 0.1*13,839

= **1,384** kg of gold produced

Gold extraction with mercury amalgamation processes

= 0.9*13,839

=**12,455** kg of gold produced

From concentrate = 0.95*12,455

= **11,832** kg of gold produced

From whole ore = 0.05*12,455

= **623** kg of gold produced

Use retorts = 0.05*11,832

= 592 kg of gold produced

Gold (and Silver) Extraction with Mercury Amalgamation results are detailed in tables 22,23 and 24 below.

Table 22: Summary of Input and Results of Gold from Whole Ore

From whole ore	Unit	Production	Use	Disposal
Activity rate	kg gold produced	623	-	-
Input factor for phase	kg Hg/kg gold produced	5	-	-
Calculated input to phase	kg Hg	3,115	-	-
Output distribution factors for phase:				
- Air		0.25	-	-
- Water		0.40	-	-
- Land		0.35	-	-
- Products		0.00	-	-
- General waste treatment		0.00	-	-
- Sector specific waste treatment		0.00	-	-
Calculated outputs/releases to:				
- Air	kg Hg	778.75	-	-
- Water	kg Hg	1,246.00	-	-
- Land	kg Hg	1,090.25	-	-
- Products		0.00	-	-
- General waste treatment		0.00	-	-
- Sector specific waste treatment		0.00	-	-

Table23: Summary of Input and Results of Gold from Concentrate

From concentrate	Unit	Production	Use	Disposal
Activity rate	kg gold produced	11,832	-	-
Input factor for phase	kg Hg/kg gold produced	1.3	-	-
Calculated input to phase	kg Hg	15,382	-	-
Output distribution factors for phase:				
- Air		0.75	-	-
- Water		0.13	-	-
- Land		0.12	-	-
- Products		0.00	-	-
- General waste treatment		0.00	-	-
- Sector specific waste treatment		0.00	-	-
Calculated outputs/releases to:				
- Air	kg Hg	11,536.50	-	-
- Water	kg Hg	1,999.66	-	-
- Land	kg Hg	1,845.84	-	-
- Products		0.00	-	-
- General waste treatment		0.00	-	-
- Sector specific waste treatment		0.00	-	-

Table 24: Summary of Input and Results of Gold from Concentrate and with Use of Retorts

From concentrate and with use of retorts	Unit	Production	Use	Disposal
Activity rate	kg gold produced	592	-	-
Input factor for phase	kg Hg/kg gold produced	0.55	-	-
Calculated input to phase	kg Hg	326	-	-
Output distribution factors for phase:				
- Air		0.20	-	-
- Water		0.40	-	-
- Land		0.40	-	-
- Products		0.00	-	-
- General waste treatment		0.00	-	-
- Sector specific waste treatment		0.00	-	-
Calculated outputs/releases to:				
- Air	kg Hg	65.20	-	-
- Water	kg Hg	130.40	-	-
- Land	kg Hg	130.40	-	-
- Products		0.00	-	-
- General waste treatment		0.00	-	-
- Sector specific waste treatment		0.00	-	-

2.3.1.2 Gold extraction and initial processing methods other than mercury amalgamation

The method used is purely physical separation of alluvial ore (directly in the river) and only picking out pure gold lumps. In some cases, it involves panning the ore with water in a basin and decanting out to separate out the gold. Since there is no mercury use involved, and no chemical or thermal processing used, it is in conclusion considered that this activity is by and large not a significant mercury release source, thus the activity has been omitted from the inventory emissions and release estimations.

2.3.2 Primary Ferrous Metal Production

According to a report by the US Geological Survey, Minerals Year Book (2014), 41,959 MT iron ore was extracted in Uganda. In the absence of information on the iron content of the ore, it has been considered to correspond to the pig iron production which is detailed in table 25 below. The quantity reported is proportionally low because the industry is not yet well established.

Table 25: Summary of Input and Results of Pig Iron Production

Pig iron	Unit	Production	Use	Disposal
Activity rate	t(pig iron produced)/y	41,959	-	-
Input factor for phase	g Hg/t (pig iron produced)	0.05	-	-
Calculated input to phase	kg Hg	2	-	-
Output distribution factors for phase:				
- Air		0.95	-	-
- Water		0.00	-	-
- Land		0.00	-	-
- Products		0.00	-	-
- General waste treatment		0.00	-	-
- Sector specific waste treatment		0.05	-	-

Pig iron	Unit	Production	Use	Disposal
Calculated outputs/releases to:				
- Air	kg Hg	1.99	-	-
- Water		0.00	-	-
- Land	kg Hg	0.00	-	-
- Products		0.00	-	-
- General waste treatment		0.00	-	-
- Sector specific waste treatment	kg Hg	0.00	-	-

2.3.3 Production of Recycled Ferrous Metals (Iron and Steel)

Iron and steel are recycled in the manufacture of billets used to cast reinforcing bars. The construction industry is steadily improving all through and consequently the quantities of recycled ferrous metals are increasing. It is reported by US Geological survey[8], Minerals Year book 2014; 67,000 MT of ferrous metals were recycled in Uganda. Considering an average weight of a vehicle at 2 MT, the quantity of recycled ferrous material is 33,500 vehicles. The summary of Input and results of Recycled Ferrous Metals (Iron and Steel) are contained in table 26 below.

Table 26: Summary of Input and Results of Recycled Ferrous Metals (Iron and Steel)

Production of recycled ferrous metals	Unit	Production	Use	Disposal
Activity rate	Vehicles	33,500	-	-
Input factor for phase	g Hg	1.1	-	-
Calculated input to phase	kg Hg	36.85	-	-
Output distribution factors for phase:				
- Air		0.33	-	-
- Water		0.00	-	-
- Land		0.34	-	-
- Products		0.00	-	-
- General waste treatment		0.33	-	-
- Sector specific waste treatment		0.00	-	-
Calculated outputs/releases to:				
- Air	kg Hg	12.16	-	-
- Water		0.00	-	-
- Land	kg Hg	12.53	-	-
- Products		0.00	-	-
- General waste treatment	kg Hg	12.16	-	-
- Sector specific waste treatment		0.00	-	-

2.4 Production of other Minerals and Materials with Mercury impurities

2.4.1 Cement Production

Currently, there are three operational cement producing industries in the country namely; Tororo, Hima and Kampala Cement. From the US Geological Survey, Minerals Year Book (2014), 2,141,000 MT of cement were produced in Uganda. It is assumed that all the cement produced is without co-incineration of waste and use simple particle matter technology for their pollution abatement systems. Results on cement production are detailed in table 27 below.

Table 27: Summary of Inputs and Results of Cement Production

Cement production	Unit	Production	Use	Disposal
Activity rate	t(cement produced)/y	2,141,000	-	-
Input factor for phase	g Hg/t (cement produced)	0.11	-	-
Calculated input to phase	kg Hg	236	-	-
Output distribution factors for phase:				
- Air		0.70	-	-
- Water		0.00	-	-
- Land		0.00	-	-
- Products		0.30	-	-
- General waste treatment		0.00	-	-
- Sector specific waste treatment		0.00	-	-
Calculated outputs/releases to:				
- Air	kg Hg	165.20	-	-
- Water		0.00	-	-
- Land		0.00	-	-
- Products	kg Hg	70.80	-	-
- General waste treatment		0.00	-	-
- Sector specific waste treatment		0.00	-	-

2.5 Waste Incineration

2.5.1 Incineration of Hazardous Waste

In Uganda, National Environment Management Authority (NEMA) licences and regulates waste management (handling and disposal). Findings from field visits by NEMA indicate about 2,782 MT of hazardous waste were incinerated in the country in 2014. The practice is usually done at specific locations with simple particulate matter systems for abating pollution. Results on incineration of hazardous waste are detailed in table 28 below.

Table 28: Summary of Input and Results of Incineration of Hazardous Waste

Incineration of hazardous waste	Unit	Production	Use	Disposal
Activity rate	t(waste incinerated)/y			2,782
Input factor for phase	g Hg/t (waste incinerated)			24
Calculated input to phase	kg Hg			67
Output distribution factors for phase:				
- Air			-	0.90
- Water			-	0.00
- Land			-	0.00
- Products			-	0.00
- General waste treatment			-	0.00
- Sector specific waste treatment			-	0.10
Calculated outputs/releases to:				
- Air	kg Hg		-	60.30
- Water			-	0.00
- Land			-	0.00
- Products			-	0.00
- General waste treatment			-	0.00
- Sector specific waste treatment	kg Hg			6.70

2.5.2 Incineration of Medical Waste

To quantify the total generated medical waste in Uganda, the number of medical facilities in variance with their waste generation rates has been considered by categorising them into; National Referral Hospitals, Regional Referral Hospital and General Hospitals. Based on the available literature Uganda has 2 National Referral Hospitals, 14 Regional Referral and 139 General Hospitals as reported by the Ministry of Health. Most of the medical waste is believed to be generated from the mentioned facilities. National Referral Hospitals are estimated to generate an average of 1338 kg of medical waste per day. A case study (NEMA, 2014) at Soroti Regional Referral Hospital gives an average of 92 kg of waste (all waste combined) per day and 87 kg of waste is estimated for General Hospitals. Medical waste is assumed to be 40% of the waste in Referral and General Hospitals. In this assessment, it is assumed medical wastes are incinerated at facilities under simple particulate matter systems. The quantities of medical waste are estimated as shown below;

Amount of medical waste from National Referral Hospitals;

= 2*1,338*365

= 976,740 kg

Amount of medical waste from Regional Referral Hospitals;

= 0.4*14*92*365

=188,048 kg

Amount of medical waste from General Hospitals;

=0.4*139*87*365

=1,765,578 kg

Total medical waste generated in the country (**MT**)

= (976,740 + 188,048 + 1,765,578)/1,000

= **2,930**

The summary of Inputs and results of incineration of medical waste is detailed in table 29 below.

Table 29: Summary of Inputs and Results of Incineration of Medical Waste

Incineration of medical waste	Unit	Production	Use	Disposal
Activity rate	t(waste incinerated)/y			2,930
Input factor for phase	g Hg/t (waste incinerated)			24
Calculated input to phase	kg Hg			70
Output distribution factors for phase:				
- Air			-	0.90
- Water			-	0.00
- Land			-	0.00
- Products			-	0.00
- General waste treatment			-	0.00
- Sector specific waste treatment			-	0.10
Calculated outputs/releases to:				
- Air	kg Hg		-	63.00
- Water			-	0.00
- Land			-	0.00
- Products			-	0.00
- General waste treatment			-	0.00
- Sector specific waste treatment	kg Hg			7.00

2.5.3 Informal Waste Burning (open fire waste burning on landfills and informally)

A study was conducted on waste management in nine Urban Centres from the political-administrative regions of Uganda namely; Central: Kampala City, Entebbe Municipality, Masaka Municipality and Nansana Town Council; Eastern: Jinja Municipality, Mbale Municipality and Soroti Municipality; Northern: Lira Municipality; Western: Fort Portal Municipality. Selection of the urban areas for the study was based on urban population and socio-cultural variations.

The findings indicated that waste was predominantly biodegradable (78%) with a generation rate of 0.55 (0.3 to 0.66) kg/capita/day[9] and collection coverage of 43.7%. A range of methods involving interviews, questionnaires, observations and document reviews were used to obtain quantitative and qualitative data. The survey found out that the average waste generation rate of 0.55 kg/cap/day was comparable to National Environment Management Authority (2007) results. Uncollected wastes are burnt (74.1%) or dumped (15.2%) in open places. The rest is understood to be well managed under city and municipality authorities.

The above generation rate and the human population of Uganda as of 2014 (34,856,813 inhabitants) were

used to extrapolate the total waste generated in 2014.

The amount of Informal waste burning (open fire waste burning on landfills and informally dumped) is as below;

0.741*total waste generated in the country in 2014

0.741*34,856,813*0.55*365 = 5,185,151,360.42 Kg (**5,185,151 MT**)

The summary of input and results of waste burning are detailed in table 30 below.

Table 30: Summary of Input and Results of Waste Burning

Informal waste burning	Unit	Production	Use	Disposal
Activity rate	t(waste burned)/y			5,185,151
Input factor for phase	g Hg/t (waste burned)			1
Calculated input to phase	kg Hg			5,185
Output distribution factors for phase:				
- Air			-	1.00
- Water			-	0.00
- Land			-	0.00
- Products			-	0.00
- General waste treatment			-	0.00
- Sector specific waste treatment			-	0.00
Calculated outputs/releases to:				
- Air	kg Hg		-	5,185.00
- Water			-	0.00
- Land			-	0.00
- Products			-	0.00
- General waste treatment			-	0.00
- Sector specific waste treatment				0.00

2.6 Waste deposition/landfilling and waste water treatment

2.6.1 Test of Waste and Wastewater Default Factors

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

The test made for general waste compares the calculated inputs to all four general waste sub-categories with the sum of general waste outputs from intentional mercury uses in products plus processes as follows, using data from the Inventory Level 2 spread sheet:

In the IL2 spread sheet the test was done as follows; tab “Level 2-Summary”:

A test with original IL2 input factor of 5 g/ tonne of waste:

(E59+E63+E65+E68) > 2*(J23 + ∑(J36 to J53)).

(0 + 25,926 + 30 + 31,314) > 2(0 + (4 + 1,464 +119 +2,369 + 17 +33))*

*57,270> 8,013.5 (**test is positive**)*

A test with revised input factor of 1 g/ tonne of waste:

(0 + 5,185 + 6 + 1,078) < 2*(0 + (6 + 132 + 60 + 4,025 + 32 + 62))

6,269< 8,632.34 (test is negative)

The test made for wastewater compares the calculated inputs to wastewater treatment with the sum of outputs to water from intentional mercury uses in products plus processes as follows, using data from the Inventory level 2 spread sheets:

In the IL2 spread sheet the test was done as follows; tab "Level 2-Summary":

E69 > 2*(G23 + ∑ (G36 to G53)).

380 < 2*(2,301 + 4 + 99 + 20 + 33)

380 < 4,916 (***test is negative***)

The tests made for waste in light of the final choice of input factors indicate that the default input factors for general waste does not over-estimate the mercury releases from waste treatment. The same is the case for wastewater treatment.

2.6.2 Controlled Landfills/ Deposits

Findings by NEMA (2014) indicate that about 600,000 MT of waste is estimated to have been landfilled across the country in 2014. It is further reported that there are fifteen (15) controlled landfills in the country; each with a full operational capacity of 20,000 MT per six (6) months. Based on this information, the quantity of total waste into controlled landfills is as shown below;

Total waste estimated:

= (20,000*15 landfills*2) MT/Year

= 600,000MT/Year

However, the estimates used in the calculation were based on;

a) The landfill capacity assuming in full operation, and not on the actual waste received and landfilled;

b) The assumption that the landfills are in full operation throughout the year.

The summary of inputs and results of controlled landfills/deposits are detailed in table 31 below

Table 31: Summary of Inputs and Results of Controlled Landfills/Deposits

Controlled landfills/deposits	Unit	Production	Use	Disposal
Activity rate	t(waste)/y			600,000
Input factor for phase	g Hg/t (waste)			1
Calculated input to phase	kg Hg			600
Output distribution factors for phase:				
- Air			-	0.01
- Water			-	0.0001
- Land			-	0.00
- Products			-	0.00
- General waste treatment			-	0.00
- Sector specific waste treatment			-	0.00
Calculated outputs/releases to:				
- Air	kg Hg		-	6.00
- Water	kg Hg		-	0.06
- Land			-	0.00
- Products			-	0.00
- General waste treatment			-	0.00
- Sector specific waste treatment				0.00

Plate 8: Unsorted waste in the Kiteezi land fill in Kampala

Plate 9: Kiteezi land fill (left) and waste in a drainage channel (right) in Kampala

2.6.3 Informal Dumping of General Waste

From the literature as discussed in chapter 2.6.3, the amount general waste that is informally dumped is estimated as below;

= 0.154*total waste generated in the country in 2014

= 0.154*34856813*0.55*365
= 1,077,615,802.302 Kg (**1,077,616 MT**)

Based on the calculated estimates of mercury inputs to intentional mercury uses, and the default input test performed on the intermediate default factor (5 g Hg/t waste), which tested high estimates, the low range default value of 1 g Hg/t waste was applied in the calculations.The summary of inputs and results of informal dumping of general waste are detailed in table 32 below.

Table 32: Summary of Inputs and Results of Informal Dumping of General Waste

Informal dumping of general waste	Unit	Production	Use	Disposal
Activity rate	t(waste)/y			1,077,616
Input factor for phase	g Hg/t (waste)			1
Calculated input to phase	kg Hg			1,078
Output distribution factors for phase:				
- Air		-		0.10
- Water		-		0.10
- Land		-		0.80
- Products		-		0.00
- General waste treatment		-		0.00
- Sector specific waste treatment		-		0.00
Calculated outputs/releases to:				
- Air	kg Hg	-		107.80
- Water	kg Hg	-		107.80
- Land	kg Hg	-		862.40
- Products		-		0.00
- General waste treatment		-		0.00
- Sector specific waste treatment		-		0.00

Plate 10: Open dumping of waste at a Health Center in Butambala District

2.6.4 Waste Water System/Treatment

There are 2 conventional waste water treatment systems and 27 stabilisation ponds with capacities of 33,000 m^3 and 5,000 m^3 per day respectively as reported by National Water & Sewerage Corporation[10].The former is only applicable at Bugolobi Sewage Treatment Works for Kampala City and one plant in Masaka. Farmers collect dried sludge for use as manure in crop and flower gardens. 73,365,000 m^3 is estimated to be generated annually from all the systems in Uganda as calculated below;

Total waste water at conventional treatment systems

$2*33,000*365 = 24,090,000\ m^3$

Total waste water at stabilization ponds

$27*5,000*365 = 49,275,000\ m^3$

Total waste water from all systems

$= (49,275,000 + 49,275,000)\ m^3$

$= \mathbf{73,365,000\ m^3}$

The summary of inputs and results of waste water systems/treatment are detailed in table 33 below

Table 33: Summary of Inputs and Results of Waste Water Systems/Treatment

Waste water systems/treatment	Unit	Production	Use	Disposal
Activity rate	m^3 waste water			73,365,000
Input factor for phase	mg Hg/m^3 waste water			5.25
Calculated input to phase	kg Hg			385
Output distribution factors for phase:				
- Air		-		0.00
- Water		-		0.50
- Land		-		0.20
- Products		-		0.00
- General waste treatment		-		0.15
- Sector specific waste treatment		-		0.15
Calculated outputs/releases to:				
- Air		-		0.00
- Water	kg Hg	-		192.50
- Land	kg Hg	-		77.00
- Products		-		0
- General waste treatment	kg Hg	-		57.75
- Sector specific waste treatment	kg Hg	-		57.75

2.7 Consumer Products with Intentional use of Mercury and other Intentional Products/ Process uses

2.7.1 Medical Thermometers and Manometers

There is no production of such measuring equipment in Uganda. COMTRADE data has been used to ascertain the number of medical thermometers that were imported in the recent years 2013-2015 and it should be noted there is no production of such items in the country. Thermometers and pyrometers; liquid filled, for direct reading, not combined with other instruments- 902511 ("Mercury Learn - HS codes," 2015) has been used for the search. It has been estimated by informant health officers that 80% of the medical thermometers are estimated to be filled with mercury. The average number of thermometers for inventory calculations has been based on the quantities imported in the years 2013, 2014 and 2015. From interactions with medical practitioners, it is estimated, there is 1 manometer blood pressure gauge for every 10 thermometers. Usually for cases of such waste, there is no separate collection and waste handling is informal.

$Consumption_{average}$ for the years 2013- 2015

The quantity of medical thermometers is detialed in table 34 below.

Table 34: Quantity of Medical Thermometers

Year	Import(items)	Export(items)	Consumption(items)
2011	2,488	-	2,488
2012	9,573	10	9,563
2013	62,760	56	62,704
2014	13,953	-	13,953
2015	270	1	269

$Consumption_{average}$ for 2013-15:

= (62,704 + 13,953 + 269)/3

= 25642

Considering 80% of the total to be mercury filled medical thermometers,

= 0.8*25,642

= **20,514**

Number of manometer blood pressure gauges = 0.1*25,642

= 2,564

The summary of input and results of mercury filled medical thermometers is detailed in table 35 below.

Table 35: Summary of Input and Results of Mercury Filled Medical Thermometers

Medical thermometers	Unit	Production	Use	Disposal
Activity rate	Items	-	-	20,514
Input factor for phase	g Hg/item	-	-	1
Calculated input to phase	kg Hg	-	-	21
Output distribution factors for phase:				
- Air		-	-	0.20
- Water		-	-	0.30
- Land		-	-	0.20
- Products		-	-	0.00
- General waste treatment		-	-	0.30
- Sector specific waste treatment		-	-	0.00
Calculated outputs/releases to:				
- Air	kg Hg	-	-	4.10
- Water	kg Hg	-	-	6.15
- Land		-	-	4.10
- Products		-	-	0.00
- General waste treatment	kg Hg	-	-	6.15
- Sector specific waste treatment	kg Hg			0.00

2.7.2 Electrical Switches and Relays with Mercury

Plate 11: Pressure gauge with Mercury

Plate 12: Medical thermometers with Mercury

Switches are devices used to open or close an electrical circuit, or a liquid or gas valve. Examples of switches are; float switches triggered by a change in liquid levels, tilt switches activated by a change in position and flame sensors activated by a change in temperature. These switches can be found in pumps, appliances,

ranges/ovens and a variety of machinery. Relays are devices used to open or close electrical contacts to control another device in the same circuit. They are often used to turn off large electrical currents by supplying a small amount of electricity to a control circuit. They can be found in telecommunication circuit boards and industrial ovens.

There is currently no production of electrical switches and relays in the country. The data has been estimated using the number of inhabitants and electrification rate in 2014. It is reported that 34,856,813 inhabitants were in the Uganda in 2014 and 9% was the electrification rate (UNEP, 2005) resulting into 439 kg Hg as observed in the toolkit. It has been found that informal waste handling is more pronounced in Uganda and there is no separate collection and handling for the switches. The summary of inputs and results of electrical switches and relays with mercury is detailed in table 36 below.

Table 36: Summary of Inputs and Results of Electrical Switches and Relays with Mercury

Electrical Switches and relays with mercury	Unit	Production	Use	Disposal
Activity rate	Inhabitants	-	-	34,856,813
Input factor for phase	g Hg/inhabitant	-	-	0.14
Calculated input to phase	kg Hg	-	-	439
Output distribution factors for phase:				
- Air		-	-	0.30
- Water		-	-	0.00
- Land		-	-	0.40
- Products		-	-	0.00
- General waste treatment		-	-	0.30
- Sector specific waste treatment		-	-	0.00
Calculated outputs/releases to:				
- Air	kg Hg	-	-	131.76
- Water		-	-	0.00
- Land	kg Hg	-	-	175.68
- Products		-	-	0.00
- General waste treatment	kg Hg	-	-	131.76
- Sector specific waste treatment				0.00

2.7.3 Light Sources with Mercury

These include; compact fluorescent lamps often used in residential settings as an energy efficient substitute for incandescent lamps, linear fluorescent lamps frequently found in commercial and industrial buildings, high pressure mercury vapour lamps used for large area overhead lighting such as factories, warehouses, sports arena and streetlights and Cold cathode fluorescent lamps and external electrode fluorescent lamps for electronic displays.

There is currently no production of mercury containing lamps in Uganda. All lamps into the country are imported from other countries, the majority from China.

Under the category “light sources with Mercury”, the quantities for the different sub-categories with the following HS codes : 853931 - Lamps; discharge, (excluding ultra-violet), fluorescent, hot cathode (“Mercury Learn - HS codes,” 2015), 853939 - Lamps; discharge, (excluding ultra-violet, excluding fluorescent, hot cathode) and 853949 - Lamps; ultra-violet or infra-red lamps, (excluding arc-lamps); have been obtained from COMTRADE. The average values for the years 2013-2015 for each of the sub-categories have been considered as the estimated net consumption. The proportion of fluorescent tubes (double end) to single ended fluorescent compact lamps has estimated to be 50% of the total. In conclusion, light sources wastes have no separate collection and are informally dumped.

The results from COMTRADE database are as shown in tables 37,38,39,40 and 41 below;

Table 37: Quantities of Fluorescent Lamps- Hot cathode

Year	Import(items)	Export(items)	Consumption(items)
2011	700,259	498	699,761
2012	4,089,914	1,458	4,088,456
2013	2,615,560	152	2,615,408
2014	3,437,206	56,476	3,380,730
2015	2,243,837	81	2,243,756

$Consumption_{average}$ for 2013-15:

= (2,615,408 + 3,380,730 + 2,243,756)/3

= 2,746,631 lamps

Table 38 Quantities of Discharge Lamps Excluding UV

Year	Import(items)	Export(items)	Consumption(items)
2011	498,665	1,558	497,107
2012	4,505,565	679	4,504,886
2013	4,347,344	67	4,347,277
2014	7,959,239	942	7,958,297
2015	4,713,234	4,459	4,708,775

$Consumption_{average}$ for 2013 to 15:

= (4,504,886 + 7,958,297 + 4,708,775)/3

= 5,671,450 lamps

Table 39: Lamps-UV or Infra-red Including Arc Lamps

Year	Import(items)	Export(items)	Consumption(items)
2011	13,538	75	13,463
2012	75,503	126	75,377
2013	19,617	2,578	17,039
2014	86,493	371	86,122
2015	72,844	280	72,564

$Consumption_{average}$ for 2013 to 15:

= (17,039 + 86,122 + 72,564)/3

= 58,575 lamps.

Number of double ended fluorescent tubes

= 0.5*(58,575 + 5,671,450 + 2,746,631)

= **4,238,328**

Table 40: Quantities of High Pressure Sodium Lamps

Year	Import(items)	Export(items)	Consumption(items)
2011	1,315	-	1,315
2012	4,429	-	4,429
2013	5,165	-	5,165
2014	56,457	-	56,457
2015	6,652	-	6,652

$Consumption_{average}$ for 2013 to 15:

= (5,165 + 56,457 + 6,652)/3

= **22,758** lamps

To minimise the potential error in the mercury content of lamps, quantities of high pressure sodium lamps have been distributed evenly on the 2 specialty lamp categories imported in Uganda because their mercury contents are quite alike.

Therefore, the number of single ended fluorescent compact lamps = 4,238,328 + (22758/2)

= 4,249,707 lamps

Table 41: Summary of Input and Results of Light Sources with Mercury

Light sources with mercury	Unit	Production	Use	Disposal
Activity rate	-	-	-	-
Input factor for phase	-	-	-	-
Calculated input to phase	kg Hg	-	-	149
Output distribution factors for phase:				
- Air		-	-	0.30
- Water		-	-	0.00
- Land		-	-	0.30
- Products		-	-	0.00
- General waste treatment		-	-	0.40
- Sector specific waste treatment		-	-	0.00
Calculated outputs/releases to:				
- Air	kg Hg	-	-	44.64
- Water		-	-	0.00
- Land	kg Hg	-	-	44.64
- Products		-	-	0.00
- General waste treatment	kg Hg	-	-	59.52
- Sector specific waste treatment				0.00

2.7.4 Batteries with Mercury

For batteries with mercury, quantities used in the country in recent years (2013-2015) were obtained from the average of sub categories with HS codes of: 850630 Cells and batteries; primary, mercuric oxide ("Mercury Learn - HS codes," 2015) as showcased in the COMTRADE database. From the assessment, 4,578 MT is the net import into Uganda in 2014. This figure appears quite high for this kind of specialty battery, and as

well it cannot be ruled out that some other batteries with lower mercury contents (for example other button cell battery types) could have been misreported under this code.

The quantities of batteries with mercury are contained in table 42 below.

Table 42: Quantities of Batteries with Mercury

Year	Import(kg)	Export(kg)	Consumption(kg)
2011	1,347	960	387
2012	304	23,700	(23,396)
2013	4,050	-	4,050
2014	6,278	1,700	4,578
2015	38,126	200	37,926

For clear statistical purposes, years; 2011, 2013 and 2014 are considered for this category of batteries.

Average Consumption = (387 + 4,050 + 4,578)/3

= 3,005 kg (**3 MT**)

Cells and batteries (850660); primary, air-zinc and 850640 Cells and batteries; primary, silver oxide ("Mercury Learn - HS codes," 2015) revealed 5.804MT as imports in 2014 as seen in Table 43 below.

Table 43: Quantities of Batteries with Mercury

Year	Import(kg)	Export(kg)	Consumption(kg)
2011	16,570	4,400	12,170
2012	2,026	200	1,826
2013	518	65,343	(64,825)
2014	5,804	-	**5,804**
2015	3,371	1,800	1,571

Cells and batteries (850640); primary, silver oxide gives 3.06 MT as net imports into the Uganda in 2014 as seen in the Table 44 below.

Table 44: Quantities of Batteries with Mercury

Year	Import(kg)	Export(kg)	Consumption(kg)
2011	13	1,760	(1,747)
2012	27	2,354	(2,327)
2013	9,802	79,000	(69,198)
2014	3,060	-	**3,060**
2015	149	500	(351)

Other batteries with mercury (plain cylindrical alkaline, permanganate) include; 850610 - cells and batteries; primary, manganite dioxide and 850680 – cells and batteries; primary (other than manganese dioxide, mercury oxide, silver oxide, Lithium or air zinc). The results from COMTRADE database are as seen in the table hereunder, average consumption for the years 2013-2015 of the individual types are estimated as the consumptions for 2014. The individual contributions are summed up to have the total quantity of other batteries with mercury. In Uganda, cells and batteries wastes of have no separate collection and are informally handled and disposed.

Cells and batteries (850610); primary, manganite dioxide, see Table 45,46 and 47 below

Table 45 Quantities of Batteries with Mercury

Year	Import(kg)	Export(kg)	Consumption(kg)
2011	675,405	2,985	672,420
2012	1,116,293	2,058	1,114,235
2013	1,279,430	72,120	1,207,310
2014	1,284,163	1,450	1,282,713
2015	1,382,135	14,315	1,367,820

$Consumption_{average}$ for 2013 to 15:

= (1,207,310 + 1,282,713 + 1,367,820)/3

= 1,285,948 kg (**1,286** MT)

Cells and batteries (850680); primary (other than manganese dioxide, mercury oxide, silver oxide, Lithium or air zinc):

Table 46: Quantities of Batteries with Mercury

Year	Import(kg)	Export(kg)	Consumption(kg)
2011	17,480,326	366,255	17,114,071
2012	13,061,347	9,034	13,052,313
2013	10,722,226	102,195	10,620,031
2014	12,340,296	211,225	12,129,071
2015	9,441,151	25,833	9,415,318

$Consumption_{average}$ for 2013 to 15:

= (10,620,031 + 12,129,071 + 9,415,318)/3

= 10,721,473.3 kg (**10,721** MT)

Total quantity of other batteries with mercury (MT) = 1,286 + 10,721= **12,007**

Table 47: Summary of input and results of Batteries with Mercu

Batteries with mercury	Unit	Production	Use	Disposal
Activity rate	-	-	-	-
Input factor for phase	-	-	-	-
Calculated input to phase	kg Hg	-	-	8,050
Output distribution factors for phase:				
- Air		-	-	0.25
- Water		-	-	0.00
- Land		-	-	0.25
- Products		-	-	0.00
- General waste treatment		-	-	0.50
- Sector specific waste treatment		-	-	0.00
Calculated outputs/releases to:				
- Air	kg Hg	-	-	2,012.38
- Water		-	-	0.00
- Land	kg Hg	-	-	2,012.38
- Products		-	-	0.00
- General waste treatment	kg Hg	-	-	4,024.75
- Sector specific waste treatment				0.00

2.7.5 Polyurethane with Mercury Catalysts

For mercury emissions and releases quantification assessment, the number of inhabitants of 34,856,813 (Statistics, 2015) and electrification rate of 9 % (UNEP, 2005) have been used to ascertain the amount of mercury released into the environment from polyurethane with mercury catalysts. The summary of inputs and results of polyurethane with mercury catalysts is contained in table 48 below.

Table 48: Summary of Inputs and Results of Polyurethane with Mercury Catalysts

Polyurethane with mercury catalysts	Unit	Production	Use	Disposal
Activity rate	-	-	-	-
Input factor for phase	-	-	-	-
Calculated input to phase	kg Hg	-	-	282.34
Output distribution factors for phase:				
- Air		-	-	0.20
- Water		-	-	0.10
- Land		-	-	0.40
- Products		-	-	0.00
- General waste treatment		-	-	0.30
- Sector specific waste treatment		-	-	0.00
Calculated outputs/releases to:				
- Air	kg Hg	-	-	56.47
- Water		-	-	28.23
- Land	kg Hg	-	-	112.94
- Products		-	-	0.00
- General waste treatment	kg Hg	-	-	84.70
- Sector specific waste treatment				0.00

2.7.6 Cosmetics and Related Products with Mercury

There is no production of mercury containing cosmetics that has been concretely identified in Uganda. Mercury containing skin lightening cosmetics[11] are smuggled into the country from West African countries through porous borders.

Quantities of cosmetics and related products with mercury have been estimated from the amounts of the aforementioned products seized by customs officers of Uganda Revenue Authority (URA) since their importation is banned by the government of Uganda. The seized quantity obtained has been used to extrapolate for the estimated total quantities smuggled into the country for the year 2014 with the assumption that the seized figures represented only 20 % of the total smuggled. Therefore, a total of about 3.465 MT was obtained as the cosmetics and related products with mercury estimated to have been smuggled into the country in 2014.

Quantity of estimated cosmetics with mercury as seized by the Customs Officers in 2014 was 63 cartons, each with averagely 11 kg.
Assuming a 20% efficiency of the operation due to the porous nature of the boarders, the estimated weight of cosmetics with mercury into Uganda is;

= (63/0.2) *11
= 3,465 kg (**4** MT)

The summary of inputs and results of cosmetics and related products with mercury is contained in table 49 below.

Table 49: Summary of Inputs and Results of Cosmetics and Related Products with Mercury

Cosmetics and related products with mercury	Unit	Production	Use	Disposal
Activity rate	t/y	-	-	4
Input factor for phase	kg Hg/t	-	-	30
Calculated input to phase	kg Hg	-	-	104
Output distribution factors for phase:				
- Air		-	-	0.00
- Water		-	-	0.95
- Land		-	-	0.05
- Products		-	-	0.00
- General waste treatment		-	-	0.00
- Sector specific waste treatment		-	-	0.00
Calculated outputs/releases to:				
- Air		-	-	0.00
- Water	kg Hg	-	-	98.75
- Land	kg Hg	-	-	5.20
- Products		-	-	0.00
- General waste treatment		-	-	0.00
- Sector specific waste treatment				0.00

2.7.7 Dental Amalgam Fillings

National Environment Management Authority implemented a project "East African Dental Amalgam Phase Down" in 2012 in relation to the Minamata Convention on Mercury which identified and described, in Article 4 and Annex A part II, measures to be undertaken in order to phase down the use of dental amalgam while taking into account the country's domestic circumstances and relevant international guidance.

This project aimed at;

a) increasing national capacity to reduce need, demand, and use of dental amalgam as well as reducing the releases of dental amalgam waste to water and land in a measurable, equitable and sustainable manner; and,

b) Increasing adoption and use of standardised guidance, resources and tools to reduce need, demand and use of dental amalgam and disposal of dental amalgam waste in an environmentally sound manner.

The project activities included awareness raising, training of dental health staff, production of dental awareness materials, installation of dental separators at demonstration sites (Jubilee Dental, Mengo Hospital and Mulago Hospital), documentation of country dental trade data and waste management practices among others

However, during the implementation of the project the following challenges were encountered;

a) Low acceptability by dentists on phasing down dental amalgam.

b) Difficulty in co-ordinating stakeholders (traders/importers, dental health sector, regulators and the public) and yet management of mercury in products and dental amalgam is cross cutting.

c) Non availability of separators (blockage/filling up of the separators require installation of separators as quickly as possible and yet they are not locally available).

d) Awareness raising and sound management of mercury waste are still a challenge.

Mercury output estimates have been calculated using country population of 34,856,813 inhabitants (2014) and dentistry personnel density of 0.0017. The output scenarios include; preparations of fillings at dentist clinics, use and disposal as seen in tables 50,51 and 52 below. In Uganda, a few clinics, only those supported during the East African Dental Amalgam Phase down project, are equipped with high efficiency amalgam filters (95% retention rate). However, it should be noted that, during the process of undertaking the mercury inventory, Health Ministry representatives estimated about 15% of fillings are made in facilities with amalgam separators.

Table 50: Summary of Input and Results of Dental Amalgam preparing of fillings

Dental amalgam(preparation of fillings)	Unit	Production	Use	Disposal
Activity rate	Inhabitants	34,856,813	-	-
Input factor for phase	g Hg/inhabitant	0.2	-	-
Calculated input to phase	kg Hg	143	-	-
Output distribution factors for phase:				
- Air		0.02	-	-
- Water		0.14	-	-
- Land		-	-	-
- Products		-	-	-
- General waste treatment		0.12	-	-
- Sector specific waste treatment		0.12	-	-
Calculated outputs/releases to:				
- Air		2.86	-	-
- Water	kg Hg	20.01	-	-

Dental amalgam(preparation of fillings)	Unit	Production	Use	Disposal
- Land	kg Hg	0.00	-	-
- Products		0.00	-	-
- General waste treatment		17.15	-	-
- Sector specific waste treatment		17.15		-

Table 51 Summary of input and results of Dental Amalgam (Use)

Dental amalgam(Use)	Unit	Production	Use	Disposal
Activity rate	Inhabitants		34,856,813	-
Input factor for phase	g Hg/inhabitant		0.2	-
Calculated input to phase	kg Hg		143	-
Output distribution factors for phase:				
- Air		-	-	-
- Water			0.02	-
- Land		-	-	-
- Products		-	-	-
- General waste treatment		-	-	-
- Sector specific waste treatment		-	-	-
Calculated outputs/releases to:				
- Air			0.00	-
- Water	kg Hg		2.86	-
- Land			0.00	-
- Products			0.00	-
- General waste treatment			0.00	-
- Sector specific waste treatment			0.00	-

Table 52: Summary of input and results of Dental Amalgam (Disposal)

Dental amalgam(Disposal)	Unit	Production	Use	Disposal
Activity rate	Inhabitants	-	-	34,856,813
Input factor for phase	g Hg/inhabitant	-	-	0.2
Calculated input to phase	kg Hg	-	-	143
Output distribution factors for phase:				
- Air		-	-	-
- Water			-	0.3
- Land		-	-	0.08
- Products		-	-	0.06
- General waste treatment		-	-	0.08
- Sector specific waste treatment		-	-	0.08
Calculated outputs/releases to:				
- Air				0.00
- Water	kg Hg	-	-	36.45
- Land	kg Hg	-	-	9.72
- Products	kg Hg	-	-	7.29
- General waste treatment	kg Hg	-	-	9.72
- Sector specific waste treatment	kg Hg	-	-	9.72

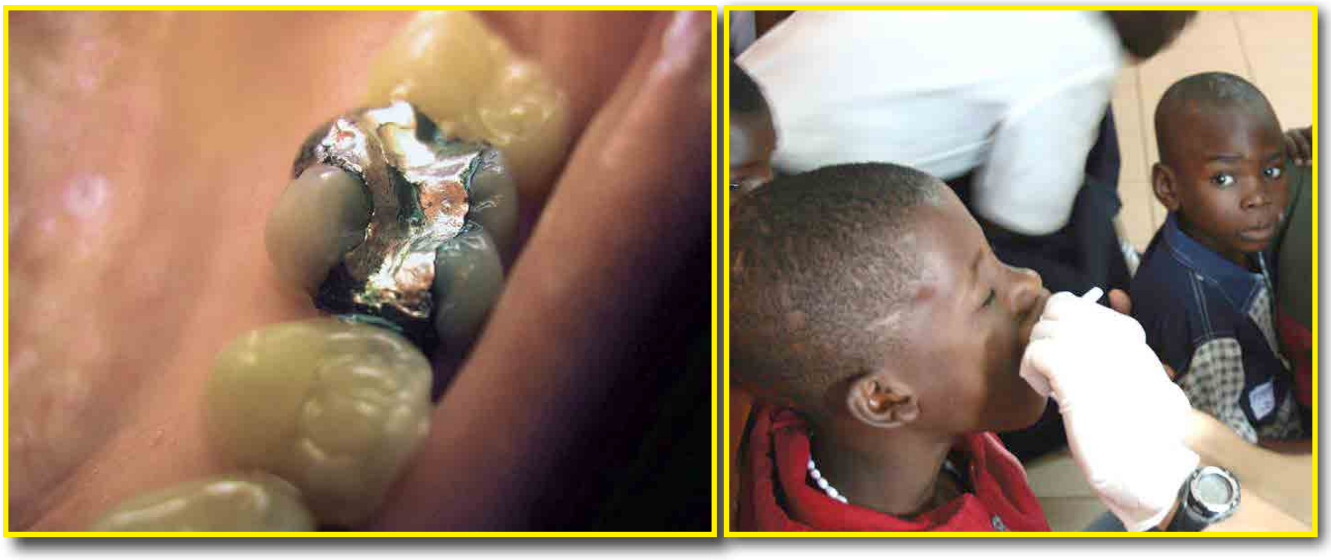


PLate 13*: L-R:* Dental amalgam fillings
Source: Ministry of Health-Uganda

Plate 14: Dental amalgam
Source: Ministry of Health-Uganda

2.8 Data and Inventory on Crematoria and Cemeteries

2.8.1 Crematoria

From the population statistics, mortality rate was at 10.4 persons per 1000; and it is reported that 30,000 Asians live in Uganda. It is reported that due to fact that Asians cremate dead bodies by virtue of their culture, about 312 Asians are estimated to have died and were cremated in 2014 using the calculations seen below;

Total Number of death = mortality rate*total population

= (10.4/1,000) *34,856,813
= 362,511 corpses

Estimated Number of Asians who died in 2014 = (30,000/34,856,813) *362,511

= 312 corpses

In consideration of the relatively low level of dental care in Uganda, the low range default factor for mercury per corpse was selected for burial. For the Asian population (using cremation), the same may not be the case, as they generally belong to the higher income groups.The summary of inputs and results of crematoria is contained in table 53 below

Table 53: Summary of Inputs and Results of Crematoria

Crematoria	Unit	Production	Use	Disposal
Activity rate	Corpses			312
Input factor for phase	g Hg			2.5
Calculated input to phase	kg Hg			0.78
Output distribution factors for phase:				
- Air		-	-	1.00
- Water		-	-	0.00
- Land		-	-	0.00
- Products		-	-	0.00
- General waste treatment		-	-	0.00
- Sector specific waste treatment		-	-	0.00
Calculated outputs/releases to:				
- Air	kg Hg	-	-	0.78
- Water		-	-	0.00
- Land		-	-	0.00
- Products		-	-	0.00
- General waste treatment		-	-	0.00
- Sector specific waste treatment		-	-	0.00

2.8.2 Cemeteries

This is the most common form of burial practiced in Uganda. Statistically, mortality rate of 10.4 persons per 1000 is used to compute the number of corpses from the number of inhabitants in 2014. From crematoria estimates above, the number of cemeteries is equal to the total number of corpses in the country in 2014 less than that by crematoria; 362,199 corpses are estimated to have been buried.

In the light of the low general level of dental care in the country, the input factor here was adjusted to the low range default factor 1 g Hg/corpse. Thesummary of inputs and results of cemeteries is contained in table 54 below.

Table 54: Summary of Inputs and Results of Cemeteries

Cemeteries	Unit	Production	Use	Disposal
Activity rate	Corpses			362,199
Input factor for phase	g Hg/corpse			1
Calculated input to phase	kg Hg			362
Output distribution factors for phase:				
- Air		-	-	0.00
- Water		-	-	0.00
- Land		-	-	1.00
- Products		-	-	0.00
- General waste treatment		-	-	0.00
- Sector specific waste treatment		-	-	0.00
Calculated outputs/releases to:				
- Air	kg Hg	-	-	0.00
- Water		-	-	0.00
- Land		-	-	362.00
- Products		-	-	0.00
- General waste treatment		-	-	0.00
- Sector specific waste treatment		-	-	0.00

2.9 Contaminated Sites

The main mercury contaminated sites are ASGM sites due to mercury tailings and processing/burning activities of the amalgam. A comprehensive assessment of mercury contaminated sites has not yet been conducted in Uganda. Figure 4 details ASGM/ potential mercury contaminated sites in Uganda.

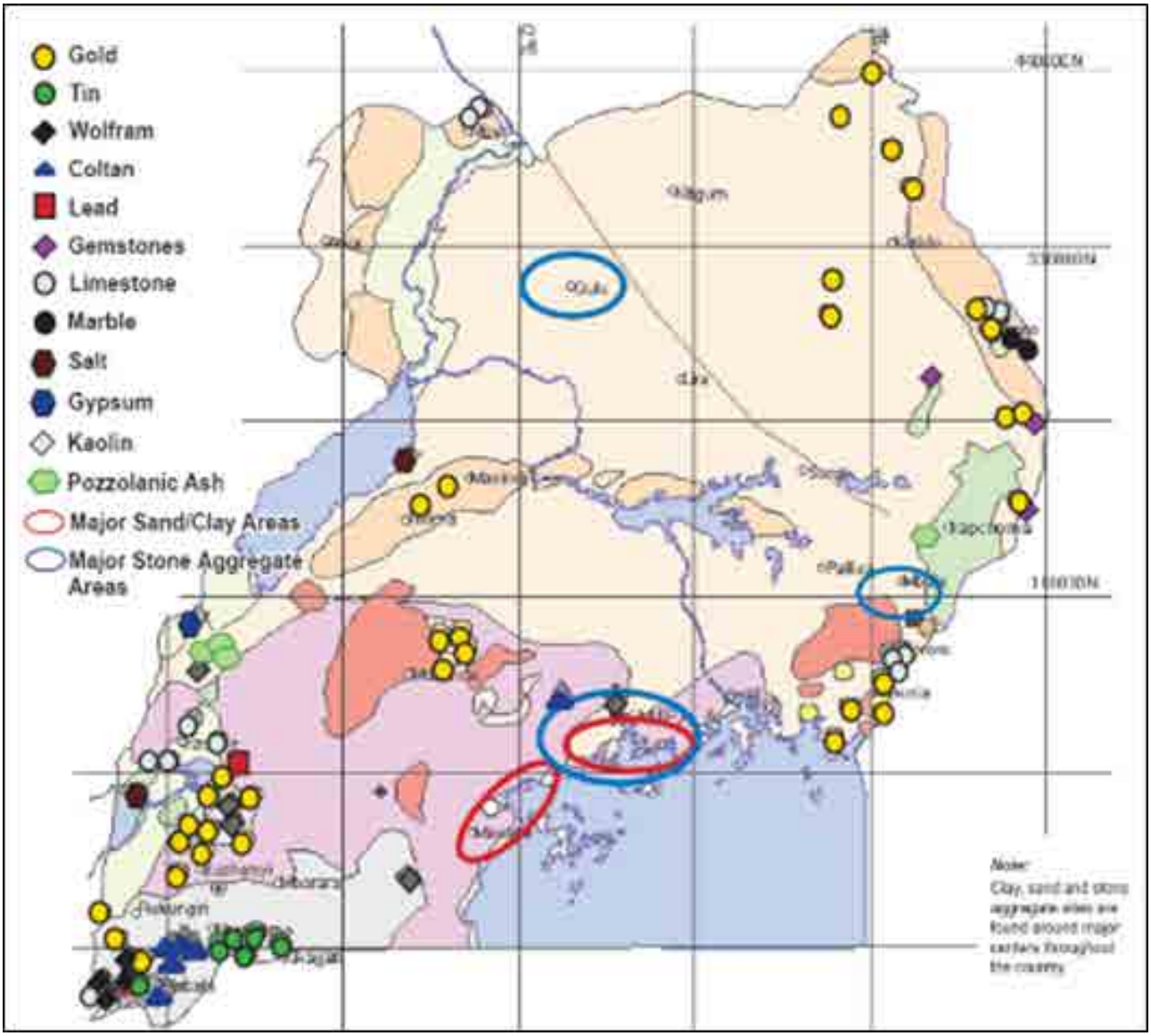


Figure 4: ASGM sites in Uganda

Artisanal and Small scale Gold Mining (ASGM) is of great national and local importance in Uganda. Gold was the second most important export after coffee in Uganda. Gold earned 204 million USD in foreign revenue in the financial year 2015/2016[12]. Locally, ASGM is an important source of income and employment to miners and their dependents. The widespread unemployment and poverty in rural areas where alternative work is not available or is of low/ no pay, ASGM has become a primary mean of survival. Despite the economic and social benefits of ASGM, the practice has far reaching negative externalities on the environment, society and human health. It is important to note that;

a) Artisanal and Small scale Gold Mining has a number of negative effects on the environment. Natural landscapes are destroyed as miners excavate deep into the earth's crust in search of gold. These resulting pits are usually not refilled after excavation.

In addition, ASGM miners who use mercury to amalgamate gold indiscriminately dispose tailing back into the environment (soils and water bodies). This introduces mercury (an inorganic and non-degradable compound) into the environment.

b) Artisanal and Small scale Gold Mining has resulted into sharp increase in the price of land as more land is brought under mining as speculators buy more land. Similarly, there has been an influx of migrant workers looking for work. This increases pressure on natural resource services but also as more people go into ASGM, less labour is available for agriculture.
As more people migrate into ASGM areas, there has been an increase in the costs of living in ASM areas as there are a lot of people and money chasing few goods,

c) Another potential risk of ASGM is increase in child labour. This has a significant negative effect on education levels as more and more children leave school and join the informal Labour force in the mines. The percentage of children (<18 years) among miners ranges from 0 to 5% whereas children (<14 years) ranges from 0 to 2% (NEMA, 2016).
The children pan concentrates containing mercury and burn the gold amalgam. This has a long run implication of reducing social capital in the ASGM areas. Such areas are thus at a risk of chronically remaining poor when the gold deposits become exhausted.

d) Truancy; with increased child Labour, there is a high level of school drops outs in the artisanal mining communities. Children are lured into works, with little payments, which makes them have no time for school at all.

2.9.1 Impacts of Mercury on Human Health and the Environment

The effects of mercury on human health are well documented (ATSDR, 1999; Clarkson 2002; Counter and Buchanan 2004). The tragic poisoning event of 2000 people around Minamata Bay, Japan between 1953 and 1968 instigated numerous studies that identified the neurological system and kidney as primary target organs of methyl mercury exposure (Clarkson 2002; Counter and Buchanan 2004; Wiggle 2003). Another devastating outbreak of methyl mercury poisoning occurred in rural Iraq in 1971-1972 where 40,000 people were poisoned and 6000 cases were admitted to the hospital (Clarkson 2002; Counter and Buchanan 2004; Wiggle (2003). The outbreak occurred after seed grain treated with a methyl mercury fungicide was accidentally consumed by locals (Clarkson 2002; Counter and Buchanan 2004).

Evidence of the severe health effects associated with mercury exposure in these major epidemics have been the cornerstone and impetus for further epidemiologic and clinical studies investigating the biological effects of mercury. The outcome of these studies has led to numerous health warnings and the creation of mercury pollution regulations and monitoring programs around the globe. Health effects of mercury include;

a) It is a threat to the development of fetuses and young children.
b) In the vapour form, it is rapidly absorbed into the blood stream when inhaled and damages the central nervous system, thyroid, kidneys, lungs, immune system, eyes, gums and skin.
c) In children it can cause neurological damage resulting in symptoms such as mental retardation, seizures, vision and hearing loss, delayed development, language disorders and memory loss (ATSDR, 1999; Clarkson 2002; Counter and Buchanan 2004; Wiggle (2003).

Studies have also shown that children with higher levels of contamination are more likely to be diagnosed with attention deficit hyperactivity disorder (Boucher *et al*., 2012). Symptoms can include numbness in the hands and feet, general muscle weakness, narrowing of the field of vision, and damage to hearing and speech. In extreme cases, insanity, paralysis, coma and death have been known to ensue rapidly (ATSDR, 1999; Clarkson 2002; Parson and Percival 2005; Wiggle (2003). Neurological and behavioral disorders may be signs of low levels of mercury exposure, with symptoms such as tremors, insomnia, memory loss, neuromuscular effects, headaches, and cognitive and motor dysfunction. In addition, studies have also shown mercury.

Chapter III: Policy, Regulatory and Institutional Framework Assessment

3.1 Policy and Regulatory Assessment

Ratification (or acceptance, approval or accession) of the Minamata Convention on mercury by a member country legally binds the country to the Convention's obligations. It is then important that local policies and regulations in member countries are aligned to the provisions and articles of the Convention that are binding and which apply in the Ugandan context. The current analysis aligns the binding articles of the convention with existing regulations and policies in Uganda. It also establishes the needs in the jurisprudence to ensure compliance to the provisions of the convention to enable Uganda reduce and eventually eliminate human and environmental exposure to mercury. Table 55 below presents summarizes national policies and regulatory measures needs for effective implementation of the Minamata Convention in Uganda.

Table 55: National Policy and Regulatory needs for effective implementation of the Minamata convention

Article 3 - Mercury supply sources and trade	
Description of Article	This article deals with sources of mercury and trade in mercury with the aim of reducing existing stock of mercury. It contains control measures aimed at limiting the global supply of mercury to complement and reinforce the demand reduction control measures.
Summary of Article Provisions	▪ Not to allow new primary mercury mining ▪ Prevent the import and use of mercury from primary mercury mining for artisanal and small-scale gold mining (ASGM) ▪ Obtain information on stocks of mercury or mercury compounds exceeding 50 metric tons (MT), and mercury supply generating stocks exceeding 10 MT/yr.[1] ▪ Not to allow the export of mercury unless the importing country provides written consent, [2] the mercury is for an allowed use or environmentally sound storage, and all other conditions of Article 3.6 are met[3] ▪ Not to 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)
Policy and regulatory measures in place that enable the country to comply with the above listed provisions:	
Mining Act, 2003	▪ No person may explore or prospect for, retain or mine or dispose of any mineral in Uganda except under a license issued under the Act. ▪ It is a criminal offence to mine without a license. ▪ The commissioner may grant to any person a permit to export minerals from Uganda on conditions determined by or under the Act.
Occupational Safety and Health Act, 2006	▪ In circumstances prescribed by the Government, it is the duty of a person who imports any article or chemical substance for use at work, to obtain adequate research information on its toxicity and harmful effects to the health of any worker exposed to it and to avail this information to any person concerned, in order to eliminate or minimise any risks to health or safety which the article or chemical substance may give rise to.
External Trade Act Cap 88	▪ This act makes provisions for the regulation of external trade and other connected matters. ▪ Export restricted goods under the Act mean goods in respect of which the Minister has made a statutory order prohibiting their export without a license. Import restricted goods mean goods in respect of which the Minister has made a statutory order prohibiting their import without a license. ▪ This act provides for restriction of import and export of certain goods.
Regulatory or policy recommendations to ensure compliance with the Convention's provisions:	
▪ New primary mining of mercury needs to be prohibited ▪ Prohibit the import of primary mercury for use in artisanal and small-scale gold mining (ASGM) ▪ Mercury needs to be classified as an export/import restricted good whose import and export are can only be permitted for specialized purposes or use. This needs to be accompanied by policy guidelines/laws regulating export and import of mercury which domesticate the provisions of the convention ▪ Creating an inventory of all mercury supplied for artisanal and small scale mining (ASGM).	

Article 4 - Mercury Added Products	
Description of Article	Deals with mercury added products banning their manufacture, import or export after their phase out date and minimizing use of mercury in dental amalgam. It seeks to reduce mercury demand in products 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.
Summary of Article Provisions	▪ Mercury-added product means a product or product component that contains mercury or a mercury compound that was intentionally added. ▪ Not allow the manufacture, import or export of mercury-added products listed in Part I of Annex A after the phase-out date specified for those products except where exclusion is specified in Annex A or the Party has a registered exemption pursuant to Article 6. ▪ Report at the first opportunity to the Conference of the Parties a description of the measures or strategies implemented, including a quantification of the reductions achieved. ▪ Consider additional measures to achieve further reductions. ▪ Take measures to prevent the incorporation into assembled products of mercury-added products the manufacture, import and export of which are not allowed for it under this Article. ▪ Discourage the manufacture and the distribution in commerce of mercury-added products not covered by any known use of mercury-added products. ▪ Take measures for the mercury-added products listed in Part II of Annex A in accordance with the provisions set out therein.
Policy and regulatory measures in place that enable the country to comply with the above listed provisions:	
Uganda National Bureau of Standards Act Cap 327	▪ This act establishes Uganda National Bureau of Standards (UNBS). It ensures that products comply with certain standards in manufacture, composition, treatment or performance and to prohibit substandard goods where necessary. ▪ It also enforces standards in the protection of the public against harmful ingredients, dangerous components, shoddy material and poor performance. In regard to the management of mercury, the bureau is thus required to ensure that manufacture of products such as drugs that use mercury or mercury compounds is done in accordance with sound and prescribed standards.
Food and Drugs Act Cap 278	▪ Under this Act, no person is to add any substance to food, use any substance as an ingredient in the preparation of food that renders the food injurious to health with intent that the food shall be sold for human consumption in that state. ▪ No person is to add any substance to a drug so as to affect injuriously the quality, constitution or potency of the drug. ▪ It is a criminal offence to sell foods and drugs whose quality has been injuriously affected by addition of substances such as mercury.

National Drug Policy and Authority Act Cap 206	▪ Exportation of restricted and controlled drugs without license is prohibited under the Act. ▪ There are certain drugs containing mercury compounds. Under the Act these are classified into different classes. These include restricted drugs namely; Hydrocyanic acid, cyanides; double cyanides of mercury and zinc Mercury, oxides of; nitrate of mercury, mercuric ammonium chlorides, potassio-mecuric iodides, organic compounds of mercury; oxycyanides, mercuric thiocyanates, mercuric chloride, mercuric iodide, mercurous chloride under Class B drugs or controlled drugs. These drugs and preparations containing them may only be supplied by retail by a registered pharmacist or licensed pharmacy. ▪ Class C drugs are licensed drugs which may be sold by retail only by a person or company operating a licensed pharmacy or a licensed drug seller. These include mercuric oxide when contained in yellow oxide of mercury ointment and mercury, its halides when contained in preparations for use in agriculture or horticulture. ▪ The Act imposes a strict restriction on the manufacture of classified drugs. Under the Act, no person is to mix, compound, prepare, supply or dispense any restricted drug unless that person is a registered pharmacist, medical practitioner, dentist or veterinary surgeon or a licensed person. ▪ No person is to supply any classified or restricted drug unless the drug is in a container of the prescribed description and the container bears a label giving the prescribed particulars of its contents. Such drugs containing mercury or compounds of mercury should clearly be labeled. ▪ No person is to carry on a business of supplying restricted drugs by wholesale unless he or she is authorized to carry on that business by a license. This expressly bars person not licensed from dealing in restricted or controlled drugs having mercury as one of their ingredients. ▪ In regard to Storage, the Act prescribes means of storage of prescribed and restricted drugs. ▪ Exportation of such drugs without license is prohibited under the Act. ▪ The Drugs bureau; this bureau keeps and maintains a list of all toxic substances, their composition, toxicity and antidotes. It supplies such information to medical practitioners, dentists or veterinary surgeons in respect of drugs as may be in its possession in emergency cases of poisoning.
Agricultural Chemicals (Control) Act, 2006	▪ No person is to manufacture, package, store, display, distribute, transport, possess, use or advertise any agricultural chemical except in accordance with regulations made under this Act and in accordance with the National Environment Act, Cap 153. This also applies to mercury containing agricultural chemicals ▪ No person is to import, export or re-export or sell in Uganda any agricultural chemical unless that chemical has been registered, packed and labeled in accordance with regulations made under this Act and conforms to the standards required. This also applies to mercury containing agricultural chemicals.
Regulatory or policy recommendations to ensure compliance with the Convention's provisions:	
▪ Prohibit and/restrict the import and export of mercury or mercury products by the External Trade Act. ▪ Prohibit and/or restrict the manufacture and trade of mercury added products including creams, pharmaceutical and agricultural products on the Ugandan market, pharmaceutical preparations and sale of mercury-added drugs. ▪ Restrict and reduce the use of dental amalgam	
Article 5 – Manufacturing processes in which mercury or mercury compounds are used	
Description of Article	Deals with use of mercury or mercury compounds in the manufacturing processes, listed in Part I of Annex B and Part II of Annex B of the Minamata Convention, by not allowing their use and reducing their use respectively. Some manufacturing processes do consume large quantities of mercury, thus control measures to prohibit or restrict their mercury use are crucial.

Summary of Article Provisions	▪ Not allow the use of mercury or mercury compounds in the manufacturing processes listed in Part I of Annex B after the phase-out date specified in that Annex for the individual processes, except where the Party has a registered exemption pursuant to Article 6. ▪ Take measures to restrict the use of mercury or mercury compounds in the processes listed in Part II of Annex B in accordance with the provisions set out therein. ▪ Take measures to address emissions and releases of mercury or mercury compounds from facilities that use mercury or mercury compounds facilities. ▪ Identify facilities within its territory that use mercury or mercury compounds for processes listed in Annex B and submit to the Secretariat, no later than three years after the date of entry into force of the Convention for it, information on the number and types of such facilities and the estimated annual amount of mercury or mercury compounds used in those facilities. ▪ Not allow the use of mercury or mercury compounds in a facility that did not exist prior to the date of entry into force of the Convention for it using the manufacturing processes listed in Annex B. ▪ Discourage the development of any facility using any other manufacturing process in which mercury or mercury compounds are intentionally used that did not exist prior to the date of entry into force of the Convention.
Policy and regulatory measures in place that enable the country to comply with the above listed provisions:	
Occupational Safety and Health Act, 2006	▪ Under this Act, a duty is placed on the employer to take all measures reasonable for the protection of employees and the general public from dangerous aspects of the employer's undertaking and ensure that the working environment is kept free from any hazard due to pollution through sound technical measures. ▪ Under the Act toxic materials are to be used as a last resort and kept to a minimum. The use of mercury in manufacture of any product allowed by the Minamata Convention on Mercury should only be as a last resort. ▪ Wherever possible, hazardous substance such as mercury should be replaced by harmless or less harmless substances. ▪ An employer is also under obligation to take general preventive measures including administrative and technical measures to prevent or reduce the contamination of a work environment to the lowest possible level or where possible to levels specified by the exposure limits prescribed by the commissioner. ▪ Under this Act, a duty is placed on the employer to take all measures reasonable for the protection of employees and the general public from dangerous aspects of the employer's undertaking and ensure that the working environment is kept free from any hazard due to pollution through sound technical measures. ▪ It is the duty of manufacturers to ensure that the chemical substance or mixture of chemical substances for use at work is designed or constructed or formulated to be safe and without risk to health when used properly and for the purpose for which it is meant. ▪ The manufacture, supply and use of chemical substances in a working environment, which the government chemist or any other authority mandated by law considers highly toxic, or dangerous or capable of causing grave harm to health, the environment, or an undertaking is subject to specific authorization by government chemist or other authorities, after measures are taken to ensure adequate protection.
Agricultural Chemicals (Control) Act, 2006	▪ Under this Act, no person is to manufacture, package, store, display, distribute, transport, possess, use or advertise any agricultural chemical except in accordance with regulations made under this Act and in accordance with the National Environment Act, Cap 153. ▪ No person is to import, export or re-export or sell in Uganda any agricultural chemical unless that chemical has been registered, packed and labeled in accordance with regulations made under this Act and conforms to the standards required.
Regulatory or policy recommendations to ensure compliance with the Convention's provisions:	
Currently, mercury is not used in any industrial processes in Uganda. Despite this, it is important to regulate against the possible use of mercury in any industrial processes currently and in the future ▪ Prohibit the use of mercury and mercury compounds in any facility. ▪ Prohibit the establishment of any facility using mercury or mercury compounds in its industrial processes	
Article 7 – Artisanal and Small scale Gold Mining[4]	
Description of Article	This Article applies to artisanal and small-scale gold mining and processing in which mercury amalgamation is used to extract gold from ore.

Summary of Article Provisions	▪ Take steps to reduce, and where feasible eliminate, the use of mercury in gold mining. ▪ Notify the Secretariat if the artisanal and small-scale gold mining and processing in its territory is more than insignificant. ▪ Develop and implement a national action plan in accordance with Annex C;
Policy and regulatory measures in place that enable the country to comply with the above listed provisions:	
Mining Act, 2003	▪ Any person who wishes to carry on small-scale prospecting and mining operations must apply for a location license. ▪ The license is not renewed if the applicant has not carried out effective restoration of the surface areas to the satisfaction of the commissioner.
Regulatory or policy recommendations to ensure compliance with the Convention's provisions:	
▪ Formulate a national action plan on Artisanal and small-scale gold mining. ▪ Reduce and eventually prohibit the use of mercury in gold mining.	
Article 8 – Emissions	
Description of Article	This Article concerns controlling and, where feasible, reducing emissions of mercury and mercury compounds to the atmosphere through measures to control emissions from the point sources.
Summary of Article Provisions	▪ Take measures to control emissions. ▪ Use the Best Available Techniques (BAT) and Best Environmental Practices (BEP) to control and reduce emissions. ▪ Establish an inventory of emissions from relevant sources.
Policy and regulatory measures in place that enable the country to comply with the above listed provisions:	
National Environment Act Cap 153	Establishes emission standards for various sources.
Occupational Safety and Health Act, 2006	▪ It is the duty of a person with control of premises to which section 26 applies, to use the best practicable means to prevent the emissions into the atmosphere from the premises, of toxic or offensive substances and to render harmless and inoffensive any substance that may be emitted.
Regulatory or policy recommendations to ensure compliance with the Convention's provisions:	
▪ Establish mercury emission standards, guidelines and objectives for mercury emission processes in the country ▪ Develop an Inventory of mercury emissions. ▪ Develop Best Available Techniques (BAT) and Best Environmental Practices (BEP) to control and reduce mercury emissions	
Article 9 – Releases	
Description of Article	This Article concerns controlling and, where feasible, reducing releases of mercury and mercury compounds, often expressed as "total mercury", to land and water from the relevant point sources not addressed in other provisions of the Convention.
Summary of Article Provisions	▪ Identify the relevant point source categories. ▪ Take measures to control releases using the Best Available Techniques (BAT) and Best Environmental Practices (BEP) to control. ▪ Establish an inventory of releases from relevant sources.
Policy and regulatory measures in place that enable the country to comply with the above listed provisions:	
National Environment Act Cap 153	▪ Prohibition of pollution contrary to established standards. ▪ No discharge of any hazardous substance in any waters or any other segment of the environment except in accordance with prescribed guidelines. ▪ It is an offence to discharge hazardous substance contrary to the prescribed guidelines.
Occupational Safety and Health Act, 2006	▪ Employers have an obligation to monitor and control the release of dangerous substances into the environment. ▪ Records of such monitoring are to be kept and made available to a labor inspector.
Regulatory or policy recommendations to ensure compliance with the Convention's provisions:	
▪ Develop, document and disseminate Best Available Techniques (BAT) and Best Environmental Practices (BEP) for control of mercury releases ▪ Develop an inventory of all mercury releases from various sources ▪ Identify all relevant point source categories of mercury	

Article 11 – Mercury wastes	
Description of Article	Governs management of mercury waste.
Summary of Article Provisions	▪ Take appropriate measures so that mercury waste is managed in an environmentally sound manner. ▪ Not transported across international boundaries except for the purpose of environmentally sound disposal.
Policy and regulatory measures in place that enable the country to comply with the above listed provisions:	
National Environment Act Cap 153	▪ National Environment Management Authority (NEMA) issues guidelines and prescribes measures for the management of toxic and hazardous chemicals and materials.
Mining Act, 2003	▪ Every holder of an exploration license or a mining lease is required to carry out an environmental impact assessment of his or her proposed operations in accordance with the Provisions of the National Environment Act Cap 312. The holder of a mining license commences operations only after securing a certificate of approval of operations from the National Environment Management Authority. ▪ The holder of a license must carry out an annual environmental audit. ▪ A condition that the holder of a mining license takes all necessary steps to ensure the prevention and minimization of pollution under the National Environment Act. ▪ In regard to dumping of any mercury waste, the Act prohibits pollution of wetlands, waters in any spring, stream, river, watercourse, pond or lake. ▪ The Act requires person mining minerals including mercury to take all necessary steps to ensure the prevention and minimization of pollution of the environment in accordance with the standards and guidelines prescribed under the National Environment Act. ▪ The Act prohibits the disposal of minerals mercury inclusive except in accordance with the Act.
National Environment Act Cap 153	▪ Imposes a duty to manage and minimize waste upon every person whose activities generates such wastes so that it does not cause ill health or damage to the environment. ▪ Prohibits discharge of hazardous substances, chemicals, oil, etc. into the environment and spiller's liability. ▪ It provides for the environmental restoration order; This order requires any person to restore the environment as near as it may be to the state in which it was before the taking of the action which is the subject of the order, prevent any person from taking any action which would or is reasonably likely to do harm to the environment, award compensation to be paid by persons who harm the environment to people whose environment or livelihood has been harmed, levy a charge on any person which represents a reasonable estimate of the cost of any action taken by an authorized person or organization to restore the environment to the state in which it was before the taking of the action which is the subject of the order. ▪ Requires any person carrying on any activity which has or is likely to have a significant impact on the environment to keep records relating to the amount of waste and by-products generated by the activity and the observable effects of the activity on the environment. This record is transmitted to NEMA for analysis and inspection.
Land Act Cap 227	• No water of any natural spring, river, stream, watercourse, pond, or lake on or under land is to be polluted except in pursuance of permission in writing granted by the Minister responsible for water or natural resources in accordance with the Water Act.
Public Health Act Cap 281	▪ This Act clarifies nuisances that are to be dealt with. This includes supply of water made injurious by mercury disposal. Mercury itself wherever situated in a place not approved for its discharge. This Act requires the author of such nuisance to abate it for the preservation of public health. ▪ It is the duty of every local authority to take all lawful, necessary and reasonably practicable measures for preventing any pollution dangerous to health of any supply of water which the public within its district has a right to use and does use for drinking or domestic purposes and for purifying any such supply which has become so polluted, and to take measures, including, if necessary, proceedings at law, against any person so polluting any such supply or polluting any stream so as to be a nuisance or danger to health.
Occupational Safety and Health Act, 2006	▪ The disposal and transport of chemical substances in a working environment, which the government chemist or any other authority mandated by law considers highly toxic, or dangerous or capable of causing grave harm to health, the environment, or an undertaking is subject to specific authorization by government chemist or other authorities, after measures are taken to ensure adequate protection.
Regulatory or policy recommendations to ensure compliance with the Convention's provisions:	

▪ Develop environmentally sound measures, standards and guidelines for management of mercury wastes ▪ Prohibit the transportation of mercury wastes across borders except for the purpose of environmentally safe disposal	
Article 12 – Contaminated sites	
Description of Article	Makes provision for management of contaminated sites.
Summary of Article Provisions	▪ Develop appropriate strategies for identifying and assessing sites contaminated by mercury or mercury compounds. ▪ Actions to reduce the risks posed by such sites are to be performed in an environmentally sound manner incorporating, where appropriate, an assessment of the risks to human health and the environment from the mercury or mercury compounds they contain.
Policy and regulatory measures in place that enable the country to comply with the above listed provisions:	
National Environment Act Cap 153	▪ It provides for the environmental restoration order; This order requires any person to restore the environment as near as it may be to the state in which it was before the taking of the action which is the subject of the order, prevent any person from taking any action which would or is reasonably likely to do harm to the environment, award compensation to be paid by persons who harm the environment to people whose environment or livelihood has been harmed, levy a charge on any person which represents a reasonable estimate of the cost of any action taken by an authorized person or organization to restore the environment to the state in which it was before the taking of the action which is the subject of the order.
Regulatory or policy recommendations to ensure compliance with the Convention's provisions:	
▪ Developing strategies and guidelines to identify and manage contaminated sites (ASGM sites in the Ugandan context) ▪ Conduct a health and environmental risk assessment for mercury in artisanal and small scale gold mining sites	
Article 18 – Public Information, Awareness and Education	
Description of Article	Deals with creating awareness of the effects of mercury.
Summary of Article Provisions	▪ Inform the public of the health and environmental effects of mercury and mercury compound, alternatives to mercury and mercury compounds.
Policy and regulatory measures in place that enable the country to comply with the above listed provisions:	
National Environment Act Cap 153	▪ The Act provides for freedom of access to environmental information. This provision is in the spirit of the Minamata Convention on mercury which encourages parties to promote and facilitate provision to the public of available information on health and environmental effects of mercury, alternatives to mercury use, educate, train and make the public aware of the effects of exposure to mercury on human health and the environment. ▪ NEMA is further mandated to disseminate information to public and private users, carry out public information and education campaigns in the field of environment.
Regulatory or policy recommendations to ensure compliance with the Convention's provisions:	
▪ Develop behavioral change communication programs on the effects of mercury and mercury compounds and alternatives to mercury and mercury use	

3.2 Institutional Assessment

For effective implementation of the Minamata Convention, coordinated actions from institutions and stakeholders in the country are essential. The current assessment identifies the relevant Government Ministries, Agencies and institutions as well as Non-Governmental institutions, Private sector stakeholders and others; and their respective roles and responsibilities in the implementation of the Minamata Convention. Table7 maps out the roles and responsibilities of existing institutions and stakeholders in Uganda against the various articles of the Convention. It also identifies institutional capacity needs for sound management of mercury in Uganda and for effective implementation of both the binding and non-binding provisions of the Minamata Convention.

In the assessment, some capacity gaps were found not to be specific to individual articles of the Convention and were applicable to more than one or all of the Convention articles. For example, establishment of an autonomous department or secretariat to coordinate the management of chemicals (mercury) is essential for all the articles. This is because, contemporarily, the responsibility for management of mercury and mercury compounds is spread across many stakeholders yet no formal coordination mechanisms for knowledge sharing, collective enforcement, and resource sharing exists.

Table 56: National Institutional and Capacity needs for effective implementation of the Minamata convention

Article 3 - Mercury supply sources and trade	
Description of Article This articles deals with sources of mercury and trade in mercury with the aim of reducing existing stock of mercury.	
Summary of Article provisions	▪ Not to allow new primary mercury mining ▪ Prevent the import and use of mercury from primary mercury mining for artisanal and small-scale gold mining (ASGM) ▪ In accordance with Article 3.5(b), restrict the import and use of excess mercury from decommissioning chlor-alkali plants, and require environmentally sound disposal ▪ Obtain information on stocks of mercury or mercury compounds exceeding 50 metric tons (MT), and mercury supply generating stocks exceeding 10 MT/yr.[5] ▪ Not to allow the export of mercury unless the importing country provides written consent,[6] the mercury is for an allowed use or environmentally sound storage, and all other conditions of Article 3.6 are met[7] ▪ Not to 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)
Relevant national stakeholder	
Ministry of Trade, Industry and cooperatives	**Institution mandate by Constitution:** To formulate, review and support policies, strategies, plans and programs that promote and ensure expansion and diversification of trade, cooperatives, environmentally sustainable industrialization, appropriate technology development and transfer to generate wealth for poverty eradication and benefit the country socially and economically.
	Role with respect to the above listed provisions: ▪ Regulate import of mercury from primary mining ▪ Regulate import of mercury unless the final use corresponds with the provisions of the Minamata convention. ▪ Restrict the Use of mercury in artisanal gold mining sites.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Existence of a department permitting import and export of commodities.
Ministry of Energy and Mineral Development	**Institution mandate by Constitution:** To Establish, promote the Development, Strategically Manage and Safeguard the Rational and Sustainable Exploitation and Utilization of Energy and Mineral Resources for Social and Economic Development.
	Role with respect to the above listed provisions: • Not to issue any new mercury mining permits or mercury exploration certificates.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Established framework for issuance of mining licenses.
Uganda Revenue Authority	**Institution mandate by Constitution:** To assess, collect and account for Central Government Tax Revenue (includes Non-Tax Revenues) and to provide advice to government on matters of policy relating to all revenue sources.
	Role with respect to the above listed provisions: • Not to clear any imports of primary mercury in the country.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Well-developed system, institution and human capital to monitor all imports and exports at all borders in the country.

Ministry of Local Government	**Institution mandate by Constitution:** To guide, harmonize, mentor and advocate for all local governments in support of the vision of government to bring about socio-economic transformation of the country.
	Role with respect to the above listed provisions: ▪ Regulates and authorizes business operations through trade licenses.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Well-developed structures, town councils in each district are tasked with issuance of business licenses.
Uganda National Bureau of Standards	**Institution mandate by Constitution:** ▪ Formulation and promotion of the use of standards; ▪ Enforcing standards in protection of public health and safety and the environment against dangerous and sub-standard products; ▪ Ensuring fairness in trade and precision in industry through reliable measurement systems; and ▪ Strengthening the economy of Uganda by assuring the quality of locally manufactured products to enhance the competitiveness of exports in regional and international markets.
	Role with respect to the above listed provisions: ▪ Endorsing and adopting mercury and mercury added commodities that have been imported as suitable for use in Uganda in line with the Minamata Convention. ▪ UNBS is to test imported products so as to confirm if they conform to standard specifications of the Minamata Convention as regards to mercury and mercury added products.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Issuance of permits for standards mark for all products that are imported that is used to observe the conditions of the permit, failure of which would lead to withdrawal, suspension, revocation or cancellation of the permit by the National Standards Council. ▪ Fining of non-observant of the standards set by the Bureau.
Need to be addressed:	
▪ Establishment of a licensing system that enables restricted access to mercury for use in activities where it cannot be completely substituted. ▪ Establishment of an inventory of mercury importers, traders, trade volumes and users in the country. ▪ Establishment of disincentives and alternatives for mercury use and trade. ▪ Establishment of an autonomous department or secretariat to coordinate the management of chemicals (mercury) in Uganda.	
Article 4 – Mercury Added Products	
Description of Article Deals with mercury added products banning their manufacture, import or export after their phase-out date and minimizing use of mercury in dental amalgam.	

Summary of Article provisions	▪ Mercury-added product means a product or product component that contains mercury or a mercury compound that was intentionally added. ▪ Not to allow the manufacture, import or export of mercury-added products listed in Part I of Annex A after the phase-out date specified for those products except where exclusion is specified in Annex A or the Party has a registered exemption pursuant to Article 6. ▪ Report at the first opportunity to the Conference of the Parties a description of the measures or strategies implemented, including a quantification of the reductions achieved. ▪ Consider additional measures to achieve further reductions. ▪ Take measures to prevent the incorporation into assembled products of mercury-added products the manufacture, import and export of which are not allowed for it under this Article. ▪ Discourage the manufacture and the distribution in commerce of mercury-added products not covered by any known use of mercury-added products. ▪ Take measures for the mercury-added products listed in Part II of Annex A in accordance with the provisions set out therein. ▪ Take measures to prevent the incorporation into assembled products of mercury-added products the manufacture, import and export of which are not allowed for it under this Article.
Relevant national stakeholder	
Ministry of Trade, Industry and cooperatives	**Institution mandate by Constitution:** To formulate, review and support policies, strategies, plans and programs that promote and ensure expansion and diversification of trade, cooperatives, environmentally sustainable industrialization, appropriate technology development and transfer to generate wealth for poverty eradication and benefit the country socially and economically.
	Role with respect to the above listed provisions: ▪ Inspect, monitor and evaluate the progress, standards, state and efficiency of the various sectors, under the trade, industry and cooperatives. ▪ Participate in negotiations and implementations of arrangements relating to the Minamata Convention in industrial processes. ▪ Policy formulation.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Well-structured with departments, units and oversees the operations of semi-autonomous institutions namely Uganda National Bureau of standards (UNBS), Uganda Industrial Research Institute (UIRI), Uganda Cleaner Production Centre (UCPC) among others. ▪ It has a commercial services office at every district.

Uganda National Bureau of Standards	**Institution mandate by Constitution:** ▪ Formulation and promotion of the use of standards; ▪ Enforcing standards in protection of public health and safety and the environment against dangerous and sub-standard products; ▪ Ensuring fairness in trade and precision in industry through reliable measurement systems; and ▪ Strengthening the economy of Uganda by assuring the quality of locally manufactured products to enhance the competitiveness of exports in regional and international markets.
	Role with respect to the above listed provisions: ▪ Prohibit the manufacture of mercury added products ▪ Enforce requirements for mercury added products to meet certain standards in their manufacture, or production, composition treatment or performance and to prohibit substandard products. ▪ Enforce standards in protection of the public against harmful ingredients for example mercury. ▪ Make arrangements or provision of facilities for the testing or analysis of mercury added commodities and the manner in which they may be manufactured, produced, processed or treated. ▪ UNBS is the National Enquiry Point on World Trade Organisation (WTO) agreements on Technical Barriers to Trade (TBT) and Sanitary and Phyto-sanitary Measures (SPS) as well as the National Codex contact point. UNBS is also a member of the International Standardisation Organisation (ISO). ▪ Carrying out market surveillance to rid the market of dangerous, shoddy and substandard and counterfeit products.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Technical Committees that undertake development of Uganda standards in various sectors. ▪ Inspection agencies to carry out conformity assessment of goods covered by compulsory standards destined for Uganda. ▪ Empowerment to issue or refuse to issue a certificate of conformity. ▪ Handles import clearance and issues certificate of clearance. ▪ Pre-Export Verification of Conformity (PVoC) ▪ A Chemistry Laboratory that carries out chemical analysis of chemical composition of both edible and non-edible products. The laboratory provides services that help prevent contaminated and adulterated foods products from entering the domestic market. ▪ Microbiology Laboratory that routinely undertakes analysis for organisms of public health significance. The laboratory tests a range of both fresh and processed foods. These include water, fruit juices, fish, milk and milk products, pickles, meat and meat products, cereals products, canned foods and dried foods.

National Drug Authority	**Institution mandate by Constitution:** To ensure the availability, at all times, of essential, efficacious and cost-effective drugs to the entire population of Uganda as a means of providing satisfactory healthcare and safeguarding the appropriate use of drugs.
	Role with respect to the above listed provisions: • To promote and control local production of mercury and mercury added pharmaceutical products.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Drug Inspectorate Services Department that ensures that all medicines manufactured locally and imported into the country are of good quality and are properly handled. ▪ Zonal Inspectors that provide backup to the regional inspectors in ensuring that there is more NDA presence on the ground. ▪ Quality Control Department at the National Drug Quality Control Laboratory (NDQCL) conducts quality control testing of samples of medicines, medical devices and public health products (e.g. long Lasting Insecticides Treated Nets (LLINs). ▪ The Drug Assessment and Registration Department ensures that all medicines registered in Uganda meet national and internationally accepted quality, safety and efficacy standards.
Kampala City Traders Association	**Role with respect to the above listed provisions:** ▪ Compliance with Pre-Export Verification of Conformity. ▪ Compliance with import standards and requirement.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Well organized management structure and wide membership consisting of several importers and exporters traders in Kampala City.
Uganda Manufacturers Association	**Role with respect to the above listed provisions:** ▪ Not to engage in manufacture of prohibited mercury-added products. ▪ Promote the use of cost-effective and clinically effective mercury-free alternatives for dental restoration. ▪ Cooperating with relevant government institutions in implementation or reduction in manufacture of mercury added products.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Strategic partnership with Ministry of Trade, Industry and Cooperatives, Ministry of Energy and Minerals, Ministry of Local Government, Uganda Revenue Authority, Uganda National Bureau of Standards and National Environmental Management Authority. ▪ Wide membership of different manufacturers. ▪ Commitment to standards and quality.
Ministry of Health	**Institution mandate by Constitution:** Stewardship and leadership of the health sector. It is responsible for policy review and development, supervision of health sector activities, formulation and dialogue with health development partners, strategic planning, setting standards and quality assurance, resource mobilization, advising other Ministries, departments and agencies on health-related matters, and ensuring quality, health equity, and fairness in contribution towards the cost of health care.
	Role with respect to the above listed provisions: • Overseeing the manufacture and import of mercury containing pharmaceutical products • Regulate the use of dental amalgams and mercury containing health equipment.
	Relevant institutional capacity in place to comply with the above listed provisions: • Supervision over and work with specialized health service bodies like: National Medical Stores and National Public Health Laboratories, National Drug Authority, Uganda National Health Research Organization (UNHRO).

Uganda Medical and Dental Practitioners Council	**Role with respect to the above listed provisions:** ▪ Issuing licenses to dental practitioners and limitation on use of mercury products included as condition for granting of practicing licenses. ▪ Protecting the public from dental products having mercury. ▪ Inspection of health places. ▪ Advising and making recommendations to the Government on matters relating to the medical and dental professions.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Issuing licenses to dental practitioners. ▪ Fining persons who engage in practice without license. ▪ Fining with persons who fail to comply with directives relating to dental amalgam and dental products containing mercury.
Uganda Agro Input Dealers Association	**Role with respect to the above listed provisions:** ▪ All agro input shops and dealerships in Uganda have to receive operational certificates from the association.
	Relevant institutional capacity in place to comply with the above listed provisions: • Most agro input shops in the country subscribe to the association.
Agricultural Chemicals Board	**Role with respect to the above listed provisions:** Regulate the importation and manufacture of agro-chemicals in Uganda.
	Relevant institutional capacity in place to comply with the above listed provisions: Issuance of permits to suitable and approved importers and manufacturers of agro-chemicals. This ensures that only recommended agro-chemicals free from mercury are imported and/or manufactured, and they comply with the provisions of the Minamata Convention.
Needs to be addressed before:	
▪ Purchasing specialized equipment and training personnel to detect and measure mercury in mercury added products ▪ Formalization and documentation of all traders of mercury and mercury containing products ▪ Establishment of standard mercury testing laboratories in the country ▪ Development of an inventory of mercury containing and mercury added products	
Article 5 – Manufacturing processes in which mercury or mercury compounds are used	
Description of Article: This Article deals with use of mercury or mercury compounds in the manufacturing processes listed in Part I of Annex B and Part II of Annex B by not allowing their use and reducing their use respectively.	
Summary of Article provisions	▪ Not allow the use of mercury or mercury compounds in the manufacturing processes listed in Part I of Annex B after the phase-out date specified in that Annex for the individual processes, except where the Party has a registered exemption pursuant to Article 6. ▪ Take measures to restrict the use of mercury or mercury compounds in the processes listed in Part II of Annex B in accordance with the provisions set out therein. ▪ Take measures to address emissions and releases of mercury or mercury compounds from facilities that use mercury or mercury compounds facilities. ▪ Identify facilities within its territory that use mercury or mercury compounds for processes listed in Annex B and submit to the Secretariat, no later than three years after the date of entry into force of the Convention for it, information on the number and types of such facilities and the estimated annual amount of mercury or mercury compounds used in those facilities. ▪ Not allow the use of mercury or mercury compounds in a facility that did not exist prior to the date of entry into force of the Convention for it using the manufacturing processes listed in Annex B. Discourage the development of any facility using any other manufacturing process in which mercury or mercury compounds are intentionally used that did not exist prior to the date of entry into force of the Convention. Proposed use are allowed under the Convention (and applicable domestic law).
Relevant national stakeholder:	

Ministry of Trade, Industry and cooperatives	**Role with respect to the above listed provisions:** ▪ Formulate and review, where necessary appropriate policies, legislation, regulations and standards in regard to mercury use in industrial manufacturing. Regulate use of mercury and mercury compounds in manufacturing processes.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Formulation of policies that ensure environmentally sustainable use of mercury allowed by the Convention. ▪ Has a department of Industry and Technology which is responsible for policy formulation for the industrial and technology sectors. It also collects, analyzes and disseminates information on industry sector for policy guidance and decision making and such information on mercury. The Department of Industry and Technology also oversees the operations of the Uganda Industrial Research Institute and Uganda National Bureau of Standards.
Uganda Manufacturers Association	**Role with respect to the above listed provisions:** ▪ Avoid use of mercury or mercury compounds in the manufacturing processes listed in Part I of Annex B after the phase-out date specified in that Annex. Restrict the use of mercury or mercury compounds in the processes listed in Part II of Annex B in accordance with the provisions set out therein.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Strategic partnership with Ministry of Trade, Industry and Cooperatives, Ministry of Energy and Minerals, Uganda Revenue Authority, Uganda National Bureau of Standards and National Environmental Management Authority. ▪ Wide membership of different manufacturers that comply with the association's directives. Commitment to standards and quality.
Uganda National Bureau of Standards	**Role with respect to the above listed provisions:** ▪ Not allow the use of mercury or mercury compounds in the manufacturing processes listed in Part I of Annex B after the phase-out date. ▪ Ensure use of mercury or mercury compounds in the processes listed in Part II of Annex B is only in accordance with the provisions set out therein. Ensure that manufacture of products such as that use mercury or mercury compounds is done in accordance with sound and prescribed standards.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Technical Committees that undertake development of Uganda standards in various sectors. ▪ Appoints Inspection agencies to inspect if manufacturers comply with the above provisions of the convention. ▪ A Chemistry Laboratory that carries out chemical analysis of chemical composition of both edible and non-edible products. The laboratory provides services that help prevent contaminated and adulterated foods products from entering the domestic market. Microbiology Laboratory that routinely undertakes analysis for organisms of public health significance. The laboratory tests a range of both fresh and processed foods. These include water, fruit juices, fish, milk and milk products, pickles, meat and meat products, cereals products, canned foods and dried foods.
National Drug Authority (NDA)	**Role with respect to the above listed provisions:** ▪ Ensure drug manufacturer do not use mercury or mercury compounds in manufacture of drugs. Ensure that use of mercury allowed in manufacture of drugs is done in strict compliance with the allowing provisions of the Convention and prescribed standards.

	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Drug Inspectorate Services Department that ensures that all medicines manufactured locally are of good quality and are properly handled. ▪ Zonal Inspectors to provide backup to the regional inspectors in ensuring that there is more NDA presence on the ground. ▪ Quality Control Department at the National Drug Quality Control Laboratory (NDQCL) conducts quality control testing of samples of medicines, medical devices and public health products (e.g. long lasting insecticides treated nets (LLINs). Drug Assessment and Registration Department ensures that all medicines registered in Uganda meet national and internationally accepted quality, safety and efficacy standards.
National Environment Management Authority	**Role with respect to the above listed provisions:** ▪ Ensure environment impact assessment by manufacturers using mercury in manufacturing before beginning their operations. ▪ Reviews and approves environmental impact assessments and environmental impact statements submitted in accordance with this Act or any other law and discourage the development of plants that use mercury or mercury compounds. ▪ Inspection of manufacturing places that use mercury. ▪ Close any manufacturing plant that fails to comply. ▪ Control, monitor and reduce emission and releases of mercury or mercury compounds from facilities that use mercury or mercury compounds facilities. Identify facilities that use mercury.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Requires environment impact assessment statement and may refuse to approve it. ▪ Has power to appoint environmental inspectors who inspect manufacturing premises to ensure compliance. ▪ Issue improvement notice requiring the operator of any manufacturing plant or other activity to cease any activities deleterious to the environment. ▪ Monitor compliance with the listed provisions. It is an offence to fail to prepare an environmental impact assessment and to fraudulently make a false statement in an environmental impact statement.
Ministry of Gender, Labour and Social Development/ Labour Inspectors	**Role with respect to the above listed provisions:** ▪ Inspect manufacturing plants that use mercury and mercury compounds. ▪ Prosecute manufacturers who fail to comply. To seize mercury and compounds of mercury being used by plants which use is not permitted.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Power to inspect plants and cease dangerous chemicals. Institute legal proceedings against non-observant.
Needs to be addressed:	
	▪ The number of labor inspectors is low hence needs to be increased. ▪ There has been no effort to adopt mercury-free production methods for all of these manufacturing processes hence the need to create awareness, formulate guideline and ensure adherence. ▪ Responsibility is spread across many stakeholders yet there are no formal interaction and coordination mechanisms amongst these stakeholders hence the need to enhance coordination in addition to instituting a Chemicals Authority.

Article 7 – Artisanal and Small scale Gold Mining	
Description of Article: This Article applies to artisanal and small-scale gold mining and processing in which mercury amalgamation is used to extract gold from ore.	
Summary of Article provisions	▪ Take steps to reduce, and where feasible eliminate, the use of mercury ▪ Notify the Secretariat if the artisanal and small-scale gold mining and processing in its territory is more than insignificant. ▪ Develop and implement a national action plan in accordance with Annex C.
Relevant national stakeholder:	
Ministry of Energy and Mineral Development	**Institution mandate by Constitution:** To Establish, promote the Development, Strategically Manage and Safeguard the Rational and Sustainable Exploitation and Utilization of Energy and Mineral Resources for Social and Economic Development.
	Role with respect to the above listed provisions: ▪ Reduce and where feasible eliminate the use of mercury. ▪ Developing and implementing a national action plan in regard for Artisanal and small-scale gold mining ▪ Issuing location licenses.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Established framework for issuance of mining licenses.
National Environment Management Authority	**Institution mandate by Constitution:** To spearhead the development of environmental policies, laws, regulations, standards and guidelines; and guides government on sound environment management.
	Role with respect to the above listed provisions: ▪ Require environment impact assessment miners. ▪ Approving environmental impact assessments and environmental impact statements and discourage use of mercury in ASGM. ▪ Inspection of sites using mercury in Artisanal and small-scale gold mining.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Sufficient manpower to enable inspections. ▪ Power to refuse approval of new mines using mercury.
Ministry of Water and Environment	**Institution mandate by Constitution:** Initiating legislation, policy formulation, setting standards, inspections, monitoring, and coordination and back up technical support in relation to water and environment sub sectors.
	Role with respect to the above listed provisions: ▪ Inspection of wetlands and water sources near ASGM mines to assess water contamination.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Well organized and sufficient structure for inspection including NEMA that is under it.
Ministry of Local Government	**Institution mandate by Constitution:** To guide, harmonize, mentor and advocate for all local governments in support of the vision of government to bring about socio-economic transformation of the country.
	Role with respect to the above listed provisions: ▪ Licensing and regulation of all ASGM activities in the respective districts.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Well-defined structure with sufficient personnel to implement its role.

Ministry of Gender, Labour and Social Development	**Institution mandate by Constitution:** To Empower Communities to Harness their Potential through Skills Development, Labour productivity and Cultural Growth for Sustainable and Gender responsive Development.
	Role with respect to the above listed provisions: ▪ Inspection of ASGM areas to ensure that workers are not exposed to mercury and that they have adequate protective clothing.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Well-funded and established ministry that can follow up and observe working conditions of mine workers.
Ministry of Trade, Industry and Cooperatives	**Institution mandate by Constitution:** To formulate, review and support policies, strategies, plans and programs that promote and ensure expansion and diversification of trade, cooperatives, environmentally sustainable industrialization, appropriate technology development and transfer to generate wealth for poverty eradication and benefit the country socially and economically.
	Role with respect to the above listed provisions: ▪ Regulate import of mercury unless the final use corresponds with the provisions of the Minamata convention. ▪ Restrict the Use of mercury in artisanal gold mining sites.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Existence of a department permitting import and export of commodities.
Needs to be addressed:	
▪ Building of NEMA capacity to conduct environmental inspection and to develop protocols for safe use of mercury in ASGM staff especially in regards to number of environmental inspectors. ▪ Development and implementation of health and education behavioral change programs, techniques and technologies, including early recognition and identification of mercury poisoning at the community level, to reduce mercury use and poisoning in ASGM areas. ▪ Requiring gold traders to provide an environmental audit of the methods used in producing the gold they trade. ▪ Development of an inventory of artisanal gold mining sites and miners in Uganda. ▪ Development of a formal framework to guide and regulate Artisanal and small scale gold mining.	
Article 8 – Emissions	
Description of Article: This Article concerns controlling and, where feasible, reducing emissions of mercury and mercury compounds to the atmosphere through measures to control emissions from the point sources.	
Summary of Article provisions	▪ Take measures to control emissions. ▪ Use the best available techniques and best environmental practices to control and reduce emissions. ▪ Establish an inventory of emissions from relevant sources.
Relevant national stakeholder:	
National Environment Management Authority	**Institution mandate by Constitution:** To spearhead the development of environmental policies, laws, regulations, standards and guidelines; and guides government on sound environment management.
	Role with respect to the above listed provisions: ▪ Establish emission standards for various sources. ▪ Prescribe sound techniques and practices to control and reduce emission. ▪ Establishing and maintain an inventory on mercury emission.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Sufficient technical capacity example the National Environment Management Authority Laboratory with gas monitors for measuring flue gases released from fireplaces, ovens, furnaces, boilers, generator and other places. The air quality standards are used to determining compliance. The Laboratory is well equipped with instruments, chemicals and two Mobile Laboratory Vans that are well designed to work as Laboratories while in the field. NEMA has also designated some Laboratories in Uganda which are used to carry out comprehensive analytical tests as and when deemed necessary.

Ministry of Water and Environment	**Institution mandate by Constitution:** Initiating legislation, policy formulation, setting standards, inspections, monitoring, and coordination and back up technical support in relation to water and environment sub sectors.
	Role with respect to the above listed provisions: ▪ Overseeing implementation of the listed provisions by specialized institutions like NEMA. ▪ Inspection of wetlands and water sources near ASGM mines to assess water contamination.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Well organized and sufficient structure for inspection and oversight.
Ministry of Local Government	**Institution mandate by Constitution:** To guide, harmonize, mentor and advocate for all local governments in support of the vision of government to bring about socio-economic transformation of the country.
	Role with respect to the above listed provisions: ▪ Through district environment and water officers can monitor and regulate emissions into the environment.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Personnel to monitor and regulate the activity though with limited technical expertise are available.
Needs to be addressed:	
▪ Development of an inventory of mercury emissions ▪ Building NEMA's capacity to detect, profile and monitor mercury emissions ▪ Development mercury emission standards and guidelines. ▪ Development of best practices and actions that minimize mercury emissions. ▪ Procurement of equipment that can detect, trace and quantify mercury emissions.	
Article 9 – Releases	
Description of Article: This Article concerns controlling and, where feasible, reducing releases of mercury and mercury compounds, often expressed as "total mercury", to land and water from the relevant point sources not addressed in other provisions of the Convention.	
Summary of Article provisions	▪ Identify the relevant point source categories. ▪ Take measures to control releases using the best available techniques and best environmental practices to control. ▪ Establish an inventory of releases from relevant sources.
Relevant national stakeholder:	
National Environment Management Authority	**Institution mandate by Constitution:** To spearhead the development of environmental policies, laws, regulations, standards and guidelines; and guides government on sound environment management.
	Role with respect to the above listed provisions: ▪ Identifying source points of releases. ▪ Prescribing the techniques and sound environmental practices to control releases. ▪ Maintaining an inventory on releases. ▪ Industrial effluent monitoring.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Sufficient technical capacity for example; National Environment Management Authority Laboratory that does industrial effluent monitoring. The Laboratory is well equipped with instruments, chemicals and two Mobile Laboratory Vans that are well designed to work as Laboratories while in the field. ▪ NEMA has also designated some Laboratories in Uganda which are used to carry out comprehensive analytical tests as and when deemed necessary.

Ministry of Water and Environment	**Institution mandate by Constitution:** Initiating legislation, policy formulation, setting standards, inspections, monitoring, and coordination and back up technical support in relation to water and environment sub sectors.
	Role with respect to the above listed provisions: ▪ Overseeing implementation of the listed provisions by specialized institutions like NEMA. ▪ Inspection of wetlands and water sources near ASGM mines to assess water contamination.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Well organized and sufficient structure for inspection and oversight.
Ministry of Education, Science, Technology and Sports	**Institution mandate by Constitution:** To provide for, support, guide, coordinate, regulate and promote quality education and sports to all persons in Uganda for national integration, individual and national development.
	Role with respect to the above listed provisions: ▪ Teaching the subject of chemistry at levels ranging from secondary school through postgraduate training equipping the students with training regarding use, disposal, environmental and health effects of mercury.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Control over educational institutions and curriculum development.
Ministry of Trade, Industry and cooperatives	**Institution mandate by Constitution:** To formulate, review and support policies, strategies, plans and programs that promote and ensure expansion and diversification of trade, cooperatives, environmentally sustainable industrialization, appropriate technology development and transfer to generate wealth for poverty eradication and benefit the country socially and economically.
	Role with respect to the above listed provisions: ▪ Prohibiting industries that release mercury. ▪ Discourage use of mercury in industrial plants to reduce releases. ▪ Managing processing plants and control releases in the process.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Department of Industry and Technology which is responsible for policy formulation for the industrial and technological sector. It also collects, analyzes and disseminates information on industry sector for policy guidance and decision making and such information on mercury. ▪ Department of Industry and Technology also oversees the operations of the Uganda Industrial Research Institute (UIRI) that manages processing plants.
National Water and Sewerage Corporation	**Institution mandate by Constitution:** To sustainably and equitably provide cost effective quality water and sewerage services to the delight of all stakeholders while conserving the environment.
	Role with respect to the above listed provisions: ▪ Ensure proper handling of sewerage and drainage.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Frequent inspection of sewerage plants to ensure mercury is not released to the main water systems. ▪ Provision of drainage systems that basically handle only hazardous waste/ releases

Ministry of Local Government	**Institution mandate by Constitution:** To guide, harmonize, mentor and advocate for all local governments in support of the vision of government to bring about socio-economic transformation of the country.
	Role with respect to the above listed provisions: ▪ Through district environment and water officers can monitor and regulate emissions into the environment.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Personnel to monitor and regulate the activity though with limited technical expertise are available.
Needs to be addressed:	
▪ Development of an inventory of mercury releases ▪ Building NEMA's capacity to detect, profile and monitor mercury release ▪ Development of mercury release standards, guidelines and procedures. ▪ Development of best practices and actions that minimize release of mercury to the environment	
Article 11 – Mercury wastes	
Description of Article: Governs management of mercury waste.	
Summary of Article provisions	▪ Take appropriate measures so that mercury waste is managed in an environmentally sound manner. ▪ Not transported across international boundaries except for the purpose of environmentally sound disposal.
Relevant national stakeholders	
National Environment Management Authority	**Institution mandate by Constitution:** To spearhead the development of environmental policies, laws, regulations, standards and guidelines; and guides government on sound environment management.
	Role with respect to the above listed provisions: ▪ Control and supervise management of waste. ▪ Prevent transportation of mercury waste across Uganda's boundaries except for disposal. ▪ Prescribe measures of managing mercury wastes.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Organized sufficient structure. ▪ Department of District Support Coordination and Public Education. The Department is responsible for initiating and coordinating activities that support district and communities to address environmental issues including community training, environmental action planning, support to District Environment Departments and micro projects. The Department promotes the integration of environmental issues in the formal, informal and non-formal education, production and dissemination of environmental education and information materials and publications, promoting adequate environmental management skills and awareness to stakeholders and the general public. ▪ Department of Environment Monitoring and Compliance that implements environmental monitoring and compliance of the regulated community. It ensures effective implementation of procedures and guidelines and provides technical guidance in the area of Environment Impact Assessment (EIA); carries out environmental audits and inspections to ensure compliance with environmental standards and regulations.

Ministry of Water and Environment	**Institution mandate by Constitution:** Initiating legislation, policy formulation, setting standards, inspections, monitoring, and coordination and back up technical support in relation to water and environment sub sectors.
	Role with respect to the above listed provisions: ▪ Prohibit discharge of mercury waste into any water.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Equipped with power to make regulations prohibiting discharge of mercury waste into any water.
Ministry of Energy and Mineral Development	**Institution mandate by Constitution:** To Establish, promote the Development, Strategically Manage and Safeguard the Rational and Sustainable Exploitation and Utilization of Energy and Mineral Resources for Social and Economic Development.
	Role with respect to the above listed provisions: ▪ Ensure waste from ASGM is properly disposed.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Sufficient structure for monitoring compliance.
Needs to be addressed:	
▪ Creation of appropriate incentives for the sound disposal of mercury containing wastes. ▪ Development of capacity of waste management companies to detect and sort mercury containing waste for safe disposal. ▪ Establishment of dump sites and recycling areas that specifically handle mercury waste. ▪ Mainstreaming sorting and management of mercury across all the stakeholders involved in wastes including; district and municipal authorities and private companies.	
Article 12 – Contaminated sites	
Description of Article: Makes provision for management of contaminated sites.	
Summary of Article provisions	▪ Develop appropriate strategies for identifying and assessing sites contaminated by mercury or mercury compounds. ▪ Actions to reduce the risks posed by such sites are to be performed in an environmentally sound manner incorporating, where appropriate, an assessment of the risks to human health and the environment from the mercury or mercury compounds they contain.
Relevant national stakeholder:	
Ministry of Water and Environment	**Institution mandate by Constitution:** Initiating legislation, policy formulation, setting standards, inspections, monitoring, and coordination and back up technical support in relation to water and environment sub sectors.
	Role with respect to the above listed provisions: ▪ Prohibit discharge of mercury waste into any water which automatically results into contamination. ▪ Has power to make regulations prohibiting discharge of mercury waste into any water ▪ Regulates handling mercury waste that may have impact on the environment and how it is to be disposed of to rule out contamination. ▪ Duty to control pollution and to promote safe storage treatment, discharge and disposal of mercury waste which may pollute water or otherwise harm the environment and human health.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Issuing of permits by the Directorate of Water Resources Management that include water discharge permits, permits for impounding, damming, diverting, and conveying surface water and/or draining any lands.

National Environment Management Authority	**Institution mandate by Constitution:** To spearhead the development of environmental policies, laws, regulations, standards and guidelines; and guides government on sound environment management.
	Role with respect to the above listed provisions: ▪ Control and supervise management of mercury waste likely to result into contamination. ▪ Prescribe measures of managing and handling mercury wastes to avoid contamination. ▪ Carrying out impact assessment of activities done on the environment to rule out those that may have risks to human health and the environment from the mercury or mercury compounds they contain. ▪ Inspection of plants, work places to ensure mercury waste is disposed of well to avoid unwanted contamination.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Well defined technical structure and capacity in terms of personnel and technical knowhow. ▪ Carrying out routine inspection of places that produce waste that contains mercury. ▪ Routine monitoring of waste done by the department of environmental monitoring to rule out contamination risks that may arise from plants, hospitals etc.
Ministry of Health	**Institution mandate by Constitution:** Stewardship and leadership of the health sector. It is responsible for policy review and development, supervision of health sector activities, formulation and dialogue with health development partners, strategic planning, setting standards and quality assurance, resource mobilization, advising other Ministries, departments and agencies on health-related matters, and ensuring quality, health equity, and fairness in contribution towards the cost of health care.
	Role with respect to the above listed provisions: ▪ Has a responsibility to plan, deliver and maintain an efficient and effective healthcare delivery system, including preventive means and therefore ensuring the public is safe from likely health risks that may result from contamination by hazardous compounds say mercury. ▪ Advising other ministries on health matters relating to contamination. ▪ Identify contaminated sites. ▪ Ensure mercury waste from hospitals is safely handled and disposed of to rule out contamination.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Use of a comprehensive paper-based Health Management Information System (HMIS) thus ensuring fast information delivery which is key in handling contamination cases and monitoring of contaminated sites. ▪ Existence of Health Management teams that support and supervise multiple districts to ensure quality handling of hospital waste which contains mercury thus rule out contamination. ▪ supervision of waste handling and identifying of contaminated sites at hospitals at district level under the guidance of the Ministry of Health Supervision Guidelines, which operate under the Area Teams Strategy to provide technical and managerial supervision

National Water and Sewerage Corporation	**Institution mandate by Constitution:** To sustainably and equitably provide cost effective quality water and sewerage services to the delight of all stakeholders while conserving the environment.
	Role with respect to the above listed provisions: ▪ Ensure proper handling of contaminated sewerage and drainage.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Frequent inspection of drainage plants to ensure mercury is not released to the main water systems thus cause contamination. ▪ Provision of drainage systems that basically handle only hazardous waste to rule out contamination.
Needs to be addressed:	
▪ Building NEMA's capacity to identify, assess and reclaim sites contaminates by mercury and mercury compounds ▪ Development of tools, protocols and guidelines for identifying and assessing contaminated sites ▪ Development of emergency health guidelines for all people poisoned from mercury	
Article 18 – Public Information, Awareness and Education	
Description of Article: Deals with creating awareness of the effects of mercury and mercury compounds.	
Summary of Article provisions	▪ Inform and educate the public of the health and environmental effects of mercury and mercury compound, alternatives to mercury and mercury compounds.
Relevant national stakeholder:	
National Environment Management Authority	**Institution mandate by Constitution:** To spearhead the development of environmental policies, laws, regulations, standards and guidelines; and guides government on sound environment management.
	Role with respect to the above listed provisions: ▪ Promotes public awareness and education through formal and informal education about environmental issues.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ Conferences, seminars are arranged to educate the public about the impact of mercury on human health and environment.
Ministry of Education, Science, Technology and Sports	**Institution mandate by Constitution:** To provide for, support, guide, coordinate, regulate and promote quality education and sports to all persons in Uganda for national integration, individual and national development.
	Role with respect to the above listed provisions: ▪ Education of pupils, students and general public on the effects of mercury exposure.
	Relevant institutional capacity in place to comply with the above listed provisions: ▪ A spatially distributed network of primary, secondary and vocational schools and Universities.
Needs to be addressed:	
▪ Mainstreaming chemical management especially mercury management in the teaching curricula. ▪ Development of a tailored national outreach and behavioral change programs that sensitize the public on the effects of mercury and mercury containing products, and early recognition and identification of mercury poisoning at the community level and the safe alternatives to mercury. These will need to be adapted and reinforced in ASGM areas. ▪ Establishment of a national mercury knowledge/ information management system.	

Chapter IV: Identification of Populations at Risks and Gender Dimensions

4.1 Preliminary Review of Potential Populations at Risk and Potential Health risks

Artisanal Miners: Artisanal and small scale gold mining is the main occupational source of exposure to mercury in Uganda. Miners use mercury to amalgamate gold during artisanal gold mining. As such, they are in direct contact with the mercury as they mix the ore, water and mercury for amalgamating gold. In most cases, miners do not wear any form of protection during the mixing process and when burning the mercury gold amalgam to evaporate off the mercury. As such, it is possible that mercury enters their tissues directly through the skin and also through inhalation of mercury vapors. In humans, approximately 80% of inhaled mercury vapor is absorbed via the respiratory tract where it enters the circulatory system and is distributed throughout the body. Chronic exposure by inhalation, even at low concentrations in the range 0.7–42 µg/m3, has been shown in case control studies to cause effects such as tremors, impaired cognitive skills, and sleep disturbance in workers. On the other hand, elemental mercury is poorly absorbed by ingestion and skin contact. However, it is hazardous due to its potential to release mercury vapor.

Plate 15: Gold mercury amalgam burning without a retort

According to a research survey on Artisanal Gold Mining and Livelihood Security in Gold rush communities in Mubende, of the 300 respondents, 21% reported health problems emanating from use of mercury. According to a trained nurse operating a clinic in the mine site areas, many gold buyers complain of severe chest pains, shortness of breath, paralysis and swelling of legs. She attributes this to mercury. She says many gold washers come with bizarre cases of peeling skin and finger nails. She further explains that the conditions are always unresponsive to conventional treatment regimes.

Communities in ASGM areas; There are no formal and standard processes for disposal of mercury in the gold extraction process, miners dispose the tailings back into the environment indiscriminately. As such, mercury may trickle into natural ecosystems like water bodies. In addition, since most miners burn the mercury gold amalgam in the open, the vapors escape into the natural ecosystem (air and later through rainfall back to water bodies). People staying in the vicinity of the sites are therefore at a high risk of mercury induced illnesses and conditions due to inhalation of mercury vapors or through drinking mercury contaminated water and eating mercury contaminated fish. Communities in ASGM areas reported that pollution (water, environment and soil) and erosion sedimentation are some of the main externalities of gold mining in their communities.

Garbage Collectors/Sorters and Incinerators: Most solid waste collected in Uganda is not sorted; garbage collectors and sorters are involuntary exposed to mercury through the garbage that they collect and sort. Just like artisanal miners, these also have or use very minimal protection and as such they can easily get exposed to mercury. People working in incinerators may also suck in mercury fumes and suffer from resultant negative effects.

Pregnant Women and Children below 17 Years: A 2016 empirical study[13] identifies that women, pregnant women and children under the age of 17 are at a risk of mercury contamination due to mercury in the muscles and fat tissues as a result of consuming fish from Lake Albert. The report observes that pregnant women and children had a higher concentration of mercury (above WHO threshold) than men who had mercury concentration below the WHO threshold. The report argues that unlike other countries where the number of fish consumed could be regulated, in Uganda, this was not possible. As such, this predisposes the pregnant women and children who nutritionally need more proteins from fish to mercury poisoning.

Women: Women in Uganda are the major consumers of creams and lotions. Specifically, they are more likely to use mercury containing creams as a means to enhance skin lightening than men. As such, they are more at risk of mercury exposure and should therefore be treated as a higher risk group.

Students: In Uganda, all students are required to do physics and chemistry practicals as part of the school curricula where they use mercury and mercury containing equipment in the laboratories. Similarly, the protection students have is usually minimal and given and as such are highly vulnerable to poisoning from mercury. In the same way, laboratory technicians and teachers may also be exposed to mercury.

Dental Practitioners: Because alternatives to mercury dental fillings are mostly unavailable and expensive in Uganda, mercury containing dental fillings is still used. Practitioners who prepare the amalgams and patients are therefore at risk. Without adequate protection, they inhale mercury vapors that evaporate during the drilling process. Similarly, dental patients too may loosely be at risk.

Plate 16: Open Burning of amalgam during processing

Plate 17: Panning of concentrates in the river of gold by a teenager

Plate 18: Types of retorts used in Busia District appropriate for burning and mercury amalgam

4.2 Potential Gender Dimensions related to the Management of Mercury.

In the previous section, it was evident that women and children are more at risk of mercury exposure. It is therefore essential that;

- Behavioral change programs are developed disseminated and target towards women and the children who are the most at risk population to exposure due to consumption of mercury containing fish.
- Non mercury containing creams including lightening creams should be introduced so as to discourage the black market of the mercury containing creams which developed as a result of a Government ban on the mercury containing creams
- There is also need to avail alternative protein containing foods to the children and men so as to cut back on their dependence of fish which amplifies the probability of their exposure to mercury. It is important to advise women in the childbearing age to not eat the types of fish with high mercury content.
- It may be relevant to have more information on the food types with high mercury content which could be used for some targeted advice.

Plate 19: Women in gold processing at an ASGM site in Mubende

Plate 20: Women in Mubende district panning gold concentrates using mercury

ANNEX I: Stakeholder Engagement Process

The process was highly consultative and participatory and NEMA gave overall guidance and supervisory support. Semi structured interviews and focus group discussions were during data collection. The tables below include participants (key informants and National Co-ordination Committee members) during the assessment.

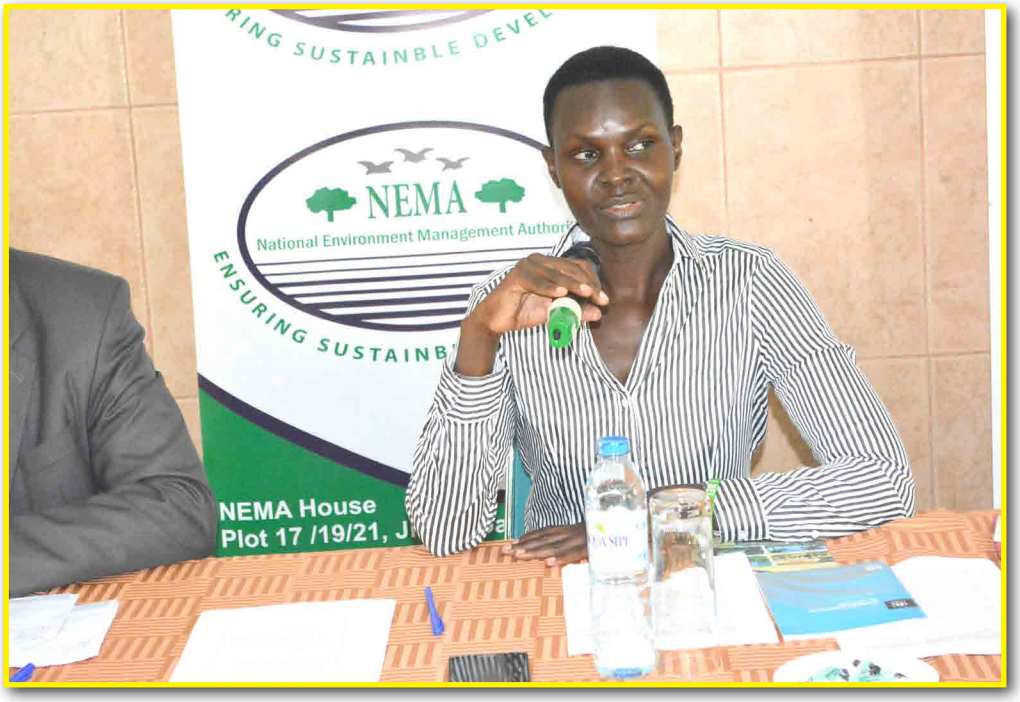
No.	DISTRICT	DNRO & DISTRICT/MUNICIPAL ENVIRONMENT OFFICERS	CONTACT ADDRESS	TELEPHONE Nos.	E-MAIL ADDRESSES
1	**BUHWEJU**	Ms. Birungi Clemencia (DEO)[8]	P.O.BOX 10 Kabwohe	**0752 400735 0783 654944**	birungiclemencia@gmail.com
2	**BUSHENYI**	Mr. Mugyenyi Cyril (DNRO)[9]	P.O. Box 1 Bushenyi	**0772-518189**	mbjcyril@yahoo.com cyrilmugyenyi@gmail.com
	BUSHENYI	Mr. Kataate Vincent (EO)[10]		**0772 686525 0702-686525**	vinkataate@gmail.com
3	**BUSIA**	Mr. Erienyu Johnson (SEO)[11]	P.O. Box 124 Busia	**0772 890721**	jefferienyu@ymail.com
	BUSIA M/C	Ms. Teopista Namajja (MEO)	P.O. Box 177 Busia Town Council	**0772-640208 0705 186 520**	teonamajja@gmail.com, namteosta@yahoo.com
4	**IBANDA**	Mr. Nuwagira Tom (SEO/ Ag. DNRO)	P.O. Box 388 Ibanda	**0772-603108**	nuwatom@gmail.com
	IBANDA	Ms. Akankwasa Confidence		**0787 966220**	akankwasaconfidence@gmail.com
	KABALE M/C	Mr. Ahimbisibwe Alfred (MEO)	P.O.BOX 144 Kabale	**0772-328451 0702 235 556**	ahimbisibwealfred@yahoo.com alfredhimbis@gmail.com
6	**KAABONG**	Mr. Longomin Emmanuel (EO)	P.O. Box 1 Kaboong	**0774143374**	emmylom@yahoo.com
7	**KIBOGA**	Mr. Musasizi Patrick (DNRO)	P.O. Box 1 Kiboga	**078333974**	muszpatrick@yahoo.com
	KIBOGA	Mr. Karuhogo Emmanuel (SEO)		**0772-389745**	karuhugoe@yahoo.com
8	**KOTIDO**	Dr. George W. Oming (DNRO)	P.O. Box 1 Kotido	**0774-026880 0392969735**	omingg@yahoo.com
	KOTIDO	Mr Kiyonga Joseph (DEO)		**0772-859759**	josephkiyonga34@gmail.com
9	**MOROTO**	Mr. John Lotyang –SEO (Ag. DNRO)	P.O. Box 4 Moroto	**0782-740147**	j_lotyang@yahoo.co.uk
10	**NAMAYINGO**	Mr. Busagwa Alex (DEO)	P.O.BOX 64, Bugiri	**0776-800444**	busagwa.a@gmail.com
11	**NAMUTUMBA**	Mr. Dauda Ikaaba (SEO &Ag. DNRO)	P.O Box 53 Busembatya	**0772-923376 0702923376**	daudaikaaba@yahoo.co.uk
12	**KISORO**	Ms. Muja Judith (SEO)	P.O.BOX 1, Kisoro	**0772-641004**	mujajudith@yahoo.com
	KISORO	Ms. Eunice Akankwasa (EO)		**0774 243152**	akankwasaeunice@yahoo.co.uk

[8]. District Environment Officer
[9]. District Natural Resources Officer
[10].Environment Officer
[11]. Senior Environment Officer

The Executive Director-NEMA, Dr. Tom O. Okurut (*8th from the front-left*), with national stakeholders at the National Inception workshop for the regional project on the Development of National Action Plans for the Artisanal and Small Scale Gold Mining in Africa held on 21st November 2016 at Imperial Botanical Beach Hotel, Entebbe.

The Director, Environment Monitoring and Compliance, NEMA, Mr. Waiswa Ayazika, (*1st from left*) appraising participants during a meeting held from 22nd to 24th February 2017 in the NEMA Board room to validate results of the national mercury inventory.

Stakeholders at a workshop held on 19th June 2017 at Ridar Hotel, Seeta in Mukono District to validate the national mercury initial assessment report. Ms Christine Akello, NEMA's Deputy Executive Director is at the extreme left; Ms Anne Nakafeero, the Mercury National Coordinator is 8th at the front row from left.



The Deputy Executive Director, NEMA, Ms Christine Akello, emphasizing the need to customize the provisions of the Minamata Convention on Mercury during the national inception workshop for the regional project on the development of national action plans for the Artisanal and Small Scale Gold Mining in Africa held on 21st November 2016 at Imperial Botanical Beach Hotel, Entebbe.

SN	NAME	TITLE	ORGANISATION	EMAIL	PHONE NUMBER
NATIONAL COORDINATION COMMITTEE MEMBERS					
1	Dr. John Wasswa	Senior Lecturer	Department of Chemistry, College of Natural Sciences, Makerere University Main Campus, JICA Building (Opp. Main Library), University Road. P.O Box 7062, **KAMPALA**	jnwasswa@cns.mak.ac.ug	0772504657 0414540985
2	Emmanuel Kaye	Senior Government Analyst	Directorate Government Analytical Laboratories, Ministry of Internal Affairs, Plot 2 Lourdel Road, P.O Box 2174, **KAMPALA**	ekaye50@yahoo.com	0776741000 0414250474 0414250207
3	Fauza Namukuve	Senior Environment Officer	Department of Environment Affairs, Ministry of Water and Environment, P.O.Box 20026 Luzira, **KAMPALA**	nfauzia2001@yahoo.co.uk	0782572362
4	John Mwanja	Senior Agricultural Inspector - Pesticide Inspection	Crop Protection Department, Ministry of Agriculture, Animal Industry and Fisheries. P.O. Box 102. **ENTEBBE**	musogajohn@gmail.com	0703103882
5	Kassim Semanda	Engineer department of industry and technology	Ministry of Trade, Industry and Cooperatives, Farmers' House, Parliamentary avenue, P.O. Box 7103, **KAMPALA**	bobs2004kassim@yahoo.com	0712189137 0703028929
6	Silver Ssebagala	Director	Uganda Cleaner Production Center. Plot 42A Mukabya Road. P.O. Box 34644, **KAMPALA**	silverssebagala@yahoo.com	0774647363
7	Wilbur Nsiyona Bukosi	Customs Officer	Compliance Unit| C&BA Division|Customs Department, Uganda Revenue Authority, 9th Floor Plot 17, Crested Towers, Hannington Road **KAMPALA**	wnsiyona@ura.go.ug	0772402375

SN	NAME	TITLE	ORGANISATION	EMAIL	PHONE NUMBER
NATIONAL COORDINATION COMMITTEE MEMBERS					
8	Allan Kasagga	Ag. Director Finance and Administration	National Environment Management Authority, NEMA House Plot 17/19/21 Jinja Road, P.O Box 22255, **KAMPALA**	akasagga@nemaug.org	0772 489997
9	Arnold Waiswa Ayazika	Director Environmental Monitoring and Compliance	National Environment Management Authority, NEMA House Plot 17/19/21 Jinja Road, P.O Box 22255, KAMPALA.	wayazika@nemaug.org	0772471139
10	Dr. Tom O Okurut	Executive Director	National Environment Management Authority, NEMA House Plot 17/19/21 Jinja Road, P.O Box 22255, **KAMPALA**	tokurut@nemaug.org	0772401039
11	Fred Onyai	Internal Monitoring and Evaluation Manager	National Environment Management Authority, Nema House Plot 17/19/21 Jinja Road, P.O Box 22255, **KAMPALA**	fonyai@nemaug.org	0772517303
12	Christine Akello Echookit	Deputy Executive Director	National Environment Management Authority, Nema House Plot 17/19/21 Jinja Road, P.O Box 22255, **KAMPALA**	cakello@nemaug.org	0772595252
13	Isaac I. G. Ntujju	Principal Environment Inspector (oil and gas)	National Environment Management Authority, Nema House Plot 17/19/21 Jinja Road, P.O Box 22255, **KAMPALA**	iignijju@nemaug.org	0772699828
14	Margaret Tuhumwire	Director	Environment in Action for Development EWA/EWAD, Plot No.1, Station Road, Entebbe Town P.O. Box 883, Entebbe, Uganda Website: http://www.ewadmission.org/	ewamission@yahoo.ca; and ewadmission.mt56@gmail.com	+256 414 321 948 +256 414 321 948; Mob: + 256 772 444 367 + 256 772 444 367 and +256 701 444 066 +256 701 444 066;
15	Tumwesigye Robert Baganda	Environment Focal Person	Pro-Biodiversity Conservationists in Uganda	tumwesigyeus@yahoo.com	0414 599 860

SN	NAME	TITLE	ORGANISATION	EMAIL	PHONE NUMBER
NATIONAL COORDINATION COMMITTEE MEMBERS					

ANNEX II: UNEP TOOLKIT Calculation Spreadsheet

Inventory Level 2 spreadsheet of UNEP 's Toolkit for identification and quantification of mercury releases

Before you start on Inventory Level 2!!

Read the Toolkit Reference Report sections carefully before using this spreadsheet!: This spreadsheet is not self-explaining and there is a clear risk of making serious mistakes, if the proposed principles and data are not read and understood carefully. Make yourself acquainted with the methodology used for mercury inventories in the Toolkit Reference Report. Before working with an individual source sub-category in this spreadsheet, read the Toolkit report's section describing the source.

Spreadsheet names: The numbers in the individual sheets' names refer to the chapter number of the source category dealt with in the individual sheet.

Metric units: All units used in this spreadsheet are - and must be - metric units, in accordance with the Toolkit report. The notation "t", means metric tons (also called "tonnes" in UK terminology).

Disclaimer:
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Guide to the column headers and the entry of data:

"C": The column shows the section number in the Toolkit report describing this source category.

"Su-C": The column shows the section number in the Toolkit report describing this source sub-category.

"Source category /phase": This column displays the name of the source category, source sub-category or life cycle phase dealt with in this line and in any lines below until the line with the next name in the column.

"Exists? (y/n/?)": Enter "yes" if it is confirmed that this source is present in the area covered by the inventory. Enter "no" if it is confirmed that this source is NOT present in the area. Enter "?", if it is not known if the source is present or not in the area covered by the inventory.
Non-existing source categories: If you have positively verified that the source in question does not exist in the country, enter the number "0" as the activity rate and as the Hg input in order to display the correct output numbers, namely "0".

"Default input factor"": These columns inform you of the default input factors defined in the Toolkit report, and their units. The appropriate unit is noted in the next column to the right.

"Enter input factor": Here you enter your choice of input factor for the source in question. For source sub categories where default factors are defined in the Toolkit report, an intermediate default input factor is already entered in the appropriate cell (generally same as used on Inventory Level 1). Remember that well documented national or local input factors should always be preferred, if available. Provide documentation for the used factors in the inventory report. The appropriate unit is noted in the next column to the right. Only this unit can be used!

"Enter activity rate": Here you enter the activity rate for the source category in question. See in the corresponding section of the Toolkit report, which type of activity rate you must use. Find appropriate activity rate data according to the principles and advice given in section 4.4 ("Data gathering and quantification of mercury releases") in the Toolkit report. Only this acitivity rate with the mentioned unit can be used!

"Calculate. Hg input": This column displays the calculated mercury input to the source in question. For source sub categories where default factors are defined in the Toolkit report, the appropriate calculation formula is already entered in the cell. For

sources where this is not the case, you must enter appropriate calculation formulas according to the Toolkit principles; often you can copy - or be inspired by - calculation formulas given for other sources in the same column. BE VERY CAREFUL THAT THE UNIT AND ORDER OF MAGNITUDE ARE CORRECT - this is one of the error types most often made in such calculations. For some source sub-categories that have several contributions to the overall releases from the sub-category, the sum of input contributions is displayed in bold red writing.

"Output scenarios, where relevant": For some source sub-categories, several output scenarios are defined in the Toolkit report according to the characteristics of the source. For such sources, the description of the scenario is given in this column, and corresponding output distribution factors are entered - or can be entered - in the columns to the right of this column. For sources where there is only one output scenario, this column is empty.

"Enter Hg input": In this column, the mercury INPUT to this source category, or phase, or scenario must be entered. In simple cases, the number to be entered here is the number calculated in the column "Calculat. Hg input"; for these a simple reference (e.g. "= k34") can be made or the number can be entered manually. For sources with several output scenarios you must investigate which scenario(s) is/are relevant and enter the mercury input lead to that scenario.

For some source sectors, e.g. coal combustion, the total calculated mercury input must be distributed between the relevant scenarios in accordance with information obtained in your data collection. For example for coal combustion, half of the annual coal supply may be used in facilities with no emission reduction devices, while the other half is used in facilities with fabric filters. In this example, 50% of your mercury input must be entered in the "no devises" row in this column, while the other 50% must be entered in the "fabric filters" row. For other sources, e.g. batteries, you can choose the scenario you find most appropriate for the country covered in your inventory - and enter the total calculated mercury input in that row, or you can distribute the total input between the scenarios, for example if different scenarios are relevant in different parts of the country investigated.

"Enter output distribution factors": Here you enter your choice of output distribution factors. Important: In most cases the sum of all output distributions factors for a source must be 1 (exceptions: see notes in this spreadsheet and corresponding sections in the Toolkit report). For source sub categories where default factors are defined in the Toolkit report, the default factors are already entered in the appropriate cells; note that question marks in the report are substituted here by "0" to facilitate the use of the spreadsheet for quick initial screenings. Remember that well documented national or local distribution factors should always be preferred, if available. Provide documentation for the used factors in the inventory report.

"Calculated Hg output, Kg/y": These columns display the calculated mercury releases distributed on the output pathways considered. Each cell in these columns contain a formula calculating the release estimate based on the mercury inputs to the source or phase or output scenario in question and the output distribution factor for this pathway.

"Remarks": Here you enter a few words on information on the specific fate of mercury released to "Sector specific treatment/ disposal", and you enter important key information on a summary level. Give reference to where in the inventory report the information is described in more detail.

Other important information:

"#Value!": This term appear in calculation results, if "?", "-" or similar text signs are written in input cells. If data are available, enter these instead of the "?" in the input cells. If data are not available, the sign (?,- or other) may often be the appropriate thing to show in the results cell. To present the same sign (?,- or other), enter the appropriate sign manually in the calculation cell.

User defined alterations of the spreadsheet principles: This spreadsheet is designed for mercury release quantification according to the general methodology and specific principles for each source sub-category recommended in the Toolkit report. For many source sub-categories other specific approaches may be usable (e.g. other activity rate types). This spreadsheet may be adjusted accordingly by the users as desired, requiring that the applied principles are in line with the overall approach of the Toolkit, and are well documented in the inventory reporting and that full reference is given to this Toolkit spreadsheet.

Enter calculation formulas: In this spreadsheet, default calculation formulas were only entered for source sub-categories, for which defaults were defined in the Toolkit report. Depending in the data available, inputs and releases may however be possible to estimate for more sources. In such cases, the user should enter appropriate formulas and data for the calculations. In many cases this can be done by copying appropriate formulas from other cells in this spreadsheet - be careful to be accurate.

Sub-calculations: In many cases sub-calculations will be needed, e.g. for calculations/conversions of the activity rates, or alternative input factors or alternative output distribution factors. Such calculations must be made in other spreadsheets,

for instance in new sheets inserted in this same Toolkit spreadsheet file; remember to report clear and transparent documentation of all data and calculations used - read more about this in the Toolkit report.

Decimal point/comma: In order to display decimal comma or decimal point according to your preference, make sure your MS Windows systems language is set accordingly. Note however that numbers displayed here as text (default factor intervals) will display with decimal point, in accordance with the Toolkit report format, regardless of language settings chosen.

Sum of quantified releases: The predefined summary sheets take into account the risk of double counting mercury contributions in pre-defined source categories where this can happen. If you wish to calculate sums of quantified inputs or releases, other than the ones already displayed, remember not to double-count Hg amounts quantified for several source categories (e.g. Hg amounts that are counted under both production, use, and disposal). This requires a deeper analysis based on relevant Toolkit report sections.

Adjustment for electrification rate and dental personnel: For some products types with scarce database for forming default factors, consumption estimates are calculated based on population and electrification rates; the latter as an indication of developments status. An electrification rate of 100% of the population is pre-entered. Should the electrification rate be lower in your country (see reference report Annexes), you can enter the best estimate of the actual number (listed in reference report annexes). Similar principles apply for dental personnel density in your country, where usable estimates are also given in reference report annexes.

Unit conversion sheet: For some sub-categories in the primary metals and consumer products categories, a unit conversion tool is given in this sheet.

Inventory Level 2 spreadsheet of UNEP 's Toolkit for identification and quantification of mercury releases

Summary of estimated mercury releases

For estimated mercury inputs see individual sheets

Enter year, date and responsible institution/person

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Enter description of estimation scenario presented below (medium default/maximum defaults/minimum defaults/other):

MEDIUM DEFAULTS

- If "other": Summarise main principles/characteristics in a few words (elaborate description in inventory report):

C	Sub-C	Source category	Exists? (y/n/?)	Calculat. Hg input to society	Calculated Hg output, Kg/y					
					Air	Water	Land	By-products 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	N	0	0	0	0	0	0.0	0
	5.1.2	Other coal use	Y	4	4	0	0	0	0	0
	5.1.3	Mineral oils - extraction, refining and use	Y	3	3	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	945	945	0	0	0	0	0
	5.1.7	Geothermal power production	N	0	0	0	0	0	0	0
5.2		**Source category: Primary (virgin) metal production**		0						
	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	Y	18495	12136	3333	3027	0	0	0
	5.3.3	Zinc extraction and initial processing	0	0	0	0	0	0	0	0
	5.3.4	Copper extraction and initial processing	N	0	0	0	0	0	0	0
	5.3.5	Lead extraction and initial processing	N	0	0	0	0	0	0	0
	5.3.6	Gold extraction and initial processing by methods other than mercury amalgamation	Y	0	0	0	0	0	0	0
	5.3.7	Aluminium extraction and initial processing	0	0	0	0	0	0	0	0
	5.3.8	Other non-ferrous metals - extraction and processing	N	0	0	0	0	0	0	0
	5.3.9	Primary ferrous metal production	Y	2	2	0	0	0	0	0
5.3		**Source category: Production of other minerals and materials with mercury impurities**		0						
	5.3.1	Cement production	Y	236	165	0	0	71	0	0
	5.3.2	Pulp and paper production	?	0	0	0	0	0	0	0
	5.3.3	Production of lime and light weight aggregates	0	0	0	0	0	0	0	0

5.4		**Source category: Intentional use of mercury in industrial processes**		0						
	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**		0						
	5.5.1	Thermometers with mercury	Y	21	4	6	4	-	6	0
	5.5.2	Electrical switches and relays with mercury	Y	439	132	0	176	-	132	0
	5.5.3	Light sources with mercury	Y	149	45	0	45	-	60	0
	5.5.4	Batteries with mercury	Y	4045	1011	0	1011	-	2023	0
	5.5.6	Biocides and pesticides with mercury	N	0	0	0	0	-	0	0
	5.5.7	Paints with mercury	N	0	0	0	0	-	0	0
	5.5.8	Cosmetics and related products with mercury	Y	104	0	99	5	-	0	0
5.6		**Source category: Other intentional product/process use**		0						
	5.6.1	Dental mercury-amalgam fillings (b	Y	146	3	60	10	9	32	32
	5.6.2	Manometers and gauges with mercury	Y	205	41	62	41	0	62	0
	5.6.3	Laboratory chemicals and equipment with mercury	0	0	0	0	0	0	0	0
	5.6.4	Mercury metal use in religious rituals and folklore medicine	0	0	0	0	0	0	0	0
	5.6.5	Miscellaneous product uses, mercury metal uses, and other sources	0	0	0	0	0	0	0	0
5.7		**Source category: Production of recycled metals ("secondary" metal production)**		0						
	5.7.1	Production of recycled mercury ("secondary production")	N	0	0	0	0	-	0	0
	5.4.2	Production of recycled ferrous metals (iron and steel)	Y	37	12	0	13	0	12	0
	5.4.2	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	0	0	0	0	0	0	0	0
	5.8.2	Incineration of hazardous waste	Y	67	60	0	0	0	0	7
	5.8.3	Incineration of medical waste	Y	70	63	0	0	0	0	7
	5.8.4	Sewage sludge incineration	N	0	0	0	0	0	0	0
	5.8.5	Informal waste burning	Y	5185	5185	0	0	0	0	0
5.9		**Source category: Waste deposition/landfilling and waste water treatment**		0						
	5.9.1	Controlled landfills/deposits*3	Y	6	6	0	0	0	0	0
	5.9.2	Diffuse disposal under some control	-	0	-	-	-	-	-	-
	5.9.3	Informal local disposal of industrial production waste	Y	0	0	0	0	-	-	-
	5.9.4	Informal dumping of general waste*1*3	Y	1078	108	108	862	-	-	-
	5.9.5	Waste water system/treatment*2	Y	385	0	193	77	0	58	58
5.10		**Source category: Crematoria and cemetaries**		0						
	5.10.1	Crematoria/cremation	Y	1	1	0	0	-	0	0
	5.10.2	Cemeteries	Y	362	0	0	362.199	-	0	0
SUM OF QUANTIFIED INPUTS AND RELEASES *1*2*3*4				**26220**	**19926**	**3667**	**4770**	**79.2285775**	**2384.02362**	**104**

Inventory Level 2 spreadsheet of UNEP 's Toolkit for identification and quantification of mercury releases

Executive summary table of estimated mercury releases

For estimated mercury inputs see individual sheets

Source category	Calculated Hg output, Kg/y							
	Air	Water	Land	By-products 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	952.0	-	-	-	-	0.3	952	3%
5.2: Primary (virgin) metal production	12,137.8	3,333.0	3,026.7	-	-	0.1	18,498	60%
5.3: Production of other minerals and materials with mercury impurities*1	164.9	-	-	70.7	-	-	236	1%
5.4: Intentional use of mercury in industrial processes	-	-	-	-	-	-	-	0%
5.5: Consumer products with intentional use of mercury (whole life cycle)	1,191.8	104.9	1,241.0	-	2,220.1	-	4,758	15%
5.6: Other intentional product/process use*2	43.9	173.0	50.7	8.6	145.7	85.8	508	2%
5.7: Production of recycled metals	12.2	-	12.5	-	12.2	-	37	0%
5.8: Waste incineration and burning	5,308.5	-	-	-	-	13.7	5,322	17%
5.9: Waste deposition/landfilling and waste water treatment*3*4	113.8	300.4	939.1	-	57.8	57.8	1,469	1%
5.10: Crematoria and cemeteries	0.8	-	362.2	-	-	-	363	1%
SUM OF QUANTIFIED RELEASES*3*4	19,926	3,719	4,770	79	2,436	158	31,087	100%

(a and (b: See note text in the relevant sheets

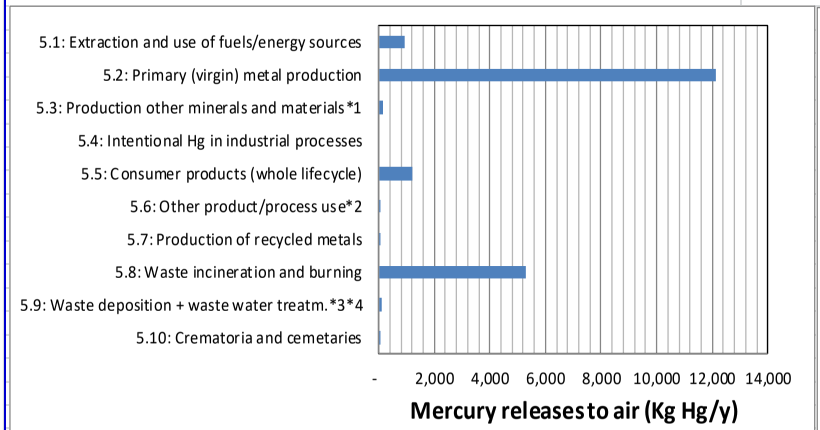
*1 Includes production of cement, pulp and paper, lime and light weight aggregates

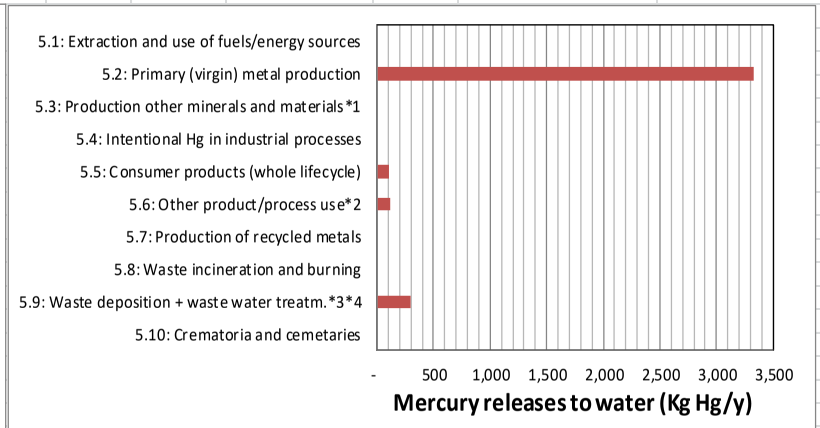
*2 Includes dental amalgam fillings, manometers and guages, lab chemicals and equipment, Hg use in religious rituals and folklore medicine, and miscellanous product uses.

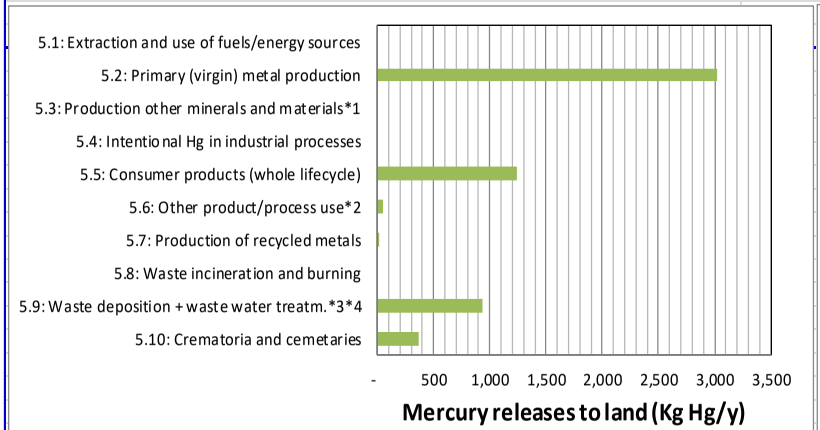
*3: The estimated quantities include mercury in products which has also been accounted for under each product category.
To avoid double counting, the release to land from informal dumping of general waste has been subtracted automatically in the TOTALS.

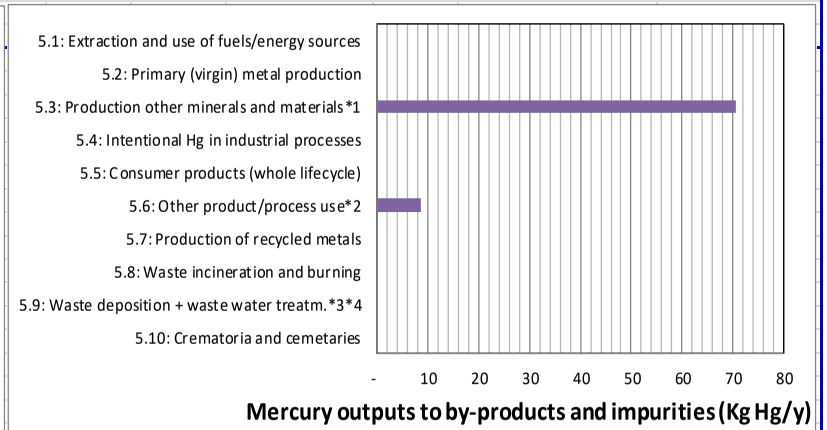
*4: The estimated input and release to water include mercury amounts which have also been accounted for under each source category.
To avoid double counting, release to water from, waste water system/treatment have been subtracted automatically in the TOTALS.

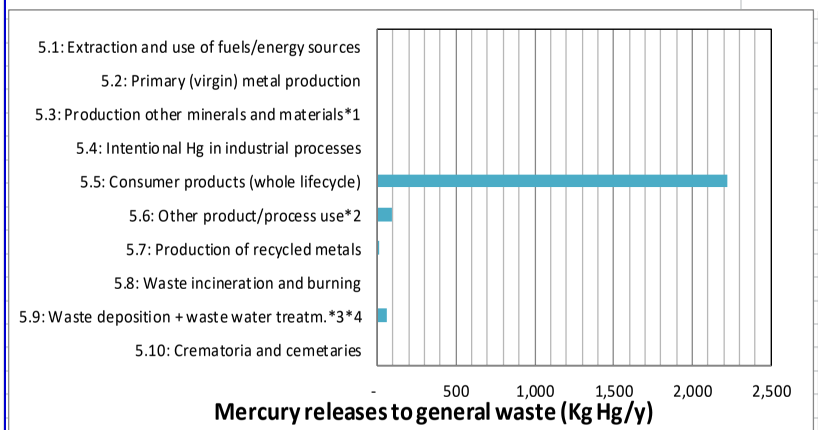
Notes: (a and (b: See note text in the relevant sheets
*1: The estimated quantities include mercury in products which has also been accounted for under each product category.
To avoid double counting, the release to land from informal dumping of general waste has been subtracted automatically in the TOTALS.
*2: The estimated release to water include mercury amounts which have also been accounted for under each source category.
To avoid double counting release to water from waste water system/treatment have been subtracted automatically in the TOTALS.
*3: To avoid double counting of mercury inputs from waste and products in the input TOTAL, only 10% of the mercury input to waste incineration sources, waste deposition and informal dumping is included in the total for mercury inputs. These 10% represent approximately the mercury input to waste from materials which were not quantified individually in Inventory Level 1 of this Toolkit.
*4 To avoid double counting of mercury in products produced domestically and sold on the domestic market (inlucing oil and gas), only the part of mercury inputs *released* from production are included in the input TOTAL.

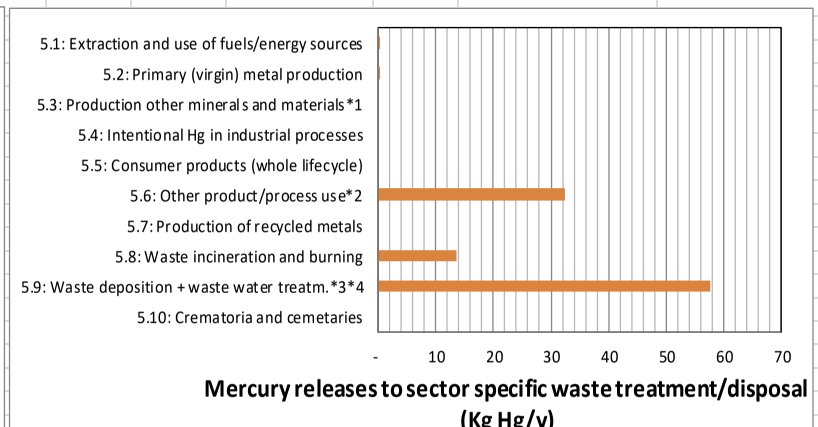

5.1: Extraction and use of fuels/energy sources
5.2: Primary (virgin) metal production
5.3: Production other minerals and materials*1
5.4: Intentional Hg in industrial processes
5.5: Consumer products (whole lifecycle)
5.6: Other product/process use*2
5.7: Production of recycled metals
5.8: Waste incineration and burning
5.9: Waste deposition + waste water treatm.*3*4
5.10: Crematoria and cemetaries
- 2,000 4,000 6,000 8,000 10,000 12,000 14,000
Mercury releases to air (Kg Hg/y)


5.1: Extraction and use of fuels/energy sources
5.2: Primary (virgin) metal production
5.3: Production other minerals and materials*1
5.4: Intentional Hg in industrial processes
5.5: Consumer products (whole lifecycle)
5.6: Other product/process use*2
5.7: Production of recycled metals
5.8: Waste incineration and burning
5.9: Waste deposition + waste water treatm.*3*4
5.10: Crematoria and cemetaries
- 500 1,000 1,500 2,000 2,500 3,000 3,500
Mercury releases to water (Kg Hg/y)


5.1: Extraction and use of fuels/energy sources
5.2: Primary (virgin) metal production
5.3: Production other minerals and materials*1
5.4: Intentional Hg in industrial processes
5.5: Consumer products (whole lifecycle)
5.6: Other product/process use*2
5.7: Production of recycled metals
5.8: Waste incineration and burning
5.9: Waste deposition + waste water treatm.*3*4
5.10: Crematoria and cemetaries
- 500 1,000 1,500 2,000 2,500 3,000 3,500
Mercury releases to land (Kg Hg/y)


5.1: Extraction and use of fuels/energy sources
5.2: Primary (virgin) metal production
5.3: Production other minerals and materials*1
5.4: Intentional Hg in industrial processes
5.5: Consumer products (whole lifecycle)
5.6: Other product/process use*2
5.7: Production of recycled metals
5.8: Waste incineration and burning
5.9: Waste deposition + waste water treatm.*3*4
5.10: Crematoria and cemetaries
- 10 20 30 40 50 60 70 80
Mercury outputs to by-products and impurities (Kg Hg/y)


5.1: Extraction and use of fuels/energy sources
5.2: Primary (virgin) metal production
5.3: Production other minerals and materials*1
5.4: Intentional Hg in industrial processes
5.5: Consumer products (whole lifecycle)
5.6: Other product/process use*2
5.7: Production of recycled metals
5.8: Waste incineration and burning
5.9: Waste deposition + waste water treatm.*3*4
5.10: Crematoria and cemetaries
- 500 1,000 1,500 2,000 2,500
Mercury releases to general waste (Kg Hg/y)


5.1: Extraction and use of fuels/energy sources
5.2: Primary (virgin) metal production
5.3: Production other minerals and materials*1
5.4: Intentional Hg in industrial processes
5.5: Consumer products (whole lifecycle)
5.6: Other product/process use*2
5.7: Production of recycled metals
5.8: Waste incineration and burning
5.9: Waste deposition + waste water treatm.*3*4
5.10: Crematoria and cemetaries
- 10 20 30 40 50 60 70
Mercury releases to sector specific waste treatment/disposal (Kg Hg/y)

Inventory Level 2 spreadsheet of UNEP 's Toolkit for identification and quantification of mercury releases

															Enter output distribution factors (unitless)						Calculated Hg output, Kg/y					
C	Su-C	Source category /phase	Exists? (y/n/?)	Default input factor	Unit	Enter input factor	Unit	Enter activity rate	Unit	Calculat. Hg input	Unit	"Output scenario (where relevant)	Enter Hg input	Unit	Air	Water	Land	Products	General waste	Sector specific treatment/disposal	Air	Water	Land	Products	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**	N																		0.00	0.00	0.00	0.00	0.00	0.00
		/Coal wash (a		0.05-0.5	g Hg/t	0.15	g Hg/t		Coal, t/y	0.0	Kg Hg/y			Kg Hg/y		0.01		0.8	0.19		0.00	0.00	0.00	0.00	0.00	0.00
		/Combustion (a																								
		- of anthrasite (hard) coal		0.05-0.5 (a	g Hg/t	0.15	g Hg/t		Coal, t/y	0	Kg Hg/y (a	**Combustion of anthrasite**		Kg Hg/y												
												Level 0: None		Kg Hg/y	1						0.00	0.00	0.00	0.00	0.00	0.00
												Level 1: Particulate matter simple APC: ESP/PS/CYC		Kg Hg/y	0.75					0.25	0.00	0.00	0.00	0.00	0.00	0.00
												Level 2: Particulate matter (FF)		Kg Hg/y	0.5					0.5	0.00	0.00	0.00	0.00	0.00	0.00
												Level 3: Efficient APC: PM+SDA/wFGD		Kg Hg/y	0.35					0.65	0.00	0.00	0.00	0.00	0.00	0.00
												Level 4: Very efficient APC: PM+FGD+SCR		Kg Hg/y	0.3					0.7	0.00	0.00	0.00	0.00	0.00	0.00
												Level 5: Mercury specific filters		Kg Hg/y	0.03					0.97	0.00	0.00	0.00	0.00	0.00	0.00
		- of bituminous (hard) coal		0.05-0.5 (a	g Hg/t	0.15	g Hg/t		Coal, t/y		Kg Hg/y (a	**Combustion of bituminous coal**		Kg Hg/y												
												Level 0: None		Kg Hg/y	1						0.00	0.00	0.00	0.00	0.00	0.00
												Level 1: Particulate matter simple APC: ESP/PS/CYC		Kg Hg/y	0.75					0.25	0.00	0.00	0.00	0.00	0.00	0.00
												Level 2: Particulate matter (FF)		Kg Hg/y	0.5					0.5	0.00	0.00	0.00	0.00	0.00	0.00
												Level 3: Efficient APC: PM+SDA/wFGD			0.35					0.65	0.00	0.00	0.00	0.00	0.00	0.00
												Level 4: Very efficient APC: PM+FGD+SCR		Kg Hg/y	0.1					0.9	0.00	0.00	0.00	0.00	0.00	0.00
												Level 5: Mercury specific filters		Kg Hg/y	0.03					0.97	0.00	0.00	0.00	0.00	0.00	0.00
		- of sub-bituminous (brown) coal		0.05-0.5 (a	g Hg/t	0.15	g Hg/t		Coal, t/y	0	Kg Hg/y (a	**Combustion of sub-bituminous coal**		Kg Hg/y												
												Level 0: None		Kg Hg/y	1						0.00	0.00	0.00	0.00	0.00	0.00
												Level 1: Particulate matter simple APC: ESP/PS/CYC		Kg Hg/y	0.9					0.1	0.00	0.00	0.00	0.00	0.00	0.00
												Level 2: Particulate matter (FF)		Kg Hg/y	0.5					0.5	0.00	0.00	0.00	0.00	0.00	0.00
												Level 3: Efficient APC: PM+SDA/wFGD			0.6					0.4	0.00	0.00	0.00	0.00	0.00	0.00
												Level 4: Very efficient APC: PM+FGD+SCR		Kg Hg/y	0.75					0.25	0.00	0.00	0.00	0.00	0.00	0.00
												Level 5: Mercury specific filters		Kg Hg/y	0.25					0.75	0.00	0.00	0.00	0.00	0.00	0.00
		- of lignite (brown) coal		0.05-0.5 (a	g Hg/t	0.15	g Hg/t		Coal, t/y	0	Kg Hg/y (a	**Combustion of lignite**		Kg Hg/y												
												Level 0: None		Kg Hg/y	1						0.00	0.00	0.00	0.00	0.00	0.00
												Level 1: Particulate matter simple APC: ESP/PS/CYC		Kg Hg/y	0.98					0.02	0.00	0.00	0.00	0.00	0.00	0.00
												Level 2: Particulate matter (FF)		Kg Hg/y	0.95					0.05	0.00	0.00	0.00	0.00	0.00	0.00
												Level 3: Efficient APC: PM+SDA/wFGD			0.8					0.2	0.00	0.00	0.00	0.00	0.00	0.00
												Level 4: Very efficient APC: PM+FGD+SCR		Kg Hg/y	0.8					0.2	0.00	0.00	0.00	0.00	0.00	0.00
												Level 5: Mercury specific filters		Kg Hg/y	0.25					0.75	0.00	0.00	0.00	0.00	0.00	0.00
	5.1.2	**Other coal use**	Y																		3.65	0.00	0.00	0.00	0.00	0.19
		Coke production		0.05-0.5	g Hg/t	0.15	g Hg/t		Coal, t/y	0	Kg Hg/y				1						0.00	0.00	0.00	0.00	0.00	0.00
		Coal combustion																			0.00	0.00	0.00	0.00	0.00	0.00
		/Coal wash (a		0.05-0.5	g Hg/t	0.15	g Hg/t		Coal, t/y	0.0	Kg Hg/y		0	Kg Hg/y		0.01		0.8	0.19		0.00	0.00	0.00	0.00	0.00	0.00
		/Combustion (a																			0.00	0.00	0.00	0.00	0.00	0.00
		- of hard coal (anthrasite and bituminous)		0.05-0.5 (a	g Hg/t	0.15	g Hg/t	7	Coal, t/y	0.0	Kg Hg/y (a	**Combustion of hard coal**														
												Level 0: None			1						0.00	0.00	0.00	0.00	0.00	0.00
												Level 1: Particulate matter simple APC: ESP/PS/CYC	0		0.75					0.25	0.00	0.00	0.00	0.00	0.00	0.00
												Level 2: Particulate matter (FF)			0.5					0.5	0.00	0.00	0.00	0.00	0.00	0.00
												Level 3: Efficient APC: PM+SDA/wFGD			0.5					0.5	0.00	0.00	0.00	0.00	0.00	0.00
												Level 4: Very efficient APC: PM+FGD+SCR			0.1					0.9	0.00	0.00	0.00	0.00	0.00	0.00
												Level 5: Mercury specific			0.03					0.97	0.00	0.00	0.00	0.00	0.00	0.00
		- of sub-bituminous (brown) coal		0.05-0.5 (a	g Hg/t	0.15	g Hg/t	0	Coal, t/y	0.0	Kg Hg/y (a	**Combustion of sub-bituminous coal**														
												Level 0: None			1						0.00	0.00	0.00	0.00	0.00	0.00
												Level 1: Particulate matter simple APC: ESP/PS/CYC			0.95					0.05	0.00	0.00	0.00	0.00	0.00	0.00
												Level 2: Particulate matter (FF)			0.5					0.5	0.00	0.00	0.00	0.00	0.00	0.00
												Level 3: Efficient APC: PM+SDA/wFGD			0.7					0.3	0.00	0.00	0.00	0.00	0.00	0.00
												Level 4: Very efficient APC: PM+FGD+SCR			0.8					0.2	0.00	0.00	0.00	0.00	0.00	0.00
												Level 5: Mercury specific			0.25					0.75	0.00	0.00	0.00	0.00	0.00	0.00
		- of lignite (brown) coal	Y	0.05-0.2 (a	g Hg/t	0.1	g Hg/t	38,392	Coal, t/y	3.8	Kg Hg/y (a	**Combustion of lignite**														
												Level 0: None			1						0.00	0.00	0.00	0.00	0.00	0.00
												Level 1: Particulate matter simple APC: ESP/PS/CYC	4		0.95					0.05	3.65	0.00	0.00	0.00	0.00	0.19
												Level 2: Particulate matter (FF)			0.5					0.5	0.00	0.00	0.00	0.00	0.00	0.00
												Level 3: Efficient APC: PM+SDA/wFGD			0.7					0.3	0.00	0.00	0.00	0.00	0.00	0.00
												Level 4: Very efficient APC: PM+FGD+SCR			0.8					0.2	0.00	0.00	0.00	0.00	0.00	0.00
												Level 5: Mercury specific			0.25					0.75	0.00	0.00	0.00	0.00	0.00	0.00

5.1.3	**Mineral oils - extraction, refining and use**																			3.39	0.00	0.00	0.00	0.00	0.10
	/Extraction	N	1 - 66	mg Hg/t	3.4	mg Hg/t		Oil, t/y	0						0.2					0.00	0.00	0.00	0.00	0.00	0.00
	/Refining	N	1 - 66	mg Hg/t	3.4	mg Hg/t		Oil, t/y	0	Kg Hg/y				0.25	0.01				0.15	0.00	0.00	0.00	0.00	0.00	0.00
	/Use of heavy oil and petroleum coke:																								
	Uses (other than combustion)	N	10 - 100	mg Hg/t	20	mg Hg/t	0	Oil, t/y	0	Kg Hg/y				1						0.00	0.00	0.00	0.00	0.00	0.00
	Oil combustion facilities	Y	10 - 100	mg Hg/t	20	mg Hg/t	50,712	Oil, t/y	1.0	Kg Hg/y	Oil Combustion Facility with no emissions controls			1						0.00	0.00	0.00	0.00	0.00	0.00
											Oil Combustion Facility with PM control using an ESP or scrubber	1		0.9					0.1	0.91	0.00	0.00	0.00	0.00	0.10
											Power plants with cESP and FGD			0.5					0.5	0.00	0.00	0.00	0.00	0.00	0.00
	/Use of gasoline, diesel, light fuel oil, kerosene, LPG and other light to medium distillates:																								
	Transportation and other uses other than combustion	Y	1 - 10	mg Hg/t	2	mg Hg/t	865,971	Oil, t/y	2	Kg Hg/y		2	Kg Hg/y	1						1.73	0.00	0.00	0.00	0.00	0.00
	Residential heating with no controls	N	1 - 10	mg Hg/t	2	mg Hg/t		Oil, t/y	0.0	Kg Hg/y				1						0.00	0.00	0.00	0.00	0.00	0.00
	Other oil combustion facilities	Y	1 - 10	mg Hg/t	2	mg Hg/t	371,131	Oil, t/y	0.7	Kg Hg/y	Oil Combustion Facility with no emissions controls	1	Kg Hg/y	1						0.74	0.00	0.00	0.00	0.00	0.00
											Oil Combustion Facility with PM control using an ESP or scrubber			0.9					0.1	0.00	0.00	0.00	0.00	0.00	
											Power plants with cESP and FGD			0.5					0.5	0.00	0.00	0.00	0.00	0.00	0.00
5.1.4	**Natural gas - extraction, refining and use**	N																		0.00	0.00	0.00	0.00	0.00	0.00
	/Extraction/refining		2 - 200	µg Hg/Nm3	100	µg Hg/Nm3 gas		Gas, Nm3/y	0	Kg Hg/y	Gas processing without mercury removal			0.2	0.2		0.5		0.1	0.00	0.00	0.00	0.00	0.00	0.00
											Gas processing with mercury removal			0.1	0.2		0.1		0.6	0.00	0.00	0.00	0.00	0.00	0.00
	/Use of raw or pre-cleaned gas		2 - 200	µg Hg/Nm3	100	µg Hg/Nm3 gas		Gas, Nm3/y	0	Kg Hg/y				1						0.00	0.00	0.00	0.00	0.00	0.00
	/Use of pipeline gas (consumer quality)		0.03 - 0.4	µg Hg/Nm3	0.22	µg Hg/Nm3 gas		Gas, Nm3/y	0.0	Kg Hg/y				1						0.00	0.00	0.00	0.00	0.00	0.00
5.1.5	**Other fossil fuels - extraction and use**	N																		0.00	0.00	0.00	0.00	0.00	0.00
	Combustion of peat		40 - 193	mg Hg/t (dry	117	mg Hg/t (dry weight)		Peat, t/y	0.0	Kg Hg/y				1						0.00	0.00	0.00	0.00	0.00	0.00
	Use of oil shale				?	?		Oil shale, t/y	0	Kg Hg/y				1						0.00	0.00	0.00	0.00	0.00	0.00
	Combustion of other fossil fuels													1											
5.1.6	**Biomass fired power and heat production**	Y	0.007-0.07	g Hg/t(dry w	0.03	g Hg/t(dry weight)	31,500,000	Biomass, t (dry weight)/y	945	Kg Hg/y		945	Kg Hg/y	1						945.00	0.00	0.00	0.00	0.00	0.00
	Charcoal combustion	Y	4x conc. in biomas	g Hg/t(dry w	0.12	g Hg/t(dry weight)	18,000,000	Charcoal, t (dry weight)/y	2,160	Kg Hg/y		2,160	Kg Hg/y	1						2,160.00	0.00	0.00	0.00	0.00	0.00
5.1.7	**Geothermal power production**	N	?	?	0	?	0	?	0	Kg Hg/y				1						0.00	0.00	0.00	0.00	0.00	0.00

Notes: (a: Important: If coal wash is aplied, the Hg input to coal combustion is the calculated output "Products" from coal wash. For more complicated mixes, see the relevant section in the toolkit report.

Inventory Level 2 spreadsheet of UNEP 's Toolkit for identification and quantification of mercury releases

C	Su-C	Source category /phase	Exists? (y/n/?)	Default input factor	Unit	Enter input factor	Unit	Enter activity rate	Unit	Calculat. Hg input	Unit	Output scenario (where relevant)	Enter Hg input	Unit	Enter output distribution factors (unitless) Air	Water	Land	Products	General waste	Sector specific treatment/disposal	Calculated Hg output, Kg/y Air	Water	Land	Products	General waste	Sector specific treatment/disposal
5.2		**Source category: Primary (virgin) metal production**																								
	5.2.1	**Mercury (primary) extraction and initial processing (a**	N	1020-1040	kg Hg/t Hg produced	1030	kg Hg/t Hg produced	0	Hg produced, t/y	0	Kg Hg/y a)		0	Kg Hg/y	0.00728	0.0017	0.0201				0.00	0.00	0.00	0.00	0.00	0.00
	5.2.2	**Gold (and silver) extraction with mercury amalgamation processes**																			12,135.76	3,332.96	3,026.71	0.00	0.00	0.00
		/From whole ore	Y	3	kg Hg/kg gold produced	5	kg Hg/kg gold produced	622.74	Gold produced, kg/y	3113.7	Kg Hg/y	Extraction from whole ore (no retort use)	3113.7	Kg Hg/y	0.25	0.4	0.35				778.43	1,245.48	1,089.80	0.00	0.00	0.00
		/From concentrate	Y	1	kg Hg/kg gold produced	1.3	kg Hg/kg gold produced	11832.1	Gold produced, kg/y	15381.73	Kg Hg/y	Extraction from concentrate (no retort use)	15056.35	Kg Hg/y	0.75	0.13	0.12				11,292.26	1,957.33	1,806.76	0.00	0.00	0.00
		/From concentrate and with use of retorts	Y	0.1	kg Hg/kg gold produced	0.55	kg Hg/kg gold produced	591.6	Gold produced, kg/y	325.38	Kg Hg/y	Extraction from concentrate and with use of retorts and mercury recycling	325.38	Kg Hg/y	0.2	0.4	0.4				65.08	130.15	130.15	0.00	0.00	0.00
	5.3.3	**Zinc extraction and initial processing**																			0.00	0.00	0.00	0.00	0.00	0.00
		/Mining and concentrating	N	0	?	0	?	0		0	Kg Hg/y		0	Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
		/Production of zinc from concentrates	N	5 - 130	g Hg/t	65	g Hg/t	0	Concentrate used, t/y	0	Kg Hg/y	Smelter with no filters or only coarse, dry PM retention	0	Kg Hg/y	0.9					0.1	0.00	0.00	0.00	0.00	0.00	0.00
												Smelters with wet gas cleaning	0	Kg Hg/y	0.49	0.02				0.49	0.00	0.00	0.00	0.00	0.00	0.00
												Smelters with wet gas cleaning and acid plant		Kg Hg/y	0.1	0.02		0.42		0.46	0.00	0.00	0.00	0.00	0.00	0.00
												Smelters with wet gas cleaning, acid plant and Hg specific filter		Kg Hg/y	0.02	0.02		0.48		0.48	0.00	0.00	0.00	0.00	0.00	0.00
	5.3.4	**Copper extraction and initial processing**	N																		0.00	0.00	0.00	0.00	0.00	0.00
		/Mining and concentrating		0	?	0	?	0		0	Kg Hg/y		0	Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
		/Production of copper from concentrates	N	1-100	g Hg/t	30	g Hg/t	0	Concentrate used, t/y	0	Kg Hg/y	Smelter with no filters or only coarse, dry PM retention	0	Kg Hg/y	0.9					0.1	0.00	0.00	0.00	0.00	0.00	0.00
												Smelters with wet gas cleaning		Kg Hg/y	0.49	0.02				0.49	0.00	0.00	0.00	0.00	0.00	0.00
												Smelters with wet gas cleaning and acid plant		Kg Hg/y	0.1	0.02		0.42		0.46	0.00	0.00	0.00	0.00	0.00	0.00
												Smelters with wet gas cleaning, acid plant and Hg specific filter		Kg Hg/y	0.02	0.02		0.48		0.48	0.00	0.00	0.00	0.00	0.00	0.00
	5.3.5	**Lead extraction and initial processing**	N																		0.00	0.00	0.00	0.00	0.00	0.00
		/Mining and concentrating	N	0		0	?	0		0	Kg Hg/y		0	Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
		/Production of lead from concentrates	N	2-60	g Hg/t	30	g Hg/t concentrate		Concentrate used, t/y	0	Kg Hg/y	Smelter with no filters or only coarse, dry PM retention		Kg Hg/y	0.9					0.1	0.00	0.00	0.00	0.00	0.00	0.00
												Smelters with wet gas cleaning		Kg Hg/y	0.49	0.02				0.49	0.00	0.00	0.00	0.00	0.00	0.00
												Smelters with wet gas cleaning and acid plant		Kg Hg/y	0.1	0.02		0.42		0.46	0.00	0.00	0.00	0.00	0.00	0.00
												Smelters with wet gas cleaning, acid plant and Hg specific filter		Kg Hg/y	0.02	0.02		0.48		0.48	0.00	0.00	0.00	0.00	0.00	0.00
	5.3.6	**Gold extraction and initial processing by methods other than mercury amalgamation**	Y	1 - 30	g Hg/t ore used (extracted)	15	g Hg/t ore used	0	Gold ore used, t/y	0	Kg Hg/y		0	Kg Hg/y	0.04	0.02	0.9	0.04			0.00	0.00	0.00	0.00	0.00	0.00
	5.3.7	**Aluminium extraction and initial processing**																			0.00	0.00	0.00	0.00	0.00	0.00
		/Alumina production from bauxite	N	0.07-1	g Hg/t bauxite	0.5	g Hg/t bauxite		Bauxite used, t/y	0	Kg Hg/y			Kg Hg/y	0.15	0.1			0.65	0.1	0.00	0.00	0.00	0.00	0.00	0.00
		/Aluminium production from alumina	N	0	?	0	?	0	?	0	Kg Hg/y		0	Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	5.3.8	**Other non-ferrous metals - extraction and processing**	N	?	?	0	?	0	?	0	Kg Hg/y		0	Kg Hg/y	1						0.00	0.00	0.00	0.00	0.00	0.00
	5.3.9	**Primary ferrous metal production**	Y	0.05	g Hg/t pig iron produced	0.05	g Hg/t pig iron produced	41959	Pig iron produced, t/y	2	Kg Hg/y		2	Kg Hg/y	0.95					0.05	1.99	0.00	0.00	0.00	0.00	0.10

Note:
(a: As always, the total mercury input to the process is what we calculate as the "Calculated Hg input", only for this specific source sub-category,
only the part of the mercury actually being released during production is included in the release estimates. Therefore, the output distribution factors only sum up to the share of mercury being released.
The output distribution factors shown correspond to air: 25%, water: 6% and land: 69% of total releases.

Inventory Level 2 spreadsheet of UNEP 's Toolkit for identification and quantification of mercury releases

														Enter output distribution factors (unitless)						Calculated Hg output, Kg/y					
C	Su-C	Source category /phase	Exists? (y/n/?)	Default input factor	Unit	Enter input factor	Unit	Enter activity rate	Unit	Calculat. Hg input	Unit	Output scenario (where relevant)	Enter Hg input	Unit	Air	Water	Land	Products	General waste	Sector specific treatment/disposal	Air	Water	Land	Products	General waste	Sector specific treatment/disposal
5.3		**Source category: Production of other minerals and materials with mercury impurities**																								
	5.3.1	**Cement production**								236	Kg Hg/y	Cement production										164.86	0.00	0.00	70.65	0.00	0.00
		/without co-incineration of waste	**Y**	0.004 - 0.5	g Hg/ t cement produced	0.11	g Hg/ t cement produced	2,141,000	Cement produced, t/y	236		**With no filters**		Kg Hg/y	0.8			0.2			0.00	0.00	0.00	0.00	0.00	0.00
												With filters and no filter dust recycling:		Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
												Simple particle control (ESP / PS / FF)		Kg Hg/y	0.6			0.2		0.2	0.00	0.00	0.00	0.00	0.00	0.00
												Optimized particle control (FF+SNCR / FF+WS / ESP+FGD / optimized FF)		Kg Hg/y	0.4			0.2		0.4	0.00	0.00	0.00	0.00	0.00	0.00
												Efficient Hg pollution control (FF+DS / ESP+DS / ESP+WS / ESP+SNCR)		Kg Hg/y	0.2			0.2		0.6	0.00	0.00	0.00	0.00	0.00	0.00
												Very efficient Hg pollution control (wetFGD+ACI / FF+scrubber+SNCR)		Kg Hg/y	0.04			0.2		0.76	0.00	0.00	0.00	0.00	0.00	0.00
												With filters and filter dust recycling *2:		Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
												Simple particle control (ESP / PS / FF)	236	Kg Hg/y	0.7			0.3			164.86	0.00	0.00	70.65	0.00	0.00
												Optimized particle control (FF+SNCR / FF+WS / ESP+FGD / optimized FF)		Kg Hg/y	0.6			0.4			0.00	0.00	0.00	0.00	0.00	0.00
												Efficient Hg pollution control (FF+DS / ESP+DS / ESP+WS / ESP+SNCR)		Kg Hg/y	0.5			0.5			0.00	0.00	0.00	0.00	0.00	0.00
												Very efficient Hg pollution control (wetFGD+ACI/FF+scrubber+SNCR)		Kg Hg/y	0.04			0.5		0.46	0.00	0.00	0.00	0.00	0.00	0.00
																					0.00	0.00	0.00	0.00	0.00	0.00
		/with co-incineration of waste		0.06 - 1	g Hg/ t cement produced	0.15	g Hg/ t cement produced		Cement produced, t/y	0		**With no filters**		Kg Hg/y	0.8			0.2			0.00	0.00	0.00	0.00	0.00	0.00
												With filters an no filter dust recycling:		Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
												Simple particle control (ESP / PS / FF)		Kg Hg/y	0.6			0.2		0.2	0.00	0.00	0.00	0.00	0.00	0.00
												Optimized particle control (FF+SNCR / FF+WS / ESP+FGD / optimized FF)		Kg Hg/y	0.4			0.2		0.4	0.00	0.00	0.00	0.00	0.00	0.00
												Efficient Hg pollution control (FF+DS / ESP+DS / ESP+WS / ESP+SNCR)		Kg Hg/y	0.2			0.2		0.6	0.00	0.00	0.00	0.00	0.00	0.00
												Very efficient Hg pollution control (wetFGD+ACI / FF+scrubber+SNCR)		Kg Hg/y	0.04			0.2		0.76	0.00	0.00	0.00	0.00	0.00	0.00
												With filters and filter dust recycling *2:		Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
												Simple particle control (ESP / PS / FF)		Kg Hg/y	0.7			0.3			0.00	0.00	0.00	0.00	0.00	0.00
												Optimized particle control (FF+SNCR / FF+WS / ESP+FGD / optimized FF)		Kg Hg/y	0.6			0.4			0.00	0.00	0.00	0.00	0.00	0.00
												Efficient Hg pollution control (FF+DS / ESP+DS / ESP+WS / ESP+SNCR)		Kg Hg/y	0.5			0.5			0.00	0.00	0.00	0.00	0.00	0.00
												Very efficient Hg pollution control (wetFGD+ACI/FF+scrubber+SNCR)		Kg Hg/y	0.04			0.5		0.46	0.00	0.00	0.00	0.00	0.00	0.00
																					0.00	0.00	0.00	0.00	0.00	0.00
	5.3.2	**Pulp and paper production**	**?**	0,007-0,07	g Hg/ t biomass used in producti	0.03	g Hg/t biomass (dry weight)		Biomass, t/y	0	Kg Hg/y	No filter		Kg Hg/y	1						0.00	0.00	0.00	0.00	0.00	0.00
												PM control with general ESP, or PS		Kg Hg/y	0.9				0.1		0.00	0.00	0.00	0.00	0.00	0.00
	5.3.3	**Production of lime and light weight aggregates**									Kg Hg/y										0.00	0.00	0.00	0.00	0.00	0.00
		Lime production		?			?				Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
		Light weight aggregate kilns		?	?		?				Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	5.3.4	**Other minerals and materials**		?	?		?		?	?	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00

Inventory Level 2 spreadsheet of UNEP 's Toolkit for identification and quantification of mercury releases

															Enter output distribution factors (unitless)						Calculated Hg output, Kg/y					
C	Su-C	Source category /phase	Exists? (y/n/?)	Default input factor	Unit	Enter input factor	Unit	Enter activity rate	Unit	Calculat. Hg input	Unit	"Output scenario (where relevant)	Enter Hg input	Unit	Air	Wate	Land	Products	General waste	Sector specific treatment/disposal	Air	Water	Land	Products	General waste	Sector specific treatment/disposal
5.4		**Source category: Intentional use of mercury in industrial processes**	N																							
	5.4.1	**Chlor-alkali production with mercury-technology**	N							0		**Chlor-alkali prod.**														
				10 - 200	g Hg/t Cl2 produced	100	g Hg/t Cl2 produced	0	Cl2 produsd, t/y	0	Kg Hg/y	Hg unaccounted for presented under "Sector specific treatment/disposal" (a			0.1	0.01	0.01	0.01		0.87	0.00	0.00	0.00	0.00	0.00	0.00
												Hg unaccounted for is presented as releases (a			0.2	0.02	0.38	0.1		0.3	0.00	0.00	0.00	0.00	0.00	0.00
	5.4.2	**VCM production with mercury catalyst**	N	100-140	g Hg/t VCM produced	120	g Hg/t VCM produced	0	VCM produced, t/y	0	Kg Hg/y				0.02	0.02		0.36		0.6	0.00	0.00	0.00	0.00	0.00	0.00
	5.4.3	**Acetaldehyde production with mercury catalyst**	N	?	?	120	g Hg/t acetaledhyde	0	Acetaldehyde produced, t/y	0	Kg Hg/y				0.02	0.02		0.36		0.6	0.00	0.00	0.00	0.00	0.00	0.00
	5.4.4	**Other production of chemicals and polymers with mercury**	N	?	?	?	?	0	?	0	Kg Hg/y										0.00	0.00	0.00	0.00	0.00	0.00

Note:
(a: These two possible presentation forms pertains to the way "unaccounted losses" is chosen to be presented - see the Toolkit report section. It is up to the users to decide which one of the release presentations they choose.
In order for the releases to be presented correctly in the summary sheet, only one of the presentation options can be used (or the summary sheet should be adjusted for this source by the user).

Inventory Level 2 spreadsheet of UNEP 's Toolkit for identification and quantification of mercury releases

C	Su-C	Source category /phase	Exists? (y/n/?)	Default input factor	Unit	Enter input factor	Unit	Enter activity rate	Unit	Calculat. Hg input	Unit	"Output scenario"	Enter Hg input	Unit	Enter output distribution factors (unitless) Air	Water	Land	Impurity in	General waste	Sector specific treatment/disposal	Calculated Hg output, Kg/y Air	Water	Land	Inpurity in	General waste	Sector specific treatment/disposal
5.5		**Source category: Consumer products with intentional use of mercury**																								
	5.5.1	**Thermometers with mercury**																				4.10	6.15	4.10	0.00	6.15	0.00
		/Production (a	N			1			Hg used for production, kg/y	0	Kg Hg/y	**/Production (a**	0	Kg Hg/y	0.01	0.005	0.1		0.1	0.01	0.00	0.00	0.00	0.00	0.00	0.00
		Medical thermometers		0.5-1.5	g Hg/item	1	g Hg/item		Items/y	0	Kg Hg/y															
		Ambient air thermom.		2-5	g Hg/item	3.5	g Hg/item		Items/y	0	Kg Hg/y															
		Industrial and special th.		5-200	g Hg/item	103	g Hg/item		Items/y	0	Kg Hg/y															
		Other glass Hg thermometers		1-40	g Hg/item	20.5	g Hg/item		Items/y	0	Kg Hg/y															
		/Use+disposal:							**Total**	21	Kg Hg/y	**/Use+disposal:**														
		Medical thermometers	Y	0.5-1.5	g Hg/item	1	g Hg/item	20514	Items/y	21	Kg Hg/y	(a1) No separate collection. Waste handl. controlled		Kg Hg/y	0.1	0.3			0.6		0.00	0.00	0.00	0.00	0.00	0.00
		Ambient air thermom.		2-5	g Hg/item	3.5	g Hg/item		Items/y	0	Kg Hg/y	(a2) No separate collection. Informal waste handl. widespread	21	Kg Hg/y	0.2	0.3	0.2		0.3		4.10	6.15	4.10	0.00	6.15	0.00
		Industrial and special th.		5-200	g Hg/item	103	g Hg/item		Items/y	0	Kg Hg/y	(a3) Separate collection. Waste handl. controlled		Kg Hg/y	0.1	0.3			0.3	0.3	0.00	0.00	0.00	0.00	0.00	0.00
		Other glass Hg thermometers		1-40	g Hg/item	20.5	g Hg/item		Items/y	0	Kg Hg/y															
	5.5.2	**Electrical switches and relays with mercury**																				131.76	0.00	175.68	0.00	131.76	0.00
		/Production	N			1		0	Hg used for production, kg/y	0		**/Production**			0.01	0.005	0.1		0.1	0.01	0.00	0.00	0.00	0.00	0.00	0.00
		/Use+disposal:	Y	0.02-0.25	g Hg/(y*inhabitant)	0.14	g Hg/(y*inhabitant)	34856813	Inhabitants	439	Kg Hg/y	**/Use+disposal:**														
			Adjustment for electrification rate			9	Percent of population with access to electricity																				
												(a1) No separate collection. Waste handl. controlled			0.1		0.1		0.8		0.00	0.00	0.00	0.00	0.00	0.00
												(a2) No separate collection. Informal waste handl. widespread	439	Kg Hg/y	0.3		0.4		0.3		131.76	0.00	175.68	0.00	131.76	0.00
												(a3) Separate collection. Waste handl. controlled			0.1		0.1		0.4	0.4	0.00	0.00	0.00	0.00	0.00	0.00
	5.5.3	**Light sources with mercury**					3978677.5															44.64	0.00	44.64	0.00	59.52	0.00
		/Production	N			1			Hg used for production, kg/y	3,978,678	Kg Hg/y	**/Production**			0.01	0.005	0.1		0.1	0.01	0.00	0.00	0.00	0.00	0.00	0.00
		/Use+disposal:								149	Kg Hg/y	**/Use+disposal:**														
		Fluorescent tubes (double end)	Y	10 - 40	mg Hg/item	25	mg Hg/item	4238328	Items/y	106	Kg Hg/y	(a1) No separate collection. Waste handl. controlled			0.05				0.95		0.00	0.00	0.00	0.00	0.00	0.00
		Compact fluorescent lamp	Y	5 - 15	mg Hg/item	10	mg Hg/item	4238328	Items/y	42	Kg Hg/y	(a2) No separate collection.	149	Kg Hg/y	0.3		0.3		0.4		44.64	0.00	44.64	0.00	59.52	0.00
		High pressure mercury vapour	Y	30	mg Hg/item	30	mg Hg/item		Items/y	0	Kg Hg/y	(a3) Separate collection. Waste handl. controlled			0.05				0.8	0.15	0.00	0.00	0.00	0.00	0.00	0.00
		High-pressure sodium lamps	Y	10 - 30	mg Hg/item	20	mg Hg/item	22758	Items/y	0	Kg Hg/y															
		UV light for tanning	N	5 - 25	mg Hg/item	15	mg Hg/item	0	Items/y	0	Kg Hg/y															
		Metal halide lamps	N	25	mg Hg/item	25	mg Hg/item	0	Items/y	0	Kg Hg/y															
	5.5.4	**Batteries with mercury**																				1,011.34	0.00	1,011.34	0.00	2,022.67	0.00
		/Production (a	N			1			Hg used for production, kg/y	0		**/Production (a**		Kg Hg/y	0.005	0.005	0.1		0.1	0.01	0.00	0.00	0.00	0.00	0.00	0.00
		Mercury oxide (all sizes); also called mercury-zinc cells		320	kg Hg/t batteries	320	kg Hg/t batteries		Batteries, t/y	0	Kg Hg/y															
		Zinc-air button cells		12	kg Hg/t batteries	12	kg Hg/t batteries		Batteries, t/y	0	Kg Hg/y															
		Alkaline button cells		5	kg Hg/t batteries	5	kg Hg/t batteries		Batteries, t/y	0	Kg Hg/y															
		Silver oxide button cells		4	kg Hg/t batteries	4	kg Hg/t batteries		Batteries, t/y	0	Kg Hg/y															
		Alkaline, other than button cell shapes		0.25	kg Hg/t batteries	0.25	kg Hg/t batteries		Batteries, t/y	0	Kg Hg/y															
		/Use+disposal:	Y							4,045	Kg Hg/y	**/Use+disposal:**														
		Mercury oxide (all sizes); also called mercury-zinc cells	Y	320	kg Hg/t batteries	320	kg Hg/t batteries	3.005	Batteries, t/y	962	Kg Hg/y	(a1) No separate collection. Waste handl. controlled							1		0.00	0.00	0.00	0.00	0.00	0.00
		Zinc-air button cells		12	kg Hg/t batteries	12	kg Hg/t batteries	5.804	Batteries, t/y	70	Kg Hg/y	(a2) No separate collection. Informal waste handl. widespread	4,045	Kg Hg/y	0.25		0.25		0.5		1,011.34	0.00	1,011.34	0.00	2,022.67	0.00
		Alkaline button cells		5	kg Hg/t batteries	5	kg Hg/t batteries		Batteries, t/y	0	Kg Hg/y	(a3) Separate collection. Waste handl. controlled							0.6	0.4	0.00	0.00	0.00	0.00	0.00	0.00
		Silver oxide button cells	Y	4	kg Hg/t batteries	4	kg Hg/t batteries	3.06	Batteries, t/y	12	Kg Hg/y															
		Alkaline, other than button	Y	0.25	kg Hg/t batteries	0.25	kg Hg/t batteries	12007.421	Batteries, t/y	3,002	Kg Hg/y															
	5.5.5	**Polyurethane with mercury catalysts**																				56.46804	28.23402	112.9361	0	84.70205559	0
		/Production (a										**/Production**														
		/Use+disposal	Y	0.01-0.05	g Hg/(y*inhabitant)	0.09	g Hg/(y*inhabitant)	34856813	Inhabitants	282	Kg Hg/y	**/Use+disposal:**														
			Adjustment for electrification rate			9	Percent of population with access to electricity																				
												(a1) No separate collection. Waste handl. controlled			0.1	0.05			0.85		0.00	0.00	0.00	0.00	0.00	0.00
												(a2) No separate collection. Informal waste handl. widespread	282	Kg Hg/y	0.2	0.1	0.4		0.3		56.47	28.23	112.94	0.00	84.70	
	5.5.6	**Biocides and pesticides with mercury**	N																			0.00	0.00	0.00	0.00	0.00	0.00
		/Production (a		?		1			Hg used for production, kg/y	0	Kg Hg/y	**/Production**		Kg Hg/y	0.01	0.005	0.1		0.1	0.01	0.00	0.00	0.00	0.00	0.00	0.00
		/Use+disposal		?		?				?		**/Use+disposal:**										0.00	0.00	0.00	0.00	0.00	0.00
	5.5.7	**Paints with mercury**	N																			0.00	0.00	0.00	0.00	0.00	0.00
		/Production (a				1			Hg used for production, kg/y	0	Kg Hg/y	**/Production**		Kg Hg/y	0.01	0.005	0.1		0.1	0.01	0.00	0.00	0.00	0.00	0.00	0.00
		/Use+disposal		0.3-5	kg Hg/t	2.6	kg Hg/t		Paint, t/y	0	Kg Hg/y	**/Use (application + when appl.)**			0.92	0.05			0.03		0.00	0.00	0.00	0.00	0.00	0.00
	5.5.8	**Cosmetics and related products with mercury**																				0.00	98.75	5.20	0.00	0.00	0.00
		/Production (a	N		kg Hg/t	1		0	Hg used for production, kg/y	0	Kg Hg/y	**/Production**		Kg Hg/y	0.01	0.005	0.1		0.1	0.01	0.00	0.00	0.00	0.00	0.00	0.00
		/Use+disposal	Y	10-50	kg Hg/t	30	kg Hg/t	3.465	Cream and soap, t/y	104	Kg Hg/y	**/Use (application + when appl**	104	Kg Hg/y		0.95	0.05				0.00	98.75	5.20	0.00	0.00	0.00

Notes: (a: Mercury inputs to production can either be entered as an annual consumption (data from factory), or roughly estimated based on the sum of annual production of different product types made; be careful to "Enter Hg input" correctly in column N.
Note also that output distribution factors should not sum up to 1 for this source or phase.

Inventory Level 2 spreadsheet of UNEP 's Toolkit for identification and quantification of mercury releases

C	Su-C	Source category /phase	Exists? (y/n/?)	Default input factor	Unit	Enter input factor	Unit	Enter activity rate	Unit	Calculat. Hg input	Unit	"Output scenario"	Enter Hg input	Unit	Enter output distribution factors (unitless) Air	Water	Land	Products	General waste	Sector specific treatment/disposal	Calculated Hg output, Kg/y Air	Water	Land	Products	General waste	Sector specific treatment/disposal
5.6		**Source category: Other intentional product/process use**																								
	5.6.1	**Dental mercury-amalgam fillings (b**																			**2.86**	**59.74**	**9.72**	**8.58**	**32.44**	**32.44**
		/Preparations of fillings at dentist clinics (share of current mercury supply for amalgam fillings)	Y	0.05-0.2	g Hg/(y*inhabitant)	0.2	g Hg/(y*inhabitant)	34856813	Inhabitants	143	Kg Hg/y	**Preparations of fillings** at dentist clinics (input is current Hg supply for amalgam fillings)	143	Kg Hg/y	0.02	0.14			0.12	0.12	2.86	20.01	0.00	0.00	17.15	17.15
							Dentist per 1000 inhabitants, country (See Reference report Annexes)		*Dentist per 1000 inhabitants, reference country (default: DK. **DO NOT CHANGE**)*																
		Adjustment for dental personnel density (optional; use high end default input factor):				0.017		*0.829190791*																		
		/Use - from fillings in the mouth (releases from mercury supply for fillings 5-15 years ago)										**Use** (input is Hg supply for *fillings* 5-15 years ago (a)	143	Kg Hg/y		0.02					0.00	2.86	0.00	0.00	0.00	0.00
		/Disposal (releases from mercury supply for fillings 10-20 years ago)										**Disposal** (input is Hg supply for preparation of fillings 10-20 years ago (a)														
												- In countries where most dental clinics are equipped with high efficiency amalgam filters (95% retention rate)	21	Kg Hg/y		0.02		0.06	0.26	0.26	0.00	0.43	0.00	1.29	5.57	5.57
												- In countries where only dental chair filters/strainers are used in most clinics	121	Kg Hg/y		0.3	0.08	0.06	0.08	0.08	0.00	36.45	9.72	7.29	9.72	9.72
	5.6.2	**Manometers and gauges with mercury**																			**41.03**	**61.54**	**41.03**	**0.00**	**61.54**	**0.00**
		Production (c	N			1		0	Hg used for production, kg/y	0				Kg Hg/y	0.01	0.005	0.1		0.1	0.01	0.00	0.00	0.00	0.00	0.00	0.00
		Use+disposal of medical blood pressure gauges	Y	70-85	g Hg/item	80	g Hg/item	2564.2	Items/y	205	Kg Hg/y	**/Use+disposal:**									41.03	61.54	41.03	0.00	61.54	0.00
												(a1) No separate collection. Waste handl. controlled		Kg Hg/y	0.1	0.3			0.6		0.00	0.00	0.00	0.00	0.00	0.00
												(a2) No separate collection. Informal waste handl. widespread	205	Kg Hg/y	0.2	0.3	0.2		0.3		41.03	61.54	41.03	0.00	61.54	0.00
												(a3) Separate collection. Waste handl. controlled		Kg Hg/y	0.1	0.3			0.3	0.3	0.00	0.00	0.00	0.00	0.00	0.00
		Use+disposal of other manometers (level 1 default for whole group below)	Y	0.005	g Hg/y*inhabitant	0.005	g Hg/y*inhabitant	34856813	Inhabitants	16	Kg Hg/y	**/Use+disposal:**	16	Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
		Adjustment for electrification rate				9	Percent of population with access to electricity (See Reference report Annexes)																			
		Alternative calculations method can be used below for this sub-catergory (but not both methods):																								
		Manometers		?	g Hg/item		g Hg/item		Items/y	0	Kg Hg/y	(a1) No separate collection. Waste handl. controlled		Kg Hg/y	0.1	0.3			0.6		0.00	0.00	0.00	0.00	0.00	0.00
		U-shaped manometers		?	g Hg/item		g Hg/item		Items/y	0	Kg Hg/y	(a2) No separate collection. Informal waste handl. widespread		Kg Hg/y	0.2	0.3	0.2		0.3		0.00	0.00	0.00	0.00	0.00	0.00
		Manometers for milking systems		?	g Hg/item		g Hg/item		Items/y	0	Kg Hg/y	(a3) Separate collection. Waste handl. controlled		Kg Hg/y	0.1	0.3			0.3	0.3	0.00	0.00	0.00	0.00	0.00	0.00
		Manometers and barometers used for measuring air pressure		?	g Hg/item		g Hg/item		Items/y	0	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
		Barometers		?	g Hg/item		g Hg/item		Items/y	0	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
		Environmental manometers		?	g Hg/item		g Hg/item		Items/y	0	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
a		**Pressure valves in district heating plants**		?	g Hg/item		g Hg/item		Items/y	0	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
		Pressure gauges		?	g Hg/item		g Hg/item		Items/y	0	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	5.6.3	**Laboratory chemicals and equipment with mercury /Use and disposal**																			**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
		Laboratory chemicals	Y			0.01	g Hg/y*inhabitant	34856813	Inhabitants	31	Kg Hg/y		31	Kg Hg/y		0.33			0.33	0.34	0.00	10.35	0.00	0.00	10.35	10.67
		Other laboratory equipment (level 1 default for group)	Y			0.04	g Hg/y*inhabitant	34856813	Inhabitants	125	Kg Hg/y		125	Kg Hg/y		0.33			0.33	0.34	0.00	41.41	0.00	0.00	41.41	42.66
		Adjustment for electrification rate				9	Percent of population with access to electricity																			

	Alternative calculations method can be used below for this sub-category (but not both methods):																								
	Blood gas analyzer		?	g Hg/item		g Hg/item		Items/y	0	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	Mercury electrodes (calomel)		?	g Hg/item		g Hg/item		Items/y	0	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	Blood lead analyzer		?	g Hg/item		g Hg/item		Items/y	0	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	Mercury dropelectrode		?	g Hg/item		g Hg/item		Items/y	0	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	Coulter counter		?	g Hg/item		g Hg/item		Items/y	0	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	Sample collector for oil offshore		?	g Hg/item		g Hg/item		Items/y	0	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	Centrifuges		?	g Hg/item		g Hg/item		Items/y	0	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	Electron microscope		?	g Hg/item		g Hg/item		Items/y	0	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	Thermostats		?	g Hg/item		g Hg/item		Items/y	0	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	Thermometers, manometers, and other measuring equipment		?	g Hg/item		g Hg/item		Items/y	0	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	Mercury lamps for atomic absorption spectrophotometers and other equipment		?	g Hg/item		g Hg/item		Items/y	0	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
5.6.4	Mercury metal use in religious rituals and folklore medicine		?	?		?		?	?	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
5.6.5	Miscellaneous product uses, mercury metal uses, and other sources																			0.00	0.00	0.00	0.00	0.00	0.00
	Infra red detection semiconductors		?	?		?		?	?	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	Bougie tubes and Cantor tubes		?	?		?		?	?	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	Educational uses		?	?		?		?	?	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	Gyroscopes with mercury		?	?		?		?	?	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	Vacuum pumps with mercury		?	?		?		?	?	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	Use of mercury as a refrigerant in certain cooling systems		?	?		?		?	?	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	Light houses (Marine navigation lights)		?	?		?		?	?	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	Mercury in large bearings of rotating mechanic parts in for example older waste water treatment plants		?	?		?		?	?	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	Tanning		?	?		?		?	?	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	Pigments		?	?		?		?	?	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	Browning and etching steel		?	?		?		?	?	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	Certain colour photograph paper types		?	?		?		?	?	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	Recoil softeners in rifles		?	?		?		?	?	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	Explosives (mercury-fulminate a.o.)		?	?		?		?	?	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	Fireworks		?	?		?		?	?	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	Executive toys		?	?		?		?	?	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	Others		?	?		?		?	?	Kg Hg/y			Kg Hg/y							0.00	0.00	0.00	0.00	0.00	0.00
	Notes:	(a: See detailed explanations in the dental fillings section in the Toolkit report.																							
		If no change in the amalgam fillings supply have been observed, current supply may be used as a substitute; changes are likely to have occurred in most countries.																							
		(b: Note that output distribution factors should not sum up to 1 for this source or phase.																							
		(c: Mercury inputs to production can either be entered as an annual consumption (data from factory), or roughly estimated based on the sum of annual production of different product types made; be careful to "Enter Hg input" correctly in column N.																							

Inventory Level 2 spreadsheet of UNEP 's Toolkit for identification and quantification of mercury releases

C	Su-C	Source category /phase	Exists? (y/n/?)	Default input factor	Unit	Enter input factor	Unit	Enter activity rate	Unit	Calculat. Hg input	Unit	Output scenario (where relevant)	Enter Hg input	Unit	Enter output distribution factors (unitless) Air	Water	Land	Product	General waste	Sector specific treatment/disposal	Calculated Hg output, Kg/y Air	Water	Land	Products	General waste	Sector specific treatment/disposal
5.7		Source category: Production of recycled metals ("secondary" metal production)																								
	5.7.1	Production of recycled mercury ("secondary production")	N	-	-	1.00452	kg Hg input/kg total Hg output		Mercury recycled, kg/y	0	(b Kg Hg/y	(c	0	Kg Hg/y	0.002	0.0024		-		0.00012	0.00	0.00	0.00	-	0.00	0.00
	5.4.2	Production of recycled ferrous metals (iron and steel)	Y	0.2-2	g Hg/vehicle	1.1	g Hg/vehicle	33500	Vehicles recycled/y	36.85	Kg Hg/y		36.85	Kg Hg/y	0.33		0.34		0.33		12.16	0.00	12.53	0.00	12.16	0.00
	5.4.2	Production of other recycled metals	N	?	?	0.6	?		?	0	Kg Hg/y			Kg Hg/y	0.3	0.1			0.3	0.3	0.00	0.00	0.00	0.00	0.00	0.00

Note:

(b: Enter sum for total inputs to recycling, if know from other sources

(c: Note that output distribution factors should not sum up to 1 for this source or phase.

Inventory Level 2 spreadsheet of UNEP 's Toolkit for identification and quantification of mercury releases

C	Su-C	Source category /phase	Exists? (y/n/?)	Default input factor	Unit	Enter input factor	Unit	Enter activity rate	Unit	Calculat. Hg input	Unit	"Output scenario (where relevant)	Enter Hg input	Unit	Enter output distribution factors (unitless) Air	Water	Land	Products	General waste	Sector specific treatment/disposal	Calculated Hg output, Kg/y Air	Water	Land	Products	General waste	Sector specific treatment/disposal
5.9		**Source category: Waste deposition/landfilling and waste water treatment**																								
	5.9.1	**Controlled landfills/deposits (a**	Y	1-10	g Hg/t waste	1	g Hg/t waste	600,000	Waste landfilled, t/y	600	Kg Hg/y		600	Kg Hg/y	0.01	0.0001					**6.00**	**0.06**	**0.00**	**0.00**	**0.00**	**0.00**
	5.9.2	**Diffuse disposal under some control**	-	-	-	-	-		-		-				-	-	-	-	-	-	-	-	-	-	-	-
		This source category is expected covered under the original sources of the mercury containing material, under det output path "sector specific treatment/disposal accompanied by a descriptive note; e.g. solid residues from waste incineration or metal extraction.																								
	5.9.3	**Informal local disposal of industrial production waste**	Y	1-10	g Hg/t waste	5	g Hg/t waste		Waste dumped, t/y	-	Kg Hg/y			Kg Hg/y				-	-	-	**0.00**	**0.00**	**0.00**	-	-	-
	5.9.4	**Informal dumping of general waste (b**	Y	1-10	g Hg/t waste	1	g Hg/t waste	1,077,616	Waste dumped, t/y	1,078	Kg Hg/y		1,078	Kg Hg/y	0.1	0.1	0.8				**107.76**	**107.76**	**862.09**	-	-	-
	5.9.5	**Waste water system/treatment**																			**0.00**	**192.58**	**77.03**	**0.00**	**57.77**	**57.77**
			Y	0.5-10	mg Hg/m3 waste water	5.25	mg Hg/m3 waste water	73365000	Waste water, m3/y	385	Kg Hg/y	No treatment; direct release from sewage pipe		Kg Hg/y		1					0.00	0.00	0.00	0.00	0.00	0.00
												Mechanical treatment only		Kg Hg/y		0.9			0.1		0.00	0.00	0.00	0.00	0.00	0.00
												Mechanical and biological (activated sludge) treatment; no land application of sludge		Kg Hg/y		0.5			0.3	0.2	0.00	0.00	0.00	0.00	0.00	0.00
												Mechanical and biological (activated sludge) treatment; 40% of sludge used for land application	385	Kg Hg/y		0.5	0.2		0.15	0.15	0.00	192.58	77.03	0.00	57.77	57.77

Notes:
(a: Note that output distribution factors should not sum up to 1 for this source or phase.
(b: It should be noted that mercury releases to informal waste incineration and waste dumping under the individual product and materials sub-categories are quantified in these sub-sections as direct releases to land, air and water.
Beware of double-counting. Note, however, that mercury inputs to dumping from mercury trace concentrations in high volume materials (plastics, paper, etc.) are not quantified individually elsewhere in this Toolkit

Inventory Level 2 spreadsheet of UNEP 's Toolkit for identification and quantification of mercury releases

ANNEX III: Gold Rush Artisanal and Small-scale Mining Hotspots

District	Busia	Busia	Busia	Busia	Busia	Busia	Bushenyi	Namayingo	Namayingo	Namayingo
County	Samia Bugwe North	Samia-Bugwe	Samia Bugwe North	Samia-Bugwe	Samia-Bugwe	Samia Bugwe North	Igara	Bukooli South	Bukooli South	Bukooli south
Sub County	Sikuda	Busitema	Sikuda	Buteba	Buteba	Sikuda	Kyamuhunga	Buyinja	Banda	Bukana
Parish	Tirra	Syanyoja	Ajuket	Mawero	Amonika-kinei	Sikuda	Nyakazinga	Gifuyo	Bujwanga	Bukana
Village	Tirra	Syanyoja	Ajuket B	Mawero	Amonika-kinei	Tirra	Nyakazinga	Budde	Nakudi & Simase	Bukana
Site Name	Busia United Small Scale Mining Association	Syanyoja Mining Group	Jacob	Multiple sites	Multiple sites	Greenstone resources Camp	Nyakazinga	Nsango B	Nakudi& Simase	Bukana
Population	50-60	80-106	150- 250	50-60 Each	50-60 Each	1500-2000	20-80 each	1700	2300 each	1650
Mining site type	Mix of Hard rock -70%and Alluvial-30%	Mix of alluvial and Hard rock	Mix of alluvial and Hard rock	Mix of alluvial and Hard rock	Mix of alluvial and Hard rock	Mix of alluvial and Hard rock	Mix of Hard rock -70%and Alluvial-30%	Hard rock	Hard rock	Hard rock
Mine size	0.14sqkm	0.85sqkm	1.25sqkm	0.14sqkm	0.14sqkm	1.`5 SqKm	0.85sqkm	1.`5 SqKm	1.3 & 1.85 SqKm respectively	1.6 SqKm
Mercury use	100% Amalgamation from concentrates	Whole ore amalgamation	100% Amalgamation from concentrates	100% Amalgamation from concentrates	100% Amalgamation from concentrates	Whole ore amalgamation	100% Amalgamation from concentrates	100% Amalgamation from concentrates	100% Amalgamation from concentrates	100% Amalgamation from concentrates

District	Buhweju	Buhweju	Buhweju	Moroto	Moroto	Moroto	Kaabong	Kaabong	Kaabong	Kaabong
County	Buhweju	Buhweju	Buhweju	Matheniko	Matheniko	Matheniko	Dodoth	Dodoth	Dodoth	Dodoth
Sub County	Rwengwe	Bisya	Engaju	Rupa	Rupa	Rupa	Lodiko	Loyoro	Kathile	Lodiko
Parish	Kashenyi	Bisya	Katongo	Lotongir	Musupo	Rupa	Lopedo	Nakapel	Kamachari kol	sakatan
Village	Rwomushojwa	Ruzuga	Katenga	Lotongir	Musupo	Nakabaat & lokolete	Lopedo	Nakapel	Lois and Sokodu	Naukoret
Site Name	Katenga mining site	Ruzuga	Buhweju ASGM Association	Lotongir	Musupo	Nakabaat & lokolete	Lopedo FFP army detach	Nakapel	Lois and Sokodu	Naukoret
Population	80- 150 people	340-370 people	150-250	150 -370 people	340-370 people	150-250 people	220-370 people	300-500 people	350-370 people	400- 450 people
Mining site type	70% hard rock and Alluvial-30%	100% alluvial	70% hard rock and Alluvial-30%	100% alluvial	100% alluvial	100% alluvial	100% alluvial	100% alluvial	100% alluvial	100% alluvial
Mine size	20-40 hectares	2 hectares	30-60 hectares	22 hectares	12 hectares	12 hectares	12 hectares	100 hectares	13 hectares	77 hectares
Mercury use	Yes	None	Yes	None	None	None	None	None	None	None
Source of mercury	Kampala	NA	Kampala	NA	NA	NA	NA	NA	NA	NA
Price of mercury on site	500 - 1000Ugx/g of Hg	NA	500 - 1000Ugx/g of Hg	NA	NA	NA	NA	NA	NA	NA
Price of gold on site - UGX/g Au	Pp 90,000 – 120,000	90,000 – 120,000	90,000 – 120,000	90,000 – 120,000	90,000 – 120,000	90,000 – 120,000	90,000 – 120,000	90,000 – 120,000	90,000 – 120,000	90,000 – 120,000

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
- **Mercury Learn 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
- **National Population and Housing Census 2014, Main Report (UBOS, 2016)**
  http://www.ubos.org

- **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**

* **Statistical Abstract (2016). Uganda Bureau of Statistics.**
http://www.ubos.org